2013 Plan for the Revoked 1-Hour Ozone Standard

SJVUAPCD

Executive Summary

2013 Plan for the Revoked 1-Hour Ozone Standard
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EXECUTIVE SUMMARY

In addition to the multiple attainment plans currently in place, the San Joaquin Valley Unified Air Pollution Control District (District) is now mandated by the federal Clean Air Act (CAA) to develop and implement two new ozone attainment plans (state implementation plans [SIPs]) in the near future: a plan for the U.S. Environmental Protection Agency's (EPA) revoked 1-hour ozone standard and a plan for EPA's newest 8-hour ozone standard (established in 2008). While EPA revoked their 1-hour ozone standard in 2005 to pursue a more health-protective 8-hour ozone standard, delayed action by EPA on the District's *2004 Extreme Ozone Attainment Demonstration Plan* (*2004 Plan*), and subsequent litigation resulted in court rulings requiring the submission of a new plan.

Currently, the San Joaquin Valley (Valley) is subject to non-attainment penalties for approximately $30 million dollars per year due to non-attainment of the revoked 1-hour standard. This matter is also under litigation with certain environmental groups seeking to increase non-attainment penalties charged to Valley businesses. Attaining the standard will remove exposure by Valley businesses to additional penalties and will return full local control to the Valley for decisions regarding the need, the magnitude, and the expenditure of Department of Motor Vehicle (DMV) dollars.

Due to the Valley's significant investment and hard work in reducing emissions, the District anticipates attaining EPA's revoked 1-hour standard as measures from more recent 8-hour ozone and PM2.5 (particulate matter 2.5 microns or less in diameter) plans continue to be implemented. Addressing EPA's 2008 8-hour ozone standard, however, will pose a tremendous challenge for the Valley, and the District's focus needs to remain on this more health-protective standard. Within this CAA context, the District's Health-risk Reduction Strategy will prioritize those measures that accelerate the reduction of Valley ozone concentrations, and provide for maximum air quality and health benefits.

Since 1992, the District has adopted numerous attainment plans to reduce ozone and particulate precursor emissions. Leaving no stone unturned, the District has implemented these plans and adopted over 500 rules and rule amendments that have resulted in significant emissions reductions. Many of the District's innovative rules and strategies, such as Indirect Source Review, Glass Melting Furnaces, and Conservation Management Practices, now serve as models for the rest of the nation. In addition to having the toughest air regulations in the nation, the District also has the most effective and efficient incentive grants program. To date, the District has awarded over $500 million in grants, resulting in over 100,000 tons of emissions reductions. Through implementation of District regulations and incentives, Valley businesses and residents have invested billions of dollars to reduce emissions.

Through these combined efforts, the Valley's air quality is better than it has been at any other time on record, the last three years having the cleanest winters and cleanest summers. Furthermore, the District's recent ozone and PM2.5 plans contain over 100 regulations that will achieve almost 250 tons per day of reductions in oxides of nitrogen (NOx) over the coming years.

As of the posting of this plan, the Valley could attain the revoked 1-hour ozone standard as early as 2013 with already adopted and implemented measures. On the other hand, it takes as little as four hours over a three-year period (where those four hours occur on four separate days at a single air monitoring site) to keep an area out of attainment, and a single episode of ozone build up could prolong nonattainment past 2013. Therefore, 2017 is the official attainment year for this plan, per the modeling and other analyses conducted as part of this planning effort.

Beyond 1-hour ozone, and despite the significant air quality progress that has been made in the Valley, many challenges remain as the District develops new attainment plans for increasingly stringent federal standards. The Valley's geography and meteorology exacerbate the formation and retention of high levels of air pollution. Surrounding mountains and consistently stagnant weather patterns prevent the dispersal of pollutants that accumulate within the Valley. Adding to the geographic challenges is the fact that the state's major arteries for goods and people movement, which attract a large volume of vehicular traffic, run the length of the Valley. Also, biogenic emissions and pollution transported from outside of the District's boundaries significantly contribute to the Valley's challenges. These factors will continue to impact the Valley's progress towards attainment of federal air quality standards.

Summary of Existing and Upcoming Ozone Standards and Schedules

Table ES-1 summarizes EPA's ozone standards and the timing of attainment plans under those standards consistent with CAA requirements. EPA established the first ozone standard in 1979, setting this standard at 0.12 part per million (ppm) over a 1-hour exposure or 124 parts per billion (ppb) when accounting for the adopted rounding conventions. An area meets the 1-hour ozone standard when, for each monitoring station, the 1-hour ozone levels do not exceed 124 ppb more than one day per year as averaged over any three-year period. The CAA Amendments of 1990 established attainment planning requirements and attainment deadlines for the 1979 1-hour ozone standard, and the District subsequently adopted various 1-hour ozone plans and plan amendments. EPA revoked the 1-hour standard effective June 15, 2005 based on evidence that the 84 ppb 8-hour ozone standard adopted in 1997 was more health protective. In response, the District and other agencies nationwide shifted their ozone efforts to address 8-hour ozone.

The District's *2007 Ozone Plan* demonstrates attainment of the 1997 8-hour ozone standard no later than the 2024 attainment deadline. It includes aggressive measures for reducing pollutants from all Valley sectors as well as "black box" reductions needed to ultimately attain the standard, but for which technologies did not exist. In 2008, EPA revised its 8-hour ozone standard, lowering the standard from 84 ppb to 75 ppb. EPA considered lowering the standard once again in 2010, but ultimately retained the 75 ppb standard. EPA designated the Valley as nonattainment of the 2008 8-hour ozone standard in 2012; the attainment plan for the 2008 standard will be due in 2015 or 2016, pending EPA's final implementation rule for the 2008 standard. EPA is expected to review and consider further revisions to the 8-hour ozone standard in the 2013–2014 timeframe.

Despite the complexity of overlapping standards and plans, efforts to reduce ozone precursors under one standard and plan also will help to reduce ozone precursors necessary to meet other ozone standards, including more stringent ozone standards on the horizon. The control measures adopted by the District and ARB under the *2007 Ozone Plan* and other attainment plans are achieving significant reductions of ozone precursors. These measures and strategies will continue to achieve intended emissions reductions as they are implemented. These emission reductions help decrease both 1-hour ozone and 8-hour ozone concentrations, contributing to attainment of the 1-hour ozone standard and the multiple 8-hour ozone standards. Building on the District's *2007 Ozone Plan, 2008 PM2.5 Plan*, and the *2012 PM2.5 Plan*, the District continues to coordinate emission reduction strategies whenever possible to address multiple standards, to maximize efficiency for staff and stakeholders, and to maximize health benefits.

Table ES-1 Federal Air Quality Standards and Valley Status for Ozone

	Ozone Standards and Timelines			
	1979 1-hour	**1997 8-hour**	**2008 8-hour**	**2014 8-hour**
Federal Standard	**124 ppb (1-hour average)**	**84 ppb (8-hour average)**	**75 ppb (8-hour average)**	**TBD**
1979–2003	EPA sets standard (1979)	EPA sets standard (1997)		
2004	SJV attainment plan	EPA finalizes attainment designations and classifications		
2005	**EPA revokes standard**	EPA implementation rule		
2006	*Litigation reinstates portions of implementation requirements under the revoked standard*			
2007		Attainment plan due (SJV's *2007 Ozone Plan*)		
2008			EPA sets standard	
2009				
2010	EPA approved SJV 2004 plan	Midcourse review	EPA proposes to revise standard: down to 60 or 70 ppb	
2011	Ninth Circuit remands plan approval to EPA; EPA finds SJV failed to attain		EPA announces that it won't revise the standard	
2012	EPA finalizes withdrawal of approval of 2004 1-hour ozone plan. SJV plan withdrawn	EPA approves SJV's *2007 Ozone Plan*	EPA attainment designation (SJV: extreme nonattainment)	
⇨ 2013	**SJV to submit new 1-hour ozone plan (final attainment year to be determined)**		EPA proposes implementation rule	EPA to propose standard
2014		District/ARB to revisit 2007 plan		EPA to finalize standard
2015			SJV to submit 8-hour ozone plan (2015 or 2016, based on proposed implementation rule)	*Designations & attainment plan timing to be determined*
2016				
2017				
2018				
2019		Identify specific "Long-Term Control Measures"		
2020		Contingency measures needed if advanced technologies don't achieve planned emissions reductions		
2021–2040		Final attainment deadline: 2024 (2021-2023 data)	Final attainment deadline: 2032	

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1-Hour Ozone Air Quality Progress

The revoked 1-hour ozone standard is 0.12 ppm rounded to the closest hundredth. Thus, 1-hour ozone concentrations at or greater than 0.125 ppm are above the standard, and 1-hour ozone concentrations at or lower than 0.124 ppm meet the standard. If any hour in a day is above the standard, then that day is an *exceedance* day. The highest hourly concentration on a given day is recorded as the 1-hour ozone concentration for that day (though all hourly concentrations are kept on record and analyzed as well).

The attainment test for the 1-hour ozone standard is based on the number of exceedance days per year, averaged over a three-year period. A site with an average of 1.0 or fewer exceedance days per year, as averaged over a three-year period, meets the standard. In other words, if the site has 3.0 or fewer exceedance days in a three-year period, then it meets the standard; if that site has more than 3.0 exceedance days in a three-year period, then it does not meet the standard.

In 1996, there were 56 exceedance days of the revoked 1-hour ozone standard, basin-wide; in 2012, there were only two (see Figure ES-1). The 3-year average of 2009–2011 had only two sites failing the attainment test (Clovis and Arvin-Bear Mountain); for 2010–2012, only the Clovis site failed the attainment test. Compared to the average values 20 years ago, the Valley has a come a long way in reducing ozone concentrations and meeting its attainment goal.

In addition, the number of hours over the standard per year has decreased 97%, from 281 hours over the standard in 1996 to just 7 hours over the standard in 2012 (see Figure ES-2). Peak 1-hour ozone concentrations have decreased 13% from 2003 to 2012 (see Figure ES-3).

Figure ES-1 San Joaquin Valley Basin-Day 1-hour Ozone Exceedances

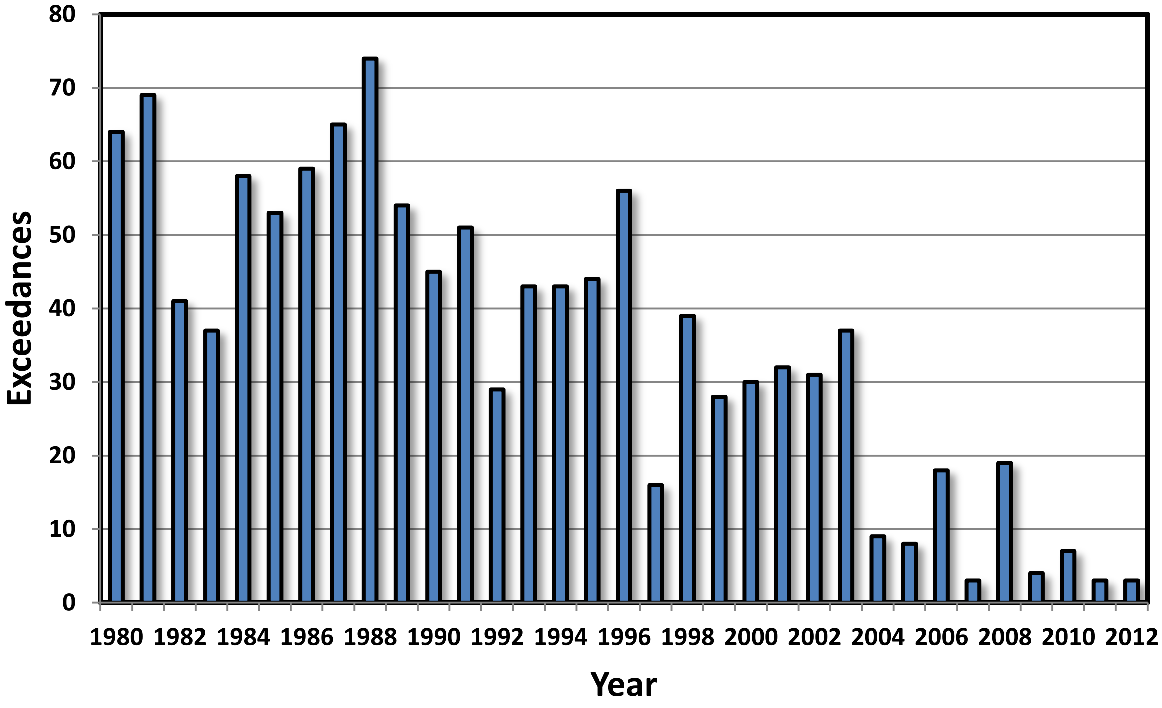


Figure ES-2 Total Hours Over the 1-hour Ozone Standard Among All Sites

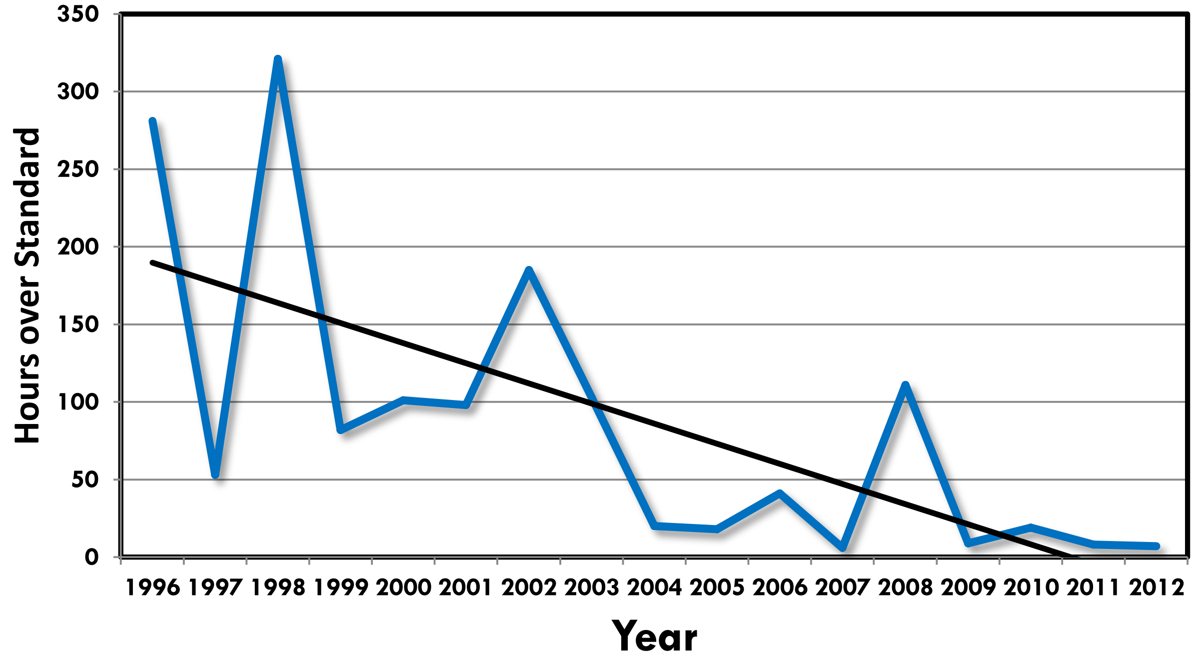
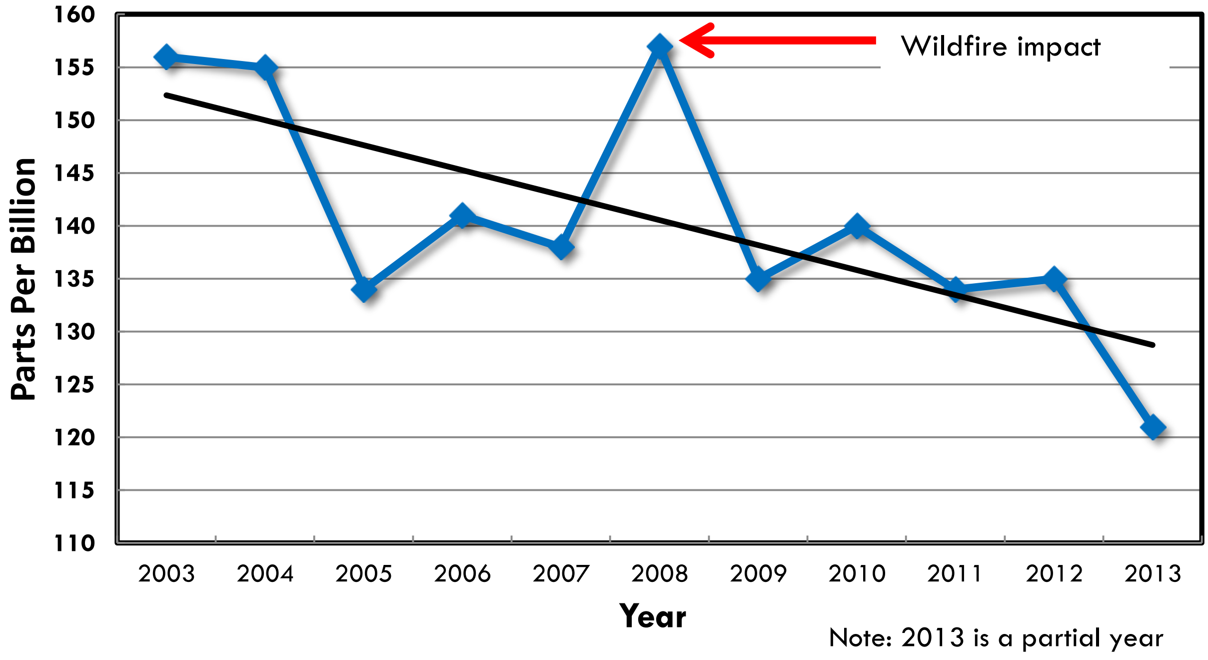


Figure ES-3 District Regional 1-Hour Ozone Maximum Value Trend



Note: 2013 is a partial year

Plan Requirements

The District's most recent full-attainment planning effort for 1-hour ozone was the *2004 Plan*, which used the best available information at the time and projected that the Valley would attain the 1-hour ozone standard in 2010. However, as discussed above, the District and other agencies nationwide shifted their ozone efforts to the more health-protective 8-hour ozone when EPA revoked the 1-hour ozone standard in 2005.

In its 2005 revocation of the 1-hour standard, EPA clarified which requirements were revoked and which remained in place. EPA adopted anti-backsliding provisions to preserve existing 1-hour ozone control measure and emissions reductions obligations; therefore, areas were still obligated to meet Rate of Progress (ROP) emissions reductions targets, adopt mandatory control measures, and meet any unmet attainment demonstration obligations. However, EPA revoked attainment designations and classifications, and stated that they would no longer make failure-to-attain findings, and would not require areas to demonstrate conformity for the 1-hour standard. Furthermore, EPA found that contingency measures for failure to make the appropriate Rate of Progress (ROP) milestones or to attain by the applicable attainment date were no longer required for 1-hour ozone.

Agencies moved forward based on these assumptions, but subsequent litigation and regulatory actions have reinstated many of the revoked 1-hour ozone requirements. For example, EPA issued a failure-to-attain finding for the Valley (and other areas) in 2011, noting in that finding that contingency measures and 185 fees (as discussed below) were required when an area fails to attain. When EPA withdrew its 2010 approval of the District's *2004 Plan* in 2012, it specified that the plan elements summarized in Table ES-2 must be included in a new 1-hour ozone plan. The District's *2013 Plan for Revoked 1-Hour Ozone Standard* will meet all applicable federal requirements.

Nonattainment of the federal 1-hour ozone standard past the 2010 attainment deadline also requires the District, per CAA §185, to impose and collect nonattainment penalty fees, all of which were to be deposited in the federal treasury with no likely expenditures in the Valley. However, using 2010 EPA guidance and 2008 California Assembly Bill 2522 (Arambula), codified as Health and Safety Code §40610, the District was allowed to implement a more equitable approach for collecting CAA §185 fees through DMV fees. These fees ultimately fund incentive programs to reduce emissions in the Valley. Together, DMV fees and District Rule 3170 (Federally Mandated Ozone Nonattainment Fee, amended May 19, 2011) meet the nonattainment fee requirements of CAA §185.

Table ES-2 *2013 Plan for Revoked 1-Hour Ozone Standard* Federal Requirements

Requirement	**Federal CAA**	**Location in plan**
Rate of Progress (ROP) demonstration	§172(c)(2) and 182(c)(2)	Chapter 4
Contingency measures: • For ROP • For attainment year	§172(c)(9) and 182(c)(9)	Chapter 4
Attainment demonstration	§182(c)(2)(A) and 172(a)(2)	Chapters 2 and 4
Reasonably Available Control Measures (RACM) demonstration	§172(c)(1)	Chapters 3 and 4; Appendix C
Clean fuels/clean technologies for boilers	§182(e)(3)	Chapter 4
Vehicle miles traveled (VMT) offset demonstration	§182(d)(1)(A)	Appendix D

Meeting the 1-Hour Ozone Standard

As a result of the hard work that has already been done to reduce emissions in the Valley, as discussed earlier in this Executive Summary, preliminary modeling indicates that the Valley will attain the 1-hour ozone standard by 2017 – before the final attainment year of 2022 and without relying on long-term measures under CAA §182(e)(5) (“black box reductions”).

The Upcoming Plan for the *2008 8-Hour Ozone Standard*

The plan for the 2008 8-hour ozone standard of 75 ppb would be due to EPA in 2015 or 2016, pending EPA’s final implementation rule for this standard. The foundational District and ARB analyses needed for this plan are already underway.

Given the naturally high background ozone levels and ozone transport into the Valley, attainment will be extremely difficult. Attaining the 2008 8-hour ozone standard will require significant additional emissions reductions. Attainment may not even be possible without a virtual elimination of the emissions associated with fossil-fuel combustion and transition to zero-emission technology. Although an attainment deadline of 2032 may seem like the distant future, in reality this deadline may not provide adequate time for the necessary transformative measures to be planned and implemented. These issues must be carefully considered in the course of preparing the plan for the 2008 8-hour ozone standard.

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ACRONYMS, ABBREVIATIONS, AND INITIALISMS

AADT: annual average daily trips
AB: Assembly Bill
ACC: Advanced Clean Cars
ACT: alternative control techniques
AEO: annual energy outlook
AERO: Advanced Emissions Reductions Options
AIP: achieved in practice
AIR: Association of Irritated Residents
AMI: acute myocardial infarction
AO: agricultural operations
APCO: Air Pollution Control Officer
AQI: Air Quality Index
AQIP: Air Quality Incentive Program
AQMD: Air Quality Management District
AQMP: Air Quality Management Plan
AQS: Air Quality System
ARB: California Air Resources Board
ARRA: American Reinvestment & Recovery Act
ATCM: Airborne Toxic Control Measure
ATV: all-terrain vehicles
AUSPEX: Atmospheric Utility Signatures, Predictions and Experiments
AWE: area-weighted exposure
BAAQMD: Bay Area Air Quality Management District
BACM: Best Available Control Measure
BACT: Best Available Control Technology
BAM/FEM: Real-time Beta-attenuation method monitors designated as federal equivalent method
BAM: beta-attenuation method
BAR: Bureau of Automotive Repair
BC: Boundary Conditions
BEIGIS: geographic information system based model for estimating BVOC emissions
BenMAP: The Environmental Benefits Mapping and Analysis Program
bhp: brake horsepower
BMP: best management practice
BVOC: biogenic volatile organic compound
CAA: Clean Air Act
CAF: confined animal facility
CAPCOA: California Air Pollution Control Officers Association
CARB: California Air Resources Board
CART: Classification and Regression Trees Method
CASAC: Clean Air Scientific Advisory Committee

CAV: clean air vehicle
CBIV: Carbon Bond IV Chemical Mechanism
CCAQS: Central California Air Quality Studies
CCDAQ: Clark County Department of Air Quality
CCOS: Central California Ozone Study
CCSE: California Center for Sustainable Energy
CEC: California Energy Commission
CE-CERT: University of California, Riverside College of Engineering - Center for Environmental Research and Technology
CEFS: California Emission Forecasting and Planning Inventory System
CEIDARS: California Emission Inventory Development and Reporting System
CEMS: Continual Emissions Monitoring System
CEPAM: California Emissions Projection Analysis Model
CEQA: California Environmental Quality Act
CFO: Clean Fuels Outlet
CFR: Code of Federal Regulations
CGYM: Clean Green Yard Machine
CH&SC: California Health and Safety Code
ChIP: Charbroiler Incentive Program
CM: control measures
CMAQ: Community Multi-Scale Air Quality
CMAS: Community Modeling and Analysis System
CMB: chemical mass balance
CMP: Conservation Management Practice
CNG: compressed natural gas
CO: carbon monoxide
CO2: carbon dioxide
COG: Council of Governments
COI: cost of illness
CPF: conditional probability function
CRF: concentration response function
CRPAQS: California Regional Particulate Air Quality Study
CSN: Chemical Speciation Network
CTG: Control Techniques Guidelines
CTM: chemical transport models
CV: cardiovascular; or coefficient of variation
CVAQ: Central Valley Air Quality Coalition
CVRP: Clean Vehicle Rebate Project
DC&E: Design, Community, and Environment
DERA: Diesel Emission Reductions Act
DF: deposition fraction
District: San Joaquin Valley Air Pollution Control District
DMV: Department of Motor Vehicles

DOE: Department of Energy
DOF: Department of Finance
DOGGR: California Department of Conservation’s Division of Oil, Gas, and Geothermal Resources
DOORS: Diesel Off-road On-line Reporting System
DPF: diesel particulate filter
DPR: Department of Pesticide Regulation
DTIM: Direct Travel Impact Model
DV: design value
EC: elemental carbon
EE: exceptional event
EF&EE: Engine, Fuel, and Emissions Engineering, Inc.
EF: emission factor
EFMP: Enhanced Fleet Modernization Program
EIC: Emission Inventory Code
EJ: Environmental Justice
EMFAC: Emission Factors Model
EPA: U.S. Environmental Protection Agency
EPDC: expected peak daily concentration
EQIP: Environmental Quality Incentives Program
ER: emergency room
ERC: emission reduction credits
ESP: electrostatic precipitator
eTRIP: Employer Trip Reduction Implementation Plan
FDDA: Four Dimensional Data Assimilation
FDOC: final determination of compliance
FEM: federal equivalent method
FFMP: Farmland Mapping and Monitoring Program
FIP: federal implementation plan
FMP: Flare Minimization Plan
FORTRAN: The IBM Mathematical Formula Translating System
FR: Federal Register
FRM: Federal Reference Method
FTIP: Federal Transportation Improvement Plan
FY: fiscal year
GE: gross error
GHG: greenhouse gas
GICG: Gridded Inventory Coordination Group
GIS: geographic information systems
GMRP: Proposition 1B Goods Movement Emission Reduction Program
GSE: ground support equipment
GVWR: gross vehicle weight rating
HEP: head end power

HHDV: heavy heavy-duty vehicles
HO: hydroxyl radical
HOTS: heavy oil test stations
HRRS: Heath-Risk Reduction Strategy
HVIP: Hybrid Truck and Bus Voucher Incentive Program
IC: internal combustion; or initial conditions
ICAPCD: Imperial County Air Pollution Control District
IEPR: Integrated Energy Policy Report
ILD: idle limiting device
ILEV: inherently low emission vehicle
IMP: imputed values
IMPROVE: Interagency Monitoring of Protected Visual Environments
IMS-95: Integrated Monitoring Study in 1995
IQR: interquartile range
ISR: indirect source review
JPA: joint powers authority
kW: kilowatt
lb/MMBtu: pounds per million British thermal units of heat output
LD50: dose causing death for 50% of the exposed subjects
LDA: light-duty passenger
LDT: light-duty trucks
LEV: low-emission vehicles
LHDV: light heavy-duty vehicles
LMA: Land Management Agency
LNB: low-NOx burners
LNG: liquefied natural gas
LPG: liquefied petroleum gas
LSI: large spark-ignited
LTO: low temperature oxidation
MACT: maximum achievable control technology
MCY: motorcycles
MDL: minimum detection limit
MDV: medium-duty vehicles
MEGAN: Model of Emissions of Gases and Aerosols from Nature
MFB: mean fractional bias
MFE: mean fractional error
MH: motor homes
MHDV: medium heavy-duty vehicles
MHP: medium horsepower
MIR: maximum incremental reactivity
MM5: Mesoscale Meteorological Model Version 5
MMBtu/hr: million British thermal units per hour
MMS: Mesoscale Meteorological Model

MODIS: Moderate Resolution Imaging Spectroradiometer
MOU: Memorandum of Understanding
MOZART: Model for Ozone and Related chemical Tracers
MPO: Metropolitan Planning Organization
MSA: metropolitan statistical area
MSW: municipal solid waste
MTBE: methyl tertiary butyl ether
MVCP: motor vehicle control program
MW: megawatt
NAAQS: national ambient air quality standards
NAICS: North American Industry Classification System
NAMS: National Air Monitoring Station
NB: normalized bias
NCAR: National Center for Atmospheric Research
NCEP: Nation Centers for Environmental Prediction
NESHAP: National Emission Standards for Hazardous Air Pollutants
ng/J: nanograms per Joule of heat output
NH3: ammonia
NMB: normalized mean bias
NMOC: non-methane organic compounds
NOAA: National Oceanic and Atmospheric Administration
NOx: oxides of nitrogen
NOy: reactive nitrogen
NQ: not quantifiable
NRCS: Natural Resources Conservation Service
NSCR: non-selective catalytic reduction
NSPS: new source performance standards
NSR: new source review
NTE: not-to-exceed
O3: ozone
OB: other buses
OBD: on board diagnostics
OBS: observed values
OC: organic carbon
OFP: ozone forming potential
OH: hydroxyl radicals
PAH: polycyclic aromatic hydrocarbons
PAMS: photochemical assessment monitoring stations
PAN: peroxy acetyl nitrate
PASS: Polluting Automobile Scrap and Salvage
PEER: Permit-Exempt Equipment Registration
PERP: Portable Equipment Registration Program
PEV: plug-in electric vehicles

PEVCC: Plug-in Electric Vehicle Coordinating Council
PFC: portable fuel container
PM: particulate matter
PM0.1: ultrafine particles
PM10: particulate matter that is 10 microns or less in diameter
PM2.0: particulate matter that is 2.0 microns or less in diameter
PM2.5: particulate matter that is 2.5 microns or less in diameter
PMF2: Positive Matrix Factorization Model version 2
POA: primary organic aerosols
Ppb: parts per billion
Ppm: parts per million
Ppmv: parts per million volume
PPN: particulate protein nitrogen
PPPA: peak prediction accuracy
PRB: policy relevant background
PROC REG: regression procedure
PST: Pacific Standard Time
PTFE: poly tetra fluoro ethylene
PUC: Public Utilities Commission
PWE: population-weighted exposure
QA: quality assurance
QC: quality control
RAAN: Real-Time Air Quality Advisory Network
RACM: reasonably available control measure
RACT: reasonably available control technology
RARE: Regional Applied Research Effort
RBS: Risk-Based Strategy
REES: Regional Energy Efficiency Strategy
REHEX: Regional Human Exposure Model
REMI: Regional Economic Models, Inc.
REMOVE: REduce MOtor Vehicle Emissions
RFP: reasonable further progress
RFP: request for proposal
RH: relative humidity
ROAR: Real-time Outdoor Activity Risk
ROG: reactive organic gases
ROP: rate of progress
ROS: reactive oxygen species
RRD: respirable road dust
RRF: relative response factors
RSAC: Reactivity Scientific Advisory Committee
RSD: remote sensing device
RTO: regenerative thermal oxidizer

RTP: regional transportation plan
RV: recreational vehicles
RVP: Reid Vapor Pressure
RWC: residential wood combustion
SAFETEA-LU: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SAPRC: State-wide Air Pollution Research Center chemical mechanism
SARMAP: SJVAQS/AUSPEX Regional Modeling Adaptation Project
SASS: Spiral Aerosol Speciation Sampler
SB: school buses
SB: Senate Bill
SBCAPCD: Santa Barbara County Air Pollution Control District
SBS: sodium bisulfate
SC: source category
SCAQMD: South Coast Air Quality Management District
SCC: source classification code
SCGC: Southern California Gas Company
SCM: suggested control measure
SCR: selective catalytic reduction
SCS: C-35 Sustainable Community Strategy
SEP: standard error of prediction
SFBA: San Francisco Bay Area
SFM: state Fire Marshall
SIC: standard industrial classification
SIP: state implementation plan
SJV: San Joaquin Valley
SJVAB: San Joaquin Valley Air Basin
SJVUAPCD: San Joaquin Valley Unified Air Pollution Control District
SLAM: state & local air monitoring system
SLAMS: state and local air monitoring stations
SMAQMD: Sacramento Metropolitan Air Quality Management District
SMAT: Speciated Modeled Attainment Test
SMOKE: Sparse Matrix Object Kernel Emission
SMS: Smoke Management System
SO2: sulfur dioxide
SO3: sulfur trioxide
SOA: secondary organic aerosol
SORE: small off-road engines
SOx: oxides of sulfur
SPM: special purpose monitoring
Study Agency: San Joaquin Valleywide Air Pollution Study Agency
SUV: sport utility vehicles
SWCV: solid waste collection vehicle

TAC: toxic air contaminant
TBD: to be determined
TCM: transportation control measure
TDM: transportation demand management
TOR: thermal optical reflectance
TOT: thermal optical transmittance
Tpd: tons per day
Tpy: tons per year
TRU: transport refrigeration unit
TSD: technical support document
TSM: transportation system management
TSP: total suspended particulates
UB: urban buses
UCD-CIT: University of California-California Institute of Technology
UCSF: University of California San Francisco
UFP: ultrafine particles
UHI: urban heat island
ULNB: ultra-low NOx burner
USDA: United States Department of Agriculture
USDA-ARS: United States Department of Agriculture-Agricultural Research Service
USG: unhealthy for sensitive groups
UTV: utility terrain vehicles
UV: ultraviolet
Valley: San Joaquin Valley
VCAPCD: Ventura County Air Pollution Control District
VDE: visible dust emissions
VDT: vehicle daily trips
VIP: Voucher Incentive Program
VMT: vehicle miles traveled
VOC: volatile organic compounds
VSL: value of a statistical life
WE: weekend effect
WFU: wildland fire use
WKW: West Kern Water
WOE: Weight of Evidence
WRF: Weather and Research Forecasting Model
WTP: willingness to pay
XRF: X-ray fluorescence
ZEB: zero-emission bus
ZEV: zero-emission vehicle
µg/m^3: micrograms per cubic meter

Chapter 1

Introduction

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CHAPTER 1: INTRODUCTION

The U.S. Environmental Protection Agency (EPA) periodically reviews and establishes health-based air quality standards (also referred to as National Ambient Air Quality Standards, or NAAQS) for ozone, particulates, and other pollutants. Although the San Joaquin Valley's (Valley) air quality is steadily improving, the Valley experiences unique and significant difficulties in achieving these increasingly stringent standards. Over the past couple of decades, the San Joaquin Valley Air Pollution Control District (District) has implemented several generations of emissions control measures for stationary and area sources under its jurisdiction. Similarly, the California Air Resources Board (ARB) has adopted regulations for mobile sources. Together, these efforts represent the nation's toughest air pollution emissions controls and have greatly contributed to reduced ozone and particulate matter concentrations in the Valley. Despite the significant progress under these regulations, greatly aided by the efforts of Valley businesses and residents, many air quality challenges remain.

The District is compiling this *2013 Plan for the Revoked 1-Hour Ozone Standard* to satisfy federal requirements under EPA's revoked 1-hour ozone standard. While this plan does not establish new emissions reductions strategies, it builds upon the District's 8-hour ozone and particulate matter (PM) strategies. Under these combined efforts, the Valley's 1-hour ozone concentrations have been and will continue to improve.

As of the posting of this plan, the Valley could attain the 1-hour ozone standard as early as 2013 with adopted and implemented measures. On the other hand, it takes as little as four hours over a three-year period (where those four hours occur on four separate days at a single air monitoring site) to keep an area out of attainment, and a single episode of ozone build up could prolong nonattainment past 2013. Therefore, 2017 is the official attainment year for this plan, per the modeling and other analyses conducted as part of this planning effort.

1.1 THE VALLEY'S UNIQUE CHALLENGES

The Valley's geography and meteorology exacerbate the formation and retention of high levels of air pollution. Surrounding mountains and consistently stagnant weather patterns prevent the dispersal of pollutants that accumulate within the Valley. The Valley has significant naturally occurring biogenic emissions. The California landscape also allows for air pollutant transport within the Valley, as well as between the Valley and other air basins. The Valley's low precipitation levels, high temperatures, and light winds are conducive to elevated ozone levels. These natural factors will continue to impact the Valley's progress toward attainment of air quality standards.

The Valley is also one of the fastest growing regions in the state (see Appendix B for more information). The Population Research Unit of the California Department of Finance (DOF) released interim revised population growth projections in May 2012.[1]

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[1] California Department of Finance [DOF]: Interim Population Projects for California and its Counties 2010–2050. (May 2012). Retrieved from http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php

Based on the revised 2010 to 2020 DOF data, the Valley's population is expected to increase by 18% (Table 1-1). In contrast, the total population for the State of California is projected to increase by only 9% over the same time period. Increasing population generally means increases in air pollutant emissions as a result of increased consumer product use and more automobile and truck travel. Between 2010 and 2020, the Valley's total vehicle miles traveled (VMT) will increase about 21%,[2] consistent with the Valley's population growth. In addition to increased VMT resulting from increased Valley population, the Valley will also see increased vehicular traffic along the State's major goods and people movement arteries, both of which run the length of the Valley.

Table 1-1 Estimated Valley Population by County, 2010–2020 [3]

County	Estimated 2010	Projected 2020
Fresno	932,926	1,083,889
Kern*	841,609	1,041,469
Kings	152,996	179,722
Madera	151,136	183,176
Merced	256,345	301,449
San Joaquin	686,651	795,631
Stanislaus	515,229	582,746
Tulare	443,567	536,429
Total	3,980,459	4,704,511

*Kern County is separated into two air districts: San Joaquin Valley and Eastern Kern. This data is for the Valley portion of Kern County only.

Although reducing mobile source emissions is critical to the Valley's attainment of air quality standards, the District does not have direct regulatory authority to reduce motor vehicle tailpipe emissions. These emissions are regulated by the EPA and ARB. As described in Chapter 3 of this plan and in Appendix D, the District must collaborate with its interagency partners and use innovative and non-regulatory approaches to reduce mobile source emissions, or a combination of regulatory and non-regulatory approaches such as new District Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs).

1.2 OZONE AND ASSOCIATED HEALTH IMPACTS

Ozone is a gas of three oxygen atoms (O3). Ground-level ozone is the main component of smog. It is not directly emitted into the atmosphere, but produced by a photochemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight (see Figure 1-1). The Valley generally experiences its highest ozone concentrations on hot, sunny summer days.

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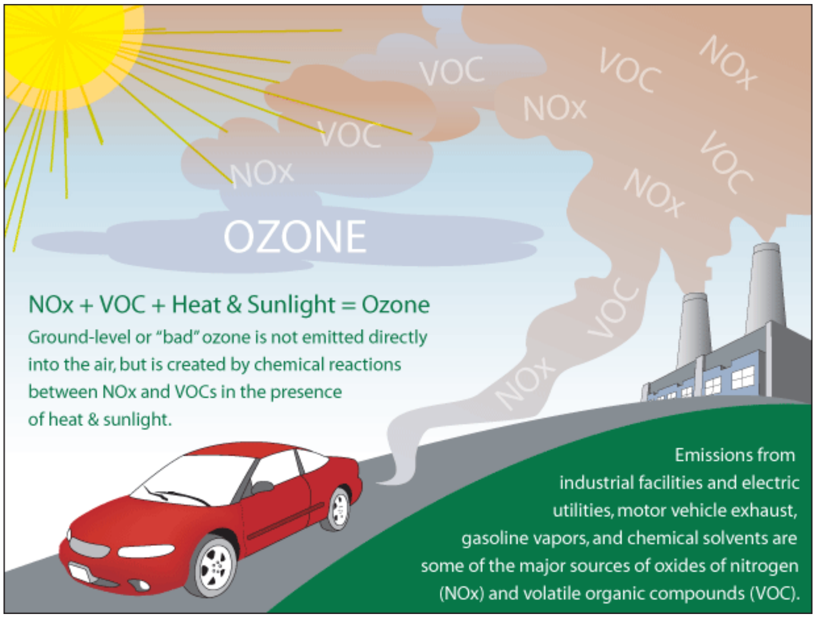
[2] California Air Resources Board: 2009 Almanac – Population and Vehicle Trends Tool. Retrieved July 2012 from http://www.arb.ca.gov/app/emsinv/trends/ems_trends.php

[3] Ibid. footnote 1.

Figure 1-1 Ozone Formation



Source: AirNow, <http://airnow.gov/index.cfm?action=jump.jump_ozone>

Breathing ozone can trigger a variety of health problems, including chest pain, coughing, throat irritation, and congestion. Breathing ozone can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. Other negative symptoms triggered by ozone include wheezing, coughing, and breathing difficulties or pain during exercise or outdoor activities. Children are at a greater risk of experiencing negative health impacts because their lungs are still developing and they are more likely to be active outdoors when ozone levels are high, thus increasing their exposure. Studies have linked rising hospital admissions and emergency room visits to higher ozone levels.

The District has several strategies for reducing public health impacts associated with ozone, including the following:

- ***2007 Ozone Plan* and Related District Regulations**. The District's *2007 Ozone Plan* outlines a comprehensive strategy for reducing ozone precursors to attain EPA's 1997 health-based standard for 8-hour ozone. See Chapter 3 for information on regulations implemented under this plan that have been reducing emissions and improving air quality.
- **Real-Time Air Advisory Network (RAAN).** The District launched RAAN in 2010 to provide the most accurate and timely information about local air quality. RAAN combines real-time, local air quality information with specific health recommendations to help schools, parents, and others make informed decisions about when outdoor activities should be limited and for whom.

- **Air Quality Index (AQI) and Daily Air Quality Forecasting.** An AQI is a color-coded designation for the day that projects the forecasted air quality and recommends corresponding activity modifications based on pollution levels.
- **Health-Risk Reduction Strategy (HRRS).** The District Governing Board adopted the HRRS to maximize public health improvements resulting from the District's attainment strategies and related initiatives. The HRRS works in parallel with the District's other strategies to minimize cumulative population exposure to air pollution and the corresponding regional health risk.
- **Air Alerts.** An Air Alert notifies the Valley of ongoing conditions that may lead to a federal ozone standard exceedance. When the District calls an Air Alert, Valley residents and businesses are advised to reduce vehicle use to proactively reduce emissions and protect public health. See Chapter 3 of this plan for more information.

1.3 NATIONAL AMBIENT AIR QUALITY STANDARDS

1.3.1 EPA's Standard-Setting Process

Clean Air Act (CAA) Sections (§) 108 and 109 require EPA to set health-based standards for six criteria pollutants. EPA periodically reviews existing standards to consider the most recent health studies. These reviews are to be conducted every five years, though in the past, some standard revisions did not meet the 5-year deadline.

The review process starts as the Clean Air Scientific Advisory Committee (CASAC) analyzes available science and then, if supported by research, suggests to EPA a range of revised standards that would protect public health from the adverse effects of air pollution. The EPA Administrator appoints CASAC members, who are non-EPA experts in the fields of science, engineering, or the social sciences. The committee is to provide objective, independent advice to EPA on the technical basis for the standard. Thousands of peer-reviewed scientific studies are considered as EPA formulates its proposed standard, which is made available for scientific peer review and public comment. EPA then sets the standard.

In evaluating and setting new standards, federal law prohibits EPA from taking into account economic feasibility. However, economic feasibility issues *can* be considered as EPA promulgates the implementation rules that establish the deadlines for meeting the standards and in devising individual control measures aimed at attaining the standards.

Once a standard is set, EPA designates an area as *attainment* or *nonattainment* based on the most recent three years of air quality data available. For ozone, EPA classifies nonattainment areas as *marginal*, *moderate*, *serious*, *severe*, or *extreme*. The classification sets the attainment deadline and other planning requirements. The classification is to be based on certain air quality parameters, though areas can request reclassification with adequate documentation.

EPA also adopts implementation rules to guide states and local air districts as they prepare state implementation plans (SIPs) to bring areas into attainment with the standard. While EPA cannot consider costs or difficulty in setting the standards, costs and difficulty are inescapable for local air districts as they determine the best way to bring areas into attainment. That being said, local air districts must meet planning and attainment requirements to avoid federal sanctions and to improve public health.

There are a number of serious penalties and risks associated with any failure to submit approvable attainment strategies for meeting federal standards. Upon development of an attainment strategy, an area submits the plan to EPA for approval. If EPA finds that an area fails to submit an approvable plan on time or fails to implement plan commitments after the plan has been approved, then the following sanctions may be applied:

- Two-to-one offset requirement for major sources, leading to a de facto ban on new and expanding business
- Loss of federal highway funds, which would cost the Valley an estimated $250 million per year
- A federal implementation plan (FIP), which would result in a loss of local control

Once EPA approves a SIP, that plan becomes federally enforceable. The plan can then be enforced by the public or EPA through lawsuits. In addition, failure to reach attainment by the deadline would result in the assessment of CAA §185 penalty fees.

1.3.2 Federal Ozone Standards and Implementation

Table 1-2 summarizes EPA's ozone standards and the timing of attainment plans under those standards consistent with CAA requirements. EPA established the first ozone standard in 1979, setting this standard at 0.12 parts per million (ppm) over a 1-hour exposure, or 124 parts per billion (ppb) when accounting for the adopted rounding conventions. An area meets the 1-hour ozone standard when, for each monitoring station, the 1-hour ozone levels do not exceed 124 ppb more than one day per year over any three-year period.[4] The CAA Amendments of 1990 established attainment planning requirements and attainment deadlines for the 1979 1-hour ozone standard, and the District subsequently adopted various 1-hour ozone plans and plan amendments. EPA revoked the 1-hour standard effective June 15, 2005,[5] maintaining that the 84 ppb 8-hour ozone standard adopted in 1997 was more health protective. In response, the District and other agencies nationwide shifted their ozone efforts to 8-hour ozone.

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[4] National 1-Hour Primary and Secondary Ambien Air Quality Standards for Ozone, 40 C.F.R. §50.9 (2012)

[5] Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas with Deferred Effective Dates, 69 Fed. Reg. 84, pp. 23858–23951. (2004, April 30). (to be codified at 40 C.F.R. Part 81)

Table 1-2 Federal Air Quality Standards and Valley Status for Ozone

Federal Standard	**Ozone Standards and Timelines**			
	1979 1-hour	**1997 8-hour**	**2008 8-hour**	**2014 8-hour**
	124 ppb (1-hour average)	**84 ppb (8-hour average)**	**75 ppb (8-hour average)**	**TBD**
1979–2003	EPA sets standard (1979)	EPA sets standard (1997)		
2004	SJV attainment plan	EPA finalizes attainment designations and classifications		
2005	**EPA revokes standard**	EPA implementation rule		
2006	*Litigation reinstates portions of implementation requirements under the revoked standard*			
2007		Attainment plan due (SJV's *2007 Ozone Plan*)		
2008			EPA sets standard	
2009				
2010	EPA approved SJV 2004 plan	Midcourse review	EPA proposes to revise standard: down to 60 or 70 ppb	
2011	Ninth Circuit remands plan approval to EPA; EPA finds SJV failed to attain		EPA announces that it won't revise the standard	
2012	EPA finalizes withdrawal of approval of 2004 1-hour ozone plan. SJV plan withdrawn	EPA approves SJV's *2007 Ozone Plan*	EPA attainment designation (SJV: extreme nonattainment)	
⇨ 2013	**SJV to submit new 1-hour ozone plan (final attainment year to be determined)**		EPA proposes implementation rule	EPA to propose standard
2014		District/ARB to revisit 2007 plan		EPA to finalize standard
2015			SJV to submit 8-hour ozone plan (2015 or 2016, based on proposed implementation rule)	*Designations & attainment plan timing to be determined*
2016				
2017				
2018				
2019		Identify specific "Long-Term Control Measures"		
2020		Contingency measures needed if advanced technologies don't achieve planned emissions reductions		
2021–2040		Final attainment deadline: 2024 (2021–2023 data)	Final attainment deadline: 2032	

The District's *2007 Ozone Plan* demonstrates attainment of the 1997 8-hour ozone standard no later than the 2024 attainment deadline. In 2008, EPA revised its 8-hour ozone standard, lowering the standard to 75 ppb. EPA considered lowering the standard once again in 2010, but ultimately retained the 75 ppb standard. EPA designated the Valley as nonattainment of the 2008 8-hour ozone standard in 2012, and the attainment plan for the 2008 standard is due in 2015 or 2016 based on the EPA implementation rule. However, EPA has not revoked the 1997 standard, so planning commitments related to that standard also remain in place. EPA is expected to review and consider further revision to the 8-hour ozone standard in the 2013–2014 timeframe.

Despite the complexity of overlapping standards and plans, efforts to reduce ozone precursors under one standard and plan also will help to reduce ozone precursors necessary to meet other ozone standards, including more stringent ozone standards on the horizon. The control measures adopted by the District and ARB under the *2007 Ozone Plan* and other attainment plans are achieving significant reductions of ozone precursors. These measures and strategies will continue to achieve intended emissions reductions as they are implemented. These reductions help decrease both 1-hour ozone and 8-hour ozone concentrations, contributing to attainment of the revoked 1-hour ozone standard and the multiple 8-hour ozone standards. Building on the District's *2007 Ozone Plan, 2008 PM2.5 Plan*, and the *2012 PM2.5 Plan*, the District continues to coordinate emission reduction strategies whenever possible to address multiple standards, to maximize efficiency for staff and stakeholders, and to maximize health benefits.

1.3.3 1-Hour Ozone Requirements

The most recent full-attainment planning effort for 1-hour ozone was the *2004 Extreme Ozone Attainment Demonstration Plan* (*2004 Plan*), which used the best available information at the time and projected that the Valley would attain the 1-hour ozone standard in 2010. However, as discussed above, the District and other agencies nationwide shifted their ozone efforts to 8-hour ozone when EPA revoked the 1-hour ozone standard in 2005.

In its 2005 revocation of the 1-hour standard, EPA clarified which requirements were revoked and which remained in place. EPA adopted anti-backsliding provisions to preserve existing 1-hour ozone control measure and emissions reductions obligations; therefore, areas were still obligated to meet Rate of Progress (ROP) emissions reductions targets, adopt mandatory control measures, and meet any unmet attainment demonstration obligations (i.e., submit a 1-hour attainment demonstration or satisfy one of EPA's alternative compliance options). However, EPA revoked attainment designations and classifications, and stated that they would no longer make failure-to-attain findings, and would not require areas to demonstrate conformity for the revoked 1-hour standard. Furthermore, EPA found that contingency measures for failure to make the appropriate Rate of Progress (ROP) milestones or to attain by the applicable attainment date were no longer required for 1-hour ozone.[6]

Agencies moved forward based on these findings, but subsequent litigation and regulatory actions have reinstated many of the revoked 1-hour ozone requirements. For example, EPA issued a failure-to-attain finding for the Valley (and other areas) in 2011, noting in that finding that contingency measures and 185 fees (as discussed below) were required when an area fails to attain. When EPA withdrew its 2010 approval of the District's *2004 Plan* in 2012, it specified that the plan elements summarized in Table 1-3 must be included in a new 1-hour ozone plan. The District's *2013 Plan for Revoked 1-Hour Ozone Standard* meets all applicable federal requirements.

Table 1-3 *2013 Plan for the Revoked 1-Hour Ozone Standard* Federal Requirements

Requirement	Federal CAA	Location in plan
Rate of Progress (ROP) demonstration	§172(c)(2) and 182(c)(2)	Chapter 4
Contingency measures: • For ROP • For attainment year	§172(c)(9) and 182(c)(9)	Chapter 4
Attainment demonstration	§182(c)(2)(A) and 172(a)(2)	Chapters 2 and 4
Reasonably Available Control Measures (RACM) demonstration	§172(c)(1)	Chapters 3 and 4; Appendix C
Clean fuels/clean technologies for boilers	§182(e)(3)	Chapter 4
Vehicle miles traveled (VMT) offset demonstration	§182(d)(1)(A)[7]	Appendix D

Nonattainment of the revoked federal 1-hour ozone standard past the 2010 attainment deadline also requires the District, per CAA §185, to impose and collect nonattainment penalty fees, all of which were to be deposited in the federal treasury with no likely expenditures in the Valley. However, using 2010 EPA guidance and 2008 California Assembly Bill 2522 (Arambula), codified as Health and Safety Code §40610, the District was allowed to implement a more equitable approach for collecting §185 fees through Department of Motor Vehicle (DMV) fees. These fees ultimately fund incentive programs to reduce emissions in the Valley. Together, DMV fees and District Rule 3170 (Federally Mandated Ozone Nonattainment Fee, amended May 19, 2011) meet the nonattainment fee requirements of CAA §185.

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[6] Implementation of the 8-Hour Ozone National Ambient Air Quality Standard – Phase 1: Reconsideration. 70 Fed. Reg. 101, pp 30592–30604 at p. 30592. (2005, May 26). Retrieved from http://www.epa.gov/fedrgstr/EPA-AIR/2005/May/Day-26/a10580.pdf

[7] See also EPA Guidance: Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled. (2012, August). Retrieved from http://www.epa.gov/otaq/stateresources/policy/general/420b12053.pdf.

1.3.4 State Standards

California also sets ambient air quality standards for several pollutants, including ozone. The California ambient air quality standards are considerably more stringent than the federal standards and are more protective of human health. California's 1-hour ozone standard is 0.09 ppm, and its 8-hour ozone standard is 0.070 ppm.

Despite the more stringent California standards, California Health and Safety Code §39602 states, "Notwithstanding any other provision of this division, the state implementation plan shall only include those provisions necessary to meet the requirements of the [federal] Clean Air Act." While the federal standards provide the framework for SIPs, including this ozone plan, progress toward federal standards also brings areas closer to attainment of the lower, California standards.

1.4 PUBLIC PROCESS OF PLAN DEVELOPMENT

The District and ARB worked collaboratively on the required 1-hour ozone plan components. The District expected to present this plan to the Governing Board at a public hearing in June 2013, but postponed plan adoption to allow for additional modeling. The District ultimately used the following timeline for the public process (Table 1-4).

Table 1-4 *2013 Plan for Revoked 1-Hour Ozone Standard* Timeline

April 2013	Public workshop and commenting period
May – July 2013	Additional modeling and analysis
August 2013	Proposed draft of the plan
September 2013	District Governing Board public hearing to adopt the plan
November 2013	ARB hearing to adopt the SJV plan

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Chapter 2

Scientific Foundation, Trends, and Modeling Results

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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CHAPTER 2: SCIENTIFIC FOUNDATION, TRENDS, AND MODELING RESULTS

Ozone (O_3), a molecule of three oxygen atoms, is a product of atmospheric reactions involving volatile organic compounds (VOCs), oxides of nitrogen (NOx), the hydroxyl radical (HO), other radicals, and sunlight. As such, ozone is not emitted directly but, rather, is formed secondarily. Ozone is found in two regions of the Earth's atmosphere: the upper regions of the atmosphere (the stratosphere), where the ozone layer is effective in absorbing the Sun's ultraviolet (UV) radiation; and ground-level (or tropospheric) ozone. At high concentrations, this ground-level ozone can be harmful to public health and can degrade the environment.

As a pollutant, ozone has been measured in the San Joaquin Valley air basin (Valley) and across the nation for decades. The District, ARB, EPA, and private partners have invested millions of dollars into Study Agency field study, analysis, and modeling over the last several decades to build a strong scientific foundation for the Valley's ozone attainment plans.

This chapter summarizes the contributions to the Valley's 1-hour ozone levels, ozone research, trends in the Valley's 1-hour ozone concentrations, and projections of 1-hour ozone that show attainment of the 1979 standard by 2017. For more information, see Appendix A (Ambient 1-Hour Ozone Data Analysis), Appendix B (Emissions Inventory), and Appendix F (Modeling Approach and Results).

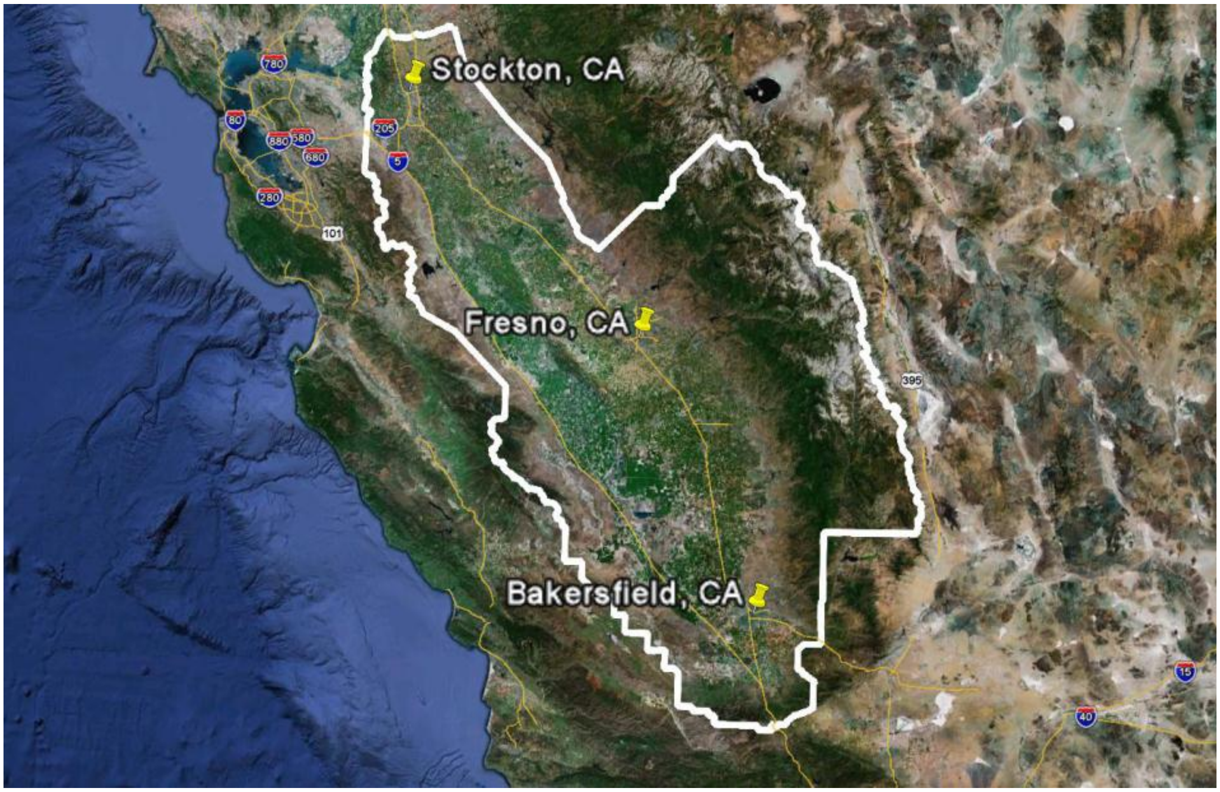
2.1 CONTRIBUTIONS TO THE VALLEY'S 1-HOUR OZONE LEVELS

Contributions to the Valley's ozone levels are a function of geography and natural environment (including meteorology), the production and presence of ozone precursors (e.g. NOx and VOCs), the atmospheric chemistry that controls the ozone life cycle, and the import of non-Valley emissions into the Valley. All of these factors, except geography, vary throughout the year, but during the summer months they combine to account for the Valley's highest annual ozone concentrations.

2.1.1 The Valley's Natural Environment

The topography and climate in the Valley create ideal conditions for generating and trapping ozone precursors, and then creating and retaining ozone air pollution. Comprising nearly 25,000 square miles, the Valley is a continuous intermountain basin (Figure 2-1).

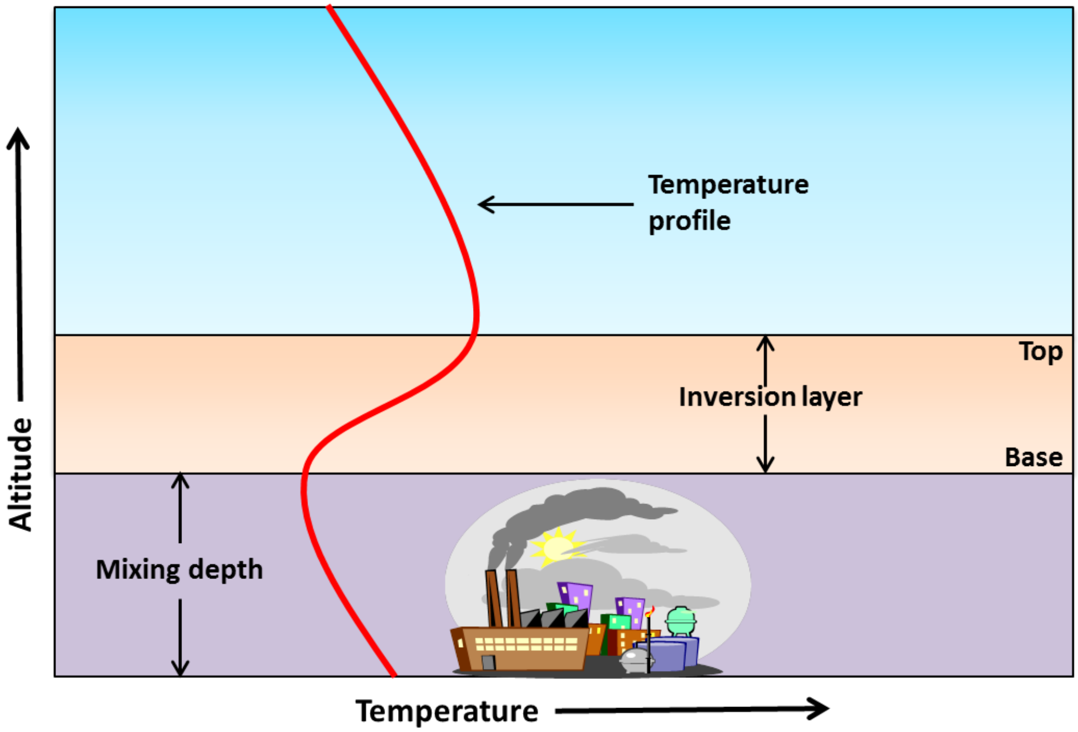
Figure 2-1 San Joaquin Valley Air Basin



During the summer months, low precipitation levels, high temperatures, light winds, and afternoon northwesterly winds in the Valley are conducive to forming and transporting elevated ozone levels from the northern to southern region of the Valley. The Valley averages over 260 sunny days per year. Nearly 90% of the annual precipitation in the Valley falls between the months of November through April, with little to none occurring during the summer months.

Inversion layers and vertical mixing can influence ambient air quality. A temperature inversion, or increasing temperature with increasing height (Figure 2-2), can shut down the vertical mixing of an air mass, thus creating a situation in which pollutants are trapped near the earth's surface. Temperature inversions are common in the Valley throughout the year. The base of the inversion acts as a lid on the atmosphere, trapping pollution by limiting vertical dispersion. During the summer, inversion events caused by high pressure systems cause air pollutant emissions to build up. Ozone precursors then react to form ozone, which can in turn build in concentrations from day to day under a prolonged period of atmospheric stagnation.

Figure 2-2 Effect of Temperature Inversion on Pollutant Dispersion

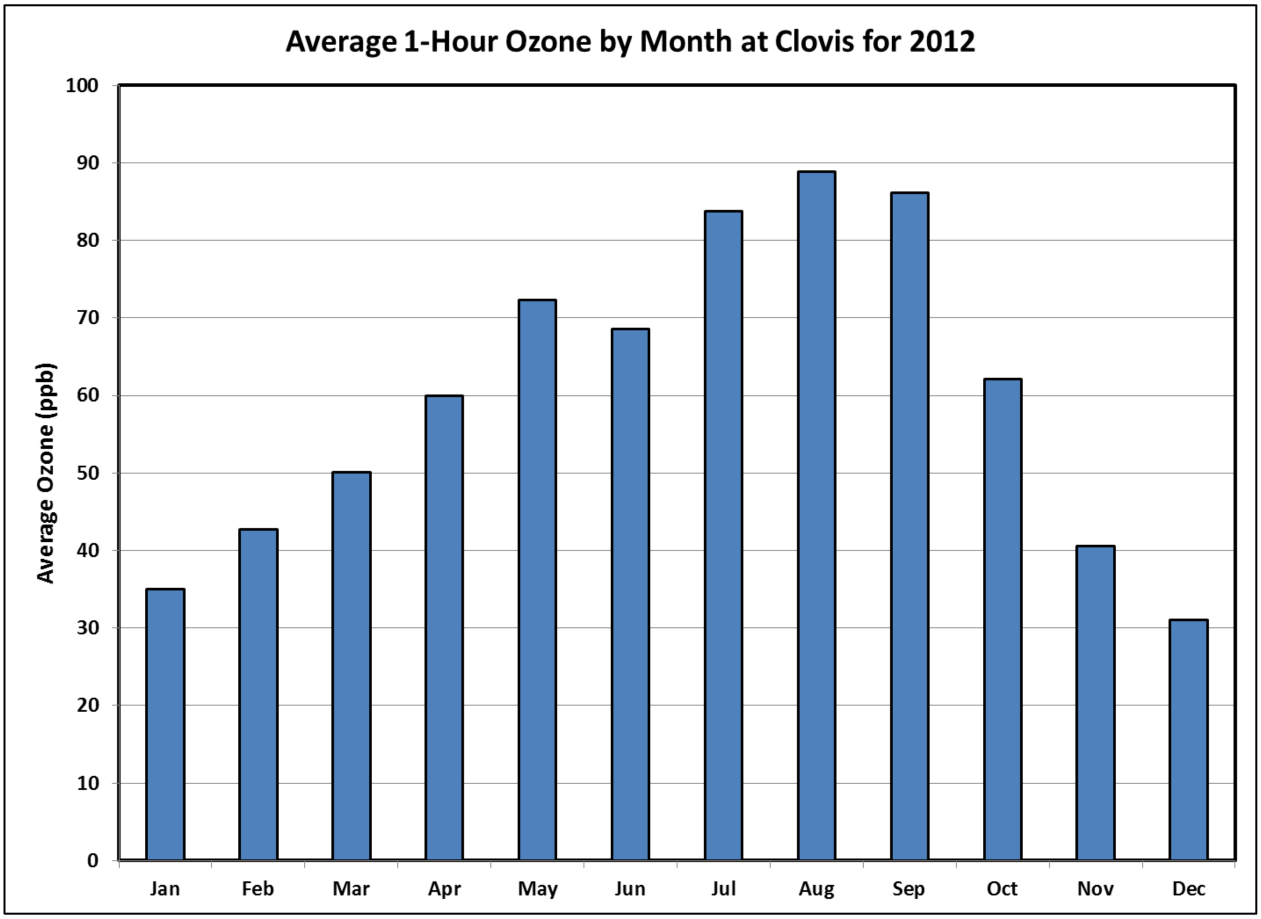


Winds, at ground level or at higher altitudes, transport pollutants from other regions into the Valley, within the Valley to areas downwind, and from the Valley into other regions. The amount of pollution transported from other areas into the Valley varies. Typically during an average summer day, surface winds pick up ozone precursors emitted in regions to the north of the Valley and transports them southeast toward the central and southern end of the basin where ozone levels have the potential to form at their highest concentrations. Air flow also moves upslope along the Sierra Nevada Mountains during the day as the air heats up, and then moves downslope as the air cools in the evening.

Because of frequent high pressure systems influencing Valley meteorological and dispersion conditions during the summer months, ozone concentrations tend to be the highest from June to September. As an example, Figure 2-3 shows the average 1-hour ozone concentration per month during 2012 for the Clovis air monitoring site. Ozone concentrations rise from the beginning of the year toward the summer where levels reach their peak by August when temperatures are usually the warmest and when high pressure and stagnation over the Valley are most common.

California’s summer wildfires can also affect ozone air quality. These fires emit ozone precursors and particulates that can be transported by wind to the Valley. The precursors react to form ozone, although particulates in the smoke plume can sometimes reduce ozone formation rates by blocking sunlight. During the summer of 2008, California experienced a record number of wildfires. The resulting emissions caused serious public health impacts and unprecedented levels of PM2.5 and ozone in the Valley and other regions throughout the state.

Figure 2-3 2012 Monthly Average Ozone at Clovis



2.1.2 Emissions of Ozone Precursors

The District and the California Air Resources Board (ARB) maintain an accounting of ozone precursor emissions for the Valley. This emissions inventory represents an estimate of how much direct pollution is being emitted from various pollutant-generating activities and sources. The emissions inventory is used to develop control strategies, to determine the effectiveness of permitting and control programs, to provide input into air quality modeling, to fulfill rate-of-progress (ROP) requirements, and to address other planning needs.

Appendix B contains NOx and VOC emissions inventories for anthropogenic (emissions generated from human activities) sources for the years 2007 through 2022. As shown in Figure 2-4, NOx emissions will steadily decline through 2017 as current control strategies continue to be implemented. Figure 2-5 shows that VOC emissions are projected to be relatively stable from 2014 forward; however, VOC emissions decreased 28% between 2000 (not shown) and 2014. These emissions inventory trends show the progress made through progressive regulatory and non-regulatory activities. As rules are adopted or amended with tighter emission limits, or as emission reduction control technologies improve, overall emissions decrease. In light of the Valley's projected increase in population over this time period, the projected emissions reductions highlight the success of the control measures adopted and enforced by the District, ARB, and other regulatory agencies.

Figure 2-4 Summer NOx Trends in the Valley

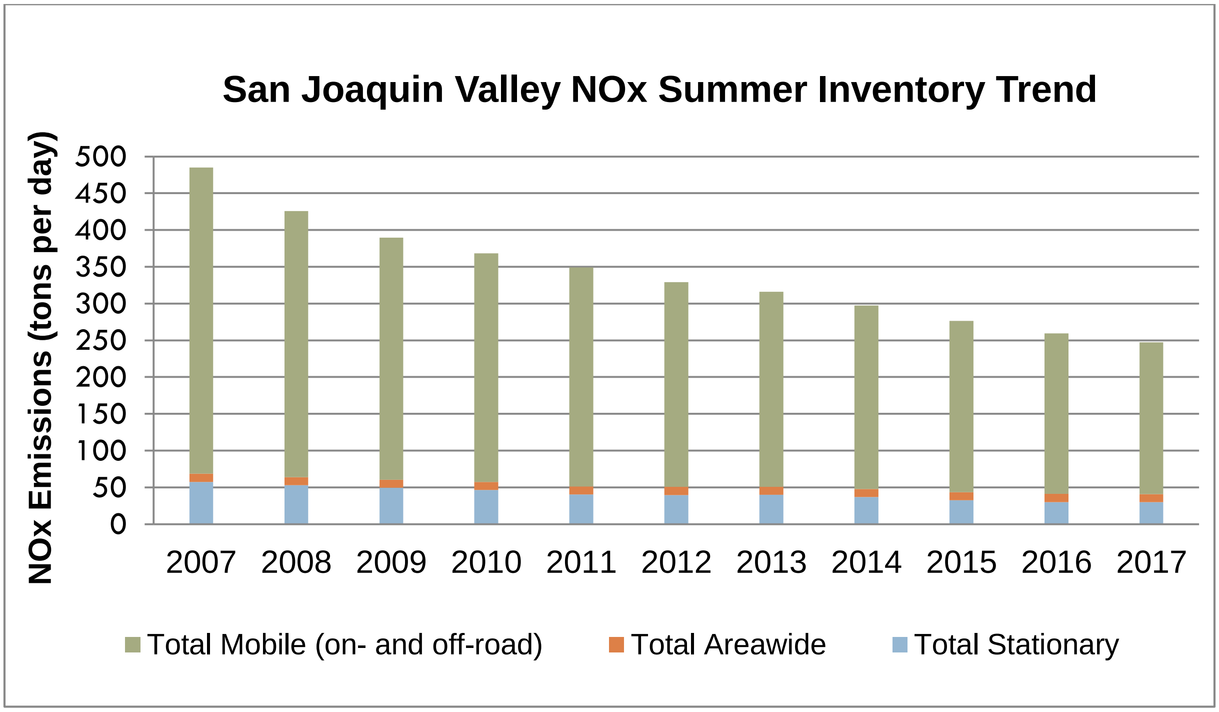
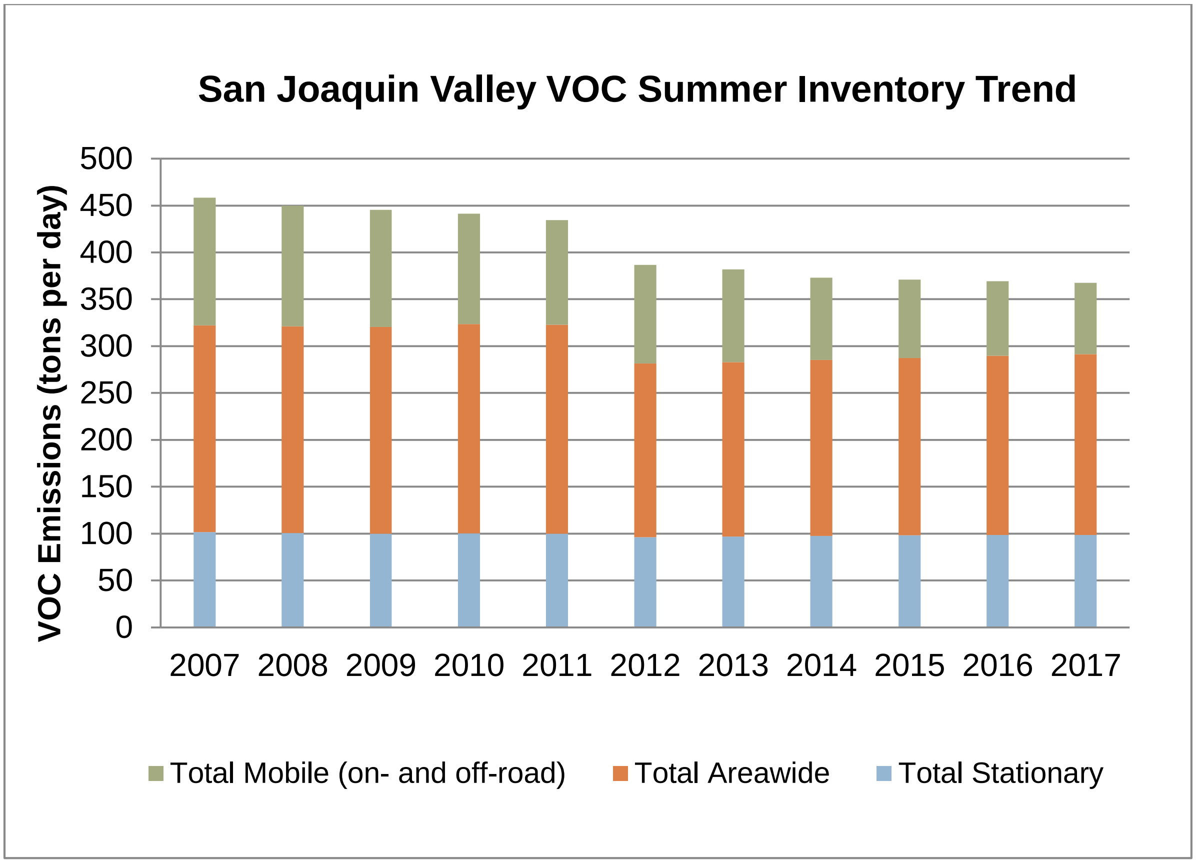


Figure 2-5 Summer VOC Trends in the Valley



Only anthropogenic emissions are subject to regulatory requirements. However, biogenic emissions from vegetation, which are estimated and included in photochemical modeling analyses, can overwhelm anthropogenic VOC emissions, particularly during the Valley's ozone season (see Appendix E (Modeling Protocol) for more information).

2.1.3 The Nature and Formation of Ozone

Ozone is a product of intricate atmospheric reactions involving VOCs, NOx (such as NO_2 and NO), the hydroxyl radical (HO), other radicals, and sunlight (photon energy). The concentration of ambient ozone at any given location in the Valley is a function of the natural environment, ozone precursor emissions, and atmospheric chemistry.

2.1.3.1 The Ozone Life Cycle

In a balanced atmosphere, where precursor emissions of VOC and NOx levels are relatively low, ozone is both created and destroyed at a pace to keep ozone at acceptable background levels. This ozone life cycle occurs continuously while sunlight is present, but ends at nightfall.

The following reactions summarize the ozone life cycle process:

(1) NO_2 + photon energy from the sun → NO + O
(2) O + $O_2 \rightarrow O_3$ (*ozone formed*)
(3) O_3 + NO → NO_2 + O_2 (*ozone breaking down*)
The O_3 molecule is a very strong oxidizing agent. It is very willing to give away the additional oxygen atom to another molecule and become the more stable O_2.

The ozone life cycle becomes unbalanced in the presence of elevated precursor emissions. As noted in Section 2.1.2, biogenic VOC emissions are especially high during the Valley's summer ozone season. The same photon energy that reacts with NO_2 in the balanced reaction set also reacts with ozone in the presence of water (humidity) to form hydroxyl radicals (HO) that quickly oxidize VOCs to produce peroxy radicals (RO_2), which in turn react quickly with dissociated NO to form NO2, bypassing the ozone consumption process. The following set of reactions summarizes this alternate chain of events:

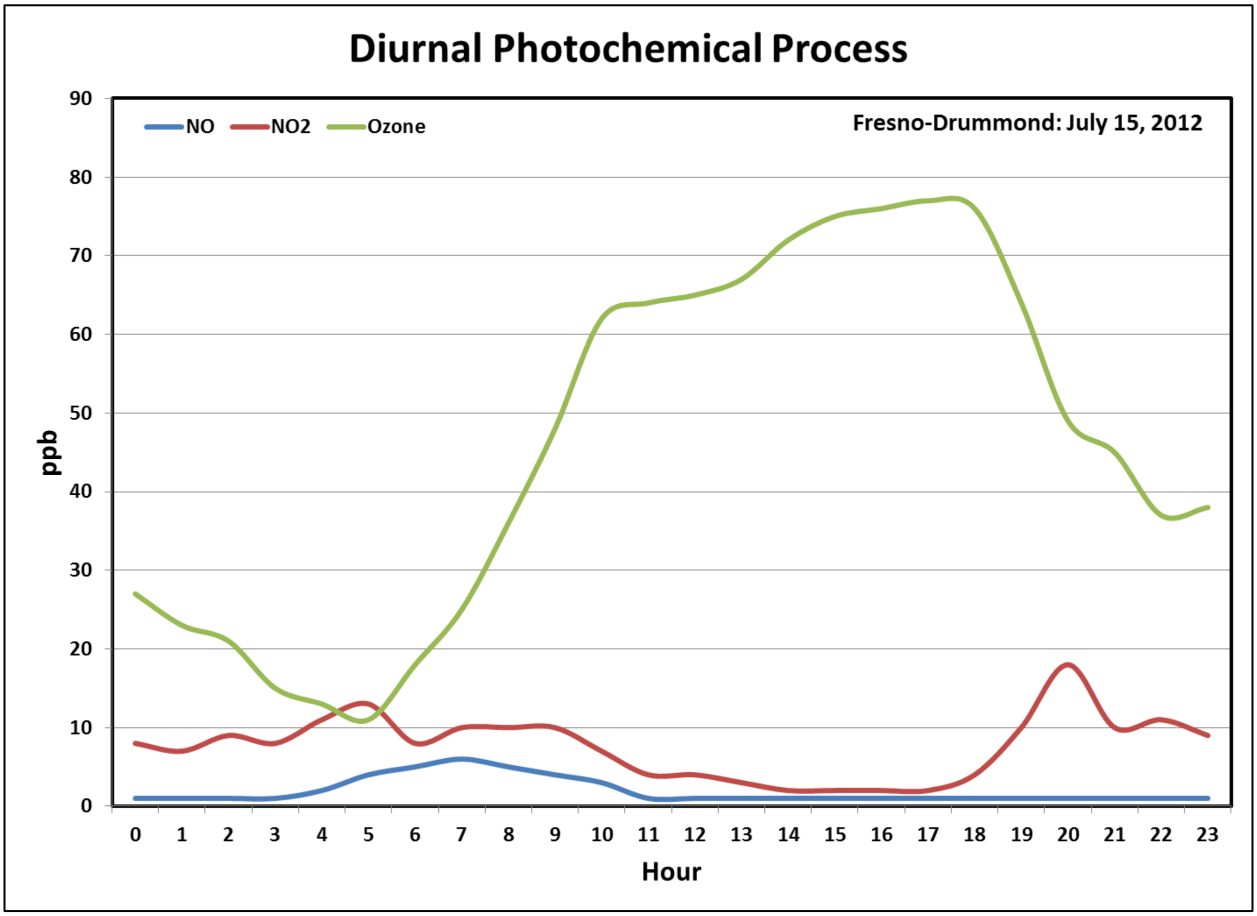
(1) NO_2 + photon energy from the sun → NO + O
(2) O + $O_2 \rightarrow O_3$ (*ozone formed*)
(3) RO_2 + NO → RO + NO_2 (*ozone does NOT break down*)

The multi-step breakdown of VOCs (mostly biogenic) regenerates radicals, which work as the fuel, or catalyst, consuming the dissociated NO and driving the ozone production cycle (without ozone break down).

This catalytic process is cut off as night falls, or with the removal of the photon energy input. Once the sun sets, ozone levels fall. Figure 2-6 is an example of the diurnal photochemical ozone formation process under unbalanced conditions and shows the concentration of NO, NO_2, and ozone throughout the hours of a common summer day. The day begins with low ambient levels of NOx (NO and NO_2) and ozone. As the morning commute begins, NOx emissions increase as these pollutants are emitted directly from motor vehicle traffic. The influx of NOx emissions between hours four and seven provide the initial startup of the rapid, unchecked photochemical production of ozone beginning at hour five and increasing into the late afternoon. As ozone production increases, NO and NO_2 concentrations fall quickly to almost zero (being consumed by VOC reactions). In the early evening, with waning sunlight and decreasing photon energy, ozone production ceases and its concentration rapidly diminishes as NO and NO_2 levels return to normal ambient levels.

While biogenic VOC emissions are prevalent throughout the Valley, additional VOC emissions from the combustion of fossil fuels combined with NOx emissions from the same mobile and stationary sources found in metropolitan areas give rise to the highest concentrations of ground level ozone in the Valley.

Figure 2-6 Photochemical Process for a Valley Summer Ozone Day



2.1.3.2 Relative Roles of VOCs and NOx in Ozone Formation

Both VOC and NOx emissions contribute to the formation of ozone. However, although the breakdown of VOCs provides the fuel for unchecked ozone production throughout a summer day in the Valley, ozone production is more sensitive to the amount of NOx under high-VOC and relatively lower-NOx conditions. For most of the summer ozone season, the Valley is characterized by this *NOx-limited regime*.

Determination of an ozone chemical regime is not a straight-forward task. As described below, the District, ARB, EPA, and private partners have invested millions of dollars into Study Agency field study, analysis, and modeling over the last several decades to build a strong scientific foundation for the Valley's ozone attainment plans. To date, grid-based photochemical models remain the best available tool to determination relative precursor limitations. Modeling for the *2013 Plan for the Revoked 1-Hour Ozone Standard* and other ozone SIPs shows that the Valley is a *NOx-limited regime*, especially in projections of future years. For this reason, the District focuses its emissions reductions efforts on NOx reductions, as they are most effective in reducing Valley ozone concentrations.

Other ozone chemical regimes include a *NOx-rich* regime, in which ozone formation is more sensitive to the amount of VOCs, and a regime in which VOC and NOx equally contribute to ozone formation. As proven through extensive modeling and successful reduced ambient ozone levels based on NOx-centric strategies, developing reduction strategies based on these regimes would not be effective in the Valley.

2.1.3.3 The Propensities of Different VOCs to Form Ozone

The potential of VOCs to form ozone is specific to the type of VOC. VOCs include many different compounds, each with different properties that contribute differently to ozone formation. These differences in ozone forming potential, or *propensities*, of VOCs are quantified as ozone *reactivities*.

VOC *reactivity scales* have been developed to measure the ozone forming potential of individual VOCs,[1,2,3] of which the most frequently used is the *maximum incremental reactivity* (MIR) scale.[4,5] Incremental reactivity is defined as the amount of additional ozone formation, under optimal NOx conditions, resulting from an addition of a small amount of the given VOC to the system in which ozone is formed, divided by the amount of VOC added. See Section 2.2.3 for recent research results on Valley VOC reactivity trends. While understanding VOC reactivity is an important component of ozone plan analysis, research and modeling have shown the Valley to be NOx-limited; therefore, NOx reductions are the most effective strategy for reducing Valley ozone concentrations.

2.1.4 SJV Trans-Boundary Emissions and Policy-Relevant Background Ozone

As ozone research continues, evidence is mounting that ozone formation is not only affected by precursor emissions originating within the Valley, but is in part affected by trans-boundary emissions; in other words, pollutants are migrating from sources outside the Valley and settling within the Valley. This issue has given rise to the term *policy relevant background* (PRB) ozone, which is defined as the surface ozone concentration that would be present over the U.S. in the absence of North American anthropogenic (human caused) emissions. PRB ozone includes emissions from both biogenic (plant life) and trans-boundary sources.

The 1990 amendments to the Clean Air Act (CAA) recognize the potential threat of trans-boundary ozone flow to attainment. While not absolved from implementing reasonably available controls to reduce emission from sources under their control, CAA §179B (International Border Areas), mandates that state, local, and regional authorities

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[1] Bowman, F. M. & Seinfeld, J. H. (1994). Ozone Productivity of Atmospheric Organics. *Journal of Geophysical Research, 99*, 5309–5324.

[2] Bowman, F. M. & Seinfeld, J. H. (1994). Fundamental Basis of Incremental Reactivities of Organics in Ozone Formation in VOC/NOx Mixtures. *Atmospheric Environment, 28*, 3359–3368.

[3] Carter, W.P.L (1994). Development of Ozone Reactivity Scales for Volatile Organic Compounds. *Journal of the Air & Waste Management Association, 44*, 881–899.

[4] Ibid.

[5] Carter, W.P.L., Pierce, J.A., Luo, D., & Malkina, I.L. (1995). Environmental Chamber Study of Maximum Incremental Reactivities of Volatile Organic Compounds. *Atmospheric Environment, 29*, 2499–2511.

will not be penalized or otherwise burdened and held responsible for the impact of pollution emissions from foreign sources:[6]

> *Notwithstanding any other provision of law, any State that establishes to the satisfaction of the Administrator that, with respect to an ozone nonattainment area in such State, such State would have attained the national ambient air quality standard for ozone by the applicable attainment date, but for emissions emanating from outside of the United States, shall not be subject to the provisions of section 181(a)(2) or (5) or section 185.*[7]

As emissions in many other parts of the world increase, both the relative and absolute contributions of international transport to U.S. air quality problems have increased, especially in the western continental United States (U.S.). Evidence collected to date suggests that the incremental contributions of these flows into U.S. regions will affect air quality degradation on the same order of magnitude as the incremental air quality improvements that are expected to result from the recent strengthening of the 2008 8-hour ozone standard.[8] As air districts, especially those along the west coast and in higher elevations in the western U.S., plan for attainment of the 2008 standard, and perhaps more stringent standards in the future, the understanding of such trans-boundary ozone flow will be of great importance.

The volume of research on trans-boundary ozone has grown considerably in the past 10 years. Transport of ozone to North America from Asia along prevailing air currents is now well-established in the scientific literature.[9] Driven by increasing fossil fuel combustion, tropospheric ozone concentrations entering the west coast of the U.S. have increased by about 10 parts per billion (ppb) from the mid-1980s to the mid-2000s.[10] Closely related to this trend, NOx emissions from southern and eastern Asia increased 44% during the 2001 to 2006 timeframe. During the same period, NOx emissions in China rose 55%.[11] In contrast, European ozone precursor emissions decreased by more than 33% from 1990 to 2005 and by a comparable level in the U.S. from 1985 to 2008. Furthermore, a recent study of trans-boundary ozone flows into western North America from 1995 to 2008 found a comparable upward annual trend in ozone (0.80

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[6] Clean Air Act, U.S.C. § 7509a.

[7] Ibid 5. Note: The U.S. Chamber of Commerce and other interested parties have complained that EPA has provided no clear, consistent guidance to state, local, and regional authorities seeking to account for the impact of foreign emissions in calculating attainment of CAA standards.

[8] National Research Council. (2009). Global Sources of Local Pollution: An Assessment of Long-Range Transport of Key Air Pollutants to and from the United States. Washington, DC: The National Academies Press, p. 31. Retrieved from http://www.nap.edu/catalog.php?record_id=12743#toc

[9] Hudman, R. C., Jacob, D. J., Cooper, O. R., Heald, C.L., Park, R.J. ... Ryerson, T. (2004) Ozone Production in Transpacific Asian Pollution Plumes and Implications for Ozone Air Quality in California. *Journal of Geophysical Research: Atmospheres, 109,* D23S10.

[10] Oltmans, S. J., Lefohn, A. S., Harris, J. M., & Shadwick, D. S. (2008). Background Ozone Levels of Air Entering the West Coast of the U.S. and Assessment of Longer-Term Changes. *Atmospheric Environment, 42*, 6020–6038.

[11] Zhang, Q., Streets, D.G., Carmichael, G.R., He, K.B., Huo, H., Kannari, A. … Yao, Z.L.. (2009). Asian Emissions in 2006 for the NASA INTEX-B Mission. *Atmospheric Chemistry and Physics, 9*, 5131–5153. Retrieved from http://www.atmos-chem-phys.net/9/5131/2009/acp-9-5131-2009.pdf

ppb per year) on those days when air masses transported across the Pacific Ocean had originated in China, India, and Southeast Asia.[12]

Such understanding of trans-boundary flow has direct implications for establishing reasonably accurate PRB levels. Air quality agencies will use the PRB level to create accurate emission and transport models that form the foundation for cost-effective control measures. For example, if the Valley PRB ozone level is underestimated, subsequent emission controls put on local, regional, or state precursor sources will fail to achieve expected ozone reductions.

This mounting evidence of an escalating PRB in the western U.S. is now impacting EPA's ongoing policy deliberations regarding a new 8-hour ozone standard. In establishing the 2008 8-hour ozone standard of 75 ppb, the EPA assumed a PRB ozone range of 15–35 ppb. In its current reassessment of this standard, members of the EPA's Clean Air Scientific Advisory Committee (CASAC) assert that this range seriously underestimates PRB ozone, particularly in the western U.S. Ongoing research on trans-boundary and PRB ozone will be key in future policy decisions and the establishment of subsequent federal ozone standards.

2.2 AIR QUALITY RESEARCH FOCUSED ON OZONE

Because of its unique combination of geography, meteorology, and chemistry, the Valley continues to be one of the most studied airsheds in the world. On a number of academic and professional fronts, including the efforts of the San Joaquin Valleywide Air Pollution Study Agency (Study Agency), a substantial amount of research has focused on ozone in the Valley. In addition to Study Agency and District sponsored research, many academic groups, independent from the District, regularly study the air quality dynamics of Valley and contribute to the body of shared knowledge. It is this shared knowledge that informs the District's planning process and guides the ultimate success and implementation of its attainment plans.

2.2.1 Central California Ozone Study

The Study Agency has developed and funded extensive ozone research specific to the Valley. The Study Agency was established in 1985 under a joint-powers agreement between local counties and includes input from districts, the State, EPA, public and private industry representatives, and other governmental agencies to create a cooperative and unbiased research program. The Study Agency's main purpose is to further the scientific understanding of regional air quality issues to assist regulatory agencies in attainment strategy and policy development.

The Central California Ozone Study (CCOS) is the most recent major Study Agency field program to study ozone in the Valley. This study was conducted during the summer of 2000 and included extensive monitoring throughout the Valley and

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[12] Cooper, O.R., Parrish, D.D., Stohl, A., Trainer, M., Nédélec, P., Thouret, V. … Avery, M.A. (2010). Increasing Springtime Ozone Mixing Ratios in the Free Troposphere over Western North America. *Nature, 463,* 344–348.

surrounding regions to provide a robust and spatially dense dataset for a large portion of California. Many subsequent research projects have taken advantage of CCOS data to provide a better understanding of ozone in the Valley. The results from these studies have given academics and air quality regulators alike a more robust understanding of Valley ozone formation and have aided in the development of the most effective control strategies.

2.2.2 PAMS monitoring

The District participates in EPA's enhanced Photochemical Assessment Monitoring Stations (PAMS) program. PAMS sites measure ozone precursors, including NOx and VOC, in addition to a variety of meteorological parameters in serious, severe, or extreme ozone nonattainment areas. The District's current PAMS monitoring network is comprised of two smaller networks focused on the Fresno and Bakersfield metropolitan statistical areas (MSAs). Each of these MSAs include three PAMS sites, with each site filling the role of either a Type 1, Type 2, or Type 3 site:

- Type 1 PAMS sites monitor morning upwind ozone and ozone precursor concentrations
- Type 2 PAMS sites monitor morning ozone and ozone precursor concentrations at the downwind edge of the central business district
- Type 3 PAMS sites monitor peak afternoon ozone concentration downwind of the MSA

PAMS monitoring sites are usually established at existing state and local air monitoring stations (SLAMSs). Table 2-1 summarizes the sites that make up the Valley's PAMS network. There is currently no Type 3 PAMS monitor in the Bakersfield MSA because the Arvin-Bear Mountain air monitoring site was closed in 2010 (see Section 2.2.5). PAMS monitoring will eventually be transitioned to the permanent Arvin-Bear Mountain replacement site.

Table 2-1 San Joaquin Valley PAMS Monitoring Network

MSA	Type 1	Type 2	Type 3
Fresno	Madera-Pump	Clovis	Parlier
Bakersfield	Shafter	Bakersfield-Muni	--

Valley PAMS monitoring typically occurs each summer from June to August, when ozone concentrations tend to reach annual maximums. Through Valley PAMS monitoring, over 50 VOCs are measured and analyzed. Table 2-2 lists the targeted and measured compounds for the PAMS program.

Table 2-2 PAMS VOC Target Species

Type	Compound	Type	Compound
Hydrocarbon	Ethylene	Hydrocarbon	3-methylhexane
Hydrocarbon	Acetylene	Hydrocarbon	2,2,4-trimethylpentane
Hydrocarbon	Ethane	Hydrocarbon	n-Heptane
Hydrocarbon	Propylene	Hydrocarbon	Methylcyclohexane
Hydrocarbon	Propane	Hydrocarbon	2,3,4-trimethylpentane
Hydrocarbon	Isobutane	Hydrocarbon	Toluene
Hydrocarbon	1-Butene	Hydrocarbon	2-methylheptane
Hydrocarbon	n-Butane	Hydrocarbon	3-methylheptane
Hydrocarbon	t-2-Butene	Hydrocarbon	n-Octane
Hydrocarbon	c-2-Butene	Hydrocarbon	Ethylbenzene
Hydrocarbon	Isopentane	Hydrocarbon	m&p-Xylenes
Hydrocarbon	1-Pentene	Hydrocarbon	Styrene
Hydrocarbon	n-Pentane	Hydrocarbon	o-Xylene
Hydrocarbon	Isoprene	Hydrocarbon	n-Nonane
Hydrocarbon	t-2-pentene	Hydrocarbon	Isopropylbenzene
Hydrocarbon	c-2-pentene	Hydrocarbon	n-Propylbenzene
Hydrocarbon	2,2-Dimethylbutane	Hydrocarbon	m-Ethyltoluene
Hydrocarbon	Cyclopentane	Hydrocarbon	p-Ethyltoluene
Hydrocarbon	2,3-dimethylbutane	Hydrocarbon	1,3,5-Trimethylbenzene
Hydrocarbon	2-methylpentane	Hydrocarbon	o-Ethyltoluene
Hydrocarbon	3-Methylpentane	Hydrocarbon	1,2,4-trimethylbenzene
Hydrocarbon	2-Methyl-1-Pentene	Hydrocarbon	n-Decane
Hydrocarbon	n-hexane	Hydrocarbon	1,2,3-trimethylbenzene
Hydrocarbon	Methylcyclopentane	Hydrocarbon	m-Diethylbenzene
Hydrocarbon	2,4-dimethylpentane	Hydrocarbon	p-Diethylbenzene
Hydrocarbon	Benzene	Hydrocarbon	n-Undecane
Hydrocarbon	Cyclohexane	Carbonyl	Formaldehyde
Hydrocarbon	2-methylhexane	Carbonyl	Acetone
Hydrocarbon	2,3-dimethylpentane	Carbonyl	Acetaldehyde

2.2.3 VOC Reactivity Trends

In 2010, a study was conducted to analyze trends historical PAMS data recorded for the Valley focusing on the 1994 through 2007 time frame.[13] Within this study, the Maximum Incremental Reactivity (MIR) scale was used to quantify the strength of the ozone forming potential for each VOC. The compounds found to be the most conducive to ozone formation throughout all of the PAMS sites were toluene, two xylenes, ethylene, propylene, isopentane, and 1,2,4-trimethylbenzene. Figure 2-7, taken from the study's final report, shows the median reactivity trend among all compounds for each site over the 1994–2007 time period.

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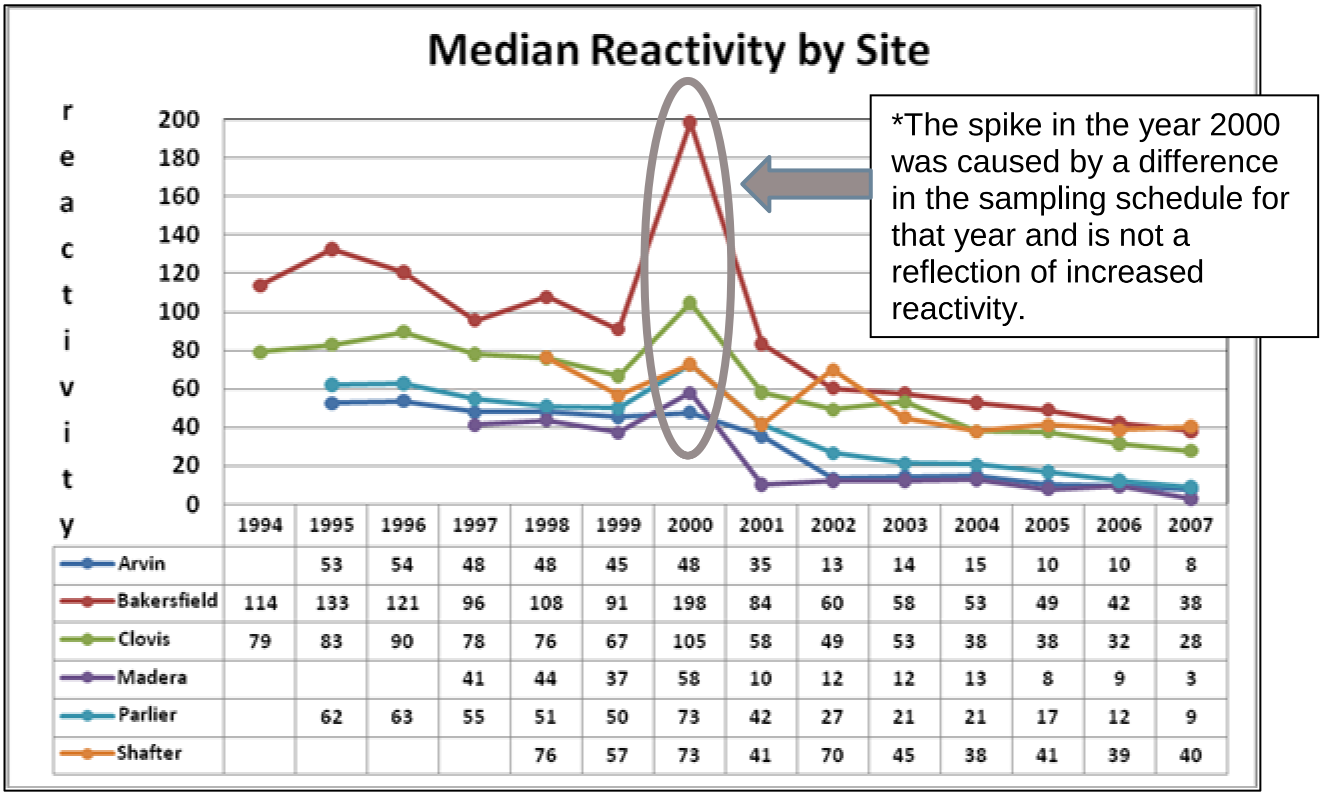
[13] Providence Engineering and Environmental Group (2010). *Analysis of PAMS Data 1994–2007*.

Figure 2-7 VOC Reactivity Trends by PAMS Site



*The spike in the year 2000 was caused by a difference in the sampling schedule for that year and is not a reflection of increased reactivity.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Arvin		53	54	48	48	45	48	35	13	14	15	10	10	8
Bakersfield	114	133	121	96	108	91	198	84	60	58	53	49	42	38
Clovis	79	83	90	78	76	67	105	58	49	53	38	38	32	28
Madera				41	44	37	58	10	12	12	13	8	9	3
Parlier		62	63	55	51	50	73	42	27	21	21	17	12	9
Shafter					76	57	73	41	70	45	38	41	39	40

Generally, the report noted that the Bakersfield PAMS site had the highest reactivity, exceeding the reactivity levels among all of the PAMS sites in the Fresno MSA. The report also noted that the Arvin PAMS site had low reactivity coupled with high ozone concentrations. This observation supports the assessment that the high ozone concentrations in the Arvin area are not formed locally, but are transported from upwind areas.

Overall, the trend in median VOC reactivity among all of the PAMS sites in the Valley is declining, meaning that over time, and as emissions reductions have occurred, more VOC is required than in the past to form an equal amount of ozone.

2.2.4 Trans-Boundary Ozone Research

Recent research by the National Oceanic and Atmospheric Administration (NOAA) found evidence that trans-boundary ozone flow from Asia was significantly impacting ground-level ozone monitors in the northern Sacramento Valley. Additionally, daily flows of trans-boundary ozone were found to be highly correlated with ozone exceedance events in Butte County, CA.

Based on these results, in 2011 the District awarded the University of California at Davis $130,000 for the installation of a trans-boundary ozone and PM2.5 monitoring station on Chews Ridge, east of Big Sur. The site sits at an elevation of 5,200 feet and is the home of Monterey Institute for Research in Astronomy Observatory. The goal of this work is to investigate whether trans-boundary ozone is mixing downward into the boundary layer of the Valley and subsequently transported to ambient monitors. The project includes bimonthly air flights over the Valley and the marine boundary layer during peak ozone season. Monitoring and data collection is slated to continue through September 2013.

In addition, in June, 2013 the District awarded a grant of $100,000 to the same UC Davis research team to conduct an intensive flight campaign over the course of the 2013 ozone season consisting of four three-day flights during periods of ozone buildup. Data collection includes north to south Valley transects in the Valley boundary layer and free troposphere as well as spiral transects in the south Valley around Bakersfield. The research design builds on previously published research by NOAA scientists in the 2010 CalNEX campaign that estimated Bakersfield ozone enhancements from trans-boundary flows of 12-23% on peak days.

2.2.5 Arvin Ozone Saturation Study

Since 1989, ARB had maintained an air quality monitoring station at 20401 Bear Mountain Boulevard in Arvin, at the Arvin-Edison Water Storage District facility. In December 2010, ARB discontinued monitoring at that station, but prior to closure, established a new site at Di Giorgio Elementary School (19405 Buena Vista Blvd), also in Arvin, just 2.2 miles away from the Bear Mountain site. ARB operated both stations in parallel for the approximately one year (including the summer of 2010).

Results of the parallel monitoring indicated that the new site at Arvin-Di Giorgio measured concentrations approximately 10% lower than the levels historically recorded at the Arvin-Bear Mountain site. While this relative difference may be due to accuracy levels inherent to air quality monitoring equipment, EPA has indicated that this difference may impact their ability to find the Valley in attainment of federal ozone standards. The data also suggests that ozone concentrations measured at the Di Giorgio Elementary School are more representative of residents’ exposure.

Understandably, residents and others have concerns about the different measurements at the two sites. In response to those concerns, the District is sponsoring an Arvin Saturation Study to further evaluate the relative differences in ozone concentrations in the Arvin area. Through this study, the District will measure ozone levels in multiple locations in and around Arvin to develop relationships between measurements at the new air monitoring location (Arvin-Di Giorgio), City of Arvin, and other points in the area during the summer ozone season, in particular, August through September of 2013.

2.3 1-HOUR OZONE AIR QUALITY IN THE VALLEY

Past records of Valley 1-hour ozone concentrations show many days in which all Valley monitoring sites recorded values well over the standard, accounting for many exceedance days and many hours over the standard per exceedance day. The record also shows that 1-hour ozone exceedances occurred in many months throughout the year. In contrast, during 2011 and 2012, very few days exceeded the 1-hour ozone standard, with peak values on those days only slightly above the standard. Not only where there significantly fewer exceedance days, but the number of hours of each exceedance dropped to one or two hours per event, and only a couple of months experienced 1-hour ozone exceedances. Appendix A presents detailed analyses of these trends. Some of these analyses are summarized below.

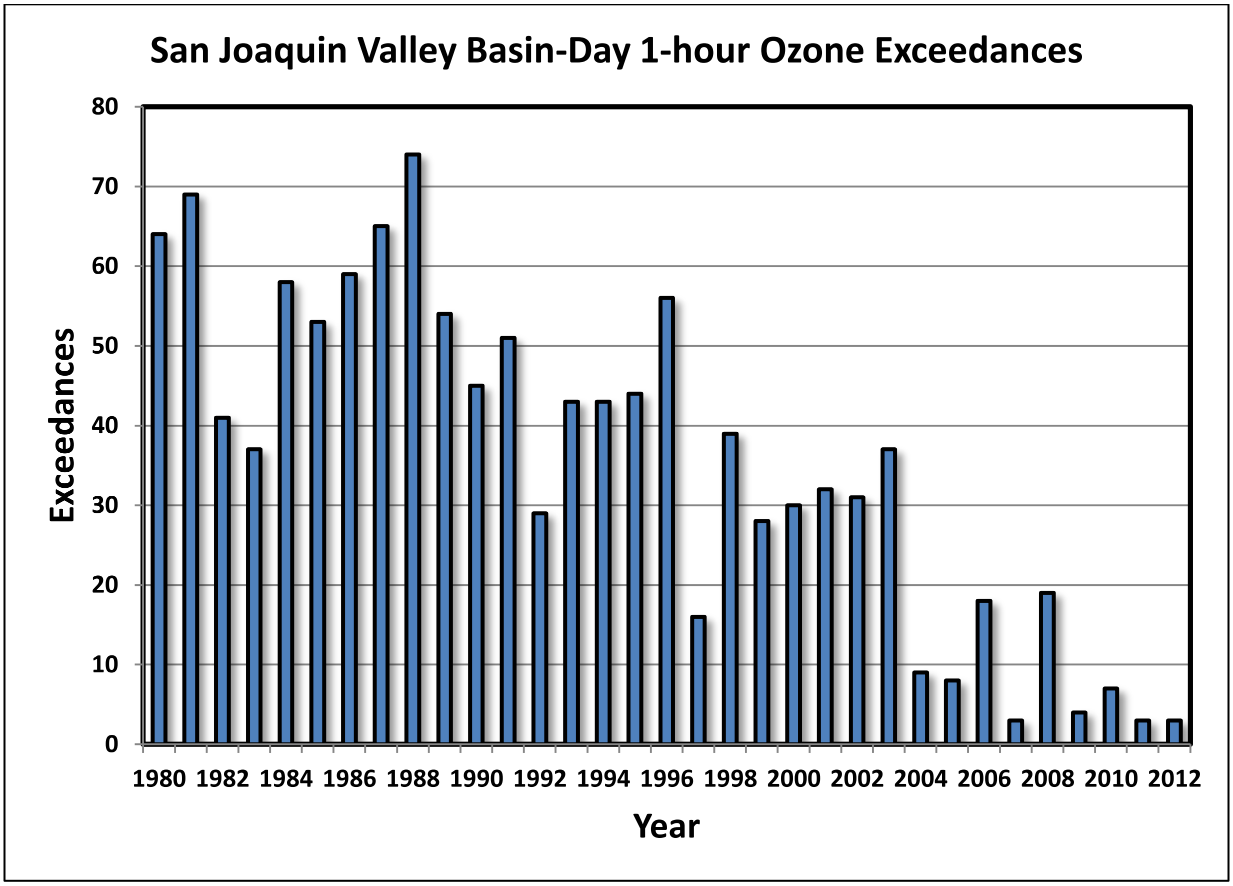
2.3.1 Number of Exceedance Days as the Attainment Test

The attainment test for the 1-hour ozone standard is based on the number of exceedance days per year, averaged over a three-year period. The 1-hour ozone standard is 0.12 parts per million (ppm) rounded to the closest on hundredth. Thus, 1-hour ozone concentrations at or greater than 0.125 ppm exceed the standard, and 1-hour ozone concentrations at or lower than 0.124 ppm meet the standard. If any hour in a day is above the standard, then that day is an exceedance day. The highest hourly concentration on a given day is recorded as the 1-hour ozone concentration for that day; although, all hourly concentrations are kept on record and analyzed.

A site with an average of 1.0 or fewer exceedance days per year, as averaged over a three-year period, meets the standard. In other words, if the site has 3.0 or fewer exceedance days in a three-year period, it meets the standard; if that site has more than 3.0 exceedance days in a three-year period, then it does not meet the standard.

As Figure 2-8 shows, in the 1980s the number of annual exceedance days during the 1980s was near or above 60 days, even exceeding 70 days in 1988. Since that time, the number of exceedances per year has decreased, even becoming rare in the last few years. Comparing the years 2012 to 1980, the number of annual exceedances has decreased by over 95%.

Figure 2-8 Basin-Day Exceedances per Year from 1980–2012

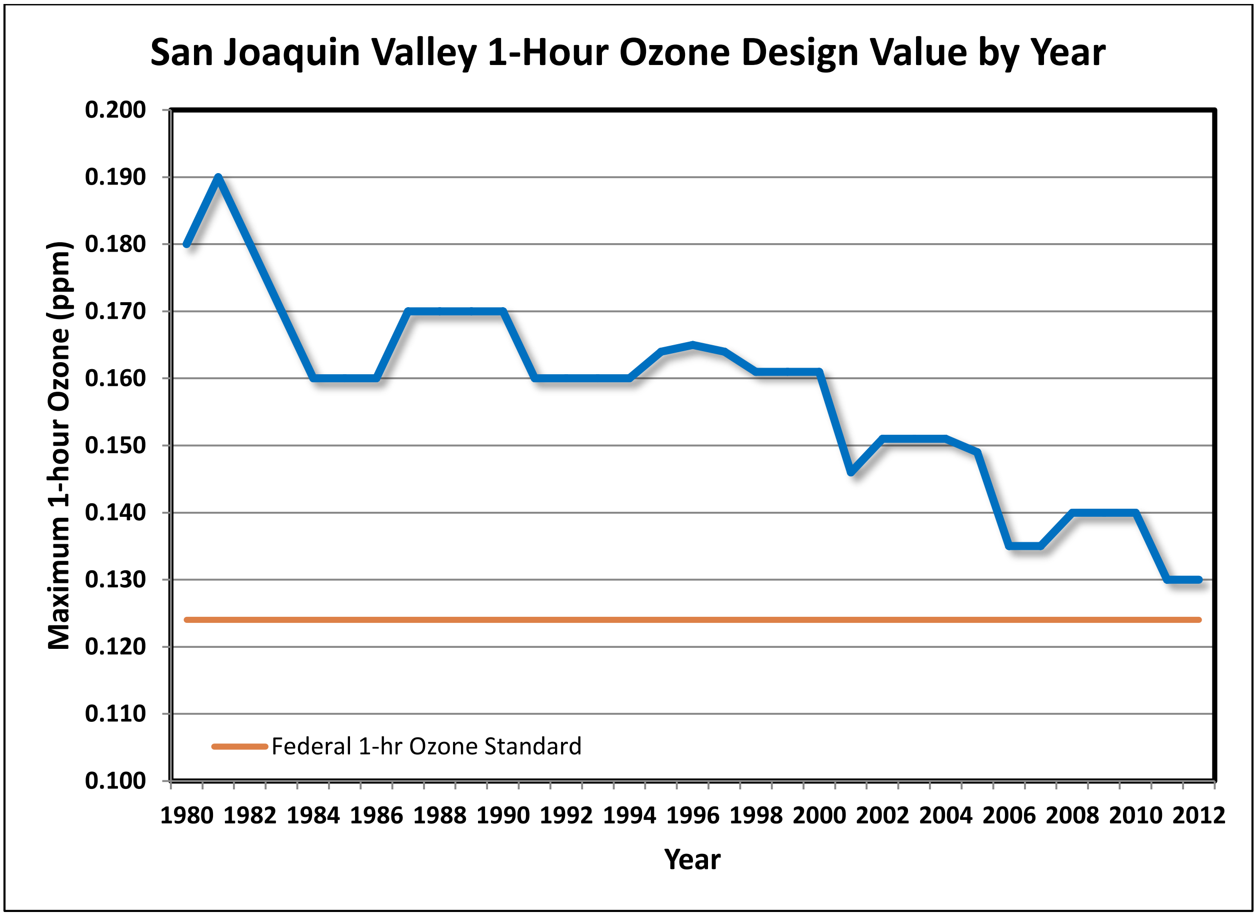


2.3.2 1-Hour Ozone Design Value Trend

The fourth highest 1-hour ozone value for the three-year period, also referred to as the *design value*, indicates how close an area is to attainment. Design value calculations follow EPA protocols for rounding, averaging conventions, data completeness, sampling frequency, data substitutions, and data validity. A 1-hour ozone design value at or greater than 0.125 ppm indicates nonattainment for that monitor (if the fourth highest value over the three-year period is an exceedance day, then there were more than the 3.0 allowed exceedance days over that three-year period). Because of this connection between design values and the exceedance-day-based attainment test, future year design values are modeled to determine when the region will reach attainment, as discussed later in this chapter.

The trend of the maximum 1-hour ozone design values among the ozone sites in the Valley has also changed dramatically over the monitoring history of the region. Figure 2-9 shows the change in the basin maximum design value from 1980 (0.18 ppm) through 2012 (0.13 ppm). The change represents a 27% reduction in the ozone design value.

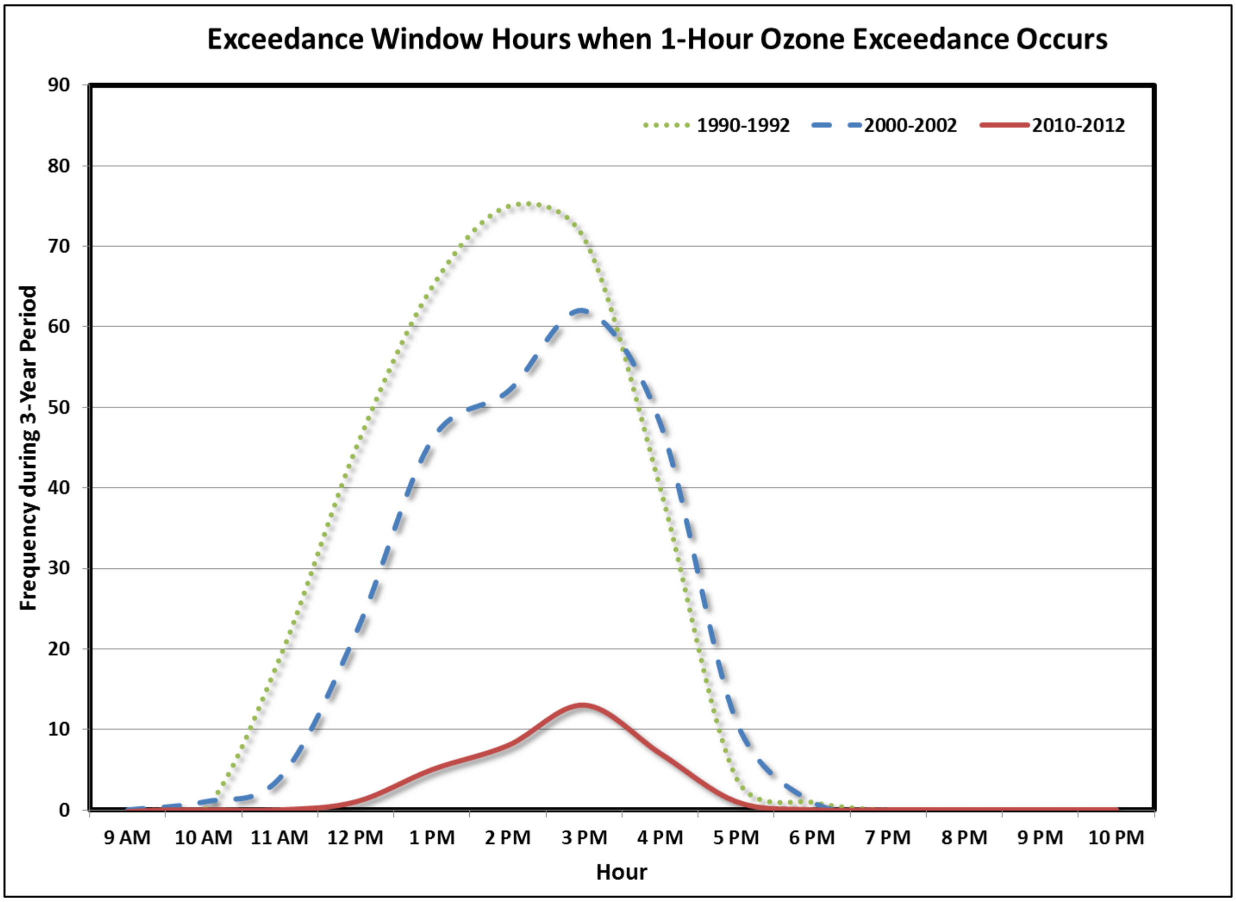
Figure 2-9 Valley Maximum 1-Hour Ozone Design Value Trend



2.3.3 Exceedance Window

The number of hours over which a 1-hour ozone exceedance occurs is also decreasing over time. Figure 2-10 shows this 1-hour ozone exceedance window as a frequency of exceedances measured at a particular hour, from 9 a.m. to 10 p.m., for the three-year time periods of 1990–1992, 2000–2002, and 2010–2012. In the most recent three-year period, the 1-hour ozone exceedance window is significantly narrower compared to the earlier periods, and the frequency of 1-hour exceedances has significantly decreased as illustrated in Figure 2-10.

Figure 2-10 1-Hour Ozone Exceedance Window Trend



2.4 MODELING APPROACH AND RESULTS

Consistent with EPA guidelines, ARB used a modeled attainment test to predict future 1-hour ozone concentrations at each monitoring site in the Valley to demonstrate attainment of the revoked 1-hour ozone standard. A photochemical model simulates the observed ozone levels using precursor emissions and meteorology in the region. The model also simulates future ozone levels based on projected changes in emissions, while keeping the meteorology constant. This modeling is used to identify the relative benefits of controlling different ozone precursor pollutants, as well as to determine the most expeditious attainment date. The modeling protocol is presented as Appendix E to this plan, and a summary of the modeling process and results is included as Appendix F to this plan.

In summary, the modeling shows that the Valley will attain the 1-hour ozone standard by 2017 based on implementation of the ongoing control program (Table 2-3). The air quality monitoring site with the highest predicted 1-hour ozone concentration is Edison, which is 4.7 ppb below the 124.0 ppb standard. Other Valley air monitoring sites, which have historically registered above the standard, are predicted to be measured at 15 to 30 ppb below the standard. Therefore, the air quality simulations predict that the entire Valley will attain the standard by 2017.

This is not to say that attainment before 2017 is not possible. In fact, the Valley's 1-hour ozone air quality has greatly improved over the past several years through the implementation of already-adopted control measures. As of the posting of this plan, attainment could be possible as early as 2013. On the other hand, it takes as little as four hours over a three-year period (where those four hours occur on four separate days at a single air monitoring site) to keep an area out of attainment. A single episode of ozone build up could prolong nonattainment past 2013, or even past 2017, depending on the circumstances.

With this challenging nature of the 1-hour ozone standard in mind, based on the modeling and other analysis conducted as part of this planning effort, 2017 is the official attainment year for this plan. The 2017 attainment year is consistent with the five-year attainment timeframe of CAA §172(a)(2)(A); in addition, this plan is not using the full 10-year attainment timeframe allowed under CAA §172(a)(2), nor does it rely on yet-to-be-identified "black box" emission reductions under CAA §182(e)(5).

Table 2-3 Base Year and Future Year 1-Hour Ozone Design Values

Monitoring Station	DV (2005-07)	DV (2015-17)
Edison	135	119.3
Arvin-Bear_Mountain_Blvd	131	107.4
Fresno-1st_Street	130	103.7
Clovis-N_Villa_Avenue	125	104.1
Fresno-Sierra_Skypark_#2	124	98.8
Parlier	121	97.4
Sequoia_and_Kings_Canyon	118	102.4
Bakersfield-5558_California	117	98.0
Sequoia_Natl_Park-Lower	113	98.5
Visalia-N_Church_Street	112	94.5
Oildale-3311_Manor_Street	112	95.2
Fresno-Drummond_Street	110	93.0
Hanford-S_Irwin_Street	110	92.6
Modesto-14th_Street	109	95.9
Shafter-Walker_Street	105	87.7
Turlock-S_Minaret_Street	104	91.8
Merced-S_Coffee_Avenue	102	85.4
Stockton-Hazelton_Street	101	86.3
Maricopa-Stanislaus_Street	100	83.5
Madera-Pump_Yard	95	82.4

Chapter 3

Control Strategy

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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CHAPTER 3: CONTROL STRATEGY

The San Joaquin Valley Unified Air Pollution Control District's (District) strategy for attaining the revoked 1979 1-hour ozone standard includes adopted strategies from previous District plans (*2007 Ozone Plan, 2008 PM2.5 Plan, 2012 PM2.5 Plan*) and strategies implemented by the California Air Resources Board (ARB). The District strategy is a multi-faceted approach that uses a combination of conventional and innovative control strategies. This comprehensive strategy includes regulatory actions; incentive programs; technology advancement programs; policy and legislative activities; public outreach, participation, and communication; and other innovative strategies.

Per Sections 182(b)(2) and 182(f) of the federal Clean Air Act, ozone nonattainment areas are required to implement reasonably available control technology (RACT) for sources that are subject to control techniques guidelines (CTG) issued by EPA and for major sources of volatile organic compounds (VOCs) and oxides of nitrogen (NOx), which are ozone precursors. EPA defines RACT as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."[1]

In response to the District's *2009 RACT Demonstration for Ozone State Implementation Plans* (*2009 RACT SIP*) and related rule amending projects, EPA has issued federal actions documenting its approval of District rules and its concurrence that District rules are at least as stringent as RACT levels. In fact, these efforts show that many District rules are more stringent than established RACT standards. The continued RACT status of District rules was confirmed recently by the extensive analysis performed under the District's *2012 PM2.5 Plan*, which is discussed in Appendix C of this plan and summarized throughout this chapter. In the rare instances where additional opportunities to reduce ozone precursor emissions were identified, the District made commitments for rule amendments (see Table 3-3). Additionally, the District's next ozone attainment plan to address the 2008 8-hour ozone standard will build on the foundation established by this and previous plans.

3.1 COMPREHENSIVE REGULATORY CONTROL STRATEGY

Air quality improvements in the San Joaquin Valley Air Basin (Valley) document the success of the District's innovative and effective rules. Previously adopted *2007 Ozone Plan* and the *2008 PM2.5 Plan* regulatory control measures are achieving 247.8 tons per day (tpd) of NOx emission reductions; these measures include both stationary and area source control measures as well as ARB rules for mobile sources.

The District's regulatory authority is centered on stationary sources and some area-wide sources, and the District's stringent and innovative rules on these sources, such as those for residential fireplaces, glass manufacturing, and agricultural burning, have set benchmarks for California and the nation. States and the federal government—but not

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[1] 44 FR 53762 (September 17, 1979).

regional agencies like the District—can directly regulate tailpipe emissions from mobile sources. ARB has adopted tough regulations for heavy-duty trucks, off-road equipment, and other mobile sources. However, the District has also adopted innovative regulations such as Indirect Source Review and Employer-based Trip Reduction to reduce emissions from mobile sources within the District's limited jurisdiction over these sources.

3.1.1 Current Regulatory Control Strategy

The District and ARB have implemented a comprehensive regulatory control strategy over the past couple of decades. Since 1992, the District has adopted over 500 new rules and amendments to implement this aggressive control strategy. Many current rules are fourth or fifth generation, meaning that they have been revised and emission limits have been lowered as new emission control technology has become available and cost-effective. These and other District and ARB rules already guarantee that emissions will continue to be reduced.

3.1.1.1 District Regulations Contributing to Continued Ozone Reductions

The District's current rules and regulations reflect technologies and methods that are far beyond minimum required control levels. In December 2010, ARB determined, based on the District's State Implementation Plans (SIP) and the evaluation of control feasibility in all rulemaking actions, that the District has undertaken *all feasible measures* to reduce nonattainment air pollutants from sources within the District's jurisdiction and regulatory control.[2] This determination considered all air pollution controls and standards applicable to all source categories under the District's authority based on maximum reductions achievable as well as technological, social, environmental, energy and economic factors, including cost-effectiveness.[3]

The aggressive regulations already adopted under previous attainment plans also serve as control measures for this plan. EPA prefers reliance on control measures that have already been adopted over ones that have yet to be approved, and has gone so far as to disapprove attainment plans that demonstrated an over-reliance on unapproved measures. As such, the recognition of recently adopted and implemented District and ARB control measures is an important component of this plan.

The following table identifies many of the adopted District rules achieving new emissions reductions after 2007, the base year for this plan. However, even pre-2007 emissions reductions are contributing and will continue to contribute to the Valley's progress toward attainment.

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[2] California Air Resources Board [ARB]. (2010, December 10), ARB Executive Order G-10-126, required under California Health and Safety Code §40612.

[3] California Administrative Code, Title 17 §70600(a)(1). (2012)

Table 3-1 Adopted District Rules

Adopted District Regulatory Control Measures	*Date Adopted or Last Amended*
Rule 4103 Open Burning	04/15/2010
Rule 4106 Prescribed Burning and Hazard Reduction Burning	01/21/2001
Rule 4307 Boilers, Steam Generators, and Process Heaters 2 to 5 MMBtu/hr	05/19/2011
Rule 4308 Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	12/17/2009
Rule 4309 Dryers, Dehydrators, and Ovens	12/15/2005
Rule 4311 Flares	06/18/2009
Rules 4306 & 4320 Boilers, Steam Generators, and Process Heaters >5 MMBtu/hr	10/16/2008
Rule 4352 Solid Fuel Fired Boilers, Steam Generators and Process Heaters	12/15/2011
Rule 4354 Glass Melting Furnaces	05/19/2011
Rule 4565 Biosolids, Animal Manure, and Poultry Litter Operations	03/15/2007
Rule 4566 Organic Material Composting Operations	08/18/2011
Rule 4570 Confined Animal Facilities	10/21/2010
Rule 4601 Architectural Coatings	12/17/2009
Rule 4603 Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts	09/20/2007
Rule 4604 Can and Coil Coating Operations	09/20/2007
Rule 4605 Aerospace Assembly and Component Coating Operations	09/20/2007
Rule 4606 Wood Products and Flat Wood Paneling Products	09/20/2007
Rule 4607 Graphic Arts and Paper, Film, Foil, and Fabric Coatings	12/18/2008
Rule 4612 Motor Vehicle and Mobile Equipment Coating Operations	09/20/2007
Rule 4621 Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants	12/20/2007
Rule 4622 Gasoline Transfer into Motor Vehicle Fuel Tanks	12/20/2007
Rule 4624 Transfer of Organic Liquid	12/20/2007
Rule 4653 Adhesives and Sealants	09/16/2010
Rule 4661 Organic Solvents	09/20/2007
Rule 4662 Organic Solvent Degreasing Operations	09/20/2007
Rule 4663 Organic Solvent Cleaning, Storage, and Disposal	09/20/2007
Rule 4682 Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	09/20/2007
Rule 4684 Polyester Resin Operations	09/20/2007
Rule 4692 Commercial Charbroiling	09/17/2009
Rule 4694 Wine Fermentation and Storage Tanks	12/15/2005
Rule 4695 Brandy Aging and Wine Aging Operations	09/17/2009

Adopted District Regulatory Control Measures	*Date Adopted or Last Amended*
Rule 4702 Internal Combustion Engines	08/18/2011
Rule 4703 Stationary Gas Turbines	09/20/2007
Rule 4902 Residential Water Heaters	03/19/2009
Rule 4905 Natural Gas-Fired, Fan-Type Residential Central Furnaces	10/20/2005
Rule 9310 School Bus Fleets	09/21/2006
Rule 9410 Employer-based Trip Reduction	12/17/2009
Rule 9510 Indirect Source Review	12/12/2005
Rule 9610 State Implementation Plan Credit for Emission Reductions Generated Through Incentive Programs	06/20/2013

3.1.1.2 ARB Regulations Contributing to Attainment

Since 1989, ARB has adopted and amended a number of regulations aimed at reducing exposure to diesel particulate matter (PM) and NOx from fuel sources, freight transport sources like heavy-duty diesel trucks, transportation sources like passenger cars and buses, and off-road sources like large construction equipment.

Table 3-2 includes a list of all the regulations adopted or amended by ARB from 2000 through 2011. Phased implementation of these regulations will produce emission reduction benefits through 2017 and beyond as the regulated fleets are retrofitted, and as older and dirtier fleet units are replaced with newer and cleaner models at an accelerated pace. Several rules in particular, including the Cleaner In-Use Heavy-Duty Trucks, the Cleaner In-Use Off-Road Equipment, the Advanced Clean Car Program, the Enhanced Fleet Modernization Program, and the Enhanced Smog-Check Program, will be achieving significant emissions reductions critically needed to attain the ozone standard under this plan.

Table 3-2 Adopted ARB Regulations

ARB Regulation	Adoption Date	Category
Advanced Clean Car Program	1/27/2012	On-road
Expanded Off-Road Recreational Vehicle Emission Standards	12/16/2011	Off-road
Cleaner In-Use Off-Road Equipment	12/17/2010	Off-road
Port Truck Modernization	12/17/2010	Off-road
Consumer Products Regulation	11/18/2010	Consumer Products
Cleaner In-Use Heavy-Duty Trucks	12/16/2010	On-road
Accelerated Introduction of Cleaner Line-Haul Locomotives	06/24/2010	Other
Enhanced Fleet Modernization Program (formerly called the Expanded Vehicle Retirement Program)	06/24/2010	On-road
Smog-Check Improvements	08/31/2009	On-road
Portable Outboard Marine Tanks	09/25/2008	Off-road

ARB Regulation	Adoption Date	Category
Clean Up Existing Harbor Craft	11/15/2007	Other
Aftermarket Catalyst Requirements	10/25/2007	Stationary
Voluntary Accelerated Retirement Regulation	12/07/2006	On-road
Vapor Recovery from Above-Ground Storage Tanks	6/21/2007	Stationary
Phase 3 Reformulated Gasoline Amendments	6/14/2007	Stationary
Emergency Regulation for Portable Equipment Registration Program, Airborne Toxic Control Measures and Portable and Stationary Diesel-Fueled Engines	12/06/2006	Off-road
Airborne Toxic Control Measure for Stationary Compression Ignition Engines (Agricultural Eng. Exemption removal)	11/16/2006	Other
Distributed Generation Guidelines and Regulations	10/19/2006	Other
Zero-Emission Bus Regulation	10/19/2006	On-road
Heavy-Duty In-Use Compliance Regulation	09/28/2006	On-road
On-Board Diagnostic II	09/28/2006	On-road
Off-Highway Recreational Vehicles and Engines	07/20/2006	Off-road
California Motor Vehicle Service Information Rule	06/22/2006	On-road
Portable Equipment Registration Program	06/22/2006	Off-road
Fork Lifts and Other Industrial Equipment (Large Off-Road Spark-Ignition Engines > 1 liter)	05/26/2006	Off-road
Technical Amendments to Evaporative Exhaust and Evaporative Emissions Test Procedures	05/25/2006	On-road
Diesel Verification Procedure, Warranty & In-Use	03/23/2006	On-road
AB1009 Heavy-Duty Vehicle Smoke Inspection Program	01/26/2006	On-road
Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Diesel-Fueled Vehicles Owned or Operated by Public Agencies and Utilities	12/08/2005	On-road
Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards	12/08/2005	Off-road
Marine Inboard Stern-drive Engines	11/17/2005	Off-road
Requirements to Reduce Idling Emissions from New and In-Use Trucks, Beginning in 2008	10/20/2005	On-road
2007–2009 Model-Year Heavy-Duty Urban Bus Engines and the Fleet Rule for Transit Agencies	09/15/2005	On-road
Portable Fuel Containers (PFC) [Part 1 of 2]	09/15/2005	Off road
Portable Fuel Containers (PFC) [Part 2 of 2]	09/15/2005	Off road
On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD)	07/21/2005	On-road
Airborne Toxic Control Measure for Stationary Compression Ignition Engines amendments	05/26/2005	Other
Transit Fleet Rule	02/24/2005	On-road
Off-Road Compression-Ignition Engines	12/09/2004	Off-road
Emergency Regulation for Temporary Delay of Diesel Fuel Lubricity Standard	11/24/2004	Fuels
Diesel Fuel Standards for Harbor Craft & Locomotives	11/18/2004	Fuels
Greenhouse Gas	09/23/2004	On-road

ARB Regulation	Adoption Date	Category
Airborne Toxic Control Measure for Diesel Particulate from Diesel-Fueled Commercial Vehicle Idling	07/22/2004	On-road
Urban Bus Engines/Fleet Rule for Transit Agencies	06/24/2004	On-road
Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model Heavy-Duty Engines	05/20/2004	On-road
Heavy-Duty Diesel Engine-Chip Reflash	03/27/2004	On-road
Airborne Toxic Control Measure for Diesel-Fueled Portable Engines	02/26/2004	Off-road
Modifications to the Statewide Portable Equipment Registration Program (PERP) Regulations	02/26/2004	Off-road
CA Motor Vehicle Service Information Rule	01/22/2004	On-road
Airborne Toxic Control Measure for Diesel Particulate for Transport Refrigeration Units	12/11/2003	On-road
Airborne Toxic Control Measure for Stationary Compression Ignition Engines	12/11/2003	Other
Diesel Retrofit Verification Procedure, Warranty and In-Use Compliance Requirements Amendments	12/11/2003	On-road
Small Off-Road Engines (SORE)	09/25/2003	Off-road
Solid-Waste Collection Vehicles	09/24/2003	On-road
Off-Highway Recreation Vehicles	07/24/2003	Off-road
Specifications for Motor Vehicle Diesel Fuel	07/24/2003	Fuels
Zero-Emission Vehicle Amendments for 2003	03/25/2003	On-road
Airborne Toxic Control Measure for Diesel Particulate from School Bus Idling	12/12/2002	On-road
Low-Emission Vehicles II. Align Heavy-Duty Gas Engine Standards with Federal Standards; minor administrative changes	12/12/2002	On-road
Revision to Transit Bus Regulations Amendments	10/24/2002	On-road
Diesel Retrofit Verification Procedure, Warranty and In-Use Compliance Requirements	05/16/2002	On-road
On-Board Diagnostic II Review Amendments	04/25/2002	On-road
Airborne Toxic Control Measure for Outdoor Residential Waste Burning	02/21/2002	Other
Voluntary Accelerated Light-Duty Vehicle Retirement Regulations	02/21/2002	On-road
California Motor Vehicle Service Information Rule	12/13/2001	On-road
Distributed Generation Guidelines and Regulations	11/15/2001	Other
Low-Emission Vehicle Regulations	11/15/2001	On-road
Heavy-Duty Diesel Engine Standards for 2007 and Later	10/25/2001	On-road
Marine Inboard Engines	07/26/2001	Off-road
Zero-Emission Vehicle Infrastructure and Standardization of Electric-Vehicle Charging Equipment	06/28/2001	On-road
Zero-Emission Vehicle Regulation Update	01/25/2001	On-road
Heavy-Duty Diesel Engines "Not-to-Exceed (NTE)" Test Procedures	12/07/2000	On-road
Light- and Medium- Duty Low-Emission Vehicle Alignment with Federal Standards. Exhaust Emission Standards for Heavy-Duty Gas Engines	12/07/2000	On-road
Architectural Coatings	6/22/2000	Stationary

ARB Regulation	Adoption Date	Category
Air Toxic Control Measure for Chlorinated Toxic Air Contaminants from Automotive Maintenance and Repair Facilities	04/27/2000	Other
Enhanced Vapor Recovery	6/22/2000	Stationary
Transit Bus Standards	02/24/2000	On-road
Off-Road Compression-Ignition Engines	01/27/2000	Off-road

Some of the most significant regulations adopted by ARB in recent years, such as the Truck and Bus Regulation and the Off-Road Regulation, depend on truck and equipment owners playing a key role in implementation. Accordingly, ARB's approach to ensuring compliance is based on a comprehensive outreach and education effort. ARB staff develops regulatory assistance tools, conducts and coordinates compliance assistance and outreach activities, administers incentive programs, and actively enforces the entire suite of diesel regulations. ARB's goal is to provide readily accessible and clear information for all diesel rules and incentive programs.
ARB compliance assistance and outreach activities also include the following:

- Training and implementation classes conducted by ARB staff in classroom settings throughout the State, including at community colleges
- Participation at business events throughout California, giving presentations, displaying materials, providing handouts, and responding to questions
- Marketing efforts such as advertisements, press releases, a television presence, and radio spots, including public service announcements statewide
- Websites for ARB's multiple programs

Complementing these efforts, ARB and District enforcement actively provide a level playing field for the regulated entities and ensure the emission reduction benefits are achieved.

3.1.2 Evaluation of Potential Future Regulatory Control Strategies

The District has evaluated all sectors and equipment types for additional emission reduction opportunities, as presented in Appendix C. The District has used the following key factors to evaluate potential emission reduction opportunities:

- **Technological Feasibility.** The District looked for any control technologies not already required that might be available to further reduce emissions from sources of air pollution in the Valley. This includes new technologies and technologies that may not have been cost-effective in the past. The technologies used in BACT guidelines; permits; and other air districts' rules, regulations, guidelines, and studies were reviewed for their feasibility, including how commercially available the technology currently is and whether the technology has been used in practice.

- **Cost-Effectiveness.** Cost-effectiveness is the cost of emissions controls compared to the amount of emissions reductions that would be achieved by those controls. The District does not have a pre-determined cost-effectiveness threshold, but control options with extremely high cost-effectiveness (high dollars per ton of pollutant reduction) are unreasonable and inappropriate for regulation.

- **Reasonably Available Control Technology (RACT).** RACT is the lowest reasonable emissions limit that a particular source is capable of meeting, considering technological and economic feasibility of the technology. RACT changes over time as new technologies become feasible and cost-effective, thus making them reasonable to require. The District has conducted comprehensive reviews of all NOx and VOC rules for compliance with federal RACT requirements. For these reviews, the District evaluates all District rules against federal rules, regulations, and technology guidelines, as well as any comparable rules and compliance methods from California's most technologically progressive air districts. In response to the District's *2009 RACT SIP* and related rule amending projects, EPA has issued federal actions documenting their approval of District rules and their concurrence that District rules are at least as stringent as RACT levels. In fact, these efforts show that many District rules are more stringent than established RACT standards.

  RACT is, by definition, reasonable. Although air quality attainment plans must include a thorough analysis of reasonably available measures, it need not analyze every conceivable measure; reasonableness must drive the analysis. The District would not require any measure that is absurd, unenforceable, impractical, or socioeconomically disruptive.

3.1.3 New Regulatory Control Measure Commitments

The District's thorough evaluation of control measures in the District's *2012 PM2.5 Plan* for potential opportunities to further reduce emissions resulted in numerous commitments for future regulatory actions.

As noted at the beginning of this chapter, the District is using a multi-faceted emissions control approach to reach beyond traditional regulations. For various reasons, some control measure opportunities are not appropriate for regulatory commitments at this time. These reasons include limits on the District's regulatory authority, costs, the need for additional information, the need for technology development, and the need to demonstrate the technology in practice. Such opportunities that are better suited for incentive programs, technology demonstration, and other approaches as discussed later in this chapter. These combined efforts expedite emissions reductions and pave the way for future regulatory measures that might be needed under upcoming attainment plans for future EPA air quality standards.

The District committed to five rule projects in the *2012 PM2.5 Plan*, including one new rule and four amendments to existing rules. Two of these commitments will reduce directly emitted PM2.5, and the other three will reduce NOx (the two remaining NOx rules are shown in Table 3-3 below; the third NOx commitment from the PM2.5 plan has already been adopted).

Table 3-3 Regulatory Control Measure Commitments

Rule	Amendment Date	Compliance Date	Emissions Reductions*
Rule 4308 Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	2013	2015	TBD
Rule 4905 Natural Gas-Fired, Fan-Type Residential Central Furnaces	2014	2015	TBD
* Based on full implementation and best available information as of this plan. A more thorough evaluation of control techniques and feasibility will be conducted at the time of rule development.			

3.1.4 Commitments for Further Study

The District thoroughly reviewed the Valley's current emissions sources and emissions control measures to search for additional control measure opportunities. In some cases, though, additional information is needed regarding the current emissions inventory, the effectiveness of current controls, and the potential of additional controls. Consistent with the commitments in the *2012 PM2.5 Plan,* the District will continue to review these areas as *further study measures*, as summarized in Table 3-4. These analyses can provide the foundation for related control measure commitments in future attainment plans.

Some of the measures included in Table 3-4 are measures related to VOC emissions reductions. Historically, the Valley has been required to demonstrate RACT for VOC sources, although research and modeling has consistently demonstrated that the Valley is a NOx-limited area, and reducing NOx emissions continues to be the most effective strategy for reducing Valley ozone concentrations (much more effective than reducing VOC emissions). However, in EPA's proposed implementation rule for the 2008 8-hour ozone standard[4], EPA proposed to consider any lack of air quality benefit of further VOC controls as part of a region's RACT demonstration. If EPA confirms this approach in the final implementation rule, the District would consider the relative air quality benefit of further VOC controls as part of any further study measure evaluating an opportunity to reduce VOC emissions.

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[4] Implementation of the 2008 NAAQS for Ozone: State Implementation Plan Requirements (Proposed Rule). 78 Fed. Reg. 109, pp 34178-34239 at p. 34193. (2013, June 6). Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2013-06-06/pdf/2013-13233.pdf

Table 3-4 Further Study Measures

Control Measure	Description	Completion Date
Rule 4103 Open Burning	Evaluate the feasibility of postponed burning activities every 5 years, as outlined in the current rule.	2015
Rule 4106 Prescribed Burning	Examine the feasibility of implementing a biomass removal program similar to one in Placer County.	2013
Rule 4311 Flares	Review of flare minimization plans and annual reports for further emission reduction opportunities.	2013
Rule 4601 Architectural Coatings	Further evaluate potential opportunities for future emission reductions during the development of the next ozone plan.	2014
Rule 4624 Transfer of Organic Liquids	Evaluate the technological feasibility of lowering the VOC limit to be as stringent as BAAQMD Regulation 8 Rule 33 and BACT limits during the development of the next ozone plan.	2014
Rule 4693 Bakery Ovens	Evaluate the feasibility and potential for emission reductions from implementing a 30 ppmv @3% O_2 NOx emission limit during the development of the next ozone plan.	2014
Lawn Care Equipment	Evaluate emissions inventory and technology demonstration efforts to identify potential emission reduction opportunities.	2013
Asphalt and Concrete Operations	Examine feasibility of warm-mix asphalt as a potential emission reduction opportunity.	2013
Ongoing Study and Research	Conduct and support ongoing research that continues to enhance the District's understanding of ozone concentrations and formation, including further health research.	Ongoing

Rule 4103 Open Burning

The District evaluated the *2010 Final Staff Report and Recommendations on Agricultural Burning* in May 2012 and found there were no significant changes in the economic feasibility of various alternatives to agricultural burning. Annually, the District evaluates each crop category still allowed to burn and determines a cost threshold based on the economic feasibility of alternatives to burning. The District carefully manages the agricultural burning under its Smoke Management System to ensure that burning is only allowed on days when the amount burned would not cause or contribute to an exceedance of any air quality standard, and to ensure that there are no cost-effective alternatives available. The District will continue to consider the economic feasibility of burning alternatives on a case-by-case basis and continue with the five-year evaluation period outlined in Rule 4103.

Rule 4106 Prescribed Burning

Placer County Air Pollution Control District has implemented a successful program for reducing emissions from hazard reduction burning by removing biomass from the area and sending it for combustion at a biomass plant. The District has considered the feasibility of implementing a similar program in the Valley; however, the unique Valley geography presents several challenges in implementing a comparable program. Such challenges and the on-going success of the Placer County program need to be evaluated before determining whether a biomass removal program could be implemented successfully and whether it would result in cost-effective emissions reductions for the Valley. The District commits to further evaluating these challenges and the potential for such a program in the future.

Rule 4311 Flares

Effective July 1, 2012, facilities subject to the flare minimization plans (FMPs) provision in Rule 4311 are required to submit annual reports to the District with *reportable flaring event* and *annual monitoring report* data. District Rule 4311 is one of the most stringent rules in the nation for flaring operations, and limits within the rule are as stringent as established RACT requirements. The District has analyzed Santa Barbara APCD Rule 359, and has found while it appears to include a performance standard restricting the use of flaring, it actually allows flaring under broad conditions, and the District's rule is at least as stringent, as further supported by EPA analysis and approval of rule requirements as satisfying RACT requirements.

Pursuant to a commitment in the District's *2012 PM2.5 Plan* the District has begun the further study process for flares; immediate opportunities for further reducing emissions from these sources has not been identified as of yet. However, staff continues to research the annual reports and FMPs because information in these annual reports could potentially provide insight for further emissions reduction opportunities for this source category. Given the time necessary to thoroughly analyze the FMPs, reportable flaring event reports, and annual monitoring reports, the District commits to analyzing these documents by the end of 2013. Additionally, because flares are a relatively small source of ozone precursor emissions, attempting to expedite this further study would not affect the Valley's projected 1-hour ozone attainment year.

Rule 4601 Architectural Coatings

In the control measure evaluation of Rule 4601, the District did not identify any feasible emission reduction opportunities for sources subject to this rule at this time. The South Coast Air Quality Management District (SCAQMD) amended their architectural coatings rule (Rule 1113) in June 2011 and implemented some VOC emission limits that are more stringent then established RACT requirements. Rule 4601 satisfies RACT requirements. The District commits to further evaluate potential opportunities for future reductions as adopted in the SCAQMD rule during the development of the next ozone plan.

Rule 4624 Transfer of Organic Liquids

District Rule 4624 implements RACT level requirements on facilities subject to the rule. However, Bay Area Air Quality Management District (BAAQMD) Regulation 8 Rule 33 (Gasoline Bulk Terminals and Gasoline Cargo Tanks) has a VOC limit beyond RACT of 0.04 lb VOC/1,000 gallons. Additionally, BAAQMD BACT and SCAQMD BACT requirements have some limits more stringent than those in Rule 4624. Research of the District's permit database indicates that most Valley facilities are not currently permitted at the more stringent BACT limits and BAAQMD Regulation 8 Rule 33 limits. Therefore, there may be a potential opportunity for emission reductions if it is ultimately determined that these limits are technologically feasible and cost effective as retrofits to existing facilities. The District will evaluate these limits further during the development of the next ozone plan.

Rule 4693 Bakery Ovens

The District identified a potential opportunity to reduce emissions from units subject to Rule 4693 by implementing BACT requirements. The District's BACT requirements, while beyond RACT, limit NOx emissions from these units to 30 ppmv @ 3% O_2. This standard can be achieved by using low-NOx burners. However, further study is needed to determine if low-NOx burners are cost-effective and technologically feasible retrofits for all facilities. The District commits to further evaluate this potential opportunity during the development of the next ozone plan.

SC 001 Lawn Care Equipment

The District's Governing Board approved funding for District-sponsored research to quantify Valley-specific lawn care activity levels through public survey. The survey results will allow review and improvement of the emissions inventory for this source category.

The District is also demonstrating zero-emission lawn-care equipment technology through the recent launch of the Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program. This program is funded with State Air Quality Improvement Program funds and will provide eligible cordless, zero-emission commercial lawn and garden equipment to commercial landscape professionals who conduct business within the Valley. The District will continue its work with commercial operators to address the concerns with commercial viability through the implementation of this program. Based on findings and feedback from program participants, the District commits to developing more incentive program options for commercial operators to help deploy zero-emissions lawn and garden technologies.

SC 005 Asphalt and Concrete Operations

Warm-mix asphalt shows promise for reducing emissions associated with the production of asphalt for paving projects, when compared to hot-mix asphalt, because lower temperatures result in lower levels of criteria pollutant emissions. The cost, unfamiliarity with potential implementation issues, and uncertainty in the exact percentages of potential emissions reductions are potential barriers to the technology's use in the Valley. District staff commits to further evaluate the cost, effectiveness, and feasibility of this technology for Valley sources in the future.

3.2 INCENTIVES

Incentive programs are an integral part of the District's emissions reduction effort. These programs provide an effective way to accelerate emissions reductions and encourage technology advancements, particularly in the mobile source sector, a sector not directly under the District's regulatory jurisdiction. Given that 80% of the Valley's NO_X emissions come from mobile sources, these successful voluntary incentive grant programs help the Valley achieve highly cost-effective emissions reductions that are surplus of the reductions required by regulations.

The District operates one of the largest and most well-respected voluntary incentive programs in the state. Through strong advocacy at the state and federal levels, the District has increased its incentive funding levels over the past five years to a proposed incentive program appropriation of $121.6 million in the 2013–2014 District Budget. Since the District's inception in 1992, considerable funding has been expended in support of clean-air projects in the Valley. These projects have achieved significant emissions reductions with corresponding air quality and health benefits. The District typically requires match funding of 30% to 70% from grant recipients. To date, the District has provided over $500,000,000 in incentive funding and grant recipients have provided over $400,000,000 in matching funds.

Over the past 10 years (01/01/2002 through 12/11/2012), the District has provided incentive funding to purchase, replace, or retrofit thousands of pieces of equipment, including the following:

- 4,456 agricultural irrigation pump engines
- 928 agricultural tractor replacement
- 903 off road repower projects
- 37 locomotives
- 339 alternative fuel light duty
- 14 bicycle infrastructure
- 697 car crushing (PASS)
- 153 car crushing (Tune-In Tune-Up)
- 2,537 commuter subsidies
- 2,723 fireplace
- 3,186 heavy duty trucks
- 3,567 lawnmower replacements
- 435 school bus replacements
- 1,889 school bus retrofits

The District's incentive programs generate reductions that are SIP-creditable, and serve as a model for other agencies throughout the state. Recent audits noted the District's efficient and effective use of incentive grant funds in reducing air pollution. The District has collaborated with EPA, ARB, and the California Natural Resource Conservation Service (NRCS) to establish criteria for quantifying incentive program emissions reductions for use in the SIP through new District Rule 9610 (State Implementation Plan

Credit for Emission Reductions Generated through Incentive Programs). Adopted in 2013, District Rule 9610 provides a mechanism for the District to claim credit in state implementation plans for SIP-creditable incentive-based emission reductions achieved in the Valley through incentive programs administered by ARB, NRCS, and the District.

3.2.1 EPA Section 185 Fees

In December 2011, the EPA took action against three California air districts for their failure to attain the 1-hour ozone standard. Even though EPA revoked the standard in 2005, to comply with anti-backsliding requirements of the CAA, air districts that did not meet the standard prior to the revocation were still required to work toward attainment of the standard; this includes the District. The District's nonattainment of 1-hour ozone standard past the 2010 attainment year caused EPA to impart the failure-to-attain determination, which in turn imposed certain penalty fees to satisfy requirements of Section 185 of the CAA.

In anticipation of such action, in October 2010, the District proposed and was approved for an innovative alternative to outright payment of the penalty fees to EPA. In lieu of imposing nonattainment penalties strictly on Valley business and stationary sources that have already invested billions into clean air technologies, the District, as authorized by California Health and Safety Code Section 40610 through 40613, increased the motor vehicle fees established under Sections 44223 and 44225. Imposition of the fee increase on all motor vehicles in the Valley provides an equitable distribution of responsibility to mobile sources; thus, not diminishing the enormous expenditure and sacrifice that Valley businesses have made to significantly reduce emissions Valley wide. Through District collection of the necessary Section 185 fees, the Valley is assured that all monies collected from the increased motor vehicle fees will be spent on emissions reductions activities within the Valley.

Collection of the additional motor vehicles fees was established through Assembly Bill 2522 (AB 2522). To date, these fees are supporting existing District incentive programs, either by adding functionality or increasing participation, and will be used to fund District programs in development. AB 2522 funds are fully or partially funding the following District programs:

- Public Benefit Grant Program (public agencies)
    - Light-duty vehicle program
    - Alternative-fuel infrastructure
    - Advanced transit and transportation
- Drive Clean! Rebate Program (light-duty vehicle incentives)
- Tune-In Tune-Up Program
- Heavy-Duty Engine Program
    - Agriculture equipment replacement
    - Refuse truck replacement (in development)
    - Small Business Truck Voucher Program

3.2.2 Current District incentives programs

The District offers numerous incentives programs to reduce emissions from a variety of equipment types such as heavy-duty engines, school buses, and lawn and garden equipment. The District places particular emphasis on providing incentives to environmental justice communities. To date, the District has awarded over $500 million in incentive funding resulting in over 100,000 tons of lifetime emissions reductions. The District will continue to expand on the success of its current programs and craft new incentive programs for additional emissions reductions from Valley sources. The following summarizes incentive programs the District currently implements:

3.2.2.1 Heavy-Duty Trucks

The District has administered numerous incentive programs targeted at on-road heavy-duty trucks, one of the biggest sources of NO_X emissions in the Valley. Through the State's Proposition 1B Goods Movement Emission Reduction Program, Carl Moyer Voucher Incentive Program (VIP), and other District-operated voucher incentive programs funded by grants from EPA and locally generated incentive funds, the District has replaced hundreds of older, high-polluting trucks with cleaner trucks certified to meet the latest ARB emissions standards.

The District's truck voucher programs have been designed to provide an alternative source of incentive funding for small businesses that do not qualify for funding under the Proposition 1B Program. The District contracts with Valley dealerships and makes the review and approval process efficient and streamlined to provide vouchers to truck operators.

3.2.2.2 Agricultural Pumping Engines

The District provides grant funding in amounts up to 85% of the cost of low-emission Tier 4 engines or zero-emission electric motors to farmers looking to replace older, dirtier diesel engines. This program not only provides for significant emissions reductions from agricultural operations, but provides economic relief to Valley farmers, ranchers, and dairy operators. Eligible projects are funded with local, state, and federal sources, including but not limited to District Indirect Source Review (ISR) mitigation fees, Carl Moyer Program funding, AB 923 funding, federal designated funding, and federal Diesel Air Shed Grant funding. In the past, collaboration with the California Public Utilities Commission and local utilities has allowed for additional incentives on electric line extensions and special rate schedules, enhancing participation in the District's replacement program.

Over the past ten years, the District has funded the replacement of over 4,584 agricultural pump engines, with more projects currently in the queue. Over 2,000 of these replacements involved replacing older diesel engines with electric motors. The District has seen an increased demand for emissions-compliant diesel-engine repowers to electric motors in recent years. This option is ideal for both parties, since the District achieves the maximum emissions reductions with electric motor repowers and farmers lower their operating costs by switching to electricity, a more affordable fuel source.

3.2.2.3 Agricultural Equipment

Off-road agricultural equipment replacements and repowers play a crucial role in reducing emissions. These equipment units include, but are not limited to, tractors, backhoes, wheel loaders, and other off-road farming vehicles. Eligible projects are funded with local, state, and federal sources, including but not limited to ISR, Carl Moyer funding, AB923 funding, federal designated funding, and federal Diesel Air-Shed Grant funding.

The District has funded the repower or replacement of over 1,017 off-road agricultural vehicles, with more projects currently in the queue. The District estimates that a large inventory of vehicles that qualify for repower or replacement still exists, and the program has the potential for significant and very cost-effective emissions reductions. Whether a farmer wishes to repower the current equipment with a cleaner engine or replace the equipment altogether, this program allows the District to achieve surplus emissions reductions while also facilitating the early equipment retirement and fleet turnover, both of which result in more efficient farming operations with less overall hours of operation.

An important component of the District’s incentive efforts in this category has been its collaboration with the NRCS to replace agricultural tractors. Over the course of this collaborative tractor replacement program, the District has obligated $21.4 million in incentive funds, NRCS has obligated $72.2 million, and this has leveraged $89.9 million in applicant cost share for new tractors. This $183 million investment by the District, NRCS, and Valley farmers has resulted in significant emissions reductions, and work is underway with EPA to ensure the reductions from this investment can be credited to the SIP.

3.2.2.4 Locomotives

The emissions from goods movement are a significant source of diesel particulate matter (PM) in the Valley and the state. The locomotive component of the Heavy-Duty Engine Program awards up to 85% grant funding for newer, cleaner diesel locomotive engines and locomotive replacements. Eligible projects are funded with local, state, and federal sources, including but not limited to the Carl Moyer Program, federal Diesel Air Shed Grant funding, and DERA funding. One of the major benefits to the locomotive repower and replacement program is increased efficiency and longevity and reduction of unnecessary emissions.

3.2.2.5 Forklifts

The District funds the replacement and retrofit of forklifts through its Large Spark-Ignited (LSI) Forklift Retrofit program and its Electric Forklift New-Purchase program. Because emission standards for new engines in this source category have only been in effect for the past few years, a significant number of high-emitting units are still in operation and available for retrofit. Operators can meet the proposed in-use fleet-average emission standards by purchasing low- and zero-emission equipment and by retrofitting uncontrolled equipment in their fleets. The use of new controlled engines and the retrofit of existing engines can reduce fuel use and improve engine life. Eligible projects are funded with federal, state, and local sources, including Carl Moyer Program funds, and motor vehicle surcharge fees.

The District has funded 17 forklift projects. The installation of a LSI retrofit system will improve engine operation and reduce fuel use. Closed-loop fuel systems generally improve the engine’s overall efficiency. There is an estimated 10% to 20% reduction in fuel consumption with engines using closed-loop systems. An electric forklift has as obvious advantage as an emission-free vehicle, but can typically cost $1,500 to $5,000 more than a comparable LSI forklift. However, since an electric forklift has a longer useful life and reduced fuel and maintenance costs, the electric forklift can reduce life-cycle costs compared to a LSI forklift.

3.2.2.6 School Bus Replacement and Retrofit

School bus replacements and retrofits play a vital role in reducing school children's exposure to both cancer-causing and smog-forming pollution. The School Bus Replacement and Retrofit programs provide grant funding for new, safer school buses and air pollution control equipment (retrofit devices) on buses that are already on the road. Public school districts in California that own their buses are eligible to receive funding. Eligible projects are funded with local, state, and federal funds including the Lower-Emission School Bus Program (Proposition 1B), DERA funding, and the American Reinvestment and Recovery Act (ARRA).

The District has provided funding to retrofit 1,879 school buses and replace 432 school buses. New buses purchased to replace older buses may be fueled with diesel or an alternative fuel, such as compressed natural gas (CNG), provided that the required emissions standards specified in the current guidelines for the Lower-Emission School Bus Program are met. Funds are also available for replacing on-board CNG tanks on older school buses and for updating deteriorating natural gas fueling infrastructure. Commercially available hybrid-electric school buses may be eligible for partial funding.

3.2.2.7 Alternative Fuel Infrastructure

The District has undertaken a variety of efforts to support alternative fuel infrastructure. The District currently has an open solicitation under the Public Benefit Grants Program for Alternative Fuel Infrastructure projects. $5 million has been allocated for this solicitation for projects that construct new infrastructure or expand existing infrastructure that provide alternative fuels such as compressed natural gas (CNG), liquefied natural gas (LNG), a combination of both, large-scale electricity for transit vehicles, or other alternative fuels such as propane.

The District has also received two Plug-in Electric Vehicle (PEV) Readiness grants, one from the Department of Energy (DOE) and the other from the California Energy Commission (CEC), to help prepare the Valley for PEVs. The DOE grant ($75,000) was a statewide project, in which the District collaborated with other regions around the state to review and document best practices to be electric vehicle ready. The CEC grant ($200,000 from CEC, with $50,000 in-kind match provided by the District) built upon the DOE grant by looking at the Valley’s challenges to PEV adoption on a more detailed level. The District created the San Joaquin Valley Plug-in Electric Vehicle Coordinating Council (SJV PEVCC), comprised of representatives from industry, local government, utility companies, etc., as required by the grant to help the District appropriately address the challenges unique to our area. The final deliverable for this project is a comprehensive Readiness Plan (includes best practices info, templates, etc.) that can be used as a tool by local municipalities to help get more electric vehicles on the road and infrastructure in place. The District expects to present this plan to the Governing Board in early 2014.

The District currently offers incentive funding for Alternative Fuel Mechanic Training, up to $15,000 per year, to help owners and operators of alternative fuel programs train their personnel in subjects such as the safe operation, maintenance, etc. of infrastructure and vehicles.

The District is an executive committee member of the San Joaquin Valley Clean Cities Coalition, which actively promotes alternative fuel technology and infrastructure. The District is also a member of the a member of an Action Team coordinated by the Fresno State Office of Community and Economic Development with the purpose of “advancing and supporting industry-specific partnerships and career pathways throughout the eight-county San Joaquin Valley in alternative motor vehicles and fuels.” The District is currently exploring additional opportunities for regional planning to evaluate barriers to the wider deployment of alternative fuel infrastructure, and develop strategies.

3.2.2.8 Community Incentives

The District currently operates several incentive programs designed to give the general public the opportunity to contribute to the goal of cleaner air for all Valley residents. The District’s community incentives include a wide range of project types and source categories. Current community incentive programs include the following:

- **Burn Cleaner Program –** The Burn Cleaner Program helps Valley residents upgrade their current wood-burning devices and open hearth fireplaces to natural gas, propane gas, or clean-pellet devices. The District offers a financial incentive to any interested resident and an additional incentive to low-income residents through a streamlined voucher program that involves partnering with interested retailers. The program has upgraded over 2,300 wood-burning devices, and continues to receive a steady stream of applicants.

- **Polluting Automobile Scrap and Salvage (PASS) –** The PASS program offers a cash incentive for participants who have retired their older vehicle; a voucher toward the replacement of an older high-emitting vehicle with a newer cleaner vehicle; or a voucher for emissions-related repairs to high-emitting vehicles. The program has replaced 202 high-emitting vehicles with newer, cleaner vehicles, retired 504 additional vehicles through a cash incentive. Additionally, the District’s award-winning “Tune-In Tune-Up” program has screened nearly 5,000 vehicles for high emissions, and provided nearly 3,000 vouchers for emissions-related repairs. The program has been operated with locally generated incentive funds and will continue to retire and replace vehicles with funding provided by the State's Enhanced Fleet Modernization Program. Vehicle repairs were conducted with grant funding from the Reformulated Gasoline Settlement Fund created as a result of an antitrust class action, and it will continue to be funded using locally generated incentive funds.

- **Clean-Green-Yard-Machine (CGYM) –** The CGYM program helps clean the Valley's air through incentives for residents to retire their old, gas mowers in favor of nonpolluting, electric mowers. The program has used locally generated incentive funds as well as funding from the State's AQIP. Over the past two years, the program has replaced over 3,500 gas lawn mowers with clean electric models.

- **Drive Clean! Rebate Program –** During the 2011–2012 fiscal year, the District revamped its incentive program structure to encourage Valley residents to drive advanced, clean vehicles, including electric and other alternative-fuel vehicles. In addition to clean-vehicle rebates, the Drive Clean! Program includes incentives that cover a portion of the charging infrastructure cost associated with electric vehicles.

- **Alternatives to Professionally Managed Pyrotechnic Firework Displays –** In 2012, the District provided incentive funding for a pilot program to demonstrate clean laser-light shows as an alternative to pyrotechnics for July 4th celebrations.

- **Public Benefit Grants Program –** The Public Benefit Grant Program provides funding to Valley cities, counties, and other public agencies for a variety of clean-air, public-benefit projects. Eligible applicants include cities, counties, special districts (e.g. water districts and irrigation districts), and public educational institutions (e.g. school districts, community colleges, and state universities) located within the Valley.

- **REduce MOtor Vehicle Emissions (REMOVE) –** The REMOVE program provides incentives for specific projects that will reduce the Valley's motor vehicle emissions, including e-mobility (video-telecommunications), bicycle infrastructure, alternative-fuel-vehicle mechanic training, and public transportation and commuter vanpool subsidies. The program allocates funds to cost-effective projects that have the greatest motor vehicle emissions reductions resulting in long-term impacts on air pollution problems in the Valley. All projects must have a direct air quality benefit in the Valley.

3.2.3 Potential new incentive programs

The District has successfully launched and expanded incentive programs in the Valley while steadily increasing the scope, accessibility, and efficiency of those programs. The District's incentive programs have been models for other agencies to follow: the State used the District's successful PASS program as a model for its Enhanced Fleet Modernization Program, the SCAQMD implemented the District's augmentation of the State's Hybrid Truck and Bus Voucher Incentive Program (HVIP), and the U.S. Department of Agriculture's NRCS used the District's highly successful agricultural equipment replacement program as the model for their own complementary program. The District's commitment to developing new and innovative incentive programs will continue to serve as a shining example for other agencies nationwide.

In addition to funding the existing core incentive programs that have traditionally achieved highly cost-effective emissions reductions (heavy-duty tractors, trucks, etc.), the District has evaluated some additional opportunities to expand the portfolio of programs available. As new funding sources and opportunities are identified, the District will continue to look for additional incentive programs and expansions to existing programs.

Table 3-5 Potential New Incentive Programs

Potential New Incentive Measures	Implementation Date
Ongoing Enhancements. Continue to seek additional funding to implement incentive programs and continue to support existing incentive programs for mobile sources, as appropriate.	Ongoing
Internal Combustion Engines. Consider funding new programs to further promote replacement of remaining agricultural internal combustion engines with electric motors, including but not limited to providing additional incentives for the high cost associated with utility line extensions to remove irrigation pump installations.	Ongoing
Lawn Care. Continue to evaluate commercial lawn care technologies through the Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program; once new technologies are verified as viable for the Valley, develop on-going incentive programs to encourage use of these new technologies; consider expanding the Clean Green Yard Machine program to include other eligible types of yard-care equipment, including low- or zero-emission equipment.	Ongoing
Energy Efficiency. Continue to foster and incentivize programs, as appropriate, consistent with the District Regional Energy Efficiency Strategy; including but not limited to continued support of the use of state Energy Efficiency and Conservation Block Grant funds, the funding of a pilot program to assess and analyze two manufacturing facilities to determine the potential to operate more efficiently, and funding outreach program showing government and service organizations the benefits of "going green."	Ongoing
Construction Equipment Replacement. Consider providing incentives for construction fleets to replace their heavy-duty off-road equipment sooner than required by the State's In-Use Off-Road Diesel Vehicle Regulation.	Ongoing
Refuse Vehicle Replacement Program. Consider providing incentives for the replacement of older refuse trucks, with a particular emphasis in environmental justice and other vulnerable communities.	Ongoing

3.3 TECHNOLOGY ADVANCEMENT

The District Governing Board approved creation of the Technology Advancement Program in March 2010 to accelerate development of technologies that can help reduce air pollutant emissions in the Valley. Meeting EPA's increasingly stringent ozone and PM2.5 air quality standards requires significant advancements in low-emissions technologies from mobile and stationary sources. The Technology Advancement Program provides a strategic and comprehensive means to identify, solicit, and support technology advancement opportunities. Ongoing refinement of the program's technology focus areas targets efforts to achieve the greatest impact on the Valley's attainment and other health-based goals under the *2012 PM2.5 Plan,* the *2013 Plan for the Revoked 1-Hour Ozone Standard,* and the District's other attainment plans.

The Valley's air quality challenges are not completely unique to the Valley, nor are they isolated within the boundaries of the air basin. Technology development can benefit regional and state air quality. Strategies for reducing emissions in the Valley can be enhanced through partnerships and collaborations with other air districts and state agencies. The District is currently collaborating with the ARB and the SCAQMD to prepare a document outlining a common vision for attainment of federal air quality standards, common greenhouse gas goals, and reduced exposure to toxics. The market penetration of transformative technologies will be a critical component of realizing a common vision, and the Technology Advancement Program will help to identify and support upcoming technology opportunities.

3.3.1 Technology Focus Areas

The District has structured the 2013 Technology Advancement Program to encourage participation within three focus areas:

Renewable Energy. Renewable energy projects are those that overcome barriers to using renewable energy such as remote solar energy/storage, vehicle-to-grid, wind energy, or peak-shaving systems with zero- or near-zero-emissions technologies.

Waste Solutions. Waste solutions focus on waste systems or technologies that minimize or eliminate emissions from existing waste management systems and processes, including waste-to-fuel systems, such as dairy digesters and other bio-fuel applications.

Mobile Sources. Mobile source projects include, but are not limited to, retrofit technologies for reducing particulate or NO_X emissions from heavy-duty trucks, zero- or near-zero-emissions goods movement solutions, clean alternative fuels (hydrogen, electric, etc.), vehicle hybridization, and efficiency improvements to on-road or off-road equipment.

Innovative projects that advance alternative fuel infrastructure technologies are a good fit to the program's mobile sources focus area and are actively encouraged to participate in this competitive program. For example, the District's Technology

Advancement Program has awarded funding to projects that advance technologies relevant to alternative fueling infrastructure. Gaseous fuel projects include landfill gas to CNG and digester gas to LNG projects. The program has also funded a project demonstrating dual high-capacity inverter/charger units for rapid charging between shifts allowing electric heavy-duty truck use for full 8-hour shifts in a distribution center setting.

These focus areas represent the current needs of the Valley; they also reflect the types of proposals previously received by the District within this and other programs. The District will continue to evaluate and, if necessary, update these technology focus areas to address to the Valley's air quality challenges.

3.3.2 Future demonstration projects

For fiscal year 2013 – 2014, the District has committed $6,103,900 of funding for new demonstration projects. In addition to directly funding demonstration projects, the District actively seeks opportunities to collaborate with technology innovators in seeking additional funding. An example of this type of funding is the District's administration of the Zero-Emission Commercial Lawn and Garden Technology Demonstration, funded with State Air Quality Improvement Program funds.

Moving forward, District staff will continue to search for opportunities to support projects that build the air quality technology research and demonstration capacity of colleges and universities in the Valley. This emphasis will improve the ability of local institutions to engage in future clean-technology projects that are specifically suited to the Valley's needs. To accomplish this, staff has adapted the Technology Advancement Program scoring criteria so that projects that incorporate local colleges and universities will score higher in that category than those that do not.

3.3.3 Interagency Collaborative Demonstration Projects

In addition to projects selected through the request-for-proposals process, the District has partnered with other California air quality agencies to demonstrate new and emerging technologies.

3.3.3.1 Zero-Emission Commercial Lawn and Garden Equipment Demonstration – ARB

The goals of the Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program (Demonstration Program) were to allow participating commercial landscape professionals (participants) to gain hands-on experience with cordless zero-emission commercial lawn and garden equipment (zero-emission equipment) and to initiate deployment of zero-emission equipment to the commercial sector. The ARB and the District funded $501,351 for the Demonstration Program, which concluded in June 2013.

The District worked with ARB, participating manufacturers and vendors (Technology Demonstrators), and participants to implement the Demonstration Program. The five

Technology Demonstrators who participated in the Demonstration Program included STIHL, TMC Power Equipment, Mean Green Products, The Greenstation, and EcoCut & Trim. The Technology Demonstrators offered a total of 23 items through the Demonstration Program, which consisted of zero-emission equipment, batteries, chargers, and related accessories. The Demonstration Program had a total of 60 participants with near equal distribution of participation across the San Joaquin Valley in all eight counties and included private landscape businesses and public agencies.

The Demonstration Program allowed the participants to conduct real world, in-use testing of zero-emission equipment and provide valuable performance data. The length of equipment use varied based on the size and type of field work and how the zero-emission equipment was operated. Data collection during the Demonstration Program showed that many participants used multiple batteries or required more than one charge per battery to operate a piece of equipment during a typical work day. Additionally, the equipment usage by the participants was determined by, but was not limited to, the location and season.

Several participants were impressed with the technology and felt that some of the zero-emission equipment provided through the Demonstration Program are ready for commercial use, specifically the riding lawnmowers, some regular lawnmowers, hedge trimmers, and chainsaws. District staff has shared the participant’s data and feedback with the Technology Demonstrators as informational tools to help further improve the zero-emission equipment, as necessary. Some of the Technology Demonstrators mentioned that certain zero-emission equipment that were used for the Demonstration Program have since undergone additional improvements and are available for commercial use.

3.3.3.2 Natural-Gas-Fired, Fan-Type Central Furnaces with Reduced NO_X Emissions – South Coast AQMD

SCAQMD is currently conducting a demonstration project focused on prototype natural-gas-fired, fan-type central furnaces with reduced NOx emissions. South Coast released a program opportunity notice for this demonstration project in February 2010, which solicited a number of proposals from furnace manufacturers and gas industry technology developers in partnership with furnace manufacturers. This technology assessment of reduced-NOx central furnaces was initiated with the November 2009 amendment of SCAQMD Rule 1111. The District committed to financial support of the technology assessment in June 2010, and has provided $50,000 for the demonstration project.

The goal of this technology assessment is to demonstrate reduced-NOx furnaces capable of meeting an emissions goal of 14 nanograms NOx per joule of useful heat. Based on the preliminary results of the SCAQMD furnace demonstration project, the technology required to meet new NOx standards will be available by 2015.

3.3.3.3 Vision for Clean Air: A Framework for Air Quality and Climate Planning – SCAQMD & ARB

While the District's air quality challenges are significant, many aspects of those challenges are not unique, and they are not isolated to the boundaries of the Valley. Strategies for reducing emissions in the Valley are enhanced through partnerships and collaborations with other air districts and state agencies. The District seeks out opportunities for such collaborations to build strong relationships and even stronger attainment strategies.

In 2012, ARB, the District and SCAQMD, collaborated to develop the *Vision for Clean Air: A Framework for Air Quality and Climate Planning*. The goal of this collaboration is to draft a common vision for mobile and stationary source strategies that integrate the need to meet federal air quality standards for PM2.5 and ozone, the need to reach California's greenhouse gas goals, and the need to reduce public exposure to toxics (e.g. diesel particulates). This collaborative effort will take advantage of the efficiencies inherent in dealing with these three issues as inter-dependent problems with inter-dependent solutions.

Through the *Vision for Clean Air* effort, the three agencies have been evaluating pollutant reductions needed to meet overlapping air quality requirements for 2023 and 2032 for ozone, and 2020 and 2050 for GHG emission targets. The *Vision for Clean Air* effort is a process that is just beginning to look at the scope of transformation needed to meet these goals; the specific actions and advanced technologies needed are still under development. Ultimately, the needed reductions will depend on the integration of transformative measures and emerging technologies (including zero- and near-zero emission goods movement) with long-range planning and control strategies.

Critical to the attainment of targets will be the evaluation of the potential policies, legislation, infrastructure, and efficiencies that will ensure that South Coast, the Valley, and California are prepared to meet the long-term goals. More detailed analyses will be conducted as part of the planning efforts for the upcoming 8-hour ozone SIPs in 2016.

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

A consortium of funding partners including the California Energy Commission, SCAQMD, and Southern California Gas Company are conducting development and demonstration projects to develop production-intent or production near-zero NO_X emission heavy-duty natural gas engines, integrate the engines into heavy-duty vehicles chassis, and evaluate the performance of the vehicles in a variety of heavy-duty vehicle applications in the South Coast Air Basin and the Valley.

The target for these projects is to demonstrate engines capable of producing 90% less NO_X than the current 2010 engine standards, with minimal increases in ammonia emissions. Vehicles will be deployed and demonstrated in commercial services to evaluate performance, reliability, and emissions expectations.

3.4 LEGISLATIVE STRATEGY

The extreme air quality challenges of the Valley demand that the District and the community take extraordinary measures to improve air quality and public health. The District has developed the most stringent rules and regulations in the nation, and has already achieved such significant emissions reductions that the Valley is at the point of diminishing returns from new regulatory controls on stationary and area sources. The District's legislative strategy is an example of the innovative, multi-faceted approach that it takes to reduce emissions in the Valley.

3.4.1 Current Legislative Strategy

Each year the District Governing Board adopts a legislative platform to guide District advocacy and policy efforts. Through state and federal lobbying efforts and delegation visits to Washington D.C., the District informs elected officials about Valley needs and concerns based on the priorities established in the legislative platform. The policy positions outlined in the legislative platform provide guidance on legislative and regulatory actions, and reflect current priorities involving air quality issues in the Valley. The District 2013 legislative platform was adopted by the District Governing Board on January 17, 2013; the following is a summary of the legislative platform priorities for 2013. Table 3-7 summarizes the 2013 Legislative Platform priorities. Refer to http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2013/January/i11-CorrectedCorrectedFinalGBItemLegPlatform2013.pdf for more information about the District's entire legislative strategy.

Table 3-6 Summary of the 2013 Legislative Platform Priorities

Policy Level	Legislative platform priority
Federal	Seek common sense improvements to the federal Clean Air Act
State	Support SB 11 and AB 8 that would re-authorize the Carl Moyer and AB 118 incentive programs and provide funding for the Clean-Fuel Outlet mandate
State/ Federal	As the state and federal governments implement climate change programs, support measures that target a portion of any revenues generated under cap and trade programs to emissions reduction projects in areas that are already disproportionately impacted by air pollution, support measures that have co-benefits to criteria pollutant reductions, and oppose measures that may lead to increases in criteria pollutant or toxic emissions
State	Support streamlining of the California Environmental Quality Act (CEQA).
Federal	Support the establishment of an Air Quality and Health Empowerment Zone designation that would provide financial assistance to regions that have significant air quality, health, and economic challenges
State/ Federal	Seek funding and other support from the ARB and EPA to install and operate additional air quality monitoring instruments throughout Valley
State/ Federal	Support efforts that provide for cost-effective alternatives to agricultural burning including subsidies and preferential utility rates for power produced from biomass and additional research to identify other technologically and economically feasible alternatives
State/ Federal	Support energy efficiency and alternative energy policies and initiatives that will result in emissions reductions and cost-effective alternatives to burning agricultural waste
State/ Federal	Support adequate resources and policies to reduce the impact of wildfires and their attendant public health impact
Federal	Support the continuation of air quality funding in the federal Farm Bill that is designated to accelerate the replacement of agricultural equipment

3.4.1.1 Common Sense Improvements to the Federal Clean Air Act

Since its adoption, the CAA has led to significant improvements in air quality and public health throughout the nation. However, areas of the nation with mature, local air quality management programs, like the Valley, have reached the point of diminishing returns. After more than 20 years since the last amendments to the CAA in 1990, many well-intentioned provisions are leading to unintended adverse consequences. The antiquated provisions of the CAA are now leading to confusion, and the lack of updated congressional directive has the courts into policy makers.

The District supports the well-intentioned concepts in the CAA that call for routine review of health-based air quality standards, clean air objectives that are technology-forcing, and clean air deadlines that ensure expeditious attainment and timely action. However, the CAA should be amended to eliminate current confusion, restore congressional leadership in clean air policy, and maintain and strengthen its health-protective core.

3.4.1.2 Extend Sunset Dates of Critical State Funding Programs

The District has aggressively pursued air quality incentive funds to achieve accelerated emissions reductions from mobile sources of pollution. Two programs that have historically provided incentive funding, the Carl Moyer and the AB 118 alternative fuels programs, are set to expire in the coming years. The District supports SB 11(Pavley and Rubio) and AB 8 (Perea and Skinner) that would extend the sunset dates of these critical programs. Funds from these two programs, and other similar programs, would be used by the District for incentive programs to achieve SIP creditable emissions reductions through District Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs) adopted in 2013 per a commitment in the District's *2012 PM2.5 Plan.*

Additionally, the bills provide funding under AB 118 for hydrogen-fueling infrastructure funding necessary to support commercial fuel-cell vehicle deployment in California beginning in 2015. Fuel-cell vehicles, in addition to other advanced clean vehicles, are necessary to meet federal and state clean air standards. Without this legislation, installing this fueling infrastructure is an unfunded mandate on the oil industry.

3.4.1.3 Support Streamlined Climate Change Regulations that Do Not Hinder Criteria and Toxic Pollutant Emissions Reductions

In response to AB 32 and SB 375, the ARB has adopted a number of climate change regulations including a cap and trade program. EPA has begun including climate change considerations in their regulations for large stationary emissions sources. Many of the sources that are, or will be, regulated by ARB and EPA are currently regulated by the District. These new requirements have the potential to require duplicate inefficient reporting by businesses to multiple regulatory agencies. Using the existing infrastructure at local air districts can provide for a more efficient and expeditious implementation of these new mandates. Therefore, the District supports measures that would integrate the new state and federal mandates into existing local air district programs.

The cap and trade program recently adopted by ARB sets up a mechanism by which affected sources can procure allowances or offsets to meet specified and declining caps on their greenhouse gas emissions. This scenario can potentially lead to adverse impacts in areas that are already disproportionately impacted by criteria pollutant emissions. The District supports measures that would target a portion of any revenues generated under the sale or auctioning of cap and trade allowances to emissions reduction projects in such areas, including the Valley. Although climate change measures provide for many co-benefits in reducing both greenhouse gasses and criteria pollutant emissions, there are some measures that may lead to increases in criteria pollutant or toxic emissions. Therefore, the District will support only those reasonable climate protection measures that reduce greenhouse gas emissions as well as toxic and criteria pollutants.

3.4.1.4 Support Streamlining of CEQA

California Environmental Quality Act (CEQA) provides a process for government to evaluate and mitigate adverse environmental impacts from projects and programs. While the original intent of CEQA must remain intact, the law has been abused by interest groups that are opposed to projects or those that want concessions from projects not related to the environment. Frivolous CEQA lawsuits cost taxpayers money, unnecessarily slow economic activity, and lead to considerable expense and uncertainty for project proponents. The Governor and the State's legislative leaders have indicated that CEQA reform is a top priority for the 2013 legislative session. The District supports reform that maintains CEQA as a forum to evaluate and mitigate environmental impacts, streamlines the review process, provides more certainty to project timelines, avoids duplicative reviews, lessens opportunities for litigation, and provides for better integration and coordination with environmental protection mandates.

3.4.1.5 Support the Establishment of an Air Quality and Health Empowerment Zone Designation

This new program would provide financial assistance for incentive programs in areas that face significant air quality, health, and economic challenges. Given the Valley's air quality challenges and continued double-digit unemployment rates, the Valley would be a prime candidate for designation under this new program. The program would provide a mechanism for ongoing appropriations for incentive programs to accelerate the introduction of new emissions reduction technologies.

3.4.1.6 Seek Funding and Support from ARB and EPA for Additional Monitoring Equipment

The Valley is currently designated nonattainment for both the ozone and PM2.5 NAAQS and operates one of the most extensive air monitoring networks in the nation. Data from these monitors provides schools, parents, and the general public with instant, real-time access to local air quality information through the District's first-in-the-nation Real-Time Air Advisory Network (RAAN). A more extensive monitoring network would greatly enhance the data that the District provides to the public and help to limit the health impact associated with exposure to elevated levels of air pollution. Data from these monitors also provides the foundation of the District's attainment planning efforts. The state and federal government should continue to fund, and enhance, the existing monitoring network for ozone and PM2.5.

The federal government is also requiring new monitoring sites near roadways to monitor nitrogen dioxide (NO_2). Local fee revenues from stationary sources cannot support the significant cost associated with installation and operation of these new monitors. The current proposal identifies existing EPA 105 grant funds for constructing and operating the new monitoring sites and does not provide additional funding to agencies. The District cannot use existing 105 funds for the new stations because these funds are already fully expended to operate our existing federally required air monitoring network. To have to divert existing EPA 105 grant funding from the existing monitoring network to construct the new NO_2 near-road monitors could affect the District's ozone and particulate attainment strategies and limit the availability of information that is critical to protecting public health. With state and federal government having the primary authority over mobile sources, it is imperative that the state and federal governments provide funding to offset the substantial cost of establishing and operating new monitoring sites near roadways. Additionally, as the near roadway monitors are designed to be *hotspot* monitors for impact from mobile sources, EPA should make it clear that the data obtained from these monitors is not to be used to determine compliance with other ambient air quality standards that were established using monitors more representative of community-wide exposure.

3.4.1.7 Support Cost-Effective Alternatives to Agricultural Burning

The District has been phasing out agricultural burning per the SB 705 schedule. To date, agricultural burning has been reduced by 70% and with the latest amendments approved by the District, approximately 90% of agricultural burning is projected to be eliminated in the coming years. Further progress and complete phase-out of agricultural burning requires economically feasible alternatives that do not currently exist. Subsidies or preferential utility rates for power produced from biomass can serve as measures to enhance the economic feasibility of this alternative. Additional research is also needed to identify other technologically and economically feasible alternatives. A comprehensive strategy to promote these alternatives will also help in meeting renewable power goals and standards.

3.4.1.8 Support Energy Efficiency and Alternative Energy Policies for Emissions Reductions and Alternatives to Agricultural Burning

Energy efficiency and clean-energy alternatives provide an opportunity for meaningful reductions in emissions in areas where stationary sources are already well-regulated, such as in the Valley. The District has identified energy efficiency and renewable energy as part of its effort to attain air quality standards as expeditiously as possible. Toward that end, the District supports policies and initiatives that encourage renewable energy and energy efficiency including the following: a) developing additional biomass capacity using agricultural waste materials; b) expansion of net metering and feed-in tariffs for the use of solar and other renewable sources of energy; c) programs that promote energy efficiency for energy end-users that will result in lower pollutant emissions and a more stable electrical distribution system; and d) measures that incentivize and encourage low-emission technologies for use of waste gas as an alternative to waste-gas venting or flaring.

3.4.1.9 Support Resources and Policies to Reduce the Impact of Wildfires

Wildfires result in significant loss of life and property. Air pollution generated from wildfires is also significant and far exceeds the total industrial and mobile source emissions in the Valley. In the summer of 2008, California experienced a record number of wildfires, and the resulting emissions caused adverse public health impacts and unprecedented levels of PM2.5 and ozone in the Valley and throughout the state. The resulting pollutant levels caused multiple exceedances of the health-based standards, and in some cases were higher than levels in recorded history. Reducing wildfires and the resulting air pollutants requires a sustained, multi-faceted approach to reduce fuel supplies and adequate resources to manage fires when they occur. Toward that end, the District supports policies and initiatives that would encourage rapid disposal of the fuel supply, including the following: a) additional financial and staffing resources for public and private land managers to conduct prescribed burning for reducing fuel supplies that lead to large and uncontrollable wildfires; b) additional resources to manage wildfires when they occur; c) lessening or removal of contradictory environmental protection policies that prohibit the use of mechanized methods, or prescribed burning to reduce fuels when those are the only feasible methods available; and d) changes in the federal policies that better incorporate air quality concerns by shifting focus to prescribed burning and employing fire management techniques that reduce air quality impact when wildfires occur.

3.4.1.10 Support Continued Federal Farm Bill Funding for Equipment Replacement

As part of the efforts to attain NAAQS in the Valley, ARB committed to a reduce emissions from in-use agricultural equipment to achieve five to ten tons per day of NOx reductions in the Valley by 2017. ARB's measure would accelerate fleet turnover to equipment with engines meeting cleaner, new engine NOx standards as quickly as possible. The District and the State support efforts to secure federal funds and other mechanisms to achieve near-term reductions from agricultural equipment that can be credited to the SIP. Toward that end, the District supports the inclusion of continued air quality funding through the NRCS in the Farm Bill, including funding to reduce emissions from agricultural equipment.

3.4.2 Potential Future Legislative Strategies

Consistent with *2012 PM2.5 Plan*, the District will continue to provide support for the following through its legislative platform: viability of biomass facilities as an alternative to open burning, cleaner burning alternative fuels, the removal of contradictory environmental protection policies, additional resources to manage wildfires, legislative measures to provide reliable water supplies to the Valley, and additional state and federal funding for incentive programs.

3.5 PUBLIC OUTREACH

The District's public outreach efforts are examples of the innovative multi-faceted approach that the District takes to reduce emissions in the Valley. Engaging the public in efforts to reduce emissions is a key element of the District's attainment strategy; however, further education is needed to increase public support for new and controversial regulations. These activities may not directly generate SIP-creditable emissions reductions, but they reinforce the District's and Valley's commitment in meeting NAAQS as efficiently and expeditiously as possible.

3.5.1 Current Public Outreach Strategy

3.5.1.1 Air Alerts

The District developed the Air Alerts notification system to address potential exceedances of the 1-hour ozone standard. Used in late summer when the air basin historically experiences such exceedances, Air Alerts provide a structured process to notify the public that ozone levels are rising and advise them that emission-reduction actions are needed to prevent an exceedance, such as using alternative transportation and postponing emission-causing activity that creates ozone precursors. Notification is provided through the District's website, direct faxes, social media, and emails using targeted recipient lists, Valley media advisories, and press releases. Besides being an effective tool to communicate ozone trends, the Air Alerts notification system is also a way to broaden the public discourse about the 1-hour ozone standard and educate Valley residents and businesses about the economic penalty for exceeding the standard.

Based on the first two seasons of Air Alert activity, the District has seen a reduction in the number and length of 1-hour ozone exceedances. In 2011, the first season of Air Alerts, the air basin recorded just three exceedance days, down from 56 days in 1996 and 30 days in 2002. August 2011 was the only August in the history of the air basin without a 1-hour ozone exceedance. Also in 2011, the Valley had the longest stretch of time without an exceedance, with the first 1-hour ozone exceedance not occurring until September 22, 2011. Throughout the season, the Valley experienced lower 1-hour ozone peaks and shorter-term exceedances on days when the standard was exceeded, and those results continued into 2012.

There is a causal correlation between the Valley’s incidences of 1-hour ozone exceedances and the beginning of the new school year. During the past few years, the only exceedances have occurred during mid-afternoon hours at the beginning of the school year, suggesting that the increase in traffic to and from school sites is the source of these emissions. Recognizing this, the Air District has embarked on an aggressive public education and outreach campaign to 1) educate Valley drivers, particularly those with school-aged children, of the correlation and 2) encourage them to modify their behavior when dropping off and picking up students. The Air District’s Governing Board recently approved funding to conduct targeted outreach to an estimated 841 schools and 168,000 students during the 2013-14 school year to reduce school-site idling. Outreach components include:

- Educating and training school staff regarding the effect of idling on students
- Providing educational materials to schools for distribution to parents regarding the effects of idling on air quality
- Providing educational materials to teachers to share with students regarding the effects of idling on air quality
- Continuing to provide and encourage use of No-Idling signs at schools where parents pick up students after school
- Promoting teacher incentive program to fund small classroom projects related to idling and air quality.

3.5.1.2 Real-Time Air Advisory Network (RAAN)

Pollution levels can vary greatly during the day. While the District issues a daily air quality forecast for each county in the Valley, localized air quality often deviates from these generalized, county-wide forecasts. Access to real-time data advises the public of such deviations and helps ensure that outdoor activity can be limited to periods of the day when air quality is acceptable and healthier.

The District launched the Real-time Air Advisory Network (RAAN) in 2010. This program is the first communication network in the nation to provide automated notification of poor or changing local air quality to the public throughout the Valley. While the District initially developed the program for schools as a tool to determine appropriate levels of outdoor activity for their students, the District expanded the program in 2011, and now it is available to all Valley residents. Through RAAN, the District combines local air quality information with specific, concentration-based health recommendations that allow RAAN subscribers to make informed decisions about when and for whom outdoor activities should be limited.

Anyone can subscribe to RAAN at no charge through the District's website; all that is required is the subscriber's email address. Once subscribed, the District will send email notifications with a link to the real-time data of the closest monitoring station within the District's extensive monitoring network. The District sends automated notifications on an hourly basis when air quality deteriorates or improves.

3.5.1.3 Multi-Media Efforts

Reflecting both radical changes in methods of communication and the District's ongoing strategy to incorporate the newest technologies in delivering critical air quality information to the District's stakeholders and residents, the District has integrated the use of social media into its message-delivery systems. Advances in social media have provided a new tool to connect and unite Valley residents around the mission of improving air quality. Social networking allows the District to expand its outreach and improve its ability to interact with and serve the public.

The Outreach and Communications department uses Facebook, Twitter and a newly developed, free iPhone application to disseminate time-sensitive information including real-time air quality data, forecasts of deteriorating air quality, Air Alert advisories and health cautionary statements. This enables the delivery of important air-quality information to diverse populations that may not engage in the use of traditional media and ensures that critical health information is accessible to the broadest population possible.

Additionally, the District uses LinkedIn to engage stakeholders, industry colleagues, and the professional community in technical discussions and inform them of grant programs, air quality developments, and related topics.

3.5.1.4 Real-Time Outdoor Activity Risk (ROAR)

To support the expanded RAAN program, the District developed the Real-Time Outdoor Activity Risk (ROAR) scale, which has specific recommendations and limitations for increasing levels of activity—from recess through competitive athletic events. This scale is based on the Air Quality Index system used for the daily air quality forecasts, but provides more detailed activity recommendations based on the latest health science. The ROAR system, when used in conjunction with the Air Quality Flag Program and daily air quality forecasts, is part of a comprehensive set of tools available to schools and the public for effective health protection.

3.5.1.5 Healthy Air Living

Most of the District's outreach activities and programs are covered by the Health Air Living umbrella. As a year-round message, the Healthy Air Living idea of "make one change" promotes and encourages Valley residents and businesses to implement voluntary measures to reduced emissions and improved air quality. Emission-reduction recommendations address PM2.5 emissions, either directly emitted or as byproducts of other pollutants (e.g. reducing the number of miles traveled in a car reduces NOx and, therefore, particulates) and NOx emissions for overall reductions in Valley ozone levels.

Components of the Health Air Living message include the *For Reel Video Contest*, aimed at middle-school, high-school, and college-aged students; the *Healthy Air Living Kids Calendar* for kindergarteners through high-school students; and *Healthy Air Living Pledge Cards*, which are customized for residents, businesses, schools, and faith-based organizations. In addition to these specific programs and others, the Healthy Air Living logo and message are incorporated into the District's communications, collateral, incentive materials, and outreach efforts.

3.5.1.6 Air Quality Flag Program

The Air Quality Flag Program is provided free of charge to hundreds of elementary and secondary schools throughout the Valley. The District provides to each school a set of colored flags mirroring the levels of the Air Quality Index (AQI), which are used to convey the daily air quality forecast. These flags represent a visual cue for students, faculty, and staff as to the daily air quality and potential risks associated with the expected air quality. School site training is a critical component of the flag program, providing school staff with the background and knowledge to effectively execute this program.

3.6 OTHER INNOVATIVE STRATEGIES

Non-regulatory strategies help accelerate attainment of the NAAQS and have been an important part of recent District plans. For example, through the District's Fast Track strategy, the District and its Fast Track task force have evaluated several innovative and collaborative emissions-reducing measures, complementing the more traditional measures included in the *2007 Ozone Plan,* the *2008 PM2.5 Plan,* the *2012 PM2.5 Plan*, and now this plan. These Fast Track efforts have resulted in increased incentive funding being brought to the Valley and have expanded public outreach through Healthy Air Living, guidance documents, and model policies.

3.6.1 Green Purchasing and Contracting

Valley businesses and government agencies can get involved in air quality improvements by considering the environmental impacts when making purchasing and contracting decisions. Green purchasing and contracting is the selection of goods, services, and vehicles that have a reduced impact on human health and the environment when compared with other products that serve the same purpose. These efforts can reduce waste, energy consumption and the overall impact of day to day operations. When making purchasing decisions, give preference to environmentally responsible products, materials and supplies; fuel-efficient, low-emission and hybrid vehicles; energy-efficient and water-efficient appliances; service providers who employ greener methods.

The District has created the *Green Purchasing and Contracting: A guide to reducing environmental impacts through the procurement process* guideline and made it available on the District webpage at http://www.valleyair.org/Programs/FastTrack/2011/GreenPurchasingReport4-6-11%20_2_.pdf. The District has also set an example for other agencies by adopting and implementing its own Green Procurement & sustainable Practices Policy in January 2012. The District will continue to support Valley organizations in adopted policies and practices to make green purchasing and contracting a routine part of their operations.

3.6.2 Energy Efficiency

California has been on the forefront of developing renewable energy sources, and has implemented regulations to ensure cleaner, non-renewable energy. The District's involvement in energy efficiency and renewable energy is guided by its Regional Energy Efficiency Strategy (REES), which was adopted in January 2010.[5] This policy identifies the District's commitment to fostering energy efficiency and clean energy alternatives as opportunities for emissions reductions. Consistent with the District's Legislative Platform, the District continues to work with stakeholders and state agencies to expand net metering and feed-in tariffs for use of solar and other renewable energy sources, promote energy efficiency programs for energy end users that will result in lower emissions and a more stable electrical distribution system, and develop measures that incentivize and encourage low-emission technologies for use of waste gas as an alternative to waste-gas venting or flaring.

3.6.3 Eco-Driving

Given that mobile source emissions now represent approximately 80% of the NOx emissions in the Valley, and that mobile sources are essentially outside the regulatory control of the District, finding ways through education and outreach to reduce such emissions in the Valley is critical to future attainment of the NAAQS. One such program in development is *Eco-Driving*. Eco-Driving refers to everyday techniques that drivers can do to maximize the fuel economy of their vehicles. These include observing good operating maintenance, such as proper tire pressure, wheel alignment, and oil viscosity; improving aerodynamics; traveling at efficient speeds; choosing the appropriate gear for manual transmissions; driving defensively to avoid unnecessary braking; accelerating at a constant pace; and other simple, yet often forgotten, driving techniques. As with other

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[5] San Joaquin Valley Air Pollution Control District. (2010). *Approval of the District's Regional Energy Efficiency Strategy*. Memorandum to the SJVAPCD Governing Board. Public Hearing, January 21, 2010. http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2010/January/Agenda_Item_7_Jan_21_2010.pdf

informational activities conducted by the District, an Eco-Driving program could be encompassed under the Healthy Air Living umbrella.

3.6.4 Urban Heat Island Mitigation

Pavement, dark-colored roofs, and other hard surfaces absorb sunlight, trap heat, and increase local temperatures. Urban areas, with excessive heat-absorbing surfaces and less vegetation, tend to be warmer than surrounding rural areas. The increase in temperature in urban areas increases ozone formation potential within those areas. Reducing the extent of such surfaces and increasing the amount of vegetation can have a positive effect on reducing local temperature and reducing the potential for ozone to form. Increased temperatures also result in greater demand for interior cooling by way of air conditioners, fans, and evaporative coolers, all of which require more energy.

As part of its effort to educate and inform the public about their role in clean air, the District will expand its outreach to include techniques for reducing the effects the urban heat island, including: re-roofing with light-colored roofs, reducing the extent of paved surfaces in residential and commercial development, and planting site-appropriate vegetation to enhance cooling during harsh central-valley summers. The District can also work with local developers and jurisdictions to encourage the use of light-colored roofs and alternative parking lot surfaces in new development.

3.6.5 Alternative Energy

The District encourages cleaner ways of generating electricity and mechanical power, and moving vehicles, in addition to overall reductions in energy use. These alternative energy choices include renewable energy, waste-to-energy systems, and alternative fuels and vehicle technologies. The District also encourages the use of alternative energy sources that are clearly cleaner than industry standards in terms of criteria pollutants. The *District's Alternative Energy: On the Fast Track to Clean Air* is a guideline for considering clean energy options in the Valley that discuss, and provide additional resources for, the District's current recommendations regarding the most advantageous and viable alternative energy systems. Alternative energy choices include solar energy, wind turbines, biomass, dairy digesters, and electric irrigation pumps, just to name a few. This guidance document is available on the District webpage at http://www.valleyair.org/Programs/FastTrack/2011/Alternative%20Energy.pdf.

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Chapter 4

Demonstration of Federal Requirements

2013 Plan for the Revoked 1-Hour Ozone Standard
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CHAPTER 4: DEMONSTRATION OF FEDERAL REQUIREMENTS

The federal Clean Air Act (CAA), Title 1, Part D, Subparts 1 and 2, requires California to submit the following documentation specific to the San Joaquin Valley (Valley) to address the 1-hour ozone National Ambient Air Quality Standards (NAAQS):

1. An attainment demonstration meeting the requirements of CAA sections 182(c)(2) and 172(a)(2);
2. A reasonably available control measures (RACM) demonstration meeting the requirements of CAA section 172(c)(1);
3. A rate of progress (ROP) demonstration meeting the requirements of CAA sections 172(c)(2) and 182(c)(2);
4. Contingency measures for ROP milestone years and the attainment year, meeting the requirements of CAA Section 172(c)(9) and 182(c)(9);
5. Provisions satisfying the requirements for clean fuels and clean technologies for boilers in CAA 182(e)(3); and
6. Provisions satisfying the vehicle miles traveled (VMT) provisions of CAA section 182(d)(1)(A).

This chapter demonstrates or discusses each of these requirements.

4.1 ATTAINMENT DEMONSTRATION

As discussed in Chapter 2, the California Air Resources Board (ARB) used a modeled attainment test consistent with U.S. Environmental Protection Agency (EPA) guidelines to predict future 1-hour ozone concentrations at each monitoring site in the Valley and to demonstrate attainment. A photochemical model simulates the observed ozone levels using precursor emissions and meteorology in the region. The model also simulates future ozone levels based on projected changes in emissions while keeping the meteorology constant. This modeling is used to identify the relative benefits of controlling different ozone precursor pollutants and the most expeditious attainment date. Appendix E contains the modeling protocol for this plan. Appendix F contains a summary of the modeling process and results.

As discussed in Chapter 1, the revoked 1-hour ozone standard is 124.0 parts per billion (ppb). Modeling shows that the Valley will attain the 1-hour ozone standard by 2017 based on implementation of the ongoing control measures. As illustrated in Table 4-1, the monitoring site with the highest predicted ozone concentration is Edison with a predicted design value at 119.3, which is 4.7 ppb below the standard, and the two sites with the second and third current highest ozone concentrations are predicted to be 15 to 30 ppb below the standard.

Table 4-1 Base-Year and Future-Year 1-Hour Ozone Design Values (DV)

Monitoring Station	DV (2005-07)	DV (2015-17)
Edison	135	119.3
Arvin-Bear_Mountain_Blvd	131	107.4
Fresno-1st_Street	130	103.7
Clovis-N_Villa_Avenue	125	104.1
Fresno-Sierra_Skypark_#2	124	98.8
Parlier	121	97.4
Sequoia_and_Kings_Canyon	118	102.4
Bakersfield-5558_Califor	117	98.0
Sequoia_Natl_Park-Lower	113	98.5
Visalia-N_Church_Street	112	94.5
Oildale-3311_Manor_Stree	112	95.2
Fresno-Drummond_Street	110	93.0
Hanford-S_Irwin_Street	110	92.6
Modesto-14th_Street	109	95.9
Shafter-Walker_Street	105	87.7
Turlock-S_Minaret_Street	104	91.8
Merced-S_Coffee_Avenue	102	85.4
Stockton-Hazelton_Street	101	86.3
Maricopa-Stanislaus_Stre	100	83.5
Madera-Pump_Yard	95	82.4

4.2 REASONABLY AVAILABLE CONTROL MEASURES (RACM) DEMONSTRATION

CAA Section 172(c)(1) requires attainment plans to provide for the implementation of RACM as expeditiously as practicable (including emissions reductions from existing sources in the areas as may be obtained through the adoption of at least reasonably available control technology) and shall provide for attainment of the standard.

Put another way, the total of all potential emissions reductions opportunities that are *not* included as plan commitments must not advance attainment by one year. Measures that are not necessary to satisfy Rate of Progress (ROP) or expeditious attainment are also not required RACM for the area.

To advance attainment by at least one year, the collective emissions reductions that could be achieved through unused but reasonably available controls would have to achieve the 2017 emissions levels by 2016. As noted in Chapter 2, modeling for this and other ozone plans has shown that the Valley is very much NOx limited, especially in future years; as such, NOx emission reductions are most effective in reducing Valley ozone concentrations, whereas Valley ozone is not as responsive to VOC emission reductions and therefore, VOC emission reductions have minimal impact on advancing attainment. Advancing attainment by one year would therefore depend on expediting NOx emission reductions.

Valley NOx emissions are already being significantly reduced as adopted regulations are fully implemented through fleet turn-over and normal equipment replacement. As illustrated in Appendix B to this plan, about 89% of NOx emission reductions occurring between the 2007 base year and the 2017 attainment year come from mobile sources. These reductions cannot be expedited through additional stationary and area source regulations, for which the District has regulatory authority. Based on the difference between 2017 and 2016 NOx emissions levels, unused control measures would have to achieve 12.1 tons per day (tpd) of NOx emission reductions to advance attainment by one year. However, as previously discussed, there are no unused control measures in this plan because every reasonable control measure is used in this plan.

This is not to say that attainment before 2017 is not possible. In fact, the Valley's 1-hour ozone air quality has greatly improved over the past several years through the implementation of already-adopted control measures. As of the posting of this plan, attainment could be possible as early as 2013. On the other hand, it takes as little as four hours over a three-year period (where those four hours occur on four separate days at a single air monitoring site) to keep an area out of attainment, and a single episode of ozone build up could prolong nonattainment past 2013. Therefore, 2017 is the official attainment year for this plan, per the modeling and other analyses conducted as part of this planning effort. The 2017 attainment year is consistent with the five-year attainment timeframe of CAA §172(a)(2)(A); in addition, this plan is not using the full 10-year attainment timeframe allowed under CAA §172(a)(2), nor does it rely on yet-to-be-identified "black box" reductions under CAA §182(e)(5).

RACM are, by definition, reasonable. Although an air quality attainment plan must include a thorough analysis of reasonably available measures, it need not analyze every conceivable measure; reasonability must drive the analysis. Any measure that is absurd, unenforceable, impractical, or would cause severely disruptive socioeconomic impacts is unreasonable. This analysis must consider all agencies' opportunities together, but the starting point is the separate analyses of each agency.

4.2.1 District RACM Opportunities

As discussed in Appendix C, all reasonable control measures under the District's jurisdiction are being implemented. The District has adopted many of the toughest stationary and area sources rules in the nation. There are no reasonable regulatory control measures excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures.

4.2.2 ARB RACM Opportunities

As discussed in Chapter 3, all reasonable control measures under ARB's jurisdiction for mobile sources are being implemented. Given the significant emissions reductions needed for attainment in California, ARB has adopted some of the most stringent control measures nationwide for on-road and off-road mobile sources and the fuels that power them. There are no reasonable regulatory control measures excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures.

4.2.3 Metropolitan Planning Organizations (MPOs) RACM Opportunities

As discussed in Appendix C of the recently adopted *2012 PM2.5 Plan*, all reasonable control measures under MPO jurisdiction are being implemented. There are no reasonable regulatory control measures excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures.

There are no reasonable regulatory control measures from any agency's jurisdiction that have been excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures.

4.3 RATE OF PROGRESS (ROP)

This section explains and demonstrates ROP and quantitative milestones that are required until the District reaches attainment of the revoked federal 1-hour ozone air quality standard. The data in this section is based on information that has been provided in other chapters and appendices of this plan. The information and conclusions presented here are based on the best available information as of August 2013 but are subject to change.

4.3.1 ROP Requirements

Nonattainment areas that have already met the 15% VOC emissions reduction requirement for the revoked 1-hour ozone standard are subject to the ROP requirement to obtain an average of 3% annual reductions of VOC or NOx in milestone years (every three years) after the baseline year until the attainment year. EPA approved the District's *1994 Ozone Attainment Demonstration Plan* and its 15% ROP demonstration in the Federal Register on January 8, 1997.[1] The District has submitted periodic milestone compliance demonstrations to show retrospectively that the required ROP emissions reductions have occurred in the District.

The District must now obtain an average of 3% annual reductions of VOC or NOx emissions every 3-year period until the attainment year. The baseline year for this plan in 2007, so the milestone years are 2010, 2013, 2016, and 2017.

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[1] Approval and Promulgation of Implementation Plans; California—Ozone, 62 Fed. Reg. 5, pp. 1150–1187. (1997, January 8). (to be codified at 40 CFR pt. 52)

4.3.2 ROP Calculations and Demonstration

The CAA specifies the baseline from which each milestone's emissions reduction is calculated.[2] It is defined as "the total amount of actual VOC or NOx emissions from all anthropogenic sources in the area, minus the non-creditable emissions reductions associated with the pre-1990 motor vehicle control program (MVCP) regulations, and Reid Vapor Pressure (RVP) regulations promulgated by the time of enactment."[3] Non-creditable pre-1990 MVCP and RVP emissions reductions must be removed from the base year and milestone year emissions in order to develop an inventory of creditable emissions for the ROP demonstration.

ARB staff estimated the non-creditable pre-1990 MVCP and RVP emissions reductions in accordance with EPA technical guidance, using an EMFAC[4] simulation. This simulation, following EPA guidance, is designed to estimate the benefits of the pre-1990 motor vehicle and fuels regulations today and into the future without consideration of more stringent regulations adopted and implemented since 1990. The EMFAC model simulates motor vehicle fleet turnover while fleet activity is kept constant at the base-year level. In addition, new vehicles entering the fleet after the base year are assumed to be equipped with emission control equipment required of new 1990 vehicles. This simulation yields the non-creditable California pre-1990 MVCP/RVP adjustment for each ROP year. Table 4-2 shows the ROP calculations for VOC and NOx.

The ROP demonstration in Table 4-2 shows that VOC and NOx emission reductions are more than sufficient to meet the required ROP in all milestone years. The required 3% contingency was secured by the first milestone year (2010) and carried through to the attainment year (2017).

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[2] Clean Air Act, Title 1, Part D, Section 182 (b)(1)(C) and (D).

[3] Clean Air Act, Title 1, Part D, Section 182 (b)(1).

[4] EMFAC is California's model for estimating emissions from on-road vehicles operating in California; EMFAC2011 is the most recent update.

Table 4-2 ROP Demonstration

	2007	2010	2013	2016	2017
Baseline ROG	457.2	440.5	380.5	368.0	366.3
CA MVCP/RVP Adjustment	0.0	5.6	9.3	12.0	12.7
RACT Corrections	0	0	0	0	0
Adjusted 2007 Baseline ROG in milestone year[5]	457.2	451.7	448.0	445.2	444.5
RFP commitment for ROG reductions from new measures		0	0	0	0
Milestone Year ROG with existing and proposed measures		440.5	380.5	368.0	366.3
Required % change since previous milestone year (ROG or NOx) relative to 2007		9%	9%	9%	3%
Target ROG levels		411.0	370.7	334.8	324.1
Apparent shortfall in ROG		29.5	9.9	33.2	42.2
Apparent shortfall in ROG, %		6.5%	2.2%	7.5%	9.5%
ROG shortfall previously provided by NOx substitution, %		0%	6.5%	6.5%	7.5%
Actual ROG shortfall, %		6.5%	-4.3%	0.9%	2.0%
	2007	**2010**	**2013**	**2016**	**2017**
Baseline NOx	484.9	368.2	316.0	259.2	247.1
CA MVCP Adjustment	0.0	4.9	7.7	9.3	9.7
Adjusted 2007 Baseline NOx in milestone year[6]	484.9	480.0	477.2	475.6	475.2
RFP commitment for NOx reductions from new measures	0	0	0	0	0
Change in NOx since 2007		111.8	161.2	216.4	228.2
Change in NOx since 2007, %		23.3%	33.8%	45.5%	48.0%
NOx reductions since 2007 already used for RFP substitution and contingency through last milestone year, %		0.0%	9.5%	9.5%	10.5%
NOx reductions since 2007 available for RFP substitution and contingency in this milestone year, %		23.3%	24.3%	36.0%	37.6%
Change in NOx since 2007 used for ROG substitution in this milestone year, %		6.5%	0.0%	0.9%	2.0%
Change in NOx since 2007 available for contingency in this milestone year, %		3.0%	3.0%	3.0%	3.0%
Change in NOx since 2007 surplus after meeting substitution and contingency needs in this milestone year, %		13.8%	24.3%	35.0%	35.5%
RFP shortfall, if any		0.0%	0.0%	0.0%	0.0%
RFP Met?		YES	YES	YES	YES
Contingency Met?		YES	YES	YES	YES

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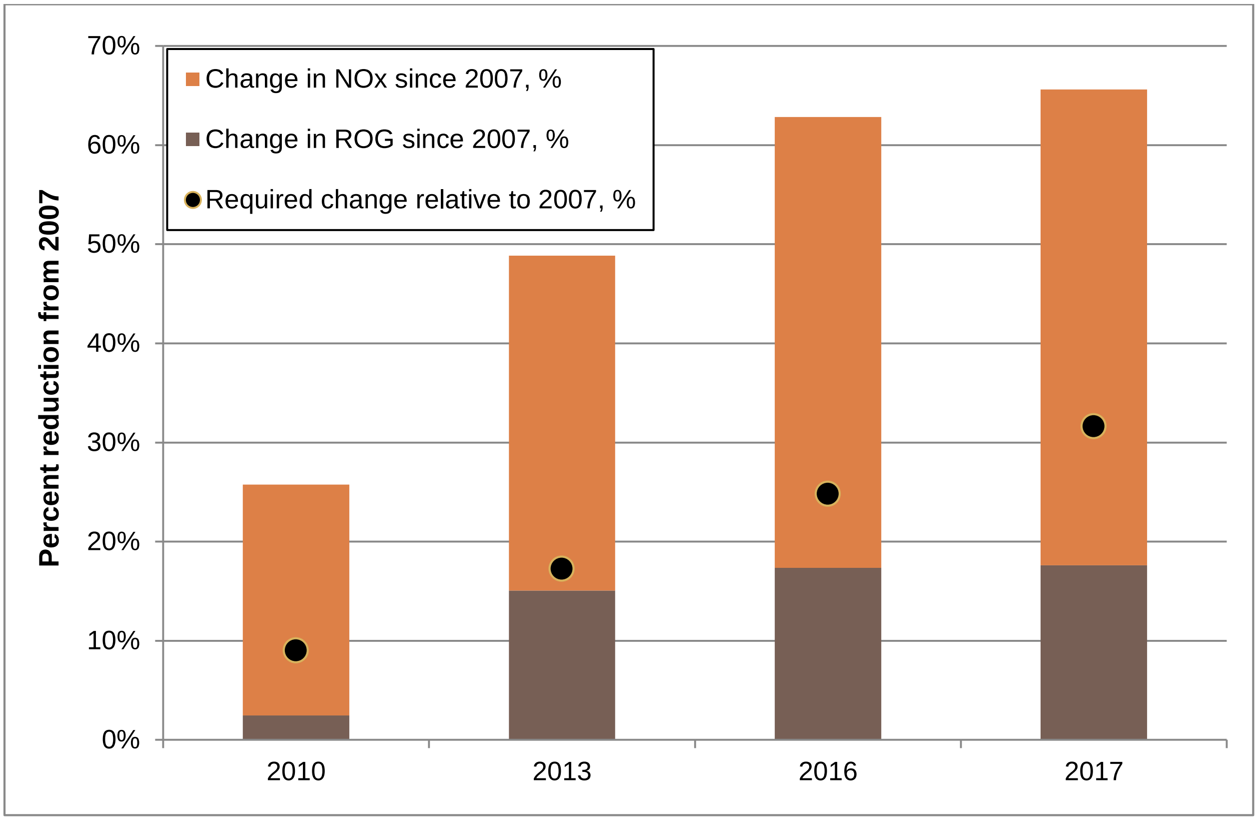
[5] The “Adjusted 2007 Baseline in milestone year” is derived by subtracting the CA MVCP/RVP adjustment from the base year (2007) baseline.

[6] The “Adjusted 2007 Baseline in milestone year” is derived by subtracting the CA MVCP/RVP adjustment from the base year (2007) baseline.

Figure 4-1 shows the percentage reductions in creditable VOC and NOx along with the required percent reduction targets relative to 2007. The combined VOC and NOx percent reductions far exceed the required ROP percent change targets.

Figure 4-1 Creditable Emissions Reductions Relative to ROP Targets



4.4 CONTINGENCY REDUCTIONS

Contingency measures are commitments for extra measures to reduce emissions that go into effect without further regulatory action. In an attainment plan, the measures must be *extra* in the sense that the reductions are not accounted for in ROP or in the attainment demonstration. Contingency reductions must be implemented automatically if either of the following scenarios occurs:

- **ROP contingencies:** Used if planned emissions controls fail to reach the emissions targets specified in the attainment plan for ROP. The need to implement ROP contingencies is based on the emissions inventory in the ROP milestone years.
- **Attainment contingencies:** Used if a region fails to attain a federal standard by the final attainment date. The need to implement attainment contingencies is based on ambient air quality data as of the end of the attainment year. If EPA finds that an area fails to attain a standard on time, contingency reductions must be implemented automatically. Depending on the requirements associated with

the standard in question, an area may have to adopt a new attainment plan or incur other penalties.

The contingency years for this plan are the ROP milestone years (2010, 2013, and 2016) and the attainment year (2017). The total emissions reductions available from contingency measures should be equivalent to about one year of reductions needed for ROP.[7]

Table 4-2 includes a deduction of emissions reductions reserved for contingency and not relied upon in the ROP demonstration. This shows that there are sufficient contingency reductions for each ROP milestone year. Thus, the ROP contingency requirement has been met in this plan.

Attainment year contingency reductions can use additional reductions occurring between the attainment year and the following year—in this case, the reductions between 2017 and 2018. These reductions occur through continued implementation of adopted regulations. Similar to ROP, the 3% reduction from the 2007 baseline can come from either VOC or NOx. Since VOC emissions are not further reduced in 2018, this analysis shows that NOx emission reductions satisfy the attainment year contingency needed. A 3% reduction from the 2007 baseline is equivalent to 14.5 tpd of NOx.

Areas with significant nonattainment challenges, such as the Valley, have developed several generations of aggressive, far-reaching emissions reduction measures to meet various CAA requirements. This no-stone-left-unturned policy ensures that as viable emissions reductions are identified, they are implemented, rather than held in reserve, to contribute to expeditious attainment. For this reason, Valley contingency measure demonstrations in have been a challenge.

Table 4-3 shows that the NOx emission reductions achieved from previously adopted prohibitory regulations provide a significant component of the needed contingency, but not the full amount.

Table 4-3 Attainment Contingencies from Adopted Regulatory Reductions*

	2017 emissions (tpd)	2018 emissions (tpd)	Attainment Contingency (tpd)
NOx (adopted measures only)	247.1	236.1	**11.0**

**based on Appendix B emissions inventories*

Another source of additional reductions not already relied upon in the SIP are provided by SIP-creditable, incentive-based emissions reductions. As discussed in Chapter 3 of this plan, incentive programs achieve emissions reductions beyond those achieved by regulations alone. Incentive programs accelerate the adoption of cleaner technologies

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[7] Clean Air Fine Particle Implementation Rule [PM2.5 Implementation Rule]. 72 Fed. Reg. 79, pp. 20586–20667. At 20642-43. (2007, April 25). Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2007-04-25/pdf/E7-6347.pdf#page=1

and encourage the use of such technologies by those not yet subject to air quality regulations. Incentives allow the District to reduce emissions from source categories outside of the District's traditional regulatory authority, as well as source categories where socioeconomic impacts would otherwise prevent traditional control strategies from being implemented.

As discussed in Chapter 3, the District adopted new Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs) to provide the District with a mechanism to claim SIP credit for SIP-creditable incentive-based emission reductions achieved in the Valley. Both ARB and the District are committed to continuing to seek opportunities for additional incentive-based emissions reductions Valley-wide to meet contingency requirements, which will also expedite public health benefits.

At this time, the District proposes to claim **3.5 tpd of NOx emission reductions** through Rule 9610 and related incentive programs to use as attainment-year contingency reductions. This amount is only slightly higher than the 1.9 tpd NOx commitment for the 2019 attainment year already included in the District's recently adopted *2012 PM2.5 Plan*. Both commitments are limited to projected emissions reductions achieved through secured or reasonably anticipated incentive program funding, estimated availability of emissions reductions projects, and willing participants, and based on historical participation and estimates of remaining equipment. The total reductions achieved through Rule 9610 and associated incentive programs are very likely to be much higher than these contingency commitments.

Based the ROP demonstration in Table 4-2, this plan meets the ROP milestone year contingency requirement. Also, based on Rule 9610 and the contingency reductions already available through adopted regulations (Table 4-3), this plan satisfies the attainment year contingency commitment (Table 4-4). Furthermore, as shown in Table 4-1, projected 2017 design values are actually 4.7 ppb or more below the standard, providing added confidence that attainment will be met in 2017 and attainment-year contingency reductions will not be needed.

Table 4-4 Demonstration of Sufficient Attainment-Year Contingency Reductions

	NOx Reductions (tpd)
Surplus from adopted regulations (Table 4-3)	*11.0*
SIP-creditable incentives	*3.5*
Total NOx contingency	14.5
Contingency reductions required	14.5
Contingency need met?	**Yes**

4.5 CLEAN FUELS AND CLEAN TECHNOLOGIES FOR BOILERS

CAA §182(e)(3) directs extreme nonattainment areas to require each new, modified, or existing electric utility, industrial, or commercial boiler that emits more than 25 tons per year of NOx to use natural gas, methanol, or ethanol (or comparably low polluting fuel) as its primary fuel (used 90% or more of the operating time); or use advanced control technology, such as catalytic control technology or other comparably effective control methods, for reduction of NOx emissions.

District Rules 4306 and 4352 address NOx emissions limits for the boilers in this category. These boilers generally use natural gas and therefore satisfy the first requirement of CAA §182(e)(3). Liquid-fuel fired boilers are also addressed by those rules and the applicable NOx emission limits satisfies the second requirement of CAA §182(e)(3). Solid-fuel fired boilers are addressed by Rule 4352 and the applicable NOx emissions limit satisfies the second requirement as well. Therefore, the District already complies with CAA §182(e)(3).

4.6 VEHICLE MILES TRAVELED (VMT) DEMONSTRATION

Based on ARB modeling and analysis, the District prepared a VMT emissions offset demonstration for the 1-hour (revoked) and 8-hour ozone NAAQS pursuant to CAA §182(d)(1)(A) and in accordance with the EPA's August 2012 guidance entitled *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled.*[8]

ARB used the EMFAC2011 model[9] to calculate two base-year/attainment-year scenarios: one for the revoked 1-hour ozone standard using 1990 as the base year and 2017 as the attainment year, consistent with the *2013 Plan for the Revoked 1-hour Ozone Standard*; and one for the 8-hour ozone standard using 1990 as the base year and 2023 as the attainment year, consistent with the *2007 Ozone Plan*. The scenarios include emissions estimates for the attainment year with no new additional motor vehicle controls, but with increases in VMT; with no new motor vehicle controls and no VMT growth; and with full motor vehicle controls and projected VMT growth. The motor vehicle controls used in the analysis include state-implemented transportation control strategies and locally implemented transportation control measures. Figures 4-2 and 4-3 show the results for the 1-hour and 8-hour ozone plan scenarios, respectively.

---

[8] U.S. Environmental Protection Agency [EPA]: Office of Transportation and Air Quality. (2012, August). *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled* (EPA-420-B-12-053). Retrieved from http://www.epa.gov/otaq/stateresources/policy/general/420b12053.pdf

[9] EMFAC is California's model for estimating emissions from on-road vehicles operating in California; EMFAC2011 is the most recent update. All model runs were for the San Joaquin Valley Air Basin using average summer emissions.

Figure 4-2 VOC and NOx Emissions Using Valley "2013 FTIP" VMT for 1-Hour Ozone Planning

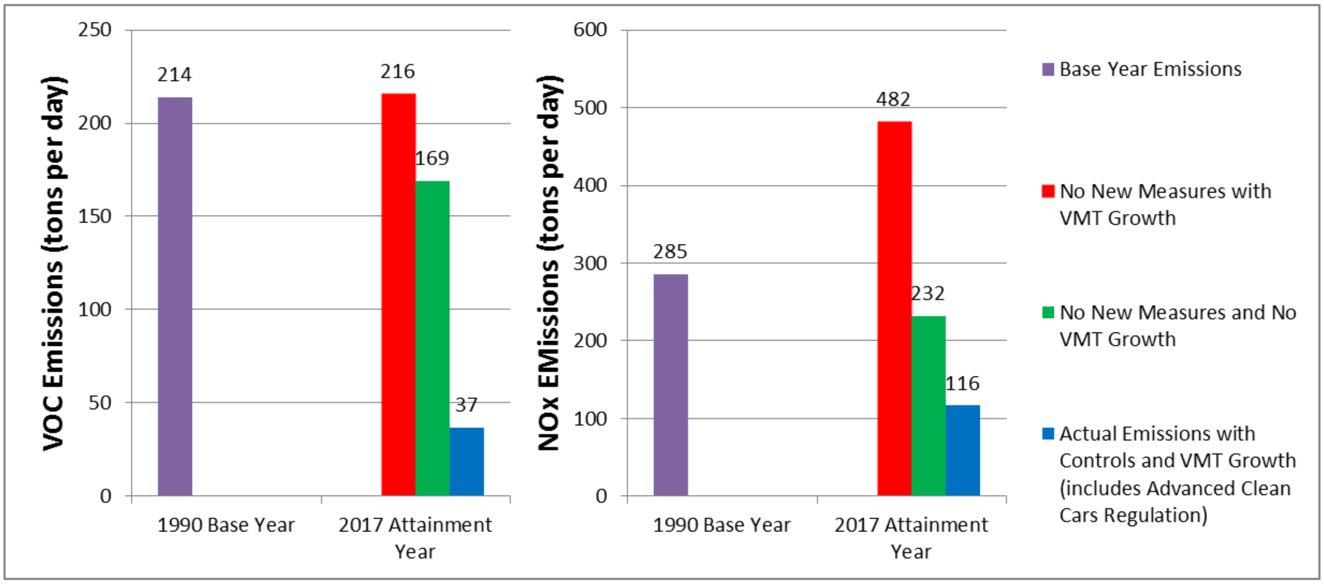
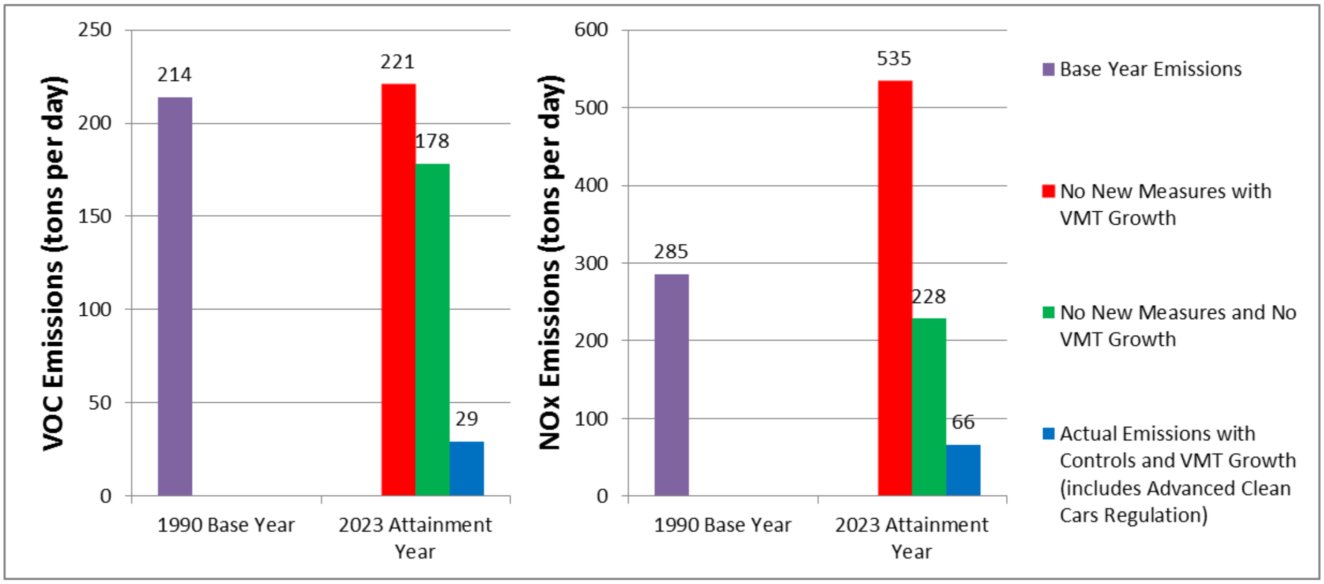


Figure 4-3 VOC and NOx Emissions Using Valley "2013 FTIP" VMT for 8-Hour Ozone Planning



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Appendix A

Ambient 1-Hour Ozone Data Analysis

2013 Plan for the Revoked 1-hour Ozone Standard
SJVUAPCD

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CONTENTS

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APPENDIX A: AMBIENT 1-HOUR OZONE DATA ANALYSIS

A.1 OVERVIEW

The concentration of ambient ozone at any given location in the San Joaquin Valley (Valley) is a function of meteorology, the natural environment, atmospheric chemistry, and ozone precursor emissions from both biogenic (natural) and anthropogenic (human caused) sources. The San Joaquin Valley Air Pollution Control District (District), the California Air Resources Board (ARB), and other agencies monitor ozone concentrations throughout the Valley, as detailed in the 2011 Air Monitoring Network Plan.[1] The U.S. Environmental Protection Agency (EPA) serves as the official repository of ambient ozone data.[2]

The District uses the collected data to show air quality improvement through the standardized design value and attainment test calculations, using EPA protocols to document basin-wide improvement and attainment of the National Ambient Air Quality Standards (NAAQS). As shown in this appendix, the design value data show steady, long-term air quality improvement.

The District also uses the data to evaluate the impact of changing daily, monthly, and annual ozone concentrations on public health. These trend analyses provide the District with critical information about how to develop control measures and incentive programs that contribute to the greatest public health improvements and greatest progress toward EPA air quality standards. This appendix provides the technical details used to evaluate and analyze the District's ozone concentration data, as summarized in Chapter 2 of this *2013 Plan for the Revoked 1-hour Ozone Standard*.

A.2 OZONE MONITORING NETWORK

The District operates an extensive air monitoring network to measure progress towards compliance with the NAAQS. As shown in Figure A-1, the ozone monitoring network in the Valley is comprised of a number of ozone monitoring sites, including sites operated by the District, ARB, the National Park Service, the Tachi Yokut Tribe, and the Chukchansi Indians.

Most sites are intended to represent population exposures and maximum concentrations; therefore most ozone monitors are representative of neighborhood and regional scales. Ozone monitoring networks are designed to monitor areas with high population densities, areas with high pollutant concentrations, areas impacted by major pollutant sources, and areas representative of background concentrations. Among the ozone monitors operating in the Valley, the majority are suitably located to measure

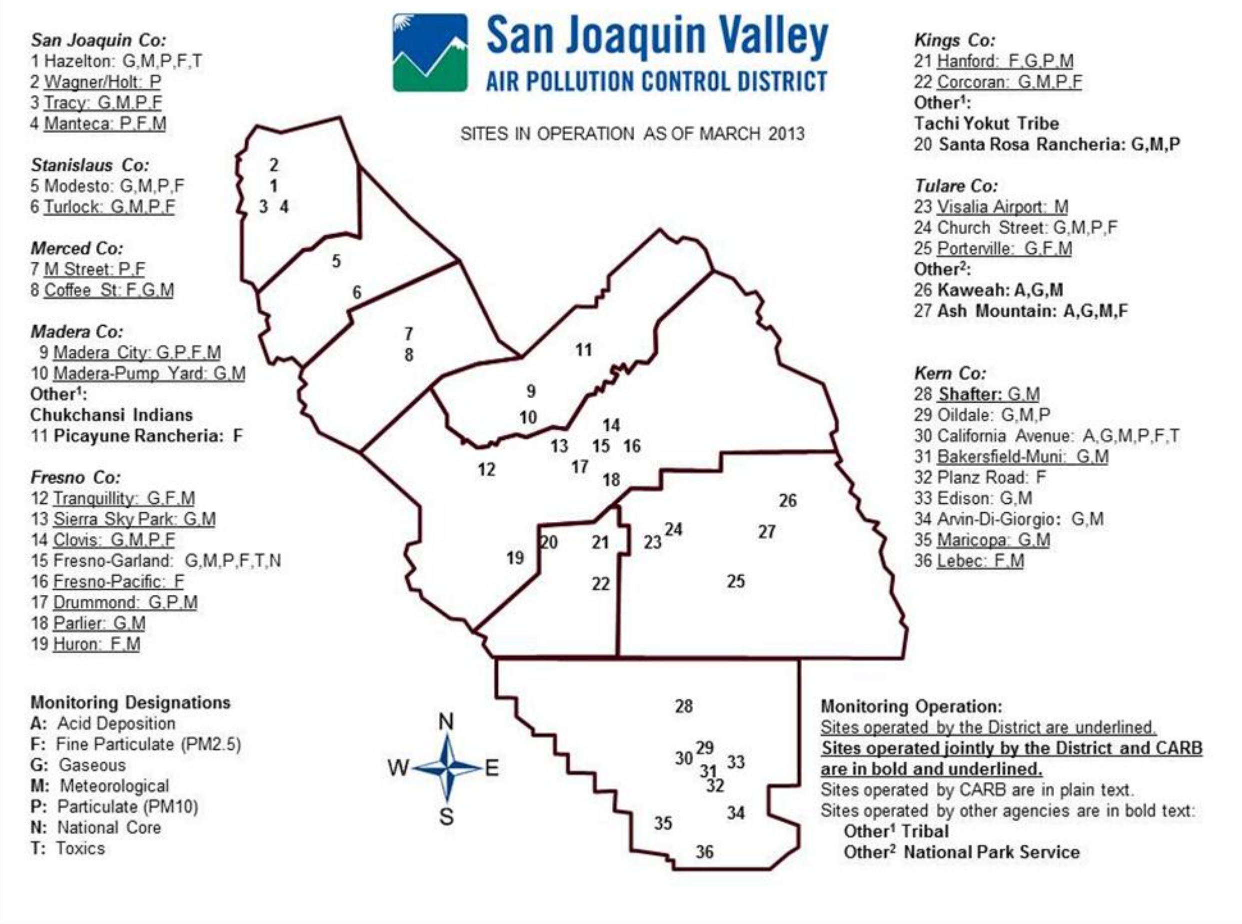
---

[1] San Joaquin Valley Air Pollution Control District [SJVAPCD]. (2011). *2011 Air Monitoring Network Plan.* Fresno, CA: June 30, 2011 submittal to EPA. Available at http://www.valleyair.org/aqinfo/Docs/2011/1_2011AirMonitoringNetworkPlanandAppendixA_Final2.pdf

[2] U.S. Environmental Protection Agency: Technology Transfer Network (TTN), Air Quality System (AQS): *AQS Web Application.* (2010). Available at http://www.epa.gov/ttn/airs/airsaqs/aqsweb/

representative concentrations in areas of high population density, while the remaining monitors are located in high ozone concentration areas, areas intended to measure air moving into Fresno and Bakersfield, and remote areas to measure background ozone concentrations. The Valley's State and Local Air Monitoring Stations (SLAMS) ozone monitors are continuous analyzers that detect ozone through ultraviolet absorption. As continuous devices, these monitors meet the timely and public monitoring objectives, providing District staff with the data used in Air Quality Index forecasting and reporting.

Figure A-1 Monitoring Network within the San Joaquin Valley

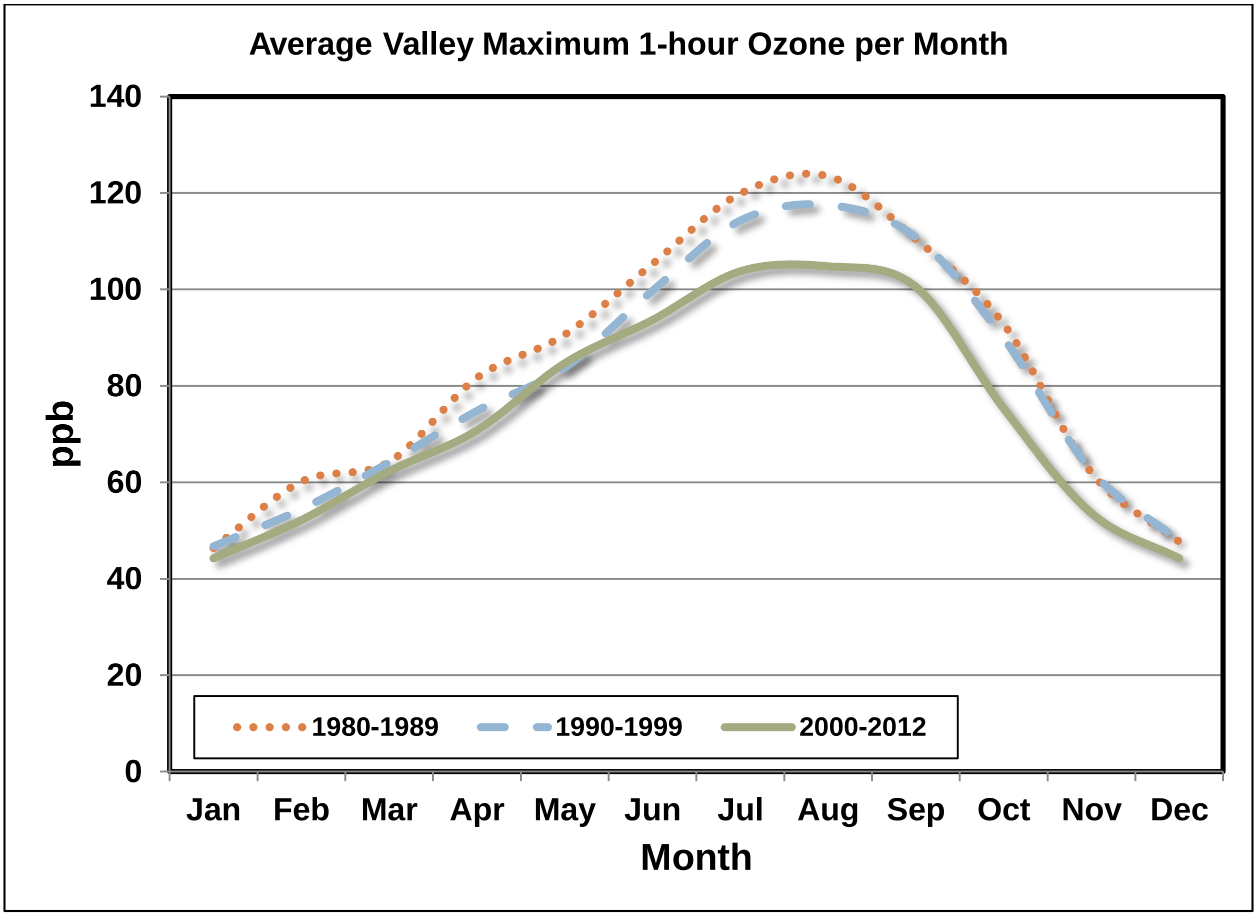


A.3 EFFECT OF THE NATURAL ENVIRONMENT ON OZONE IN THE VALLEY

A.3.1 Meteorology

The peak of ozone season occurs during the summer months. Figure A-2 shows the average basin maximum ozone concentration per month in the Valley for both past and recent time periods.

Figure A-2 Peak Concentrations during Ozone Season

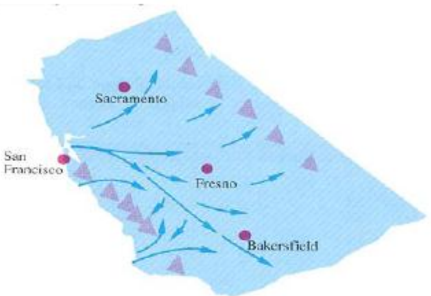


The Valley is located in a semi-arid climate characterized by long, hot, dry summers and mild winters. During the summer, the presence of high pressure over the eastern Pacific Ocean and a thermal low pressure system over the Desert Southwest produces hot, dry conditions and causes thermally driven wind flow patterns across the Valley. Such conditions cause poor dispersion and stagnation which are conducive to the formation of elevated ozone concentrations in the Valley. Atmospheric stability causes ozone precursors to accumulate over time.

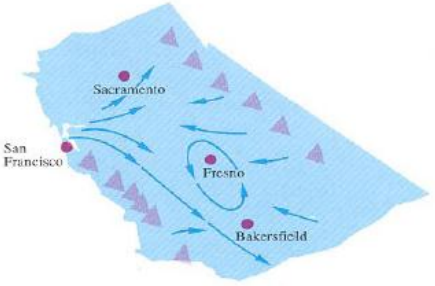
Wind speed and direction play an important role in the dispersion and transport of air pollutants. Wind directs ozone precursors downwind from emission sources where ozone formation occurs. The dominant wind flow pattern during the daytime in the

Valley is from the northwest to the southeast. Figure A-3 depicts typical daytime and nighttime wind flow patterns during the ozone season in the Valley.

Figure A-3 San Joaquin Valley Wind Patterns during the Ozone Season



Daytime Wind Flow Patterns



Nighttime Wind Flow Patterns

Surface winds enter the Valley from the northwest through the Delta, and also through passes in the Coastal Range. The airflow generally moves from Stockton to Bakersfield, carrying ozone and its precursor emissions that contribute to ozone formation. While the effect of the transport is seen in the accumulation of ozone in the central and southern portions of the Valley, high ozone levels also occur closer to emission sources. Historically, the city of Parlier (down-wind of Fresno) and the communities of Edison and Arvin (down-wind of Bakersfield) have often experienced the highest ozone levels in the Valley. In recent years, high ozone levels have also occurred in the cities of Clovis and Fresno.

Ozone is also transported out of the Valley as air flows over the Tehachapi Mountains (southeast of Bakersfield) into the Mojave Desert during the daytime. Additionally, daytime heating causes air to flow upslope and carry ozone into the Sierra Nevada and coastal mountains.

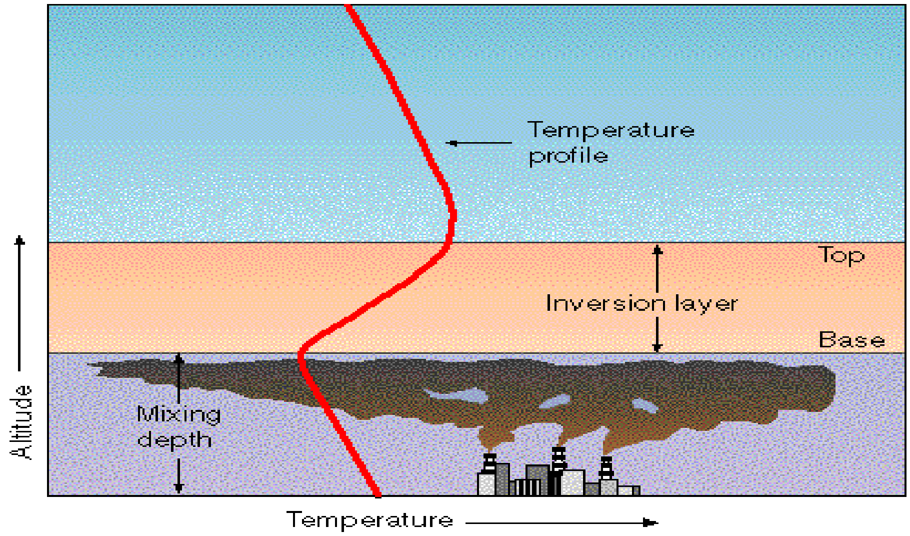
At night, the general northwest to southeast surface wind flow pattern continues along the western parts of the Valley; however, some nighttime wind circulation changes also occur:

1) The airflow is no longer able to exit the southern end of the Valley because it encounters cooler drainage winds from the surrounding mountains.
2) A nocturnal jet stream approximately 1,000 feet above the surface flows at speeds up to 33 miles per hour (mph), transporting air into the southern portion of the Valley (over the western parts of the Valley); however, the mountains surrounding the southern end of the Valley cause the air to turn counterclockwise and flow back toward the north along the eastern edge of the Valley. This flow, referred to as the Fresno eddy, circulates the pollution plume back toward Fresno, where it accumulates more ozone precursors.
3) Pollutants carried upslope the mountains during the day via daytime heating are then carried downslope back toward the Valley floor via mountain breezes caused by nocturnal surface cooling.

Temperature Inversion

Vertical mixing of the air mass can result from atmospheric instability. A temperature inversion, or increasing temperature with increasing height (Figure A-4), can shut down the vertical mixing of an air mass, thus creating a situation in which pollutants are trapped near the surface. Temperature inversions are common in the Valley throughout the year. Since the inversion is often lower than the height of the surrounding mountain ranges, the Valley effectively becomes a bowl capped with a lid that traps pollution near the surface. When horizontal dispersion (transport flow) and vertical dispersion (rising air) are minimized, ozone concentrations can rapidly build, especially during the summer.

Figure A-4 Effect of Temperature Inversion on Pollutant Dispersion



When high pressure is dominating the weather pattern during the overnight and early morning hours, a surface based temperature inversion forms. The morning inversion erodes during the day with daytime heating. Depending on the atmospheric conditions, inversions may not erode completely and, in some cases, pooling of ozone aloft can occur. Subsequently, the next day's heating and vertical mixing mechanisms enable the "ozone" pollutant pool aloft to mix down and accumulate with the new ozone being formed at the surface, causing higher ozone concentrations to occur.

Radiation Inversion

During many high ozone events, the Valley is likely experiencing a combination of radiation and subsidence inversions. A radiation inversion is primarily caused by overnight cooling of the air near the Earth's surface. The radiation inversion extends upward several hundred feet from the ground and occurs during the evening and early morning hours. During a radiation inversion, little vertical and horizontal mixing occurs, which minimizes pollutant dispersal. At daybreak, the sun begins to heat the ground, which in turn heats the lower layers of the atmosphere and eventually erodes or breaks the inversion, thereby facilitating pollutant dispersal. As daytime heating increases the height of the inversion rises and can range from 2,000 to over 5,000 feet, and even higher over mountain ranges due to heating of the slopes. On the worst dispersion days the inversion may remain only a few hundred feet above the surface of the Valley.

Subsidence Inversion

Subsidence inversions are caused by downward motion (subsidence), high in the atmosphere, and help reinforce the "lid" that traps pollutants at the surface. Subsidence inversions are typically associated with a ridge of high pressure over California. The ridge results in sinking air causing strengthening stability (poor dispersion) and clear skies.

During strong high pressure events, temperature inversions strengthen, air pollutant emissions build up in the atmosphere below the inversion. In the presence of sunlight; ozone precursors then react to form ozone, and levels increase from day to day. 1-hour concentrations of ozone that exceed federal standards typically occur in the Valley when strong inversions and light winds are present.

A.3.2 Wildfires

Wildfires emit particulates and ozone precursors into the atmosphere, which are then carried away by the wind. Although particulates in the smoke plume can slightly reduce ozone formation rates by blocking sunlight, the precursors still have the potential to react and form ozone. A single 1,000-acre wildfire can generate particulate matter and ozone precursors that are up to three times higher than the Valley's daily total emission inventory. Intense wildfires can consume 1,000 acres in a matter of minutes, while less intense wildfires may take several days or weeks.

Wildfires have been linked to increased ozone concentrations in the Valley. For example in 2008, California experienced a record number of wildfires: a total of 6,255 fires burned 1,593,690 acres.[3] The resulting emissions caused serious public health impacts and unprecedented levels of particulate matter and ozone in the Valley and other regions throughout the state. Historically clean rural areas experienced their worst air quality in decades. Throughout the Valley, pollutant levels and the number of daily exceedances of the health-based standards in 2008 were significantly higher than other recent years.

With proper documentation and EPA concurrence, data influenced by exceptional events like wildfires can be excluded from official attainment demonstration calculations. Such documentation is extensive and requires significant District resources.[4] But since exceptional events are not reasonably preventable or controllable, it is inappropriate to use data influenced by these events without recognition of these circumstances.

EPA generally reviews only those requests that will directly affect an area’s attainment status. Although not every event results in a formal submittal to EPA, the District tracks these events and their impact on attainment as part of its ongoing air quality analysis. These ongoing efforts help the District to more accurately characterize ambient ozone concentrations and attainment progress.

A.4 EXCEEDANCE DAY TRENDS

A.4.1 Exceedance Days as the Attainment Test

If any monitoring site in the Valley does not meet the federal 1-hour ozone standard, then the entire Valley is deemed as not demonstrating attainment of the standard, also referred to as “nonattainment”. The 1-hour ozone standard is 0.12 parts per million (ppm) rounded to the closest one hundredth. Thus, 1-hour ozone concentrations at or greater than 0.125 ppm are above the standard, and 1-hour ozone concentrations at or lower than 0.124 ppm meet the standard. If any hour in a day is above the standard, then that day is an exceedance day. The highest hourly concentration on a given day is

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[3] CALFire 2008 Fire Summary, http://www.fire.ca.gov/downloads/redbooks/2008/02-wildland-statistic-all-agencies/11-2008-FIRE-SUMMARY.pdf

[4] Treatment of Air Quality Monitoring Data Influenced by Exceptional Events, 72 Fed. Reg. 55, pp. 13560–13581. (2007, March 22). (to be codified in 40 C.F.R. pts. 50 and 51)

recorded as the 1-hour ozone concentration for that day (though all hourly concentrations are kept on record and analyzed as well).

The attainment test for the 1-hour ozone standard is based on the number of exceedance days per year, averaged over a three-year period. A site with an average of 1.0 or fewer exceedance days per year, as averaged over a three-year period, meets the standard. In other words, if the site has 3 or fewer exceedance days in a three-year period, it meets the standard; if that site has more than 3 exceedance days in a three-year period, then it does not meet the standard.

Table A-1 shows the number of exceedance days per year, per monitoring site in the Valley. The attainment test results are shown in Table A-2, which displays the three-year average number of days over the standard for each site over the time period of 1990-2012. The cells shaded red signify the attainment test resulting in an average over 1.0, indicating non-attainment. This data shows that the counties of Fresno and Kern have historically had a number of air monitoring sites that had not yet met the 1-hour ozone attainment test. However, the averages have decreased substantially since the 1990s. Over the 1990-2012 time period, the highest Valley maximum 3-year average occurred in 1993-1995, with 30.67 exceedance days. Comparing this to the maximum average value in 2010-2012, which was 1.67, this metric has decreased by over 94%.

The 3-year average of 2009-2011 had only two sites that failed the attainment test, those being Clovis and Arvin-Bear Mountain. The average during the 3-year timeframe of 2010-2012 had only the Clovis and Fresno-Drummond sites fail the attainment test. Since the Arvin-Bear Mountain site was closed in December 2010, the 3-year averages for 2009-2011 and 2010-2012 were not included in Table A-2 due to incomplete data. The Valley continues to be very close to attaining this standard, and compared to the average values 20 years ago, the region has a come a long way in reducing ozone concentrations and meeting this goal.

Table A-1 1-Hour Ozone Exceedance Days by Site per Year from 1990-2012

Monitoring Site	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
San Joaquin County																							
Stockton-Hazelton Street	0	0	0	0	1	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Tracy-Airport	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0
Stanislaus County																							
Modesto-14th Street	1	0	0	0	0	2	2	0	3	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Turlock-S Minaret Street	--	--	0	2	0	2	1	0	4	0	1	0	1	0	0	0	0	0	3	1	0	0	0
Merced County																							
Merced-S Coffee Avenue	--	2	0	1	0	3	1	0	3	2	0	0	2	0	0	0	0	0	3	0	0	0	0
Madera County																							
Madera-28261 Avenue 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0
Madera-Pump Yard	--	--	--	--	--	--	--	--	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Fresno County																							
Clovis-N Villa Avenue	1	3	17	13	9	7	16	9	26	5	8	10	7	1	1	2	2	0	5	0	3	2	0
Fresno-1st Street	8	27	12	11	7	14	15	1	15	4	5	5	11	5	0	3	4	0	7	0	2	0	--
Fresno-Garland	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Fresno-Drummond Street	7	8	7	5	0	0	8	1	8	4	2	1	9	4	0	0	0	0	0	0	0	3	1*
Fresno-Sierra Skypark	1	5	3	6	3	3	5	1	13	1	8	10	15	1	0	2	1	0	2	0	2	0	1
Parlier	5	14	12	10	3	9	18	9	13	15	17	12	21	14	0	1	1	0	2	0	1	1	1
Tranquillity	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0
Kings County																							
Hanford-S Irwin Street	--	--	--	--	0	0	8	2	3	2	0	1	1	0	0	0	1	0	--	--	2	0	0
Corcoran-Patterson Avenue	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	0	--	--	--
Santa Rosa Rancheria	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	2	0	0	0	0
Tulare County																							
Porterville	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0
Ash Mountain - SNP	--	--	--	--	--	--	--	--	--	2	0	0	1	2	0	1	0	0	5	0	0	0	0
Lower Kaweah - SNP	0	0	0	2	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Visalia-N Church Street	1	1	2	9	10	2	4	1	6	1	1	2	1	0	1	0	0	0	3	0	0	0	0
Kern County																							
Arvin-Di Giorgio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0
Arvin-Bear Mountain Blvd	23	28	9	13	17	19	37	7	12	9	9	16	15	26	8	6	12	3	14	3	2	--	--
Bakersfield-5558 California Avenue	--	--	--	--	0	2	3	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
Bakersfield-Golden State Avenue	--	--	--	--	0	1	3	0	1	0	0	1	0	0	0	0	0	1	0	--	--	--	--
Edison	22	22	3	27	31	34	25	3	22	5	9	6	8	3	1	0	9	1	5	2	1	0	0
Maricopa-Stanislaus Street	0	0	0	0	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oildale-3311 Manor Street	1	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shafter-Walker Street	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Basin	**45**	**51**	**29**	**43**	**43**	**44**	**56**	**16**	**39**	**28**	**30**	**32**	**31**	**37**	**9**	**8**	**18**	**3**	**19**	**4**	**7**	**3**	**3**

*The 1-hour ozone exceedance at the Fresno-Drummond air monitoring site on August 10, 2012 has been flagged as an exceptional event due to a fire that potentially caused the exceedance. As an exceptional event, this exceedance would not be counted toward attainment determination, upon concurrence by EPA.

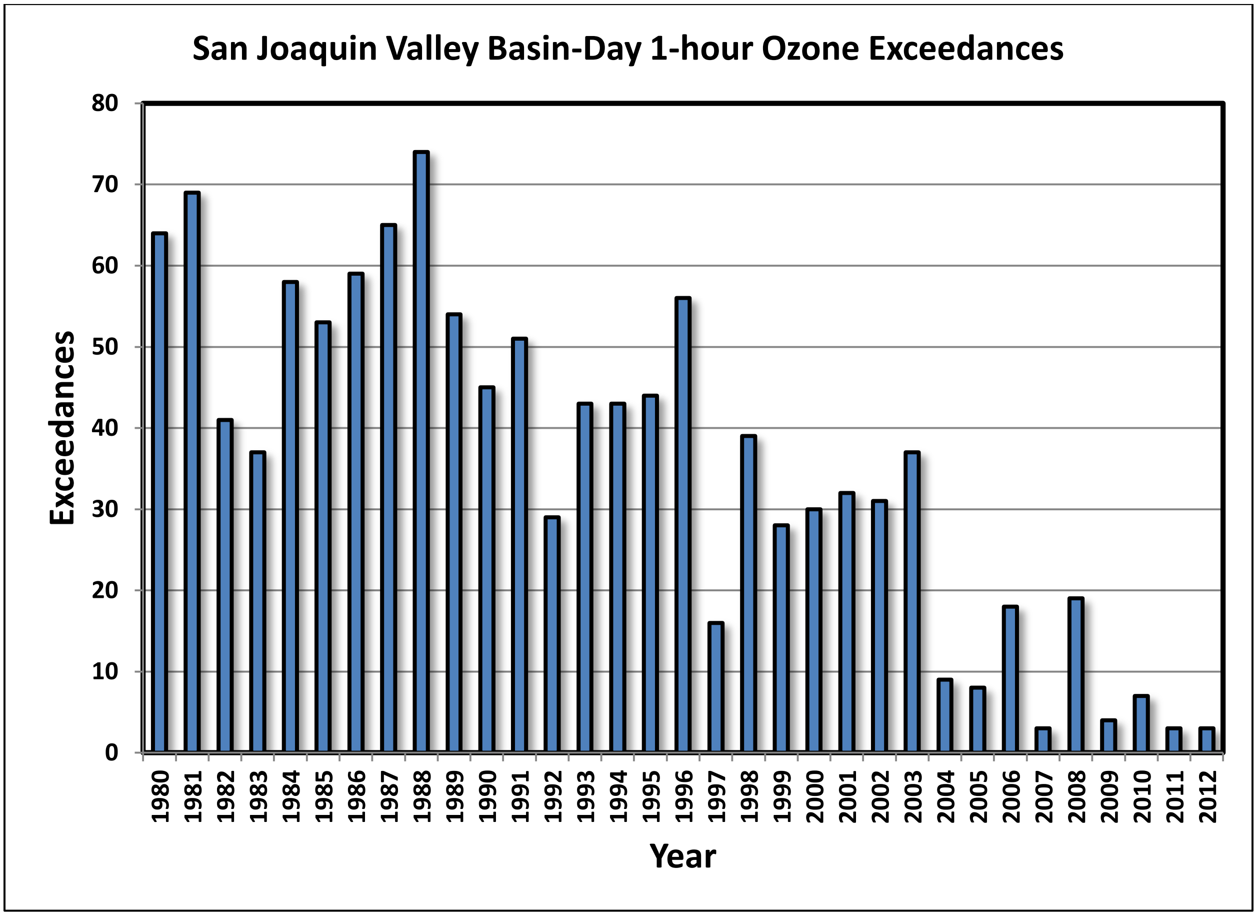
Table A-2 Attainment Test: Number of Exceedance Days per 3-Year Averaging Period from 1990 to 2012

Monitoring Site	1990-92	1991-93	1992-94	1993-95	1994-96	1995-97	1996-98	1997-99	1998-00	1999-01	2000-02	2001-03	2002-04	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10	2009-11	2010-12
San Joaquin County																					
Stockton-Hazelton Street	0.00	0.00	0.33	0.67	0.67	0.33	0.33	1.00	1.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tracy-Airport	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	0.00
Stanislaus County																					
Modesto-14th Street	0.33	0.00	0.00	0.67	**1.33**	**1.33**	**1.67**	1.00	**1.33**	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00
Turlock-S Minaret Street	--	--	0.67	**1.33**	1.00	1.00	**1.67**	**1.33**	**1.67**	0.33	0.67	0.33	0.33	0.00	0.00	0.00	1.00	**1.33**	**1.33**	0.33	0.00
Merced County																					
Merced-S Coffee Avenue	--	1.00	0.33	**1.33**	**1.33**	**1.33**	**1.33**	**1.67**	**1.67**	0.67	0.67	0.67	0.67	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00
Madera County																					
Madera-28261 Avenue 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00
Madera-Pump Yard	--	--	--	--	--	--	--	--	0.67	0.00	0.67	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fresno County																					
Clovis-N Villa Avenue	**7.00**	**11.00**	**13.00**	**9.67**	**10.67**	**10.67**	**17.00**	**13.33**	**13.00**	**7.67**	**8.33**	**6.00**	**3.00**	**1.33**	**1.67**	**1.33**	**2.33**	**1.67**	**2.67**	**1.67**	**1.67**
Fresno-1st Street	**15.67**	**16.67**	**10.00**	**10.67**	**12.00**	**10.00**	**10.33**	**6.67**	**8.00**	**4.67**	**7.00**	**7.00**	**5.33**	**2.67**	**2.33**	**2.33**	**3.67**	**2.33**	**3.00**	0.67	--
Fresno-Garland	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fresno-Drummond Street	**7.33**	**6.67**	**4.00**	**1.67**	**2.67**	**3.00**	**5.67**	**4.33**	**4.67**	**2.33**	**4.00**	**4.67**	**4.33**	**1.33**	0.00	0.00	0.00	0.00	0.00	1.00	1.00*
Fresno-Sierra Skypark	**3.00**	**4.67**	**4.00**	**4.00**	**3.67**	**3.00**	**6.33**	**5.00**	**7.33**	**6.33**	**11.00**	**8.67**	**5.33**	1.00	1.00	1.00	1.00	0.67	**1.33**	0.67	1.00
Parlier	**10.33**	**12.00**	**8.33**	**7.33**	**10.00**	**12.00**	**13.33**	**12.33**	**15.00**	**14.67**	**16.67**	**15.67**	**11.67**	**5.00**	0.67	0.67	1.00	0.67	1.00	0.67	1.00
Tranquillity	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00
Kings County																					
Hanford-S Irwin Street	--	--	--	--	**2.67**	**3.33**	**4.33**	**2.33**	**1.67**	1.00	0.67	0.67	0.33	0.00	0.33	0.33	--	--	--	--	0.67
Corcoran-Patterson Avenue	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Santa Rosa Rancheria	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.67	0.67	0.00	0.00
Tulare County																					
Porterville	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00
Ash Mountain - SNP	--	--	--	--	--	--	--	--	--	0.67	0.33	1.00	1.00	1.00	0.33	0.33	**1.67**	**1.67**	**1.67**	0.00	0.00
Lower Kaweah - SNP	0.00	0.67	1.00	1.00	0.33	0.00	0.33	0.33	0.33	0.00	0.33	0.33	0.33	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00
Visalia-N Church Street	**1.33**	**4.00**	**7.00**	**7.00**	**5.33**	**2.33**	**3.67**	**2.67**	**2.67**	**1.33**	**1.33**	1.00	0.67	0.33	0.33	0.00	1.00	1.00	1.00	0.00	0.00
Kern County																					
Arvin-Di Giorgio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00
Arvin-Bear Mountain Blvd	**20.00**	**16.67**	**13.00**	**16.33**	**24.33**	**21.00**	**18.67**	**9.33**	**10.00**	**11.33**	**13.33**	**19.00**	**16.33**	**13.33**	**8.67**	**7.00**	**9.67**	**6.67**	**6.33**	--	--
Bakersfield-5558 California Avenue	--	--	--	--	**1.67**	**1.67**	1.00	0.00	0.33	0.67	0.67	0.33	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00
Bakersfield-Golden State Avenue	--	--	--	--	**1.33**	**1.33**	**1.33**	0.33	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.33	0.33	--	--	--	--
Edison	**15.67**	**17.33**	**20.33**	**30.67**	**30.00**	**20.67**	**16.67**	**10.00**	**12.00**	**6.67**	**7.67**	**5.67**	**4.00**	**1.33**	**3.33**	**3.33**	**5.00**	**2.67**	**2.67**	1.00	0.33
Maricopa-Stanislaus Street	0.00	0.00	0.00	0.33	0.33	0.33	**2.67**	**2.67**	**2.67**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oildale-3311 Manor Street	0.67	0.33	0.00	0.33	1.00	1.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shafter-Walker Street	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00
Maximum	**20.00**	**17.33**	**20.33**	**30.67**	**30.00**	**21.00**	**18.67**	**13.33**	**15.00**	**14.67**	**16.67**	**19.00**	**16.33**	**13.33**	**8.67**	**7.00**	**9.67**	**6.67**	**6.33**	**1.67**	**1.67**

*The 1-hour ozone exceedance that occurred at the Fresno-Drummond air monitoring site on August 10, 2012 is being evaluated as a possible exceptional event. Upon formal documentation of the event and concurrence by EPA, this data point would be removed from attainment calculations for the District.

Figure A-5 shows for each year from 1980-2012 the number of days that at least one air monitoring site in the Valley exceeded of the 1-hour ozone standard, also referred to as a “basin-day”. Since 1980, basin-day exceedances of the 1-hour ozone standard have sharply declined, decreasing by over 95%.

Figure A-5 Basin-Day Exceedances per Year



A.4.2 Where Do Exceedance Days Occur?

The following figures (Figures A-6 through A-9) show the decreasing trends in exceedance days over time at some of the Valley monitoring sites that have historically experienced the highest 1-hour ozone concentrations.

Note that the Fresno-First Street site was closed in 2011 and moved two blocks north to the Fresno-Garland Avenue site. Based on previous analysis and the close proximity of these locations, observations from these two sites were merged into a single continuous data record for the following analyses.

Figure A-6 Exceedance Day Trend at Fresno-First (Garland 2012)

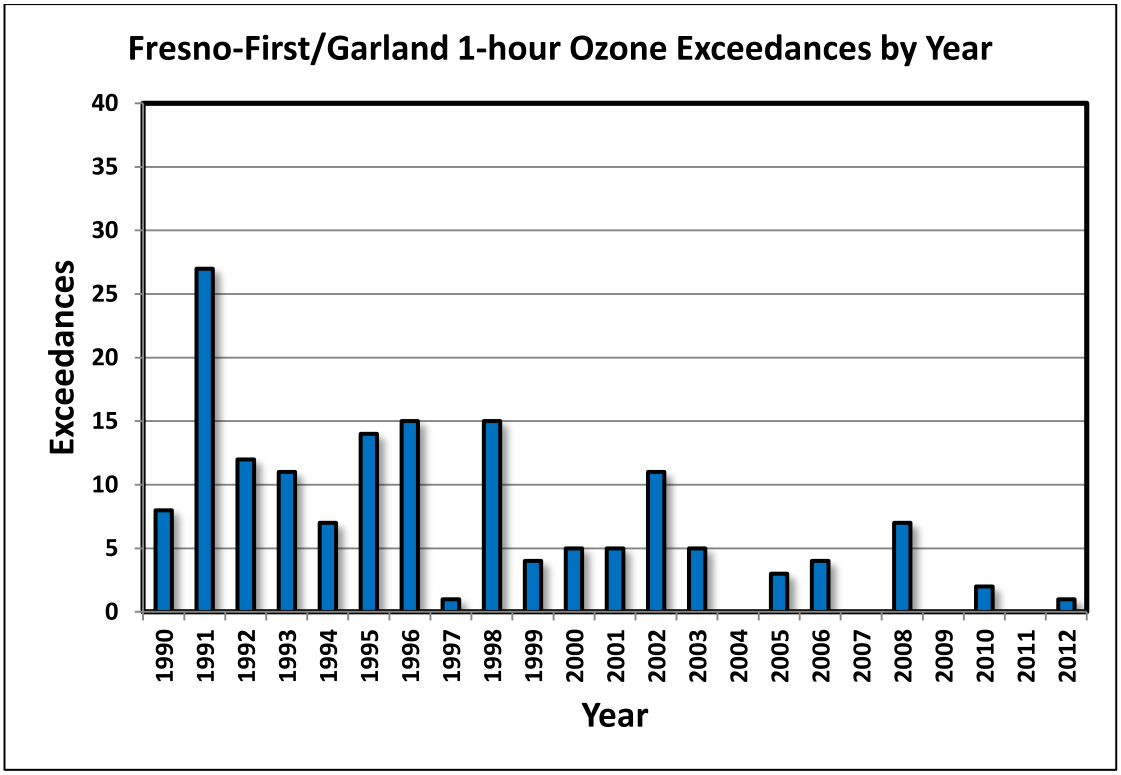


Figure A-7 Exceedance Day Trend at Parlier

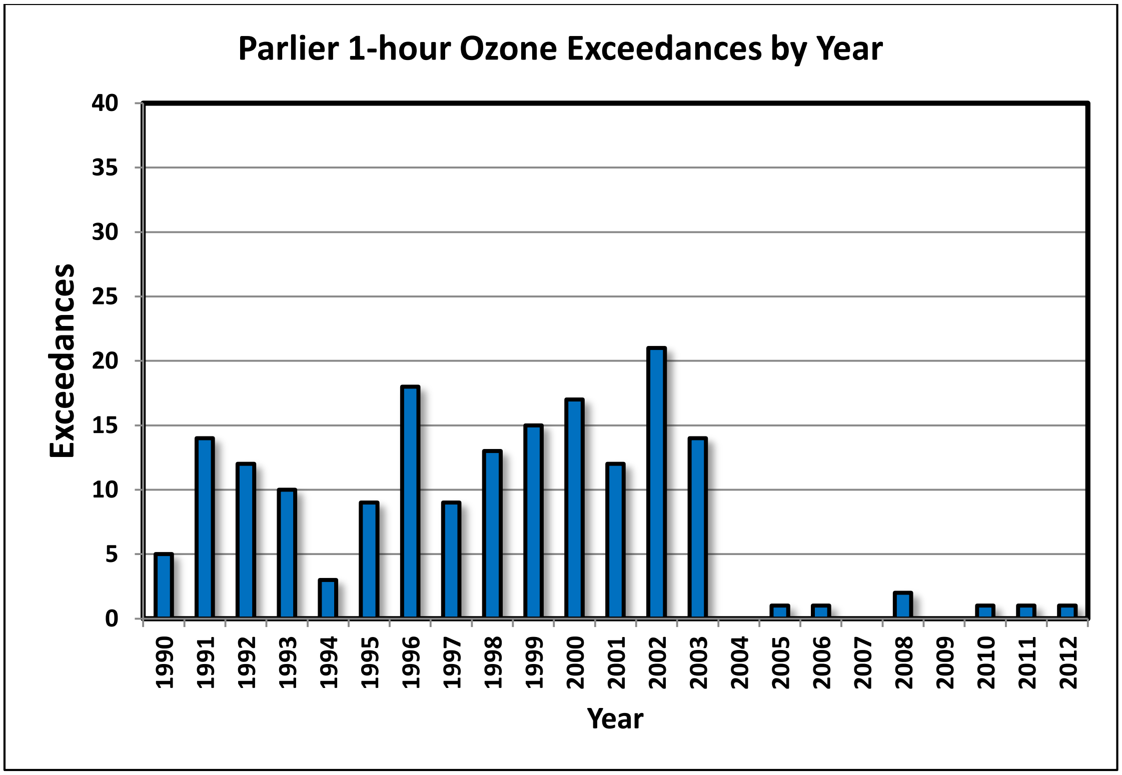


Figure A-8 Exceedance Day Trend at Edison

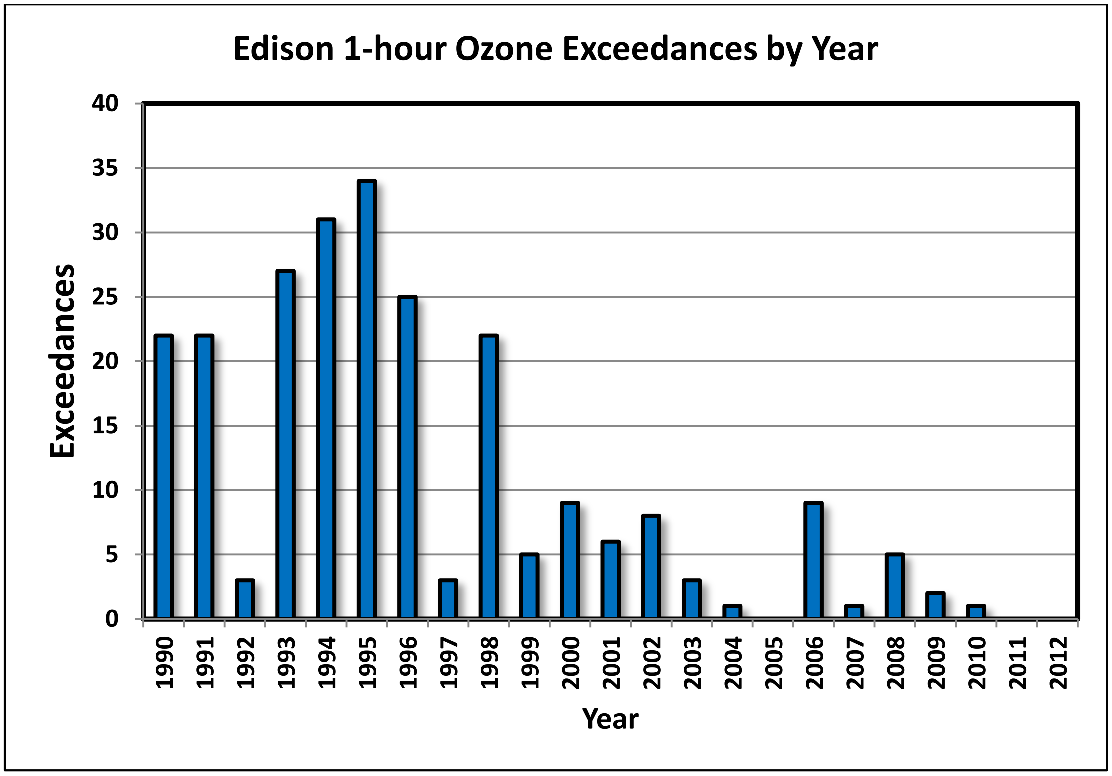


Figure A-9 Exceedance Day Trend at Arvin-Bear Mountain

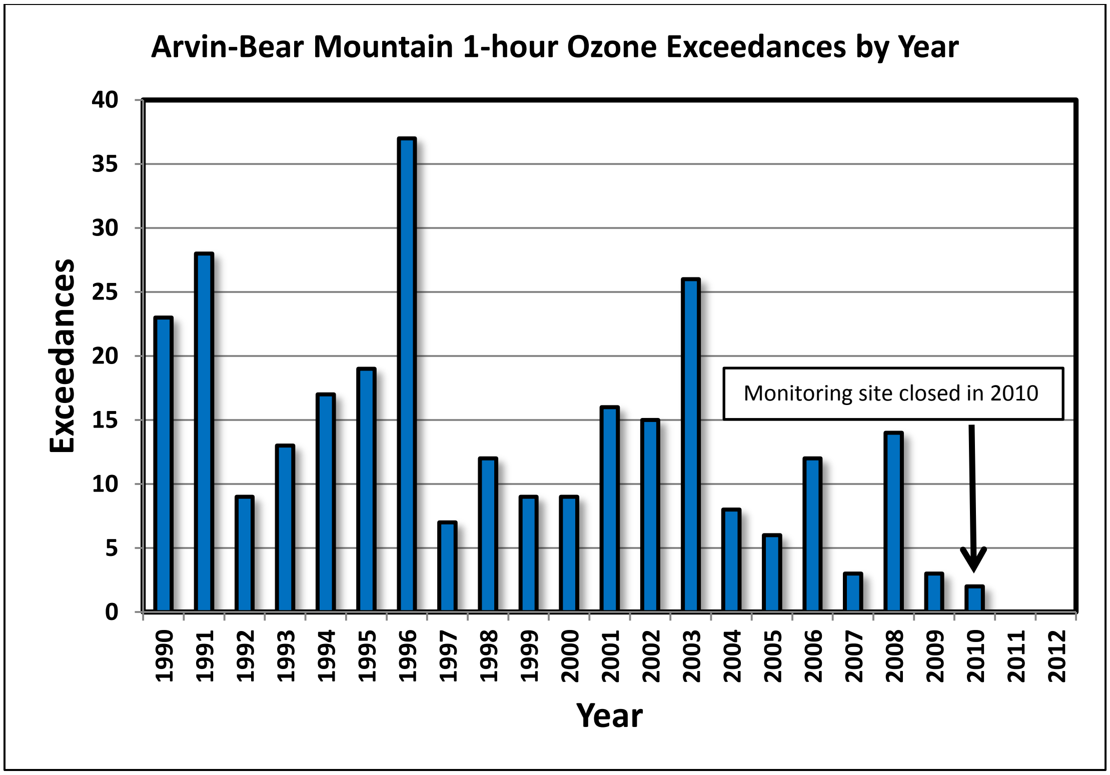


Table A-3 shows the number of days over the standard by county. Historically, 1-hour ozone exceedances have been most common in Fresno and Kern counties, while days over the standard in the northern portion of the Valley have been and continue to be rare. In the last two years, 2011 and 2012, 1-hour ozone exceedances have been restricted to Fresno County only. Comparing this to 1996, when exceedances occurred in every county, it is apparent that the peak ozone problem that was once a Valley-wide problem has now narrowed to a smaller portion of the Valley.

Table A-3 1-hour Ozone Exceedance Days by County per Year from 1980-2012[5]

Year	San Joaquin	Stanislaus	Merced	Madera	Fresno	Kings	Tulare	Kern	Basin
1980	6	2	--	--	54	1	10	23	**64**
1981	4	11	--	--	36	0	2	50	**69**
1982	1	0	--	--	26	0	13	21	**41**
1983	4	5	--	--	23	1	4	20	**37**
1984	4	13	--	--	38	0	3	26	**58**
1985	5	10	--	--	34	2	6	27	**53**
1986	3	2	--	--	39	0	13	33	**59**
1987	1	18	--	--	43	2	10	45	**65**
1988	4	5	--	1	47	3	4	56	**74**
1989	0	3	--	0	24	1	10	42	**54**
1990	1	3	--	0	14	0	1	37	**45**
1991	0	0	2	2	30	0	1	37	**51**
1992	0	0	0	0	25	0	2	10	**29**
1993	1	2	1	6	19	0	10	37	**43**
1994	1	0	0	0	14	0	12	37	**43**
1995	2	2	3	0	22	0	3	38	**44**
1996	2	2	1	2	31	8	4	44	**56**
1997	0	0	0	0	13	2	1	8	**16**
1998	1	4	3	2	30	3	6	29	**39**
1999	3	0	2	0	18	2	3	12	**28**
2000	0	1	0	0	23	0	1	16	**30**
2001	0	0	0	0	21	1	2	16	**32**
2002	0	1	2	2	25	1	3	17	**31**
2003	0	0	0	0	17	0	3	28	**37**
2004	0	0	0	0	1	0	1	8	**9**
2005	0	0	0	0	5	0	1	6	**8**
2006	0	0	0	0	5	1	0	15	**18**
2007	0	0	0	0	0	0	0	3	**3**
2008	0	3	3	0	9	3	6	14	**19**
2009	0	1	0	0	0	0	0	3	**4**
2010	0	0	0	0	5	2	0	2	**7**
2011	0	0	0	0	3	0	0	0	**3**
2012	0	0	0	0	3	0	0	0	**3**

---

[5] The basin total is not the sum of the individual counties. A basin exceedance day is any day where at least one site in the basin (in one or more counties) recorded an exceedance day.

A.4.3 When Are Exceedance Days Occurring?

Exceedance Days by Month

Not only are 1-hour ozone exceedance days now limited to a smaller geographical area than in the past (as discussed above), but 1-hour ozone exceedances are now limited to a smaller window of time than they once were.

Table A-4 shows the number of basin-days over the standard for each year and for each month from 1980 through 2012. The cells in Table A-4 are shaded according to the magnitude of the value, where the highest numbers are shaded a darker color of red and progressing toward values of zero with no shading.

In past years, 1-hour ozone exceedances used to occur as early as the spring months of March, April, and May, with maximum frequency occurring through the summer, and extending into the fall months of October and November. In recent years, days over the 1-hour ozone standard are only occurring during the months of June to September. Ozone has become a much more focused summer time issue, and is less of a concern during the spring and fall.

Table A-4 1-hour Ozone Basin Exceedances by Month per Year from 1980-2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
1980	0	0	0	1	2	4	16	10	13	14	4	0	64
1981	0	0	0	3	1	13	22	21	9	0	0	0	69
1982	0	0	0	0	4	2	13	11	10	1	0	0	41
1983	0	0	0	0	5	2	8	8	11	3	0	0	37
1984	0	0	0	0	7	7	15	16	13	0	0	0	58
1985	0	0	0	4	1	11	12	14	6	5	0	0	53
1986	0	0	2	0	3	10	13	24	6	1	0	0	59
1987	0	0	0	5	2	10	6	17	15	10	0	0	65
1988	0	0	1	1	2	7	18	16	14	15	0	0	74
1989	0	0	0	2	0	4	17	9	13	8	1	0	54
1990	0	0	0	1	0	6	13	13	9	3	0	0	45
1991	0	0	0	0	0	3	10	9	14	15	0	0	51
1992	0	0	0	1	1	1	4	11	9	2	0	0	29
1993	0	0	0	0	0	7	7	11	14	4	0	0	43
1994	0	0	0	0	0	13	12	13	5	0	0	0	43
1995	0	0	0	0	1	5	9	18	11	0	0	0	44
1996	0	0	0	1	1	10	16	18	5	5	0	0	56
1997	0	0	0	0	1	2	4	6	3	0	0	0	16
1998	0	0	0	0	0	1	14	19	5	0	0	0	39
1999	0	0	0	0	1	1	6	6	12	2	0	0	28
2000	0	0	0	0	1	6	5	9	8	1	0	0	30
2001	0	0	0	0	7	6	5	8	3	3	0	0	32
2002	0	0	0	0	1	3	6	11	10	0	0	0	31
2003	0	0	0	0	3	6	8	6	14	0	0	0	37
2004	0	0	0	0	0	1	0	6	2	0	0	0	9
2005	0	0	0	0	0	0	5	1	2	0	0	0	8
2006	0	0	0	0	1	4	3	3	7	0	0	0	18
2007	0	0	0	0	0	0	1	2	0	0	0	0	3
2008	0	0	0	0	0	5	5	6	3	0	0	0	19
2009	0	0	0	0	0	0	0	2	2	0	0	0	4
2010	0	0	0	0	0	0	0	2	5	0	0	0	7
2011	0	0	0	0	0	0	0	0	3	0	0	0	3
2012	0	0	0	0	0	1	1	1	0	0	0	0	3

Exceedance Days by Day of the Week

Anthropogenic ozone precursor emissions rates can vary day to day throughout the week based on human activity. For example, a weekday (Monday through Friday) will have a higher rate of emissions early in the morning and late in the afternoon during their respective rush hours, while a weekend (Saturday and Sunday) may have a more uniform rate of emissions throughout the day. These differences in activity can translate to higher ozone concentrations during specific times of the week.

In this analysis, the number of 1-hour ozone exceedances per day of the week were averaged over three separate 3-year periods: 1990-1992, 2000-2002, and 2010-2012. This analysis used the basin maximum 1-hour ozone value per day.

For the 1990-1992 time period displayed in Figure A-10, 1-hour ozone exceedances occurred more often on Monday, Tuesday, and Friday, with Wednesday close behind. The 1-hour ozone exceedances occurred less on Sunday. Since emissions levels were much higher in the early 1990s relative to recent years, exceedances were likely to happen any day of the week without any discernible pattern among the days of the week.

For the 2000-2002 time period shown in Figure A-11, the chart clearly shows a trend of fewer 1-hour ozone exceedances occurring at the beginning of the week and progressively having the most on Thursday. Sunday and Monday were the cleanest days of the week. As emissions were reduced through the 1990s and into the early 2000s, the lower emissions load in the Valley may have a required a multi-day buildup toward the end of the week in order for exceedances to become more frequent. This would explain the gradual increasing trend in the frequency of days over the 1-hour ozone standard toward the end of the week as emissions in the Valley continued to build upon itself from day to day toward the weekend.

The more recent 2010-2012 time period displayed in Figure A-12 shows that exceedances have become rare in the Valley for any day of the week, with Sunday and Monday having no 1-hour ozone exceedances. Exceedances of the 1-hour ozone standard occurred more often on Thursday, with Tuesday close behind. Similar to the 2000-2002 time period, days over the standard are still more frequent during the middle to the end of the week, showing evidence that a buildup is still required due to a reduced emissions load throughout the Valley. In addition, 1-hour ozone exceedances in recent years have required meteorology that was strongly conducive to ozone formation in order for concentrations to rise above the federal standard. These strong episodes have happened all days of the week in recent years during the summer, but exceedances still only occur in the middle to the end of the week, showing that a buildup is still necessary even under severe meteorology.

Figure A-10 Average Frequency of 1-hour Ozone Exceedances per Year per Day of the Week from 1990-1992

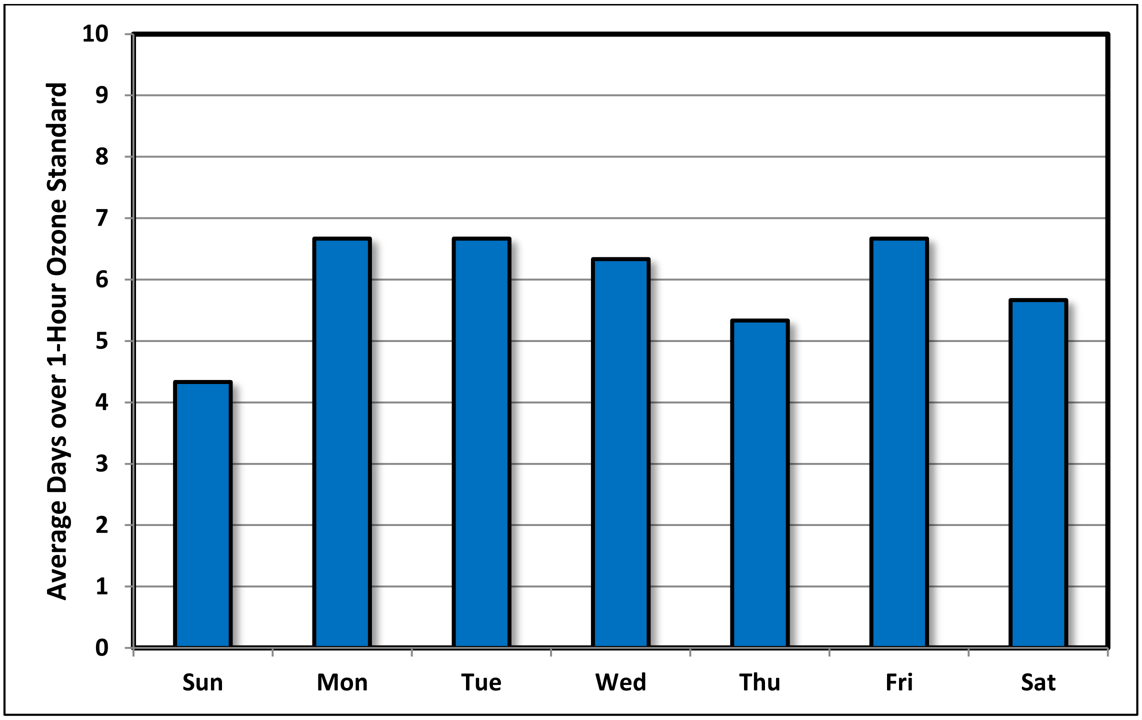


Figure A-11 Average Frequency of 1-hour Ozone Exceedances per Year per Day of the Week from 2000-2002

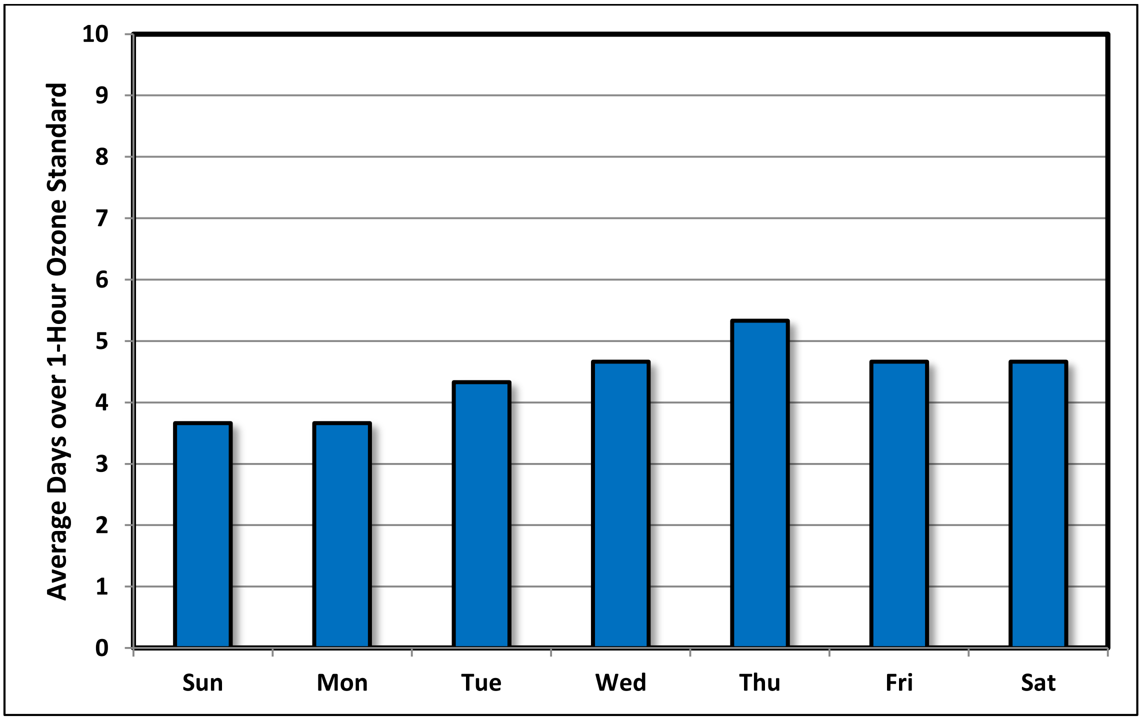
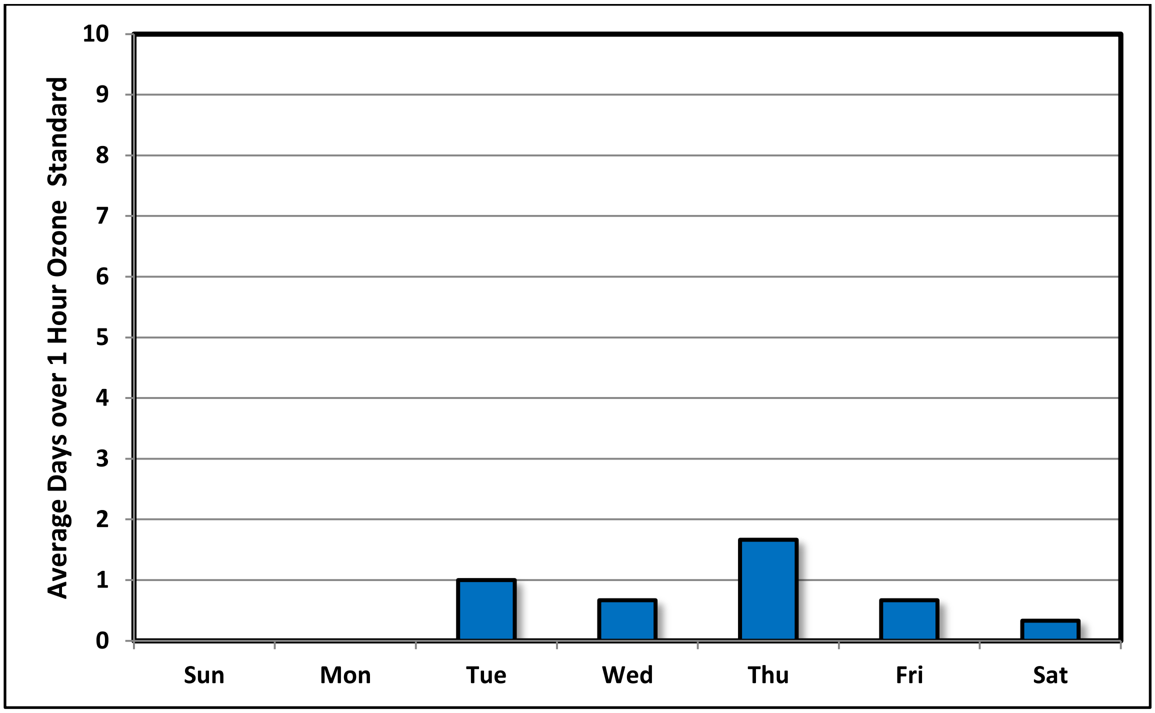


Figure A-12 Average Frequency of 1-hour Ozone Exceedances per Year per Day of the Week from 2010-2012



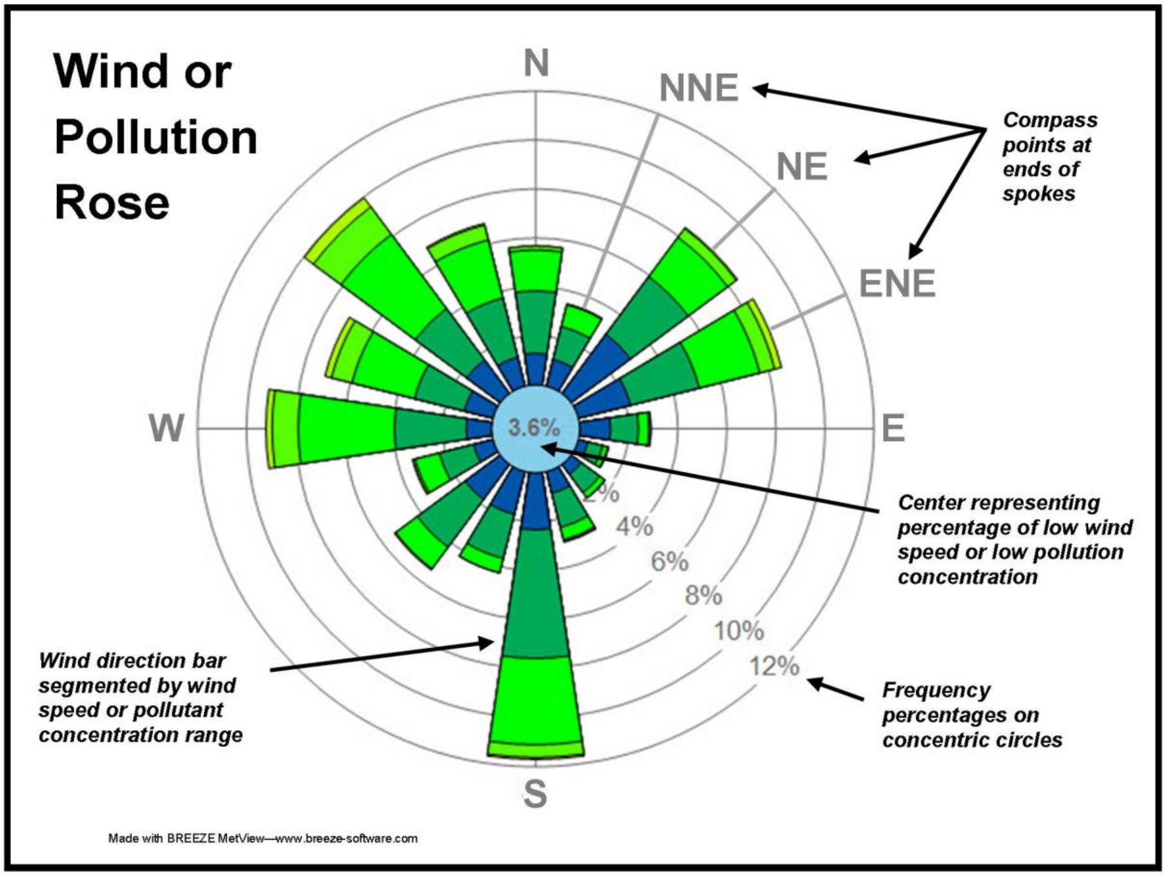
A.4.4 Analysis of 2011-2012 Exceedance Days

How to interpret wind and pollution roses

Wind roses are diagrams that show the strength and frequency of the wind from various directions over a specified amount of time. As an example in Figure A-13, a wind rose plot or diagram uses either compass points (N, NNE, NE, etc.) or degrees (0˚, 45˚, 90˚, etc.) to show the measured prevailing wind direction for each hour over the time frame being considered. These directions are the spokes of the plot. Prevailing wind direction data is organized into compass-point groupings and displayed as a percentage of the total time that the wind was coming from a specific compass direction. This percentage is designated as a bar extending from the center along the spokes to the frequency percentage, which are shown as concentric circles moving away from the center of the plot. The individual directional bars can be segmented by color and bar thickness to show the wind speed associated with a given direction with highest wind speeds (thickest bars) farthest away from the center. The center of the plot is usually reserved to show the percentage of time that the wind speed was below a certain speed, generally indicating stagnant wind flow.

Pollution roses show the correlation between the average concentrations of a pollutant, the location of the pollution plume, and wind direction. Similar to a wind rose, a *pollution rose* also summarizes the wind direction over a given period of time; however, instead of segmenting each bar along a directional spoke by wind speed, the bar is segmented to show the concentration of a given pollutant for each hour. Concentration ranges are designated by different colors and increasing bar thickness. The center of the plot is usually reserved for low pollutant concentration values, indicating the percentage of time that concentrations were below that level.

Figure A-13 Sample Wind/Pollution Rose Diagram



Wind and pollution rose analysis for recent 1-hour ozone exceedances, 2011-2012

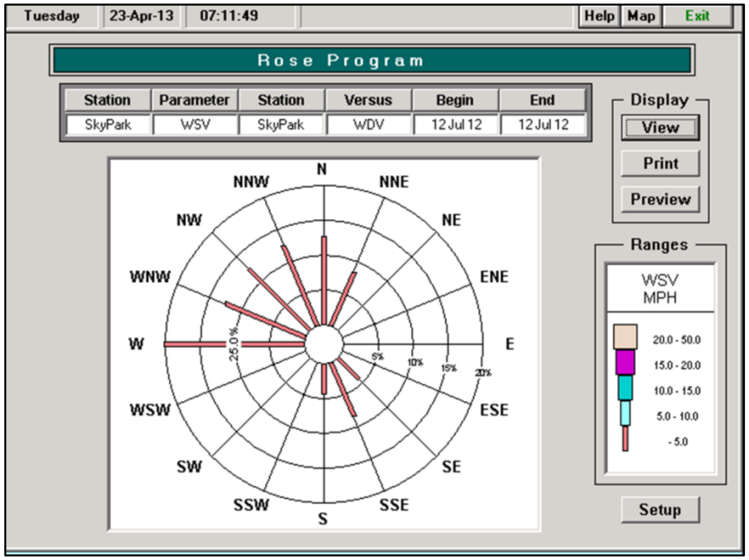
Table A-5 summarizes wind and pollution rose information for 1-hour ozone exceedance days that occurred in 2011 and 2012 at the Fresno-Sky Park, Clovis, Fresno-Garland, Parlier, and Fresno-Drummond sites. The wind and pollution rose figures for all of the events analyzed follow below (Figures A-14 to A-33).

The wind roses for those exceedance days all indicate that the wind direction varied throughout the day, but a westerly component was commonly present in the wind flow. The pollution roses show a correlation between the common wind direction component of the wind and the direction associated with the exceedances and additional peaks that occurred. In general, this analysis shows that in recent years, the meteorological conditions on an exceedance day have been stagnant with light and variable wind flow. This supports the observation that a buildup under stagnant weather conditions is necessary for a 1-hour exceedance to occur.

Table A-5 Summary of Wind and Pollution Rose Results

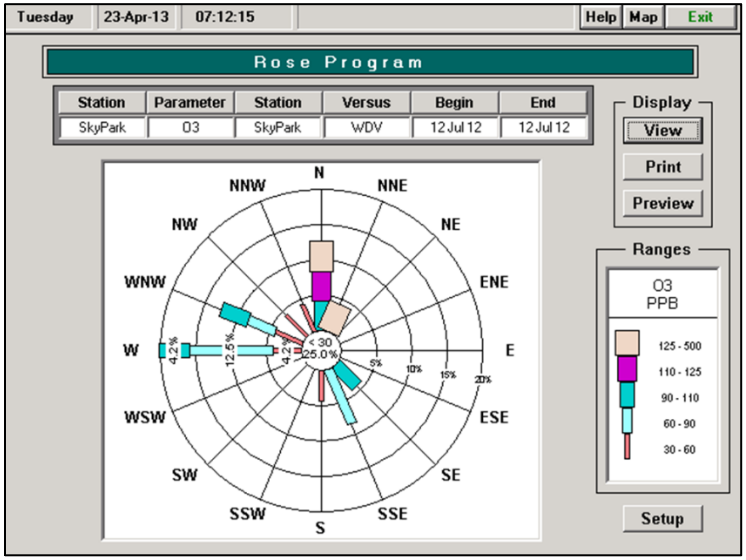
Site	Date	1-Hour Ozone Max	Common Wind Direction Component	Wind Direction Associated with Exceedance	Wind Direction Associated with Additional Peak Concentrations
Fresno-Sky Park	7/12/2012	133 ppb	Westerly	North Northeast	
Clovis	9/22/2011	133 ppb	Westerly	South Southwest	
	9/29/2011	131 ppb	Westerly and Southerly	West Northwest	West
Fresno-Garland	7/12/2012	135 ppb	Southerly	Southeast	Southwest
Fresno-Drummond	9/20/2011	127 ppb	Westerly	Northwest	
	9/22/2011	129 ppb	Southerly and Westerly	Southwest	Southeast and West Northwest
	9/29/2011	129 ppb	Westerly	Northwest	
	8/10/2012	127 ppb	Northwesterly	West Southwest	
Parlier	9/20/2011	134 ppb	Westerly	Northwest	
	6/1/2012	126 ppb	Southwesterly	Northwest	

Figures A-14 to A-17 Wind and Pollution Roses for Fresno-Sky Park (7/12/2012) and Clovis (9/22/2011)


Tuesday 23-Apr-13 07:11:49

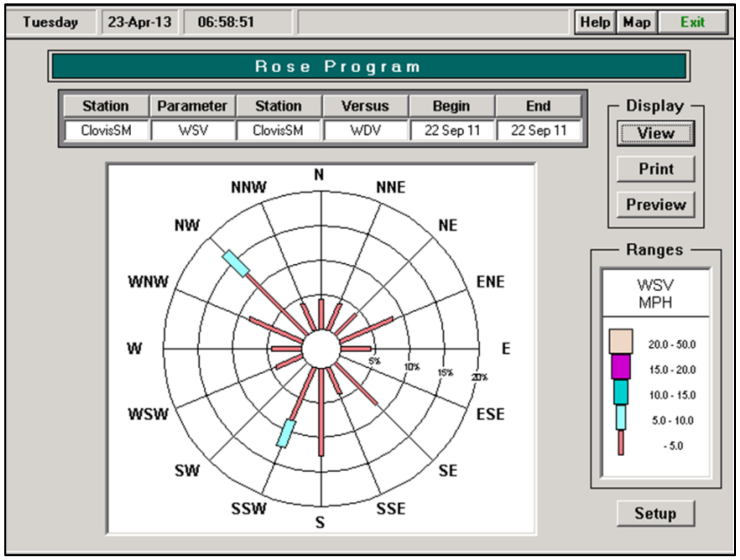
Rose Program

Station	Parameter	Station	Versus	Begin	End
SkyPark	WSV	SkyPark	WDV	12 Jul 12	12 Jul 12


Tuesday 23-Apr-13 07:12:15

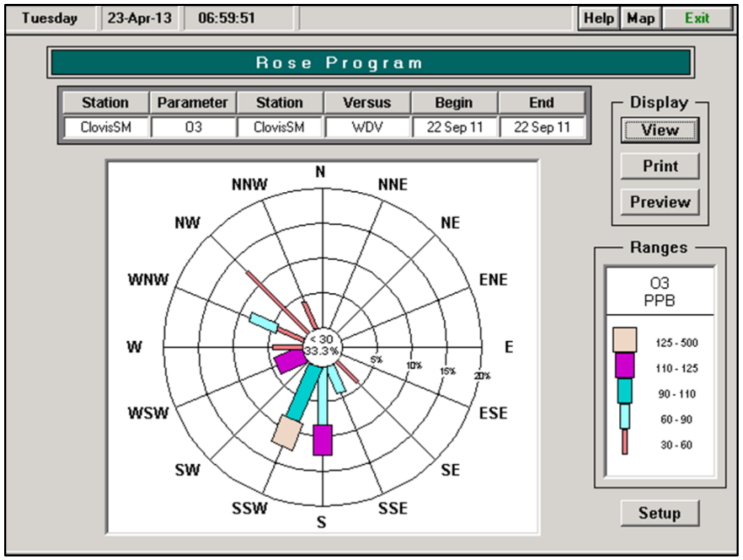
Rose Program

Station	Parameter	Station	Versus	Begin	End
SkyPark	O3	SkyPark	WDV	12 Jul 12	12 Jul 12


Tuesday 23-Apr-13 06:58:51

Rose Program

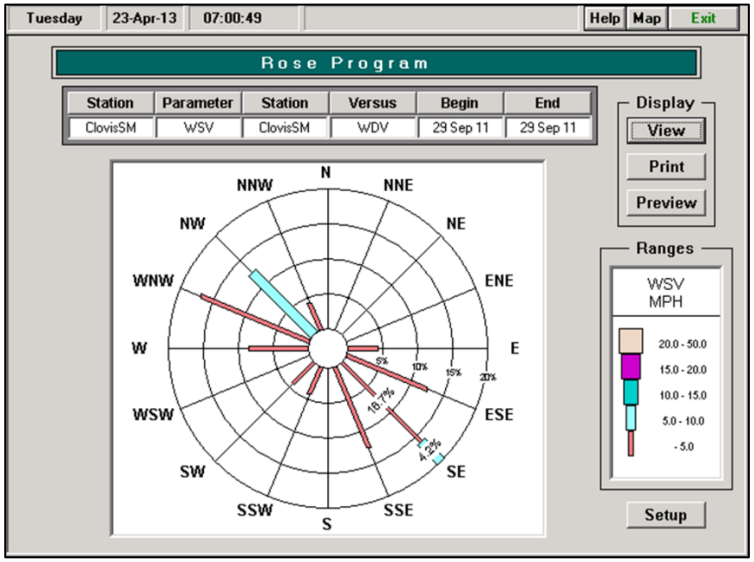
Station	Parameter	Station	Versus	Begin	End
ClovisSM	WSV	ClovisSM	WDV	22 Sep 11	22 Sep 11


Tuesday 23-Apr-13 06:59:51

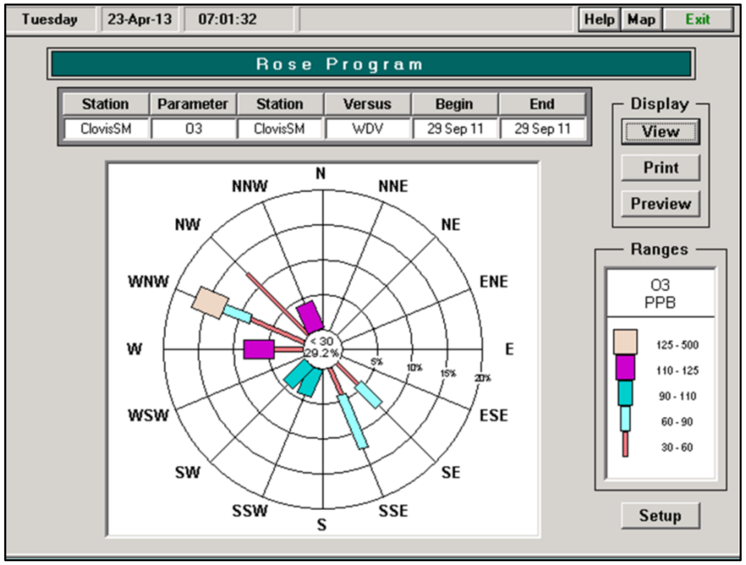
Rose Program

Station	Parameter	Station	Versus	Begin	End
ClovisSM	O3	ClovisSM	WDV	22 Sep 11	22 Sep 11

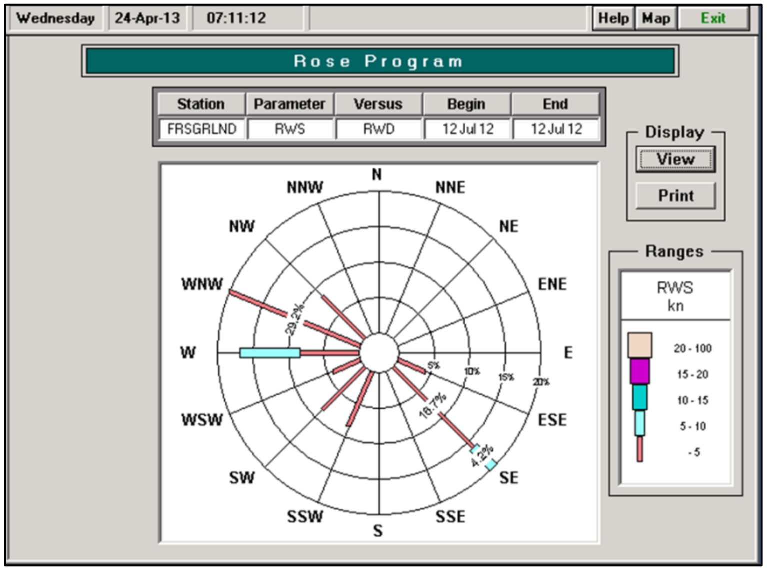
Figures A-18 to A-21 Wind and Pollution Roses for Clovis (9/29/2011) and Fresno-Garland (7/12/2012)



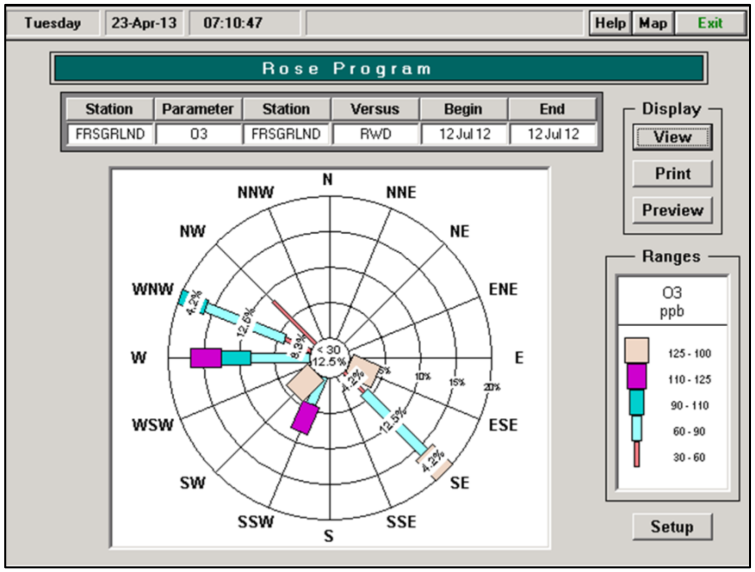
Station	Parameter	Station	Versus	Begin	End
ClovisSM	WSV	ClovisSM	WDV	29 Sep 11	29 Sep 11



Station	Parameter	Station	Versus	Begin	End
ClovisSM	O3	ClovisSM	WDV	29 Sep 11	29 Sep 11

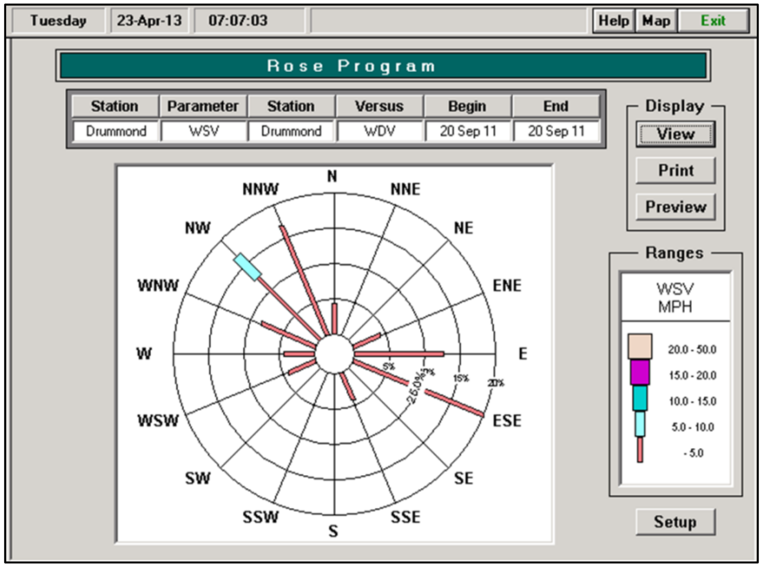


Station	Parameter	Versus	Begin	End
FRSGRLND	RWS	RWD	12 Jul 12	12 Jul 12

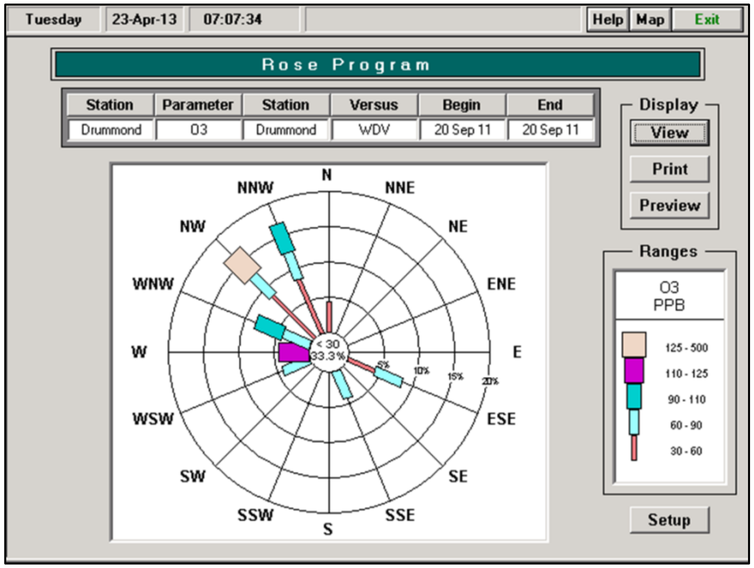


Station	Parameter	Station	Versus	Begin	End
FRSGRLND	O3	FRSGRLND	RWD	12 Jul 12	12 Jul 12

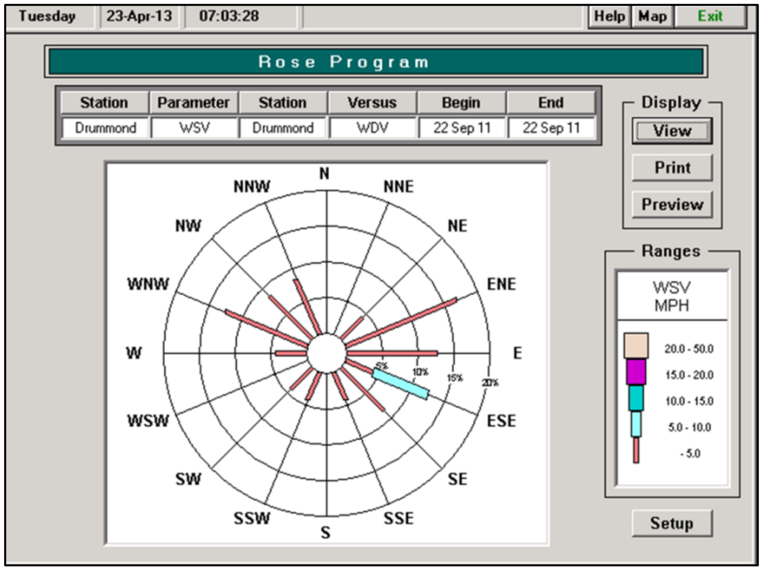
Figures A-22 to A-25 Wind and Pollution Roses for Fresno-Drummond (9/20/2011 and 9/22/2011)



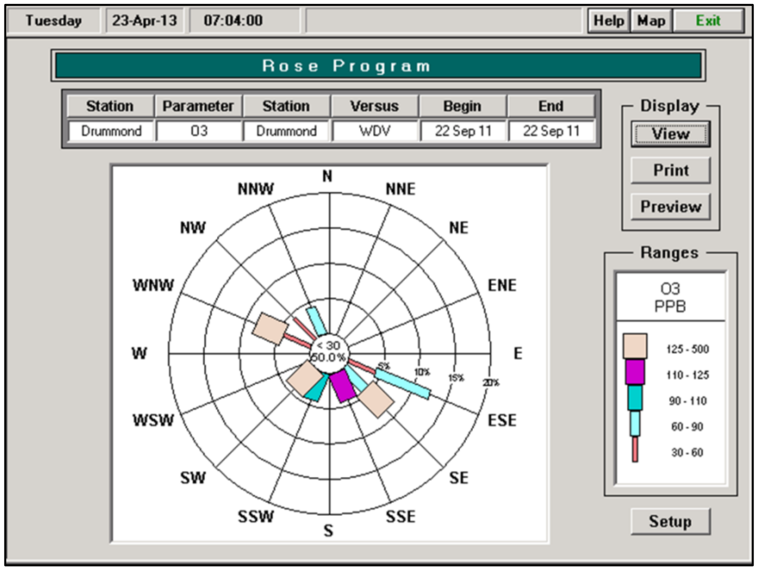
Station	Parameter	Station	Versus	Begin	End
Drummond	WSV	Drummond	WDV	20 Sep 11	20 Sep 11



Station	Parameter	Station	Versus	Begin	End
Drummond	O3	Drummond	WDV	20 Sep 11	20 Sep 11

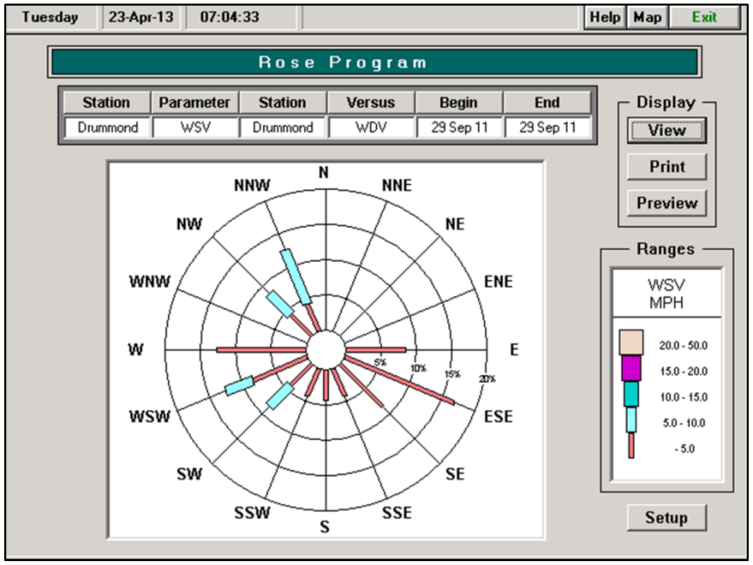


Station	Parameter	Station	Versus	Begin	End
Drummond	WSV	Drummond	WDV	22 Sep 11	22 Sep 11



Station	Parameter	Station	Versus	Begin	End
Drummond	O3	Drummond	WDV	22 Sep 11	22 Sep 11

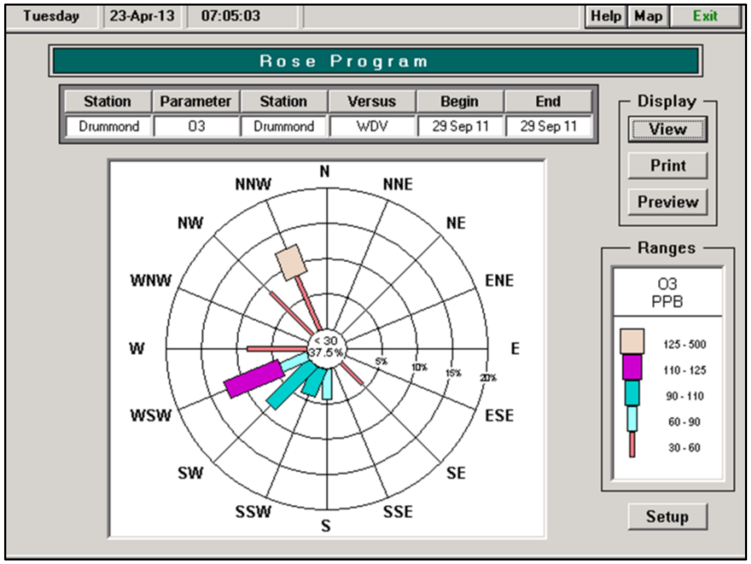
Figures A-26 to A-29 Wind and Pollution Roses for Fresno-Drummond (9/29/2011 and 8/10/2012)


Tuesday 23-Apr-13 07:04:33

Rose Program

Station	Parameter	Station	Versus	Begin	End
Drummond	WSV	Drummond	WDV	29 Sep 11	29 Sep 11

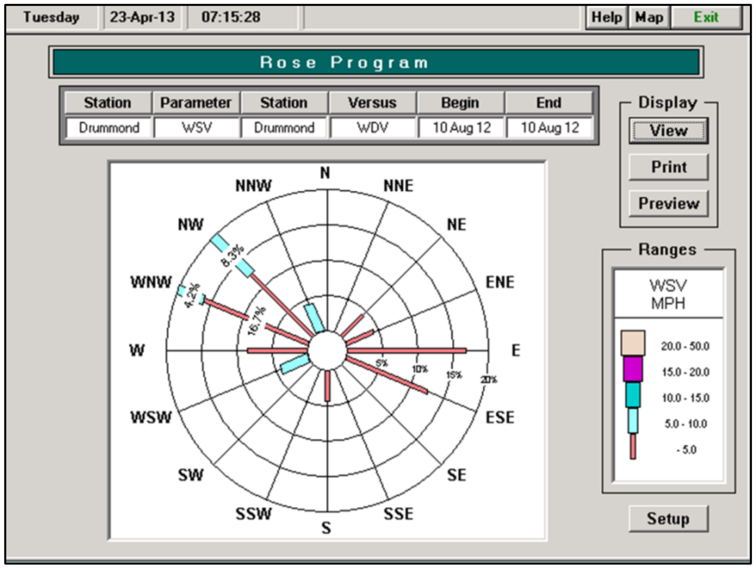
Ranges: WSV MPH
- 20.0 - 50.0
- 15.0 - 20.0
- 10.0 - 15.0
- 5.0 - 10.0
- - 5.0


Tuesday 23-Apr-13 07:05:03

Rose Program

Station	Parameter	Station	Versus	Begin	End
Drummond	O3	Drummond	WDV	29 Sep 11	29 Sep 11

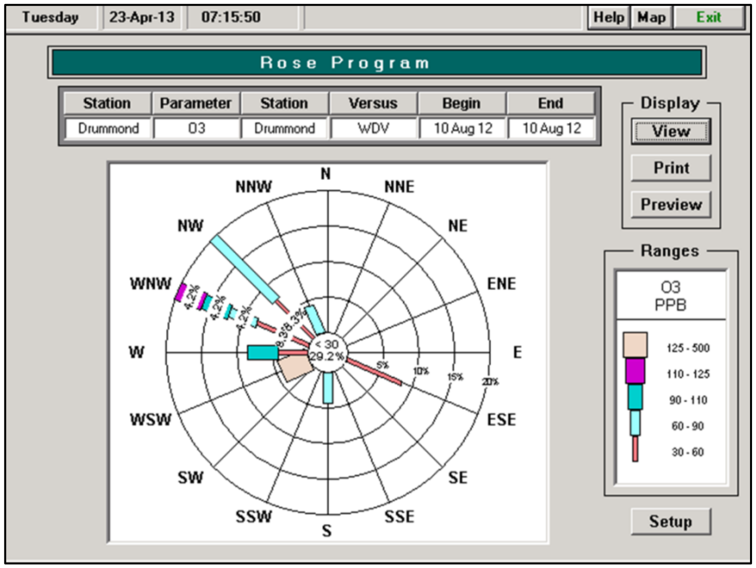
Ranges: O3 PPB
- 125 - 500
- 110 - 125
- 90 - 110
- 60 - 90
- 30 - 60


Tuesday 23-Apr-13 07:15:28

Rose Program

Station	Parameter	Station	Versus	Begin	End
Drummond	WSV	Drummond	WDV	10 Aug 12	10 Aug 12

Ranges: WSV MPH
- 20.0 - 50.0
- 15.0 - 20.0
- 10.0 - 15.0
- 5.0 - 10.0
- - 5.0

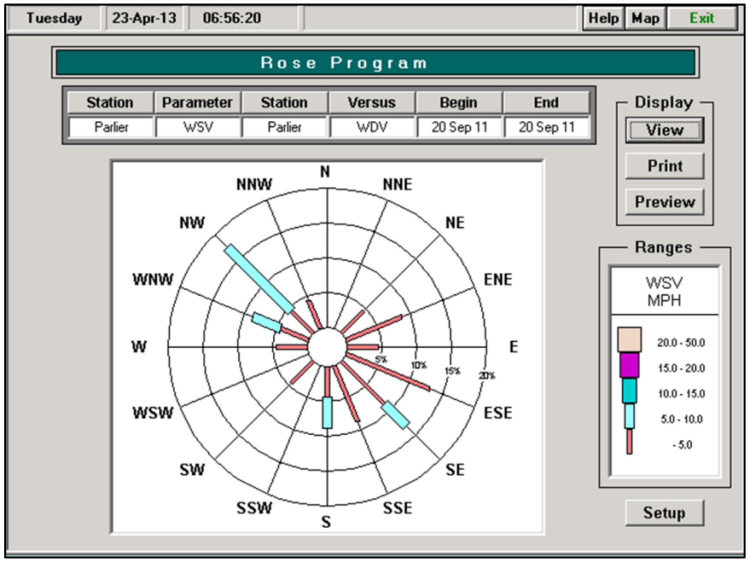

Tuesday 23-Apr-13 07:15:50

Rose Program

Station	Parameter	Station	Versus	Begin	End
Drummond	O3	Drummond	WDV	10 Aug 12	10 Aug 12

Ranges: O3 PPB
- 125 - 500
- 110 - 125
- 90 - 110
- 60 - 90
- 30 - 60

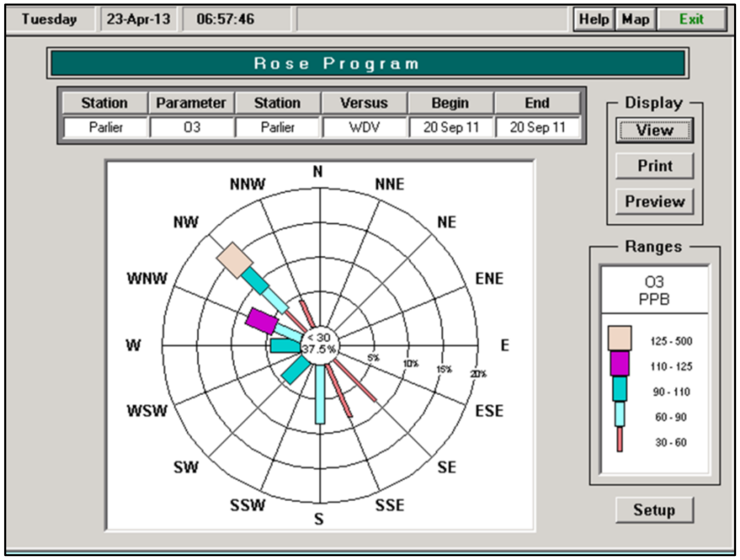
Figures A-30 to A-33 Wind and Pollution Roses for Parlier (9/20/2011 and 6/1/2012)



Tuesday 23-Apr-13 06:56:20

Rose Program

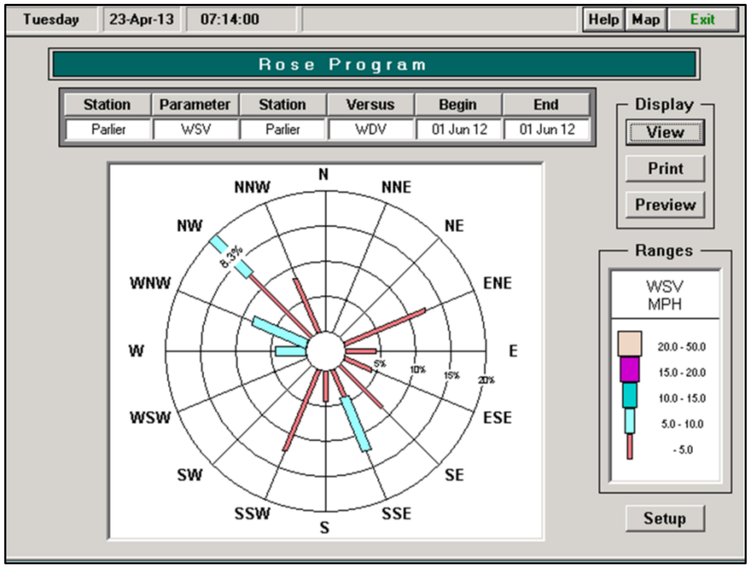
Station	Parameter	Station	Versus	Begin	End
Parlier	WSV	Parlier	WDV	20 Sep 11	20 Sep 11



Tuesday 23-Apr-13 06:57:46

Rose Program

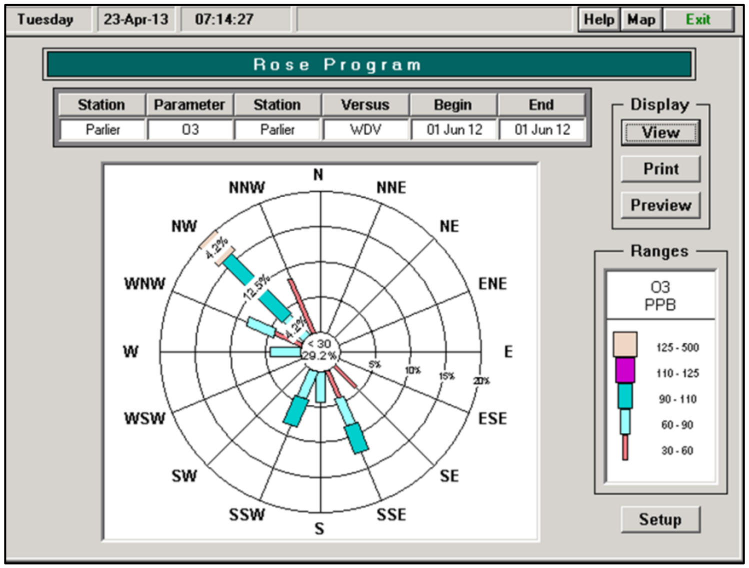
Station	Parameter	Station	Versus	Begin	End
Parlier	O3	Parlier	WDV	20 Sep 11	20 Sep 11



Tuesday 23-Apr-13 07:14:00

Rose Program

Station	Parameter	Station	Versus	Begin	End
Parlier	WSV	Parlier	WDV	01 Jun 12	01 Jun 12



Tuesday 23-Apr-13 07:14:27

Rose Program

Station	Parameter	Station	Versus	Begin	End
Parlier	O3	Parlier	WDV	01 Jun 12	01 Jun 12

A.5 HOURLY OZONE TRENDS

A.5.1 Number of Exceedance Hours

On an exceedance day, there may have been one hour over the level of the 1-hour ozone standard, or there may have been several hours over the standard. The total number of hours exceeding the ozone standard on an exceedance day has been decreasing over time Valley-wide, as shown in Figures A-34 through A-38. This trend shows that the overall exposure to peak ozone levels is declining.

Figure A-34 Number of Hours over 1-hour Ozone Standard by Year at Clovis

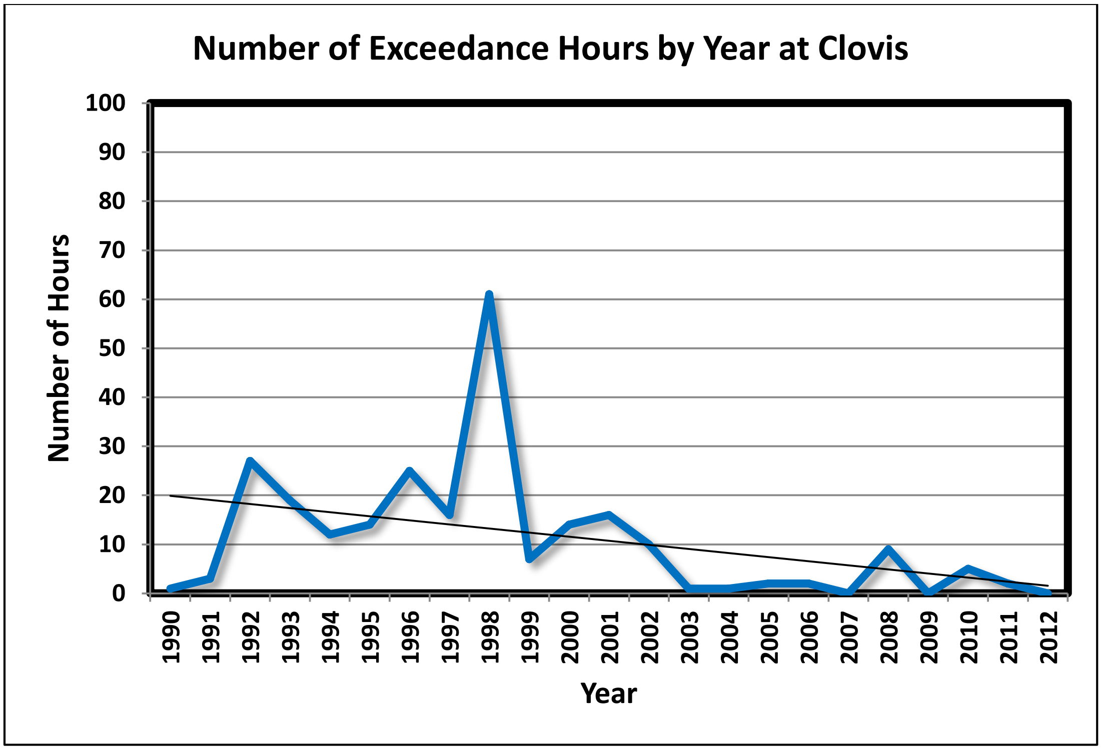


Figure A-35 Number of Hours over 1-hour Ozone Standard by Year at Fresno-First/Garland

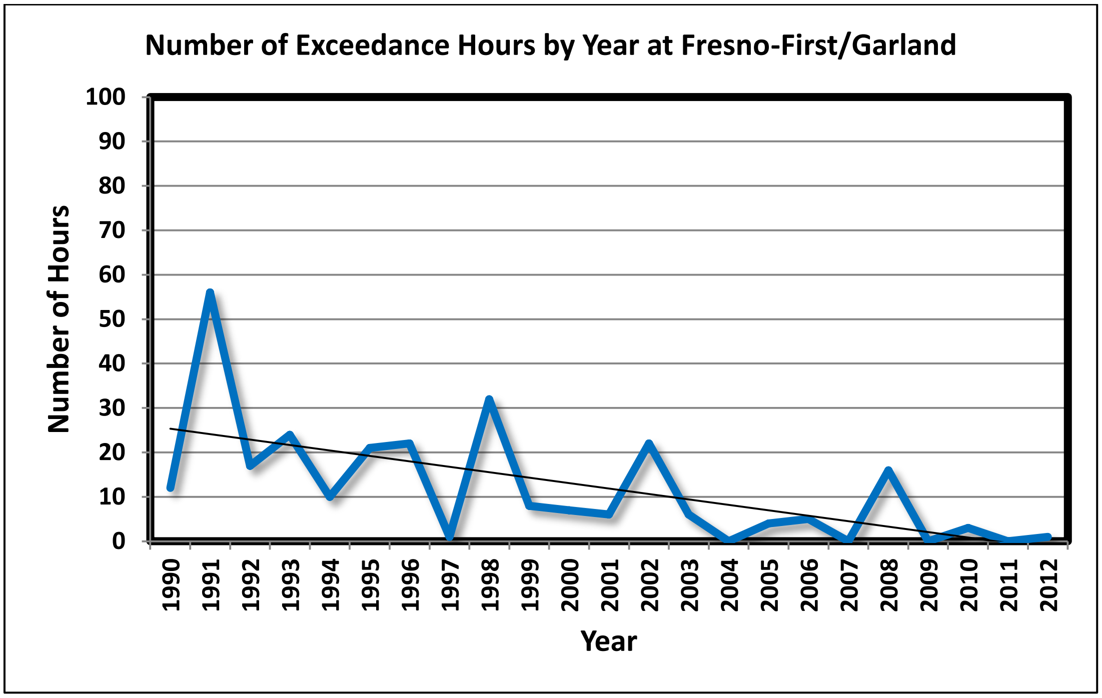


Figure A-36 Number of Hours over 1-hour Ozone Standard by Year at Parlier

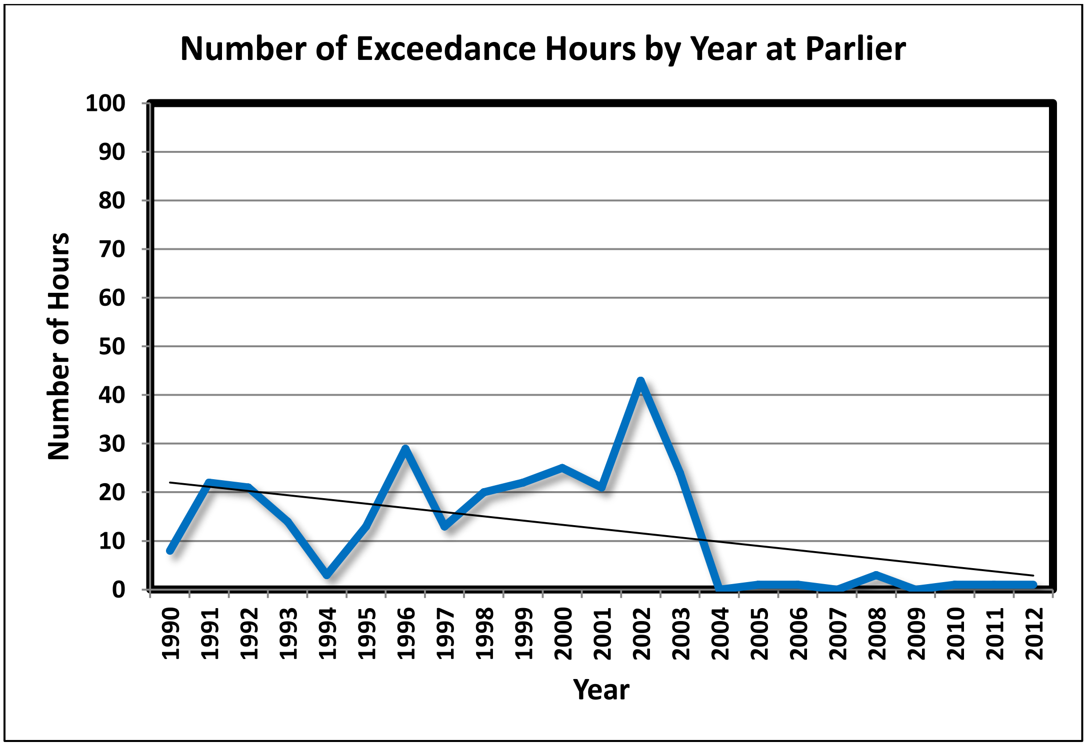


Figure A-37 Number of Hours over 1-hour Ozone Standard by Year at Edison

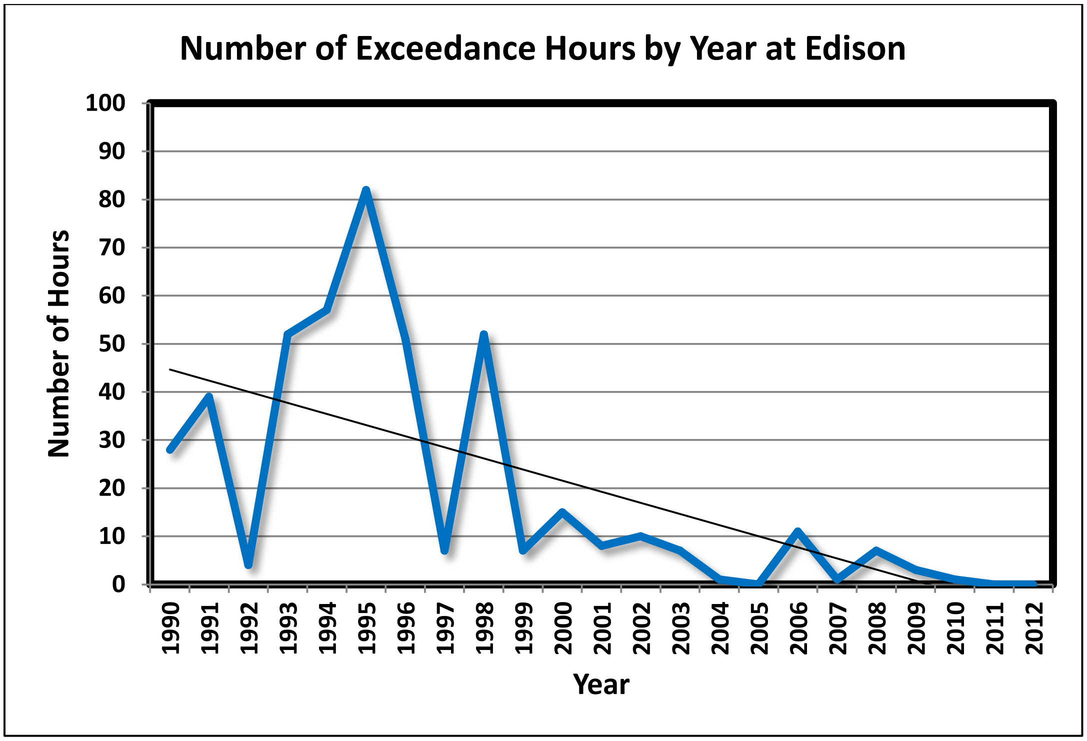
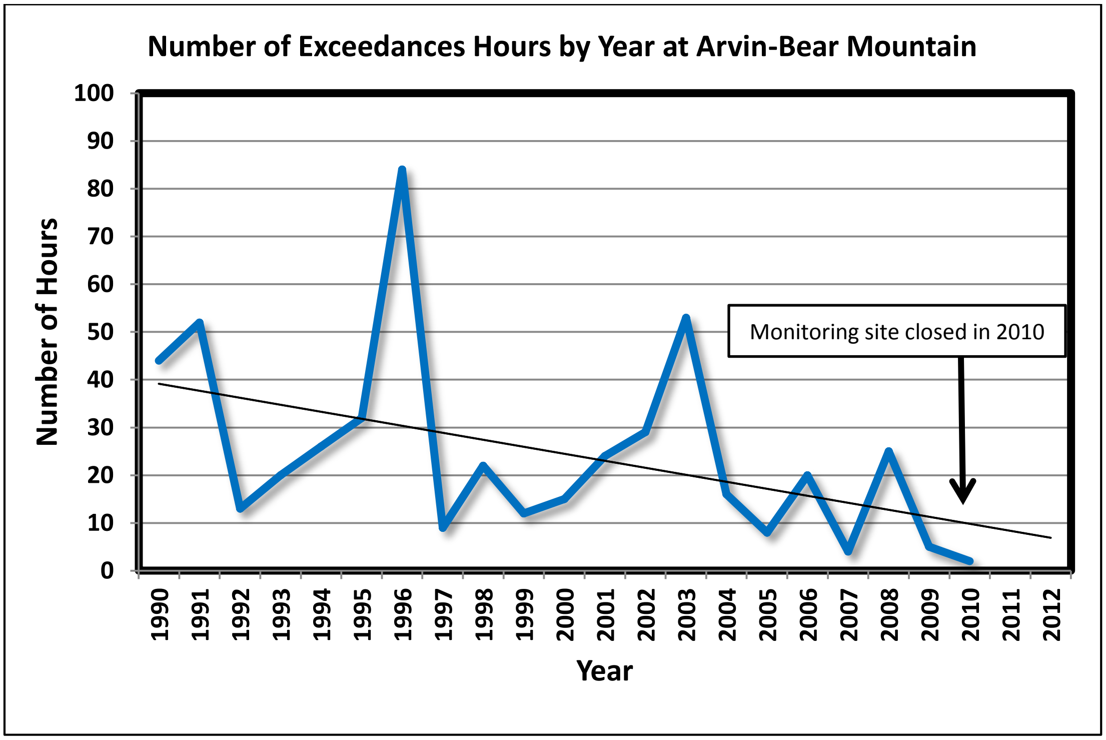


Figure A-38 Number of Hours over 1-hour Ozone Standard by Year at Arvin-Bear Mountain

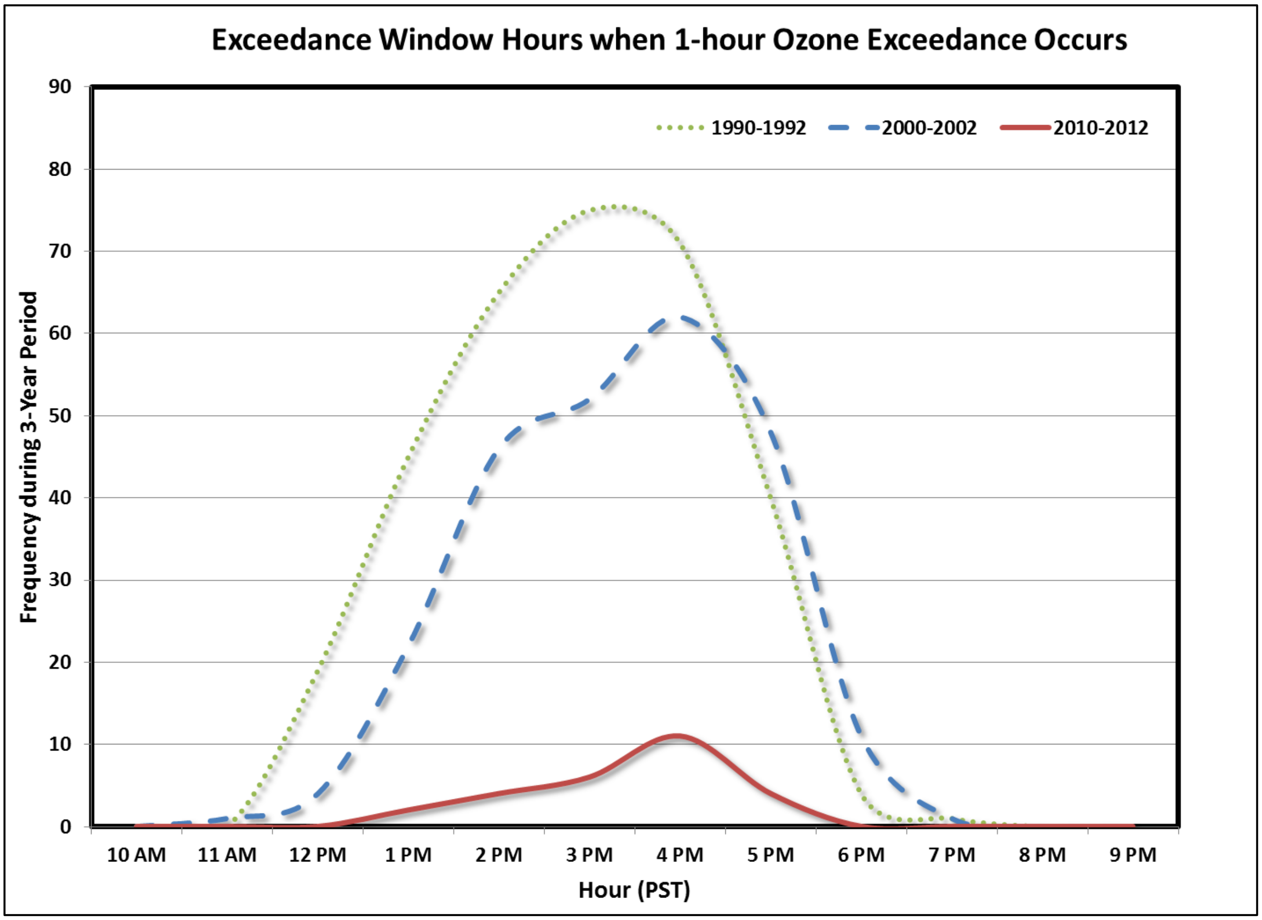


A.5.2 Exceedance Window

Analysis has shown that the number of hours over the standard per exceedance day is decreasing, but additionally the range of hours during a day in which a 1-hour ozone exceedance occurs is also decreasing. Figure A-39 shows this 1-hour ozone "exceedance window" as a frequency of exceedances measured at a particular hour, from 10 AM to 9 PM Pacific Standard Time (PST), for time periods of 1990-1992, 2000-2002, and 2010-2012. In the recent years of 2010-2012, the 1-hour ozone exceedance window has significantly narrowed compared to the earlier years of 1990-1992 and 2000-2002.

The peak occurrence of a 1-hour exceedance from 1990-1992 was hour 14 (3 PM PST), with 75 occurrences of a 1-hour ozone exceedance at a monitor during any given day, with hour 15 (4 PM PST) closely behind with 71 occurrences. From 2010-2012, the peak occurrence of a 1-hour ozone exceedance hours has shifted to hour 15 (4 PM PST), with a total of 11 occurrences, followed by hour 14 (3 PM PST) with 6 occurrences. Additionally, the peak occurrence of 1-hour ozone exceedance hours has shifted later in the day by 1-hour, from hour 14 to hour 15. Figure A-39 also reveals that the frequency of 1-hour exceedances has considerably decreased, as is evident in the smaller area beneath the 2010-2012 curve compared to the 1990-1992 and 2000-2002 curves.

Figure A-39 1-hour Ozone Exceedance Window Trend

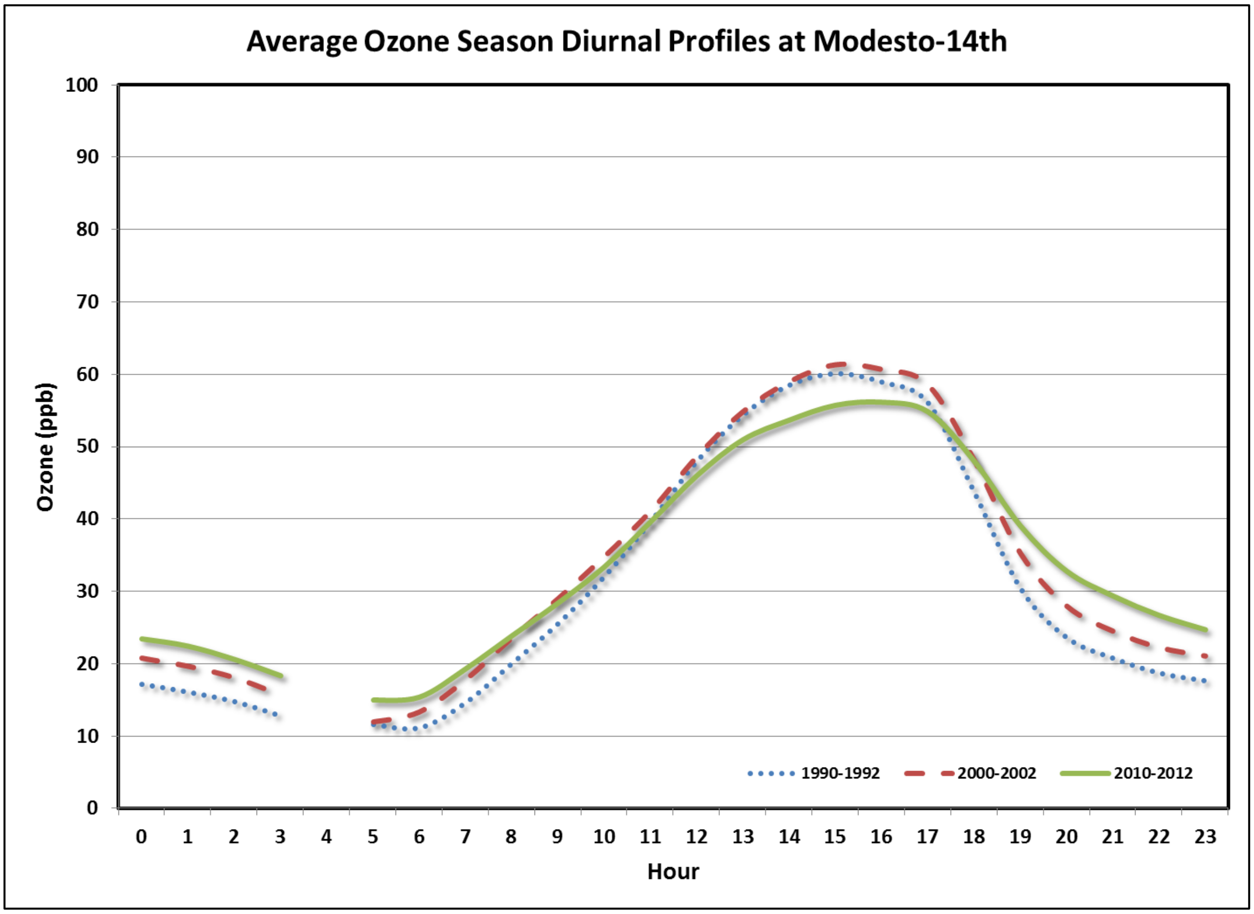


A.5.3 Trends in Diurnal Ozone Profiles

A "diurnal ozone profile" is the pattern of ozone concentrations occurring from hour to hour throughout the day. Changes in diurnal profiles may indicate changes in patterns of ozone precursor emissions. The diurnal profiles for several Valley monitoring sites (Modesto-14th, Clovis, Fresno-First/Garland, Fresno-Drummond, Parlier, Visalia-Church, Bakersfield-California, Edison, and Arvin-Bear Mountain) were evaluated for three 3-year time periods: the early 1990s (varied for each site depending on beginning of ozone monitoring), 2000-2002, and 2010-2012 (see Figures A-40 through A-48). The ozone concentrations for each hour of the day over these three 3-year periods were averaged to give an average diurnal profile for each period.

This analysis shows that the diurnal profiles maintain relatively consistent shapes over time, although the afternoon peaks have shifted downward as ozone concentrations have decreased over time, as discussed throughout this appendix. In the 1990-1992 time period, ozone concentrations decreased more rapidly in the late afternoon than in more recent years. In the past, when oxides of nitrogen (NOx) emissions levels were higher in the Valley, excess ozone was more easily scavenged and consumed by NOx through chemical reactions in the late afternoon to evening timeframe, reducing ozone concentrations rapidly. In more recent years, with much lower NOx emissions, ozone scavenging does not occur on the same scale as in the past, and so ozone concentrations tend to stay more elevated in the late afternoon to early evening.[6] [7]

Figure A-40 Ozone Diurnal Profiles at Modesto-14th



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[6] Pusede, S. & Cohen R. (2012). On the observed response of ozone to NOx and VOC reactivity reductions in San Joaquin Valley California 1995-present. *Atmospheric Chemistry and Physics*, 12, 8323-8339.

[7] European Environment Agency [EEA] (1998). *Tropospheric Ozone in the European Union "The Consolidated Report"* (Topic Report no. 8/1998). Retrieved April 25, 2013 from http://www.eea.europa.eu/publications/TOP08-98

Figure A-41 Ozone Diurnal Profiles at Clovis

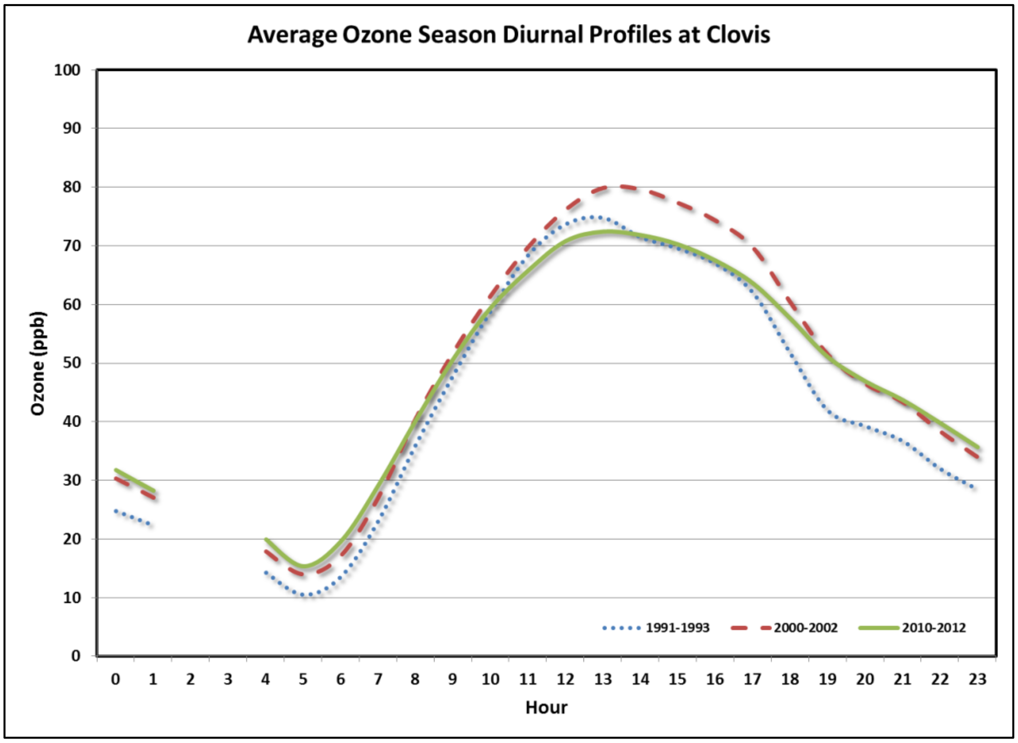


Figure A-42 Ozone Diurnal Profiles at Fresno-First/Garland

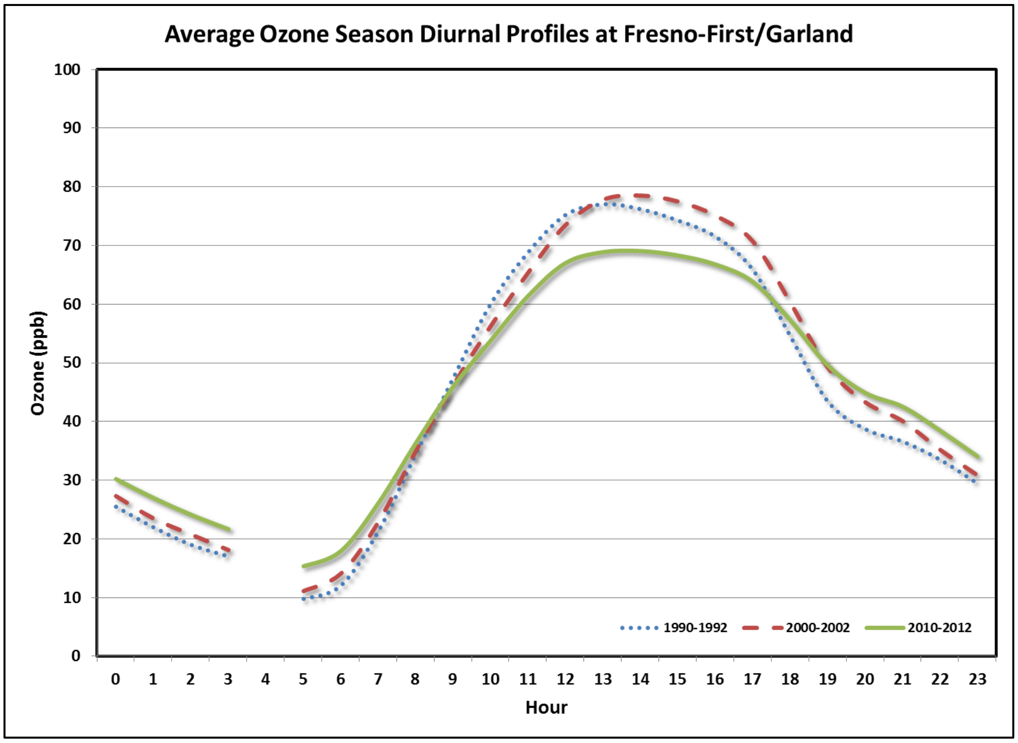


Figure A-43 Ozone Diurnal Profiles at Fresno-Drummond

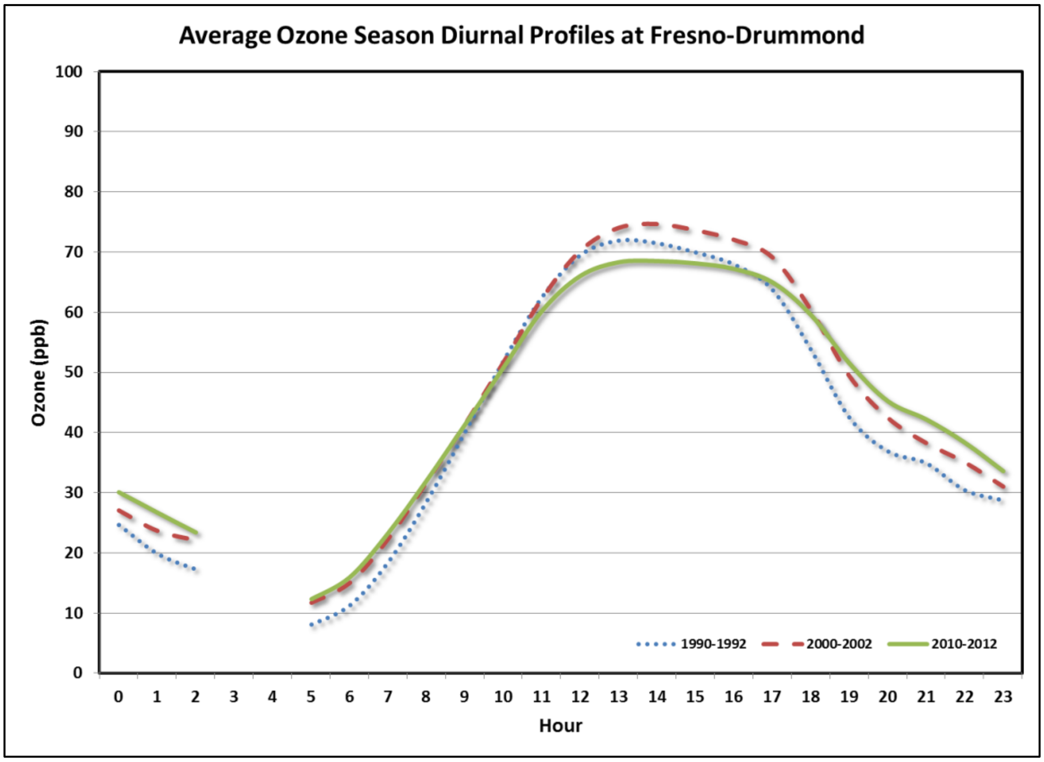


Figure A-44 Ozone Diurnal Profiles at Parlier

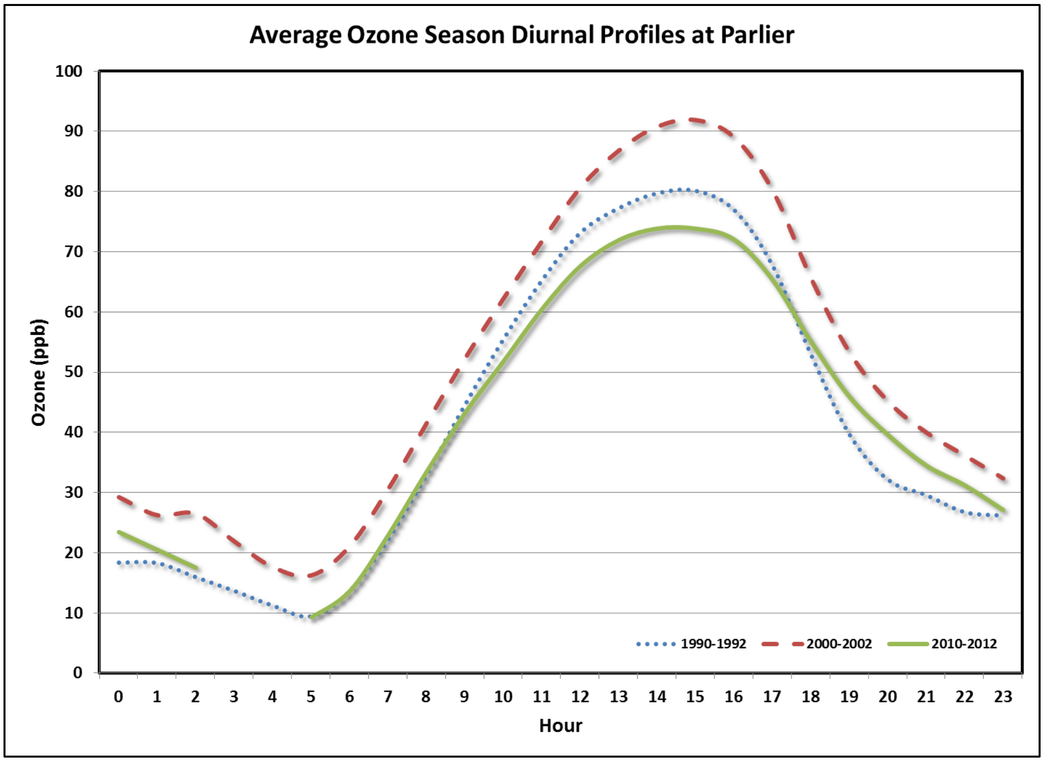


Figure A-45 Ozone Diurnal Profiles at Visalia-Church

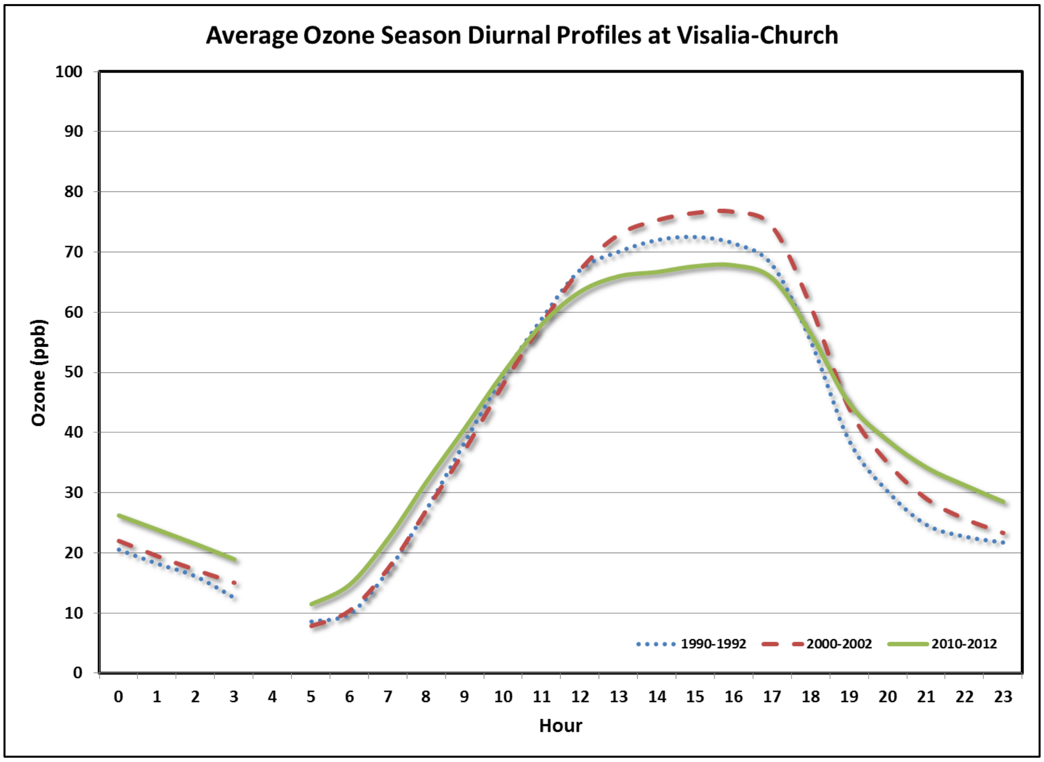


Figure A-46 Ozone Diurnal Profiles at Bakersfield-California

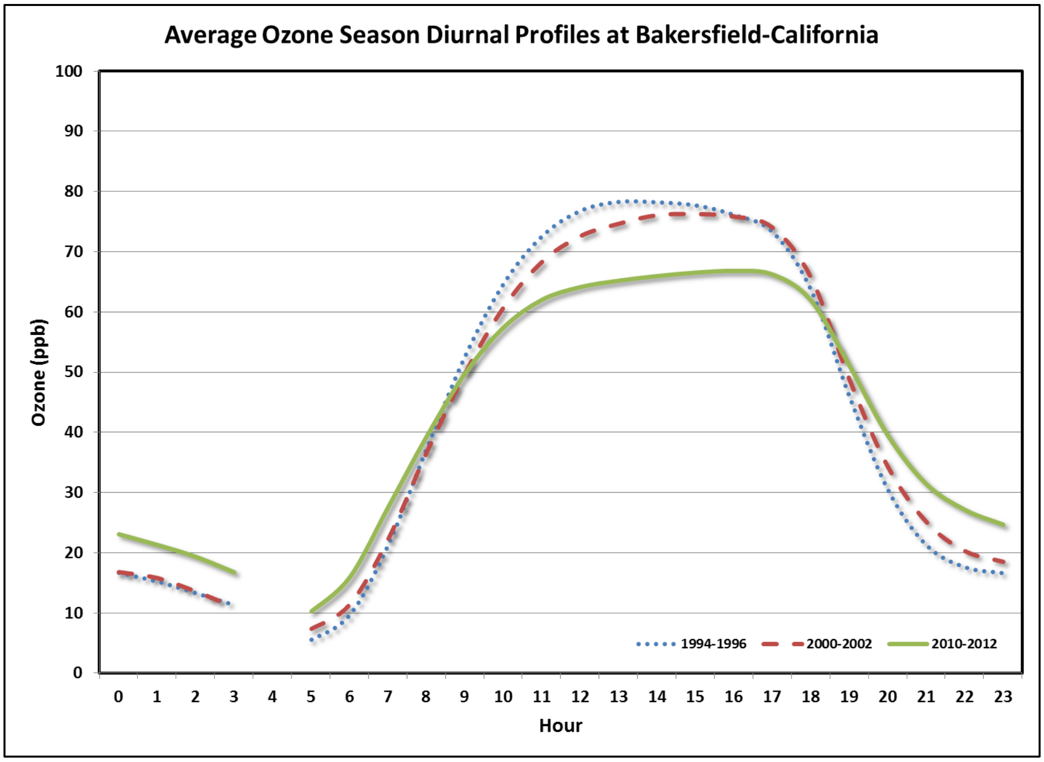


Figure A-47 Ozone Diurnal Profiles at Edison

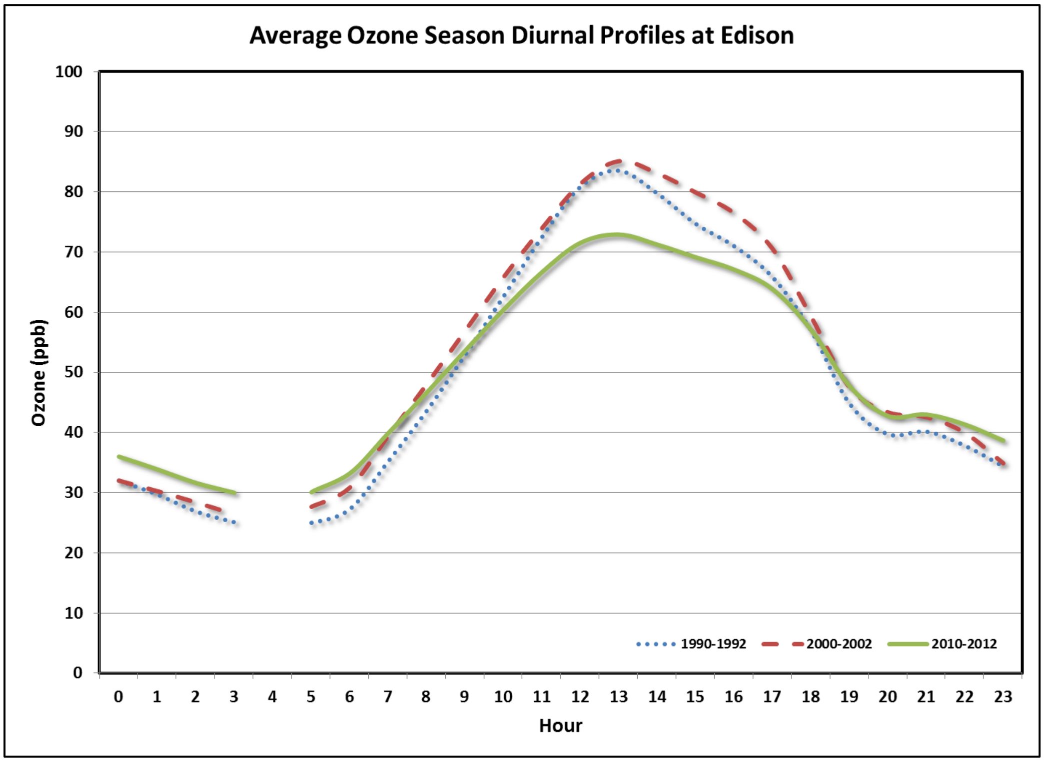
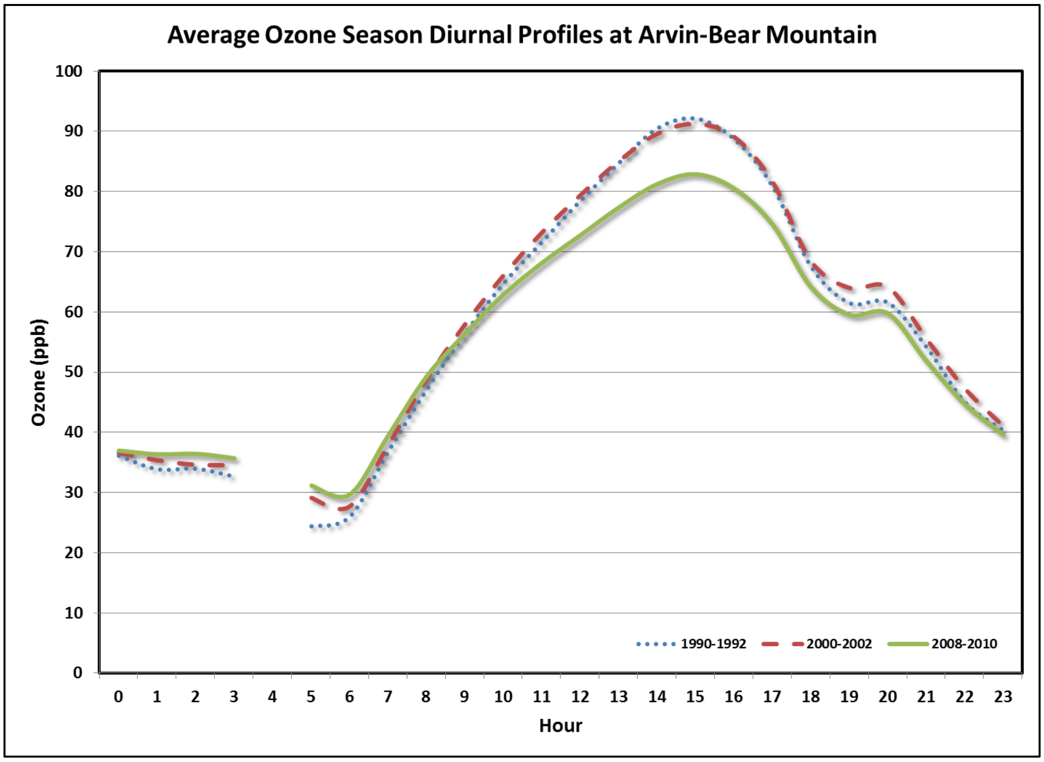


Figure A-48 Ozone Diurnal Profiles at Arvin-Bear Mountain



A.6 DESIGN VALUES

The fourth highest 1-hour ozone value for the three-year period – the “design value” – is indicative of how close an area is to attainment of the standard. Design value calculations follow EPA protocols for rounding, averaging conventions, data completeness, sampling frequency, data substitutions, and data validity. A 1-hour ozone design value at or greater than 0.125 ppm indicates nonattainment for that monitor (if the fourth highest value over the three-year period is an exceedance day, then there were more than the 3 allowed exceedance days over that three-year period). Because of this connection between design values and the exceedance-day-based attainment test, future year design values are modeled to determine when a region will reach attainment (see Chapter 2).

The generalized description of how the design value for 1-hour ozone is calculated is as follows:

- **Step 1:** Determine the daily maximum 1-hour value per day over a 3-year period of complete data.
- **Step 2:** Rank the values over the 3-year period and select the 4th highest value.
- **Step 3:** Round the resulting value to the nearest one hundredth.
- **Step 4:** Compare the result to the standard.

EPA provides detailed guidelines and standards for the calculation[8] and data handling methodologies. A design value between 0.121 and 0.124 ppm (inclusive) is considered meeting the standard since rounding these values to the closest one hundredth would both result in 0.12 ppm. Alternatively, a design value between 0.125 and 0.129 ppm (inclusive) would be rounded up to 0.13 ppm, a value above the standard of 0.12 ppm.

Table A-6 shows the trend of the 1-hour ozone design values for each ozone monitoring site in the Valley by year from 1990 through the year 2012. As a standard labeling convention, a 3-year time period used to calculate a design value is labeled as the end year, e.g. the year 2000 design value represents the 3-year timeframe of 1998-2000. The Valley basin maximum design value data in Table A-6 is also shown in Figure A-49.

Average ambient ozone concentrations vary by monitoring site within the Valley. In general, monitoring sites in the northern part of the Valley record the lowest ambient ozone concentrations, while monitoring sites in the central and southern portions of the Valley tend to record the highest ozone concentrations, namely the Fresno and Bakersfield areas. As can be observed in Table A-6, the majority of Valley ozone air monitoring site design values are currently below the 1-hour ozone standard of 0.12 ppm. The year 2012 design values show that presently the sites exceeding the standard are limited to the Clovis and Fresno-Drummond air monitoring.

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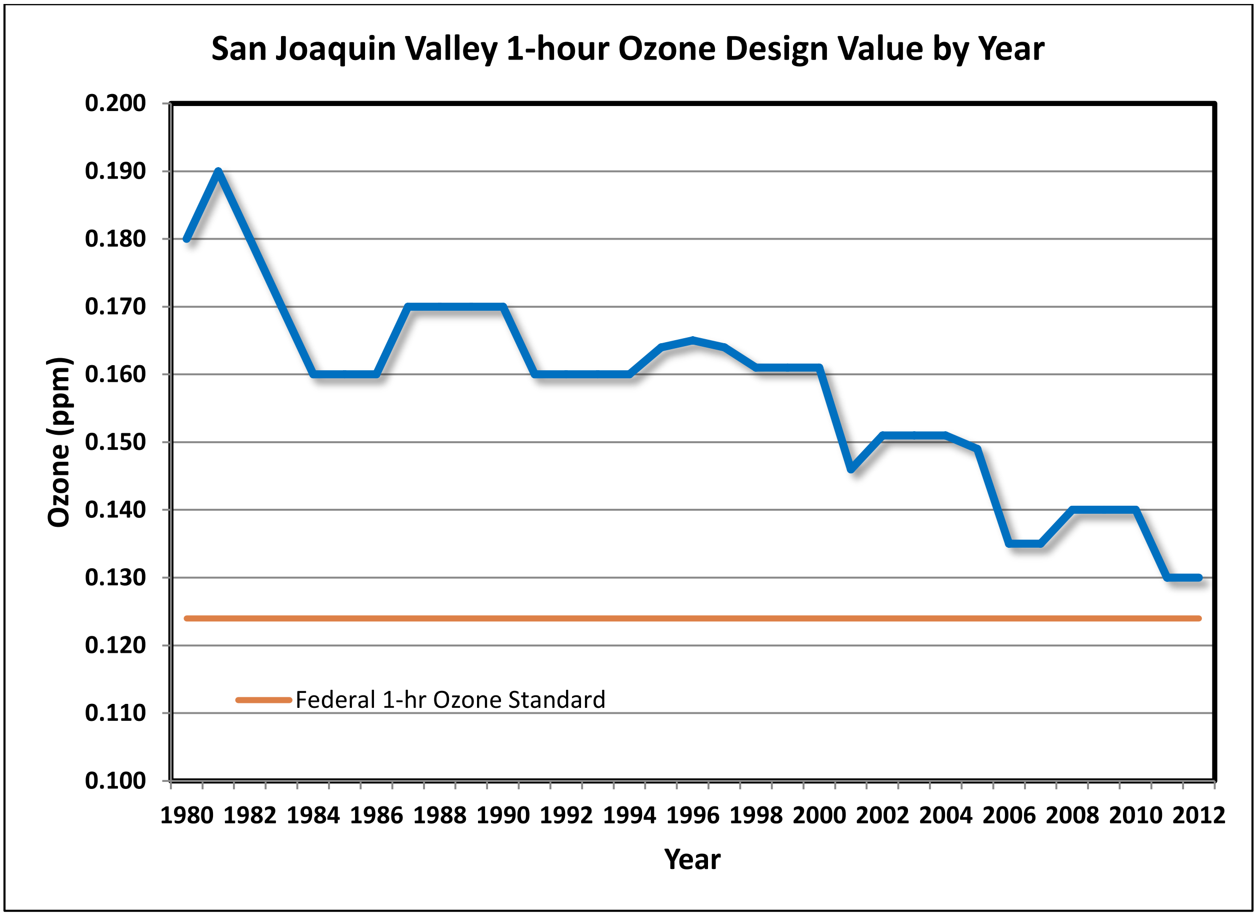
[8] Interpretation of the 1-hour Primary and Secondary National Ambient Air Quality Standards for Ozone, 40 C.F.R. Pt. 50 Appendix H (2013). Available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=a19eca235a0f73d286947df28da3381e&rgn=div9&view=text&node=40:2.0.1.1.1.0.1.19.9&idno=40

Table A-6 1-hour Ozone Design Values (ppm) by Site per Year from 1990-2012

Monitoring Site	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
San Joaquin County																							
Stockton-Hazelton Street	0.110	0.110	0.110	0.110	0.110	0.120	0.120	0.118	0.104	0.107	0.107	0.107	0.102	0.101	0.101	0.099	0.101	0.101	0.102	0.095	0.105	0.095	0.092
Tracy-Airport	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.120	0.118	0.118	0.104	0.108	0.099	0.106
Stanislaus County																							
Modesto-14th Street	0.120	0.110	0.110	0.110	0.114	0.123	0.125	0.125	0.131	0.131	0.131	0.109	0.109	0.109	0.106	0.107	0.109	0.109	0.113	0.106	0.106	0.093	0.092
Turlock-S Minaret Street	--	--	0.120	0.130	0.120	0.125	0.123	0.123	0.129	0.127	0.130	0.111	0.123	0.119	0.119	0.111	0.106	0.104	0.122	0.125	0.125	0.110	0.112
Merced County																							
Merced-S Coffee Avenue	--	--	0.130	0.130	0.120	0.125	0.125	0.125	0.131	0.132	0.132	0.120	0.121	0.122	0.122	0.118	0.106	0.102	0.125	0.118	0.118	0.108	0.108
Madera County																							
Madera-28261 Avenue 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.120	0.106	0.105
Madera-Pump Yard	--	--	--	--	--	--	--	0.085	0.123	0.118	0.117	0.104	0.115	0.119	0.119	0.103	0.097	0.095	0.105	0.105	0.110	0.104	0.097
Fresno County																							
Clovis-N Villa Avenue	0.130	0.130	0.150	0.140	0.144	0.144	0.146	0.146	0.161	0.161	0.161	0.142	0.137	0.136	0.131	0.126	0.126	0.125	0.140	0.140	0.140	0.130	0.130
Fresno-1st Street	0.150	0.160	0.160	0.160	0.140	0.140	0.140	0.140	0.146	0.146	0.146	0.135	0.135	0.135	0.135	0.131	0.130	0.130	0.133	0.127	0.127	0.124	--
Fresno-Garland	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.119
Fresno-Drummond Street	0.150	0.150	0.150	0.150	0.140	0.140	0.131	0.131	0.142	0.137	0.137	0.131	0.131	0.132	0.131	0.128	0.119	0.110	0.114	0.118	0.118	0.127	0.127
Fresno-Sierra Skypark	0.140	0.140	0.140	0.140	0.130	0.131	0.131	0.131	0.141	0.141	0.141	0.136	0.144	0.144	0.144	0.123	0.124	0.124	0.124	0.119	0.126	0.119	0.118
Parlier	0.150	0.150	0.150	0.150	0.150	0.140	0.144	0.144	0.151	0.145	0.152	0.146	0.151	0.151	0.151	0.135	0.121	0.121	0.122	0.121	0.122	0.121	0.122
Tranquillity	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.093	0.093	0.096
Kings County																							
Hanford-S Irwin Street	--	--	--	--	0.113	0.110	0.138	0.138	0.138	0.128	0.128	0.124	0.124	0.121	0.121	0.113	0.112	0.110	--	--	0.131	0.126	0.118
Corcoran-Patterson Avenue	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.132	0.132	--	--	--
Santa Rosa Rancheria	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.113	0.113	0.117	0.105	0.103
Tulare County																							
Porterville	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.109	0.104	0.104
Ash Mountain - SNP	--	--	--	--	--	--	--	--	--	0.127	0.127	0.125	0.124	0.126	0.126	0.126	0.117	0.119	0.132	0.132	0.130	0.113	0.112
Lower Kaweah - SNP	0.112	0.112	0.116	0.121	0.123	0.123	0.122	0.115	0.118	0.112	0.109	0.108	0.118	0.122	0.122	0.115	0.113	0.113	0.115	0.115	0.115	0.095	0.098
Visalia-N Church Street	0.140	0.140	0.130	0.140	0.150	0.150	0.140	0.132	0.139	0.127	0.129	0.126	0.126	0.124	0.124	0.117	0.115	0.112	0.121	0.121	0.122	0.115	0.111
Kern County																							
Arvin-Di Giorgio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.120	0.118	0.118
Arvin-Bear Mountain Blvd	0.170	0.160	0.160	0.160	0.150	0.147	0.156	0.156	0.156	0.137	0.141	0.134	0.142	0.150	0.151	0.149	0.134	0.131	0.135	0.135	0.139	--	--
Bakersfield-5558 California Avenue	--	--	--	--	0.123	0.128	0.128	0.126	0.124	0.119	0.119	0.116	0.117	0.116	0.113	0.112	0.117	0.117	0.120	0.117	0.114	0.111	0.104
Bakersfield-Golden State Avenue	--	--	--	--	0.122	0.123	0.126	0.124	0.124	0.118	0.118	0.115	0.116	0.116	0.115	0.109	0.105	0.108	0.110	--	--	--	--
Edison	0.160	0.150	0.150	0.160	0.160	0.164	0.165	0.164	0.158	0.154	0.154	0.138	0.141	0.134	0.134	0.127	0.135	0.135	0.136	0.135	0.134	0.124	0.118
Maricopa-Stanislaus Street	0.130	0.120	0.110	0.110	0.110	0.119	0.121	0.121	0.130	0.130	0.137	0.110	0.114	0.112	0.112	0.102	0.101	0.100	0.097	0.097	0.097	0.102	0.102
Oildale-3311 Manor Street	0.130	0.120	0.120	0.120	0.120	0.116	0.121	0.121	0.122	0.119	0.120	0.113	0.113	0.114	0.112	0.111	0.112	0.112	0.114	0.112	0.110	0.102	0.102
Shafter-Walker Street	0.120	0.120	0.110	0.110	0.110	0.110	0.118	0.112	0.115	0.111	0.111	0.109	0.109	0.112	0.112	0.111	0.104	0.105	0.106	0.106	0.106	0.102	0.102
Maximum	**0.170**	**0.160**	**0.160**	**0.160**	**0.160**	**0.164**	**0.165**	**0.164**	**0.161**	**0.161**	**0.161**	**0.146**	**0.151**	**0.151**	**0.151**	**0.149**	**0.135**	**0.135**	**0.140**	**0.140**	**0.140**	**0.130**	**0.130**

The Valley's maximum 1-hour ozone design values have decreased dramatically since the pollutant began to be widely monitored in the region. Figure A-49 below shows the change in the basin maximum design value from 1980 through 2012, during which maximum design values have decreased 27% (from 0.18 ppm in 1980 to 0.13 ppm in 2012). Since the Valley is close to attaining this standard, continuing this downward trend will be important to meet this federal air quality standard in the near future.

Figure A-49 Valley Maximum 1-hour Ozone Design Value Trend



A.7 TRENDS IN DAILY MAXIMUM OZONE CONCENTRATIONS

A.7.1 Daily Maximum AQI/ROAR levels

EPA and the District use the Air Quality Index (AQI) to provide daily information about the Valley's air quality, to inform the public about how unhealthy air may affect them, and to educate the public about how they can protect their health. AQI scales exist for all of the criteria pollutants regulated by the Clean Air Act, including 1-hour ozone. However, the official EPA AQI scale for 1-hour ozone does not define AQI below the federal standard, but only defines the scale above the standard for the categories of Unhealthy for Sensitive Groups (USG) and above (i.e. Good and Moderate categories are not defined). Therefore, the official scale is unable to provide the full spectrum of the change in the frequency of the days in each AQI category over time.

As an alternative, the adopted 1-hour ozone real-time outdoor activity risk (ROAR) levels used within the District's Real-Time Air Advisory Network (RAAN)[9] were used in this analysis in order to show the change in the entire AQI spectrum. Table A-7 defines the ROAR levels for 1-hour ozone as used in RAAN.

Table A-7 1-hour Ozone ROAR Levels Based on RAAN

Concentration (ppb)	ROAR Level	Color
0 - 59	Level 1: Good	Green
60 - 75	Level 2: Moderate	Yellow
76 - 95	Level 3: USG	Orange
96 - 115	Level 4: Unhealthy	Red
> 115	Level 5: Very Unhealthy	Purple

This analysis uses the Valley's basin maximum 1-hour ozone concentration for each day of each year. According to the scale defined in Table A-7, each year was separated into the five ROAR levels based on the frequency of each level occurrence. Figure A-50 shows the results of this analysis for each year from 1980 to 2012. The stacked bars represent the number of days within each year that fell within each of the ROAR levels (totaling 365 days). Within each stacked bar, the levels are ordered as Good (green), Moderate (yellow), etc. from the bottom to the top.

The frequency of Very Unhealthy days has decreased greatly since the early 1980s. As ozone concentrations have decreased over the years in the Valley, Very Unhealthy days have shifted down to Unhealthy days, Unhealthy days have shifted down to Unhealthy for Sensitive Groups days, and so forth. As this domino effect has continued down the ROAR level spectrum, the end result has been an increase in the number of Good days over the same time period. This downward shift in the frequency of the ROAR level categories provides further evidence of the improving ozone air quality in the Valley.

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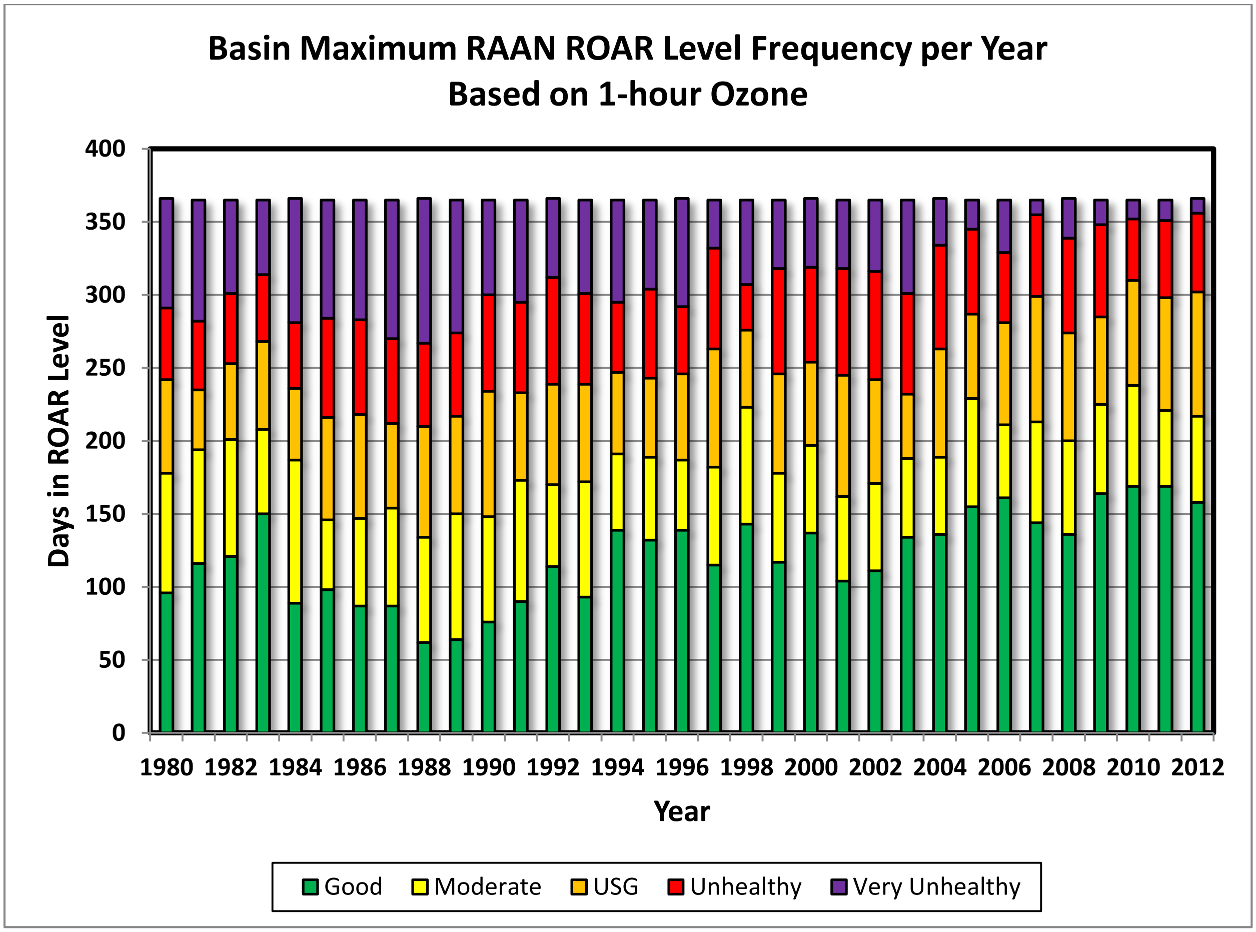
[9] http://www.valleyair.org/Programs/RAAN/raan_landing.htm

Figure A-50 Distribution of ROAR Levels from 1980 to 2012

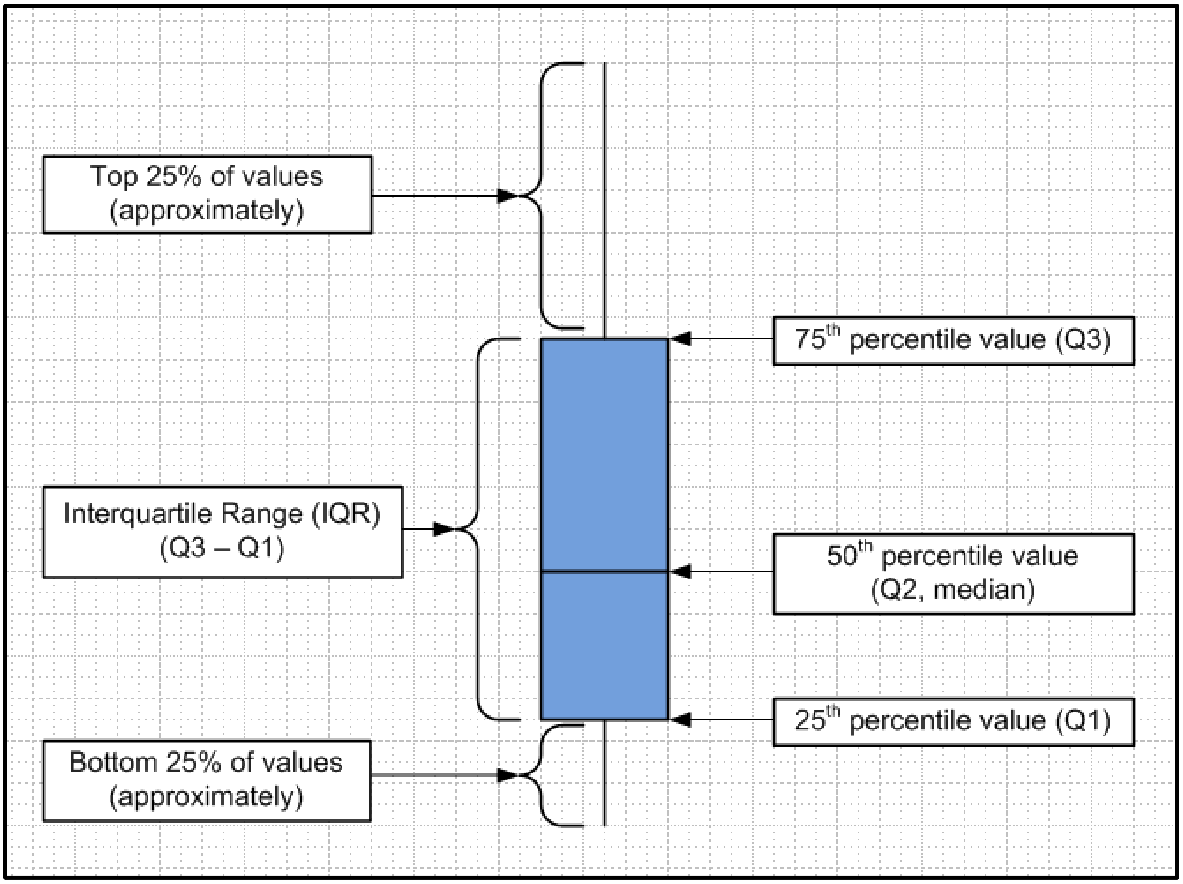


A.7.2 Box-and-Whisker Plots

The District analyzed the distribution of daily maximum ozone concentrations from year to year for potential changes in the range of recorded ozone concentrations over time. One tool for this analysis is box-and-whisker plots, which the District constructed for a number of Valley ozone air monitoring sites.

Figure A-51 illustrates the general use of the box-and-whisker plots as follows: the box-and-whisker diagram for each year is a representation of the 25th (Q1), 50th (Q2), and 75th (Q3) percentile values in the ozone concentration dataset. The “whiskers” extending from each end of the box represent the outer ends of the dataset (approximately the top and bottom 25% of the values), where any point outside of these boundaries is considered an outlier for this analysis method. The difference between Q3 and Q1 is called the interquartile range (IQR).

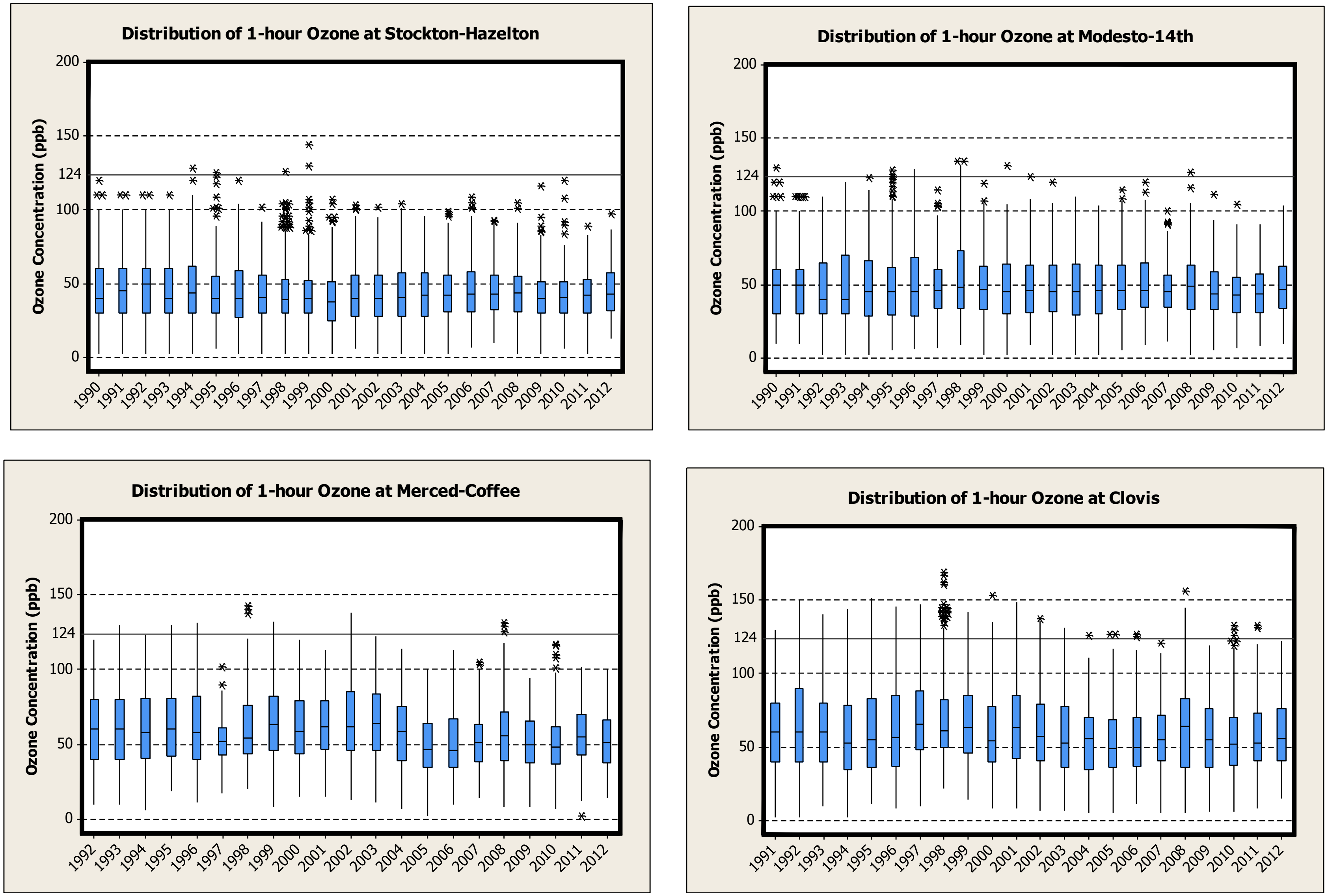
Figure A-51 Box-and-Whisker Plot Interpretation



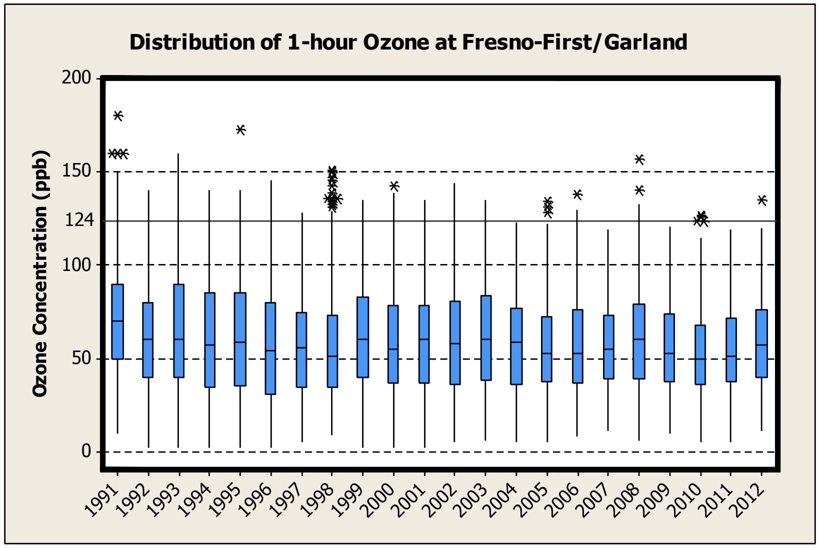
The box-and-whisker plots in the following Figures A-52 to A-63 show an analysis of the daily 1-hour ozone maximum concentrations that occurred at locations throughout the Valley from the 1990s through 2012. In general, the box-and-whisker plots displayed in the following figures show a declining IQR size, as well as gradually decreasing Q1 and Q3 values. The top 25% of values in each year have also been falling from the early 1990s to recent years. As can also be observed, both the frequency and value of outliers in the data distribution over the years have decreased over the displayed time period. Note that the figure for the Arvin-Bear Mountain ozone site has historically had minimal outliers. As a high ozone site in the Valley, this shows that the data is spread more evenly toward the higher values compared to other sites, meaning that high concentrations are much more frequent, thus reducing the number of data points meeting the outlier criteria.

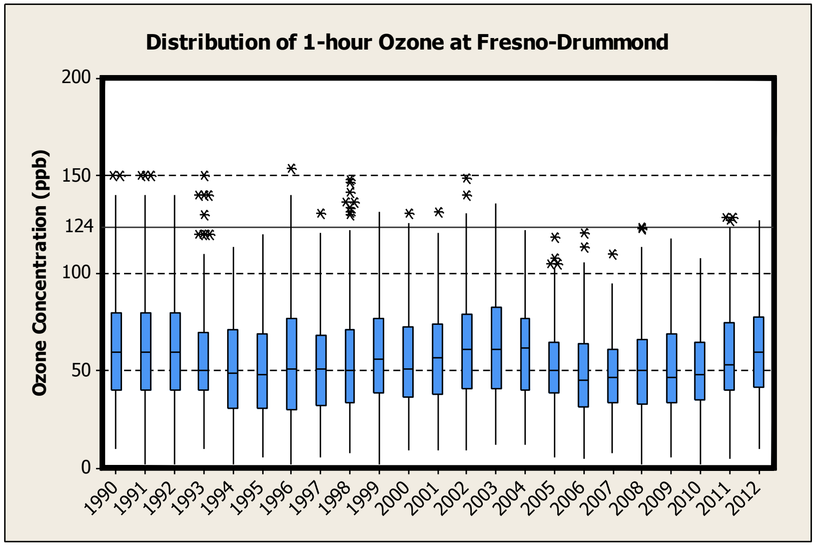
As a comparison, the northern ozone air monitoring sites tend to have smaller IQRs than the sites in the central and southern portions of the Valley. This shows that ozone in the northern part of the Valley tends to have a tighter dataset, where less variance occurs. Since the highest concentrations of ozone usually occur in the central and southern portions of the Valley, the IQR values for the sites in these regions are higher, showing greater variance.

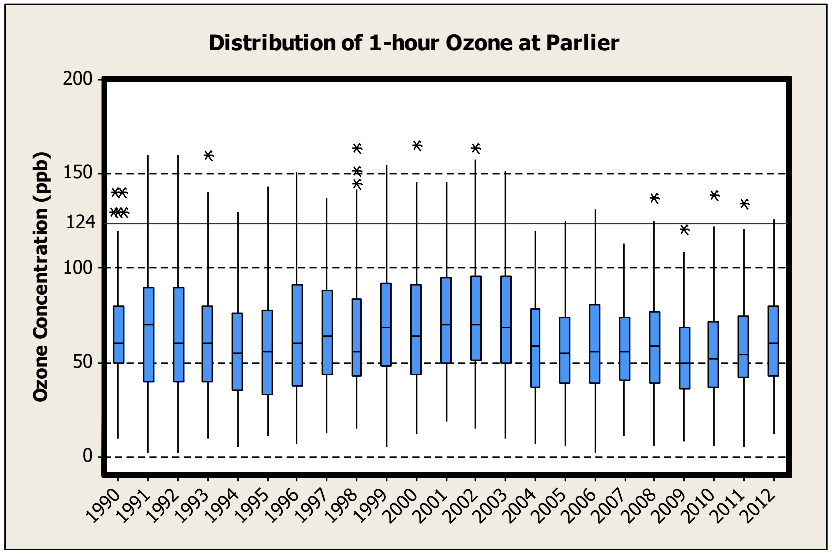
Figures A-52 to A-55 Ozone Distributions for Stockton-Hazelton, Modesto-14th, Merced-Coffee, Clovis

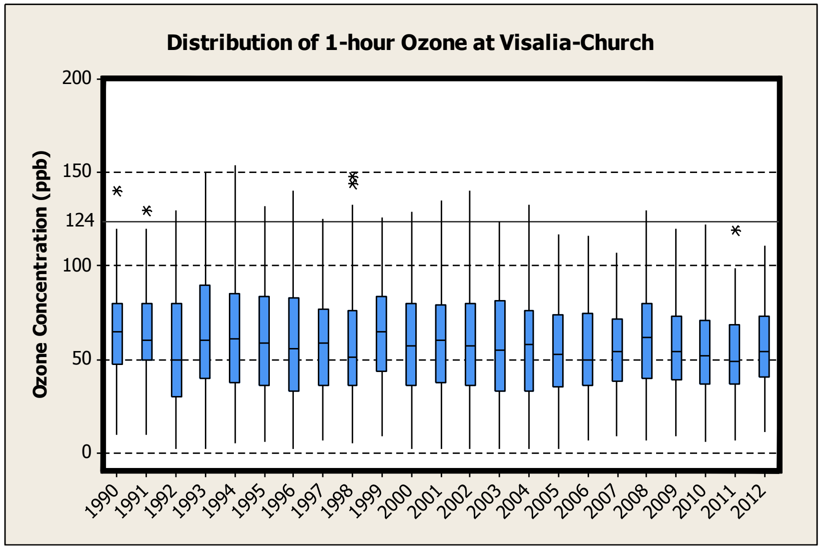


Figures A-56 to A-59 Ozone Distributions for Fresno-First/Garland, Fresno-Drummond, Parlier, Visalia-Church

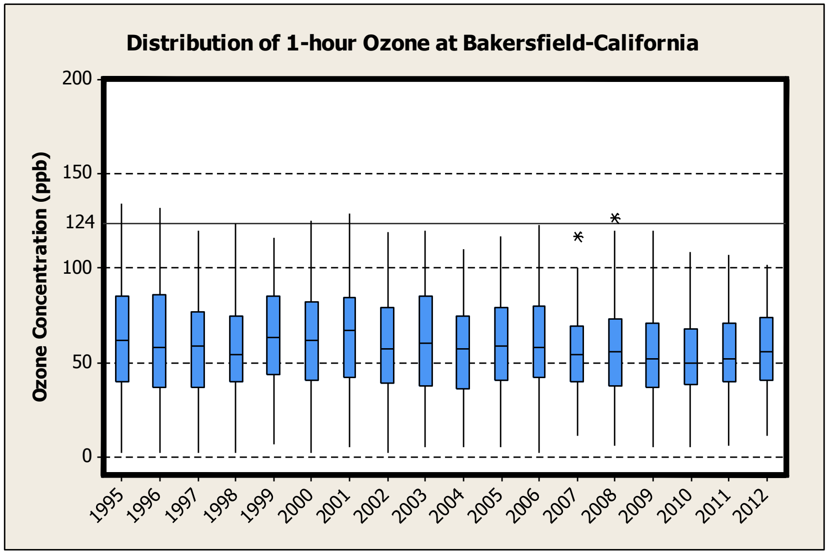


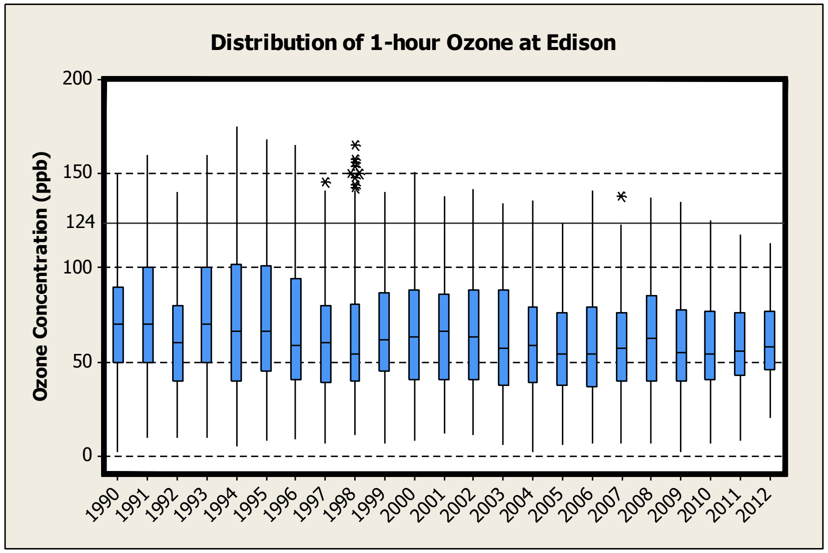


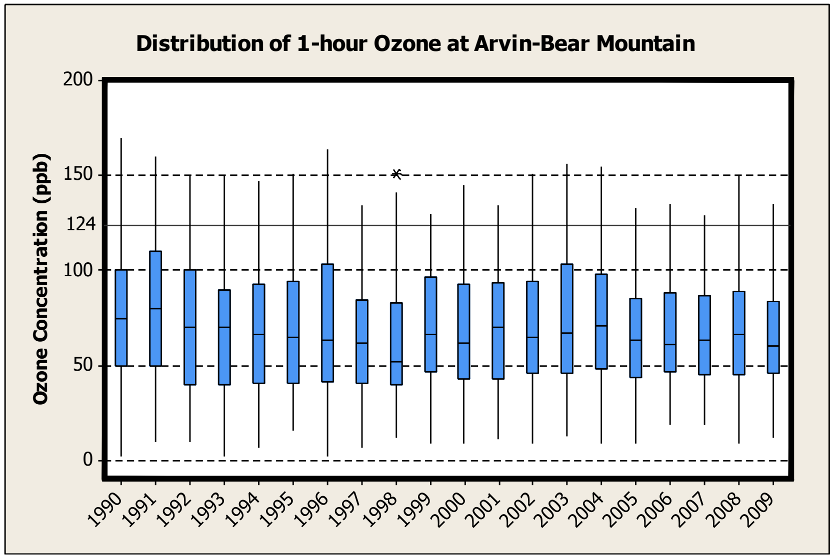


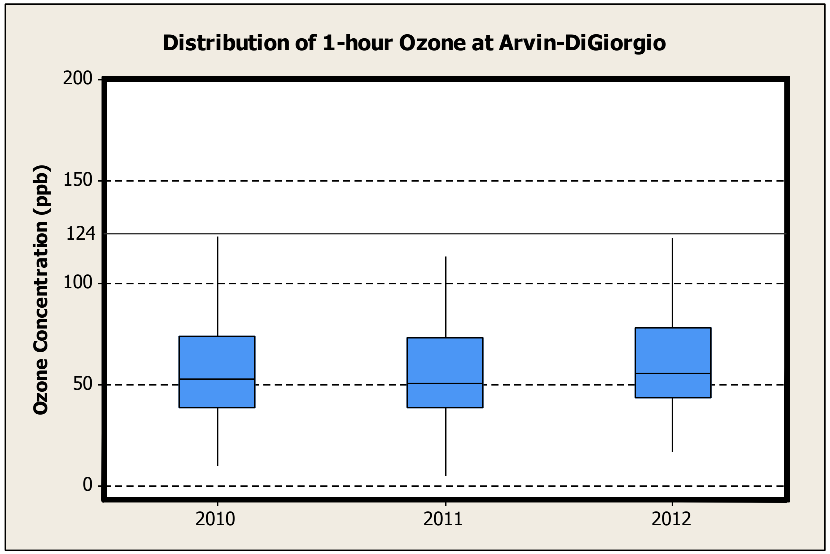


Figures A-60 to A-63 Ozone Distributions for Bakersfield-California, Edison, Arvin-Bear Mountain, Arvin-DiGiorgio









A.7.3 Meteorologically Adjusted Trends

Analysis to this point in the appendix has relied on direct observations of ozone. However, since ozone concentrations are highly dependent on weather conditions, long-term weather patterns such as cooler or windier-than-average summers make interpretation of ozone trends challenging. Variable weather parameters, such as temperature, wind, ultraviolet radiation, and vertical stability, result in years with greater or lesser potential to produce ozone than an “average” ozone season. District analysis indicates that long-term fluctuations in weather patterns create significant variability in ozone concentrations from year to year. Considering the effect of meteorology on ozone concentrations helps to determine to what extent changes in ozone concentrations are due to effective control strategies, and to what extent changes may be due to meteorological fluctuations.

During the past two decades, daily maximum 1-hour average meteorologically-adjusted ozone concentrations have steadily decreased, indicating that the observed long-term ozone improvement trend is most likely attributable to emission reductions and not weather variations. Further analysis indicates that the overall weather-adjusted ozone trend decreases faster than the overall unadjusted trend for all sites except Ash Mountain. This finding indicates that ozone trend analysis completed throughout this report is valid and potentially conservative for nearly all sites. The remainder of this section describes the process and results in further detail.

EPA developed a statistical method to account for annual weather-related variability of ozone concentrations[10]. This method compares observed daily maximum 1-hour average ozone concentrations averaged over the ozone season to estimated daily maximum 1-hour average ozone concentrations averaged over the ozone season with the influence of weather removed. Since this method uses seasonal average daily maximum concentrations, results cannot be directly compared to ambient air quality standards, which are generally based on daily maximum 1-hour concentrations. However, the method is an excellent choice for evaluating the overall influence of weather on the entire ozone season. With weather removed, the ozone trend can be used to evaluate changes in precursor emissions attributable to control measures.

To assess the underlying trends in ozone, the District first selected meteorological parameters most influential over Valley ozone concentrations. These selected parameters (temperature, relative humidity, wind speed, vertical stability and solar radiation) were used to develop quantitative relationships between ozone and meteorology for monitoring sites in the Valley. Results from these quantitative relationships were used to develop seasonal average ozone concentrations anticipated under typical weather conditions.

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[10] Camalier, L., Cox, W., Dolwick, P. (2007) *The Effects of Meteorology on Ozone in Urban Areas and Their Use in Assessing Ozone Trends*. Atmospheric Environment 41: 7127-7137.

Figures A-64 through A-68 show the seasonal average daily maximum 1-hour ozone concentrations for the summer months of May through September from 1990 through 2012, although not all sites had observations for the entire period. Observed seasonal average concentrations are represented by open circles connected by dashed lines. Meteorologically adjusted seasonal averages are represented by solid circles connected by solid black lines. The heavy dashed red line and the heavy solid red line show the linear trend in seasonal average concentrations and weather-adjusted concentrations, respectively.

When an unadjusted value (open circle) is greater than the meteorologically adjusted value (solid circle), the seasonally averaged observed concentration was higher due to weather. When an unadjusted value (open circle) is less than the meteorologically adjusted value (solid circle), the seasonally averaged observed concentration was lower due to weather. When the adjusted value closely approximates the unadjusted value, the summer was near the statistical average. The meteorologically adjusted concentrations (solid black line with solid circles) and the associated trend line (heavy solid red line) represent the change in concentrations attributable to precursor emissions.

Figures A-64 through A-68 indicate that, meteorologically speaking, the summer of 2007 was near the statistical average for most sites, since observations are closely approximated by adjustments for weather. In addition, the significant increase in observed ozone concentrations (dashed black line with open circles) from 1998 to 2003, was largely due to the influence of weather, as is evident from the generally flat trend in ozone concentrations adjusted for weather (solid black line with solid circles) at most sites.

The influence on the 2008 northern California wildfires is strongly evident at Northern and Central Valley sites (Figure A-64 through A-66) where concentrations were observed to be much greater than anticipated based on the seasons meteorological conditions. Most Southern Valley sites (Figures A-67 and A-68) also show influence from the fires, but to a lesser degree.

After being adjusted for weather, all sites evaluated (Figures A-64 through A-68) show a decreasing trend in 1-hour ozone concentrations from 1990 to 2012. Since this trend is decreasing, rather than flat or increasing, it indicates that emissions reductions, not weather, were responsible for observed ozone reductions. In addition, the overall meteorologically adjusted ozone trend decreases faster than the overall unadjusted trend for all sites except Ash Mountain. This finding indicates that ozone trend analysis completed throughout this report is valid and potentially conservative.

Figure A-64 Meteorologically Adjusted Ozone Trends in the Northern San Joaquin Valley

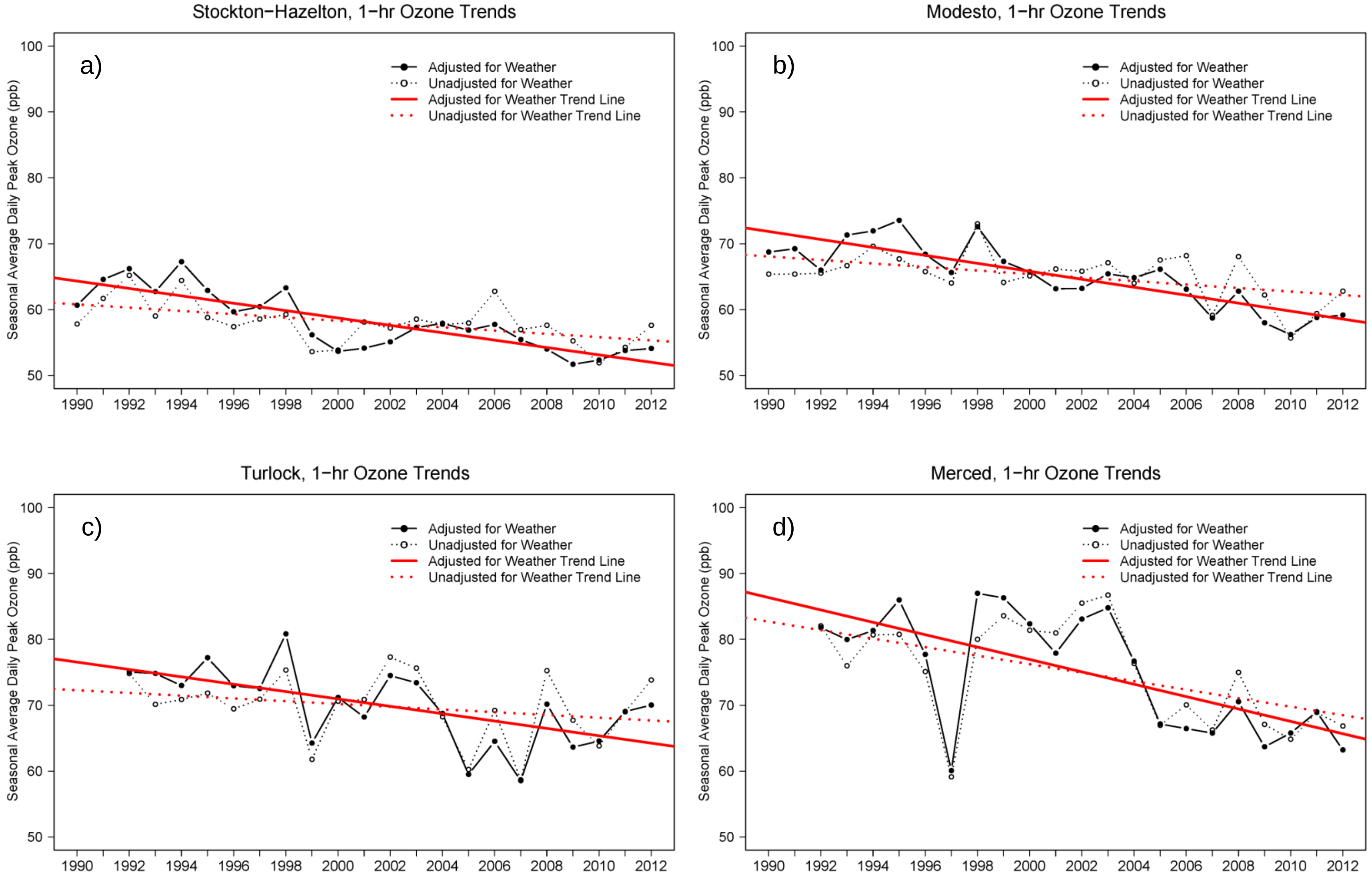


Figure A-65 Meteorologically Adjusted Ozone Trends in the Central San Joaquin Valley

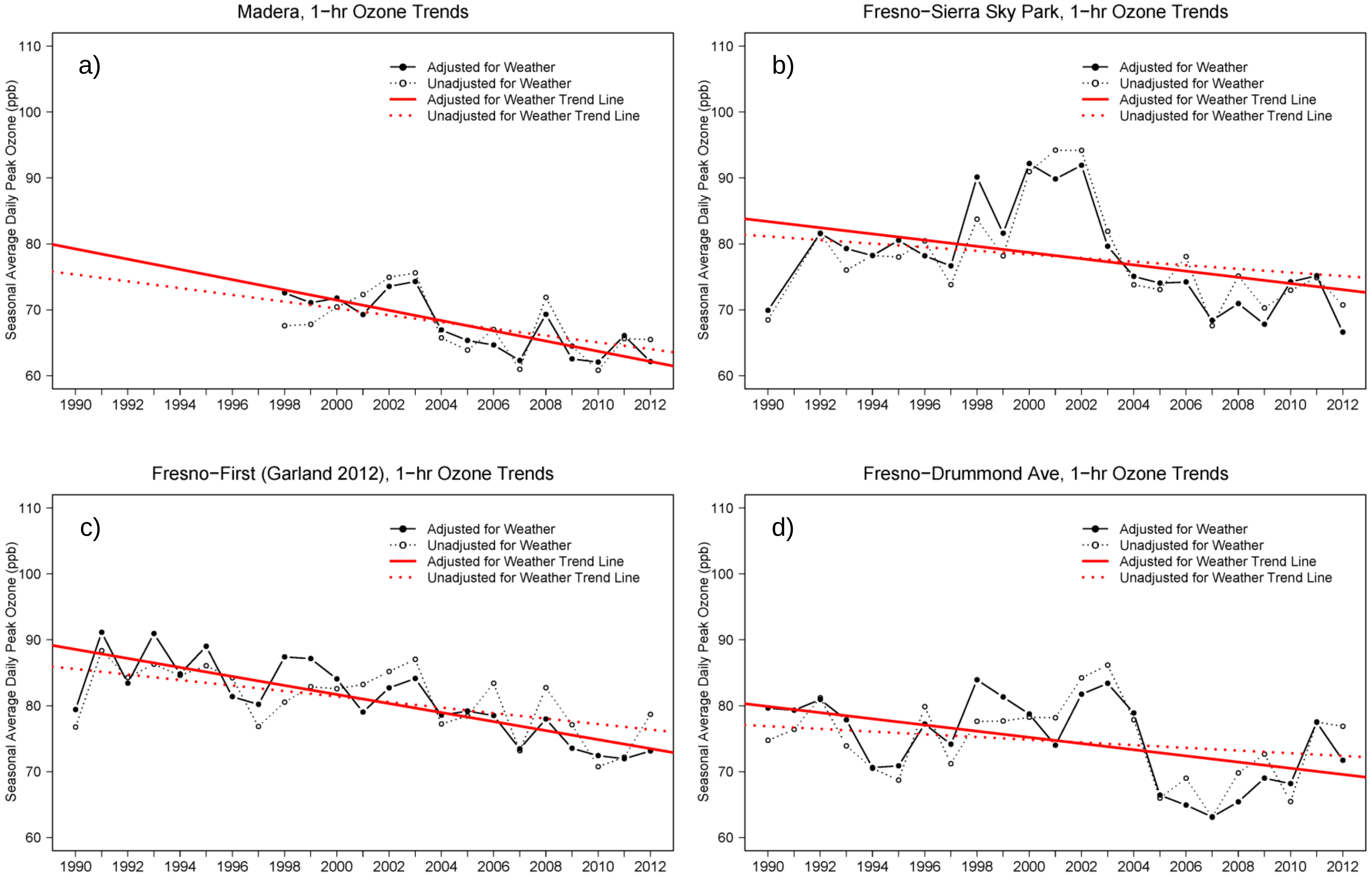


Figure A-66 Meteorologically Adjusted Ozone Trends in the Central San Joaquin Valley

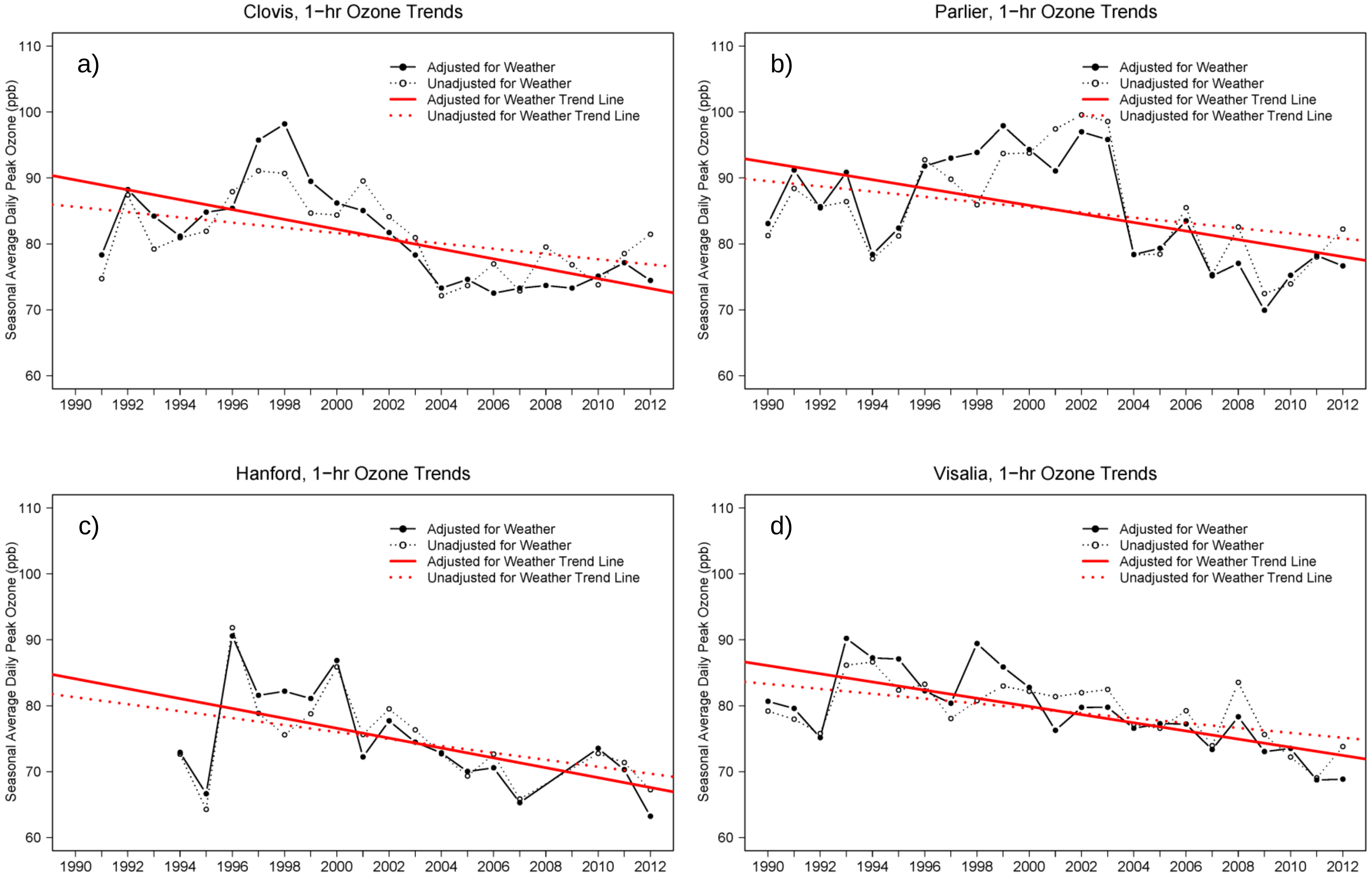


Figure A-67 Meteorologically Adjusted Ozone Trends in the Southern San Joaquin Valley

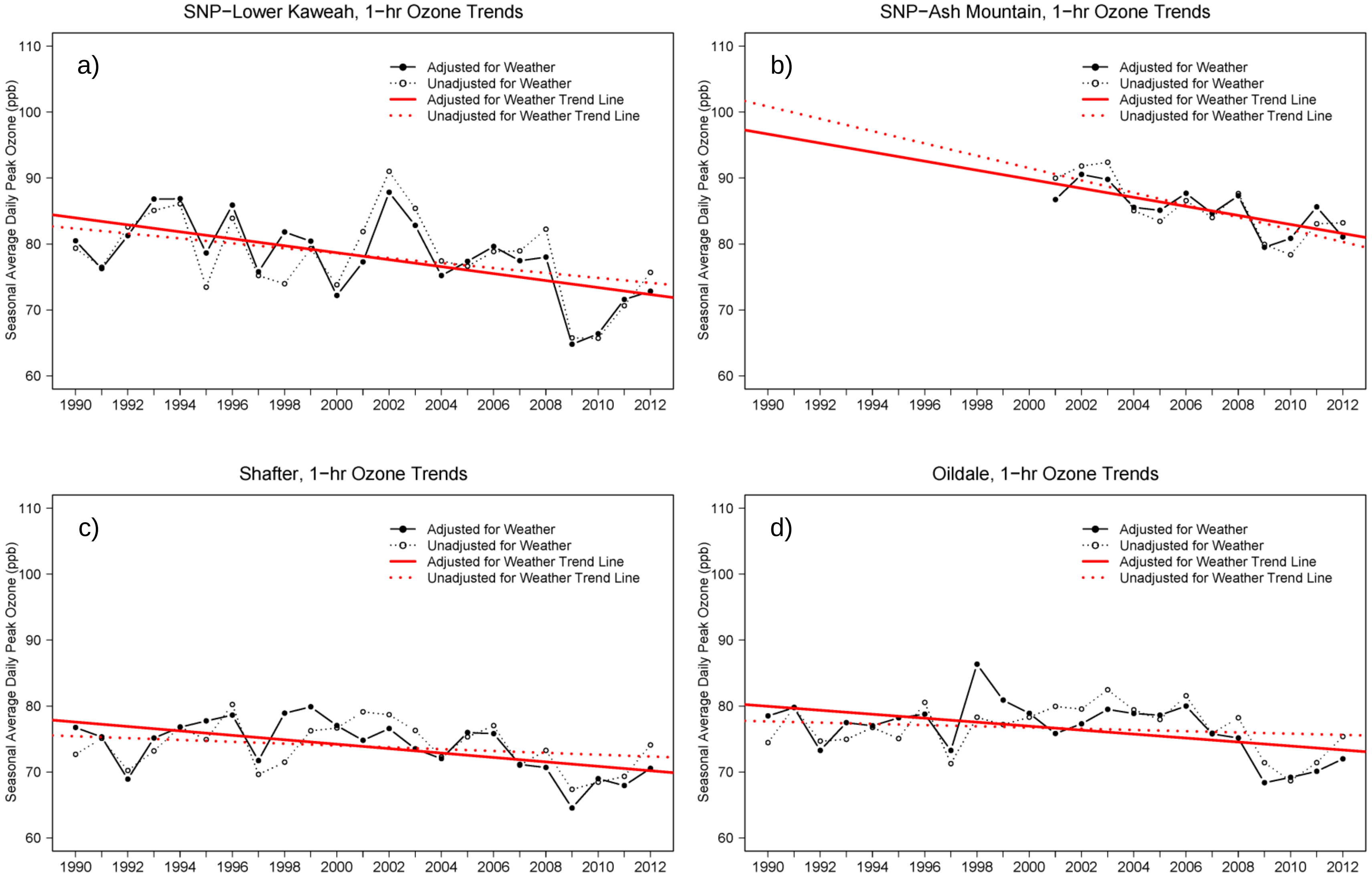
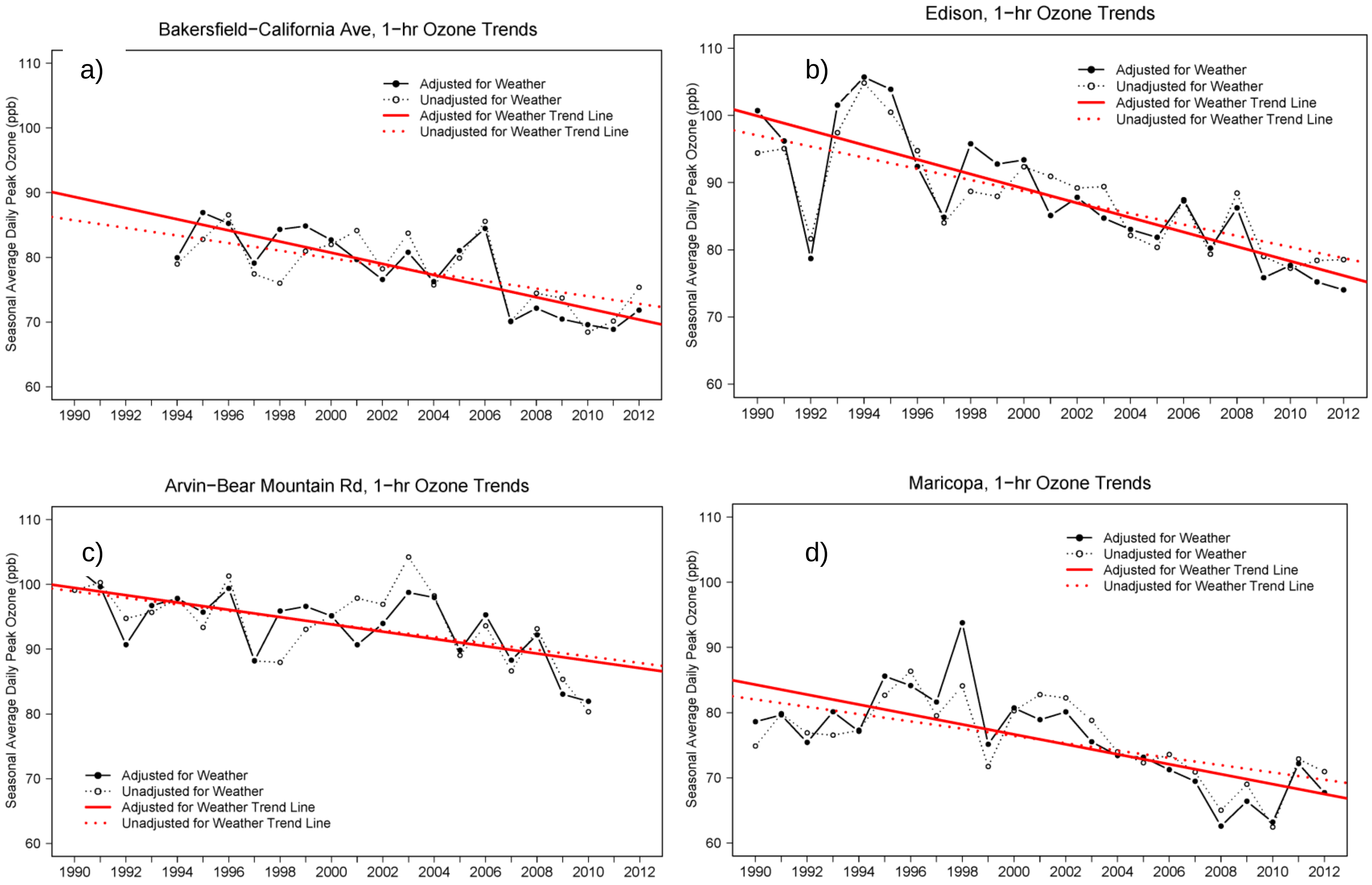


Figure A-68 Meteorologically Adjusted Ozone Trends in the Southern San Joaquin Valley



Appendix B

Emission Inventory

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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APPENDIX B: EMISSIONS INVENTORY

An emissions inventory is a critical air pollution evaluation tool. In simple terms, an emissions inventory is a systematic listing of air pollution sources along with the amount of pollution emitted from each source or category over a given time period. Emissions inventories represent estimates of the air pollution emissions from given sources; they are not measurements of ambient concentrations. Emissions inventory data are used as primary input for air quality modeling, are used for developing control strategies, and provide a means to track progress in meeting emissions reduction commitments. More specifically, the inventories in this appendix were used to evaluate and propose control measures, to track emissions for Rate of Progress (ROP), to track Emissions Reduction Credits (ERCs), to establish motor vehicle conformity budgets for transportation planning, and to assist in demonstrating attainment of the NAAQS.

Pollution sources are grouped by major industry sectors. The following are examples of pollution sources by key sectors:

- Industrial or stationary point sources—power plants and oil refineries;
- Area-wide sources—consumer products and residential fuel combustion;
- On-road sources—passenger vehicles and heavy-duty trucks;
- Off-road mobile sources—aircraft, trains, ships, recreational boats, construction equipment, and farm equipment; and
- Non-anthropogenic (natural) sources—biogenic (or vegetation), geogenic (petroleum seeps), and wildfires.

Tables B-1 and B-2 reflect anthropogenic emissions (i.e., emissions generated by human activity). Only anthropogenic emissions are subject to regulatory requirements. However, biogenic volatile organic compounds emissions (BVOC) from vegetation are evaluated and estimated for photochemical modeling. Total volatile organic compound (VOC) emissions from biogenic sources can overwhelm anthropogenic VOC emissions, particularly during the Valley's ozone season (Table B-3). Appendix E, California Air Resources Board (ARB) Photochemical Modeling Protocol, contains a more thorough discussion of BVOCs.

The U.S. Environmental Protection Agency (EPA) establishes requirements pertaining to emissions information that must be included as part of the SIP submittal package. Plans for 1-hour ozone are to include emissions inventories for oxides of nitrogen (NOx) and VOCs.

As discussed in Appendix A and throughout the *2013 Plan for the Revoked 1-Hour Ozone Standard*, the Valley's attainment challenges under the national 1-hour ozone standard occur in the summer months. For this reason, this plan focuses on summer (May through October) average daily emissions inventories, with emissions presented as tons per day (tpd).

Emissions inventories are usually developed at various geographical resolutions encompassing district, air basin, and county levels. The inventories presented in this appendix are the total emissions for the San Joaquin Valley Air Basin.

This appendix includes emissions for the San Joaquin Valley Air Basin for the years 2007 and 2013 through 2022. The base year (the year from which the inventory is projected forward and backward) for these inventories is 2007. The year 2013 has been included as a reference point for the current year. Years 2014 through 2022 have been included, as 2022 is the latest possible attainment deadline for the federal 1-hour ozone standard.

The tables in this appendix include:

- Table B-1 NOx Emissions (Summer Daily Averages in Tons per Day)
- Table B-2 VOC Emissions (Summer Daily Averages in Tons per Day)
- Table B-3 Valley-Wide Biogenic Emissions for 2007 in Tons per Day

These tables are followed by an overview of emissions inventory calculations and revisions.

B.1 Emissions Inventory Tables

Table B-1 NOx Emissions (Summer Daily Averages in Tons per Day)

NOx (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
STATIONARY SOURCES											
FUEL COMBUSTION											
ELECTRIC UTILITIES	7.1	5.5	5.2	5.2	5.4	5.5	5.6	5.6	5.6	5.6	5.7
COGENERATION	3.0	1.6	1.7	1.8	1.8	1.9	2.0	2.0	2.1	2.1	2.1
OIL AND GAS PRODUCTION (COMBUSTION)	3.5	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3
PETROLEUM REFINING (COMBUSTION)	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MANUFACTURING AND INDUSTRIAL	5.1	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
FOOD AND AGRICULTURAL PROCESSING	25.1	14.5	14.1	9.9	7.2	6.7	6.4	6.1	5.9	5.6	5.3
SERVICE AND COMMERCIAL	3.2	3.0	2.9	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.8
OTHER (FUEL COMBUSTION)	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
*** TOTAL FUEL COMBUSTION**	**48.4**	**32.4**	**31.6**	**27.1**	**24.7**	**24.2**	**24.0**	**23.8**	**23.4**	**23.2**	**22.8**
WASTE DISPOSAL											
SEWAGE TREATMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LANDFILLS	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
INCINERATORS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SOIL REMEDIATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (WASTE DISPOSAL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL WASTE DISPOSAL**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**
CLEANING AND SURFACE COATINGS											
LAUNDERING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEGREASING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COATINGS AND RELATED PROCESS SOLVENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADHESIVES AND SEALANTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (CLEANING AND SURFACE COATINGS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL CLEANING AND SURFACE COATINGS**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
PETROLEUM PRODUCTION AND MARKETING											
OIL AND GAS PRODUCTION	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
PETROLEUM REFINING	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PETROLEUM MARKETING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NOx (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
*** TOTAL PETROLEUM PRODUCTION AND MARKETING**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**	**0.2**	**0.2**
INDUSTRIAL PROCESSES											
CHEMICAL	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
FOOD AND AGRICULTURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MINERAL PROCESSES	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
METAL PROCESSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD AND PAPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GLASS AND RELATED PRODUCTS	7.8	6.3	4.0	4.1	4.2	4.3	4.3	4.4	4.4	4.6	4.7
ELECTRONICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (INDUSTRIAL PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL INDUSTRIAL PROCESSES**	**8.5**	**6.9**	**4.7**	**4.8**	**4.9**	**5.0**	**5.0**	**5.1**	**5.1**	**5.3**	**5.5**
**** TOTAL STATIONARY SOURCES**	**57.4**	**39.8**	**36.8**	**32.4**	**30.1**	**29.8**	**29.6**	**29.4**	**29.1**	**29.1**	**28.9**
AREA-WIDE SOURCES											
SOLVENT EVAPORATION											
CONSUMER PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PESTICIDES/FERTILIZERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASPHALT PAVING / ROOFING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL SOLVENT EVAPORATION**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
MISCELLANEOUS PROCESSES											
RESIDENTIAL FUEL COMBUSTION	3.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
FARMING OPERATIONS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CONSTRUCTION AND DEMOLITION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNPAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FUGITIVE WINDBLOWN DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIRES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MANAGED BURNING AND DISPOSAL	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
COOKING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (MISCELLANEOUS PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL MISCELLANEOUS PROCESSES**	**11.1**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**10.9**
**** TOTAL AREA-WIDE SOURCES**	**11.1**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**11.0**	**10.9**
MOBILE SOURCES											
ON-ROAD MOTOR VEHICLES											
LIGHT DUTY PASSENGER (LDA)	15.8	8.4	7.2	6.4	5.8	5.2	4.7	4.4	4.1	3.8	3.6
LIGHT DUTY TRUCKS - 1 (LDT1)	5.2	2.9	2.6	2.4	2.3	2.1	1.9	1.8	1.7	1.6	1.5
LIGHT DUTY TRUCKS - 2 (LDT2)	10.9	6.2	5.3	4.7	4.2	3.7	3.3	3.0	2.8	2.6	2.4
MEDIUM DUTY TRUCKS (MDV)	14.2	10.4	9.6	9.0	8.4	7.8	7.3	6.9	6.5	6.0	5.6

NOx (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	4.4	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	1.0	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3
HEAVY HEAVY DUTY GAS TRUCKS (HHDV)	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	14.3	10.6	9.8	9.2	8.7	8.1	7.6	7.2	6.7	6.3	5.9
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	3.5	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.5	1.4
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	18.5	11.7	11.1	9.9	9.1	8.3	7.6	6.9	5.5	3.9	3.4
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	177.1	93.6	85.8	76.2	68.3	62.9	58.6	55.5	49.9	43.7	39.8
MOTORCYCLES (MCY)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0
HEAVY DUTY DIESEL URBAN BUSES (UB)	2.0	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7
HEAVY DUTY GAS URBAN BUSES (UB)	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
SCHOOL BUSES (SB)	1.4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.8
OTHER BUSES (OB)	2.1	1.4	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.5	0.4
MOTOR HOMES (MH)	0.8	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4
*** TOTAL ON-ROAD MOTOR VEHICLES**	**272.9**	**157.6**	**144.6**	**130.6**	**118.8**	**109.8**	**102.5**	**96.7**	**87.9**	**78.2**	**72.1**
OTHER MOBILE SOURCES											
AIRCRAFT	2.6	2.7	2.7	2.7	2.7	2.7	2.7	5.0	5.0	5.0	5.1
TRAINS	21.7	16.6	17.0	17.1	17.0	16.9	16.7	16.5	16.3	16.1	15.8
SHIPS AND COMMERCIAL BOATS	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
RECREATIONAL BOATS	2.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
OFF-ROAD RECREATIONAL VEHICLES	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
OFF-ROAD EQUIPMENT	40.3	26.7	26.0	25.5	24.6	23.8	22.4	21.4	20.8	20.1	18.9
FARM EQUIPMENT	75.1	58.2	56.0	53.8	51.8	49.9	48.2	46.4	43.7	41.0	38.5
FUEL STORAGE AND HANDLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL OTHER MOBILE SOURCES**	143.5	107.6	104.9	102.3	99.4	96.6	93.1	92.4	88.9	85.3	81.4
**** TOTAL MOBILE SOURCES**	416.4	265.2	249.5	232.9	218.2	206.4	195.6	189.2	176.8	163.5	153.5
GRAND TOTAL FOR SAN JOAQUIN VALLEY	484.9	316.0	297.2	276.3	259.2	247.1	236.1	229.5	217.0	203.5	193.3

Table B-2 VOC Emissions (Summer Daily Averages in Tons per Day)

VOC (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
STATIONARY SOURCES											
FUEL COMBUSTION											
ELECTRIC UTILITIES	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
COGENERATION	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
OIL AND GAS PRODUCTION (COMBUSTION)	1.5	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0
PETROLEUM REFINING (COMBUSTION)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MANUFACTURING AND INDUSTRIAL	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
FOOD AND AGRICULTURAL PROCESSING	2.2	1.2	1.2	1.0	0.8	0.8	0.7	0.7	0.7	0.7	0.6
SERVICE AND COMMERCIAL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
OTHER (FUEL COMBUSTION)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
*** TOTAL FUEL COMBUSTION**	**5.1**	**3.9**	**3.8**	**3.6**	**3.3**	**3.3**	**3.2**	**3.2**	**3.1**	**3.1**	**3.0**
WASTE DISPOSAL											
SEWAGE TREATMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LANDFILLS	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6
INCINERATORS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOIL REMEDIATION	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
OTHER (WASTE DISPOSAL)	23.1	19.7	20.1	20.5	20.9	20.6	21.0	21.4	21.8	22.2	22.6
*** TOTAL WASTE DISPOSAL**	**24.6**	**21.4**	**21.8**	**22.3**	**22.7**	**22.3**	**22.8**	**23.2**	**23.6**	**24.0**	**24.5**
CLEANING AND SURFACE COATINGS											
LAUNDERING	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DEGREASING	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
COATINGS AND RELATED PROCESS SOLVENTS	7.3	8.0	8.2	8.4	8.5	8.7	8.9	9.1	9.1	9.3	9.4
PRINTING	4.4	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.7	5.8
ADHESIVES AND SEALANTS	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
OTHER (CLEANING AND SURFACE COATINGS)	3.6	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2
*** TOTAL CLEANING AND SURFACE COATINGS**	**17.6**	**19.6**	**20.0**	**20.3**	**20.7**	**21.0**	**21.4**	**21.8**	**22.1**	**22.4**	**22.7**
PETROLEUM PRODUCTION AND MARKETING											
OIL AND GAS PRODUCTION	28.5	24.6	24.1	23.5	23.0	22.5	22.0	21.5	21.1	20.6	20.2
PETROLEUM REFINING	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
PETROLEUM MARKETING	6.7	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL PETROLEUM PRODUCTION AND MARKETING**	**36.3**	**33.2**	**32.7**	**32.4**	**32.0**	**31.6**	**31.3**	**31.0**	**30.6**	**30.3**	**30.0**
INDUSTRIAL PROCESSES											

VOC (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
CHEMICAL	3.6	2.9	2.9	2.9	3.0	3.0	3.0	3.1	3.2	3.3	3.3
FOOD AND AGRICULTURE	12.4	13.9	14.2	14.4	14.7	14.9	15.2	15.5	15.7	16.0	16.2
MINERAL PROCESSES	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
METAL PROCESSES	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
WOOD AND PAPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GLASS AND RELATED PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ELECTRONICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (INDUSTRIAL PROCESSES)	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
*** TOTAL INDUSTRIAL PROCESSES**	**16.9**	**17.6**	**18.0**	**18.3**	**18.6**	**18.9**	**19.2**	**19.6**	**20.0**	**20.3**	**20.6**
**** TOTAL STATIONARY SOURCES**	**100.4**	**95.7**	**96.3**	**96.8**	**97.3**	**97.2**	**98.0**	**98.7**	**99.4**	**100.1**	**100.9**
AREA-WIDE SOURCES											
SOLVENT EVAPORATION											
CONSUMER PRODUCTS	22.8	20.3	20.6	20.8	21.2	21.5	21.9	22.2	22.5	22.9	23.3
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	13.2	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.9	11.1	11.2
PESTICIDES/FERTILIZERS	17.3	17.0	16.9	16.8	16.7	16.6	16.6	16.5	16.4	16.3	16.2
ASPHALT PAVING / ROOFING	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
*** TOTAL SOLVENT EVAPORATION**	**54.1**	**48.4**	**48.7**	**48.9**	**49.3**	**49.7**	**50.0**	**50.4**	**50.7**	**51.1**	**51.5**
MISCELLANEOUS PROCESSES											
RESIDENTIAL FUEL COMBUSTION	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
FARMING OPERATIONS	148.6	119.7	121.2	122.5	123.9	125.3	126.7	128.1	129.5	130.9	132.3
CONSTRUCTION AND DEMOLITION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNPAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FUGITIVE WINDBLOWN DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIRES	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MANAGED BURNING AND DISPOSAL	16.7	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
COOKING	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7
OTHER (MISCELLANEOUS PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** TOTAL MISCELLANEOUS PROCESSES**	**166.7**	**137.7**	**139.1**	**140.5**	**141.9**	**143.3**	**144.7**	**146.1**	**147.5**	**148.9**	**150.3**
**** TOTAL AREA-WIDE SOURCES**	**220.9**	**186.1**	**187.8**	**189.4**	**191.2**	**193.0**	**194.7**	**196.5**	**198.3**	**200.1**	**201.9**
MOBILE SOURCES											
ON-ROAD MOTOR VEHICLES											
LIGHT DUTY PASSENGER (LDA)	23.0	13.3	10.2	9.0	7.9	7.0	6.2	5.6	5.2	4.8	4.5
LIGHT DUTY TRUCKS - 1 (LDT1)	7.6	5.1	4.1	3.8	3.5	3.2	3.0	2.8	2.7	2.6	2.5
LIGHT DUTY TRUCKS - 2 (LDT2)	9.5	6.8	5.4	4.9	4.4	4.0	3.7	3.4	3.3	3.1	3.0
MEDIUM DUTY TRUCKS (MDV)	8.8	8.6	7.5	7.3	7.1	6.9	6.7	6.5	6.4	6.3	6.1
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	3.5	2.9	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8

VOC (tpd)											
SUMMARY CATEGORY NAME	**SUMMER AVERAGE**										
	2007	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	1.1	0.7	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2
HEAVY HEAVY DUTY GAS TRUCKS (HHDV)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	1.1	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	9.6	5.7	4.4	4.1	4.0	4.0	4.1	4.2	4.3	4.5	4.6
MOTORCYCLES (MCY)	4.3	3.9	3.4	3.3	3.3	3.4	3.4	3.4	3.5	3.6	3.7
HEAVY DUTY DIESEL URBAN BUSES (UB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
HEAVY DUTY GAS URBAN BUSES (UB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SCHOOL BUSES (SB)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
OTHER BUSES (OB)	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MOTOR HOMES (MH)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
*** TOTAL ON-ROAD MOTOR VEHICLES**	**70.8**	**49.4**	**40.1**	**37.2**	**34.8**	**32.7**	**31.1**	**29.9**	**29.0**	**28.4**	**27.9**
OTHER MOBILE SOURCES											
AIRCRAFT	4.2	4.2	4.2	4.2	4.3	4.3	4.3	6.0	6.1	6.1	6.1
TRAINS	1.6	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7
SHIPS AND COMMERCIAL BOATS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
RECREATIONAL BOATS	17.9	14.0	13.5	13.0	12.5	12.1	11.6	11.2	10.8	10.4	10.0
OFF-ROAD RECREATIONAL VEHICLES	5.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5
OFF-ROAD EQUIPMENT	16.8	11.8	11.4	11.1	10.7	10.4	10.1	9.9	9.8	9.9	9.8
FARM EQUIPMENT	14.8	11.2	10.6	10.0	9.5	9.1	8.7	8.3	7.9	7.6	7.3
FUEL STORAGE AND HANDLING	4.6	2.7	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.0
*** TOTAL OTHER MOBILE SOURCES**	65.1	49.3	47.6	46.2	44.7	43.4	42.2	42.8	41.9	41.3	40.5
**** TOTAL MOBILE SOURCES**	136.0	98.8	87.7	83.3	79.5	76.2	73.3	72.7	71.0	69.7	68.4
GRAND TOTAL FOR SAN JOAQUIN VALLEY	457.3	380.6	371.8	369.6	368.0	366.3	366.0	367.9	368.6	369.9	371.1

Table B-3 Valley-Wide Biogenic Emissions for 2007 in Tons per Day

	Isoprene	Methylbutenol	Terpenes	Other VOC	Total VOC
January	4	14	13	24	55
February	6	18	24	58	106
March	117	78	70	142	407
April	163	111	92	161	526
May	436	251	159	276	1121
June	734	400	261	427	1821
July	941	495	341	522	2300
August	771	394	303	440	1908
September	336	182	160	220	899
October	43	63	60	88	255
November	11	29	28	45	113
December	2	8	9	19	39

B.2 Emissions Inventory Calculations and Revisions

ARB and the District continually collect information and conduct research to improve the emissions estimates. During development of the *2013 Plan for the Revoked 1-Hour Ozone Standard*, both agencies allocated substantial resources to a thorough review of the inventory to ensure that the emissions estimates reflected accurate emissions reports for point sources, and that estimates for mobile and area-wide sources were based on the most recent methodologies.

ARB also conducts periodic evaluations and updates of the growth profiles to ensure that emission forecasts are based on data that reflect historical trends, current conditions, and recent forecasts. The most significant challenge for the *2013 Plan for the Revoked 1-Hour Ozone Standard* was to ensure that the growth projections reflected the economic recession. ARB staff conducted a category-by-category review and update of the growth profile data for all the categories that, in aggregate, comprise more than 95% of the NOx or VOC emissions. To capture the effects of the recession, ARB staff ensured that the growth profiles included historical data through at least 2008 (data through 2009 or 2010 were included when available). Growth forecasts for the years 2009 and beyond were obtained primarily from government entities with expertise in developing forecasts for specific sectors, or in some cases, from econometric models.

In addition, this comprehensive emissions inventory update process required detailed information on the timing and locations of emissions sources on the most severe air quality days. This posed a unique challenge to translate regional, annual emission estimates into the temporal and spatial resolution needed for modeling. An iterative process was used as a means to refine the modeling emission inputs to better reflect observed conditions expected at a local, 1-hour scale. Model-simulated concentrations were compared with chemical species present in the ambient monitoring data, maps of emission sources known to surround the monitoring stations, and temporal trends in the monitoring data. This led to further updates in the spatial and temporal emissions data used in the modeling.

ARB and District staff worked jointly to develop a comprehensive emissions inventory for the *2013 Plan for the Revoked 1-Hour Ozone Standard*. The District worked closely with operators of major stationary facilities to develop the point-source emissions estimates. The District also developed emissions estimates for approximately one-third of the non-point (or area-wide) sources, such as commercial cooking and agricultural burning.

ARB staff developed the emissions inventory for mobile sources (both on-road and off-road) and the remaining two-thirds of the area-wide sources. ARB worked with several state and local agencies such as the Department of Transportation (Caltrans), the Department of Motor Vehicles (DMV), the Department of Pesticide Regulation (DPR), the California Energy Commission (CEC), and local councils of government (COGs) to assemble activity information necessary to develop the mobile and area-wide source emissions estimates.

B.2.1 Base-Year Inventory

The base-year inventory is an essential element of the plan that forms the basis for all future-year projections and also establishes the emissions levels against which progress in emissions reductions will be measured. EPA regulations establish general guidelines for selecting an inventory base year. Based on those guidelines, ARB and the District selected 2007 as the base year for this plan.

B.2.2 Emissions Forecasts

In addition to a base-year inventory, EPA regulations require future-year inventories for specific milestone years. ARB develops emission forecasts for point and area-wide sources by applying growth and control factors to the base-year inventory to account for year-to-year changes resulting from anticipated trends in economic conditions and population growth, as well as the effects of adopted emission control rules.

Growth factors are expressed as a ratio of the expected activity level in a future year relative to the base year. For point and area-wide sources, growth factors are derived from surrogates such as economic activity, fuel usage, population, and dwelling unit data that best reflect the expected growth or decline rates for each specific source category.

Control factors are percentages representing the extent to which a source category is controlled. These factors are derived from data provided by the regulatory agencies responsible for the affected emission categories. Developing control factors enables agencies to take appropriate credit for adopted rules and regulations that reduce emissions, remove exemptions, or improve compliance.

Mobile source projections are generated by emission models that use sophisticated modeling routines that predict vehicle fleet turnover by vehicle model year. As with stationary sources, the mobile source models include control algorithms that account for all adopted regulatory actions.

B.2.3 Annual, Seasonal, and Modeling Inventories

Annual and seasonal emissions inventories, often referred to as planning inventories, are typically produced at a county or air basin level of resolution. Annual emissions inventories represent the total emissions over an entire year (tons per year), or a simple average of annual emissions divided by 365 days (tons per day).

Seasonal inventories (summer and winter) account for temporal activity variations throughout the year as determined by actual data from point source facilities or by temporal profiles developed for area and mobile sources. Summer inventories include emissions from May through October, and winter inventories include November through April. Because ozone concentrations in the Valley are at their highest during the summer, the plan’s attainment demonstration is based on the summer inventory.

Modeling inventories (also referred to as gridded inventories) are estimated at finer spatial and temporal scales than planning inventories. Modeling inventories are used to support hour-by-hour, grid-based calculations of ambient pollutant concentrations. As a result, these inventories must characterize hourly emissions from all sources (stationary point, area-wide, mobile, and biogenic) located within each grid cell for the region and time being simulated. Modeling inventories account for day-specific variations within grid cells (such as actual plant shut-downs or wildfires) and the effects of meteorological conditions on emission rates (*e.g.*, the hour-specific ambient temperature effects on biogenic or evaporative emission releases). A more in-depth discussion of the temporal and spatial adjustments made to the Valley’s modeling inventory is presented in Appendix E, ARB Photochemical Modeling Protocol.

B.2.4 Quality Assurance and Quality Control

ARB has established a quality assurance and quality control (QA/QC) process to ensure the integrity and accuracy of the emissions inventories used in the development of air quality plans. ARB staff performs comprehensive QA/QC checks to confirm that inventory inputs have been reliably prepared and approved for use in photochemical modeling. This process involves collaboration among ARB and air district staff to develop base- and future-year emissions estimates.

QA/QC occurs at the various stages of SIP emissions inventory development. Base-year emissions are assembled and maintained in the California Emission Inventory Development and Reporting System (CEIDARS). ARB staff works with the District, who is responsible for developing and reporting point-source emission estimates, to verify these data are accurate. The locations of point sources, including stacks, are checked to ensure they are valid. Area-wide source emissions estimates are developed by ARB staff as well as the District. The methodologies for estimating these are reviewed by ARB and District staff before their inclusion in the emissions inventory. Additionally, CEIDARS is designed with automatic system checks to prevent errors such as double counting of emissions sources. The system also makes various reports available to assist ARB staff in their efforts to identify and reconcile anomalous emissions.

Future-year emissions are estimated using the California Emission Forecasting and Planning Inventory System (CEFS). Growth and control factors are reviewed for each category and year along with the resulting emissions projections. Year-to-year trends are compared to similar and past datasets to ensure general consistency. Emissions for specific categories are checked to confirm they reflect the anticipated effects of applicable control measures. Mobile categories are verified with mobile source staff for consistency with the on- and off-road emission models (EMFAC and OFFROAD).

Prior to input into the air quality model, the spatial and temporal parameters applied to the emissions are checked. Monthly, weekly, and diurnal emission profiles are examined to ensure they appear reasonable for the category. Emissions are again summarized by region (county, air basin, and district), category, and pollutant to confirm their consistency with the overall inventory.

As modeling results become available, the results are used to further validate the inventory. The modeled concentrations in a particular grid cell are reviewed for consistency with the types of sources present nearby in the emission inventory. Additionally, the inclusion of air quality monitor data, when available, is used to re-affirm that the types and magnitude of upwind sources are accounted for in the inventory.

Appendix C

Stationary and Area Source Control Strategy Evaluation

2013 Plan for the Revoked 1-hour Ozone Standard
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APPENDIX C: STATIONARY AND AREA SOURCE CONTROL STRATEGY EVALUATION

Introduction

The San Joaquin Valley air basin (Valley) faces significant challenges in meeting the National Ambient Air Quality Standards (NAAQS). The San Joaquin Valley Air Pollution Control District (District) has demonstrated leadership in developing and implementing groundbreaking regulatory strategies to reduce emissions. Tough and innovative rules, such as those for indirect source review, residential fireplaces, glass manufacturing, and agricultural burning, have set benchmarks for California and the nation.

The District has adopted many regulatory control measures under the District's air quality attainment plans, including but not limited to commitments made under the *2007 Ozone Plan*, *2008 PM2.5 Plan,* and *2012 PM2.5 Plan.* All of these commitments serve as control measures under the *2013 Plan for the Revoked 1-hour Ozone Standard*. Under the federal Environmental Protection Agency (EPA) policy, there is a preference for reliance on control measures that have already been adopted. The *2013 Plan for the Revoked 1-hour Ozone Standard* regulatory control measures that have already been adopted include both stationary and area source control measures as well as California Air Resources Board (ARB) rules for mobile sources. Refer to Chapter 3 for a discussion about the regulatory control measures that have already been adopted and will continue to get emissions reductions and state regulations contributing towards the Valley's attainment efforts.

This appendix consists of a literature review and evaluation of emission reduction opportunities for a variety of stationary and area source categories. District staff in multiple departments with expertise in these various sectors contributed to this effort. The evaluations in this appendix are intended to capture relevant background information, examine emission reduction opportunities for technological and economic feasibility, make recommendations for appropriate District actions moving forward, and to solicit public input during the plan development process. This appendix reflects the comprehensive evaluation performed by the District to examine the Valley's various emissions sources and identify additional potential emission reduction strategies for inclusion in this plan.

Regulations Contributing to Attainment

Table C-1 below identifies many stationary and area source control measures that the District has already adopted and that are contributing to achieving attainment. These adopted District rules are achieving new emissions reductions after 2007, the base year for this plan. However, even pre-2007 emissions reductions are contributing, and will continue to contribute, to the Valley's progress toward clean air.

Table C-1 District Stationary and Area Source Regulations Contributing to NAAQS Attainment of Ozone

Rule #	Adopted District Rules	Adoption/ Amendment Date
4103	Open Burning	04/15/2010
4106	Prescribed Burning and Hazard Reduction Burning	01/21/2001
4307	Boilers, Steam Generators, and Process Heaters – 2.0 MMBtu/hr to 5.0 MMBtu/hr	05/19/2011
4308	Boilers, Steam Generators, and Process Heaters - 0.075 MMBtu/hr to less than 2.0 MMBtu/hr	12/17/2009
4309	Dryers, Dehydrators, and Ovens	12/15/2005
4311	Flares	06/18/2009
4306 & 4320	Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr	10/16/2008
4352	Solid Fuel Fired Boilers, Steam Generators, and Process Heaters	12/15/2011
4354	Glass Melting Furnaces	05/19/2011
4550	Conservation Management Practices	08/19/2004
4565	Biosolids, Animal Manure, and Poultry Litter Operations	03/15/2007
4566	Organic Material Composting Operations	08/18/2011
4570	Confined Animal Facilities	10/21/2010
4601	Architectural Coatings	12/17/2009
4603	Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts	09/20/2007
4604	Can and Coil Coating Operations	09/20/2007
4605	Aerospace Assembly and Component Coating Operations	09/20/2007
4606	Wood Products and Flat Wood Paneling Products Coating Operations	09/20/2007
4607	Graphic Arts and Paper, Film, Foil, and Fabric Coatings	12/18/2008
4612	Motor Vehicle and Mobile Equipment Coating Operations	09/20/2007
4621	Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants	12/20/2007
4622	Gasoline Transfer into Motor Vehicle Fuel Tanks	12/20/2007
4624	Transfer of Organic Liquid	12/20/2007
4653	Adhesives and Sealants	09/16/2010
4661	Organic Solvents	09/20/2007
4662	Organic Solvent Degreasing Operations	09/20/2007
4663	Organic Solvent Cleaning, Storage, and Disposal	09/20/2007
4682	Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	09/20/2007
4684	Polyester Resin Operations	09/20/2007
4694	Wine Fermentation and Storage Tanks	12/15/2005
4695	Brandy Aging and Wine Aging Operations	09/17/2009

Rule #	Adopted District Rules	Adoption/ Amendment Date
4702	Internal Combustion Engines	08/18/2011
4703	Stationary Gas Turbines	09/20/2007
4901	Wood Burning Fireplaces and Wood Burning Heaters[3]	10/16/2008
4902	Residential Water Heaters	03/19/2009
4905	Natural Gas-Fired, Fan-Type Residential Central Furnaces	10/20/2005
9310	School Bus Fleets	09/21/2006
9410	Employer Based Trip Reduction	12/17/2009
9510	Indirect Source Review (ISR)	12/12/2005
9610	State Implementation Plan Credit for Emission Reductions Generated Through Incentive Programs	06/20/2013

Appendix C Organization and Evaluation

The stationary and area source control measure categories evaluated in this appendix are organized into the following groups:

- Combustion Devices
- Industrial Processes
- Coatings and Solvents
- Oil and Gas
- Managed Burning
- Agricultural Processes
- Residential and Commercial
- Waste Management

Each control measure source category group discussion includes a summary of the category, and a list of the District rules that are grouped into that category for the purposes of this attainment plan. Each individual control measure evaluation in this appendix has its own discussion and source category analysis.

Control Measure Evaluations

Each control measure evaluation includes a brief discussion of the rule applicability; an emission inventory table for the source category; a regulatory evaluation, including an assessment of Reasonably Available Control Technology (RACT); a review of any new technologies to reduce emissions; and recommendations for commitments for future regulatory actions to be taken by the District. The sections below elaborate upon the information presented in each of the aforementioned sections.

Applicability

The applicability of each control measure specifies what units or type of operations are affected by the rule and identifies the type(s) of emissions the rule controls.

Emission Inventory

Each table lists the oxides of nitrogen (NOx) and volatile organic compound (VOC) emissions for the respective control measure for multiple years between 2007 and 2022. As discussed in detail in Chapter 2, ozone is a product of atmospheric reactions involving VOCs, NOx, the hydroxyl radical (OH), other radicals, and sunlight. Therefore, although some District rules control multiple emissions including oxides of sulfur (SOx) and particulate matter, this ozone attainment plan appendix only contains the emission inventories for NOx and VOC.

The data provided in the emission inventory section is a compilation of the data sources identified in the emission inventory appendix. See Appendix B (Emission Inventory) for additional information.

Regulatory Evaluation

As a part of the regulatory evaluation, District rules and source categories are compared to federal air quality regulations and standards, state air quality regulations, and local regulations (meaning regulations at the air district level).

Each control measure evaluation includes a regulatory evaluation section that begins with a table summarizing the results of the evaluation; refer to Table C-2 below. The first two columns describe if the rule has been determined by EPA to implement RACT and the year of that RACT determination. The third, fourth, and fifth columns identify if there have been new federal, state, or local regulations adopted *after* the date of the RACT determination. If new regulations and guidance documents have been adopted after the RACT determination, then there is a potential for a new RACT standard. Potential new RACT standards are discussed in the Technology Evaluation (see below).

Table C-2 Regulatory Evaluation Summary[1]

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes/No	XXXX	Yes/No	Yes/No	Yes/No

The sections below discuss the regulatory evaluation results summarized in each of the columns in the regulatory evaluation summary table (Table C-2).

RACT

RACT is "*the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility"* (44 FR 53762; September 17, 1979). Per Sections 182(b)(2) and 182(f) of the federal Clean Air Act, ozone nonattainment areas are required to implement RACT for sources that are subject to Control Techniques

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[1] Some District rules are not subject to RACT requirements because they are not an EPA Control Techniques Guidelines source category and do not regulate major sources in the Valley. As such, the Regulatory Evaluation Summary table has been revised for those rules to state: "EPA Approved" in the first column, "EPA Approval Year" in the second column, and "Regulatory Actions Since EPA Approval" above the last 3 columns.

Guidelines (CTG) issued by EPA and for “major sources” of VOCs and NOx, which are ozone precursors.

RACT is a moving target that changes over time as new technologies become feasible and cost effective, thus making them reasonable to require. Therefore, the District focuses its review on changes in technologies since the last RACT demonstration. For these reviews, the District evaluates District rules against federal rules, regulations, and technology guidelines, state guideline documents, and any comparable rules from California’s most technologically progressive air districts. In response to the District’s *2009 RACT Demonstration for Ozone State Implementation Plans* (2009 RACT SIP) and related rule-amending projects, EPA has issued federal actions documenting their approval of District rules and concurrence that District rules implement RACT. Many District rules are more stringent than established RACT standards.

Federal Regulations

Investigation of federal regulations includes literature review of the following regulations and guidance documents:

- **CTG**: Control Techniques Guidelines
- **ACT**: Alternative Control Techniques
- **NSPS**: New Source Performance Standards
- **NESHAP**: National Emission Standards for Hazardous Air Pollutants
- **MACT**: Maximum Achievable Control Technology

State Regulations

Generally, state regulations are specific to mobile sources and consumer products. However, sometimes the ARB will adopt a **suggested control measure (SCM)** for stationary sources, such as the SCM for architectural coatings promulgated in September of 2007. While most of the rules evaluated in this *2013 Plan for the Revoked 1-hour Ozone Standard* do not have an ARB regulation or SCM associated with their source category, the District has included mention of any relevant state guidelines within the applicable control measure evaluations.

Local Regulations

As agreed to by EPA staff for the *2009 RACT SIP*, the rules were also compared to analogous regulations adopted by California’s most progressive air districts. Investigation of control strategies and measures in other air districts and agencies includes, but is not limited to the following air districts:

- **SCAQMD**: South Coast Air Quality Management District
- **SMAQMD**: Sacramento Metropolitan Air Quality Management District
- **BAAQMD**: Bay Area Air Quality Management District
- **VCAPCD**: Ventura County Air Pollution Control District

Technology Evaluation

The District's control measure evaluations include an analysis of new technologies, if any are identified, to determine if any potential for emissions reductions exists for the source category. Each identified new technology is evaluated using the following key factors:

- **Technological Feasibility** – The technological feasibility analysis determines if a potential opportunity to reduce emissions is viable for existing facilities and operators in the Valley, given their current operating needs and restrictions. District analysis of technological feasibility includes a literature review of Best Available Control Technology (BACT) guidelines, District permits, and environmental and technological studies to identify potential opportunities and determine the technological feasibility of any identified potential opportunities. Since BACT requirements are typically the best available technology for a category of units, BACT is required for facilities that are proposing new installations or modifications to existing ones and may not necessarily be technologically feasible for retrofits in all existing facilities.

- **Cost Effectiveness** – The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of an air pollution control measure or technology as it applies to operators in the Valley. A cost effectiveness analysis examines the added cost, in dollars per year, of the control technology or technique, divided by the emissions reductions achieved, in tons per year.

Additionally, the technology evaluation draws from a literature review of recent staff reports for District rules, analyses from the *2009 RACT SIP* and *2012 PM2.5 Plan,* and applicable study data from the scientific community. These recent analyses are examined to determine if any potential opportunities identified have already been evaluated thoroughly for technological feasibility and cost effectiveness.

Recommendations

The District examined each control measure for any additional feasible regulatory actions; however, no technologically feasible and cost effective opportunities were identified at this time. The District does have several regulatory commitments carrying over from the *2012 PM2.5 Plan* that will take place within the next few years. Where additional research is required to determine if a potential opportunity to further reduce emissions of VOC or NOx may be feasible for the Valley, the District recommends further study. Further study commitments are an example of the District's commitment to continuously pursue emission reduction opportunities, even after an air quality plan has been adopted.

The existing regulatory commitments from the *2012 PM2.5 Plan* and further study commitments from the *2012 PM2.5 Plan* and this *2013 Plan for the Revoked 1-Hour Ozone Standard* are summarized in Chapter 3 (Control Strategy).

C.1 COMBUSTION DEVICES

Combustion devices are equipment that burn fuel to create power, heat, or other forms of energy. The process of burning fuel via internal or external combustion creates multiple pollutants, including VOC, NOx, and SOx. Establishing effective emission reduction strategies for combustion devices continues to be a key component of the District's strategy to reduce emissions and achieve attainment of federal air quality standards.

Combustion devices are utilized in numerous applications throughout the public and private sectors. The control measure source categories affect several industries in the Valley including but not limited to: electrical utilities, cogeneration, oil and gas production, petroleum refining, manufacturing processes, industrial activities, and food and agricultural processing.

Regulatory Evaluation

The following is a list of District rules that apply to the Combustion Devices category. Units subject to these rules are subject to some of the most stringent regulations and standards in the nation and have been subject to several generations of rule amendments. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emissions reductions; recommendations are made as appropriate.

Table C-3 Current Combustion Devices Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4301	Fuel Burning Equipment	5/21/1992	12/17/1992	NOx, SOx
4307	Boilers, Steam Generators, and Process Heaters – 2.0 MMBtu/hr to 5.0 MMBtu/hr	12/15/2005	5/19/2011	NOx, SOx, CO, PM
4308	Boilers, Steam Generators, and Process Heaters – 0.075 MMBtu/hr to less than 2.0 MMBtu/hr	10/20/2005	12/17/2009	NOx, CO
4309	Dryers, Dehydrators, and Ovens	12/15/2005	n/a	NOx, CO
4320	Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr	10/16/2008	n/a	NOx, SOx, CO, PM
4352	Solid Fuel Fired Boilers, Steam Generators, and Process Heaters	9/14/1994	12/15/2011	NOx, CO
4702	Internal Combustion Engines	8/21/2003	8/18/2011	NOx, VOC, SOx, CO
4703	Stationary Gas Turbines	8/18/1994	9/20/2007	NOx, CO

C.1.1 RULE 4301 FUEL BURNING EQUIPMENT

Applicability

The purpose of this rule is to limit the emission of air contaminants from fuel burning equipment. This rule limits the concentration of combustion contaminants by specifying maximum emission rates for SOx, NOx, and particulate matter (identified in the rule as combustion contaminant emissions).

Summer Average Emission Inventory

Rule 4301 was last amended in 1992 and applies to all types of fuel burning equipment. However, since 1992 the District has adopted rules with more stringent requirements for specific types of fuel burning equipment and the emissions from these sources are presented with those control measures and in Appendix B.

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4301 on May 18, 1999 and deemed this rule as being at least as stringent as established RACT requirements: 64 FR 26876, http://www.gpo.gov/fdsys/pkg/FR-1999-05-18/pdf/99-12157.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Facilities subject to Rule 4301 are subject to various federal requirements, such as ACT, CTG, NESHAP, MACT, and NSPS. However, several District rules, including Rules 4306, 4307, 4308, 4309, and 4352, have superseded Rule 4301 with more stringent NOx requirements for fuel burning equipment and these rules are at least as stringent as the applicable federal requirements. Comparisons of those District rules to other applicable air districts' rules are discussed within the individual control measure evaluations in this appendix.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-39 through 4-41 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.2 RULE 4307 BOILERS, STEAM GENERATORS, AND PROCESS HEATERS – 2.0 MMBTU/HR TO 5.0 MMBTU/HR

Applicability

This rule applies to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input of 2.0 million British thermal units per hour (MMBtu/hr) up to and including 5.0 MMBtu/hr. The purpose of this rule is to limit emissions of NOx, carbon monoxide (CO), sulfur dioxide (SO2), and particulates from units subject to this rule.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.72	0.37	0.35	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.26
VOC	0.19	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2008 amendments to Rule 4307 on January 13, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 1715, http://www.gpo.gov/fdsys/pkg/FR-2010-01-13/pdf/2010-352.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4307 is at least as stringent as the applicable federal ACT, NSPS, NESHAP, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4307 RACT approval. There are no EPA CTG requirements for this source category.
- Rule 4307 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1146.1, BAAQMD Regulation 9 Rule 7, BAAQMD Regulation 9 Rule 10, SMAQMD Rule 411, and VCAPCD Rule 74.15.1.
    - VCAPCD Rule 74.15.1 was amended on September 11, 2012; however, the amendment did not implement any requirements more stringent than the requirements in District Rule 4307.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-45 through 4-46 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunity for this source category in the District's *2012 PM2.5 Plan*:
    - EMx Technology: the District researched EMx, the second generation SCONOx technology that reduces NOx, SOx, CO, and VOC emissions; however, the technology has not been achieved in practice in the District, no available data indicates that it has been installed on boilers, and it has proven to not be cost effective for turbines.
    - See pages D-13 through D-18 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.3 RULE 4308 BOILERS, STEAM GENERATORS, AND PROCESS HEATERS – 0.075 MMBTU/HR TO LESS THAN 2.0 MMBTU/HR

Applicability

This rule applies to any person who supplies, sells, offers for sale, installs, or solicits the installation of any boiler, steam generator, process heater, or water heater with a rated heat input capacity greater than or equal to 0.075 MMBtu/hr and less than 2.0 MMBtu/hr. The purpose of this rule is to limit NOx emissions from units within this source category.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	1.37	0.70	0.66	0.62	0.60	0.58	0.56	0.55	0.53	0.51	0.50
VOC	0.36	0.32	0.32	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.28

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2009 amendments to Rule 4308 on January 31, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 5276, http://www.gpo.gov/fdsys/pkg/FR-2011-01-31/pdf/2011-1927.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4308 is at least as stringent as the applicable federal ACT since the requirements have not been strengthened for this regulation since the Rule 4308 RACT approval. Federal requirements such as NSPS, NESHAP, MACT, and CTG are not applicable to boilers, steam generators, and process heaters of this size.
- Rule 4308 is at least as stringent as the following rules for similar sources in other California air districts': SMAQMD Rule 411, SMAQMD Rule 414, and VCAPCD Rule 74.15.1.
- SCAQMD Rule 1146.2, BAAQMD Regulation 9 Rule 6, and VCAPCD Rule 74.11.1 have a 20 ppmv NOx limit for natural gas-fired instantaneous water heaters 0.075 – 0.4 MMBtu/hr, whereas Rule 4308 contains a limit of 55 ppmv for these units.
    - VCAPCD recently amended Rule 74.11.1 on September 11, 2012 to implement a 20 ppmv NOx limit for all natural gas units 0.075-0.4 MMBtu/hr.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP.* No feasible opportunities were identified. See pages 4-47 through 4-53 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the *2012 PM2.5 Plan*:
    - Removing the exemption for mobile homes: mobile home water heaters are not available in the 0.075-2.0 MMBtu/hr size range, so this would not result in any additional emission reductions.
    - Removing the exemption for recreational vehicles (RVs): this would likely not result in additional emission reductions because there are very few, if any, RV units that fall under this size category. Also, since RV units are used infrequently, they are small contributors to the total NOx emissions of this source category.
    - Lowering the NOx limit for instantaneous water heaters 0.075 – 0.4 MMBtu/hr: the incremental cost of an instantaneous water heater of this size that meets a NOx limit of 20 ppmv is a small fraction of the total cost of a new unit; therefore, the District committed to amending Rule 4308 to lower the NOx limit to 20 ppmv for these units in 2013.
    - See pages D-19 through D-25 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

Lowering the NOx limit for natural gas-fired instantaneous water heaters 0.075 – 0.4 MMBtu/hr to 20 ppmv is a potential opportunity to reduce emissions, as identified and committed to in the *2012 PM2.5 Plan.* The recommendation is to amend Rule 4308 in 2013 as planned.

C.1.4 RULE 4309 DRYERS, DEHYDRATORS, AND OVENS

Applicability

Rule 4309 is applicable to any dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is 5.0 MMBtu/hr or greater. The purpose of this rule is to limit NOx and CO emissions from these units.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.22	0.20	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.24	0.24
VOC	0.22	0.23	0.24	0.25	0.25	0.26	0.27	0.27	0.28	0.28	0.29

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 adoption of Rule 4309 on May 30, 2007 and deemed this rule as being at least as stringent as established RACT requirements: 72 FR 29886, http://www.gpo.gov/fdsys/pkg/FR-2007-05-30/pdf/E7-10236.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4309 is at least as stringent as the applicable federal ACT since the requirements have not been strengthened for this regulation since the Rule 4309 RACT approval. There are no federal CTG, NSPS, NESHAP, or MACT requirements for this source category.
- The only rules at other California air districts' for similar sources are BAAQMD Regulation 12 Rule 3, SCAQMD Rule 470, and VCAPCD Rule 69; however, these rules only regulate asphalt plants, and Rule 4309 is more stringent than the requirements in all three rules. SMAQMD does not have an analogous rule to Rule 4309.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See pages 4-54 through 4-55 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:

- Requiring PUC-quality natural gas for all asphalt plants: this is not technologically feasible because some facilities are too far removed from natural gas lines. Also, most of the facilities that do not use natural gas use LPG fuel or propane to comply with the same NOx limit as natural gas, so requiring PUC-quality natural gas for all asphalt plants would not generate significant emission reductions.
- Reducing the NOx limit for gas-fired asphalt plants from 4.3 ppmv to 3.9 ppmv: operators have already installed control technologies claimed to reach 3.9 ppmv in order to meet 4.3 ppmv. Based on District permit records, a good portion of asphalt plants are already meeting 3.9 ppmv, so there would not be significant emissions reductions from reducing the NOx limit.
- Enforcing NOx emission limits and thus requiring the use of low-NOx burners (LNB) for dehydrators: this is infeasible because LNBs can negatively affect product quality; monitoring and source testing of dehydrators is difficult, if not impossible, to perform; and the cost effectiveness of LNBs for dehydrators is $49,273/ ton of NOx reductions.
- Removing the exemption for column dryers and dryers with no stack and one or more sides open to the atmosphere: monitoring and source testing of these types of dryers is difficult because there is not a stack where all emissions are exhausted. Therefore, compliance with NOx emission limits would be difficult or impossible to determine reliably, making this technologically infeasible.
- See pages D-26 through D-31 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.5 RULE 4320 ADVANCED EMISSION REDUCTION OPTIONS FOR BOILERS, STEAM GENERATORS, AND PROCESS HEATERS GREATER THAN 5.0 MMBTU/HR

Applicability

This rule applies to any gaseous fuel or liquid fuel-fired boiler, steam generator, or process heater with a total rated heat input greater than 5 MMBtu/hr. The purpose of Rule 4320 is to limit NOx and CO emissions from boilers, steam generators, and process heaters of this size range.

Rule 4306 preceded Rule 4320 in regulating this source category. The implementation of Rule 4320 does not substitute the requirements of Rule 4306, but enforces requirements supplementary to Rule 4306. As such, this evaluation is applicable to both Rule 4320 and Rule 4306, but for simplicity will be referred to as Rule 4320.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	2.87	1.47	1.39	1.30	1.25	1.22	1.18	1.14	1.11	1.08	1.04
VOC	0.76	0.67	0.66	0.65	0.65	0.64	0.62	0.62	0.61	0.60	0.60

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- Since Rule 4320 contains a provision that allows for the payment of an annual fee if further controls are not cost effective, this rule is not sufficient to ensure that RACT is implemented for this source category. Because sources have a separate obligation to comply with Rule 4306, RACT is implemented for the source category and Rule 4320 is consistent with RACT requirements.
- EPA finalized approval of the 2008 amendments to Rule 4306 on January 13, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 1715, http://www.gpo.gov/fdsys/pkg/FR-2010-01-13/pdf/2010-352.pdf
- EPA finalized approval of the 2008 adoption to Rule 4320 on March 25, 2011 and determined that this is a SIP strengthening rule: 76 FR 16696, http://www.gpo.gov/fdsys/pkg/FR-2011-03-25/pdf/2011-7090.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed Rule 4306 as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf

- Rule 4320 is at least as stringent as the applicable federal ACT, NSPS, NESHAP, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4320 approval. There are no EPA CTGs for this source category.
- Rule 4320 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1146, BAAQMD Regulation 9 Rule 7, BAAQMD Regulation 9 Rule 10, SMAQMD Rule 411, and VCAPCD Rule 74.15. Rule 4320 also meets or exceeds the established BACT requirements for these units at BAAQMD and SCAQMD and currently dictates District BACT requirements for Valley sources.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-42 through 4-44 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:
  - Low Temperature Oxidation (LTO) System: the District researched the LTO system, which utilizes ozone to oxidize and control pollutants, including NOx; however, the technology has not been achieved in practice and it is cost prohibitive without significant subsidies.
  - EMx Technology: the District researched EMx, the second generation SCONOx technology that reduces NOx, SOx, CO, and VOC emissions; however, the technology has not been achieved in practice in the District, no available data indicates that it has been installed on boilers, and it has proven to not be cost effective for turbines.
  - See pages D-32 through D-38 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.6 RULE 4352 SOLID FUEL FIRED BOILERS, STEAM GENERATORS, AND PROCESS HEATERS

Applicability

This rule applies to any boiler, steam generator, or process heater fired on solid fuel. The purpose of Rule 4352 is to limit NOx and CO emissions from these units.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	3.92	4.41	4.50	4.68	4.87	4.97	5.08	5.16	5.30	5.32	5.38
VOC	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	Yes	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4352 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4352 on November 6, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 66548, http://www.gpo.gov/fdsys/pkg/FR-2012-11-06/pdf/2012-26779.pdf
- Rule 4352 is at least as stringent as the applicable federal ACT, NSPS, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4352 RACT approval. Additionally, there is no EPA CTG listed for this category.
    - EPA proposed amendments to the applicable NESHAP for Rule 4352 in the Federal Register on November 30, 2012. The amendments did not implement NOx limits more stringent than those in Rule 4352. Therefore, Rule 4352 still meets or exceeds NESHAP requirements.
- Rule 4352 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 9 Rule 7, BAAQMD Regulation 9 Rule 11, VCAPCD Rule 74.15, SCAQMD Rule 1146, Placer County Rule 233 and SMAQMD Rule 411. Units subject to District Rule 4352 would be exempt from the following rules in other air districts: VCAPCD Rule 59, VCAPCD Rule 74.15, and SCAQMD Rule 1135.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-61 through 4-68 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:
    - Selective Catalytic Reduction: when comparing Rule 4352 to EPA and other air districts' BACT requirements, it was noted that SCR systems are considered BACT. A SCR system reduces NOx emissions by converting the emissions to water and elemental nitrogen. However, this technology is not cost effective as either a retrofit or new system for solid fuel fired units.
    - Changes to Start-up Requirements: the possibility of reducing the allowed start-up period of solid fuel fired boilers was considered, since facilities are exempt from emission limits during this period. However, this is not a technologically feasible option for solid fuel fired facilities given the needs of current work practices.
    - See pages D-39 through D-46 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.7 RULE 4702 INTERNAL COMBUSTION ENGINES

Applicability

This rule applies to any internal combustion (IC) engine rated at 25 brake horsepower (bhp) or greater. The purpose of this rule is to limit NOx, CO, VOC, and SOx emissions from units subject to this rule.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	26.36	15.97	15.50	11.11	8.45	7.92	7.60	7.35	7.01	6.76	6.35
VOC	2.90	1.87	1.83	1.62	1.36	1.32	1.29	1.26	1.22	1.19	1.14

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4702 on January 10, 2008 and deemed this rule as being at least as stringent as established RACT requirements: 73 FR 1819, http://www.gpo.gov/fdsys/pkg/FR-2008-01-10/pdf/E8-171.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4702 is at least as stringent as the applicable federal ACT, NSPS, NESHAP, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4702 RACT approval. There are no EPA CTGs for this source category.
- Rule 4702 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 9 Rule 8, SMAQMD Rule 412, and VCAPCD Rule 74.9.
- SCAQMD Rule 1110.2 has a NOx limit of 11 ppmv for most engine categories, which is lower than some of the NOx emission limits in Rule 4702. As discussed below, this limit is beyond RACT.
- SCAQMD amended Rule 1110.2 in September 2012 to extend the compliance deadline to January 1, 2016 for waste gas fueled lean-burn engines to meet the 11 ppmv NOx limit. The compliance date was previously set for January 1, 2012.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See pages 4-363 through 4-365 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:
    - Lowering the NOx limit to 11 ppmv for spark-ignited non-agricultural engines: as part of the August 2011 rule amendment, the District analyzed the technological and cost effectiveness of an 11 ppmv NOx limit for all engines in this category, but determined that this was infeasible for certain categories of engines. See pages 9 through 11 of the staff report for more detailed information: http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2011/August/Agenda_Item_10_Aug_18_2011.pdf
    - Lowering the NOx limit to 11 ppmv for spark-ignited agricultural engines: additional time is needed to fully evaluate the effectiveness of current control devices and to determine if it is technologically feasible to reach 11 ppmv with those controls. These systems have faced challenges due to the nature of agricultural engine installations, including remote locations, fluctuations in gas pressures, and unattended operations. There are also significant potential economic impacts associated with implementing lower NOx emission limits because unlike diesel engines, agricultural spark-ignited engines are not eligible for Moyer incentive funding and agriculture is unable to pass increased production costs along to consumers. If costs become too high, operators could replace their spark-ignited engines with higher-polluting diesel engines. Due to these feasibility issues, an 11 ppmv NOx emission limit is beyond RACT for these engines.
    - Changing the exemption requirements for emergency standby engines and low-use engines: existing requirements are consistent with ARB RACT/Best Available Retrofit Control Technology (BARCT) requirements and controlling these emissions is not cost effective.
    - See pages D-47 through D-53 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf
- As mentioned above, SCAQMD amended Rule 1110.2 in September 2012 to extend the compliance deadline for waste gas engines from 2012 to 2016. At this time, it is unclear whether a NOx limit of 11 ppmv is technologically feasible and cost effective for waste gas units because SCAQMD has not yet completed their Final Technology Assessment of control technologies for waste gas engines. The SCAQMD compliance deadline was extended to 2016 to allow for more time to finish the assessment. The District will review the results of this study upon SCAQMD's completion.

- For the August 2011 amendment of Rule 4702, District staff considered whether it was feasible to lower the VOC emission limit for spark-ignited engines in Rule 4702 to 30 ppmv, like SCAQMD Rule 1110.2. This was determined to be infeasible because:
    - When a spark-ignited engine is adjusted to reduce VOCs, NOx emissions increase.
    - SCAQMD has approved several variances allowing temporary relief from the 30 ppmv VOC limit due to feasibility issues.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.1.8 RULE 4703 STATIONARY GAS TURBINES

Applicability

This rule is applicable to all stationary gas turbine systems, which are subject to District permitting requirements, and with electrical generation ratings equal to or greater than 0.3 megawatt (MW) or a maximum heat input rating of more than 3 MMBtu/hr. The purpose of this rule is to limit NOx emissions from units subject to Rule 4703.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	6.99	3.43	3.16	3.07	3.12	3.18	3.19	3.20	3.12	3.14	3.16
VOC	0.45	0.43	0.40	0.38	0.39	0.40	0.40	0.40	0.39	0.39	0.40

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4703 on October 21, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 53888, http://www.gpo.gov/fdsys/pkg/FR-2009-10-21/pdf/E9-25173.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4703 is at least as stringent as the applicable federal ACT, NSPS, NESHAP, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4703 RACT approval. There are no EPA CTG requirements listed for this source category.
- Rule 4703 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1134, BAAQMD Regulation 9 Rule 9, SMAQMD Rule 413, and VCAPCD Rule 74.23.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP.* No feasible opportunities were identified. See pages 4-366 through 4-371 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- Some BACT NOx emission limits are more stringent than Rule 4703 emission limits through the use of Selective Catalytic Reduction (SCR) and the EMx technology; however, lower limits have not proven to be technically or economically feasible through these technologies, as discussed in the District's *2012 PM2.5 Plan*.
    - SCR: many of the larger units >3 MW have already employed SCR and for units <3MW, the technology is not cost effective, ranging from approximately $218,000-$360,000/ton of NOx emission reductions.
    - EMx Technology: this technology is technologically infeasible for simple cycle turbines and has not been achieved in practice for combined cycle turbines in the District. Also, based on information from BAAQMD, EMx has not been scaled up for use on larger turbines and has not been proven to achieve an equivalent or lower NOx emissions level than SCR.
    - See pages D-54 through D-64 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2 INDUSTRIAL PROCESSES

The Valley is home to a wide range of industries and industrial processes. The industrial sector is a vital contributor to the health of the Valley's economy, and has made important contributions to air quality improvement. Whether coming under regulation for the first time or having undergone several generations of rules, the emissions reductions achieved represent significant investments of finances and energy.

While the broad category of Industrial Processes includes many source categories, for the purposes of this appendix, this discussion is limited to the categories in the table below. Other industry groups and technologies addressed in this plan, but not addressed in this section, are discussed in other parts of this appendix.

The control measure source categories discussed in this section affect several industries in the Valley including, but not limited to glass and related products, manufacturing, food and agricultural material processing, oil and gas production, asphalt operations, tire manufacturing, foam production, and wine and brandy production.

Regulatory Evaluation

The following is a list of rules specific to the Industrial Processes category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emissions reductions.

Table C-4 Current Industrial Processes Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4311	Flares	6/20/2002	6/18/2009	NOx, VOC, SOx
4313	Lime Kilns	3/27/2003	n/a	NOx
4354	Glass Melting Furnaces	9/14/1994	5/19/2011	NOx, VOC, SOx, CO, PM
4641	Cutback, Slow Cure, and Emulsified Asphalt, Paving, and Maintenance Operations	4/11/1991	12/17/1992	VOC
4681	Rubber Tire Manufacturing	5/16/1991	12/16/1993	VOC
4682	Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	5/21/1992	12/15/2011	VOC
4684	Polyester Resin Operations	5/19/1994	8/18/2011	VOC
4691	Vegetable Oil Processing Operations	4/11/1991	12/17/1992	VOC
4694	Wine Fermentation and Storage Tanks	12/15/2005	n/a	VOC
4695	Brandy Aging and Wine Aging Operations	9/17/2009	n/a	VOC

C.2.1 RULE 4311 FLARES

Applicability

This rule applies to operations involving the use of flares. The purpose of this rule is to limit emissions of VOC, NOx, and SOx from the operation of flares.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.38	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
VOC	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	Yes	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2009 amendments to Rule 4311 on November 3, 2011 and deemed this rule as being at least as stringent as established RACT requirements:76 FR 68106, http://www.gpo.gov/fdsys/pkg/FR-2011-11-03/pdf/2011-28391.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4311 is at least as stringent as one of the applicable federal NSPSs (40 CFR 60.18) and the flares section of the Consolidated Federal Air Rule (40 CFR 65.147). There are no applicable CTG, ACT, NESHAP, or MACT requirements for this source category.
- In 2012, EPA modified an existing NSPS for flares (40 CFR 60 Subpart Ja) and added a new NSPS (40 CFR 60 Subpart OOOO) applicable to this source category.
    - 40 CFR 60 Subpart Ja: EPA modified this NSPS requirement on September 12, 2012 (77 FR 56422, http://www.gpo.gov/fdsys/pkg/FR-2012-09-12/pdf/2012-20866.pdf). Some of the amendments may be more stringent than the requirements in Rule 4311, including: what constitutes a reportable flaring event, a new testing method for flares, and some new requirements for Flare Minimization Plans (FMPs). The District already committed to a further study measure for this source category in the *2012 PM2.5 Plan*. The District recommends evaluating these new NSPS requirements at that time to see if they are in fact more stringent than Rule 4311 requirements and if they are feasible for Valley facilities.
    - 40 CFR 60 Subpart OOOO: on August 16, 2012, EPA finalized approval of a new NSPS requirement (77 FR 49490,

http://www.gpo.gov/fdsys/pkg/FR-2012-08-16/pdf/2012-16806.pdf). This NSPS indirectly affects flares since there is a possibility that a flare is exempt from the majority of Rule 4311 and is used as a control device for a vapor controlled tank that is subject to Subpart OOOO. The District's Permits department already evaluates this NSPS on a case-by-case basis to ensure the relevant flares comply with these requirements. Adding these requirements into Rule 4311 would not achieve additional emissions reductions for this source category.

- Rule 4311 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1118 and BAAQMD Regulation 12 Rules 11 and 12. SMAQMD and VCAPCD do not have flare-specific prohibitory rules.
- The District has also analyzed Santa Barbara APCD Rule 359, and has found while it appears to include a performance standard restricting the use of flaring, it actually allows flaring under broad conditions, and the District's rule is at least as stringent.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-56 through 4-58 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the *2012 PM2.5 Plan*:
  - Additional Recordkeeping and Monitoring Practices: although additional recordkeeping and monitoring requirements are occasionally suggested, Rule 4311 already includes appropriate recordkeeping and monitoring. Additional recordkeeping and monitoring would not further reduce emissions.
  - See pages D-70 through D-73 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time. However, the District committed in the *2012 PM2.5 Plan* to conduct a further study in 2013 of submitted FMPs, annual reportable flaring event data, and annual monitoring report data to determine if there are any opportunities for additional emissions reductions. The District also recommends evaluating the new NSPS requirements for flares in greater detail during this further study. Because flares are a relatively small source of ozone precursor emissions, attempting to expedite this further study would not affect the Valley's projected 1-hour ozone attainment year.

C.2.2 RULE 4313 LIME KILNS

Applicability

This rule applies to the operation of lime kilns. The purpose of this rule is to limit emissions of NOx from this source category.

Summer Average Emission Inventory

Lime kilns are not included in the ARB emission inventory. There are no lime kilns currently operating in the Valley.

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2003 amendments to Rule 4313 on September 4, 2003 and deemed this rule as being at least as stringent as established RACT requirements: 68 FR 52510, http://www.gpo.gov/fdsys/pkg/FR-2003-09-04/pdf/03-22445.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are currently no lime kilns operating in the Valley. Any lime kilns beginning operation in the Valley in the future would be required to meet District BACT requirements, per District Rules 2201 (New and Modified Stationary Source Review Rule) and 4001 (New Source Performance Standards).

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP.* No feasible opportunities were identified. See pages 4-59 through 4-60 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan.* No feasible opportunities were identified. See page D-74 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

There are no lime kilns operating in the Valley and thus no emissions or emission reduction opportunities for this source category. Therefore, there are no recommendations for further regulatory action at this time.

C.2.3 RULE 4354 GLASS MELTING FURNACES

Applicability

This rule applies to any glass melting furnace. The purpose of this rule is to limit emissions of NOx, CO, VOC, SOx, and PM from these units.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	7.75	6.30	4.02	4.12	4.21	4.31	4.35	4.39	4.43	4.58	4.74
VOC	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4354 on January 31, 2013 and deemed this rule as being at least as stringent as established RACT requirements: 78 FR 6740, http://www.gpo.gov/fdsys/pkg/FR-2013-01-31/pdf/2013-02015.pdf
- Rule 4354 is at least as stringent as the applicable federal ACT, NESHAP, and MACT guidelines since the requirements have not been strengthened for these regulations since the Rule 4354 RACT approval. There are no EPA CTG or NSPS requirements for this source category.
- Rule 4354 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1117 and BAAQMD Regulation 9 Rule 12. There are no similar rules for SMAQMD or VCAPCD.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP.* No feasible opportunities were identified. See pages 4-69 through 4-72 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*. No feasible opportunities were identified. See pages D-75 through D-78 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.4 RULE 4641 CUTBACK, SLOW CURE, AND EMULSIFIED ASPHALT, PAVING, AND MAINTENANCE OPERATIONS

Applicability

This rule applies to the manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations. The purpose of this rule is to limit VOC emissions by restricting the application and manufacturing of certain types of asphalt for paving and maintenance operations.

Summary Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.75	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4641 on March 9, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 10690, http://www.gpo.gov/fdsys/pkg/FR-2010-03-09/pdf/2010-4967.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4641 is at least as stringent as the applicable federal CTG, the EPA Bluebook, and East Coast State's rules since the requirements have not been strengthened for these regulations since the Rule 4641 RACT approval. There are no applicable ACT, NSPS, MACT, or NESHAP requirements for this source category.
- Rule 4641 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1108, SCAQMD Rule 1108.1, BAAQMD Regulation 8 Rule 15, SMAQMD Rule 453, and VCAPCD Rule 74.4.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-275 through 4-280 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.5 RULE 4681 RUBBER TIRE MANUFACTURING

Applicability

This rule applies to rubber tire and recapping treadstock manufacturing facilities. The purpose of this rule is to limit emissions of VOC from these facilities.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1993 amendments to Rule 4681 on August 17, 1998 and deemed this rule as being at least as stringent as established the then established RACT requirements: 63 FR 43881, http://www.gpo.gov/fdsys/pkg/FR-1998-08-17/pdf/98-21900.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as satisfying RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- The District adopted a Negative Declaration on December 16, 2010 to satisfy Clean Air Act CTG RACT requirements for this source category. There are currently no rubber tire manufacturers operating in the Valley. Any rubber tire manufacturers beginning operation in the Valley in the future would be required to go beyond CTG RACT requirements and meet District BACT requirements, per District Rules 2201 (New and Modified Stationary Source Review Rule) and 4001 (New Source Performance Standards).

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified due to the fact that there are no sources in the Valley. See pages 4-330 through 4-337 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no facilities in the Valley and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.6 RULE 4682 POLYSTYRENE, POLYETHYLENE, AND POLYPROPYLENE PRODUCTS MANUFACTURING

Applicability

The provisions of this rule apply to any manufacturing, processing, and storage of products composed of polystyrene, polyethylene, or polypropylene. The purpose of this rule is to limit emissions of VOC, trichlorofluoromethane, and dichlorofluoromethane from this source category.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.39	0.31	0.32	0.32	0.33	0.33	0.34	0.34	0.35	0.36	0.37

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District’s regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4682 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4682 on September 20, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 58312, http://www.gpo.gov/fdsys/pkg/FR-2012-09-20/pdf/2012-21218.pdf
- Rule 4682 is at least as stringent as the applicable federal ACT for this source category, as this requirement has not been amended since Rule 4682’s RACT approval. There are two federal CTGs and an NSPS guideline that regulate the manufacturing of raw polystyrene, polyethylene, and polypropylene. The facilities subject to Rule 4682 use these raw materials in their manufacturing processes, but do not manufacture such material on site; as such, these regulations do not apply to this source category. There are also no applicable NESHAP or MACT guidelines for this source category.
- Rule 4682 is at least as stringent as other California air districts’ rules for similar sources, including: SCAQMD Rule 1175 and BAAQMD Regulation 8 Rule 52. There are no analogous rules for VCAPCD and SMAQMD.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-338 through 4-344 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.7 RULE 4684 POLYESTER RESIN OPERATIONS

Applicability

The provisions of this rule apply to commercial and industrial polyester resin operations, fiberglass boat manufacturing operations, and to the organic solvent cleaning and the storage and disposal of all solvents and waste solvent materials associated with such operations. The purpose of this rule is to reduce VOC emissions from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.25	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.24

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4684 on February 6, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 5709, http://www.gpo.gov/fdsys/pkg/FR-2012-02-06/pdf/2012-2599.pdf
- Rule 4684 is at least as stringent as the applicable federal CTGs, NESHAP, MACT requirements since the requirements have not been strengthened for these regulations since the Rule 4684 RACT approval. There are no ACT or NSPS requirements for this source category.
- Rule 4684 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1162, BAAQMD Regulation 8 Rule 50, SMAQMD Rule 465, and VCAPCD Rule 74.14.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-345 through 4-352 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- Rule 4684 was recently amended in 2011 to add new specialty coating categories, lower VOC limits, and raise control system effectiveness limits to match existing limits in other air districts. There were no additional feasible emission reduction opportunities that were identified at that time.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.8 RULE 4691 VEGETABLE OIL PROCESSING OPERATIONS

Applicability

This rule applies to facilities that extract oil from vegetable sources such as cottonseeds and corn. The purpose of this rule is to limit VOC emissions from vegetable oil processing operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.43	0.54	0.55	0.56	0.56	0.57	0.58	0.59	0.60	0.61	0.61

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the original 1991 District Rule 461.2 (Vegetable Oil Processing Operations), which subsequently became District Rule 4691, on January 18, 1994: 59 FR 2535, http://www.gpo.gov/fdsys/pkg/FR-1994-01-18/html/94-1059.htm
- The 1992 amendments to Rule 4691 were not submitted to EPA for SIP approval.
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, which included evaluation of Rule 4691: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4691 is at least as stringent as the applicable federal MACT standard. There are no other federal rules and regulations pertaining to vegetable oil processing operations.
- Rule 4691 is at least as stringent as BAAQMD Regulation 8 Rule 41, which is the only other comparable California air district that regulates this source.

Technology Evaluation

- The District evaluated this source category in the District's *2009 RACT SIP* and did not identify any further emission reduction opportunities. See pages 4-353 through 4-354 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.9 RULE 4694 WINE FERMENTATION AND STORAGE TANKS

Applicability

This rule applies to any winery fermenting and/or storing wine in bulk containers. The purpose of this rule is to limit emissions of VOC from the fermentation and bulk storage of wine, or achieve equivalent emission reductions from alternative emission sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	4.71	5.24	5.34	5.44	5.53	5.63	5.73	5.84	5.93	6.01	6.10

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 adoption of Rule 4694 on November 29, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 71109, http://www.gpo.gov/fdsys/pkg/FR-2012-11-29/pdf/2012-28826.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4694 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no applicable federal requirements, including: CTG, ACT, NSPS, NESHAP, and MACT.
- There are no state or local regulations for similar sources.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See page 4-361 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated two technologies for VOC control from active wine fermentation: a water scrubber-based system and a refrigerated condenser system. While demonstrations of the equipment have been conducted, they are not cost effective and cannot be considered RACT.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.2.10 RULE 4695 BRANDY AGING AND WINE AGING OPERATIONS

Applicability

This rule applies to brandy aging and wine aging operations. The purpose of this rule is to limit VOC emissions from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	6.66	7.41	7.55	7.69	7.83	7.98	8.12	8.28	8.42	8.54	8.66

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of Rule 4695 on August 4, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 47076, http://www.gpo.gov/fdsys/pkg/FR-2011-08-04/pdf/2011-19384.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no applicable federal requirements, including: CTG, ACT, NSPS, NESHAP, and MACT.
- There are no existing local regulations for similar sources in other air districts, including: SCAQMD, BAAQMD, VCAPCD, and SMAQMD.

Technology Evaluation

- The District evaluated seven potential emission reduction opportunities and technologies for this source category for the 2010 rule adoption. While five of the control technologies evaluated were determined to be either achieved in practice or feasible for meeting Rule 4695 requirements, the following control systems are either not technologically feasible or cost effective:
  - Emissions Capture System: brandy aging and wine aging operations are a continuous 24 hour/day operation throughout the year. As a result, it would be difficult and too expensive to continuously maintain the warehouse in a total enclosure status needed for an Emissions Capture System due to the ongoing requirements to transport the product into and out of the warehouse and for maintenance during which the warehouse must be opened or the control device must be shut down. The District does not consider an Emissions Capture System to be technologically feasible.

  - Catalytic Thermal Oxidation: catalytic thermal oxidation is technologically feasible for brandy and wine aging and a control efficiency of 98% is reasonably achievable. However, since catalysts are employed, these systems are subject to catalyst poisoning or deactivation due to operation upset. They may require periodic catalyst replacement, which represents a substantial operating cost. As a result, no systems are in place in the District and other control systems are easier to maintain and more cost effective to operate.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3 COATINGS AND SOLVENTS

The Coatings and Solvents control measure source category is one of the most diverse and far reaching categories in the District. Coating and solvent manufacture, distribution, and use affect almost every industry in the Valley as well as the general public. Coatings and solvents have many uses and are generally applied onto a surface of a substrate for protective, decorative, functional, or cleaning purposes. Coatings and solvents include, but are not limited to paints, thinners, varnishes, sealers, stains, ink, strippers, and cleaners. Coatings and solvents are of interest because as these products are applied, used, and dried, they off-gas VOC emissions. District prohibitory regulations set work practice standards and VOC content and emitting limitations for the sale, use, storage, and disposal of coatings and solvents in the Valley.

The ARB provides Suggested Control Measures (SCMs) for some categories of coatings and solvents. Clean Air Act Section 183(e) directs EPA to list for regulation those categories of products that account for at least 80 percent of the VOC emissions from consumer and commercial products; as such, the EPA also provides guidance documents affecting many coatings and solvents categories. These EPA guidance documents are called Control Techniques Guidelines (CTG). State and federal guidance documents act as model rules to assist air districts in setting standards for these sources. However, the development, adoption and enforcement of rules and regulations that control these emissions are the responsibility of the local air districts.

The control measure source categories under the Coatings and Solvents group affect several industries in the Valley, including but not limited to: architectural operations, motor vehicle maintenance and restoration operations, manufacturing processes, industrial processes, the graphic arts industry, aerospace assembly operations, industrial activities, and cleaning operations.

Regulatory Evaluation

The following is a list of rules specific to the Coatings and Solvents category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emission reductions.

Table C-5 Current Coatings and Solvents Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4601	Architectural Coatings	4/11/1991	12/17/2009	VOC
4602	Motor Vehicle Assembly Coatings	4/11/1991	9/17/2009	VOC
4603	Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts	4/11/1991	9/17/2009	VOC
4604	Can and Coil Coating Operations	4/11/1991	9/20/2007	VOC
4605	Aerospace Assembly and Component Coating Operations	12/19/1991	6/16/2011	VOC

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4606	Wood Products and Flat Wood Paneling Products Coating Operations	12/19/1991	10/16/2008	VOC
4607	Graphic Arts and Paper, Film, Foil, and Fabric Coatings	4/11/1991	12/18/2008	VOC
4610	Glass Coating Operations	5/16/2002	4/17/2003	VOC
4612	Motor Vehicle and Mobile Equipment Coating Operations	9/21/2006	10/21/2010	VOC
4652	Coatings and Ink Manufacturing	5/21/1992	12/17/1992	VOC
4653	Adhesives and Sealants	3/17/1994	9/16/2010	VOC
4661	Organic Solvents	5/21/1992	9/20/2007	VOC
4662	Organic Solvent Degreasing Operations	4/11/1991	9/20/2007	VOC
4663	Organic Solvent Cleaning, Storage, and Disposal	12/20/2001	9/20/2007	VOC
4672	Petroleum Solvent Dry Cleaning Operations	4/11/1991	12/17/1992	VOC

C.3.1 RULE 4601 ARCHITECTURAL COATINGS

Applicability

This rule applies to any person who supplies, sells, offers for sale, applies, or solicits the application of any architectural coating, or who manufactures, blends, or repackages any architectural coating for use within the District. The purpose of this rule is to limit VOC emissions from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	11.31	8.38	8.46	8.53	8.63	8.72	8.82	8.92	9.01	9.13	9.24

Regulatory Evaluation

EPA Approved	EPA Approval Year	Regulatory Actions Since EPA Approval:		
		Federal	State	Local
Yes	2011	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- Rule 4601 was evaluated in the *2009 RACT SIP* demonstration; however EPA's Technical Support Document for the partial approval/partial disapproval of the *2009 RACT SIP* states the rule is not subject to RACT because it is not a CTG category and it does not regulate major sources.
- EPA finalized approval of the 2009 amendments to Rule 4601 on November 8, 2011: 76 FR 69135, http://www.gpo.gov/fdsys/pkg/FR-2011-11-08/pdf/2011-28788.pdf
- There are no specific federal guidelines applying to this source category in terms of CTG, ACT, NSPS, MACT, and NESHAP.
- Rule 4601 is at least as stringent as the applicable ARB SCM for Architectural Coatings, promulgated in September 2007. ARB's adoption of the SCM established consistent VOC content standards for architectural coatings used in California based on multiple years of public processes, which included exhaustive research and collaborative efforts between ARB and coating manufacturers.
- Rule 4601 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 8 Rule 3, VCAPCD Rule 74.2, and SMAQMD Rule 442.
- SCAQMD amended Rule 1113 on June 3, 2011.
    - The amendment, effective January 2014, implements new limits for the dry fog, form release compounds, graphic arts, and metallic pigmented coatings categories; these limits go beyond SCM standards. Some of SCAQMD's coating limits are infeasible for the Valley due to the climate differences between the Valley and the SCAQMD region; these differences create freeze/thaw stability, safety, and performance standard

issues, as demonstrated in the Final Draft Staff Report for the 2010 rule amendments.

  - The aforementioned coating categories are very small subsection of the architectural coatings category and as such represent a small percentage of the emissions from the source category. As noted in Chapter 2, modeling for this and other ozone plans has shown that the Valley is NOx limited, especially in future years; as such, NOx reductions are most effective in reducing Valley ozone concentrations, whereas VOC reductions do not advance attainment.
  - The District will evaluate SCAQMD's new emission limits further during the development of the next ozone plan.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. The District recognized that some of the coatings limits in SCAQMD Rule 1113 were more stringent than some limits in District Rule 4601; however, the District was already planning a rule amendment project in late 2009 to fully evaluate these coating limits in the SCAQMD rule. During that rule project, as previously mentioned, the District determined that there are technological feasibility issues with implementing SCAQMD's more stringent limits in the Valley. Thus, in November 2011 EPA determined that Rule 4601 is as stringent as reasonably possible given the Valley's unique characteristics.
  - See pages 4-170 through 4-171 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time; however, the District recommends continuing efforts to evaluate potential opportunities for future emission reductions, as adopted in the SCAQMD rule, during the development of the next ozone plan.

C.3.2 RULE 4602 MOTOR VEHICLE ASSEMBLY COATINGS

Applicability

This rule is applicable to any person who applies VOC-containing coatings to new automobiles, light-duty trucks, heavier vehicles, and other parts coated along with these bodies or body parts during the assembly process and associated solvent cleaning activities. The purpose of this rule is to limit VOC emissions from motor vehicle assembly coating operations.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4612 (Motor Vehicle and Mobile Equipment Coating Operations).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2011	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2009 amendments to Rule 4602 on November 1, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 67369, http://www.gpo.gov/fdsys/pkg/FR-2011-11-01/pdf/2011-28251.pdf
- There are currently no motor vehicle assembly operations in the Valley. Any such facilities beginning operation in the Valley in the future would be required to meet District BACT requirements, per District Rules 2201 (New and Modified Stationary Source Review Rule) and 4001 (New Source Performance Standards).

Technology Evaluation

- Emission reduction technologies or practices have not been evaluated for this source category because there are no motor vehicle assembly operations in the Valley.

Recommendation

There are no motor vehicle assembly operations in the Valley and thus no emissions or emission reduction opportunities for this source category. Therefore, there are no recommendations for further regulatory action at this time.

C.3.3 RULE 4603 SURFACE COATING OF METAL PARTS AND PRODUCTS, PLASTIC PARTS AND PRODUCTS, AND PLEASURE CRAFTS

Applicability

The provisions of this rule apply to the surface coating of metal parts or products, large appliances' parts or products, metal furniture, plastic parts and products, and pleasure crafts, and to the organic solvent cleaning and storage and disposal of all solvents and waste solvent materials associated with such coatings. The purpose of this rule is to limit VOC emissions from these coatings.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.80	0.99	1.02	1.05	1.07	1.10	1.12	1.15	1.17	1.19	1.22

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2009 amendments to Rule 4603 on November 1, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 67369, http://www.gpo.gov/fdsys/pkg/FR-2011-11-01/pdf/2011-28251.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4603 is at least as stringent as the applicable federal CTG, ACT, NSPS, MACT, and NESHAP since the requirements have not been strengthened for these regulations since the Rule 4603 RACT approval.
- Rule 4603 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1136, SCAQMD Rule 1107, BAAQMD Regulation 8 Rule 14, BAAQMD Regulation 8 Rule 19, SMAQMD Rule 451, and VCAPCD Rule 74.12.
    - SMAQMD Rule 451 was amended in 2010, but the rule requirements are not more stringent than the requirements in Rule 4603.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. The District committed to incorporating new CTG requirements into the rule during a rule-amending project in September 2009. See pages 4-172 through 4-188 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.4 RULE 4604 CAN AND COIL COATING OPERATIONS

Applicability

This rule applies to can and coil coating operations and to organic solvent cleaning, storage, and disposal associated with can and coil coating operations. The purpose of this rule is to limit VOC emissions from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.30	0.34	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.39	0.40

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4604 on January 19, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 2796, http://www.gpo.gov/fdsys/pkg/FR-2010-01-19/pdf/2010-747.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4604 is at least as stringent as the applicable federal CTG, NSPS, and NESHAP, since the requirements have not been strengthened for these regulations since the Rule 4604 RACT approval. There are not any applicable MACT or ACT guidelines for this source category.
- Rule 4604 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1125, BAAQMD Regulation 8 Rule 11, and SMAQMD Rule 452. There is not a similar rule in VCAPCD.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-189 through 4-195 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- There are BACT guidelines that are more stringent than what is required in Rule 4604. However, these requirements are beyond RACT and not technologically feasible or cost effective for all sources applicable to Rule 4604. Also, given the relatively small emissions inventory for this source category, emissions reductions would be extremely minimal. These BACT guidelines do not represent feasible opportunities for this source category at this time.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.5 RULE 4605 AEROSPACE ASSEMBLY AND COMPONENT COATING OPERATIONS

Applicability

This rule applies to the manufacturing, assembling, coating, masking, bonding, paint stripping, surface cleaning, service, and maintenance of aerospace components; the cleanup of equipment; and the storage and disposal of solvents and waste solvent materials associated with these operations. The purpose of this rule is to limit the emissions of VOCs from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2011 amendments to Rule 4605 on November 16, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 70886, http://www.gpo.gov/fdsys/pkg/FR-2011-11-16/pdf/2011-29466.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4605 is at least as stringent as the applicable federal CTG, MACT, and NESHAP since the requirements have not been strengthened for these regulations since the Rule 4605 RACT approval. There are no applicable ACT or NSPS requirements.
- Rule 4605 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1124, BAAQMD Regulation 8 Rule 29, SMAQMD Rule 456, and VCAPCD Rule 74.13.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-196 through 4-205 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.6 RULE 4606 WOOD PRODUCTS AND FLAT WOOD PANELING PRODUCTS COATING OPERATIONS

Applicability

This rule applies to the application of coatings to wood products, including furniture, cabinets, flat wood paneling, and custom replica furniture. The rule also applies to the organic solvent cleaning, and the storage and disposal of all solvents and waste solvent materials associated with such coating operations. The purpose of this rule is to limit the emissions of VOCs from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	1.18	1.47	1.51	1.54	1.56	1.59	1.67	1.69	1.71	1.73	1.75

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2008 amendments to Rule 4606 on October 15, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 52894, http://www.gpo.gov/fdsys/pkg/FR-2009-10-15/pdf/E9-24687.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4606 is at least as stringent as the applicable federal CTG and NESHAP, since the requirements have not been strengthened for these regulations since the Rule 4606 RACT approval. There are no applicable ACT, MACT, or NSPS requirements.
- Rule 4606 was compared to other California air districts' rules for similar sources, including: SCAQMD Rule 1136, SCAQMD Rule 1104, BAAQMD Regulation 8 Rule 32, SMAQMD Rule 463, and VCAPCD Rule 74.30.
    - Rule 4606 is at least as stringent as the SCAQMD, SMAQMD and VCAPCD rules.
    - BAAQMD Regulation 8 Rule 32 was amended in 2009 after the *2009 RACT SIP* was compiled. BAAQMD Regulation 8 Rule 32 was amended to include VOC limits that go beyond RACT for "Custom and Contract Furniture". EPA's partial approval of the *2009 RACT SIP,* which includes Rule 4606, further demonstrates that the BAAQMD limits are beyond RACT.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-206 through 4-214 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.7 RULE 4607 GRAPHIC ARTS AND PAPER FILM, FOIL, AND FABRIC COATINGS

Applicability

This rule is applicable to graphic arts printing operations; digital printing operations; paper, film, foil, or fabric coating operations; and the organic solvent cleaning materials and processes associated with such operations. The purpose of this rule is to limit VOC emissions from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	4.69	5.30	5.40	5.50	5.59	5.69	5.79	5.89	5.98	6.08	6.18

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2008 amendments to Rule 4607 on October 15, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 52894, http://www.gpo.gov/fdsys/pkg/FR-2009-10-15/pdf/E9-24687.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4607 is at least as stringent as the applicable federal CTGs, NSPS, and NESHAP since the requirements have not been strengthened for these regulations since the Rule 4607 RACT approval. There are no applicable ACT or MACT requirements.
- Rule 4607 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1128, SCAQMD Rule 1130, SCAQMD Rule 1130.1, SCAQMD Rule 1171, BAAQMD Regulation 8 Rule 4, BAAQMD Regulation 8 Rule 12, BAAQMD Regulation 8 Rule 20, SMAQMD Rule 450, VCAPCD Rule 74.19, VCAPCD Rule 74.19.1, and VCAPCD Rule 74.3.
    - VCAPCD Rule 74.19 was amended in 2011, but is not more stringent than District Rule 4607.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-215 through 4-233 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.8 RULE 4610 GLASS COATING OPERATIONS

Applicability

The requirements of this rule apply to any major source that coats glass products with VOC-containing materials. The purpose of this rule is to limit the emissions of VOCs from the coating of glass products.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4354 (Glass Melting Furnaces).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2003 amendments to Rule 4610 on October 14, 2004 and deemed this rule as being at least as stringent as established RACT requirements: 69 FR 60962, http://www.gpo.gov/fdsys/pkg/FR-2004-10-14/pdf/04-22956.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no applicable federal requirements for this source category, including CTG, ACT, NSPS, NESHAP, or MACT requirements.
- Rule 4610 was compared to other California air districts' rules for similar sources, including: SCAQMD Rule 1145 and BAAQMD Regulation 8 Rule 4.
  - Rule 4610 is at least as stringent as BAAQMD Regulation 8 Rule 4. SMAQMD and VCAPCD do not have comparable rules.
  - SCAQMD Rule 1145 was amended after the *2009 RACT SIP* was compiled. SCAQMD adopted VOC limits in Rule 1145 that go beyond RACT for one-component, two-component, optical, and mirror backed roll coatings. EPA's partial approval of the *2009 RACT SIP*, which includes Rule 4610, further demonstrates that the SCAQMD limits are beyond RACT.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-234 through 4-237 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- There are only two glass coating operations in the District, and neither emits enough VOCs to be considered a major source.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.9 RULE 4612 MOTOR VEHICLE AND MOBILE EQUIPMENT COATING OPERATIONS

Applicability

This rule applies to any person who supplies, sells, offers for sale, manufactures, or distributes any automotive coating for use within the District, as well as any person who uses, applies, or solicits the use or application of any automotive coating within the District. The purpose of this rule is to limit VOC emissions from coatings of motor vehicles, mobile equipment, and associated parts and components, and associated organic solvent cleaning, storage, and disposal.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	2.10	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.65	1.66	1.67

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2010 amendments to Rule 4612 on February 13, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 7536, http://www.gpo.gov/fdsys/pkg/FR-2012-02-13/pdf/2012-3172.pdf
- Rule 4612 is at least as stringent as the applicable federal CTG, ACT, MACT, NESHAP, and NSPS since the requirements have not been strengthened for these regulations since the Rule 4612 RACT approval.
- Rule 4612 is at least as stringent as ARB's SCM for Automotive Coatings since the requirements have not been strengthened or amended since the Rule 4612 RACT approval.
- Rule 4612 was compared to other California air districts' rules for similar sources, including: SCAQMD Rule 1151, BAAQMD Regulation 8 Rule 45, SMAQMD Rule 459, and VCAPCD Rule 74.18.
    - Rule 4612 is as stringent as or more stringent than SMAQMD Rule 459 and VCAPCD Rule 74.18.
    - SCAQMD Rule 1151 and BAAQMD Regulation 8 Rule 45 were last amended before the *2009 RACT SIP* was compiled. These rules contain VOC limits that go beyond RACT for two categories (Pre-Coat and Topcoat–Metallic/Iridescent). EPA's partial approval of the *2009 RACT*

SIP, which includes Rule 4612, further demonstrates that the SCAQMD and BAAQMD limits are beyond RACT.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-238 through 4-244 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated potential emission reduction opportunities for this source category during the 2010 amendment of Rule 4612. These opportunities focused on potential incentive funding for operators, since the VOC content limits and solvent cleaning provisions were already at least as stringent as federal and state requirements. The District assessment concluded that incentive funding was not available, and most users had already switched to water-base coatings. Thus, the 2010 amendment fulfilled a commitment in the *2007 Ozone Plan* to remove redundant language and clarify the intent of the rule.
- Review of the BAAQMD and SCAQMD BACT requirements revealed technologies that may be more stringent than some components of Rule 4612; however, these technologies may not be cost effective or technologically feasible for facilities subject to Rule 4612. Overall, Rule 4612 meets RACT and is generally as stringent as other air districts' rules and guidelines.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.10 RULE 4652 COATINGS AND INK MANUFACTURING

Applicability

The provisions of this rule apply to all coatings and ink manufacturing operations. The purpose of this rule is to limit VOC emissions from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Regulatory Evaluation

EPA Approved*	EPA Approval Year	Regulatory Actions Since EPA Approval:		
		Federal	State	Local
N/A	N/A	No	No	No

*EPA never acted on this rule. It has not been approved or disapproved.

The District's regulatory evaluation summary table above is based on the following assessment:

- Rule 4652 was evaluated in the *2009 RACT SIP* demonstration; however EPA's Technical Support Document for the partial approval/partial disapproval of the *2009 RACT SIP* states the rule is not subject to RACT because it is not a CTG category and it does not regulate major sources.
- There are no applicable federal CTG, ACT, NESHAP, MACT, or NSPS requirements.
- Rule 4652 is at least as stringent as SCAQMD Rule 1141.1. VCAPCD does not have a rule applicable to this source category. There are some VOC limits in which BAAQMD Regulation 8 Rule 35 and SMAQMD Rule 46 differ in stringency in comparison to District Rule 4652. However, the difference in overall emission reductions on a mass basis is insignificant; the emissions from this source category are VOCs, the emission inventory is small, and there are few facilities in the District subject to this rule. The Valley is not sensitive to additional VOC emission reductions; reducing emissions from this small emission source would not expedite attainment of the revoked ozone standard.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-304 through 4-307 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

This source category is not subject to RACT, and as described above, there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.11 RULE 4653 ADHESIVES AND SEALANTS

Applicability

This rule is applicable to any person who supplies, sells, offers for sale, or applies any adhesive product, sealant product, or associated solvent, used within the District. The purpose of this rule is to reduce emissions of VOCs from these operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.65	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2010 amendments to Rule 4653 on February 13, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 7536, http://www.gpo.gov/fdsys/pkg/FR-2012-02-13/pdf/2012-3172.pdf
- Rule 4653 is at least as stringent as the applicable federal CTG, as the requirements have not been strengthened for this regulation since the Rule 4653 RACT approval. There are no applicable ACT, NSPS, NESHAP or MACT guidelines for this source category.
- Rule 4653 is at least as stringent as the applicable state guidelines, including ARB's RACT/Best Available Retrofit Control Technology (BARCT) guidance titled, "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Adhesives and Sealants."
- Rule 4653 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1168, BAAQMD Regulation 8 Rule 51, SMAQMD Rule 460, and VCAPCD Rule 74.20.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP* and recognized that Rule 4653 was less stringent in some categories when compared to other air districts' rules and the applicable federal CTG. The rule was already scheduled for revision in 2009 under the *2008 Ozone Plan* so the District evaluated the potential emission reduction opportunities further at that time. See pages 4-308 through 4-313 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- The District BACT VOC content limit for corrugated box gluers is more stringent than the respective limit in Rule 4653. Lowering the limit is not a feasible opportunity at this time because:
    - Rule 4653 already aligns with other air districts' rules and federal regulations to implement RACT.
    - The BACT guideline applies to a small subset of sources within the "contact adhesives" category in Rule 4653 and thus a small portion of the emissions inventory for this source category.
    - Lowering the VOC content limit for the entire "contact adhesives" category is unreasonable since each facility, even amongst the corrugated box gluers, has unique operating parameters and performance specifications for the respective product being produced. Different corrugated box applications could vary the VOC content needed from the adhesive to produce a satisfactory product.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.12 RULE 4661 ORGANIC SOLVENTS

Applicability

This rule applies to any source operation that uses organic solvents, unless the source operation is exempted under Section 4.0 of the rule (generally, the manufacture or transport of organic solvents or any source operation that is subject to or exempted by another District rule). The purpose of this rule is to limit VOC emissions from the use of organic solvents.

Summer Average Emission Inventory

Rule 4661 establishes limits for the use of organic solvents, however their emissions are represented in the rules that regulate their use; Rule 4662 (Organic Solvent Degreasing Operations) and Rule 4663 Organic Solvent Cleaning, Storage, and Disposal).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4661 on May 5, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 24406, http://www.gpo.gov/fdsys/pkg/FR-2010-05-05/pdf/2010-10402.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4661 is at least as stringent as the applicable federal CTGs, ACTs and NESHAP, since the requirements have not been strengthened for these regulations since the Rule 4661 RACT approval. There are no applicable NSPS requirements for this source category.
- Rule 4661 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1171, BAAQMD Regulation 8 Rule 11, and SMAQMD Rule 441. VCAPCD does not have a comparable rule.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-314 through 4-316 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.13 RULE 4662 ORGANIC SOLVENTS DEGREASING OPERATIONS

Applicability

This rule applies to all organic solvent degreasing operations. The purpose of this rule is to limit VOC emissions and hazardous air pollutant emissions from these operations.

Summary Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	1.06	1.06	1.06	1.06	1.07	1.07	1.07	1.07	1.07	1.07	1.08

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4662 on July 30, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 37948, http://www.gpo.gov/fdsys/pkg/FR-2009-07-30/pdf/E9-18001.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4662 is at least as stringent as the applicable federal CTG (1977) since the requirements have not been strengthened for this regulation since the Rule 4662 RACT approval. There are no applicable ACT, NSPS, NESHAP, or MACT requirements for this source category.
- Rule 4662 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1122, SMAQMD Rule 454, and VCAPCD Rule 74.6. BAAQMD does not have a rule that specifically covers organic solvent degreasing operations, but conveyorized solvent cleaner requirements are included in Regulation 8, Rule 16 (Solvent Cleaning Operations); Rule 4662 is at least as stringent as these requirements.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-317 through 4-319 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- Review of the District's and EPA's BACT databases revealed technologies that may be more stringent than some components of Rule 4662; however, these requirements are not cost effective and technologically feasible for all facilities subject to Rule 4662. Overall, Rule 4662 meets RACT and is generally as stringent as other air districts' and EPA's rules and guidelines.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.14 RULE 4663 ORGANIC SOLVENT CLEANING, STORAGE, AND DISPOSAL

Applicability

This rule applies to organic solvent cleaning performed outside a degreaser during the production, repair, maintenance, or servicing of parts, products, tools, machinery, equipment, or in general work areas at stationary sources. This rule also applies to the storage and disposal of all solvents and waste solvent materials at stationary sources. The purpose of this rule is to limit VOC emissions from these processes.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.58	0.68	0.69	0.71	0.72	0.73	0.75	0.76	0.78	0.79	0.80

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4663 on July 30, 2009 and deemed this rule as being at least as stringent as established RACT requirements: FR 74 37948, http://www.gpo.gov/fdsys/pkg/FR-2009-07-30/pdf/E9-18001.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4663 is more stringent than the most recent applicable federal CTGs and ACTs. There are no applicable NSPS, NESHAP, or MACT requirements for this source category.
- Rule 4663 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1171, BAAQMD Regulation 8 Rule 16, and SMAQMD Rule 441. VCAPCD does not have a comparable rule.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-320 through 4-322 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.3.15 RULE 4672 PETROLEUM SOLVENT DRY CLEANING OPERATIONS

Applicability

This rule applies to petroleum solvent washers, dryers, solvent filters, settling tanks, vacuum stills, and other containers and conveyors of petroleum solvents used in petroleum solvent dry cleaning facilities. The purpose of this rule is to limit VOC emissions from petroleum solvent dry cleaning operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4672 on March 9, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 10690, http://www.gpo.gov/fdsys/pkg/FR-2010-03-09/pdf/2010-4967.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4672 is at least as stringent as the applicable federal NSPS since the requirements have not been strengthened for these regulations since the Rule 4672 RACT approval. There are no applicable CTG, ACT, NESHAP, or MACT requirements for this source category.
- Rule 4672 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1102, BAAQMD Regulation 8 Rule 17, SMAQMD Rule 444, and VCAPCD Rule 74.5.1.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-323 through 4-329 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4 OIL AND GAS

The Oil and Gas industry has been operating in the Valley since before the commencement of the District. This category includes the processes of extraction, processing, refining, transferring, and storing of petroleum products. Petroleum products are vital to many industries in the Valley, as the products are largely used as fuel and energy sources. Additionally, the production, distribution, refining, and retailing of petroleum contribute to the economy of the Valley, particularly in the South Valley.

The District enforces some of the toughest regulations in the nation on this industry, and they have responded by implementing successful control strategies and significantly reducing emissions from their processes over the last two decades. Establishing effective emission reduction strategies for oil and gas operations continues to be a key component of the District's strategy to reduce emissions and achieve federal air quality standards whilst maintaining the vitality of the industry in the Valley.

The Oil and Gas control measure source categories affect several industries in the Valley including but not limited to: oil and gas production, petroleum refining, petroleum production and marketing, and gasoline transfer and dispensing.

Regulatory Evaluation

The following is a list of rules specific to the Oil and Gas category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emission reductions.

Table C-6 Current Oil and Gas Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4401	Steam-Enhanced Crude Oil Production Wells	4/11/1991	6/16/2011	VOC
4402	Crude Oil Production Sumps	4/11/1991	12/15/2011	VOC
4404	Heavy Oil Test Station— Kern County	5/21/1992	12/17/1992	VOC
4407	In-Situ Combustion Well Vents	5/19/1994	n/a	VOC
4408	Glycol Dehydration Systems	12/19/2002	n/a	VOC
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	4/20/2005	n/a	VOC
4453	Refinery Vacuum Producing Devices or Systems	5/21/1992	12/17/1992	VOC
4454	Refinery Process Unit Turnaround	5/21/1992	12/17/1992	VOC
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	4/20/2005	n/a	VOC

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4621	Gasoline Transfer Into Stationary Storage Containers, Delivery Vessels, and Bulk Plants	4/11/1991	12/20/2007	VOC
4622	Gasoline Transfer Into Motor Vehicle Fuel Tanks	5/21/1992	12/20/2007	VOC
4623	Storage of Organic Liquids	4/11/1991	5/19/2005	VOC
4624	Transfer of Organic Liquid	4/11/1991	12/20/2007	VOC

C.4.1 RULE 4401 STEAM-ENHANCED CRUDE OIL PRODUCTION WELLS

Applicability

This rule applies to all steam-enhanced crude oil production wells and any associated VOC collection and control systems. The purpose of this rule is to limit VOC emissions from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	12.84	11.10	10.86	10.62	10.39	10.16	9.93	9.71	9.50	9.29	9.09

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2011	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2011 amendments to Rule 4401 on November 16, 2011 and deemed this rule as being at least as stringent as established RACT requirements: 76 FR 70886, http://www.gpo.gov/fdsys/pkg/FR-2011-11-16/pdf/2011-29466.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no CTG, ACT, NSPS, NESHAP, or MACT guidelines applicable to steam-enhanced crude oil production wells.
- Rule 4401 is at least as stringent as other California air districts' rules for similar sources, including SCAQMD Rule 1148. BAAQMD, SMAQMD, and VCAPCD do not have a prohibitory rule that covers the same emission source category.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-73 through 4-75 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.2 RULE 4402 CRUDE OIL PRODUCTION SUMPS

Applicability

This rule applies to all first, second, and third stage sumps at facilities producing, gathering, separating, processing, and/or storing crude oil in an oil field. The purpose of this rule is to limit VOC emissions from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	2.53	2.19	2.14	2.09	2.05	2.00	1.96	1.91	1.87	1.83	1.79

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4402 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4402 on October 22, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 64427, http://www.gpo.gov/fdsys/pkg/FR-2012-10-22/pdf/2012-25810.pdf
- There are no applicable federal CTG, ACT, NSPS, NESHAP, or MACT requirements for sumps.
- Rule 4402 is at least as stringent as other California air districts' rules for similar sources, including: VCAPCD Rule 71.4 and Santa Barbara County Air Pollution Control District (SBCAPCD) Rule 344. SCAQMD, BAAQMD, and SMAQMD do not have a comparable rule.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-76 through 4-79 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.3 RULE 4404 HEAVY OIL TEST STATION—KERN COUNTY

Applicability

This rule applies to the operation of heavy oil test stations with tanks that vent directly to the atmosphere. The purpose of this rule is to limit VOC emissions from the operation of heavy oil test stations (HOTS).

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.25	0.21	0.21	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.17

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4404 on March 9, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 10690, http://www.gpo.gov/fdsys/pkg/FR-2010-03-09/pdf/2010-4967.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no federal rules and regulations pertaining to HOTS, including CTG, ACT, NSPS, NESHAP, and MACT requirements.
- There are no other California air districts' rules pertaining to HOTS.
- There are no atmospheric HOTS in the Valley. All HOTS operations now employ pressure vessels that do not vent to the atmosphere, and such vessels are exempt from District permitting per section 6.13 of District Rule 2020.

Technology Evaluation

- The District evaluated this source category in the District's *2009 RACT SIP*. No feasible opportunities for emission reductions were identified since no HOTS operate in the Valley. See pages 4-80 through 4-81 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no atmospheric HOTS operating in the Valley and thus no emissions or emission reduction opportunities for this category exist. Therefore, there are no recommendations for further regulatory action at this time.

C.4.4 RULE 4407 IN-SITU COMBUSTION WELL VENTS

Applicability

This rule applies to all crude oil production wells where production has been enhanced by in-situ combustion. The purpose of this rule is to implement federally enforceable VOC emission limitations for in-situ combustion well vents.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4401 (Steam-Enhanced Crude Oil Production Wells).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1994 amendments to Rule 4407 on March 6, 1995 and deemed this rule as being at least as stringent as established RACT requirements: 60 FR 12121, http://www.gpo.gov/fdsys/pkg/FR-1995-03-06/pdf/95-5342.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no in-situ combustion well vents operating in the Valley. Any facility beginning use of such activity would be required to meet District BACT requirements, per District Rules 2201 (New and Modified Stationary Source Review Rule) and 4001 (New Source Performance Standards).

Technology Evaluation

- The District evaluated this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified since no units operate in the Valley. See pages 4-82 through 4-83 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no in-situ combustion well vents operating in the Valley and thus no emissions or emission reduction opportunities for this category exist. Therefore, there are no recommendations for further regulatory action at this time.

C.4.5 RULE 4408 GLYCOL DEHYDRATION SYSTEMS

Applicability

This rule applies to any glycol dehydration system with a glycol dehydration vent that is subject to permitting requirements pursuant to Regulation II (Permits). The purpose of this rule is to limit VOC emissions from these sources.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2002 amendments to Rule 4408 on August 26, 2003 and deemed this rule as being at least as stringent as established RACT requirements: 68 FR 51187, http://www.gpo.gov/fdsys/pkg/FR-2003-08-26/pdf/03-21584.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4408 is more stringent than the applicable federal NESHAP since Rule 4408 requires controls on systems producing much smaller flow rates than the NESHAP threshold. The requirements have not been strengthened for this regulation since the Rule 4408 RACT approval. There are no applicable CTG, ACT, or NSPS guidelines.
- Rule 4408 is at least as stringent as VCAPCD 71.5. No other California air district has a comparable rule for similar sources.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-84 through 4-85 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.6 RULE 4409 COMPONENTS AT LIGHT CRUDE OIL PRODUCTION FACILITIES, NATURAL GAS PRODUCTION FACILITIES, AND NATURAL GAS PROCESSING FACILITIES

Applicability

This rule applies to components containing or contacting VOC streams at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities. The purpose of this rule is to limit VOC emissions from leaking components at these facilities.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
VOC	9.27	8.01	7.83	7.66	7.49	7.33	7.17	7.01	6.85	6.70	6.56

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	Yes	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 adoption of Rule 4409 on March 23, 2006 and deemed this rule as being at least as stringent as established RACT requirements: 71 FR 14652, http://www.gpo.gov/fdsys/pkg/FR-2006-03-23/pdf/06-2814.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4409 is at least as stringent as the applicable federal CTG document (EPA-450/3-83-007 "Control of Volatile Organic Compound Equipment Leaks from Natural Gas/Gasoline Processing Plants," dated December 1983) since the requirements have not been strengthened for this regulation since the Rule 4409 RACT approval. Federal NSPS (40 CFR 60 Subpart OOOO—Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution) and MACT (40 CFR 63 Subpart HH—National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities) guidelines were updated in 2012, after Rule 4409's RACT approval, but no new provisions are more stringent than this rule. There are no federal ACT requirements for this source category.

- Rule 4409 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 8 Rule 18 (Equipment Leaks), BAAQMD Regulation 8 Rule 22 (Valves and Flanges at Chemical Plants), BAAQMD Regulation 8 Rule 28 (Episodic Releases From Pressure Relief Devices at Petroleum Refineries and Chemical Plants), SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants), VCAPCD Rule 74.7 (Fugitive Emissions of Reactive Organic Compounds at Petroleum Refineries and Chemical Plants), and VCAPCD Rule 74.10 (Components at Crude Oil and Natural Gas Production and Processing Facilities). SMAQMD has no rule for this source category.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See pages 4-86 through 4-87 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- Santa Barbara County Air Pollution Control District issued an Authority to Construct permit for proposed leak detection and repair thresholds lower than the thresholds required by Rule 4409. These proposed threshold levels exceed RACT requirements and have not proven to be technologically feasible for facilities in the Valley. Thus, lowering the thresholds is not a feasible opportunity at this time and the District does not recommend pursuing these limits for Rule 4409.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.7 RULE 4453 REFINERY VACUUM PRODUCING DEVICES OR SYSTEMS

Applicability

This rule applies to any vacuum producing device or system, including hot wells and accumulators installed in a refinery operation. The purpose of this rule is to limit VOC emissions from refinery vacuum producing devices or systems.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4453 on September 23, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 57862, http://www.gpo.gov/fdsys/pkg/FR-2010-09-23/pdf/2010-23808.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4453 is at least as stringent as the applicable federal CTG since the requirements have not been strengthened for this regulation since the Rule 4453 RACT approval. There are no applicable ACT, NSPS, NESHAP, or MACT guidelines for this source category.
- Rule 4453 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD 465, BAAQMD Regulation 8 Rule 9, and VCAPCD Rule 74.8. SMAQMD does not have a comparable rule for this source category.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-88 through 4-90 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.8 RULE 4454 REFINERY PROCESS UNIT TURNAROUND

Applicability

This rule applies to any refinery vessel containing VOCs, unless exempted. The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround.

Summer Average Emission Inventory

The emissions from this rule are accounted for in the discussion for Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities).

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1992 amendments to Rule 4454 on September 23, 2010 and deemed this rule as being at least as stringent as established RACT requirements: 75 FR 57862, http://www.gpo.gov/fdsys/pkg/FR-2010-09-23/pdf/2010-23808.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4454 is at least as stringent as the applicable federal CTG since the requirements have not been strengthened for this regulation since the Rule 4454 RACT approval. The applicable MACT guideline was amended in 2010; however, the amendments did not implement any requirements more stringent than what is required in Rule 4454. There are no federal ACT or NSPS requirements for this source category.
- Rule 4454 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1123, BAAQMD Regulation 8 Rule 10, and VCAPCD Rule 74.8. SMAQMD has no rule for this source category.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-91 through 4-93 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.9 RULE 4455 COMPONENTS AT PETROLEUM REFINERIES, GAS LIQUIDS PROCESSING FACILITIES, AND CHEMICAL PLANTS

Applicability

This rule applies to components containing or contacting VOC at petroleum refineries, gas liquid processing facilities, and chemical plants. The purpose of this rule is to limit VOC emissions from leaking components at these facilities.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	Yes	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 adoption of Rule 4455 on March 23, 2006 and deemed this rule as being at least as stringent as established RACT requirements: 71 FR 14652, http://www.gpo.gov/fdsys/pkg/FR-2006-03-23/pdf/06-2814.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4455 is at least as stringent as the applicable federal CTG document (EPA-450/3-83-007 "Control of Volatile Organic Compound Equipment Leaks from Natural Gas/Gasoline Processing Plants," dated December 1983), since the requirements have not been strengthened for this regulation since the Rule 4455 RACT approval. Federal NSPS (40 CFR 60 Subpart OOOO—Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution) and MACT guidelines (40 CFR 63 Subpart HH—National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities) were updated in 2012, after Rule 4455's RACT approval, but no new provisions are more stringent than this rule. There are no federal ACT requirements for this source category.

- Rule 4455 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 8 Rule 18 (Equipment Leaks), BAAQMD Regulation 8 Rule 22 (Valves and Flanges at Chemical Plants), BAAQMD Regulation 8 Rule 28 (Episodic Releases From Pressure Relief Devices at Petroleum Refineries and Chemical Plants), SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants), VCAPCD Rule 74.7 (Fugitive Emissions of Reactive Organic Compounds at Petroleum Refineries and Chemical Plants), and VCAPCD Rule 74.10 (Components at Crude Oil and Natural Gas Production and Processing Facilities). SMAQMD has no rule for this source category.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See pages 4-94 through 4-95 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.10 RULE 4621 GASOLINE TRANSFER INTO STATIONARY STORAGE CONTAINERS, DELIVERY VESSELS, AND BULK PLANTS

Applicability

Rule 4621 applies to all operations that transfer gasoline between delivery vessels and storage containers and loading racks that are used to load organic liquids with a True Vapor Pressure of 1.5 psia or greater. The purpose of this rule is to limit VOC emissions from stationary storage containers, delivery vessels, and bulk plants.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	2.45	2.75	2.80	2.86	2.92	2.98	3.04	3.10	3.16	3.22	3.28

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4621 on October 30, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 56120, http://www.gpo.gov/fdsys/pkg/FR-2009-10-30/pdf/E9-26178.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4621 is at least as stringent as the applicable federal CTGs and ACT since the requirements have not been strengthened for these regulations since the Rule 4621 RACT approval. There are no applicable NSPS, NESHAP, or MACT requirements.
- Rule 4621 aligns with ARB's certified Phase I Vapor Recovery System requirements.
- Rule 4621 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 8 Rule 7, BAAQMD Regulation 8 Rule 39, and Ventura County APCD Rule 70.
    - SMAQMD Rule 448 was amended in February 2009. The amendment required the vapor recovery system to prevent emission of at least 98%, by weight, of the gasoline vapors displaced from the storage container during the transfer of gasoline into the container. This is consistent with the District's rule.
    - SCAQMD Rule 461 was recently amended in April 2012. The amendment provides non-retail facilities that meet certain conditions and have fleets with 100% On-board Refueling Vapor Recovery with an alternate way to

comply in lieu of installing Phase II Enhanced Vapor Recovery systems certified by the ARB. The amendments also removed temporary exemptions for dispensing of E-85 fuel (85% ethanol and 15% gasoline) by deleting the definitions and aligning requirements with ARB's Executive Orders for gasoline.

  - The District is currently in amending Rule 4621 through a public workshop process, with proposed amendments expected to be taken to the Governing Board for public hearing and adoption in December 2013. Proposed amendments will make it at least as stringent as SCAQMD Rule 461.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-245 through 4-251 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no additional feasible emission reduction opportunities at this time.

C.4.11 RULE 4622 GASOLINE TRANSFER INTO MOTOR VEHICLE FUEL TANKS

Applicability

This rule applies to any gasoline storage and dispensing operation or mobile fueler from which gasoline is transferred into motor vehicle fuel tanks. The purpose of this rule is to limit emissions of gasoline vapors from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	1.84	2.07	2.11	2.16	2.20	2.24	2.29	2.33	2.38	2.42	2.47

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4622 on October 30, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 56120, http://www.gpo.gov/fdsys/pkg/FR-2009-10-30/pdf/E9-26178.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4622 is at least as stringent as the applicable federal NESHAP requirements (40 CFR Subpart 63 CCCCCC (National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities)) amended in 2011 and CTG (EPA-450/2-78-051, Control of Volatile Organic Compound Leaks from Gasoline Tank Trucks and Vapor Collection Systems) since the requirements have not been strengthened for these regulations since the Rule 4622 RACT approval. There are no applicable ACT, NSPS, or MACT requirements for this source category.
- Rule 4622 is at least as stringent as other California air districts' rules for similar sources, including: BAAQMD Regulation 8 Rule 7 (Gasoline Dispensing Facilities) and VCAPCD Rule 70 (Storage and Transfer of Gasoline).

  - SCAQMD Rule 461 (Gasoline Transfer and Dispensing) was amended in April 2012 to provide non-retail facilities that meet certain conditions and have fleets with 100% On-board Refueling Vapor Recovery with an alternate way to comply in lieu of installing Phase II Enhanced Vapor Recovery systems certified by ARB. The amendments also removed temporary exemptions for dispensing of E-85 fuel (85% ethanol and 15% gasoline) and clarified reporting requirements.
  - SMAQMD Rule 449 (Transfer of Gasoline into Vehicle Fuel Tanks) was amended in February 2009 to make the rule consistent with ARB's Enhanced Vapor Recovery regulations. The amendments also provided an exemption from Phase II vapor recovery requirements for the dispensing of E-85 fuel into flexible fuel vehicles and for non-retail gasoline dispensing facilities in which 100% of the vehicles refueled are equipped with On-board Refueling Vapor Recovery.
  - The District is currently in amending Rule 4622 through a public workshop process, with proposed amendments expected to be taken to the Governing Board for public hearing and adoption in December 2013. Proposed amendments to Rule 4622 will make it consistent with the requirements in SCAQMD Rule 461 and SMAQMD Rule 449.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See page 4-252 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

There are no additional feasible emission reduction opportunities at this time.

C.4.12 RULE 4623 STORAGE OF ORGANIC LIQUIDS

Applicability

This rule applies to any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored. The purpose of this rule is to limit VOC emissions from the storage of organic liquids.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
VOC	3.02	2.68	2.63	2.58	2.54	2.49	2.45	2.40	2.36	2.32	2.28

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 amendments to Rule 4623 on September 13, 2005 and deemed this rule as being at least as stringent as established RACT requirements: 70 FR 53936, http://www.gpo.gov/fdsys/pkg/FR-2005-09-13/pdf/05-18019.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4623 is at least as stringent as the applicable federal ACT (EPA 453/R-94-001 "Alternative Control Techniques Document for Volatile Organic Liquid Storage in Floating and Fixed Roof Tanks," dated January 1994) and CTGs (EPA-450/2-77-036 "Control Techniques Guideline Document for Control of Volatile Organic Emissions from Storage of Petroleum Liquids in Fixed Roof Tanks," dated December 1977 & EPA-450/2-78-047 "Control Techniques Guideline Document for Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks," dated December 1978) since the requirements have not been strengthened for these regulations since the Rule 4623 RACT approval.
- NSPS Requirements:
    - NSPS subpart Kb (a)(3)(i) requires a 500 ppmv leak detection limit for vapor control systems, which is lower than the current limit in Rule 4623. However, the District's oil field tanks, which make up the majority of this source category, are exempt from this NSPS requirement because Valley oil field tanks are located upstream of the custody transfer (locations where physical substances are transported from one operator to another). While there are a couple of tanks at Valley petroleum refineries that would

    be subject to subpart Kb, these facilities would already be required to comply with the NSPS requirements if they performed a major modification to their facility. As such, lowering the limit would not generate additional emission reductions.
    - In March 2013 EPA proposed amendments to the NSPS for storage tanks used in crude oil and natural gas production. These amendments are intended to facilitate compliance with the standards and clarify requirements. The District will evaluate any changes to the NSPS following EPA's final approval later this year further during the development of the next ozone plan.
- There are no applicable NESHAP or MACT guidelines.
- Rule 4623 is at least as stringent as other California air districts' rules for similar sources, including: VCAPCD Rule 71.2 (Storage of Reactive Organic Compound Liquids) and BAAQMD Regulation 8 Rule 5 (Storage of Organic Liquids). SMAQMD does not have a regulation applicable to this source category.
    - South Coast Rule 463 (Organic Liquid Storage) was amended in November 2011 to allow alternative test methods to demonstrate compliance with vapor pressure standards. The rule amendment also updated the vapor tightness definition to align with SCAQMD Rule 1178 (Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities), which in turn lowered the leak detection limit to match the NSPS limit of 500 ppmv. The SCAQMD region has more sources that would be applicable to NSPS subpart Kb, as there are much more and much larger petroleum refineries than the Valley. As discussed above, lowering the leak detection limit to match NSPS subpart Kb requirements would not generate additional emission reductions for the Valley. Also, as evidenced by EPA's January 2012 approval of Rule 4623, this leak detection limit of 500 ppmv is beyond RACT.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See pages 4-253 through 4-254 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- There are a couple District BACT standards more stringent than what is currently required in Rule 4623; however, additional add-on controls are beyond RACT and not technologically feasible and cost effective for all facilities subject to Rule 4623. In addition, Rule 4623 is already so stringent that the additional emission reductions from additional controls would be minimal. These BACT requirements do not represent feasible opportunities at this time.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.4.13 RULE 4624 TRANSFER OF ORGANIC LIQUID

Applicability

This rule applies to organic liquid transfer facilities. The purpose of this rule is to limit VOC emissions from the transfer of organic liquids.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
VOC	1.14	1.18	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4624 on October 15, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 52894, http://www.gpo.gov/fdsys/pkg/FR-2009-10-15/pdf/E9-24687.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4624 is at least as stringent as the applicable federal CTG, NSPS, NESHAP, and MACT since the requirements have not been strengthened for these regulations since the Rule 4624 RACT approval. There are no ACT requirements for this source category.
- Rule 4624 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 462, SCAQMD Rule 1142, BAAQMD Regulation 8 Rule 6, BAAQMD Regulation 8 Rule 39, VCAPCD Rule 70, VCAPCD Rule 71.3, and SMAQMD Rule 447.
    - BAAQMD Regulation 8 Rule 33 was amended in April 2009 to require an emissions limit of 0.04lb VOC/1,000 gallons, which is lower than the RACT limit in current District Rule 4624.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified at that time. See pages 4-255 through 4-269 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District reviewed BACT guidelines for the District, BAAQMD, and SCAQMD and found lower limits than required by the current Rule 4624.

  - The District's BACT requirements are more stringent than BAAQMD and SCAQMD BACT requirements by requiring vapor collection vented to a thermal incinerator or flare with destruction with 99% control efficiency.
  - BAAQMD BACT requirements list an achieved in practice limit of 0.02 lb-VOC/1000 gallons for Tank Truck & Rail Car Bulk Loading, which is more stringent than Rule 4624. SCAQMD BACT requirements have fugitive leak limits for Organic Liquid Bulk Loading facilities which also may be lower than Rule 4624 limits.
- Research of the District's permit database indicates that most Valley facilities are not currently permitted for the more stringent BACT limits and BAAQMD Regulation 8 Rule 33 limits. Therefore, there may be a potential opportunity for emission reductions if it is ultimately determined that these limits are technologically feasible and cost effective as retrofits to existing facilities. The District will evaluate these limits further during the development of the next ozone plan.

Recommendation

RACT is already in place for this source category. However, as the BAAQMD Regulation 8 Rule 33 limit is beyond RACT and the Valley ozone is not as responsive to VOC reductions as it is to NOx reductions the District recommends evaluating the potential of the aforementioned BACT requirements and BAAQMD Regulation 8 Rule 33 during the development of the next ozone plan. As such, there are no recommendations for further regulatory action at this time.

C.5 MANAGED BURNING

Managed burning is the controlled burning of materials. There are three types of managed burning that occur in the Valley including open burning of agricultural materials, hazard reduction burning, and prescribed burning. This managed burning control measure source category affects burning and disposal activities conducted by the agricultural industry, residents in the wildland/urban interface, and land management agencies operating on the Valley floor and within the National Parks and Forests.

For many years, the District managed the smoke impacts from the open burning of agricultural materials through a system of county-wide burn/no-burn days. In 2004, the District established the Smoke Management System (SMS), a more refined method of authorizing or prohibiting individual burns based on modeled smoke impacts. The SMS user considers projected meteorological conditions and air quality forecasts to determine the allowable amount and location of agricultural burning. Properly managed burning allocations under the existing District SMS ensure that air quality and health impacts of open burning of agricultural materials are minimized to the fullest extent, reducing public exposure to smoke and contributing to improvements to general air quality in the Valley. Under the SMS, agricultural burning is prohibited on days when an exceedance of a federal standard is forecast to occur. The implementation of the District's SMS, District Rule 4103 (Open Burning), and the use of sustainable agricultural practices have reduced the amount of materials being burned, thus resulting in reduced ozone emissions.

Until recently, Land Management Agencies (LMAs) operated under a policy where naturally ignited wildfires (i.e. lightning strikes) were viewed as unhealthy and destructive for the ecosystem, and therefore were actively suppressed upon discovery. As this policy continued through the decades, the amount of fuel (dead plant materials, etc.) in the Sierra Nevada Mountains grew, which increased the likelihood of uncontrollable wildfires. It was later determined that fire is a natural part of the ecosystem, and that fire is necessary to reduce fuels on the forest floors to give space and a chance for new trees to grow, thus ensuring the health and continuity of the ecosystem. To achieve this, LMAs within the Valley currently conduct prescribed burning to reduce fuels in areas that are determined to be overgrown. Through these efforts, LMAs are able to burn on days when it is favorable from both meteorological and air quality considerations. Through District Rule 4106, a LMA must request authorization from the District before beginning a prescribed burn operation. This gives the District the discretion to not allow prescribed burning on days when dispersion and/or air quality is poor. This reduces emissions and protects public health by only allowing prescribed burning on days when smoke dispersion is favorable, thus reducing the chance for high concentrations of smoke to occur in nearby communities.

Similarly, hazard reduction burning occurs in communities that are within the wildland/urban interface, where homes and businesses in the foothills are often surrounded by dry brush. This fuel must be disposed of each year to ensure a barrier of fire protection of 100 feet in all directions, per Section 4291 of the California Public Resources Code. This disposal is usually in the form of burning, and as with prescribed burning, this is only allowed if the District forecasts favorable meteorological and air quality conditions.

Regulatory Evaluation

The following is a list of rules specific to the Managed Burning category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emission reductions.

Table C-7 Current Managed Burning Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4103	Open Burning	6/18/1992	4/15/2010	NOx, VOC, SOx, PM
4106	Prescribed Burning and Hazard Reduction Burning	6/21/2001	n/a	NOx, VOC, SOx, PM

C.5.1 RULE 4103 OPEN BURNING

Applicability

The provisions of Rule 4103 apply to open burning of agricultural materials conducted in the Valley, with the exception of prescribed burning and hazard reduction burning, as defined in Rule 4106 (Prescribed Burning and Hazard Reduction Burning). The purpose of this rule is to permit, regulate, and coordinate the use of open burning while minimizing smoke impacts on the public.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	1.76	1.84	1.84	1.83	1.83	1.82	1.82	1.81	1.80	1.80	1.79
VOC	2.06	2.20	2.19	2.18	2.18	2.17	2.16	2.16	2.15	2.14	2.14

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2010 amendments to Rule 4103 on January 4, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 214, http://www.gpo.gov/fdsys/pkg/FR-2012-01-04/pdf/2011-33660.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- There are no specific federal guidelines for open burning in terms of NSPS, CTG, ACT, MACT, and NESHAP.
- Rule 4103 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 444, BAAQMD Regulation 5, SMAQMD Rule 407, Placer County Rule 302, and VCAPCD Rule 56.
  - Placer County Rule 302 was amended on February 9, 2012; however, the amendment did not implement any requirements more stringent than the requirements in Rule 4103.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-8 through 4-20 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:

- Chipping and Biomass for Citrus Orchard Removal Material: the District is unsure if biomass plants will accept citrus, especially once the economy improves and construction material is more abundant, because there is additional processing and costs required to make the citrus chips acceptable as fuel. As described in the District's *2012 Update: Recommendations on Agricultural Burning*, there has not been a significant increase in biomass fuel consumption or storage capacity from the addition of new/converted facilities. While there are concerns regarding the cost effectiveness and feasibility of chipping and biomass efforts for the removal of citrus material, the District will continue to evaluate this opportunity in the future.
- Air Curtain Burner Technology to Reduce Emissions from Raisin Tray Burning: the District funded a project through its Technology Advancement Program to test a prototype air curtain burner to reduce emissions from the open burning of raisin trays. The technology successfully demonstrated zero visible emissions and proved to be an improvement over open burning practices. It is still unclear if the technology is cost effective when compared to current practices so the District will evaluate it in the future as it becomes more commercially available.
- See pages D-85 through D-89 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time. The recommendation is to reevaluate this source category in 2015, as committed to in the Rule 4103 amendment project completed in 2010 and in the *2012 PM2.5 Plan*.

C.5.2 RULE 4106 PRESCRIBED BURNING AND HAZARD REDUCTION BURNING

Applicability

This rule applies to all prescribed burning and hazard reduction burning in the wildland/urban interface. The purpose of this rule is to permit, regulate, and coordinate the use of prescribed burning and hazard reduction burning while minimizing smoke impacts on the public.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	6.31	6.31	6.31	6.31	6.31	6.31	6.31	6.31	6.31	6.31	6.31
VOC	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64

Regulatory Evaluation

EPA Approved	EPA Approval Year	Regulatory Actions Since EPA Approval:		
		Federal	State	Local
Yes	2002	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval for the 2001 adoption of Rule 4106 on February 27, 2002. 67 FR 8894, http://www.gpo.gov/fdsys/pkg/FR-2002-02-27/pdf/02-4526.pdf
- Rule 4106 was evaluated in the *2009 RACT SIP* demonstration; however EPA's Technical Support Document for the partial approval/partial disapproval of the *2009 RACT SIP* states the rule is not subject to RACT because it is not a CTG category and it does not regulate major sources.
- There are no specific federal guidelines for prescribed burning and hazard reduction burning in terms of ACT, NSPS, CTG, MACT and NESHAP.
- Rule 4106 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 444, BAAQMD Regulation 5, SMAQMD Rule 501, VCAPCD Rule 56, and Placer County APCD Rule 301 and Rule 303.
    - Placer County Rules 301 and 303 were amended on February 9, 2012; however, the amendments did not implement any requirements more stringent than the requirements in Rule 4106.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-24 through 4-38 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:

- **For Prescribed Burning:**
    - <u>Firebox Air Curtain Burners:</u> as opposed to open burning, a Land Management Agency may be able to mechanically remove material from the project site and use a firebox air curtain burner. Firebox air curtain burners greatly reduce PM and carbon dioxide emissions, but can result in more NOx emissions than open burning. This alternative was found to not be cost effective.
- **For Hazard Reduction Burning:**
    - <u>Reorganization of Hazard Reduction Zones:</u> under Rule 4106, hazard reduction burning is only allowed when the District forecasts favorable air quality and dispersion conditions based on a county-by-county basis, with appropriate elevation breaks. As an improvement to this zone system, and similar to agricultural burning, the Valley could be separated into smaller hazard reduction zones to provide more effective smoke management. Establishing this type of management system would not cause an increase in costs for landowners, making this a cost effective opportunity. However, emissions reduced would be minimal, since the burning would still occur, just on different days when conditions are favorable.
    - <u>Chipping:</u> section 4291 of the California Public Resources Code states that structures must maintain a defensible perimeter of 100 feet in all directions; this defensible perimeter is commonly created through the clearing and burning of vegetation. Chippers are not a viable alternative because the requirement of the defensible perimeter of 100 feet is enforced annually; therefore, the types of materials to be cleared and disposed of are leaves, pine needles, weeds, and some small brush, all of which are not acceptable materials for wood chippers. The amount of useable material produced from this type of chipping would be negligible.
    - <u>Firebox Air Curtain Burners:</u> as described above, this option is not cost effective.
    - <u>Biomass Removal Program</u>: the District evaluated implementing a program similar to Placer County’s successful “Biomass Box” program, which collects the biomass from a hazard reduction area and sends it for combustion at a biomass plant. Due to the Valley’s unique geography, the number of boxes needed and the mileage required to distribute, collect, and transport the materials to a biomass power plant would be significant, likely resulting in increased truck emissions. A program similar to Placer County’s may not result in the same cost effectiveness and overall benefit to the Valley. The District recommended a further study to determine the feasibility of this type of program in the *2012 PM2.5 Plan.*

  - See pages D-90 through D-95 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

This source category is exempt from RACT, and as described above, there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time. The recommendation is to conduct a further study to determine the feasibility of utilizing a biomass removal program similar to that in Placer County, as committed to in the *2012 PM2.5 Plan*.

C.6 AGRICULTURAL PROCESSES

For many years, the Valley's agricultural community has employed sound practices to mitigate emissions from agricultural processes including land management activities and confined animal facilities. However, prior to 2004, agricultural operations were exempt from air permitting requirements in California. Agricultural processors were regulated as permitted sources and regulation of agricultural emissions was limited to Title 13 restrictions on open burning.

In September 2003, Governor Gray Davis signed Senate Bill 700 (2003) which amended air pollution control requirements in the California Health and Safety Code to include requirements for agricultural sources of air pollution. Since then, the District has implemented a series of stringent prohibitory regulations that added more oversight to agricultural operations and set new emission control requirements. The agricultural sector has responded with significant investments in new emission control programs, and considerable changes to their longstanding practices. Collectively, the mitigation measures implemented have met or exceeded desired PM10 and VOC emissions reductions. The agricultural community has also replaced thousands of old, high-emitting diesel irrigation engines with cleaner, more efficient engines and electric motors with the assistance of District grant programs.

For the purposes of this ozone plan, this control measure source category is limited to those practices which have the potential to emit VOCs and excludes practices that emit only particulate matter, as those practices are relevant to and evaluated in the District's *2012 PM2.5 Plan*. This control measure source category includes confined animal facilities, where animals are corralled, penned, or otherwise caused to remain in restricted areas for commercial purposes. For the discussions about engines or other combustion devices used at these sources, refer to the Combustion Devices control measure source category discussion of this appendix.

Regulatory Evaluation

The following is a rule specific to the Agricultural Processes category. The following rule is evaluated in this appendix to examine potential opportunities for additional emission reductions. Refer to other sections of this appendix for discussions on other rules that may be applicable to the agricultural community, but that are not agriculture-specific.

Table C-8 Current Agricultural Processes Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4570	Confined Animal Facilities	6/15/2006	10/21/2010	VOC

C.6.1 RULE 4570 CONFINED ANIMAL FACILITIES

Applicability

This rule applies to any Confined Animal Facility (CAF). The purpose of this rule is to limit emissions of VOCs from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	148.64	119.75	121.15	122.55	123.94	125.35	126.74	128.14	129.54	130.93	132.33

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2010 amendments to Rule 4570 on January 17, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 2228, http://www.gpo.gov/fdsys/pkg/FR-2012-01-17/pdf/2012-582.pdf
- There are no specific federal guidelines applying to CAFs in terms of CTG, ACT, NSPS, MACT, and NESHAP.
- Rule 4570 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 223, SCAQMD Rule 1127, BAAQMD Regulation 2 Rule 10, VCAPCD Rule 23, SMAQMD Rule 496, Imperial County Air Quality Management District Rule 217, and Butte County Air Pollution Control District Rule 450.
    - VCAPCD amended Rule 23 (Exemptions) on April 12, 2011. This rule does not contain specific requirements to reduce emissions from CAFs and the rule amendment did not implement anything more stringent than the requirements in Rule 4570.
- The Yakima Regional Clean Air Agency adopted recommended practices for dairy operations on March 8, 2012 in their document *Air Quality Management Policy and Best Management Practices for Dairy Operations*. The policy requires preparation of an annual Air Quality Management Plan and implementation of Best Management Practices to reduce emissions from dairy operations; however, the requirements of District Rule 4570 are more stringent and specific.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified at that time, as the rule was determined to already meet RACT requirements and more time was needed to thoroughly evaluate other opportunities that exceeded RACT requirements. See pages 4-99 through 4-169 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- In accordance with a commitment from the *2007 Ozone Plan*, the District went on to fully evaluate any potential opportunities identified in the *2009 RACT SIP* and amend Rule 4570 as appropriate in 2010.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.7 RESIDENTIAL AND COMMERCIAL

Emissions have been significantly reduced in the Valley through several generations of regulations focused on industrial stationary sources. With emissions from stationary sources having been greatly reduced, the Valley is receiving diminishing returns from new controls on these stationary sources. The work of identifying more regulatory control measure source categories for stationary sources continues, but it is critical that Valley residents reduce emissions in their daily routines as well.

Population-wise, the Valley is California's fastest growing region, with its population expected to grow to over four and a half million by 2019. Increased population results in increased vehicle activity and consumer product use, which leads to increased pollutant emissions – potentially undermining progress made by regulations.

The District's regulatory jurisdiction is somewhat limited when it comes to pollutant sources linked to the general population. For example, ARB regulates consumer products. Also, since direct regulatory authority on motor vehicle tailpipe emissions rests with ARB and EPA, the District can only decrease pollutant emissions from vehicles through incentives, public outreach, and innovative regulations focused on fleets or indirect means.

Through the District's Healthy Air Living program, Valley residents (as well as businesses) are provided the tools to make air quality a priority in their day-to-day decisions. In addition, the District has achieved significant emission reductions from the residential sector through District regulations for residential water heaters and furnaces. There has also been success in reducing pollutant levels from the commercial sector through District regulations for bakery ovens.

There is potential for both regulatory and innovative approaches for reducing emissions from residential sources, as is shown in the following control measure discussions.

Regulatory Evaluation

The following is a list of rules specific to the Residential and Commercial category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emission reductions.

Table C-9 Current Residential and Commercial Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4693	Bakery Ovens	5/16/2002	n/a	VOC
4902	Residential Water Heaters	6/17/1993	3/19/2009	NOx
4905	Natural Gas-Fired, Fan-Type Residential Central Furnaces	10/20/2005	n/a	NOx

C.7.1 RULE 4693 BAKERY OVENS

Applicability

The requirements of this rule apply to bakery ovens operated at major source facilities, which emit VOCs during the baking of yeast-leavened products. The purpose of this rule is to limit VOC emissions from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.39	0.44	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.50	0.51

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2002 adoption of Rule 4693 on April 26, 2004 and deemed this rule as being at least as stringent as established RACT requirements: 69 FR 22441, http://www.gpo.gov/fdsys/pkg/FR-2004-04-26/pdf/04-9279.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4693 is at least as stringent as the applicable federal ACT since the requirements have not been strengthened for this regulation since the Rule 4693 RACT approval. There are no NESHAP, MACT, NSPS, or CTG requirements for this source category.
- Rule 4693 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1153, BAAQMD Regulation 8 Rule 42, and SMAQMD Rule 458. VCAPCD does not have a specific prohibitory rule for this source category.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified at that time. See pages 4-358 through 4-360 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District identified two potential opportunities to reduce emissions from bakery operations:
    - Require a NOx standard of 30 ppmv @ 3% O2: the District's BACT database identifies 30 ppmv @ 3% O2 as achieved in practice BACT,

which can be achieved by using low NOx burners in certain bakery ovens. BACT is generally triggered for new installations or major modifications to existing units, and applying the lower NOx limit to all bakery ovens is beyond RACT. Additionally, detailed cost effectiveness and technological analyses are necessary to determine if this more stringent NOx limit will be feasible for Valley sources.

- Reduce VOC emissions from cooking by using biotrickling filters: the use of biotrickling filters can reduce ethanol emissions from the baking process. A study was conducted by PRD Tech in collaboration with EPA, USDA, and the American Baker Association that demonstrated an 80% reduction in ethanol emissions for 99.6% of the total operating time. However, this technology has not been put to commercial use. The majority of bakeries in the Valley are already equipped with catalytic or regenerative thermal oxidizers and achieve 95% control of VOC emissions. Since VOC emissions are already highly controlled for these sources, no additional VOC emission reductions are expected from this technology.

Recommendation

RACT is already in place for this source category; however, one potential opportunity to reduce emissions was identified. Therefore, the District recommends further evaluating the cost effectiveness and potential emission reductions from implementing a lower NOx emission limit for this source category during the development of the next ozone plan.

C.7.2 RULE 4902 RESIDENTIAL WATER HEATERS

Applicability

This rule applies to manufacturers, distributors, retailers, and installers of Public Utilities Commission (PUC) quality natural gas-fired residential water heaters with heat input ratings less than or equal to 75,000 British thermal units per hour (Btu/hr). The purpose of this rule is to limit NOx emissions from residential water heaters.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	1.59	1.40	1.39	1.38	1.37	1.36	1.35	1.33	1.33	1.32	1.31
VOC	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11

Regulatory Evaluation

EPA Approved	EPA Approval Year	Regulatory Actions Since EPA Approval:		
		Federal	State	Local
Yes	2010	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- Rule 4902 was evaluated in the *2009 RACT SIP* demonstration; however, EPA's Technical Support Document for the partial approval/partial disapproval of the *2009 RACT SIP* states the rule is not subject to RACT because it is not a CTG category and it does not regulate major sources.
- EPA finalized approval of the 2009 amendments to Rule 4902 on May 5, 2010: 75 FR 24408, http://www.gpo.gov/fdsys/pkg/FR-2010-05-05/pdf/2010-10404.pdf
- There is currently no federal guidance given for Rule 4902 under the federal CTG, ACT, NSPS, NESHAP, and MACT requirements.
- Rule 4902 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1121, SMAQMD Rule 414, BAAQMD Regulation 9 Rule 6, and VCAPCD Rule 74.11.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-372 through 4-374 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf
- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:
    - The use of lower emitting water heating technology: the analysis did not identify any technologically feasible and cost effective potential emission controls.

  - See pages D-128 through D-131 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

This source category is exempt from RACT, and as described above, there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.7.3 RULE 4905 NATURAL GAS-FIRED, FAN-TYPE, RESIDENTIAL CENTRAL FURNACES

Applicability

This rule applies to any person who supplies, sells, offers for sale, installs, or solicits the installation of natural gas-fired, fan-type residential central furnaces, for use within the District, with a rated heat input capacity of less than 175,000 British thermal units per hour (Btu/hr), and for combination heating and cooling units with a rated cooling capacity of less than 65,000 Btu/hr. The purpose of this rule is to limit NOx emissions from these sources.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.51	0.50	0.51	0.51	0.52	0.53	0.53	0.54	0.55	0.56	0.56
VOC	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Regulatory Evaluation

EPA Approved	EPA Approval Year	Regulatory Actions Since EPA Approval:		
		Federal	State	Local
Yes	2007	No	No	Yes

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2005 amendments to Rule 4905 on May 30, 2007: 72 FR 29886, http://www.gpo.gov/fdsys/pkg/FR-2007-05-30/pdf/E7-10236.pdf
- Rule 4905 was evaluated in the *2009 RACT SIP* demonstration; however EPA's Technical Support Document for the partial approval/partial disapproval of the *2009 RACT SIP* states the rule is not subject to RACT because it is not a CTG category and it does not regulate major sources.
- There is currently no federal guidance given for Rule 4905 under the federal CTG, ACT, NSPS, NESHAP, and MACT requirements.
- Rule 4905 is at least as stringent as other California air districts' rules for similar sources, including: SMAQMD Rule 414, BAAQMD Regulation 9 Rule 4, and VCAPCD Rule 74.22.
- SCAQMD Rule 1111 was amended in November 2009 to implement more stringent NOx emission limits than the limits in Rule 4905; however, SCAQMD has funded technology development and has been evaluating whether manufacturers will be able to meet the limits in Rule 1111. The District has already committed to amend Rule 4905 in 2014 and to review SCAQMD's technology evaluation and NOx emission limits at that time.

Technology Evaluation

- The District's *2009 RACT SIP* did not identify any feasible emission reduction opportunities for this source category. See page 4-375 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

- The District evaluated the following potential emission reduction opportunities for this source category in the District's *2012 PM2.5 Plan*:
    - Lowering the NOx emission limits for new natural gas-fired, fan-type residential central furnaces: the District committed to amending Rule 4905 in the *2008 PM2.5 Plan*. This amendment is scheduled for 2014, and will lower NOx emission limits for these units, as appropriate for the Valley, based on feedback from SCAQMD about available emission reduction technologies and after evaluating the NOx emission limits within SCAQMD Rule 1111.
    - Extending the rule applicability to commercial furnaces: SCAQMD Rule 1111 currently regulates small residential and commercial furnaces less than 175,000 Btu/hr, whereas District Rule 4905 regulates residential furnaces of the same size, but not commercial furnaces. The District has committed to amending Rule 4905 in 2014 to lower the NOx emission limits; during that rule-amending project the possibility of extending the applicability of this rule to include commercial units based on technological feasibility and cost effectiveness will also be evaluated. The District will work closely with SCAQMD to discuss the findings from their technical assessments of low-NOx technologies for commercial furnaces.
    - See pages D-132 through D-134 of the plan for more information: http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Recommendation

This source category is exempt from RACT, and the District has already committed to amending Rule 4905 in 2014. Therefore, there are no recommendations for further regulatory action at this time.

C.8 WASTE MANAGEMENT

Waste management is the collection, transport, processing or disposal, managing, and monitoring of waste materials. Waste materials are generated through either agricultural processes or produced by human activity and generate NOx and VOC emissions in the Valley. The effective management of these materials is essential to reduce their effect on health, the environment, and aesthetics in the Valley.

The District has put a high precedence on developing innovative waste management projects. “Waste Solutions” is one of the three technology focus areas identified in the District’s Technology Advancement Program. The District defines “Waste Solutions” projects as waste systems or technologies that minimize or eliminate emissions from existing waste management systems and processes, including waste-to-fuel systems, such as dairy digesters and other bio-fuel applications. Over the last couple years, the District has been successful in funding multiple projects that fall into this category.

The Waste Management category affects multiple industries in the Valley, including but not limited to: food and agricultural processing, composting operations, landfill operations, and wastewater processes. Establishing effective emission reduction strategies for waste management practices is a key component of the District’s strategy to reduce emissions and achieve federal air quality standards.

Regulatory Evaluation

The following is a list of rules specific to the Waste Management category. Each of the following rules is evaluated in this appendix to examine potential opportunities for additional emission reductions.

Table C-10 Current Waste Management Rules

Rule #	Rule Name	Adopted	Last Amended	Pollutant(s)
4302	Incinerator Burning	5/21/1992	12/16/1993	NOx, VOC
4565	Biosolids, Animal Manure, and Poultry Litter Operations	3/15/2007	n/a	VOC
4566	Organic Material Composting Operations	8/18/2011	n/a	VOC
4625	Wastewater Separators	4/11/1991	12/15/2011	VOC
4642	Solid Waste Disposal Sites	7/20/1995	4/16/1998	VOC
4651	Soil Decontamination Operations	4/16/1992	9/20/2007	VOC

C.8.1 RULE 4302 INCINERATOR BURNING

Applicability

This rule applies to any incinerator activity or equipment. The purpose of this rule is to limit air pollution by prohibiting the use of any incinerator except for multiple-chamber incinerators or one equally effective in controlling air pollution.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
VOC	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	1999	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1993 amendments to Rule 4302 on August 19, 1999 and deemed this rule as being at least as stringent as established RACT requirements: 64 FR 45170, http://www.gpo.gov/fdsys/pkg/FR-1999-08-19/pdf/99-21164.pdf
- Rule 4302 is more stringent than the applicable federal NSPS (40 CFR 60 Subpart—Standards of Performance for Incinerators) because the NSPS exempts all facilities with less than 50 tons per day charging rate. All facilities in the Valley produce less than 50 tons per day, but are still subject to Rule 4302. There are no applicable CTG, ACT, NESHAP, or MACT requirements for this source category.
- Rule 4302 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 473 (Disposal of Solid and Liquid Wastes), SMAQMD Rule 408 (Incinerator Burning), and VCAPCD Rule 57 (Incinerators). BAAQMD has no comparable rule.

Technology Evaluation

- The District did not evaluate potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. However, no new control technologies have been identified for incinerator activities or equipment.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.8.2 RULE 4565 BIOSOLIDS, ANIMAL MANURE, AND POULTRY LITTER OPERATIONS

Applicability

The provisions of this rule apply to all facilities whose throughput consist entirely or in part of biosolids, animal manure, or poultry litter and the operator who landfills, land applies, composts, or co-composts these materials. The purpose of this rule is to limit emissions of VOCs from operations involving the management of biosolids, animal manure, or poultry litter.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	22.86	19.47	19.87	20.27	20.67	20.29	20.68	21.07	21.46	21.90	22.33

This table includes emissions for both Rule 4565 and Rule 4566.

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2007 adoption of Rule 4565 on January 17, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 2228, http://www.gpo.gov/fdsys/pkg/FR-2012-01-17/pdf/2012-582.pdf
- There is no federal policy or guidance in terms of CTG, ACT, NSPS, NESHAP, or MACT describing reasonably available controls for biosolids, animal manure, or poultry litter operations.
- SCAQMD is the only other agency in the country that has a regulation for this source category, specifically Rule1133.2 (Emission Reductions from Co-Composting Operations). Based on the District's *2009 RACT SIP* analysis, SCAQMD Rule 1133.2 has less stringent requirements for smaller co-composting facilities and more stringent requirements that are not cost effective for larger co-composting facilities when compared to District Rule 4565. The District also provided additional analyses for co-composting facilities showing that all mitigation measures specified in Rule 4565 that are reasonably available are being required. EPA has determined that Rule 4565 satisfies RACT requirements for this source category based on the District's thorough analysis of both federal and California regulations and the technological and economic feasibility of the rule requirements.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-96 through 4-98 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.8.3 RULE 4566 ORGANIC MATERIAL COMPOSTING OPERATIONS

Applicability

The provisions of this rule apply to composting facilities that compost and/or stockpile organic material. The purpose of this rule is to limit emissions of VOCs from composting operations.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	21.68	18.15	18.52	18.88	19.26	18.85	19.21	19.57	19.93	20.32	20.72

This table includes emissions for both Rule 4565 and Rule 4566.

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4566 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 adoption of Rule 4566 on November 29, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 71129, http://www.gpo.gov/fdsys/pkg/FR-2012-11-29/pdf/2012-28827.pdf
- There is no federal policy or guidance in terms of CTG, ACT, NSPS, NESHAP, or MACT describing reasonably available controls for organic material composting.
- SCAQMD is the only other nonattainment area that has a composting regulation for this source category, specifically Rule 1133.3 (Greenwaste Composting) that was adopted about a month prior to the Rule 4566 adoption. Based on the District's cost effectiveness analysis, it would not be economically feasible for operators to implement more stringent controls than what is currently in the rule. EPA has determined that there is not sufficient precedent to clearly define additional RACT compost controls at this time given the lack of regulatory history for organic material composting operations. Additionally, Rule 4566 satisfies, if not goes beyond, RACT and Best Available Retrofit Control Technology (BARCT) requirements for this source category based on careful evaluation of both federal and California regulations and the technological and economic feasibility of rule requirements.

Technology Evaluation

- The District conducted research and worked with the composting community to determine any additional cost effective and technologically feasible controls, beyond what is currently required in Rule 4566. Additionally, the District directed a field study from 2009-2010 (http://www.valleyair.org/busind/pto/emission_factors/Criteria/Criteria/Composting/FINAL-COMPOST-STUDY-REPORT.pdf) to measure the effectiveness of four best management practices (finished compost cover, watering system, interactive management, and smaller piles). At this time, the District has not identified any additional feasible and cost effective controls for this source category.

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.8.4 RULE 4625 WASTEWATER SEPARATORS

Applicability

This rule applies to wastewater separators including air flotation units, as defined in this rule. The requirements of this rule only apply to the separation of crude oil and water after custody transfer. The purpose of this rule is to limit VOC emissions from wastewater separators by requiring vapor loss control devices, recordkeeping, inspection, and test methods.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012, but EPA specified that Rule 4625 was one of the few rules not approved as RACT as part of the RACT SIP approval: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- EPA finalized approval of the 2011 amendments to Rule 4625 on October 22, 2012 and deemed this rule as being at least as stringent as established RACT requirements: 77 FR 64427, http://www.gpo.gov/fdsys/pkg/FR-2012-10-22/pdf/2012-25810.pdf
- Rule 4625 is at least as stringent as the applicable federal standards, including: CTG, NSPS, MACT, and NESHAP since the requirements have not been strengthened for these regulations since the Rule 4625 RACT approval. There is no applicable ACT for this source category.
- Rule 4625 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1176, BAAQMD Regulation 8 Rule 8, and VCAPCD Rule 74.8. SMAQMD does not have a comparable rule.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-270 through 4-273 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.8.5 RULE 4642 SOLID WASTE DISPOSAL SITES

Applicability

The provisions of this rule apply to any solid waste disposal sites, which have a gas collection system and/or control device in operation, or undergoing maintenance or repair. The purpose of this rule is to reduce VOC emissions from solid waste disposal sites.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VOC	1.26	1.39	1.41	1.43	1.44	1.46	1.48	1.50	1.52	1.54	1.56

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 1998 amendments to Rule 4642 on July 26, 2001 and deemed this rule as being at least as stringent as established RACT requirements: 66 FR 38939, http://www.gpo.gov/fdsys/pkg/FR-2001-07-26/pdf/01-18535.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4642 is at least as stringent as the applicable federal NSPS and MACT since the requirements have not been strengthened for these regulations since the Rule 4642 RACT approval. There are no CTG, ACT, or NESHAP requirements for this source category.
- Rule 4642 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1150, SCAQMD Rule 1150.1, BAAQMD Regulation 8 Rule 34, VCAPCD Rule 74.17.1, and SMAQMD Rule 485.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified at that time. See pages 4-281 through 4-295 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.8.6 RULE 4651 SOIL DECONTAMINATION OPERATIONS

Applicability

This rule applies to operations involved in the excavation, transportation, handling, decontamination, and disposal of contaminated soil. The purpose of this rule is to limit VOC emissions from soil that has been contaminated with a VOC-containing liquid.

Summer Average Emission Inventory (tons per day)

Pollutant	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOx	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
VOC	0.21	0.23	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.27

Regulatory Evaluation

Approved as RACT	RACT Approval Year	Regulatory Actions Since RACT Approval:		
		Federal	State	Local
Yes	2012	No	No	No

The District's regulatory evaluation summary table above is based on the following assessment:

- EPA finalized approval of the 2007 amendments to Rule 4651 on October 30, 2009 and deemed this rule as being at least as stringent as established RACT requirements: 74 FR 56120, http://www.gpo.gov/fdsys/pkg/FR-2009-10-30/pdf/E9-26178.pdf
- EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* on January 10, 2012 and deemed this rule as still being at least as stringent as established RACT requirements: 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
- Rule 4651 implements RACT, as determined by EPA, and there is no further national guidance (CTG or ACT) or federal regulation (NSPS, NESHAP, or MACT) to further define RACT for this category.
- Rule 4651 is at least as stringent as other California air districts' rules for similar sources, including: SCAQMD Rule 1166, BAAQMD Regulation 8 Rule 40, and VCAPCD Rule 74.29. SMAQMD does not have a comparable rule for this source category.

Technology Evaluation

- The District evaluated potential emission reduction opportunities for this source category in the District's *2009 RACT SIP*. No feasible opportunities were identified. See pages 4-296 through 4-303 of the analysis for more information: http://www.valleyair.org/Air_Quality_Plans/docs/RACTSIP-2009.pdf

Recommendation

RACT is already in place for this source category, and there are no additional feasible emission reduction opportunities. Therefore, there are no recommendations for further regulatory action at this time.

C.9 EMISSION INVENTORY CODES

Control Measure	Emission Inventory Codes
Rule 4103 (Open Burning)	670-660-0262-9842; 670-660-0262-9856; 670-660-0262-9862; 670-660-0262-9874; 670-660-0262-9884; 670-660-0262-9888; 670-660-0262-9892; 670-662-0262-9866; 670-662-0262-9878; 670-662-0262-9882; 670-668-0200-9858; 670-668-0200-9872; 670-668-0200-9886; 670-995-0240-9848; 670-668-0200-9894
Rule 4106 (Prescribed Burning and Hazard Reduction Burning)	670-666-0200-0000; 670-667-0200-0000; 670-664-0200-0000; 670-670-0200-0000
Rule 4301 (Fuel Burning Equipment)	None
Rule 4302 (Incinerator Burning)	130-130-0110-0000; 130-130-0130-0000; 130-130-0240-0000; 130-130-0324-0000; 130-130-0266-0000
Rule 4307 (Boilers, Steam Generators, and Process Heaters— 2.0 to 5.0 MMBtu/hr)	010-005-0110-0000; 010-005-0124-0000; 010-005-0130-0000; 010-005-0300-0000; 010-005-1220-0000; 020-005-0110-0000; 030-005-0110-0000; 030-005-0124-0000; 030-005-0130-0000; 030-005-1220-0000; 030-005-1530-0000; 030-010-0110-0000; 030-010-0130-0000; 030-010-1220-0000; 030-010-1600-0000; 030-015-0110-0000; 030-015-0130-0000; 040-005-0110-0000; 040-005-1530-0000; 040-010-0100-0000; 040-010-0110-0000; 040-010-0120-0000; 040-010-0130-0000; 040-010-1000-0000; 050-005-0110-0000; 050-005-0122-0000; 050-005-0124-0000; 050-005-0130-0000; 050-005-0320-0000; 050-005-1100-0000; 050-005-1220-0000; 050-005-1510-0000; 050-005-1520-0000; 050-005-3220-0000; 050-010-0110-0000; 050-010-0120-0000; 050-010-0320-0000; 050-010-1220-0000; 050-010-1500-0000; 052-005-0110-0000; 052-005-0124-0000; 052-005-1220-0000; 052-010-0110-0000; 052-010-0120-0000; 052-010-1224-0000; 060-005-0110-0000; 060-005-0122-0000; 060-005-0124-0000; 060-005-0130-0000; 060-005-0142-0000; 060-005-0144-0000; 060-005-0320-0000; 060-005-1220-0000; 060-005-1510-0000; 060-005-1520-0000; 060-010-0100-0000; 060-010-0110-0000; 060-010-0120-0000; 060-010-0142-0000 The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories.

Control Measure	Emission Inventory Codes
Rule 4308 (Boilers, Steam Generators and Process Heaters— 0.075 MMBtu/hr to less than 2.0 MMBtu/hr)	The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories. See Rule 4307 for the EICs.
Rule 4309 (Dryers, Dehydrators, and Ovens)	430-422-7078-0000; 430-424-7006-0000; 430-995-7000-0000; 499-995-0000-0000; 499-995-5630-0000
Rule 4311 (Flares)	110-132-0130-0000; 110-132-0146-0000; 120-132-0136-0000; 130-132-0110-0000; 130-132-0136-0000; 310-320-0010-0000; 310-320-0110-0000; 310-320-0120-0000; 310-320-0130-0000; 320-320-0010-0000; 320-320-0110-0000; 320-320-0120-0000; 320-320-0130-0000
Rule 4313 (Lime Kilns)	Lime kilns are not included in the ARB emissions inventory. There are no lime kilns currently operating in the Valley.
Rule 4320 (Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr)	The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories. See Rule 4307 for the EICs.
Rule 4352 (Solid Fuel Fired Boilers, Steam Generators, and Process Heaters)	010-005-0214-0000; 010-005-0218-0000; 010-005-0220-0000; 010-005-0240-0000; 010-005-0243-0000; 010-005-0254-0000; 020-005-0218-0000; 020-005-0230-0000; 030-005-0214-0000; 050-005-0214-0000; 050-005-0240-0000; 050-005-0254-0000; 052-005-0240-0000; 060-005-0240-0000
Rule 4354 (Glass Melting Furnaces)	460-460-7037-0000; 460-460-7038-0000; 460-460-7039-0000
Rule 4401 (Steam-Enhanced Crude Oil Production Wells)	310-342-1600-0000; 310-344-1600-0000; 310-346-1600-0000; 310-348-1600-0000
Rule 4402 (Crude Oil Production Sumps)	310-300-1600-0000
Rule 4404 (Heavy Oil Test Station - Kern County)	310-350-1600-0000
Rule 4407 (In-Situ Combustion Well Vents)	The emissions from this source category are accounted for in Rule 4401.
Rule 4408 (Glycol Dehydration Systems)	The emissions from this source category are accounted for in Rule 4409.

Control Measure	Emission Inventory Codes
Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities)	310-302-0110-0000; 310-302-1600-0000; 310-304-1600-0000; 310-306-1600-0000; 310-308-1600-0000; 310-308-0110-0000; 310-310-0110-0000; 310-310-1600-0000; 310-316-1600-0000; 310-352-0100-0000; 310-356-0110-0000
Rule 4453 (Refinery Vacuum Producing Devices or Systems)	The emissions from this source category are accounted for in Rule 4409.
Rule 4454 (Refinery Process Unit Turnaround)	The emissions from this source category are accounted for in Rule 4409.
Rule 4455 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants)	320-302-0010-0000; 320-304-0010-0000; 320-306-0010-0000; 320-316-0010-0000
Rule 4565 (Biosolids, Animal Manure, and Poultry Litter Operations)	199-170-0240-0000; 199-170-0260-0000; 199-190-0010-0000; 199-190-0110-0000; 199-190-0300-0000; 199-995-0000-0000; 199-995-0130-0000; 199-995-0240-0000; 199-995-0260-0000; 199-995-0300-0000; 199-995-0324-0000 The EICs are the same for Rules 4565 and 4566; the two rules share a combined emission inventory.
Rule 4566 (Organic Material Composting Operations)	The EICs are the same for Rules 4565 and 4566; the two rules share a combined emission inventory.
Rule 4570 (Confined Animal Facilities)	620-618-0262-0101; 620-618-0262-0102; 620-618-0262-0103; 620-618-0262-0104; 620-618-0262-0105; 620-618-0262-0106; 620-618-0262-0107; 620-618-0262-0108; 620-618-0262-0109; 620-618-0262-0110; 620-618-0263-0000
Rule 4601 (Architectural Coatings)	520-520-91XX-0000; 520-520-92XX-0000
Rule 4602 (Motor Vehicle Assembly Coatings)	The emissions from this source category are accounted for in Rule 4612.
Rule 4603 (Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts)	230-226-9000-0000; 230-226-9100-0000; 230-226-9200-0000; 230-230-9020-0000; 230-230-9050-0000; 230-230-9052-0000; 230-230-9054-0000; 230-230-9100-0000; 230-230-9200-0000
Rule 4604 (Can and Coil Coating Operations)	230-228-9000-0000; 230-228-9020-0000; 230-228-9052-0000; 230-228-9057-0000; 230-228-9100-0000; 230-228-9200-0000
Rule 4605 (Aerospace Assembly and Component Coating Operations)	230-238-9000-0000, 230-238-9020-0000; 230-238-9100-0000, 230-238-9200-0000
Rule 4606 (Wood Products and Flat Wood Paneling Products Coating Operations)	230-232-9000-0000; 230-232-9020-0000; 230-232-9040-0000; 230-232-9052-0000; 230-232-9054-0000; 230-232-9100-0000; 230-232-9200-0000

Control Measure	Emission Inventory Codes
Rule 4607 (Graphic Arts and Paper, Film, Foil, and Fabric Coatings)	230-222-9000-0000, 230-222-9100-0000, 230-224-9200-0000; 240-240-3202-0000; 240-240-3314-0000; 240-240-8302-0000; 240-260-8400-0000; 240-262-8400-0000; 240-264-8400-0000; 240-266-8350-0000; 240-266-8400-0000; 240-268-8400-0000; 240-995-8000-0000; 240-995-8400-0000
Rule 4610 (Glass Coating Operations)	The emissions from this source category are accounted for in Rule 4354.
Rule 4612 (Motor Vehicle and Mobile Equipment Coating Operations)	230-218-9000-0000; 230-218-9010-0000; 230-218-9020-0000; 230-218-9050-0000; 230-218-9054-0000; 230-218-9100-0000; 230-218-9200-0000
Rule 4621 (Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants)	330-395-1100-0000; 330-374-1100-0000; 330-330-1110-0000; 330-397-1100-0000; 330-390-1100-0000; 330-390-1400-0000; 330-396-1100-0000; 330-330-1000-0000; 330-376-1100-0000; 330-382-1100-0000; 330-384-1100-0000; 330-384-1110-0000; 330-382-1110-0000; 330-382-1120-0000; 330-384-1120-0000; 330-390-0010-0000
Rule 4622 (Gasoline Transfer into Motor Vehicle Fuel Tanks)	330-378-1100-0000; 330-380-1100-0000
Rule 4623 (Storage of Organic Liquids)	310-326-1600-0000; 310-328-1600-0000; 310-995-1600-0000; 320-326-1000-0000; 320-326-1214-0000; 320-326-1410-0000; 320-326-1610-0000; 320-328-1000-0000; 320-328-1110-0000; 320-328-1214-0000; 320-328-1410-0000; 320-328-1610-0000; 330-326-1110-0000; 330-326-1420-0000; 330-328-1000-0000; 330-328-1110-0000; 330-328-1600-0000; 330-328-1610-0000; 430-328-7006-0000
Rule 4624 (Transfer of Organic Liquid)	330-302-0010-0000; 330-995-0110-0000; 330-304-0010-0000; 330-995-0010-0000; 330-316-0010-0000; 330-318-0110-0000
Rule 4625 (Wastewater Separators)	320-340-0010-0000
Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving, and Maintenance Operations)	540-560-0400-0000; 540-562-0400-0000; 540-564-0400-0000; 540-566-0400-0000
Rule 4642 (Solid Waste Disposal Sites)	120-120-0240-0000; 120-122-0242-0000
Rule 4651 (Soil Decontamination Operations)	140-995-0010-0000; 140-995-0110-0000; 140-995-0120-0000; 140-995-0240-0000; 330-995-0010-0000
Rule 4652 (Coatings and Ink Manufacturing)	410-995-8400-0000; 410-407-9000-0000
Rule 4653 (Adhesives and Sealants)	250-292-8200-0000; 250-292-8202-0000; 250-292-8250-0000
Rule 4661 (Organic Solvents)	The emissions from this source category are accounted for in Rules 4662 and 4663.

Control Measure	Emission Inventory Codes
Rule 4662 (Organic Solvent Degreasing Operations)	220-204-0500-0000; 220-204-3008-0000; 220-204-3022-0000; 220-204-3083-0000; 220-204-3176-0000; 220-204-3204-0000; 220-204-3246-0000; 220-204-3333-0000; 220-204-3339-0000; 220-204-3344-0000; 220-204-8104-0000; 220-204-8106-0000; 220-206-3083-0000; 220-206-3107-0000; 220-206-3246-0000; 220-206-3300-0000; 220-206-3301-0000; 220-206-3328-0000; 220-206-3344-0000; 220-206-3346-0000; 220-206-8106-0000
Rule 4663 (Organic Solvent Cleaning, Storage, and Disposal)	220-208-0500-0000; 220-208-3022-0000; 220-208-3083-0000; 220-208-3176-0000; 220-208-3204-0000; 220-208-3246-0000; 220-208-3333-0000; 220-208-3339-0000; 220-208-3344-0000; 220-208-3346-0000; 220-208-8104-0000; 220-208-8106-0000; 230-216-8350-0000; 230-240-0500-0000; 230-240-3008-0000; 230-240-3060-0000; 230-240-3202-0000; 230-240-3232-0000; 230-240-3252-0000; 230-240-3372-0000; 230-240-8300-0000; 230-240-8302-0000; 230-240-8350
Rule 4672 (Petroleum Solvent Dry Cleaning Operations)	210-200-3300-00000; 210-200-8102-0000; 210-200-8150-0000
Rule 4681 (Rubber Tire Manufacturing)	410-402-0248-0000
Rule 4682 (Polystyrene, Polyethylene, and Polypropylene Products Manufacturing)	410-404-5034-0000; 410-404-5036-0000; 410-404-5038-0000; 410-404-5044-0000; 410-404-5046-0000
Rule 4684 (Polyester Resin Operations)	410-403-5018-0000; 410-404-5016-0000; 410-404-5028-0000; 410-404-5030-0000
Rule 4691 (Vegetable Oil Processing Operations)	420-420-6030-0000
Rule 4693 (Bakery Ovens)	420-412-6012-0000; 420-412-6037-0000
Rule 4694 (Wine Fermentation and Storage Tanks)	420-408-6090-0000
Rule 4695 (Brandy Aging and Wine Aging Operations)	420-410-6090-0000
Rule 4702 (Internal Combustion Engines)	010-040-0110-0000; 010-040-1200-0000; 020-040-0110-0000; 020-040-1200-0000; 030-040-0110-0000; 030-040-0124-0000; 030-040-1200-0000; 030-040-1210-0000; 040-040-0110-0000; 050-040-0012-0000; 050-040-0110-0000; 050-040-0124-0000; 050-040-1200-0000; 052-040-0110-0000; 052-040-1200-0000; 052-042-0110-0000; 052-042-1200-0000; 052-042-1200-0010; 052-042-1200-0011; 060-040-0110-0000; 060-040-0124-0000; 060-040-0142-0000; 060-040-0146-0000; 060-040-1100-0000; 060-040-1200-0000; 060-040-1210-0000; 060-995-1220-0000; 099-040-1200-0000
Rule 4703 (Stationary Gas Turbines)	010-045-0110-0000; 010-045-1200-0000; 020-045-0110-0000; 030-045-0110-0000; 040-045-0134-0000; 050-045-1200-0000;

Control Measure	Emission Inventory Codes
	060-045-0110-0000; 060-045-1200-0000
Rule 4902 (Residential Water Heaters)	610-608-0110-0000
Rule 4905 (Natural Gas-Fired, Fan-Type Residential Central Furnaces)	610-606-0110-0000

Appendix D

Vehicle Miles Traveled Emissions Offset Demonstration

2013 Plan for the Revoked 1-Hour Ozone Standard
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APPENDIX D: VMT EMISSIONS OFFSET DEMONSTRATION

D.1 INTRODUCTION

The San Joaquin Valley Air Pollution Control District (District) has prepared this vehicle miles traveled (VMT) emissions offset demonstration for the 1-hour and 8-hour ozone National Ambient Air Quality Standards (NAAQS) as required by Section 182(d)(1)(A) of the federal Clean Air Act (CAA), which applies to areas classified as severe or extreme nonattainment of the NAAQS. Based on modeling and analysis prepared by the California Air Resources Board (ARB) the District prepared this demonstration in accordance with the U.S. Environmental Protection Agency's (EPA's) August 2012 guidance entitled *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled.*[1]

This demonstration shows that both the *2013 Plan for the Revoked 1-Hour Ozone Standard* and the *2007 Ozone Plan* comply with CAA §182(d)(1)(A). Projected attainment year emissions of both volatile organic compounds (VOC) and oxides of nitrogen (NOx), accounting for controls and VMT growth, are less than hypothetical future-year emissions that do not account for new controls or VMT growth. Therefore, the identified transportation control strategies and measures are sufficient to offset the growth in emissions attributable to VMT growth.

D.2 BACKGROUND

The EPA approved the District's *2004 Extreme Ozone Attainment Demonstration Plan* (*2004 1-Hour Ozone Plan)* and the *2007 Ozone Plan* (for the 1997 8-hour ozone NAAQS) March 8, 2010 and March 1, 2012, respectively. Each plan contained VMT emissions offset demonstrations consistent with EPA's interpretation of CAA §182(d)(1)(A) at the time of submission and approval.

Subsequent to those approvals, a decision of the Ninth Circuit Court of Appeals in *Association of Irritated Residents v. EPA* (9th Cir. 2011), reprinted as amended on January 27, 2012, 632 F.3d 584) [*AIR*] rejected EPA's interpretation of the CAA, which had provided the basis for EPA's approval of District plans with respect to VMT offset demonstrations. With the *AIR* decision, the Court determined that the CAA requires additional transportation control strategies and measures whenever vehicle emissions are projected to be higher than would have been had VMT not grown, even if aggregate vehicle emissions are decreasing. EPA issued further guidance to address the Court's decision in August 2012, *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled.*

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[1] U.S. Environmental Protection Agency [EPA]: Office of Transportation and Air Quality. (2012, August). *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled* (EPA-420-B-12-053). Retrieved from http://www.epa.gov/otaq/stateresources/policy/general/420b12053.pdf

In addition to the Court's ruling in the *AIR* case, a previous 9th Circuit Court of Appeals decision (*Sierra Club v EPA,* 671 F.3d 955 (9th Cir. 2012)) found that EPA's action in approving the *2004 1-Hour Ozone Plan* was arbitrary and capricious under the Administrative Procedure Act because it did not take into account new emissions inventory data that California had submitted subsequent to submittal of the plan. The Court remanded EPA's action in its entirety.

To address issues pertinent to both court cases, EPA, on November 26, 2012, withdrew its March 8, 2010 final action approving state implementation plan (SIP) revisions submitted by the California Air Resources Board (ARB) under the CAA to provide for attainment of the 1-hour ozone NAAQS in the San Joaquin Valley extreme ozone nonattainment area (77 FR 182, 70376–70380). In the same March 8, 2010 final action, EPA also withdrew a portion of the March 1, 2012 final rule approving the *2007 Ozone Plan*. The first part of EPA's action requires re-submittal of a 1-hour ozone plan—the preparation of the *2013 Plan for the Revoked 1-Hour Ozone Standard*, including the VMT emissions offset demonstration for the 1-hour ozone NAAQS, fulfills this requirement. The second part of EPA's action requires re-submittal of the VMT emissions offset demonstration consistent with EPA's 2012 guidance document. This appendix also fulfills the VMT offset demonstration requirement pertinent to the *2007 Ozone Plan*.

D.3 EPA GUIDANCE ON VMT OFFSET REQUIREMENT

In its 2012 guidance, EPA indicated that technology improvements such as vehicle technology improvements, motor vehicle fuels, and other control strategies that are transportation related could be used to offset emissions increases from VMT. The guidance also set forth a methodology for demonstrating achievement of the VMT offset requirement. The projected attainment year emissions, assuming no new control measures and no VMT growth, are to be compared with projected actual attainment year emissions that include new control measures and VMT growth. If the latter number is smaller than the former, then no additional transportation control measures or transportation control strategies would be required.

The guidance recommends that the base year used in the VMT offset demonstration be the base year used in the attainment demonstration for the ozone NAAQS. The District believes that in all cases the proper base year is 1990, since Section 182(d)(1)(A) was part of the 1990 CAA amendments and clearly contemplated the use of 1990 as the base year.

D.4 TRANSPORTATION CONTROL STRATEGIES AND TRANSPORTATION CONTROL MEASURES

By listing them separately, CAA §182(d)(1)(A) differentiates between transportation control strategies (TCSs) and transportation control measures (TCMs), both of which can be used as options to offset increased emissions from growth in VMT per the provisions of CAA §182(d)(1)(A) and EPA's 2012 guidance. Since 1990, when this requirement was established, California has adopted a substantial number of enforceable TCSs—more than enough to meet the requirement to offset increased emissions from VMT growth. Attachment A to this appendix is a list of the State's mobile source TCSs adopted by ARB since 1990. Attachment B to this appendix details the commitments submitted to EPA by the metropolitan planning organizations (MPOs) within the San Joaquin Valley to meet the *2002 Severe Area Ozone Plan* reasonably available control measure (RACM) requirement.

D.5 METHODOLOGY

The following calculations are based on EPA's 2012 guidance. As discussed above, this demonstration includes two sets of calculations; both are based on a 1990 base year. For the 1-hour ozone NAAQS demonstration, 1990 serves as the base year and 2017 is the projected attainment year. Similarly, the second set of calculations uses 1990 as the base year, consistent with EPA guidance, but extends the attainment year out to 2023, consistent with the *2007 Ozone Plan.*

D.5.1 Analysis Using 1990 as the Base Year for 1-Hour Ozone

Step 1. Provide the emissions levels for the 1990 base year.
Table D-1 shows the VOC and NOx emissions for the calendar year 1990 from the EMFAC2011 model.[2]

Table D-1 Base year (1990) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)	NOx (tons/day)
1990 Vehicle Miles Travelled and On-Road Emissions	52,198,974	214	285

Step 2. Calculate three emissions levels in the 2017 attainment year.

(1) Calculate emissions levels with the motor vehicle control program frozen at 1990 levels and with projected VMT in the attainment year. This represents what the emissions in the attainment year would have been if TCSs and TCMs had not been implemented after 1990.

(2) Calculate emissions levels with the motor vehicle control program frozen at 1990 levels and assuming VMT do not increase from 1990 levels.

(3) Calculate an emissions level that represents emissions with full implementation of all TCSs and TCMs since 1990, which represents the projected future year baseline emissions inventory in the attainment year.

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[2] EMFAC is California's model for estimating emissions from on-road vehicles operating in California; EMFAC2011 is the most recent update. All model runs were for the San Joaquin Valley Air Basin using average summer emissions.

Calculation 1. Calculate the emissions in the attainment year assuming no new measures since the base year with growth in VMT.
To perform this calculation, ARB staff identified the on-road motor vehicle control programs adopted since 1990 and adjusted the EMFAC2011 output to reflect the VOC and NOx emissions levels in 2017 without the benefits of the post-1990 control programs. The projected VOC and NOx emissions are 216 and 482 tons per day, respectively.

Calculation 2. Calculate the emissions with no growth in VMT.
EMFAC2011 allows the user to input different VMT values. As such, ARB ran EMFAC2011 for calendar year 2017 with the 1990 VMT level of 52,198,974 miles per day. The VOC and NOx emissions associated with the 1990 VMT level are 169 and 232 tons per day, respectively.

Calculation 3. Calculate emission reductions with full implementation of TCSs and TCMs.
ARB calculated the VOC and NOx emission levels for 2017 assuming the benefits of the post-1990 motor vehicle control program and the projected VMT levels in 2017 are calculated using EMFAC2011. The projected VOC and NOx emissions levels are 37 and 116 tons per day, respectively.

VOC and NOx emissions for the three sets of calculations described above are provided in Table D-2.

Table D-2 VOC and NOx Emissions Calculations for Attainment Year (2017)

Calculation Number	Description	VMT* (miles/day)	VOC (tons/day)	NOx (tons/day)
1	Emissions with motor vehicle control program frozen at 1990 levels (VMT at 2017 projected levels)	114,919,482	216	482
2	Emissions with motor vehicle control program frozen at 1990 levels (VMT at 1990 levels)	52,198,974	169	232
3	Emissions with full motor vehicle control program in place (VMT at 2017 projected levels)	114,919,482	37	116

**VMT based on 2013 FTIP activity*

As provided in the 2012 EPA guidance, to determine compliance with CAA §182(d)(1)(A), the Calculation 3 emissions levels should be less than the Calculation 2 emissions levels:

VOC: 37 < 169 tons per day

NOx: 116 < 232 tons per day

D.5.2 Analysis Using 1990 as the Base Year for 8-Hour Ozone

As mentioned above, this alternative analysis is for the federal 8-hour NAAQS and the attainment year 2023.

Step 1. Provide the emissions levels for the 1990 base year.
Table D-3 shows the VOC and NOx emissions for the calendar year 1990 from the EMFAC2011 model.

Table D-3 Base Year (1990) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)	NOx (tons/day)
1990 Vehicle Miles Travelled and On-Road Emissions	52,198,974	214	285

Step 2. Calculate three emissions levels in the 2023 attainment year.

(1) Calculate emissions levels with the motor vehicle control program frozen at 1990 levels and with projected VMT in the attainment year. This represents what the emissions in the attainment year would have been if TCSs and TCMs had not been implemented after 1990.

(2) Calculate emissions levels with the motor vehicle control program frozen at 1990 levels and assuming VMT do not increase from 1990 levels.

(3) Calculate an emissions level that represents emissions with full implementation of all TCSs and TCMs since 1990, which represents the projected future year baseline emissions inventory in the attainment year.

Calculation 1. Calculate the emissions in the attainment year assuming not new measures since the base year with growth in VMT.
To perform this calculation, ARB staff identified the on-road motor vehicle control programs adopted since 1990 and adjusted the EMFAC2011 output to reflect the VOC and NOx emissions levels in 2023 without the benefits of the post-1990 control programs. The projected VOC and NOx emissions are 221 and 535 tons per day, respectively.

Calculation 2. Calculate the emissions with no growth in VMT.
EMFAC2011 allows the user to input different VMT values. As such, ARB ran EMFAC2011 for calendar year 2023 with the 1990 VMT level of 52,198,974 miles per day. The VOC and NOx emissions associated with the 1990 VMT level are 178 and 228 tons per day, respectively.

Calculation 3. Calculate emission reductions with full implementation of TCSs and TCMs.
ARB calculated the VOC and NOx emission levels for 2023 assuming the benefits of the post-1990 motor vehicle control program and the projected VMT levels in 2023 are

calculated using EMFAC2011. The projected VOC and NOx emissions levels are 29 and 66 tons per day, respectively.

VOC and NOx emissions for the three sets of calculations described above are provided in the Table D-4.

Table D-4 VOC and NOx Emissions Calculations for Attainment Year (2023)

Calculation Number	Description	VMT (miles/day)	VOC (tons/day)	NOx (tons/day)
1	Emissions with motor vehicle control program frozen at 1990 levels (VMT at 2023 projected levels)	130,172,967	221	535
2	Emissions with motor vehicle control program frozen at 1990 levels (VMT at 1990 levels)	52,198,974	178	228
3	Emissions with full motor vehicle control program in place (VMT at 2023 projected levels)	130,172,967	29	66

**VMT based on 2013 FTIP activity*

As provided in the 2012 EPA guidance, to determine compliance with CAA §182(d)(1)(A), Calculation 3 emissions levels should be less than the Calculation 2 emissions levels:

VOC: 29 < 178 tons per day

NOx: 66 < 228 tons per day

D.6 SUMMARY

The previous sections provide an analysis to demonstrate compliance with CAA §182(d)(1)(A). To further illustrate the demonstration, Figures 1 and 2 graphically display the emissions benefits of the motor vehicle control programs in offsetting VOC and NOx emissions resulting from VMT increases in the San Joaquin Valley Air Basin. The left-most bar (in purple) in each figure shows the emissions in the 1990 base year. The set of three bars on the right in each figure show the emission levels in 2017 if there were no further motor vehicle controls after 1990 and with projected VMT increases (red bar), the emissions if VMT does not increase from 1990 levels and there are no TCSs or TCMs after 1990 (green bar), and the emission levels with the post-1990 motor vehicle control program in place (blue bar). Based on the 2012 EPA guidance, if the blue bar is lower than the green bar, then the identified TCSs and TCMs are sufficient to offset the growth in emissions.

Figure D-1 VOC Emissions Using San Joaquin Valley "2013 FTIP" VMT

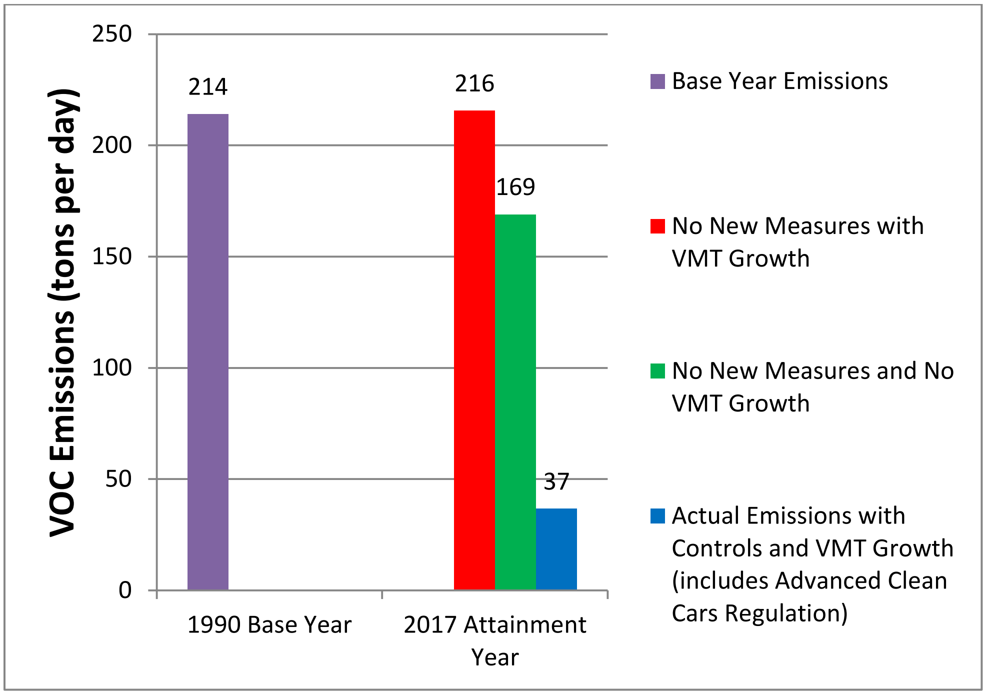
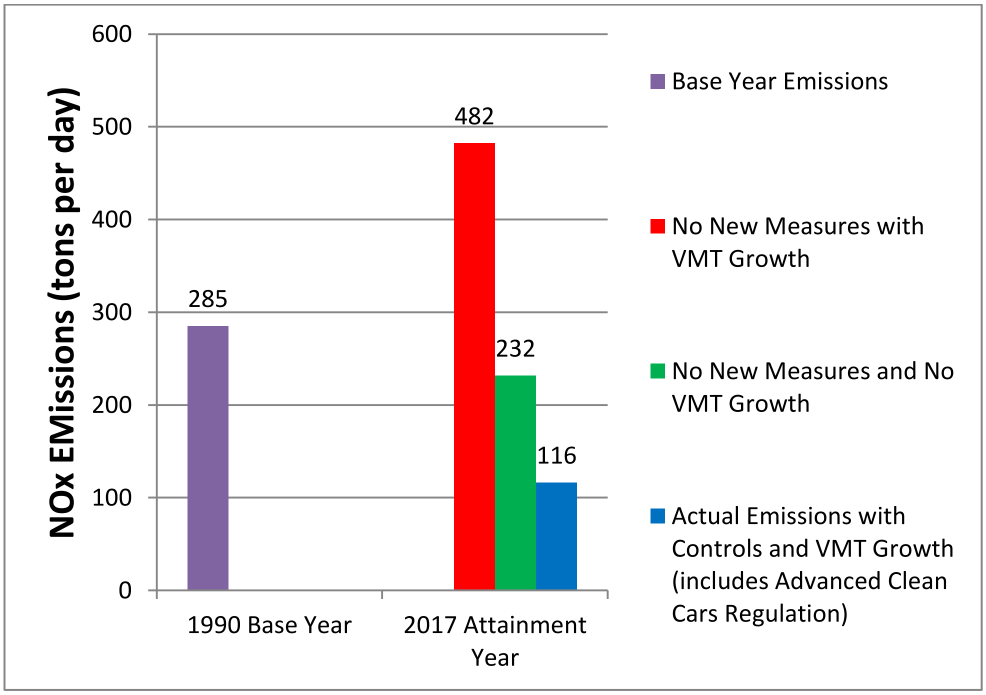


Figure D-2 NOx Emissions Using San Joaquin Valley "2013 FTIP" VMT



Figures 3 and 4 illustrate the results of the calculations for VOC and NOx, respectively, using 1990 as the base year. As with the first set of analyses, the blue bar is lower than the green bar, thus the identified TCSs and TCMs are sufficient to offset growth in emissions.

Figure D-3 VOC Emissions Using San Joaquin "2013 FTIP" VMT

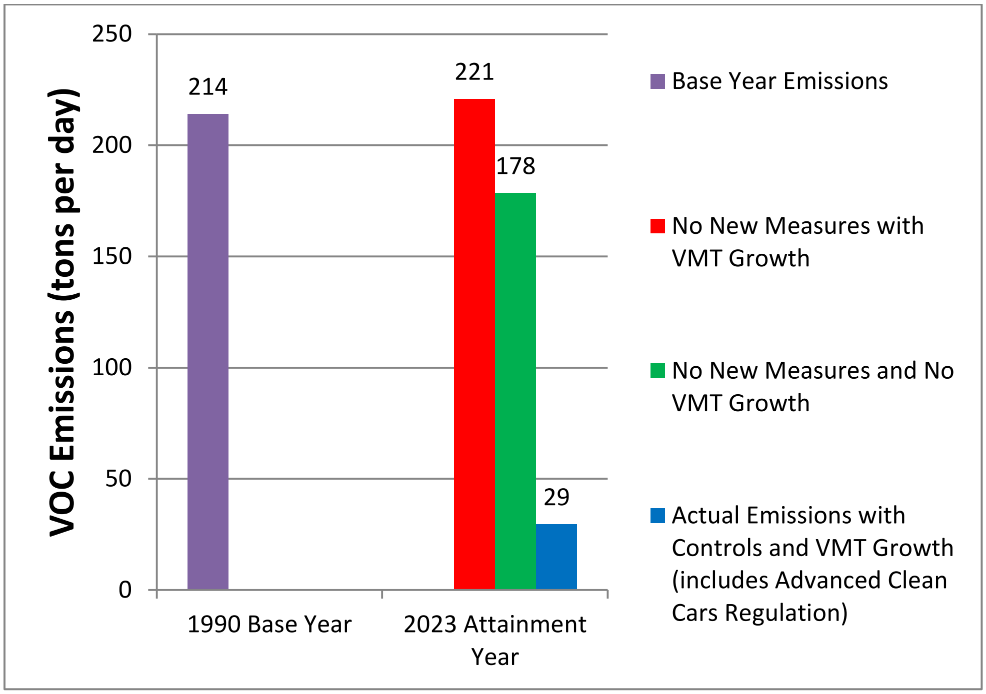
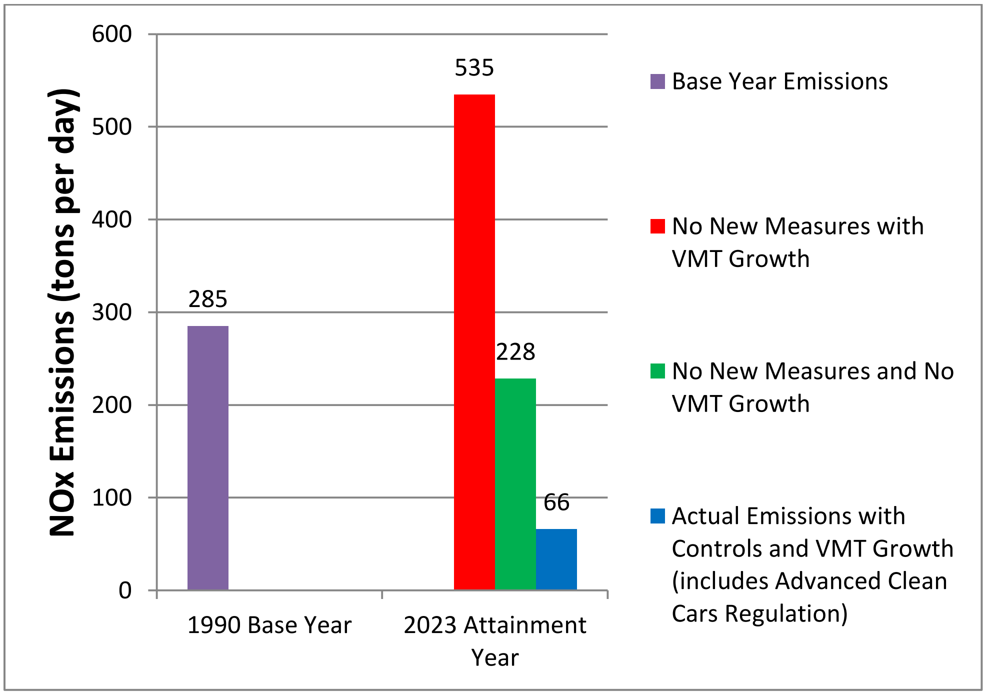


Figure D-4 NOx Emissions Using San Joaquin "2013 FTIP" VMT



Attachment A

Table D-5 State of California Motor Vehicle Control Program (1990-Present) Transportation Control Strategies Adopted by the California Air Resources Board since 1990

Measure	Hearing Date	Category
Emission Control System Warranty. T 13, CCR, 2035-2041, 1977	12/14/89	On-road
Certification Procedure for Aftermarket Parts. VC 27156 & 38391	02/08/90	On-road
Emission Standards for Medium Duty Vehicles. T 13, CCR, 1900, 1956.8, 1960.1, 1968.1, 2061, 2112, 2139	06/14/90	On-road
Wintertime Limits for Sulfur in Diesel Fuel. T 13, CCR, 2255	06/21/90	Fuels
Evaporative Emission Standards. T 13, CCR, 1976	08/09/90	On-road
California Reformulated Gasoline (CaRFG), Phase I. T 13, CCR, 2251.5	09/27/90	Fuels
Low Emission Vehicles and Clean Fuels. T 13, CCR, 1900, 1904, 1956.8, 1960.1, 1960.1.5, 1960.5 and 2111, 2112, 2125, and 2139, 2061.	09/28/90	On-road
Heavy Duty Diesel Smoke Emission Testing. T 13, CCR, 2180-2187	11/08/90	On-road
Limit on Aromatic Content of Diesel Fuel. T 13, CCR, 2256	12/13/90	Fuels
Onboard Diagnostics for Light-Duty Trucks and Light & Medium-Duty Motor Vehicles. T 13, CCR, 1977, 1968.1	09/12/91	On-road
Onboard Diagnostic, Phase II. T 13, CCR, 1968.1, 1977	11/12/91	On-road
Low Emission Vehicles amendments revising reactivity adjustment factor (RAF) provisions and adopting a RAF for M85 transitional low emission vehicles. T 13, CCR, 1960.1	11/14/91	On-road
California Reformulated Gasoline, Phase II. T 13, CCR, 2250, 2255.1, 2252, 2260 - 2272, 2295	11/21/91	Fuels
Wintertime Gasoline Program. T 13, CCR, 2258, 2298, 2251.5, 2296	11/21/91	Fuels
Specifications for Alternative Motor Vehicle Fuel. T 13, & 26, CCR, 2290, 2291, 2292.1, 2292.2, 2292.3, 2292.5, 2292.6, 2292.7, 1960.1(k), 1956.8(b), 1956.8(d)	12/12/91	Fuels
Specifications for Alternative Motor Vehicle Fuels. T 13, & 26, CCR, 2290-2292.7, 1960.1(k), 1956.8(b), 1956.8(d)	03/12/92	On-road
Standards and Test Procedures for Alternative Fuel Retrofit Systems. T 13, CCR, 2030, 2031	05/14/92	On-road
Phase 2 RFG certification fuel specifications. T 13, CCR, 1960.1, 1956.8(d)	08/13/92	On-road
Substitute Fuel or Clean Fuel Incorporated Test Procedures. T 13, CCR, 1960.1(k), 2317	11/12/92	On-road
Smoke Self Inspection Program for Heavy Duty Diesel & Gasoline Engines. T 13, CCR, 21902194, 2180-2187, 1956.8(b)	12/10/92	On-road

Measure	Hearing Date	Category
Certification Requirements for Low Emission Passenger Cars, Light-Duty Trucks & Medium Duty Vehicles. T 13, CCR, 1960.1, 1976, 2061, 1900	01/14/93	On-road
Urban Transit Buses. T 13, CCR, 1956.8, 1965, 2112	06/10/93	On-road
Onboard Diagnostic, Phase II. T 13, CCR, 1968.1	07/09/93	On-road
Wintertime Oxygenate Program. T 13, CCR, 2258, 2251.5, 2263(b), 2267, 2298, 2259, 2283, 2293.5	09/09/93	Fuels
Diesel Fuel Regulations -Emergency. T 13, CCR, 2281(h), 2282(1)	10/15/93	Fuels
Evaporative Emission Standards and Test Procedures. T 13, CCR, 1976	02/10/94	On-road
Predictive Model for Phase II CaRFG. T 13, CCR, 2261, 2262-2270	06/09/94	Fuels
Small Refiner Diesel. T 13, CCR, 2282(e)(1)	07/24/94	Fuels
Diesel Fuel Certification. T 13, CCR, 1956.8(b)&(d), 1960.1(k), 2292.6	09/22/94	Fuels
Self-Inspection Program for Heavy Duty Diesel & Gasoline Engines. T 13, CCR, 2190-2194, 21802187, 1956.8(b)	11/09/94	On-road
Onboard Diagnostics, Phase II. T 13, CCR,1963.1, & Certification Procedures	12/08/94	On-road
Periodic Smoke Inspection Program. T 13, CCR, 2190	12/08/94	On-road
Specification for Alternative Motor Vehicle Fuels (M100). T 13 CCR, 2292.1	12/08/94	Fuels
Heavy Duty Vehicle Exhaust Emission Standards. T 13, CCR, 1956.8 and incorporate test procedures.	06/29/95	On-road
Onboard Refueling Vapor Recovery Standards. T 13, CCR, 1976, 1978 and incorporate test procedures	06/29/95	On-road
Test Method for Oxygen in Gasoline. T 13, CCR, 2251.5(c), 2258(c), 2263(b)	06/29/95	Fuels
Retrofit Emission Standards. T 13, CCR, 1956.9, 2030, 2031, and incorporate test procedures	07/27/95	On-road
Low Emission Vehicle Standards 3 (LEV 3). T 13, CCR, 1956.8, 1960.1, 1965, 2101, 2061, 2062, and incorporate test procedures	09/28/95	On-road
Test Methods for CaRFG 13, CCR, 2263(b)	10/26/95	Fuels
Required Additives in Gasoline (Deposit Control Additives). T 13, CCR, 2257 and incorporates testing procedures.	11/16/95	Fuels
CaRFG Housekeeping & CARBOB. T 13, CCR, 2263.7, 2266.5, 2260, 2262.5, 2264, 2265, 2272	12/14/95	Fuels
Exemption of Military Tactical Vehicles. T 13, CCR, 1905, 2400, 2420	12/14/95	On Road/Off Road
CaRFG Variance Requirements. T 13, CCR, 2271 (Emergency)	01/25/96	Fuels
Postpone Zero Emission Vehicle Requirements. T 13, CCR, 1900, 1960.1, 1976	03/28/96	On-road

Measure	Hearing Date	Category
Regulation Improvements and Repeals (fuel additives). T 13, CCR, 2201, 2202	05/30/96	Fuels
Diesel Fuel Certification Test Methods . T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/96	Fuels
Diesel Fuel Test Methods. T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/96	Fuels
Onboard Diagnostics, Phase II, Technical Status. T 13, CCR, 1968.1, 2030, 2031	12/12/96	On-road
Liquefied Petroleum Gas Propane Limit Specification Delay. T 13, CCR, 2292.6	03/27/97	Fuels
Postpone Enhanced Evaporative Emission Requirements for Ultra-Small Volume Vehicle Manufacturers. T 13, CCR, 1976 and incorporate test procedures	05/22/97	On-road
Off-Cycle Emissions Supplemental Federal Test Procedures (SFTPs). T 13, CCR, 1960.1, 2101 and incorporate test procedures	07/24/97	On-road
Heavy Duty Vehicle Smoke Inspection Program/Periodic Smoke Inspection Program. T 13, CCR, 2180-2188 and 2190-2194	12/11/97	On-road
Heavy Duty Vehicle Regulations: 2004 Standards. T 13, CCR, 1956.8, 1965, 2036, 2112 and test procedures	04/23/98	On-road
Cleaner Burning Gasoline Model Flexibility. T 13, CCR, Sections 2260, 2262.1, 2262.3, 2262.4, 2262.5, 2262.6, 2262.7 and 2265	08/27/98	Fuels
Gasoline Vapor Recovery Systems. T 17, CCR, 94010-94015 and 94150, 94156, 94157, 94158, 94159, 94160, 94162	08/27/98	Vapor Recovery
Gasoline Deposit Control Additive Regulation. T 13, CCR, 2257, and incorporating test procedures	09/24/98	Fuels
Low Emission Vehicles Standards (LEV 2) and Compliance Assurance Program (CAP 2000). T 13, CCR,1961 & 1962 (both new); 1900, 1960.1, 1965, 1968.1, 1976, 1978, 2037, 2038, 2062, 2101, 2106, 2107, 2110, 2112, 2114, 2119, 2130, 2137-2140, 2143-2148	11/05/98	On-road
Exhaust Standards for (On-Road) Motorcycles. T 13, CCR, 1958	12/10/98	On-road
Voluntary Accelerated Light Duty Vehicle Retirement Regulations. T 13, CCR, 2600-2610	12/10/98	On-road
Cleaner Burning Gasoline (Increasing the Oxygen Content). T 13, CCR, sections 2262.5(b) and 2265(a)(2)	12/11/98	Fuels
Specifications for Liquid Petroleum Gas Used as a Motor Vehicle Fuel. T 13, CCR, 2292.6	12/11/98	Fuels
Cleaner Burning Gasoline, Oxygen Requirement for Wintertime In Lake Tahoe Area/Gas Pump Labeling for MTBE. T 13, CCR, 2262.5, and 2273	06/24/99	Fuels
Clean Fuels Regulation Requirements. T 13, CCR, sections 2300-2317, and 2303.5, 2311.5	07/22/99	On-road

Measure	Hearing Date	Category
CaRFG Phase 3 Amendments (Phase out of MTBE, standards, predictive model). T 13, CCR, 2260, 2261, 2262.1, 2262.5, 2263, 2264, 2264.2, 2265, 2266 etc…	12/09/99	Fuels
Transit Bus Standards. T 13, CCR, 1956.1, 1956.2, 1956.3, 1956.4, 1956.8, 1965	02/24/00	On-road
CaRFG Phase 3 Follow-up Amendments. T 13, CCR, sections 2260, 2261, 2262.3, 2262.5, 2263, 2264, 2265, 2266, 2266.5, 2270, 2272, 2273, 2282, 2296, 2297, 2262.9 and incorporated test procedures	11/16/00	Fuels
CaRFG Phase 3 Test Methods. T 13, CCR, sections 2263(b)	11/16/00	Fuels
Heavy Duty Diesel Engines "Not-to-Exceed (NTE)" Test Procedures. T 13 CCR, 1956.8, 2065	12/07/00	On-road
Light-and Medium Duty Low Emission Vehicle Alignment with Federal Standards. Exhaust Emission Standards for Heavy Duty Gas Engines. T 13, CCR, 1956.8 &1961	12/07/00	On-road
Zero Emission Vehicle Regulation Update. T 13, CCR, 1900, 1960.1(k), 1961, 1962 & incorporated Test Procedure	01/25/01	On-road
Zero Emission Vehicle Infrastructure and Standardization of Electric Vehicle Charging Equipment. T 13, CCR, 1900(b), 1962(b) 1962.1	06/28/01	On-road
Heavy Duty Diesel Engine Standards for 2007 and Later. T 13, CCR, 1956.8 and incorporated test procedures	10/25/01	On-road
Low Emission Vehicle Regulations. T 13, CCR, 1960.1,1960.5, 1961, 1962 and incorporate test procedures and guidelines	11/15/01	On-road
California Motor Vehicle Service Information Rule. T 13&17, CCR, 1969 & 60060.1 -60060.7	12/13/01	On-road
Voluntary Accelerated Light Duty Vehicle Retirement Regulations. T 13, CCR, 2601-2605, 2606 & appendices C & D, and 2607-2610	02/21/02	On-road
On-Board Diagnostic II Review Amendments. T 13, CCR, 1968.1, 1968.2, 1968.5	04/25/02	On-road
Diesel Retrofit Verification Procedure, Warranty and In-Use Compliance Requirements. T 13, CCR, 2700-2710	05/16/02	On-road
Revision to Transit Bus Regulations Amendments. T 13, CCR, 1956.1, 1956.2, 1956.4,1956.8, and 2112, & documents incorporated by reference	10/24/02	On-road
Airborne Toxic Control Measure for Diesel Particulate from School Bus Idling. T13, CCR, 2480	12/12/02	On-road
Low Emission Vehicles II. Align Heavy Duty Gas Engine Standards with Federal Standards; minor administrative changes. T 13, CCR, 1961, 1965, 1956.8, 1956.1, 1978, 2065 and documents incorporated by reference	12/12/02	On-road
Zero Emission Vehicle Amendments for 2003. T 13, CCR, 1960.1(k), 1961(a) and (d), 1900, 1962, and documents incorporated by reference	03/25/03	On-road

Measure	Hearing Date	Category
Solid Waste Collection Vehicles. T 13, CCR, 2020, 2021, 2021.1, 2021.2	09/24/03	On-road
Airborne Toxic Control Measure for Diesel Particulate for Transport Refrigeration Units. T 13, CCR, 2022 & 2477	12/11/03	On-road
Diesel Retrofit Verification Procedure, Warranty and In-Use Compliance Requirements (Amendments). T 13, CCR, 2701-2707 & 2709	12/11/03	On-road
CA Motor Vehicle Service Information Rule. T 13, CCR, 1969	01/22/04	On-road
Heavy Duty Diesel Engine-Chip Reflash. T 13, CCR, 2011, 2180.1, 2181, 2184, 2185, 2186, 2192, and 2194	03/27/04	On-road
Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model Heavy Duty Engines. T 13, CCR, 1971	05/20/04	On-road
Urban Bus Engines/Fleet Rule for Transit Agencies. T 13, CCR, 1956.1, 1956.2, 1956.3, and 1956.4,	06/24/04	On-road
Airborne Toxic Control Measure for Diesel Particulate from Diesel Fueled Commercial Vehicle Idling. T 13, CCR, 2485	07/22/04	On-road
Greenhouse Gas. T 13, CCR, 1961.1, 1900, 1961 and Incorporated Test Procedures	09/23/04	On-road
California Reformulated Gasoline, Phase 3. T 13, CCR, 2260, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2263, 2265 (and the incorporated "California Procedures"), and 2266.5	11/18/04	Fuels
Diesel Fuel Standards for Harborcraft & Locomotives. T 13, CCR, 2299, 2281, 2282, and 2284, and T 17, CCR, 93117	11/18/04	Fuels
Emergency Regulation for Temporary Delay of Diesel Fuel Lubricity Standard. T 13, CCR, 2284	11/24/04	Fuels
Transit Fleet Rule. T 13, CCR, 2023, 2023.1, 2023.2, 2023.3, 2023.4, 1956.1, 2020, 2021, repeal 1956.2, 1956.3, 1956.4	02/24/05	On-road
On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD). T 13, CCR, 1971.1	07/21/05	On-road
2007-2009 Model-Year Heavy Duty Urban Bus Engines and the Fleet Rule for Transit Agencies. T 13, CCR, 1956.1, 1956.2, and 1956.8	09/15/05	On-road
Requirements to Reduce Idling Emissions from New and In-Use Trucks, Beginning in 2008. T 13, CCR section1956.8 and the incorporated document	10/20/05	On-road
Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Diesel-Fueled Vehicles Owned or Operated by Public Agencies and Utilities. T 13, CCR, 2022 and 2022.1	12/08/05	On-road
AB1009 Heavy-Duty Vehicle Smoke Inspection Program. T 13, CCR, 2180, 2180.1, 2181, 2182, 2183, 2184, 2185, 2186, 2187, and 2188, 2189	01/26/06	On-road
Diesel Verification Procedure, Warranty & In-Use. T 13, CCR, 2702, 2703, 2704, 2706, 2707, and 2709.	03/23/06	On-road

Measure	Hearing Date	Category
Technical Amendments to Evaporative Exhaust and Evaporative Emissions Test Procedures. T 13, CCR, 1961,1976 and 1978.	05/25/06	On-road
California Motor Vehicle Service Information Rule. T 13, CCR, 1969 and incorporated documents	06/22/06	On-road
Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	09/28/06	On-road
On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	09/28/06	On-road
Zero Emission Bus Regulation. T13, CCR, 2023.1, 2023.3, & 2023.4	10/19/06	On-road
Voluntary Accelerated Retirement Regulation. T 13, CCR, 2601-2610 and appendices A-D	12/07/06	On-road
Phase 3 Reformulated Gasoline (Ethanol Permeation) T 13, CCR, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2270, 2271, and 2273	06/14/07	On-road
Aftermarket Catalytic Converters and Used Catalytic Converters T 13, CCR, 2222	10/25/07	On-road
Port Truck Modernization T 13, CCR, 2027	12/07/07	On-road
Cleaner In-Use Heavy-Duty Trucks T 13, CCR, 2025	12/11/08	On-road
Enhanced Fleet Modernization Program (formerly “Expanded Vehicle Retirement Program”) T 13, CCR, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, and 2630	06/26/09	On-road
Advanced Clean Cars T 13, CCR, 1900, 1956, 1960, 1961, 1962, 1965, 1968, 1976, 1978, 2037, 2038, 2062, 2112, 2139, 2140, 2145, 2147, 2235, 2300, 2302, 2303, 2304, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, and 2318	01/27/12	On-road

Attachment B

ADOPTED TRANSPORTATION CONTROL MEASURES

The following tables represent each county’s RACM commitment to implement TCMs as submitted for the *2002 Severe Area Ozone Plan* and approved by EPA.

Table D-6 San Joaquin Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	SJCOG	Escalon	Lathrop	Lodi	Manteca	Ripon	Stockton	Tracy	County of San Joaquin	San Joaquin Regional Transit District
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
											✓
SJC1.1	Regional Express Bus Program										✓
SJC1.2	Transit Access to Airports										✓
SJC1.3	Study Benefits of Bus Retrofit Program								✓		✓
SJC1.4	Mass Transit Alternatives										✓
SJC1.5	Expansion of Public Transportation Systems								✓		✓
SJC1.6	Transit Service Improvements in Combination with Park-and-Ride Lots and Parking Management								✓		✓
SJC1.7	Free (to the public) transit during special events								✓		✓
SJC1.9	Increase parking at transit centers or stops								✓		
SJC3.1	Commute Solutions	✓									
SJC3.2	Parking Cash-Out	✓									
SJC3.3	Employer Rideshare Program Incentives	✓									
SJC3.5	Preferential Parking for Carpools and Vanpools	✓									
SJC3.8	Purchase vans for vanpools	✓									
SJC3.9	Encourage merchants and employers to subsidize the cost of transit for employees	✓			✓				✓		
SJC13.16	Telecommuting	✓									
SJC5.1	Develop Intelligent Transportation Systems	✓							✓		
SJC5.2	Coordinate Traffic Signal Systems		✓	✓	✓	✓		✓	✓	✓	
SJC5.3	Reduce Traffic Congestion at Major Intersections		✓	✓	✓	✓		✓	✓	✓	
SJC5.4	Site-Specific Transportation Control Measures		✓	✓	✓	✓		✓	✓	✓	
SJC5.6	Reversible Lanes				✓						
SJC5.7	One-Way Streets							✓	✓		
SJC5.8	On-Street Parking Restrictions			✓		✓		✓	✓	✓	

Table D-6 San Joaquin Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	SJCOG	Escalon	Lathrop	Lodi	Manteca	Ripon	Stockton	Tracy	County of San Joaquin	San Joaquin Regional Transit District
SJC5.9	Bus Pullouts in Curbs for Passenger Loading			✓				✓	✓		
SJC5.10	Additional Freeway Service Patrol										
SJC5.16	Adaptive traffic signals and signal timing		✓	✓	✓			✓	✓		
SJC5.17	Freeway bottleneck improvements (add lanes, construct shoulders, etc.)	✓									
SJC6.1	Park and Ride Lots	✓	✓						✓		
SJC6.2	Park and Ride lots serving perimeter counties	✓									
SJC7.3	Involve school districts to encourage walking/bicycling to school								✓		
SJC7.4	Adjust school hours so they do not coincide with peak traffic periods and Ozone seasons										
SJC7.11	Auto restricted zones								✓		
SJC8.1	Financial Incentives	✓									
SJC8.2	Internet ridematching services	✓									
SJC8.3	Preferential parking for carpoolers	✓									
SJC8.4	Credits and incentives for carpoolers	✓									
SJC8.5	Encourage employers to provide vehicles to carpoolers for running errands or emergencies	✓									
SJC8.6	Subscription Services										✓
SJC9.1	Establish Auto Free Zones and Pedestrian Malls		✓		✓			✓			
SJC9.2	Encouragement of Pedestrian Travel		✓	✓		✓		✓	✓	✓	
SJC9.3	Bicycle/Pedestrian Program		✓	✓	✓	✓		✓	✓	✓	
SJC9.4	Close certain roads for use by non-motorized traffic		✓	✓	✓	✓		✓	✓	✓	
SJC9.5	Encouragement of Bicycle Travel	✓	✓	✓					✓		
SJC9.8	Close streets for special events for use by bikes and pedestrians when/where appropriate		✓	✓	✓	✓		✓	✓	✓	
SJC10.2	Bike Racks on Buses	✓							✓		✓
SJC10.4	Development of Bicycle Travel Facilities	✓	✓	✓	✓	✓		✓	✓	✓	

Table D-6 San Joaquin Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	SJCOG	Escalon	Lathrop	Lodi	Manteca	Ripon	Stockton	Tracy	County of San Joaquin	San Joaquin Regional Transit District
SJC13.1	Alternative Work Schedules	✓							✓		
SJC13.2	Modifications of Work Schedules	✓							✓		
SJC13.3	Telecommunications-Telecommuting	✓									
SJC13.4	Telecommunications-Teleconferencing	✓									
SJC14.3	Land Use/Development Alternatives		✓	✓	✓	✓		✓		✓	
SJC14.6	Transportation for Livable Communities (TLC)/Housing Incentive Program	✓							✓		
SJC15.1	Encouragement of Pedestrian Travel	✓							✓		
SJC15.2	Pedestrian and Bicycle Overpasses Where Safety Dictates		✓	✓	✓	✓		✓			
SJC17.1	Enforcement of Traffic, Parking, and Air Pollution Regulations		✓			✓		✓			
SJC17.6	Satellite campuses										
TCM1	Traffic Flow Improvements				✓	✓		✓	✓	✓	
TCM2	Public Transit								✓		✓
TCM3	Rideshare Programs	✓									
TCM4	Bicycle Programs	✓	✓	✓	✓	✓		✓	✓	✓	
TCM5	Alternative Fuels Program				✓			✓	✓	✓	
EPA	Commute Benefits	✓									
District	Heavy Duty Engine Emission Reduction Incentive Program										

Table D-7 Stanislaus Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	StanCOG	Ceres	Hughson	Modesto	Newman	Oakdale	Patterson	Riverbank	Turlock	Waterford	Stanislaus County
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ST1.1	Regional Express Bus Program				✓							
ST1.2	Transit Access to Airports				✓							
ST1.4	Mass Transit Alternatives		✓				✓		✓	✓		
ST1.5	Expansion of Public Transportation Systems		✓		✓					✓		✓
ST1.7	Free transit during special events		✓		✓			✓				✓
ST3.1	Commute Solutions	✓										
ST3.5	Preferential Parking for Carpools and Vanpools				✓					✓		
ST3.9	Encourage merchants and employers to subsidize the cost of transit for employees						✓					
ST13.16	Telecommuting										✓	
ST5.1	Develop Intelligent Transportation Systems		✓		✓				✓			
ST5.2	Coordinate Traffic Signal Systems		✓		✓			✓		✓		
ST5.3	Reduce Traffic Congestion at Major Intersections		✓		✓		✓	✓		✓		✓
ST5.4	Site-Specific Transportation Control Measures		✓		✓					✓		
ST5.9	Bus Pullouts in Curbs for Passenger Loading		✓		✓		✓	✓	✓	✓		✓
ST5.13	Fewer stop signs		✓		✓			✓		✓		
ST5.15	Changeable lane assignments											
ST5.16	Adaptive traffic signals and signal timing											✓
ST7.14	Incentives for cities with good development practices											
ST7.15	Cash incentives to foster jobs/housing balance						✓	✓		✓		
ST7.16	Trip reduction oriented development				✓		✓			✓		
ST7.17	Transit oriented development						✓			✓		
ST7.18	Sustainable development				✓		✓			✓		
ST7.19	Establishment of Urban Growth Boundaries									✓		
ST8.1	Financial Incentives, Including Zero Bus Fares				✓							✓

Table D-7 Stanislaus Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	StanCOG	Ceres	Hughson	Modesto	Newman	Oakdale	Patterson	Riverbank	Turlock	Waterford	Stanislaus County
ST8.2	Internet ride-matching services											
ST8.3	Preferential parking for carpoolers				✓					✓		
ST8.4	Credits and incentives for carpoolers				✓					✓		
ST9.2	Encouragement of Pedestrian Travel			✓			✓	✓		✓	✓	
ST9.3	Bicycle/Pedestrian Program	✓		✓			✓	✓	✓	✓	✓	✓
ST9.5	Encouragement of Bicycle Travel				✓	✓	✓	✓	✓	✓	✓	
ST9.11	Safe Routes to School		✓	✓	✓		✓	✓		✓		
ST10.2	Bike Racks on Buses				✓		✓		✓	✓		✓
ST11.8	Ban cruising during Ozone Alert Days				✓							
ST11.9	Discourage drive-thrus in new development				✓							
ST13.1	Alternative Work Schedules							✓	✓			
ST13.5	Internet commerce and education	✓		✓	✓	✓	✓	✓	✓	✓		✓
ST14.3	Land Use/Development Alternatives		✓		✓							
ST14.7	Incentives to increase density around transit centers											
ST14.8	Incentives for cities with good development practices											
ST15.1	Encouragement of Pedestrian Travel			✓			✓	✓			✓	
ST15.2	Pedestrian and Bicycle Overpasses Where Safety Dictates				✓		✓		✓	✓		
ST17.15	Encourage the purchase and use of alternative, cleaner vehicles								✓	✓		
STTCM1	Traffic Flow Improvements											
STTCM2	Public Transit											
STTCM3	Rideshare Programs											
STTCM4	Bicycle Programs											
STTCM5	Alternative Fuels Program											
ARB	Parking Cash-Out											

Table D-7 Stanislaus Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	StanCOG	Ceres	Hughson	Modesto	Newman	Oakdale	Patterson	Riverbank	Turlock	Waterford	Stanislaus County
EPA	Commute Benefits											
District	Heavy Duty Engine Emission Reduction Incentive Program											
	ADDITIONAL COMMITMENTS FOR MEASURES NOT ON THE SUGGESTED LIST											
10.1	Region-wide Mandatory Bile Racks at Work Sites		✓									

Table D-8 Merced County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	MCAG	Atwater	Dos Palos	Gustine	Livingston	Los Banos	Merced	County of Merced	Transit Joint Powers Authority for Merced County
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓
ME1.5	Expansion of Public Transportation Systems									✓
ME1.10	Particulate Trap Retrofit									
ME3.1	Commute Solutions	✓								
ME3.3	Employer Rideshare Program Incentives									
ME3.9	Encourage merchants and employers to subsidize the cost of transit for employees									✓
ME5.3	Reduce Traffic Congestion at Major Intersections		✓	✓	✓	✓	✓	✓	✓	
ME5.7	One-Way Streets							✓		
ME5.9	Bus Pullouts in Curbs for Passenger Loading									✓
ME5.19	Internet provided road and route information									
ME8.2	Internet ride-matching services	✓								
ME9.2	Encouragement of Pedestrian Travel									
ME9.3	Bicycle/Pedestrian Program									
ME9.4	Close certain roads for use by non-motorized traffic		✓	✓	✓	✓	✓	✓	✓	
ME9.5	Encouragement of Bicycle Travel									
ME10.2	Bike Racks on Buses									
ME14.3	Land Use/Development Alternatives		✓	✓	✓	✓	✓	✓	✓	
ME14.5	Evaluation of the Air Quality Impacts of New development and Mitigation of Adverse Impacts		✓	✓	✓	✓	✓	✓	✓	
ME15.1	Encouragement of Pedestrian Travel									
ME17.12	Use scout troops, churches, public figures to carry message of air pollution problems									

Table D-8 Merced County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	MCAG	Atwater	Dos Palos	Gustine	Livingston	Los Banos	Merced	County of Merced	Transit Joint Powers Authority for Merced County
TCM1	Traffic Flow Improvements		✓	✓	✓	✓	✓		✓	
TCM2	Public Transit							✓		
TCM3	Rideshare Programs	✓								
TCM4	Bicycle Programs									

Table D-9 Madera County Transportation Commission Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	MCTC	Chowchilla	Madera County	Madera
	Resolution Adopting Local Government Control Measures for the Sever Area Ozone Plan	✓	✓	✓	✓
MA1.5	Expansion of Public Transportation Systems		✓	✓	✓
MA1.7	Free transit during special events				✓
MA3.1	Commute Solutions	✓			
MA3.5	Preferential Parking for Carpools and Vanpools	✓			
MA3.9	Encourage merchants and employers to subsidize the cost of transit for employees	✓			
MA5.1	Develop Intelligent Transportation Systems		✓	✓	✓
MA5.2	Coordinate Traffic Signal Systems				✓
MA5.3	Reduce Traffic Congestion at Major Intersections			✓	✓
MA5.5	Removal of On-Street Parking				
MA5.9	Bus Pullouts in Curbs for Passenger Loading				✓
MA5.19	Internet provided road and route information		✓	✓	✓
MA7.3	Involve school districts to encourage walking to school				
MA9.2	Encouragement of Pedestrian Travel				
MA9.3	Bicycle/Pedestrian Program		✓	✓	✓
MA9.5	Encouragement of Bicycle Travel				
MA9.8	Close streets for special events for use by bikes and pedestrians			✓	✓
MA10.2	Bike Racks on Buses				
MA11.2	Encourage Limitations on Vehicle Idling	✓			
MA11.6	Promote use of Pony engines	✓			
MA13.3	Telecommunications-Telecommuting	✓			
MA13.4	Telecommunications-Teleconferencing	✓	✓	✓	✓
MA14.1	Area wide Public Awareness Programs	✓			

Table D-9 Madera County Transportation Commission Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	MCTC	Chowchilla	Madera County	Madera
MA14.5	Evaluation of the Air Quality Impacts of New development and Mitigation of Adverse Impacts		✓	✓	✓
MA15.1	Encouragement of Pedestrian Travel				
MA17.12	Use scout troops, churches, public figures to carry message of air pollution problems				
TCM1	Traffic Flow Improvements		✓	✓	✓
TCM2	Public Transit		✓	✓	✓
TCM3	Rideshare Programs	✓			
TCM4	Bicycle Programs				
TCM5	Alternative Fuels Program			✓	✓
EPA	Commute Benefits	*			
* MCTC has indicated that implementation of this measure is included in Measure 3.1 Commute Solutions, but was inadvertently omitted from the resolution package.					

Table D-10 Fresno Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	Fresno COG	Clovis/Clovis Transit	Coa-linga	Fire-baugh	Fowler	Fresno/Fresno Area Express	Huron	Kerman	Kings-burg	Men-dota	Orange Cove	Parlier	Reedley	Sanger	San Joaquin	Selma	Fresno County	Fresno County Rural Transit Agency
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FR1.1	Regional Express Bus Program		✓				✓												✓
FR1.2	Transit Access to Airports		✓				✓												
FR1.3	Study Benefits of Bus Retrofit Program		✓				✓												
FR1.4	Mass Transit Alternatives		✓				✓												✓
FR1.5	Expansion of Public Transportation Systems		✓				✓												✓
FR1.6	Transit Service Improvements in Combination with Park-and-Ride Lots and Parking Management																		
FR1.7	Free transit during special events		✓				✓												
FR1.9	Increase parking at transit centers or stops						✓												
FR2.3	Fixed Lanes for Buses and Carpools on Arterials																		
FR3.1	Commute Solutions	✓																	
FR3.2	Parking Cash-Out	✓																	
FR3.3	Employer Rideshare Program Incentives																		
FR3.5	Preferential Parking for Carpools and Vanpools	✓																	
FR3.6	Employee Parking Fees	✓																	
FR3.8	Purchase vans for vanpools																		
FR3.9	Encourage merchants and employers to subsidize the cost of transit for employees	✓																	
FR13.16	Telecommuting																		
FR5.1	Develop Intelligent Transportation Systems		✓				✓												
FR5.2	Coordinate Traffic Signal Systems		✓				✓	✓	✓				✓	✓	✓		✓	✓	
FR5.3	Reduce Traffic Congestion at Major Intersections		✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	
FR5.4	Site-Specific Transportation Control Measures		✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	

Table D-10 Fresno Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	Fresno COG	Clovis/Clovis Transit	Coa-linga	Fire-baugh	Fowler	Fresno/Fresno Area Express	Huron	Kerman	Kings-burg	Men-dota	Orange Cove	Parlier	Reedley	Sanger	San Joaquin	Selma	Fresno County	Fresno County Rural Transit Agency
FR5.5	Removal of On-Street Parking		✓	✓			✓	✓		✓		✓		✓	✓		✓	✓	
FR5.6	Reversible Lanes																		
FR5.7	One-Way Streets																✓		
FR5.8	On-Street Parking Restrictions		✓				✓											✓	
FR5.9	Bus Pullouts in Curbs for Passenger Loading		✓				✓											✓	
FR5.10	Additional Freeway Service Patrol	✓																	
FR5.11	Consider coordinating scheduling of arterial and highway maintenance to exclude ozone action days if the maintenance activities require lane reductions on heavily utilized arterials and highways		✓				✓											✓	
FR5.13	Fewer stop signs, remove unwarranted and "political" stop signs and signals		✓		✓		✓			✓				✓			✓	✓	
FR5.14	Ban left turns		✓				✓												
FR5.15	Changeable lane assignments																		
FR5.16	Adaptive traffic signals and signal timing		✓				✓											✓	
FR5.18	Minimize impact of construction on traveling public. Have contractors pay when lanes are closed as an incentive to keep lanes open		✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR6.1	Park and Ride Lots					✓		✓	✓	✓			✓	✓		✓	✓		
FR6.2	Park and Ride lots serving perimeter counties					✓		✓	✓	✓			✓	✓		✓	✓		
FR7.12	Incentives to increase density around transit centers		✓				✓												
FR8.1	Financial Incentives, Including Zero Bus Fares																		
FR8.2	Internet ride-matching services	✓																	
FR8.3	Preferential parking for carpoolers	✓																	
FR8.4	Credits and incentives for carpoolers	✓																	
FR8.5	Employers provide vehicles to carpoolers for running errands or emergencies	✓																	
FR8.6	Subscription Services																		✓

Table D-10 Fresno Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	Fresno COG	Clovis/Clovis Transit	Coa-linga	Fire-baugh	Fowler	Fresno/Fresno Area Express	Huron	Kerman	Kings-burg	Men-dota	Orange Cove	Parlier	Reedley	Sanger	San Joaquin	Selma	Fresno County	Fresno County Rural Transit Agency
FR9.1	Establish Auto Free Zones and Pedestrian Malls			✓			✓			✓									
FR9.2	Encouragement of Pedestrian Travel		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			
FR9.3	Bicycle/Pedestrian Program		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
FR9.4	Close certain roads for use by non-motorized traffic		✓	✓			✓			✓		✓		✓	✓		✓	✓	
FR9.5	Encouragement of Bicycle Travel		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR9.7	Cash Rebates for Bikes																		
FR9.8	Close streets for special events for use by bikes and pedestrians		✓	✓			✓			✓		✓		✓	✓		✓	✓	
FR9.10	Provide funding so volunteers do not have to pay the cost of trail creation and maintenance		✓		✓		✓							✓				✓	
FR10.2	Bike Racks on Buses		✓				✓												
FR10.4	Development of Bicycle Travel Facilities		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR10.5	Expedite Bicycle Projects from RTP		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
FR10.6	Provide Bike/Pedestrian facilities safety patrols		✓		✓		✓	✓			✓			✓			✓		
FR10.7	Require inclusion of bicycle lanes on state or federally funded thoroughfare projects.		✓	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		
FR11.3	Turn off engines while stalled in traffic																		
FR13.1	Alternative Work Schedules	✓																	
FR13.2	Modifications of Work Schedules	✓																	
FR13.3	Telecommunications-Telecommuting	✓																	
FR13.4	Telecommunications-Teleconferencing	✓																	
FR14.3	Land Use/Development Alternatives		✓			✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	
FR14.5	Evaluation of the Air Quality Impacts of New Development and Mitigation of Adverse Impacts		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR14.7	Incentives to increase density around transit centers		✓				✓												
FR15.1	Encouragement of Pedestrian Travel	✓																	
FR15.2	Pedestrian and Bicycle Overpasses Where Safety Dictates		✓				✓											✓	

Table D-10 Fresno Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	Fresno COG	Clovis/Clovis Transit	Coa-linga	Fire-baugh	Fowler	Fresno/Fresno Area Express	Huron	Kerman	Kings-burg	Men-dota	Orange Cove	Parlier	Reedley	Sanger	San Joaquin	Selma	Fresno County	Fresno County Rural Transit Agency
FR17.1	Enforcement of Traffic, Parking, and Air Pollution Regulations		✓	✓	✓		✓	✓		✓					✓		✓		
FR17.6	Satellite campuses																		
FR-TCM1	Traffic Flow Improvements		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR-TCM2	Improved Public Transit						✓						✓						✓
FR-TCM3	Voluntary Rideshare Program and Employer Incentive Program	✓																	
FR-TCM4	Bicycle Lanes and Facilities		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR-TCM5	Alternative Fuels Program		✓		✓	✓	✓				✓			✓				✓	
FR-TCM6	Park and Ride Fringe Parking					✓		✓	✓	✓			✓	✓		✓	✓		
ARB	Parking Cash-Out	✓																	
EPA	Commute Benefits	✓																	
District	Heavy Duty Engine Emission Reduction Incentive Program																		
FR19.1	Regional Express Bus Program		✓				✓												✓
FR19.2	Expansion of Public Transportation Systems		✓				✓												✓
FR19.3	Consolidation of Public Transit Operators						✓												
FR19.4	Increase Parking at Transit Centers or Stops						✓			✓				✓					
FR19.5	Transit Stop Improvements		✓				✓												✓
FR19.6	Productivity Improvements		✓				✓												✓
FR19.7	Ridership Targets						✓												
FR19.18	Pedestrian facilities		✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
FR19.25	Optimize traffic signal timing		✓				✓	✓	✓				✓	✓	✓		✓	✓	
FR19.26	Encourage employers to provide money to employees for home computer purchase so employees can work from home.	✓																	

Table D-10 Fresno Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	Fresno COG	Clovis/Clovis Transit	Coa-linga	Fire-baugh	Fowler	Fresno/Fresno Area Express	Huron	Kerman	Kings-burg	Men-dota	Orange Cove	Parlier	Reedley	Sanger	San Joaquin	Selma	Fresno County	Fresno County Rural Transit Agency
	ADDITIONAL COMMITMENTS FOR MEASURES NOT ON THE SUGGESTED LIST																		
10.7A	Require Inclusion of Paved Shoulders Adequate for Bicycle Use on State or Federally Funded Reconstruction or Widening of Federal Major Collectors or Greater																	✓	

Table D-11 Tulare County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	TCAG	Dinuba	Exeter	Farmersville	Lindsay	Porterville	Tulare	Woodlake	Visalia	County of Tulare
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TU1.1	Regional Express Bus Program							✓			✓
TU1.2	Transit Access to Airports						✓	✓		✓	
TU1.5	Expansion of Public Transportation Systems		✓	✓	✓	✓		✓	✓	✓	✓
TU1.6	Transit Service Improvements in Combination with Park-and-Ride Lots and Parking Management					✓	✓	✓			
TU1.7	Free transit during special events					✓	✓	✓		✓	
TU1.9	Increase parking at transit centers or stops						✓	✓			
											✓
TU3.1	Commute Solutions			✓	✓		✓	✓	✓		
TU3.2	Parking Cash-Out			✓			✓	✓	✓		✓
TU3.3	Employer Rideshare Program Incentives	✓					✓	✓		✓	
TU3.5	Preferential Parking for Carpools and Vanpools			✓	✓	✓	✓	✓	✓	✓	✓
TU3.8	Purchase vans for vanpools	✓									
TU3.9	Encourage merchants and employers to subsidize the cost of transit for employees	✓					✓	✓		✓	
TU5.1	Develop Intelligent Transportation Systems	✓				✓	✓	✓		✓	
TU5.2	Coordinate Traffic Signal Systems	✓					✓	✓		✓	
TU5.3	Reduce Traffic Congestion at Major Intersections	✓				✓	✓	✓		✓	
TU5.4	Site-Specific Transportation Control Measures	✓		✓	✓	✓	✓	✓	✓	✓	
TU5.5	Removal of On-Street Parking				✓	✓	✓	✓	✓	✓	✓
TU5.8	On-Street Parking Restrictions				✓	✓		✓	✓	✓	
TU5.9	Bus Pullouts in Curbs for Passenger Loading				✓		✓	✓	✓	✓	
TU5.16	Adaptive traffic signals and signal timing			✓	✓		✓	✓		✓	
TU5.19	Internet provided road and route information		✓	✓		✓		✓	✓	✓	
TU5.20	Regional route marking systems to encourage underutilized capacity	✓				✓		✓		✓	
TU6.1	Park and Ride Lots					✓	✓	✓			

Table D-11 Tulare County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	TCAG	Dinuba	Exeter	Farmersville	Lindsay	Porterville	Tulare	Woodlake	Visalia	County of Tulare
TU7.3	Involve school districts to encourage walking to school		✓	✓	✓	✓	✓	✓	✓	✓	
TU7.12	Incentives to increase density around transit centers	✓					✓	✓			
TU7.13	Land use/air quality guidelines		✓	✓	✓	✓	✓	✓	✓	✓	
TU7.14	Incentives for cities with good development practices			✓	✓	✓	✓		✓		
TU7.17	Transit oriented development						✓	✓			
TU8.1	Financial Incentives, Including Zero Bus Fares										
TU8.2	Internet ride matching services										
TU8.3	Preferential parking for carpoolers		✓	✓	✓				✓	✓	✓
TU8.4	Credits and incentives for carpoolers		✓							✓	
TU8.5	Employers provide vehicles to carpoolers for running errands or emergencies	✓				✓					
TU8.6	Subscription Services										
TU9.1	Establish Auto Free Zones and Pedestrian Malls					✓		✓			
TU9.2	Encouragement of Pedestrian Travel					✓	✓	✓			
TU9.3	Bicycle/Pedestrian Program	✓				✓	✓	✓		✓	
TU9.4	Close certain roads for use by non-motorized traffic							✓			
TU9.5	Encouragement of Bicycle Travel	✓		✓		✓	✓	✓		✓	
TU9.8	Close streets for special events for use by bikes and pedestrians					✓	✓	✓			
TU9.9	Use condemned dirt roads for bike trails							✓			
TU10.1	Region-wide mandatory bike racks at work sites	✓						✓		✓	
TU10.2	Bike Racks on Buses						✓	✓	✓	✓	✓
TU11.6	Promote use of Pony engines	✓						✓			
TU13.1	Alternative Work Schedules	✓						✓			
TU13.2	Modifications of Work Schedules	✓						✓			
TU13.3	Telecommunications-Telecommuting	✓				✓					
TU13.4	Telecommunications-Teleconferencing	✓				✓		✓		✓	

Table D-11 Tulare County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	TCAG	Dinuba	Exeter	Farmersville	Lindsay	Porterville	Tulare	Woodlake	Visalia	County of Tulare
TU14.1	Area-wide Public Awareness Programs		✓					✓			
TU14.2	Special Event Controls			✓	✓		✓		✓		
TU14.3	Land Use/Development Alternatives		✓	✓	✓	✓	✓	✓	✓	✓	✓
TU14.4	Voluntary No Drive Day Programs		✓					✓			
TU14.5	Evaluation of the Air Quality Impacts of New development and Mitigation of Adverse Impacts		✓	✓	✓	✓	✓	✓	✓	✓	✓
TU14.6	Transportation for Livable Communities (TLC)/Housing Incentive Program		✓	✓	✓	✓			✓		
TU14.7	Incentives to increase density around transit centers						✓	✓			
TU14.8	Incentives for cities with good development practices			✓	✓		✓		✓		
TU15.1	Encouragement of Pedestrian Travel									✓	
TU15.2	Pedestrian and Bicycle Overpasses Where Safety Dictates							✓			
TU17.6	Satellite campuses					✓					
TU17.12	Use scout troops, churches, public figures to carry message of air pollution problems	✓	✓	✓	✓		✓	✓	✓	✓	✓
TU17.14	Cool cities approach to reduce heat build-up					✓	✓	✓			
TCM1	Traffic Flow Improvements			✓	✓		✓		✓	✓	✓
TCM2	Public Transit		✓	✓	✓		✓			✓	✓
TCM3	Rideshare Programs						✓				
TCM4	Bicycle Programs	✓				✓		✓	✓	✓	
TCM5	Alternative Fuels Program	✓	✓				✓	✓		✓	✓
ARB	Parking Cash-Out										
EPA	Commute Benefits										
District	Heavy Duty Engine Emission Reduction Incentive Program										
	ADDITIONAL COMMITMENTS FOR MEASURES NOT ON THE SUGGESTED LIST										
TU1.8	Require that government employees use transit for home to work trips, expand transit, and encourage large businesses to promote transit use							✓			
TU3.14	Mandatory compressed work weeks					✓					
TU5.6	Reversible Lanes					☐		✓			
TU5.7	One-Way Streets					☐		✓		✓	

Table D-11 Tulare County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	TCAG	Dinuba	Exeter	Farmersville	Lindsay	Porterville	Tulare	Woodlake	Visalia	County of Tulare
TU5.13	Fewer Stop Signs						✓	✓			
TU7.15	Cash incentives to foster jobs/housing balance					✓					
TU7.16	Trip reduction oriented development					✓		✓			
TU7.18	Sustainable development					✓		✓			
TU11.2	Encourage Limitations on Vehicle Idling					☐		✓			
TU17.1	Enforcement of Traffic, Parking, and Air Pollution Regulations					✓					
	Promote Use of Cleaner Lawn and Garden Equipment such as Lower-Emission Four-Stroke and Electric-Powered Equipment							✓			
	Defer Emissions Associated with Governmental Activities							✓			

Table D-12 Kings County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCAG	Avenal	Corcoran	Hanford	Lemoore	County of Kings	Kings County Area Public Transit Agency
	Resolution Adopting Local Government Control measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓
KI1.5	Expansion of Public Transportation Systems		✓	✓				✓
KI1.6	Transit Service Improvements in Combination with Park-and-Ride Lots and Parking Management		✓	✓	✓			✓
KI1.7	Free transit during special events		✓	✓	✓			✓
KI3.1	Commute Solutions							
KI3.3	Employer Rideshare Program Incentives					✓		
KI3.5	Preferential Parking for Carpools and Vanpools						✓	
KI3.8	Purchase vans for vanpools		✓					✓
KI3.9	Encourage merchants and employers to subsidize the cost of transit for employees		✓	✓		✓		
KI6.1	Park and Ride Lots		✓		✓			
KI6.2	Park and Ride lots serving perimeter counties		✓		✓			
KI8.2	Internet ride-matching services							
KI8.3	Preferential parking for carpoolers						✓	
KI8.5	Employers provide vehicles to carpoolers for running errands or emergencies							
KI8.6	Subscription Services							
KI9.2	Encouragement of Pedestrian Travel		✓	✓	✓	✓	✓	
KI9.3	Bicycle/Pedestrian Program				✓			
KI9.4	Close certain roads for use by non-motorized traffic		✓	✓	✓	✓	✓	
KI9.5	Encouragement of Bicycle Travel		✓	✓	✓			
KI9.8	Close streets for special events for use by bikes and pedestrians		✓	✓	✓	✓	✓	
KI10.1	Region-wide mandatory bike racks at work sites				✓			
KI10.2	Bike Racks on Buses		✓	✓				✓
KI11.6	Promote use of Pony engines							

Table D-12 Kings County Association of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCAG	Avenal	Corcoran	Hanford	Lemoore	County of Kings	Kings County Area Public Transit Agency
KI13.1	Alternative Work Schedules				✓		✓	
KI13.2	Modifications of Work Schedules				✓	✓	✓	
KI13.4	Telecommunications-Teleconferencing		✓	✓	✓	✓	✓	
KI14.1	Area-wide Public Awareness Programs				✓			
KI14.3	Land Use/Development Alternatives				✓	✓	✓	
KI14.4	Voluntary No Drive Day Programs							
KI15.1	Encouragement of Pedestrian Travel		✓	✓	✓	✓	✓	
TCM1	Traffic Flow Improvements		✓	✓	✓		✓	
TCM2	Public Transit		✓	✓				✓
TCM3	Rideshare Programs	✓						
TCM4	Bicycle Programs		✓	✓	✓			
TCM5	Alternative Fuels Program				✓		✓	
EPA	Commute Benefits		✓	✓				
	ADDITIONAL COMMITMENTS FOR MEASURES NOT ON THE SUGGESTED LIST							
5.1	Develop Intelligent Transportation Systems				✓			
5.3	Reduce Traffic Congestion at Major Intersections		✓	✓	✓	✓	✓	
5.4	Site-Specific Transportation Control Measures		✓	✓	✓	✓	✓	
5.5	Removal of On-Street Parking		✓	✓	✓	✓	✓	
5.8	On-Street Parking Restrictions				✓		✓	
5.9	Bus Pullouts In Curbs for Passenger Loading				✓		✓	
5.22	Use Dynamic Message Signs to Direct/Smooth Speeds During Incidents						✓	
7.3	Involve School Districts to Encourage Walking to School				✓			
7.13	Land Use/Air Quality Guidelines				✓			
7.14	Incentives for Cities with Good Development Practices				✓			
17.6	Satellite Campuses				✓			

Table D-13 Kern Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCOG	Arvin	Bakersfield	California City*	County of Kern	Delano	Golden Empire Transit	Maricopa	McFarland	Ridgecrest*	Shafter	Taft	Tehachapi*	Wasco
	Resolution Adopting Local Government Control Measures for the Severe Area Ozone Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
KE1.1	Regional Express Bus Program		✓			✓									
KE1.2	Transit Access to Airports														
KE1.4	Mass Transit Alternatives														
KE1.5	Expansion of Public Transportation Systems		✓			✓	✓					✓	✓	☐	
KE1.7	Free transit during special events					✓	✓					✓			✓
KE1.11	Make small dial-a-ride systems free														
KE1.12	Regional Express across county lines														
KE3.1	Commute Solutions														
KE3.2	Parking Cash-Out														
KE3.5	Preferential Parking for Carpools and Vanpools	✓													
KE3.9	Encourage merchants and employers to subsidize the cost of transit for employees						✓					✓			✓
KE3.15	Extend parking cash-out rule to more employers	**													
KE3.17	Promote Employer Rideshare Program Incentives														
KE3.18	Promote compressed work weeks														
KE3.19	Promote voluntary business closures on ozone action days														
KE5.1	Develop Intelligent Transportation Systems			✓									✓	☐	
KE5.2	Coordinate Traffic Signal Systems			✓		✓									
KE5.3	Reduce Traffic Congestion at Major Intersections			✓		✓								✓	✓
KE5.4	Site-Specific Transportation Control Measures			✓		✓									
KE5.5	Removal of On-Street Parking			✓	✓	✓					✓				✓
KE5.8	On-Street Parking Restrictions				✓										
KE5.9	Bus Pullouts in Curbs for Passenger Loading														

Table D-13 Kern Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCOG	Arvin	Bakersfield	California City*	County of Kern	Delano	Golden Empire Transit	Maricopa	McFarland	Ridgecrest*	Shafter	Taft	Tehachapi*	Wasco
KE5.11	Consider coordinating scheduling of arterial and highway maintenance to exclude ozone action days if the maintenance activities require lane reductions on heavily utilized arterials and highways			✓		✓									
KE5.16	Adaptive traffic signals and signal timing			✓											
KE5.18	Minimize impact of construction on traveling public. Have contractors pay when lanes are closed as an incentive to keep lanes open			✓		✓									
KE5.19	Internet provided road and route information			✓		✓	✓					✓			
KE5.20	Regional route marking systems to encourage underutilized capacity			✓		✓	✓					✓			
KE5.22	Use dynamic message signs to direct/smooth speeds during incidents			✓											
KE5.27	Place vehicle sensors further away from intersections														
KE6.1	Park and Ride Lots														
KE7.3	Involve school districts to encourage walking to school														
KE7.4	Adjust school hours so they do not coincide with peak traffic periods and Ozone seasons														
KE7.12	Incentives to increase density around transit centers	✓		✓		✓									
KE7.13	Land use/air quality guidelines			✓		✓									
KE7.14	Incentives for cities with good development practices														
KE7.16	Trip reduction oriented development			✓		✓									
KE7.17	Transit oriented development		✓	✓		✓									✓
KE7.18	Sustainable development			✓		✓									
KE7.19	Shortened government work days during ozone alerts														
KE7.20	Distribute special parking passes for carpoolers														
KE7.21	Outreach program encouraging reduced trips during warmest part of the day														

Table D-13 Kern Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCOG	Arvin	Bakersfield	California City*	County of Kern	Delano	Golden Empire Transit	Maricopa	McFarland	Ridgecrest*	Shafter	Taft	Tehachapi*	Wasco
KE8.2	Internet ride-matching services														
KE9.1	Establish Auto Free Zones and Pedestrian Malls			✓		✓									✓
KE9.2	Encouragement of Pedestrian Travel	✓				✓	✓					✓	✓	✓	
KE9.3	Bicycle/Pedestrian Program		✓			✓	✓				✓	✓	✓	☐	✓
KE9.5	Encouragement of Bicycle Travel	✓		✓	✓	✓	✓					✓	✓	✓	✓
KE9.8	Close streets for special events for use by bikes and pedestrians			✓			✓					✓			✓
KE9.10	Provide funding so volunteers do not have to pay the cost of trail creation and maintenance														
KE10.1	Region-wide mandatory bike racks at work sites			✓		✓	✓					✓			
KE10.2	Bike Racks on Buses		✓			✓	✓								
KE10.3	Regional Bike Parking Ordinance for all new construction			✓		✓							✓	☐	
KE13.2	Modifications of Work Schedules														
KE14.1	Area-wide Public Awareness Programs	✓													
KE14.2	Special Event Controls			✓		✓									
KE14.3	Land Use/Development Alternatives			✓		✓								✓	
KE14.4	Voluntary No Drive Day Programs	✓				✓									
KE14.5	Evaluation of the Air Quality Impacts of New development and Mitigation of Adverse Impacts						✓					✓		✓	✓
KE14.7	Incentives to increase density around transit centers	✓													
KE14.11	COG comments on land use planning decisions that affect transportation and air quality issues														
	Promote Telecommunications-Telecommuting														
	Promote Telecommunications-Teleconferencing														
	Promote voluntary business closures on														

Table D-13 Kern Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCOG	Arvin	Bakersfield	California City*	County of Kern	Delano	Golden Empire Transit	Maricopa	McFarland	Ridgecrest*	Shafter	Taft	Tehachapi*	Wasco
	ozone action days														
KE15.1	Encouragement of Pedestrian Travel	✓													
KE15.2	Pedestrian and Bicycle Overpasses Where Safety Dictates			✓		✓									
KE17.6	Satellite campuses														
KE17.7	Charge more for higher emission fuels														
KE17.12	Use scout troops, churches, public figures to carry message of air pollution problems	✓													
KE17.14	Cool cities approach to reduce heat build-up														
KE17.16	Contact other areas that have been subject to EPA sanctions to determine best ways to implement new air quality measures														
KE17.17	Alternative fuel outreach program														
TCM1	Traffic Flow Improvements														
TCM2	Public Transit														
TCM3	Rideshare Programs														
TCM4	Bicycle Programs														
TCM5	Alternative Fuels Program	✓				✓									✓
ARB	Parking Cash-Out														
EPA	Commute Benefits	***													
District	Heavy Duty Engine Emission Reduction Incentive Program														
	ADDITIONAL COMMITMENTS FOR MEASURES NOT ON THE SUGGESTED LIST														
8.5	Shared LEV Vehicles at Work Sites			✓	✓										
14.9	Business, Industry and Governmental Outreach Program	✓													
14.1	Public Education Program	✓													
Local	Develop Programs that Encourage Good Movements by Rail											✓			
Local	Purchase Low Emission Vehicles (LEV) for Government Fleet Purposes													✓	

Table D-13 Kern Council of Governments Summary of Commitments - 2002 Severe Area Ozone Plan

Number	Measure Title	KCOG	Arvin	Bakersfield	California City*	County of Kern	Delano	Golden Empire Transit	Maricopa	McFarland	Ridgecrest*	Shafter	Taft	Tehachapi*	Wasco

* These jurisdictions are located in the Mohave air basin, not the San Joaquin Valley air basin.

** KCOG has indicated that this measure is financially infeasible, but was inadvertently omitted from the reasoned justification documentation.

*** KCOG has indicated that implementation of this measure is included in Measure 14.9, but was inadvertently omitted from the resolution package.

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Appendix E

Modeling Protocol

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

This appendix was provided by the California Air Resources Board (ARB).

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PHOTOCHEMICAL MODELING PROTOCOL

Photochemical Modeling for the 1-Hour Ozone State Implementation Plan in the San Joaquin Valley

Prepared by

California Air Resources Board
San Joaquin Valley Air Pollution Control District

Prepared for

United States Environmental Protection Agency Region IX

March 01, 2013

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ACRONYMS

APCD – Air Pollution Control District

AQMD – Air Quality Management District

ARB – Air Resources Board

AUSPEX – Atmospheric Utility Signatures, Predictions and Experiments

BC – Boundary Conditions

BEIGIS – Geographic Information System based model for estimating BVOC emissions

BVOC – Biogenic Volatile Organic Compounds

CARB – California Air Resource Board

CBIV – Carbon Bond IV Chemical Mechanism

CCAQS – Central California Air Quality Studies

CCOS – Central California Ozone Study

CEFS – California Emission Forecasting System

CEIDARS – California Emission Inventory Development and Reporting System

CMAQ – Community Multiscale Air Quality model

CRPAQS – California Regional PM10/PM2.5 Air Quality Study

CO – Carbon Monoxide

DTIM – Direct Travel Impact Model

EIC – Emission Inventory Code

EMFAC – ARB's tool for estimating emissions from on-road vehicles

FDDA – Four Dimensional Data Assimilation

FORTRAN – The IBM Mathematical **For**mula **Tran**slating System

FR – Federal Register

GIS – Geographic Information System

IC – Initial Conditions

MEGAN – Model of Emissions of Gases and Aerosols from Nature

MM5 – Mesoscale Meteorological Model Version 5

MOZART – Model for Ozone and Related chemical Tracers

NAAQS – National Ambient Air Quality Standards

NAICS – North American Industry Classification System

NAMS – National Air Monitoring Station
NCAR – National Center for Atmospheric Research
NCEP – National Centers for Environmental Prediction
NO_x – Oxides of nitrogen
PAMS – Photochemical Assessment Monitoring Station
PM – Particulate Matter
$PM_{2.5}$ – Particulate Matter with aerodynamic diameter less than 2.5 µm
PM_{10} – Particulate Matter with aerodynamic diameter less than 10 µm
ROG – Reactive Organic Gas
RSAC – Reactivity Scientific Advisory Committee
SAPRC – State-wide Air Pollution Research Center chemical mechanism
SARMAP – SJVAQS/AUSPEX Regional Modeling Adaptation Project
SFBA – San Francisco Bay Area
SJV – San Joaquin Valley
SJVAQS – San Joaquin Valley Air Quality Study
SIP – State Implementation Plan
SIP-GICG – The SIP Gridded Inventory Coordination Group
SLAM – State and Local Air Monitoring Stations
SCC – Source Classification Code
SIC – Standard Industrial Classification
SMOKE – Sparse Matrix Object Kernel Emission
SO_x – Oxides of Sulfur
SPM – Special Purpose Monitoring
TOG – Total Organic Gas
VMT – Vehicle Miles Traveled
VOC – Volatile Organic Compounds
U.S. EPA – United States Environmental Protection Agency
WRF – Weather and Research Forecasting Model

1 INTRODUCTION

1.1 Purpose

The previous 1-hour ozone State Implementation Plan (SIP) for the San Joaquin Valley (SJV) extreme ozone nonattainment area was submitted to the U.S. EPA effective May 17, 2004 (69 FR 20550) and was fully approved on March 8, 2010 (75 FR 10420). However, the U.S. Court of Appeals for the Ninth Circuit in Sierra Club *et. al* v. EPA, 671 F.3d 955 (9th Cir. 2012) remanded the 2010 approval. As a result, on November 9, 2012, U.S. EPA withdrew its March 8, 2010 approval of the San Joaquin Valley's 2004 1-Hour Ozone SIP (77 FR 58078). A new 1-hour SIP for the San Joaquin Valley extreme ozone nonattainment area is now due. The air quality modeling protocol that is presented in this document will form the basis for developing a new 1-hour ozone SIP for the SJV. This document describes the input data, technical decisions, and procedures that will be used for computer-based simulations of 1-hour ozone concentrations. It also describes how model results will be evaluated with field measurements and how future year air quality will be simulated.

1.2 Approach

The modeling approach draws heavily on the products of large-scale, scientific studies in the region, collaboration among technical staff of State and local regulatory agencies, as well as from participation in technical and policy groups within the region. It is also consistent with the modeling approach used for the 2012 24-hour $PM_{2.5}$ SIP that was submitted to the U.S. EPA in early 2013.

1.3 History of Field Studies in the Region

The San Joaquin Valley (SJV) airshed is perhaps the second most studied airshed in the world, in terms of the number of publications in peer-reviewed international scientific/technical journals and other major reports. The Los Angeles airshed is the first. Major field studies that have taken place in the SJV and surrounding areas are listed in Table 2-1. A comprehensive listing of publications (reports and peer-reviewed journal articles) up to 2005, compiled by Professor John Watson of the Desert Research Institute, can be found at http://www.arb.ca.gov/airways/crpaqs/publications.htm.

The first major air quality study in the SJV, dubbed Project Lo-Jet, took place in 1970 and resulted in the identification of the Fresno Eddy (Lin and Jao, 1995 and references therein). The first Valley-wide study that formed the foundation for a SIP was the San Joaquin Valley Air Quality Study/Atmospheric Utilities Signatures Predictions and Experiments (SJVAQS/AUSPEX) study, also known as SARMAP (SJVAQS/AUSPEX Regional Modeling Adaptation Project). A 1-hour Extreme Ozone Attainment Demonstration Plan based on the SARMAP Study was submitted to the U.S. EPA in 2004 and was approved in 2009 (74 FR 33933; 75 FR 10420). The next major study was the Integrated Monitoring Study in 1995 (IMS-95), which was the pilot study for the subsequent California Regional PM_{10}/$PM_{2.5}$ Air Quality Study (CRPAQS) in 2000 (Solomon and Magliano, 1998). IMS-95 formed the technical basis for the 2003 PM_{10} SIP which was approved by the U.S. EPA in 2006 (71 FR 63642). The area was re-designated as attainment in 2008 (73 FR 66759). The first annual field campaign in the SJV was CRPAQS, and embedded in it was the Central California Ozone Study (CCOS) that took place during the summer of 2000 (Fujita et al., 2001). CRPAQS was a component of the technical foundation for the 2008 annual $PM_{2.5}$ SIP which was approved by the U.S. EPA in 2011 (76 FR 41338; 76 FR 69896), and CCOS was part of the technical basis for the 2007 8-hour O_3 SIP (76 FR 57846).

While CCOS is still very relevant to the current 1-hour O_3 SIP, there are two subsequent studies that are noteworthy for several different reasons. Either of these studies would not form the technical basis for a future SIP itself, but they contributed significantly to our understanding of various atmospheric processes.

The First was the California portion of the Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS-CARB) which took place during May-July 2010 (Jacob et al., 2010).This involved two instrumented aircraft. As Jacob et al. (2010) described, the planning for the ARCTAS-CARB flights were based on the following questions:

- How good is our current understanding of the HO_x-NO_x-O_3-aerosol photochemical system over the Los Angeles Basin as represented in air quality models?
- How should upwind boundary conditions for simulating air quality in California be specified?
- How do ship emissions and long-range transport affect the sulfur budget in southern California?
- What are the state's emissions of VOCs and greenhouse gases from urban and industrial activities, agricultural operations, and wildfires?

The analyses of ARCTAS-CARB data are still in progress, but some of the findings could be applicable to the current 1-hour O_3 SIP (Kaduwela and Cai, 2009; Huang et al., 2010; Singh et al., 2010; Pfister et al., 2011a,b; Huang et al., 2011; D'Allura et al., 2011; Singh et al., 2012; Ren et al., 2012; Huang et al., 2013). Note, however, that the ARCTAS-CARB field work was conducted during June-July, 2008 but the high 1-hour O_3 concentrations in SJV occur during late summer months.

The ARCTAS-CARB campaign was considered to be the pilot phase for a more comprehensive multi-platform study known as CalNex 2010 (Research at the Nexus of Air Quality and Climate Change conducted in 2010)(www.esrl.noaa.gov/csd/calnex/). This campaign was coordinated by NOAA and CARB together with researchers from several universities and national laboratories. It involved several instrumented aircraft, an instrumented ship, two surface supersites (one in Bakersfield and another in Pasadena), and networks of meteorological and ozonesonde measurements. It was designed to answer a much broader set of questions than ARCTAS-CARB did, however the data analysis phase is still in progress and only preliminary air quality modeling has been conducted to date (Cai and Kaduwela, 2011; Kelly et al., 2011; Angevine et al., 2012).

Table 1.1: Major Field Studies in Central California and surrounding areas.

Year	Study	Significance
1970	Project Lo-Jet	Identified summertime low-level jet and Fresno eddy
1972	Aerosol Characterization Experiment (ACHEX)	First TSP chemical composition and size distributions
1979-1980	Inhalable Particulate Network	First long-term $PM_{2.5}$ and PM_{10} mass and elemental measurements in Bay Area, Five Points
1978	Central California Aerosol and Meteorological Study	Seasonal TSP elemental composition, seasonal transport patterns
1979-1982	Westside Operators	First TSP sulfate and nitrate compositions in western Kern County
1984	Southern SJV Ozone Study	First major characterization of O_3 and meteorology in Kern County
1986-1988	California Source Characterization Study	Quantified chemical composition of source emissions
1988-1989	Valley Air Quality Study	First spatially diverse, chemical characterized, annual and 24-hour $PM_{2.5}$ and PM_{10}
Summer 1990	San Joaquin Valley Air Quality Study/Atmospheric Utilities Signatures Predictions and Experiments (SJVAQS/AUSPEX) – Also known as SARMAP (SJVAQS/AUSPEX Regional Modeling Adaptation Project)	First central California regional study of O_3 and $PM_{2.5}$
July and August 1991	California Ozone Deposition Experiment	Measurements of dry deposition velocities of O_3 using the eddy correlation technique made over a cotton field and senescent grass near Fresno
Winter 1995	Integrated Monitoring Study (IMS-95, the CRPAQS Pilot Study)	First sub-regional winter study
December	California Regional PM_{10}/$PM_{2.5}$ Air	First year-long, regional-scale effort to measure

Year	Study	Significance
1999-February 2001	Quality Study (CRPAQS) and Central California Ozone Study (CCOS)	both O_3 and $PM_{2.5}$
December 1999 to present:	Fresno Supersite	First multi-year experiment with advanced monitoring technology
July 2003	NASA high-resolution lidar flights	First high-resolution airborne lidar application in SJV in the summer
February 2007	U.S. EPA Advanced Monitoring Initiative	First high-resolution airborne lidar application in SJV in the winter
June 2008	ARCTAS - CARB	First measurement of high-time resolution (1-10s) measurements of organics and free radicals in SJV.
May-July 2010	CalNex 2010 (Research at the Nexus of Air Quality and Climate Change)	Expansion of ARCTAS-CARB type research-grade measurements to multi-platform and expanded geographical area including the ocean.
January-February 2013	DISCOVER-AQ (Deriving Information on Surface Conditions from COlumn and VERtically Resolved Observations Relevant to Air Quality)	The overarching objective of the DISCOVER-AQ investigation is to improve the interpretation of satellite observations to diagnose near-surface conditions relating to air quality.

1.4 Background

The shaded relief maps provided at the end of this section illustrate the topography of California as well as the Air Basin and County political boundaries (Figure 1.1) and Air District and County boundaries (Figure 1.2).

Generally, the weather conditions that lead to high ozone levels in the San Joaquin Valley include large-scale high-pressure systems that develop over the Western United States, low wind speeds, and high temperatures. These conditions occur frequently in the San Joaquin Valley between May and September and may persist for several days.

The complex airflow within the region contributes to various types of ozone episodes in the San Joaquin Valley, the Sacramento Valley, the Mountain Counties, and the San Francisco Bay Area. Ozone and its precursors are distributed throughout the mixed layer by turbulent diffusion. When meteorological conditions are favorable, daytime sea breezes are funneled through the Carquinez Strait and nearby mountain passes, bringing ozone and precursors into the northern part of the San Joaquin Valley. Some inflow is also observed through the Pacheco Pass on the west side of the Valley.

Depending upon the nature of the airflow in the region, ozone episodes in the San Joaquin Valley or Sacramento region can be generated predominantly from locally derived pollutants or by pollutants transported from upwind regions. In the San Francisco Bay Area (SFBA), ozone concentrations are elevated when airflow from the Bay Area to the Central Valley is limited. Elevated ozone concentrations are observed in the Mountain Counties mostly due to transported pollutants. The conditions that promote the formation of a nocturnal jet within the Valley may limit ventilation of the Valley. During the day, pollutants may be transported from the San Joaquin Valley to the Mojave Desert via the Tehachapi Pass. Outflow from the San Joaquin Valley to the coast in the vicinity of San Luis Obispo area has also been observed.

Except for the warmest days, an inversion is almost always present within the Central Valley throughout the year. This inversion tends to trap pollutants either emitted within the Valley or transported into the Valley from surrounding regions. In this regime, mesoscale flow patterns such as sea breeze intrusion, local eddies, bifurcation and convergence, and mountain/valley flows are especially important in determining the distribution of pollutants throughout the region. These mesoscale characteristics are described in more detail below, and provide a reference for features to consider during qualitatively assessing meteorological model performance, which is discussed further in Chapter 7:

<u>Sea Breeze and Marine Air Intrusion:</u> Differential heating between the land and ocean causes a pressure gradient between the cooler, denser air over the ocean and the warmer air over the land. The resulting pressure gradient draws marine air into the Valley during the day. Typically, with calm coastal winds during mornings, rush hour

pollutants can accumulate in the coastal source region. As the sea breeze develops by mid-day, ozone and its precursors can enter the Valley, encountering warmer temperatures and higher insolation.

Nocturnal jet and eddies: A low-level nocturnal wind maximum can develop during evening hours. As surface temperatures cool overnight, a strong stable layer within the Central Valley can result. As this stable layer forms, the wind aloft may be decoupled from the surface and accelerate. The result is an overnight wind flow that may carry pollutants from one end of the Valley to the other. While this nocturnal jet may be present in other seasons, it has been observed during the ozone season (Smith et al. 1981; Blumenthal, 1985; Thuillier et al. 1994). It is believed to be a pollutant transport mechanism during the summer months. The rangers of high mountains in the southern Valley force the air to turn north along the Sierra foothills at the southeastern edge of the Valley. Smith et al. (1981) mapped the northerly flow, sometimes called the Fresno eddy, with pibals and described an unusual case where it extended as far north as Modesto. During the Southern San Joaquin Ozone Study, Blumenthal et al. (1985) measured the Fresno eddy extending above 900 meters above ground level about 50% of the time. Neff et al. (1991) measured the eddy using radar wind profilers during the SJVAQS/AUSPEX study.

Bifurcation and Convergence Zones: Marine air entering the Sacramento River Delta region from the west may diverge. It may flow into the San Joaquin Valley to the south and Sacramento Valley to the north. The position of this bifurcation zone may shift and can determine the relative proportion of Bay Area pollutants transported to each downwind basin. The dynamics of this bifurcation zone are currently not well understood. However, this zone may also prevent transport between air basins by functioning as a block to air moving north to south within the Delta. For example, the effect of convergence zones on air quality is provided by Blumenthal et al. (1985), where it is hypothesized that the increase in mixing heights (~200 m higher than in the northern SJV) at the southern end of the San Joaquin Valley was due to damming of the northerly flow against the Tehachapi Mountains at the southern end. Without this damming effect, the mixing levels over Bakersfield, Arvin, and Edison would be lower, with correspondingly higher ozone concentrations.

Up-slope and Down-slope Flows: The increased daytime heating in mountain canyons and valleys adjacent to the Central Valley causes significant upslope flows during the afternoons in the San Joaquin and Sacramento Valleys. This can act as a removal mechanism, and can lift mixing heights on the edges of the valleys, relative to the mixing heights at valley center. During the nighttime, mountain valleys and canyons may cool relative to the Valley floor, resulting in a reversal of the flow. Myrup et al. (1989) studied transport of aerosols from the San Joaquin Valley into Sequoia National Park. They found a net up-slope flow of most pollutant species. The return flow can bring pollutants back down. Smith et al. (1981) used tracer data to estimate pollutant budgets due to slope flow fluxes (and other ventilation mechanisms). Smith et al. suggested that polluted air at higher elevations is diluted, thus down-slope flows may result in lower pollution levels within the San Joaquin Valley.

Up-Valley and Down-Valley Flows: Up-valley and down-valley flows are similar to up-slope and down-slope flows, but take place along the valley on a larger scale. During the summer, the Sacramento River Delta tends to have cooler air temperatures during the day and warmer temperatures at night than at the extreme ends of the Central Valley due to higher humidity within the Delta. During the daylight hours, up-valley flow draws air south into the San Joaquin Valley and north into the Sacramento Valley. At night, down-valley drainage winds tend to ventilate both valleys. Hayes et al. (1984) described both regimes for the Central Valley.

Figure 1.1: California Air Basins and Counties.

Figure 1.2: California Air Districts and Counties.

2 SELECTION OF THE MODELING PERIODS

From an air quality perspective, ARB and the District have selected 2007 baseline design values for the modeled attainment test. These baseline concentrations values will serve as the anchor point for estimating future year projected concentrations. The modeling period is from May 2007 to September 2007. Table 2.1 shows the 2007 ozone design values for the San Joaquin Valley.

Table 2.1: The 2007 Ozone Design Values for the San Joaquin Valley

Site	**2007 1-Hour Ozone Design Values (ppb)**
Arvin-Bear Mountain Blvd	131
Bakersfield- 5558 California Avenue	117
Bakersfield- Golden State Highway	108
Edison	135
Maricopa-Stanislaus Street	100
Oildale-3311 Manor Street	112
Shafter-Walker Street	105
Clovis-N Villa Avenue	125
Hanford-S Irwin Street	110
Sequoia and Kings Canyon Natl Park	119
Sequoia Natl Park- Lower Kaweah	113
Visalia-N Church Street	112
Fresno-1st Street	130
Fresno-Drummond Street	110
Fresno-Sierra Skypark #2	124
Parlier	121
Madera-Pump Yard	95
Merced-S Coffee Avenue	102
Modesto-14th Street	109
Turlock-S Minaret Street	104

2.1 Available Observational Data

Model performance will be based on comparing model predictions with observational data collected from routine field measurements. The data networks for the routine collected data are described below.

2.2 Routinely Collected Data

Routine meteorological and air quality data are collected through different network systems, including (1) the State and Local Air Monitoring Stations (SLAMS) network, (2) the National Air Monitoring Station (NAMS) network, (3) the Photochemical Assessment Monitoring Station (PAMS) network and (4) Special Purpose Monitoring (SPM) that is performed at some sites. More detailed information on routinely available data can be obtained from the California Air Resources Board web site at: http://www.arb.ca.gov/html/ds.htm

The existing routine ozone and nitrogen oxides monitoring sites are shown in Figure 2.1.

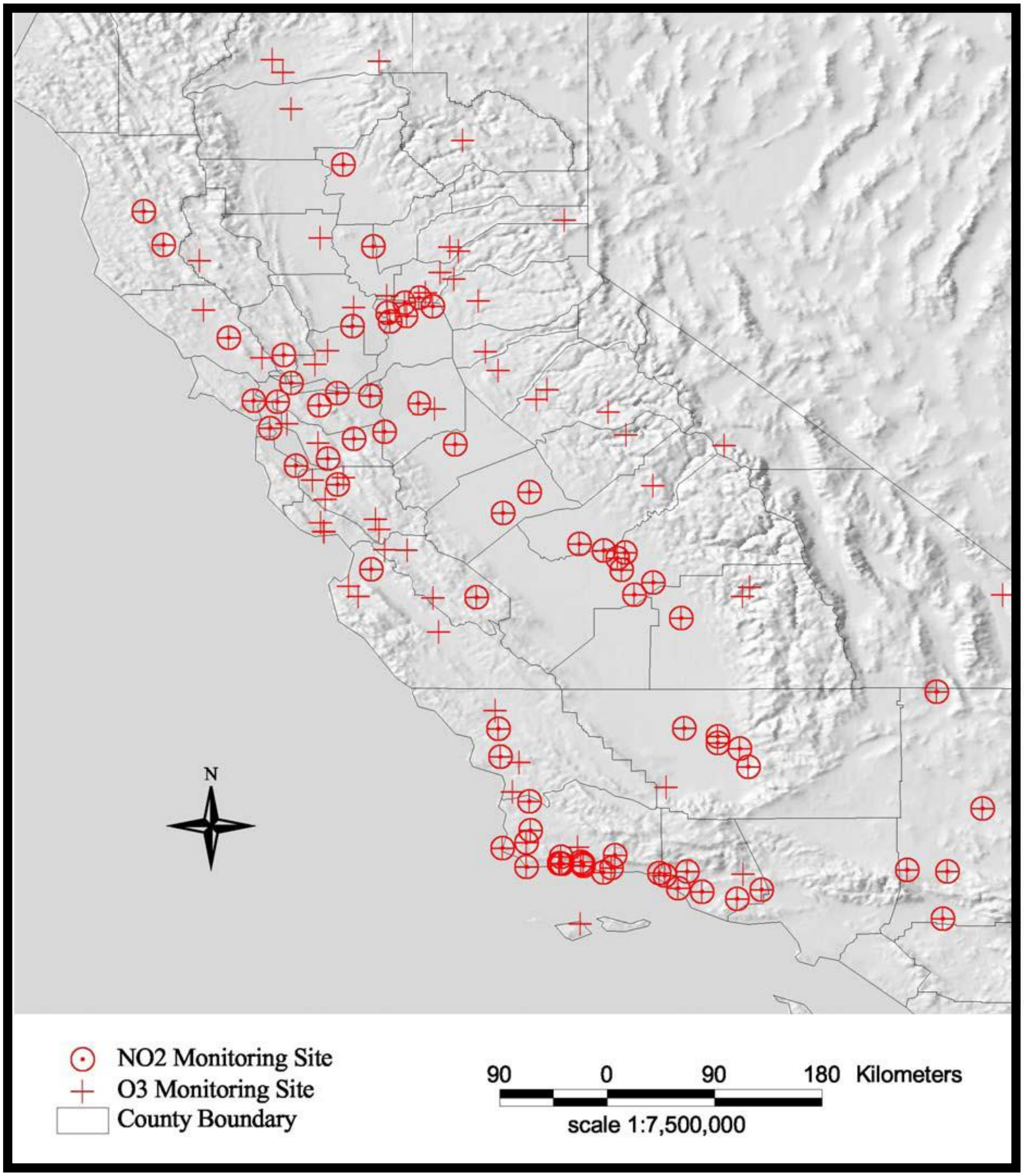


Figure 2.1: Existing routine ozone and nitrogen oxides monitoring sites

3 MODEL SELECTION

This chapter describes the selection of the meteorological and air quality models used for this effort.

3.1 Meteorological Model

Meteorological model selection is based on a need to accurately simulate the synoptic and mesoscale meteorological features observed during the selected modeling period. The main difficulties in accomplishing this are California's extremely complex terrain and its diverse climate. It is desirable that atmospheric modeling adequately represent essential meteorological fields, such as wind flows, ambient temperature variation, evolution of the boundary layer, etc. to properly characterize the meteorological component of photochemical modeling.

In the past, the ARB has applied prognostic, diagnostic, and hybrid models to prepare meteorological fields for photochemical modeling. There are various numerical models that are used by the scientific community to study the meteorological characteristics of an air pollution episode. For this SIP, the models under consideration for meteorological modeling are:

- Mesoscale Meteorological Model Version 5 (MM5) (Grell et al, 1994), and
- Weather and Research Forecasting (WRF) Model (Skamarock et al, 2005).

MM5 is a mesoscale, limited area, non-hydrostatic numerical model developed by Penn State and the National Center for Atmospheric Research (NCAR). It uses a terrain-following, Lambert Conformal, sigma coordinate system. MM5 allows users to study the atmospheric motions at small scales by explicitly treating the effects of convective motions on atmospheric circulations. It has been improved on a regular basis over the last two decades by contributions from a broad scientific community and has been maintained by NCAR along with necessary meteorological and geographical input data. Based on the complexity of terrain in northern and central California, the MM5 model represents an appropriate tool for resolving dynamics and thermodynamics using nesting capabilities. The ARB has also been using the MM5 model over the last two decades, since it has been widely used and tested for various meteorological regimes over the world and has been supported by NCAR. NCAR terminated model development for MM5 in October 2006 and the code was frozen at the minor version of V3-7-4.

Since then NCAR has devoted its resources to the development of the WRF model, which was designed to be the replacement for MM5. The WRF model is being continually updated, and WRF fields produced by ARB have shown comparable results with MM5. Therefore, the WRF numerical model was chosen to generate meteorological fields for this SIP. For a more detailed description of prognostic meteorological models and their known limitations in the complex terrain of California, see Section 7.1.

3.2 Photochemical Model

U.S. EPA guidance requires several factors to be considered as criteria for choosing a qualifying air quality model to support the attainment demonstration. These criteria include: (1) documentation and proven track record of candidate models in similar applications; (2) advanced science and technical features available in the model and/or modeling system; (3) experience of staff and available contractors; (4) required time and resources versus available time and resources; and (5) in the case of regional applications, consistency with regional models applied in adjacent regions (U.S. EPA, 2007).

The Community Multiscale Air Quality (CMAQ) Modeling System has been selected for modeling ozone in the SJV. The CMAQ model, a state-of-the-science "one-atmosphere" modeling system developed by U.S. EPA, was designed for applications ranging from regulatory and policy analysis to understanding of the atmospheric chemistry and physics. It is a three-dimensional Eulerian modeling system that simulates ozone, particulate matter, toxic air pollutants, visibility, and acidic pollutant species throughout the troposphere (UNC, 2010). The CMAQ model has undergone peer review every few years and was found to be state of the science (Aiyyer et al., 2007). The CMAQ model is regularly updated to incorporate new mechanisms, algorithms, and data as they become available in the scientific literature (e.g., Foley, et al., 2010). In addition, the CMAQ model is well documented in terms of its underlying scientific algorithms as well as guidance on operational uses (e.g., Binkowski and Roselle, 2003; Byun and Ching, 1999; Byun and Schere, 2006; Carlton et al., 2010; Foley et al., 2010; Kelly, et al., 2010a; UNC, 2010).

The CMAQ model was the regional air quality model used for the 2008 SJV annual $PM_{2.5}$ SIP. A number of previous studies have also used the CMAQ model to study ozone and $PM_{2.5}$ in the SJV (e.g., Jin et al., 2008, 2010; Kelly et al., 2010b; Liang and Kaduwela, 2005; Livingstone, et al., 2009; Pun et al, 2009; Tonse et al., 2008; Vijayaraghavan et al., 2006; Zhang et al., 2010). The CMAQ model has also been used for regulatory analysis for many of U.S. EPA's rules, such as the Clean Air Interstate Rule (U.S. EPA, 2005) and Light-duty and Heavy-duty Greenhouse Gas Emissions Standards (U.S. EPA, 2010, 2011a). There have been numerous applications of the CMAQ model in the U.S. and in the world (e.g., Appel, et al., 2007, 2008; Civerolo et al., 2010; Eder and Yu, 2006; Hogrefe et al., 2004; Lin et al., 2008, 2009; Marmur et al., 2006; O'Neill, et al., 2006; Philips and Finkelstein, 2006; Sokhi et al., 2006; Smyth et al., 2006; Tong et al., 2006; Wilczak et al., 2009; Zhang et al., 2004, 2006). Staff at CARB have developed expertise in applying the CMAQ model, since it has been used at CARB for over a decade. In addition, technical support for the CMAQ model is readily available from the Community Modeling and Analysis System (CMAS) Center (http://www.cmascenter.org/) established by the U.S. EPA.

CMAQv4.7.1 (Foley et al., 2010) will be used. While U.S. EPA released CMAQ version 5.0 in October 2011 and v5.0.1 in July 2012, the stable production version at ARB is v4.7.1. ARB is currently testing the v5.0.1 with the research-grade data obtained during two recent field studies: The California portion of the Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS) and California Research at the Nexus of Air Quality and Climate Change (CalNex). ARB intends to use v5.01.1 with SAPRC07 chemistry for the next 8-hour ozone SIP.

4 MODELING DOMAIN AND GRID STRUCTURE

4.1 Meteorological Modeling Domain

The WRF meteorological modeling domain consists of three nested grids, of 36 km, 12 km and 4 km uniform, horizontal grid spacing (illustrated in Figure 4.1). The purpose of the coarse, 36 km grid (D01) is to provide synoptic-scale conditions to all three grids; while the purpose of the 12 km grid (D02) is to provide input data to the 4 km grid (D03). The D01 grid is centered at 37 N x 120.5 W while the two inner grids, D02 and D03, are placed within the coarser grid such that they are not too close to the lateral boundaries. The D01 grid consists of 70 x 70 grid cells. The D02 grid consists of 132 x 132 grid cells and the D03 grid consists of 327 x 297 grid cells having an origin at -696 km x -576 km (Lambert Conformal projection). All three grids were run simultaneously, and the D03 grid is intended to resolve the fine details of atmospheric motion. Both D02 and D03 grids are used to feed the air quality modeling simulations. The vertical layer structure has 30 layers, as shown in Table 4.1.

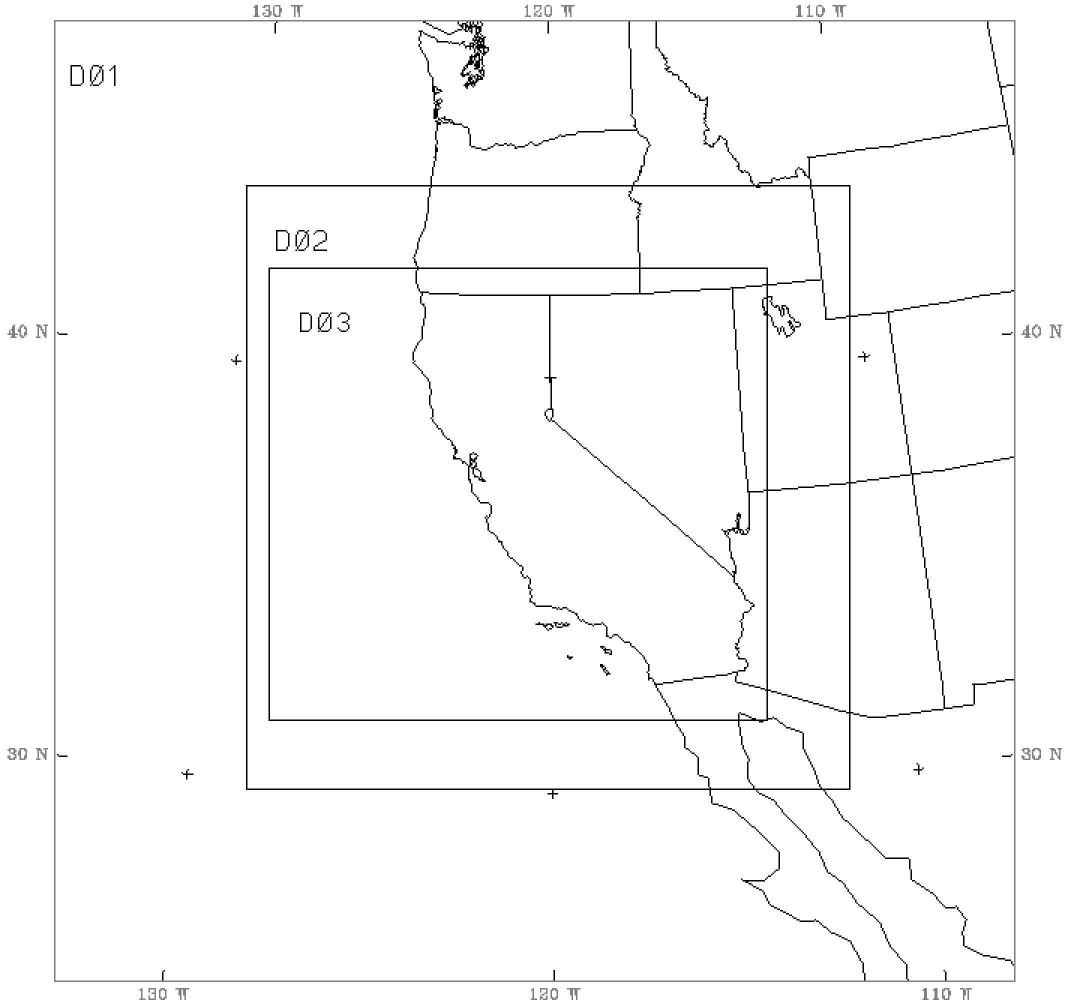


Figure 4.1: The three nested grids for the WRF model (D01 36km; D02 12km; and D03 4km).

Table 4.1: WRF 30 Vertical Layer Configuration for the modeling period.

Layer No.	Height (m)	Layer Thickness (m)
30	15674	998
29	14676	982
28	13694	976

27	12718	970
26	11748	972
25	10776	973
24	9803	979
23	8824	983
22	7841	994
21	6847	1002
20	5845	972
19	4873	818
18	4055	687
17	3368	577
16	2791	484
15	2307	407
14	1900	339
13	1561	285
12	1276	238
11	1038	199
10	839	166
9	673	139
8	534	115
7	419	97
6	322	81
5	241	67
4	174	56
3	118	47
2	71	39
1	32	32
0	0	0

4.2 Photochemical Modeling Domain

Figure 4.2 shows the modeling domains used by ARB. The two modeling domains that are proposed for this work are shown in blue (12 km coarse domain) and magenta (4 km nested domain). The coarse domain (blue) includes 107x97 lateral 12 km grid cells for each vertical layer. This domain extends from the Pacific Ocean in the west to the Eastern Nevada in the east and runs from the U.S.-Mexico border in the south to the California-Oregon border in the north. The nested domain (magenta) covers Central California with 192x192 lateral 4 km grid cells. The domain is based on a Lambert Conformal Conic projection with reference longitude at -120.5°W, reference latitude at 37°N, and two standard parallels at 30°N and 60°N, respectively.

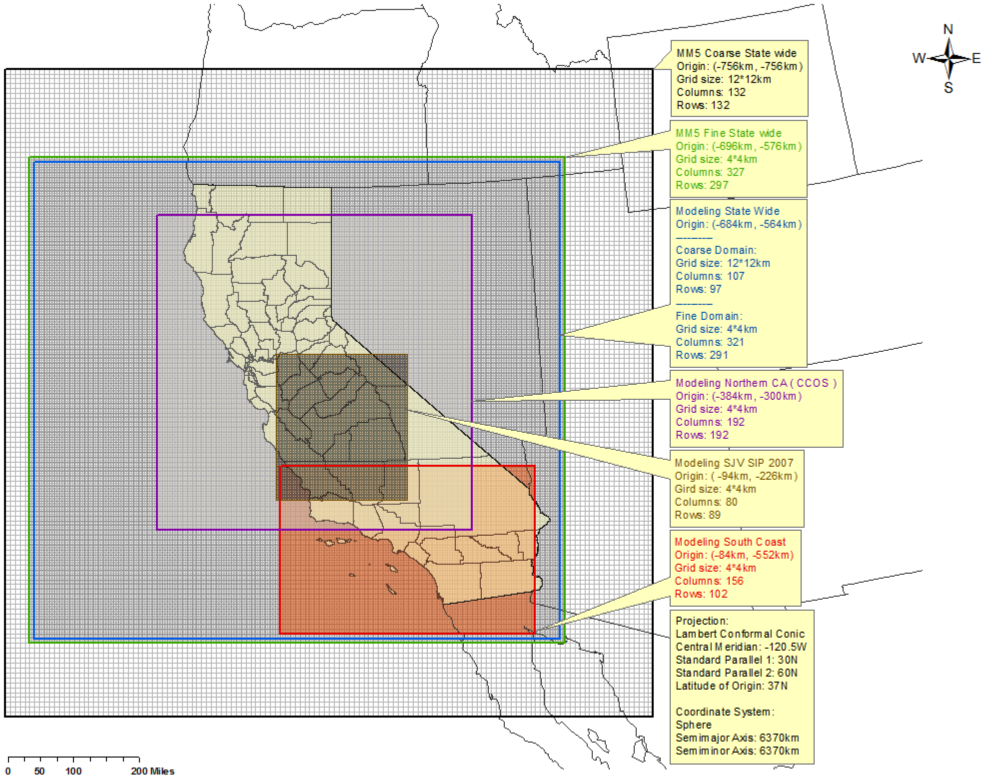


Figure 4.2: Modeling domains used by ARB

Table 4.2: Vertical Layer Heights (m) of Photochemical Modeling.

Layer No.	30 -Layer WRF configuration Height (m)
15	15674
14	12718
13	7841
12	3368
11	1900
10	839
9	673
8	534
7	419
6	322
5	241
4	174
3	118
2	71
1	32

For the coarse portions of nested regional grids, U.S. EPA guidance suggests a grid cell size of 12 km if feasible but not larger than 36 km. For the fine scale portions of nested regional grids, it is desirable to use grid cells about 4 km (U.S. EPA, 2007). Our selection of modeling domains is consistent with the guidance. U.S. EPA guidance does not require a minimum number of vertical layers for an attainment demonstration, although typical applications of “one- atmosphere” models (with the model top at 100 mb) employ 12 to 21 vertical layers. For the present SIP, 15 vertical layers will be used in the CMAQ model, extending from the surface to 100 mb. The vertical structure is based on the sigma-pressure coordinate, with the layers separated at 1.0, 0.9958, 0.9907, 0.9846, 0.9774, 0.9688, 0.9585, 0.9463, 0.9319, 0.9148, 0.8946, 0.7733, 0.6254, 0.293, 0.0788, and 0.0. This ensures that the majority of the layers are in the planetary boundary layer. The vertical layer structure in meters is shown in Table 4.2.

5 MODEL INITIALIZATION AND BOUNDARY CONDITIONS

Regional meteorological and air quality models must be initialized so that the chemical and physical conditions at the start of a model simulation approximate ambient conditions. This chapter is divided into two sub-sections that cover the initialization of the meteorological model (WRF) and the air quality model (CMAQ) separately. Each section briefly covers the data upon which model initialization is based.

5.1 Initialization of the Meteorological Model

WRF is a complex numerical model that requires setting a large number of input parameters and model options. Some of these requirements include: the specification of initial and boundary conditions (IC/BCs); gathering and processing representative data to be used for initial/boundary conditions as well as Four Dimensional Data Assimilation (FDDA); and the selection of a variety of algorithms to calculate meteorological parameters, such as winds, temperature, humidity, pressure, soil temperature, the depth of the planetary boundary layer, cloud microphysics, and radiative transfer.

There is no prior guidance on the specific data or options to be used in WRF. Rather, these decisions are determined based on optimizing model performance. Thus, during the preparation of preliminary meteorological fields for the modeling period, vast amounts of data were processed and many combinations of model options were tested. Based on the best model performance for these preliminary tests, the most successful

WRF model options and input datasets were determined. These are described in the following sections.

5.1.1 WRF Model Options

As indicated above, many sensitivity studies were conducted to choose a set of model options that result in scientifically reasonable meteorological fields that are representative of the specific conditions experienced during the modeling period. The physics options are shown in Table 5.1.

Table 5.1: WRF Physics Options.

Physics Option	D01	D02	D03
Microphysics	WSM 6-class graupel scheme	WSM 6-class graupel scheme	WSM 6-class graupel scheme
Surface Layer	MM5 Monin-Obukhov scheme	MM5 Monin-Obukhov scheme	MM5 Monin-Obukhov scheme
Land Surface Model	Unified Noah land-surface model	Unified Noah land-surface model	Unified Noah land-surface model
Planetary Boundary Layer Scheme	YSU scheme	YSU scheme	YSU scheme
Cumulus	Kain-Fritsch (new Eta) scheme	Kain-Fritsch (new Eta) scheme	None
Longwave Radiation Scheme	RRTM	RRTM	RRTM
Shortwave Radiation Scheme	Dudhia scheme	Dudhia scheme	Dudhia scheme
Number of Soil Layers	thermal diffusion scheme for temp only	thermal diffusion scheme for temp only	thermal diffusion scheme for temp only

5.1.2 WRF Initial and Boundary Conditions (IC/BC)

The initial and boundary conditions (IC/BCs) for WRF were prepared based on NCEP Eta 212 grid (40km) model output that is archived at NCAR. These data are archived from global simulations and have a 40 km horizontal resolution. Initial conditions to WRF were updated at 6-hour intervals for the 36 and 12 km grids. In addition, surface and upper air synoptic observations obtained from NCEP are also used to further refine the IC/BCs.

5.1.3 WRF Four Dimensional Data Assimilation

The WRF model was nudged toward observed meteorological conditions by using the analysis nudging option of the Four Dimensional Data Assimilation (FDDA) for the 36km grid only.

5.1.4 Meteorological Data Quality Assurance

In developing the IC/BCs and FDDA datasets, quality control is performed on all associated meteorological data. Generally, all surface and upper air data are plotted in space and time to identify extreme values that are suspected to be “outliers”. Data points are also compared to other, similar surrounding data points to determine whether there are any large relative discrepancies. If a scientifically plausible reason for the occurrence of suspected outliers is not known, the outlier data points are flagged as invalid and not used in the modeling analyses.

5.2 Initialization of the Air Quality Model

5.2.1 CMAQ Model Options

Table 5.2 shows the CMAQ v4.7.1 configuration that will be used to model ozone in the SJV. The same configuration will be used for all simulations for the base, reference, and future years. CMAQv4.7.1 will be compiled using the Portland Group FORTRAN Compiler version 10.9.

Table 5.2: CMAQ v4.7.1 Schemes used for Current Simulations.

Processes	**Scheme**
Horizontal advection	PPM (piecewise parabolic method)
Vertical advection	PPM (piecewise parabolic method)
Horizontal diffusion	Multi-scale
Vertical diffusion	Eddy
Gas-phase chemical mechanism	SAPRC99
Chemical solver	EBI
Aerosol module	Aero5
Cloud module	ACM_AE5
Photolysis rate	Table Generated by the JPROC

5.2.2 Photochemical Mechanism

Historically, over the last several decades, air quality modeling for ozone SIPs throughout California have predominately been conducted using the Carbon Bond IV (CBIV) chemical mechanism. The CBIV mechanism uses 36 chemical species and 89 chemical reactions (may vary somewhat among different air quality models) to describe the relationship between ozone and ozone precursors in the atmosphere. Over the last decade, more complex chemical mechanisms, such as the 1999 State-wide Air Pollution Research Center chemical mechanism (SAPRC99; Carter, 2000), have been developed. SAPRC99, developed by Dr. William Carter at the University of California, Riverside, is a detailed mechanism describing the gas-phase reactions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx). It is a well-known chemical mechanism and has been used widely in California and the U.S. (e.g., Hakami, et al., 2004a, 2004b; Liang and Kaduwela, 2005; Lin et al., 2005; Jackson, et al., 2006; Napelenok, 2006; Dennis et al., 2008; Jin et al., 2008, 2010; Lane et al., 2008; Tonse et al., 2008; Ying et al., 2008; Livingstone et al., 2009; Pun et al., 2009; Kelly, et al., 2010b; Zhang et al., 2010; Zhang and Ying, 2011).

CARB established the Reactivity Scientific Advisory Committee (RSAC) in April 1996. RSAC is a group of independent scientists who make non-binding recommendations on the science related to the reactivity of VOCs. RSAC consists of the following members: Drs. John Seinfeld (Chair, California Institute of Technology), Roger Atkinson (University of California at Riverside), Jack Calvert (National Center for Atmospheric Research), Harvey Jeffries (University of North Carolina at Chapel Hill), Jana Milford (University of Colorado at Boulder), and Armistead Russell (Georgia Institute of Technology). In 1998, RSAC recommended that the SAPRC99 mechanism undergo a scientific review. Following RSAC's recommendation, CARB contracted Dr. William R. Stockwell in 1999 to conduct a review of the SAPRC99 mechanism, its documentation, and the Maximum Incremental Reactivity scale derived from SAPRC99. Stockwell (1999) compared the chemical kinetic data used in the SAPRC99 mechanism with values from standard kinetic databases (e.g., Atkinson et al., 1994, 1997; DeMore et al., 1997) and the most recent literature available at the time. The kinetic parameters checked included the reactions, rate constants, product yields, and lumping methods. Stockwell's (1999) comments led to the revision of the mechanism and identification of outstanding issues to be resolved with further experimental studies. Stockwell (1999) concluded that SAPRC99 reflected the best available science at its completion date, and RSAC approved both the SAPRC99 peer review and the mechanism in October 1999. They also recommended that the SAPRC family of mechanisms be used for regulatory photochemical modeling activities in California.

Since SAPRC-99 has been thoroughly peer-reviewed, ARB's Reactivity Scientific Advisory Committee recommended unanimously in October of 1999 that ARB use SAPRC-99 instead of CBIV for SIP modeling.

In central and northern California, SAPRC has been the mechanism of choice for over a decade. Consistent with this and with the expectation of better representation of atmospheric chemical behavior for ozone modeling, the SAPRC99 chemical mechanism was selected for all 1-hour ozone air quality modeling in California.

5.2.3 CMAQ Initial and Boundary Conditions (IC/BC) and Spin-Up period

Air quality model initial conditions define the concentration distributions of chemical species within the modeling domain at the beginning of the model simulation. Boundary conditions define the chemical species concentration distributions for air entering or leaving the modeling domain. To some extent the initial and boundary conditions need to reflect the modeling domain dimensions, and the characteristics of the model being used. This section discusses the initial and boundary conditions used by the CARB in air quality modeling that will support developing the 1-hour ozone SIP.

U.S. EPA guidance recommends using a “ramp-up” period by beginning a simulation 5-10 days prior to the period of interest for modeling ozone (U.S. EPA, 2007). Instead of running the CMAQ model sequentially from the beginning to the end of the simulation year, we simulate each month in parallel. For each month, we run seven spin-up days prior to the beginning of each month to generate the initial conditions for the domain. We then use the output from the coarse modeling domain to specify the initial conditions for the nested domain because the nested domain simulation starts after the beginning of the simulation for the outer grid, consistent with U.S. EPA guidance.

The boundary conditions for the coarse domain were extracted from the global atmospheric chemical transport Model for Ozone and Related chemical Tracers (MOZART). The MOZART model is a comprehensive global model for simulating atmospheric composition including both gases and bulk aerosols (Emmons et al., 2010). It was developed by the National Center for Atmospheric Research, the Max-Planck-Institute for Meteorology (in Germany), and the Geophysical Fluid Dynamics Laboratory of the National Oceanic and Atmospheric Administration, and is widely used in the scientific community. In addition to inorganic gases and VOCs, boundary conditions were extracted for aerosol species including elemental carbon, organic matter, sulfate, soil and nitrate. The boundary conditions for the coarse domain for the reference year will be used for future years as well, consistent with U.S. EPA guidance.

The boundary conditions for the nested domain were extracted from the output for the coarse domain simulation using the BCON program in the CMAQ modeling system.

Overall, using a 4 km nested domain within the 12 km coarse domain will reduce the computational burden without compromising the accuracy of the modeling results when compared to a simulation using a 4 km grid for the entire outer domain.

6 EMISSION INPUTS

One of the necessary inputs to air quality modeling is an emission inventory with temporally and spatially resolved emissions estimates. Emissions are broadly categorized into major stationary or point sources, area sources (which include off-road mobile sources), on-road mobile sources, and biogenic sources.

6.1 Emission Inventory Development

To support the body of work conducted by stakeholders, modeling inventories have been developed by ARB staff on an on-going basis for the modeling period. The following sections describe how emissions estimates required by the selected air quality models (commonly and interchangeably referred to as 'modeling inventories' or 'gridded inventories') are estimated and how they will be used to develop base case and future year emissions estimates for modeling used to prepare the SIP. As modifications to basic inventory inputs are approved by the responsible regulatory agencies, including ARB, they will be incorporated into final SIP modeling. Once final SIP modeling is complete, the specific versions of the emission inputs used will be documented and summarized. The Air Resources Board convened the following inventory coordination group:

- The SIP Gridded Inventory Coordination Group (SIP-GICG). This group was focused on more refined emissions estimates to be used in air quality modeling (e.g. for a specific grid cell and hour). The purpose of the SIP-GICG is to conduct quality assurance of the associated data, and to distribute and coordinate the development of emission inputs for SIP modeling. Local air districts that participated included San Joaquin Valley Unified APCD, Bay Area AQMD, Sacramento Metropolitan AQMD, South Coast AQMD, Ventura County APCD, San Diego County APCD, Imperial County APCD, Mojave Desert AQMD, Northern Sierra AQMD, Yolo/Solano AQMD, Placer County APCD, El Dorado County APCD, San Luis Obispo County APCD, and Santa Barbara County APCD.

In addition to the coordination group described above, a great deal of work preceded this modeling effort through the Central California Air Quality Studies (CCAQS). CCAQS consists of two studies: 1) the Central California Ozone Study (CCOS); and 2) the California Regional PM_{10}/$PM_{2.5}$ Air Quality Study (CRPAQS). More details on CCAQS can be found at the following link: http://www.arb.ca.gov/airways/ccaqs.htm

The sections below provide details as to how the emissions inputs required by air quality modeling are created.

6.1.1 Background

In order to understand how the modeling inventories are developed, it is necessary to understand the basics of how an annual average emission inventory is developed. California's emission inventory is an estimate of the amounts and types of pollutants emitted from thousands of industrial facilities, millions of motor vehicles, and of hundreds of millions of applications of other products such as paint and consumer products. The development and maintenance of the inventory is a multi-agency effort involving the ARB, 35 local air pollution control and air quality management districts (districts), regional transportation planning agencies (RTPAs), and the California Department of Transportation (Caltrans). The ARB is responsible for the compilation of the final, statewide emission inventory, and maintains this information in a complex electronic database. Each emission inventory reflected the best information available at the time.

To produce regulatory, countywide emissions estimates, the basic principle for estimating emissions is to multiply an estimated, per-unit emission factor by an estimate of typical usage or activity. For example, on-road motor vehicle emission factors are estimated for a specific vehicle type and model year based on dynamometer tests of a small sample of that vehicle type and applied to all applicable vehicles. The usage of those vehicles is based on an estimate of such activities as a typical driving pattern, number of vehicle starts, typical miles driven, and ambient temperature. It is assumed that all vehicles of this type in each region of the state are driven under similar conditions.

Developing emission estimates for stationary sources involves the use of per unit emission factors and activity levels. Under ideal conditions, facility-specific emission factors are determined from emission tests for a particular process at a facility. More commonly, a generic emission factor is developed by averaging the results of emission tests from similar processes at several different facilities. This generic factor is then used to estimate emissions from similar types of processes when a facility-specific emission factor is not available. Activity levels from point sources are measured in such terms as the amount of product produced, solvent used, or fuel used.

ARB maintains an electronic database of emissions and other useful information. Annual average emissions are stored for each county, air basin, and district. The database is called the California Emission Inventory Development and Reporting System (CEIDARS). Emissions are stored in CEIDARS for criteria and toxic pollutants. The criteria pollutants are total organic gases (TOG), carbon monoxide (CO), oxides of nitrogen (NOx), oxides of sulfur (SOx), and total particulate matter (PM). Reactive organic gases (ROG) and particulate matter 10 microns in diameter and smaller (PM_{10}) are calculated from TOG and PM, respectively. Following are more details on how emissions are estimated for point and area sources, on-road motor vehicles, and biogenic sources. Additional information on emission inventories can be found at http://www.arb.ca.gov/ei/ei.htm

6.1.2 Terminology

There can be confusion regarding the terms “point sources” and “area sources”. Traditionally, these terms have had two different meanings to the developers of emissions inventories and the developers of modeling inventories. Table 6.1 summarizes the difference in the terms. Both sets of terms are used in this document. In modeling terminology, “point sources” refers to elevated emission sources that exit from a stack and have a potential plume rise. “Area sources” refers collectively to area-wide sources, stationary-aggregated sources, and other mobile sources (including aircraft, trains, ships, and all off-road vehicles and equipment). That is, “area sources” are low-level sources from a modeling perspective. In the development of the inventories, all point sources were treated as possible elevated sources. Processing of the inventory for the photochemical model will determine which vertical layer the emissions from a process will be placed into. So, for the modeling inventories, the use of the term "point sources" is the same whether using the modeling or emission inventory definition.

Table 6.1: Inventory Terms

Modeling Term	Emission Inventory Term	Examples
Point	Stationary – Point Facilities	Stacks at Individual Facilities
Area	Off-Road Mobile	Farm Equipment, Construction Equipment, Aircraft, and Trains
Area	Area-wide	Consumer Products, Architectural Coatings, and Pesticides
Area	Stationary - Aggregated	Industrial Fuel Use
On-Road Motor Vehicles	On-Road Mobile	Automobiles
Biogenic	Biogenic	Trees

6.2 Point and Area Source Emissions

6.2.1 Development of Base-Year Emission Inventory

The stationary source component of the emission inventory is comprised of more than 20,000 individual facilities, called "point sources", and about 160 categories of “aggregated point sources”. Aggregated point sources are groupings of many small point sources that are reported as a single source category (gas stations, dry cleaners, and print shops are some examples). These emission estimates are based mostly on area source methodologies or emission models. Thus, the aggregated point sources include emissions data for the entire category of point sources, not each specific facility. All districts report as point sources any facility with criteria pollutant emissions of 10 tons per year and greater. Some districts choose a cutoff smaller than 10 tons per year for reporting facilities as point sources. Any remaining sources not captured in the point source inventory are reported as aggregated point sources.

The area-wide source component includes several hundred source categories and is made up of sources of pollution mainly linked to the activity of people. Examples of these categories are emissions from consumer products, architectural coatings, pesticide applications, and wind-blown dust from agricultural lands. The emissions for these categories are located mostly within major population centers. Some of the emissions in these categories come from agricultural centers and construction sites.

The off-road mobile source inventory is based on the population, activity, and emissions estimates of the varied types of off-road equipment. The major categories of engines and vehicles include agricultural, construction, lawn and garden, and off-road recreation, and include equipment from hedge trimmers to cranes. ARB’s OFFROAD model estimates the relative contribution of gasoline, diesel, compressed natural gas, and liquefied petroleum gas powered vehicles to the overall emissions inventory of the state. In previous versions of the inventory, emissions from the OFFROAD model were aggregated into about 100 broad categories. Since April 2006, the inventory reports emissions in about 1800 detailed categories that match what is produced by the OFFROAD model. Carrying this level of detail allows for more accurate application of control measures as well as more specific assignments of speciation and spatial distribution. For more information, see http://www.arb.ca.gov/msei/offroad/offroad.htm.

Local air districts estimate emissions from point sources. The districts provide point source information to ARB to update the annual average CEIDARS database. Estimating emissions from area sources is a cooperative effort between ARB and air district staffs. Updating the emission inventory is a continual process, as new information becomes available.

6.2.2 Quality Assurance of Base Year Emissions

In order to prepare the best inventory possible for use in modeling, ARB and district staff devoted considerable time and effort to conduct quality assurance (QA) of the inventory. Staffs from local air districts conducted extensive quality assurance to provide an accurate and complete inventory.

In particular, facility location, stack data, and temporal data were closely checked. This information is critical whenever photochemical modeling is conducted, such as during SIP preparation or special studies such as CCAQS. However these data are not always of sufficient quality in the inventory database since this information is not needed in the actual calculation of emissions and resources are limited. ARB ran several types of QA reports on the inventory to assist the districts in locating errors or incomplete information. This QA process began with the 1999 CEIDARS database, and continued with the 2002 CEIDARS database that was used for previous $PM_{2.5}$ and ozone inventory preparation. The QA process has continued with the 2005 and subsequent CEIDARS databases. The 2005 CEIDARS database is the basis for the modeling inventories developed for the 24-hour $PM_{2.5}$ SIPs in northern California. Staff of the South Coast AQMD is using the 2008 CEIDARS database for their modeling effort covering southern California (approximately the Tehachapi Mountains southward).

> Stack data – The report checks for missing or incorrect stack data. The report lists missing stack data and also checks the data for reasonable stack height, diameter, temperature, and stack velocity. Additionally, the report compares the reported stack flow rate with the computed theoretical flow rate (calculated using the diameter and stack velocity).

Location data – The report checks for missing or wrong Universal Transverse Mercator) UTM coordinates. The report lists missing UTM coordinates for both facilities and stacks. UTM coordinates are also checked to ensure that they are in the range for a given county. Another report is also run that shows the UTM coordinates for a facility grouped by the city in which the facility is located. This allows staff to look for outliers that may indicate facilities whose locations are in the county, but not in the correct location. Additionally, ARB staff reviewed location coordinates for accuracy and completeness. Comparisons were made using address or zip code mapping.

Temporal data – The report checks for missing or invalid temporal information. Temporal codes used to describe the hours per day, days per week, and weeks per year are checked for completeness, accuracy, and validity. The relative monthly throughput, which assigns a relative amount of activity to each month of the year, is checked to ensure the sum is 100%.

Code Assignments – Source Classification Codes (SCC) and Standard Industrial Classification Codes (SIC) were reviewed for accuracy. The SCC is used to determine the speciation profile assigned (speciation is discussed in Section 6.10). The SIC and SCC combined determine emission control rules that may apply for forecasting emissions (see Section 6.3) along with the categorization of emissions for reporting purposes.

6.3 Future Year (Forecasted) Emissions

Air pollution programs have always depended on predictive models for gaining a better understanding of what the emissions will be in the future – these predictions are based on expectations of future economic conditions, population growth, and emission controls.

ARB’s model to forecast or backcast emissions is known as the California Emission Forecasting System (CEFS). The CEFS model is designed to generate year-specific emissions estimates for each county/air basin/district combination taking into account two factors: 1) the effects of growth and 2) the effects of adopted emission control rules. It does this by linking these growth and control factors directly to CEIDARS emission categories for a particular base year (2002 for this project). A key component of the model is the Rule Tracking Subsystem (RTS). The RTS was developed to link year-specific implementation of emission control rules to the emission process level. The emission process level is identified in one of two ways. For facilities, the Source Classification Code (SCC) and Standard Industrial Classification (SIC) are used. For all other sources, the Emission Inventory Code (EIC) is used. In total, the emission process level comprises more than 30,000 possible emission categories statewide.

Reports of year-specific emissions are available to district staff on-line. District staffs should contact their emission inventory liaisons for URL and password information. The reports can be generated for a variety of years, pollutants, source types, seasons, and geographical areas.

6.3.1 Growth Factors

Growth factors are derived from county-specific economic activity profiles, population forecasts, and other socio/demographic activity. These data are obtained from a number of sources, such as: districts and local regional transportation planning agencies (RTPAs) when they are available; economic activity studies contracted by the ARB; and demographic data such as population survey data from the California Department of Finance (DOF) and Vehicle Miles Traveled (VMT) data from the California Department of Transportation (Caltrans).

Growth profiles are typically associated with the type of industry and secondarily to the type of emission process. For point sources, economic output profiles by industrial sector are linked to the emission sources via industrial sector classification, such as SIC or the North American Industry Classification System (NAICS) codes. For area-wide and aggregated point sources, other growth parameters such as population, dwelling units, and fuel usage may be used. Growth factors are developed from the latest and best available data sources with input from stakeholders.

6.3.2 Control Factors

Control factors are derived from adopted State and Federal regulations and local district rules that impose emission reductions or a technological change on a particular emission process. These data are provided by the agencies responsible for overseeing the regulatory action for the particular emission categories affected. For example, the ARB staff develops the control factors for sectors regulated by the ARB, such as consumer products and clean fuels. The districts develop control factors for locally enforceable stationary source regulations that affect emissions from such equipment as internal combustion engines or power plant boilers. The Department of Pesticide Regulation (DPR) supplies control data for pesticides. In general, control factors account for three variables:

Control Efficiency which estimates the technological efficiency of the abatement strategy

Rule Effectiveness which estimates the “real-world” application of the strategy taking into account factors such as operational variations and upsets

Rule Penetration which estimates the degree a control strategy will penetrate a certain regulated sector taking into account such things as equipment exemptions.

Control factors are closely linked to the type of emission process and secondarily to the type of industry. Control levels are assigned to emission categories, which are targeted by the rules via emission inventory codes (SCC/SIC, EIC etc.) that are used in CEIDARS.

6.4 Day-Specific Emissions

Day-specific data were used for preparing base case inventories when data were available. In previous studies, day-specific data were gathered for large point sources, unusual events (e.g. breakdowns), shipping, prescribed burns, and wildfires. Those previous studies focused on an episode lasting a few days. In this current work, inventories have been created for multiple years. The gathering of day- or hour-specific data from certain kinds of sources, such as large facilities or ship activity, becomes very resource intensive. However, ARB and district staffs were able to gather hourly/daily emission information for 1) wildfires and prescribed burns 2) paved and unpaved road dust and 3) agricultural burns in the San Joaquin Valley and Sacramento County. Additionally, a special model developed for ocean-going vessels was used.

6.4.1 Wildfires and Prescribed Burns

Day-specific, base case estimates of emissions from wildfires and prescribed fires were developed in a two part process. The first part consists of estimating micro-scale, fire-specific emissions (i.e. at the fire polygon scale, which can be at a smaller spatial scale than the grid cells used in air quality modeling). The second part consists of several steps of post-processing fire polygon emission estimates into gridded, hourly emission estimates that are formatted for use in air quality modeling.

For 2007 model performance, day-specific 2007 wildfire emission estimates are used. However, for RRF determination, average-day emissions from wildfires and prescribed fires are used and, to avoid overly influencing the RRF calculation, fire emissions were held constant between the base and future years. Since the fire emissions used in the RRF determination are based on a 10-year average, fire emissions were distributed equally throughout the first ten model layers (i.e. fire-specific plume rise calculations are not made).

6.4.2 Agricultural Burn Data for San Joaquin Valley

The San Joaquin Valley Air Pollution Control District estimated emissions for each day during 2005 through 2010 when agricultural burning occurred. Emissions were estimated for the burning of prunings, field crops, weed abatement and other solid fuels. Information needed to estimate emissions came from the district’s Smoke Management System, which stores information on burn permits issued by the district. In order to obtain a daily burn authorization, the person requesting the burn provides information to the district, including the acres and type of material to be burned, the specific location of the burn and the date of the burn. Acres are converted to tons of fuel burned using a fuel loading factor based on the specific crop to be burned. Emissions are calculated by multiplying the tons of fuel burned by a crop-specific emission factor. More information is available at: http://www.arb.ca.gov/ei/areasrc/distmiscprocwstburndis.htm

To determine the location of the burn, district staff created spatial allocation factors for each 4 kilometer grid cell used in modeling. These factors were developed for “burn zones" in the San Joaquin Valley based on the agricultural land coverage. Daily emissions in each "agricultural burn zone" were then distributed across the zone/grid cell combinations using the spatial allocation factors. Emissions were summarized by grid cell and day.

Burning was assumed to occur over three hours from 10:00 a.m. to 1:00 p.m., except for two categories. Orchard removals were assumed to burn over eight hours from 10:00 a.m. to 6:00 p.m. Vineyard removals were assumed to burn over five hours from 10:00 a.m. to 3:00 p.m.

6.4.3 Ocean-Going Vessels

The emissions for ocean-going vessels were generated with version 2-3H of the ARB Marine Model. The model uses a power-based methodology to estimate emissions. Inputs to the model include vessel call data obtained from the California Lands Commission; vessel specifications and power ratings from Lloyds-Fairplay, vessel berthing statistics from port authorities, and vessel routing based upon the Ship Transportation Energy and Economic Model (STEEM) developed by the University of Delaware under contract with the Air Resources Board. Emissions were calculated by estimating ship emissions on a ship by ship and a port call by port call basis, using actual ship engine power estimates, speeds, and actual ship hoteling times where possible.

Emission control measures included in the inventory include the South Coast 20/40nm voluntary vessel speed reduction program, the 2007 Shore Power regulation, the 2005 auxiliary engine regulation (while in effect) and the subsequent 2008 low sulfur fuel regulation, IMO tier 1 NO_x engine standards, and the IMO North American Environmental Control Area which includes the IMO tier 3 NO_x engine standards.

6.5 Temporally and Spatially Resolved Emissions

Emission inventories that are temporally and spatially resolved are needed for modeling purposes, for both the base year and future years. Annual average emissions for point and area sources were used as input to version 2.6 of SMOKE (Sparse Matrix Object

Kernel Emission). The SMOKE processor was developed by the MCNC-North Carolina Supercomputing Center, Environmental Sciences Division, with U.S. EPA cooperation and support. Temporal information is input into SMOKE. Adjustments are made for variations in months, day of week and hour of day. Emissions are estimated for each county, air basin, and district combination for each day of the year. The SMOKE processor also distributes emissions to each grid cell. The spatial allocation of emissions is discussed in Section 6.9.

The emission inventories for SIP modeling in northern California were developed from the 2005 annual average CEIDARS database for TOG, NO_x, SO_x, CO, PM, and ammonia. Inventories for point and area sources were developed for each day for a variety of years between 2005 and 2020 as need for input to air quality models.

6.6 Surface Temperature and Relative Humidity Fields

The calculation of gridded emissions for some categories of the emissions inventory is dependent on meteorological variables. More specifically, biogenic emissions are sensitive to air temperatures and solar radiation while emissions from on-road mobile sources are sensitive to air temperature and relative humidity. As a result, estimates of air temperature (T), relative humidity (RH), and solar radiation are needed for each grid cell in the modeling domain in order to take into account the effects of these meteorological variables on mobile source and biogenic emissions in each grid cell.

Gridded temperature, humidity, and radiation fields are readily available from prognostic meteorological models such as MM5, which is used to prepare meteorological inputs for the air quality model. However, it is widely recognized that diagnostic (i.e. observation-based) models provide more accurate local-scale estimates of ground surface temperature and humidity. As a result, the CALMET diagnostic meteorological model is used to generate a gridded temperature field and an objective analysis scheme is used to generate a gridded humidity field. The solar radiation fields needed for biogenic emission inventory calculations were taken from the MM5 prognostic model, which is also used to generate meteorology for the air quality model.

The principal steps involved in generating a gridded, surface-level temperature field using CALMET include the following:

Compute the relative weights of each surface observation station to each grid cell (the weight is inversely proportional to the distance between the surface observation station and grid cell center).

Adjust all surface temperatures to sea level. In this step, a lapse rate of -0.0049 ^{o}C/m is used (this lapse rate is based on private communication with Gary Moore of Earth Tech, Inc., Concord, MA). This lapse rate (=2.7 F/1000 feet) is based on observational data.

Use the weights to compute a spatially-averaged sea-level temperature in each grid cell.

Correct all sea-level temperatures back to 10 m height above ground level (i.e. the standard height of surface temperature measurement) using the lapse rate of -0.0049 ^{o}C/m again.

The current version of CALMET does not generate estimates of relative humidity. As a result, a post-processing program was used to produce gridded, hourly relative humidity estimates from observed relative humidity data. The major steps needed to generate gridded, surface-level relative humidity are described as follows:

Calculate actual vapor pressure from observed relative humidity and temperature at all meteorological stations. The McRae (1980) method is used to calculate the saturated vapor pressure from temperature;

Compute the relative weights of each surface observation station to each grid in question, exactly as done by CALMET to compute the temperature field;

Use the weights from step 2 to compute a spatially-averaged estimate of actual vapor pressure in each grid cell;

For each grid cell, calculate relative humidity from values for actual vapor pressure and temperature for the same grid cell.

6.7 On-Road Mobile Source Emissions

As described in the prior sections, air quality models require gridded, hourly emission inputs. However, California's official on-road motor vehicle emission inventory model, EMFAC, is designed to produce *county-level, average-day* estimates. As a result, emission estimates from EMFAC must be disaggregated spatially and temporally from county-level, average-day estimates into gridded, hourly estimates. The general methodology that ARB has used to disaggregate EMFAC emission estimates in the past is described below and will be used again. Basically, it involves using the Direct Travel Impact Model (DTIM) (Systems Applications, Inc. 2001) to produce gridded, hourly emission estimates, and then uses these estimates as a gridded hourly spatial surrogate to distribute EMFAC emissions. The methodology has been peer reviewed by UCI under a Central California Ozone Study (CCOS) contract.

The most recent version of EMFAC, EMFAC2011, is comprised of two separate emission model components: EMFAC2011-LD and EMFAC2011-HD. The LD model generates emissions for light- and medium-duty gasoline vehicles, heavy-duty gasoline vehicles and light- and medium-duty diesel vehicles. The HD model generates emissions for heavy-duty diesel vehicles. The general methodology described below will be performed four times: the first time for light- and medium-duty gasoline vehicle emissions from EMFAC2011-LD; a second time for heavy-duty gasoline vehicle emission estimates from EMFAC2011-LD; a third time for light- and medium-duty diesel vehicle emissions from EMFAC2011-LD; and a fourth time for heavy-duty diesel vehicle emissions from EMFAC2011-HD. Light- and medium-duty vehicles are separated from heavy-duty vehicles to allow for separate reporting and control strategy applications. Methodological details are currently being updated where necessary to work with the new version of EMFAC.

6.7.1 General Methodology

Day-Specific Temperature and Relative Humidity. Mobile source emissions are sensitive to ambient temperature and humidity. Both EMFAC and DTIM account for meteorological effects using day-specific inputs (the gridded, hourly meteorological data used are described under the prior section titled "Surface Temperature and Relative Humidity Fields"). For EMFAC-LD, hourly gridded temperature and humidity fields are averaged by county using a gridded VMT weighted average (i.e. weighted proportional to the VMT per grid cell in a county). DTIM accepts gridded, hourly data directly.

EMFAC-LD provides vehicle-class-specific emissions estimates for exhaust emissions, evaporative emissions, tire wear emissions and brake wear emissions. EMFAC-LD also produces estimates of fuel consumption, vehicle miles traveled (VMT), and the number of vehicles in use. Day-specific temperature and relative humidity adjustments are not made to heavy-duty diesel vehicles; EMFAC-HD provides winter and summer emission estimates.

More information on EMFAC is available at the following link.
http://www.arb.ca.gov/msei/modeling.htm

Temporal Adjustment (Day-of-Week adjustments to EMFAC daily totals): Day-of-Week (DOW) adjustments are made to the total daily emissions estimated by EMFAC for Friday, Saturday, Sunday, and Monday. The logic behind this is that EMFAC produces emission estimates for an average weekday. It is assumed that EMFAC's average weekday emissions generally represent Tuesday, Wednesday, and Thursday. Day of week adjustment factors were developed using Automatic Vehicle Classifier (AVC) count data from the California Department of Transportation (Caltrans). These data were collected at 139 sites in the state during the summer of 2004 (specifically, data for the months of June, July and August were used, excluding data from July 2-5 to remove unusual traffic patterns around the July 4th holiday). Three factors were developed: (1) passenger cars (LD), (2) light and medium duty trucks (LM), and (3) heavy-heavy duty trucks (HHDT). An example of the prior assignment of these factors to EMFAC2007 classifications is summarized below in Table 6.2.

Table 6.2: EMFAC2007 Classifications

Caltrans' Factor for EMFAC2007 Class*	Description	Day-of-Week (DOW)
1	LDA	LD
2	LDT1	LD
3	LDT2	LD
4	MDV	LD
5	LHDT1	LM
6	LHDT2	LM
7	MHDT	LM
8	HHDT	HHDT
9	Other Bus	LM
10	School Bus	Unadjusted on weekdays, zeroed on weekend days
11	Urban Bus	LD
12	Motorhomes	LD
13	Motorcycles	LD

* Vehicle classes are being updated for use with EMFAC2011

Separate factors were developed for each Caltrans District. All counties within each Caltrans district use the same adjustment. So, the day of week adjustment process consists of applying four day of week (DOW) factors to EMFAC daily total emission estimates (i.e. which represent Tuesday, Wednesday, and Thursday): one each for Friday, Saturday, Sunday, and Monday.

Temporal Adjustment (Hour-of-Day re-distribution of hourly travel network volumes): The travel networks provided by local government agencies and used for DTIM represent an average weekday hourly distribution. It is assumed that these average weekday hourly distributions lack the day-of-week temporal variations known to occur on specific days of the week. To rectify this, hour-of-day profiles for every day of the week, Monday through Sunday, were developed for each Caltrans District using Caltrans data. These profiles are used to re-allocate the hourly travel network distributions for all vehicle classes used in DTIM.

Spatial Adjustment: The spatial allocation of countywide EMFAC emissions is accomplished using gridded, hourly emission estimates from DTIM normalized by county. DTIM uses emission rates from EMFAC along with activity data, digitized roadway segments (links) and traffic analysis zone centroids to calculate gridded, hourly emissions for travel and trip ends. DTIM considers fewer vehicle categories than EMFAC outputs, so a mapping between EMFAC and DTIM vehicle categories is necessary (this is being updated to work with EMFAC2011). DTIM emission categories are presented in the Table 6.3. The categories are represented by the listed source classification codes (SCC) and depend on vehicle type, technology, and whether the vehicle is catalyst, non-catalyst, or diesel. Light- and medium-duty vehicles are separated from heavy-duty vehicles to allow for separate reporting and control strategy applications. The light- and medium-duty vehicles include LDA, LDT1, LDT2, MDV, LHDT1, LHDT2, UBUS, MH and MCY. The heavy-duty vehicles include MHDT, HHDT, OBUS and SBUS.

Table 6.3: DTIM Emission Categories

SCC for light-duty and medium-duty gasoline vehicles	SCC for heavy-duty gasoline vehicles	SCC for light-duty and medium-duty diesel vehicles	SCC for heavy-duty diesel vehicles	Description
202	302			Catalyst Start Exhaust
203	303			Catalyst Running Exhaust
204	304			Non-catalyst Start Exhaust
205	305			Non-catalyst Running Exhaust
206	306			Hot Soak
207	307			Diurnal Evaporatives
		808	408, 508	Diesel Exhaust
209	309			Running Evaporatives
210	310			Resting Evaporatives
211	311			Multi-Day Resting
212	312			Multi-Day Diurnal
213	313	813	413, 513, 613, 713	PM Tire Wear
214	314	814	414, 514, 614, 714	PM Brake Wear
215	315			Catalyst Buses
216	316			Non-catalyst Buses
		817	617, 717	Diesel Bus
218	318			Catalyst Idle
219	319			Non-catalyst Idle
		820	420, 520, 620, 720	Diesel Idle
221	321			PM Road Dust

Summary of On-road Emissions Processing Steps: Six general steps are used to spatially and temporally allocate EMFAC emissions by hour and grid cell:

Step 1 (DTIM T & RH inputs). Gridded, hourly temperature (T) and relative humidity (RH) fields for each day are prepared as inputs to DTIM.

Step 2 (DTIM emission factor inputs). EMFAC-LD is run in default mode (i.e. without day-specific temperature and relative humidity) to generate a look-up table of on-road mobile source emission factors by speed, temperature, and relative humidity for each county.

Step 3 (Day-specific EMFAC runs to yield daily and hourly estimates). EMFAC-LD is run using episode-specific T and RH data to provide countywide on-road mobile source emission estimates by day and hour for EMFAC-LD categories. The episode-specific meteorological inputs for EMFAC-LD are generated via averaging (VMT-weighted) the gridded, hourly meteorology from Step1 by county and hour.

Step 4 (DTIM emission factor inputs for HD). Merge the HD emission rate by process (ERP) data and the EMFAC-LD ERP data (EMFAC-LD produces these data files directly as an option) and generate a look-up table of on-road mobile source emission factors by speed, temperature, and relative humidity for each county. The HD ERP data came from the HD model. The HD model also provides hourly county emissions for annual, summer and winter. However, only summer and winter are used.

Step 5 (DTIM inputs – redistribute countywide roadway network hourly volumes using Caltrans District data)

5a. Calculate Daily Total Volumes. Sum the hourly volumes by vehicle type and county on the roadway network into daily totals.

5b. Day-of-Week (DOW) adjustment. Modify daily total daily volume from step 5a using Caltrans District DOW adjustment factors to reflect day-of-week differences. For Tuesday through Thursday, no DOW adjustment is made (i.e. the DOW adjustment factor is 1.0) since the data already reflect an average mid-week (Tues-Thurs) allocation. For Friday, Saturday, Sunday, and Monday different DOW factors are applied to county-wide network data based on the Caltrans District associated with each county.

5c. Hour-of-Day adjustments. Hour-of-day profiles for every day of the week, Monday through Sunday, were developed for each Caltrans District using

Caltrans data. Each District is ‘assigned’ to one or more counties. For each county, the profiles are used to re-allocate the hourly travel network distributions for all vehicle classes used in DTIM.

Step 6 (Run DTIM and spatially/temporally distribute EMFAC emissions)

6a. For each county, run DTIM with revised roadway network activity from Step 5 for light and medium duty gasoline vehicles, heavy duty gasoline vehicles, light and medium duty diesel vehicles and heavy duty diesel vehicles (one run for each group; four runs per county).

6b. Sum DTIM emissions by county and SCC.

6c. Distribute EMFAC emissions. EMFAC daily, countywide emissions (adjusted for weekend days, if needed), are disaggregated by category into grid-cells for each hour of the day using the DTIM output as a spatial and temporal surrogate. The disaggregation follows the equation:

$$E_{P,ij,hr,cat} = \frac{EF_{P,cat} \times DTIM_{P,ij,hr,cat}}{DTIM_{P,daily,cat,cnty}}$$

where:

E = grid cell emissions

EF = EMFAC emissions

DTIM = DTIM emissions

P = pollutant

ij = grid cell

hr = hourly emissions

cat = Emission Category

daily = daily emissions

cnty = county

Future Year On-road Emissions: Forecasted on-road modeling inventories are developed using the same methodology, where future year emissions are based on running EMFAC for the associated future year.

6.8 Biogenic Emissions

Development of effective ozone control strategies in California requires accurate emission inventories, including biogenic volatile organic compounds (BVOCs) such as isoprene and monoterpenes. Due to the heterogeneity of vegetation land cover, species composition, and leaf mass distribution in California, quantifying BVOC emissions in this domain requires an emission inventory model with region-specific input databases and a high degree of spatial and temporal resolution. In response to this need, the California Air Resources Board (CARB) has developed a Geographic Information System (GIS)-based model for estimating BVOC emissions, called BEIGIS (Scott and Benjamin, 2003), which uses California-specific input databases with a minimum spatial resolution of 1 km^2 and an hourly temporal resolution. To take advantage of recent scientific advances in biogenic emissions modeling, CARB has recently transitioned from the BEIGIS model to the Model of Emissions of Gases and Aerosols from Nature (MEGAN) version 2.04 (Guenther et al., 2006). MEGAN is a state-of-the-science biogenic emissions model, which represents an evolution of the Biogenic Emissions Inventory System (BEIS), and is being integrated into the Community Multi-scale Air Quality (CMAQ) modeling system by U.S. EPA scientists.

MEGAN estimates biogenic emissions as a function of normalized emission rates (i.e., emission rates at standard conditions), which are adjusted to reflect variations in temperature, light, leaf area index (LAI), and leaf age (estimated from changes in LAI). MEGAN requires input datasets of Emission Factors (EF; at standard conditions: temperature = 303 ˚K, LAI = 5, photosynthetically active radiation ~ 1500 $\mu mol\ m^{-2}s^{-1}$), Plant Functional Type (PFT), and hourly surface temperature and insolation. The default MEGAN input databases for EFs, PFTs, and LAI are not used in the application of MEGAN in California. Instead, California-specific emission factor and PFT databases were translated from those used in BEIGIS to improve emission estimates and to maintain consistency with previous California biogenic emission inventories. LAI data is derived from the MODIS 8-day LAI satellite product. Hourly surface temperatures are from observations gridded with the CALMET meteorological model and insolation (light reaching the surface) data is provided by the MM5 meteorological model. Emissions of isoprene, monoterpenes, and methylbutenol are estimated from California-specific gridded emission factor data, while emissions of sesquiterpenes, methanol, and other volatile organic compounds are estimated from California-specific PFT data and PFT derived emission rates. For urban areas, land use/vegetation land cover databases were developed from regional planning agency data and botanical surveys (Horie et al. 1990; Nowak 1991; Sidawi and Horie 1992; Benjamin et al. 1996, 1997; McPherson et al. 1998). Natural areas are represented using the GAP vegetation database (also satellite-derived and air photo interpreted) developed by the U.S.G.S. Gap Analysis Program (Davis et al. 1995). Agricultural areas are represented using crop land cover databases developed by the California Department of Water Resources (*http://www.waterplan.water.ca.gov*).

Biogenic emissions are not estimated for future years because future inputs to BEIGIS, such as changes in climate and land use/land cover, are highly uncertain. Photochemical modeling for future years uses the biogenic emissions developed for the base year.

Table 6.4: SJV domain-wide biogenic emissions for 2007 in tons/day.

	Isoprene	Methylbutenol	Terpenes	Other ROG	Total ROG
Jan	4	14	13	24	55
Feb	6	18	24	58	106
Mar	117	78	70	142	407
Apr	163	111	92	161	526
May	436	251	159	276	1121
Jun	734	400	261	427	1821
Jul	941	495	341	522	2300
Aug	771	394	303	440	1908
Sep	336	182	160	220	899
Oct	43	63	60	88	255
Nov	11	29	28	45	113
Dec	2	8	9	19	39

The biogenic emissions for the modeling domain are shown in Table 6.4 in tons/day. Note that all biogenic emissions are higher during the warm and sunny summer months and lower in cold and gloomy winter months.

6.9 Spatial Allocation

Once the base year or future year inventories are developed, as described in the previous sections, the next step of modeling inventory development is to spatially allocate the emissions. Air quality modeling attempts to replicate the physical and chemical processes that occur in an inventory domain. Therefore, it is important that the physical location of emissions be determined as accurately as possible. Ideally, the actual location of all emissions would be known exactly. In reality, however, some categories of emissions would be virtually impossible to determine – for example, the actual amount and location of consumer products used every day. Therefore, the spatial allocation of emissions in a modeling inventory only approximates the actual location of emissions.

Before any spatial allocation can be performed, the modeling grid domain must be defined. A modeling grid domain is a rectangular area that is sufficient in size to contain all emission sources that could affect modeling results. The definition of the modeling domain is described below.

Once a grid is defined, the spatial allocation of emissions can be performed. Each area source category is assigned a spatial surrogate that is used to allocate emissions to a grid cell. Examples of surrogates include population, land use, and other data with known geographic distributions for allocating emissions to grid cells. The sections below discuss in detail the spatial surrogates developed for the modeling domain.

Point sources are allocated to grid cells using the UTM coordinates reported for each stack. If there are no stack UTM coordinates, the facility UTM coordinates are used. When location data are not reported, the county centroid is used.

Emissions are also distributed vertically into their proper layer in the air quality model. The vertical layer is determined from the calculation of buoyancy for those emissions that are released from an elevated height with a significant upward velocity and/or buoyancy. Most vertical allocation is from significant point sources with stacks. In most modeling exercises, low-level point sources are screened out at this point and placed with the area sources. However, in this modeling exercise, all point sources from the inventory were kept as possible elevated sources. The air quality model will then place the point sources in the appropriate layer of the model. Additionally in this modeling exercise, day-specific wildfire emissions were also distributed vertically.

The spatial treatment of area and point sources has been described above. The spatial allocation of on-road motor vehicles is based on DTIM as described previously. For biogenic emissions, the spatial allocation is built “from the ground up” since MEGAN estimates emissions using a Geographic Information System (GIS) at a minimum resolution of one square kilometer.

6.9.1 Grid Definition

The ARB emissions inventory domain, shown in Figure 6.1, is defined to match the WRF model domain, which is used to generate the meteorological parameter fields used for air quality modeling. WRF uses a Lambert projection and assumes a spherical Earth. The emission grid is defined in a similar way to match as closely as possible.

The emission inventory grid uses a Lambert Conical Projection with two parallels. The Parallels are at 30° and 60° N latitude, with a central meridian at 120.5° W longitude. The coordinate system origin is offset to 37° N latitude. The emissions inventory uses a grid with a spatial resolution of 4 km x 4 km.

The domain extends entirely over California and 100 nautical miles west over the Pacific Ocean. A smaller subdomain is often used when modeling is being done for the San Joaquin Valley. It has the same grid definitions and resolution as the main domain, but has a smaller area offset to cover central and northern California.

The specifications of the emissions inventory domain and CCOS subdomain are:

<u>MAP PROJECTION</u>
Lambert Conformal Conic
Datum: NONE (Clarke 1866 spheroid)
1st Standard Parallel: 30.0° N
2nd Standard Parallel: 60.0° N

Central Meridian: -120.5° W
Latitude of Projection Origin: 37.0° N

COORDINATE SYSTEM
Units: Meters
Semi-major Axis: 6370 km
Semi-minor Axis: 6370 km

DEFINITION OF GRID
321 x 291 cells (4 km x 4 km)
Lambert Origin @ (-684,000 m, -564,000 m)
Geographic Origin @ -120.5° Latitude and 37.0° Longitude

DEFINITION OF SUBGRID (CCOS)
192 x 192 cells (4 km x 4 km)
Lambert Origin @ (-384,000 m, -300,000 m)
Geographic Origin @ -120.5° Latitude and 37.0° Longitude

6.9.2 Spatial Surrogates

Spatial surrogates are processed into spatial allocation factors for use in geographically distributing countywide area source emissions to individual grid cells. Spatial surrogates are developed based on economic, demographic, and land cover data which exhibit patterns that vary geographically. As has previously been discussed, point source emissions are allocated to grid cells using the location of the emission source. On-road motor vehicle emissions are spatially allocated by DTIM. Biogenic emissions are allocated by the MEGAN emissions model.

In support of CRPAQS and CCOS, Sonoma Technology, Inc. (Funk et al. 2001) developed gridded spatial allocation factors for a 2000 base-year and three future years (2005, 2010, and 2020) for the entire state of California. STI's work was based on the statewide 4-kilometer (km) grid cell domain defined by the ARB. The definition and extent of the 4-km grid were used to create a 2-km nested grid for which spatial allocation factors were developed. In 2007, STI was contracted by CCOS again to update the spatial allocation factors. STI updated the underlying spatial data and updated the spatial surrogate cross-reference file to account for new emission source categories (Reid et al., 2006). STI then updated spatial allocation factors for ARB's statewide modeling domain for a base year of 2000 and future years of 2010, 2015, and 2020.   This task was completed in March 2008.

In preparation for modeling for the Ozone SIPs, ARB staff reviewed the STI spatial surrogates associated with the highest emissions to see which surrogates were candidates for update. ARB staff searched for more recent or improved sources of data, since the underlying data used by STI were pre-recession, then updated 15 of the surrogates using more recent data. A total of 61 unique surrogates are available for use. A summary of the spatial surrogates for which spatial allocation factors were developed is listed in the Table 6.4.

Three basic types of surrogate data were used to develop the spatial allocation factors: land use and land cover; facility location; and demographic and socioeconomic data. Land use and land cover data are associated with specific land uses, such as agricultural tilling or recreational boats. Facility locations are used for sources such as gas stations and dry cleaners. Demographic and socioeconomic data, such as population and housing, are associated with residential, industrial, and commercial activity (e.g. residential fuel combustion). To develop spatial allocation factors of high quality and resolution, local socioeconomic and demographic data were used where available; for rural regions, for which local data were not available, data from the Caltrans Statewide Transportation Model were used.

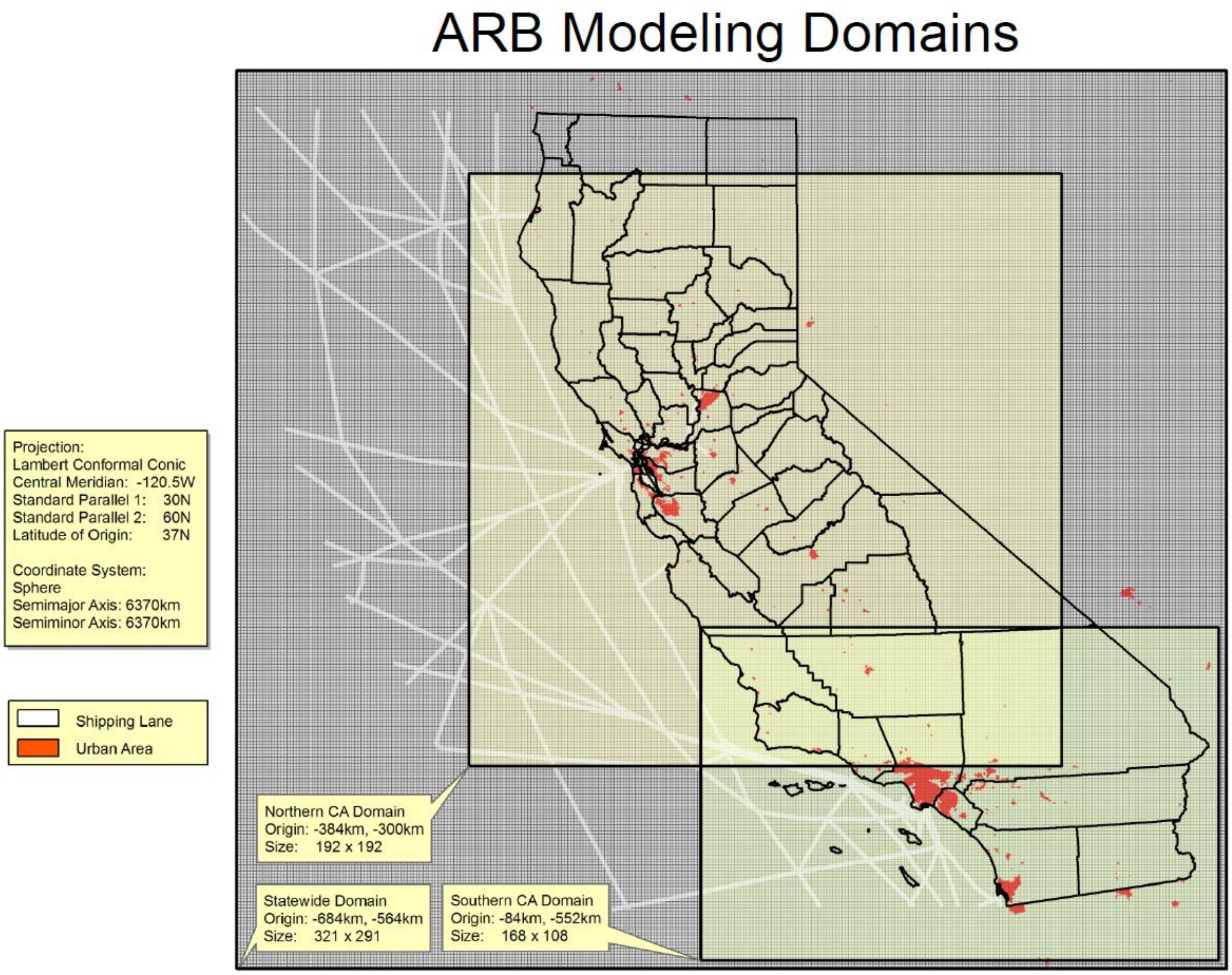


Figure 6.1: ARB Modeling Domain with urban areas and shipping lanes shown.

Table 6.5: Summary of spatial surrogates

Spatial Surrogate	Description
Airports	Spatial locations of all airports
All_PavedRds	Spatial distribution of road network (all paved roads)
AutobodyShops	Locations of autobody repair and refinishing shops
Cemeteries	Spatial locations of cemeteries
Comm_Airports	Spatial locations of commercial airports
Devplnd_HiDensity	Spatial distribution of high-density developed land
Devplnd_LoDensity	Spatial distribution of low-density developed land
Drycleaners	Locations of drycleaning facilities
DryLakeBeds	Locations of Dry lake beds
Elev5000ft	Elevation over 5000 feet developed from topological contours
Employ_Roads	Spatial distribution of total employment and road density (all paved roads)
Forestland	Spatial distribution of forest land
Fugitive_Dust	Spatial distribution of undeveloped, open land
GasStations	Locations of gasoline service stations
GasWells	Locations of gas wells
GolfCourses	Spatial locations of golf courses
HE_Sqft	Computed surrogate based on housing and employment (est. ft2 / person)
Hospitals	Spatial locations of hospitals
Housing	Spatial distribution of total housing
Housing_Autobody	Spatial distribution of housing and autobody refinishing shops
Housing_Com_Emp	Spatial distribution of total housing and commercial employment
Housing_Restaurants	Spatial distribution of total housing and restaurants/bakeries
IndusEmploy_Autobody	Spatial distribution of industrial employment and autobody/refinishing shops
Industrial_Emp	Spatial distribution of industrial employment
InlandShippingLanes	Spatial distribution of major shipping lanes within bays and inland areas
Irr_Cropland	Spatial location of agricultural cropland
Lakes_Coastline	Locations of lakes, reservoirs, and coastline
Landfills	Locations of landfills
LiveStock	Spatial distribution of cattle ranches, feedlots, dairies, and poultry farms
Metrolink_Lines	Spatial distribution of metrolink network
MiltaryAirBases	Location of military air bases
MiltaryBases	Locations of military bases
NonIrr_Pastureland	Spatial location of non-irrigated pasture land
NonRes_Chg	Computed surrogate based on the change in spatial distribution of non-residential areas

Spatial Surrogate	Description
OffShore_OilWells	Locations of off-shore oil wells
OilWells	Locations of oil wells
Pop_ComEmp_Hos	Spatial distribution of hospitals, population and commercial employment
Population	Spatial distribution of population
Ports	Locations of shipping ports
POTWs	Coordinate locations of Publically Owned Treatment Works
PrimaryRoads	Spatial distribution of road network (primary roads)
Raillines	Spatial distribution of railroad network
RailYards	Locations of rail yards
Rds_HE	Calculated surrogate based on road densities and housing/employment (est. ft2 / person)
RefinieriesTankFarms	Coordinate locations of refineries and tank farms
Res_NonRes_Chg	Computed surrogate based on the change in spatial distribution of residential and non-residential areas
ResGasHeating	Spatial distribution of gas heating population
Residential_Chg	Computed surrogate based on the change in spatial distribution of residential areas
ResNonResChg_IndEmp	Spatial distribution of industrial employment and residential/ non-residential change
Restaurants	Locations of bakeries and restaurants
ResWoodHeating	Spatial distribution of wood heating population
SandandGravelMines	Locations of sand/gravel excavation and mining
Schools	Spatial locations of schools
SecondaryPavedRds	Spatial distribution of road network (secondary roads)
Ser_ComEmp_Sch_GolfC_Cem	Spatial distribution of service and commercial employment, schools, cemeteries, and golf courses
Service_Com_Emp	Spatial distribution of service and commercial employment
Service_Emp	Spatial distribution of service employment
Shiplanes	Spatial distribution of major shipping lanes
SingleHousingUnits	Spatial distribution of single dwelling units
UnpavedRds	Spatial distribution of road network (unpaved roads)
Wineries	Locations of wineries

6.10 Speciation

The ARB's emission inventory and photochemical air quality models both quantify organic compounds as Total Organic Gases (TOG). Photochemical models simulate the physical and chemical processes in the lower atmosphere, and include all emissions of the important compounds involved in photochemistry. Organic gases are one of the most important classes of chemicals involved in photochemistry. Organic gases emitted to the atmosphere are referred to as total organic gases (TOG). ARB's chemical speciation profiles (CARB 2006) are applied to characterize the chemical composition of the TOG emitted from each source type.

TOG includes compounds of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. TOG includes all organic gas compounds emitted to the atmosphere, including the low reactivity, or exempt, VOC compounds (e.g., methane, ethane, various chlorinated fluorocarbons, acetone, perchloroethylene, volatile methyl siloxanes, etc.). TOG also includes low volatility or low vapor pressure (LVP) organic compounds (e.g., some petroleum distillate mixtures). TOG includes all organic compounds that can become airborne (through evaporation, sublimation, as aerosols, etc.), excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate.

Total Organic Gas (TOG) emissions are reported in the ARB's emission inventory and are the basis for deriving the Reactive Organic Gas (ROG) emission components, which are also reported in the inventory. ROG is defined as TOG minus ARB's "exempt" compounds (e.g., methane, ethane, CFCs, etc.). ROG is nearly identical to U.S. EPA's term "VOC", which is based on U.S. EPA's exempt list. For all practical purposes, use of the terms ROG and VOC are interchangeable. Also, various regulatory uses of the term "VOC", such as that for consumer products exclude specific, additional compounds from particular control requirements.

6.10.1 Speciation Profiles

Speciation profiles are used to estimate the amounts of various organic compounds that make up TOG. A speciation profile contains a list of organic compounds and the weight fraction that each compound composes of the TOG emissions from a particular source type. Each process or product category is keyed to one of several hundred currently available speciation profiles. The speciation profiles are applied to TOG to develop both the photochemical model inputs and the emission inventory for ROG.

It should be noted that districts are allowed to report their own reactive fraction of TOG that is used to calculate ROG rather than use the information from the assigned organic profiles. These district-reported fractions are not used in developing modeling inventories because the information needed to calculate the amount of each organic compound is not available.

To the extent possible (i.e. given available data), ARB's organic gas speciation profiles contain all emitted organic species that can be identified (ideally, detected to very low levels). This includes reactive compounds, unreactive and exempt compounds, and to the extent the data are available, low vapor pressure compounds. Research studies are conducted regularly to improve ARB's species profiles. These profiles support ozone modeling studies but are also designed to be used for aerosol and regional toxics modeling. The profiles are also used to support other health or welfare related modeling studies where the compounds of interest cannot always be anticipated. Therefore, organic gas emission profiles should be as complete and accurate as possible.

The speciation profiles used in the emission inventory are available for download from the ARB's web site at: http://www.arb.ca.gov/ei/speciate/speciate.htm.

The Organic Speciation Profiles (ORGPROF) file contains the weight fraction data (expressed as percent for ease of display) of each chemical in each profile. Each chemical fraction is multiplied by the Total Organic Gas (TOG) emissions for a source category to get the amount of each specific constituent chemical. In addition to the chemical name for each chemical constituent, the file also shows the chemical code (a 5-digit internal identifier) and the Chemical Abstracts Service (CAS) number, which is a unique identifying code (up to 9 digits) assigned to chemicals by the CAS Registry Service.

Also available for download from ARB’s web site is a cross-reference file that indicates which Organic Gas profile is assigned to each source category in the inventory. The inventory source categories are represented by an 8-digit Source Classification Code (SCC) for point sources, or a 14-digit Emission Inventory Code (EIC) for area and mobile sources. This file also contains the fraction of reactive organic gas (FROG) values for organic profiles. Some of the Organic Gas Speciation Profiles related to motor vehicles and fuel evaporative sources vary by the inventory year of interest, due to changes in fuel composition and vehicle fleet composition over time.

ARB has an ongoing effort to update speciation profiles as data become available, such as through testing of emission sources or surveys of product formulation. New speciation data generally undergo technical and peer review, and updating of the profiles is coordinated with users of the data. Several recent changes to ARB's speciation profiles were for: 1) consumer products, 2) aerosol coatings, 3) architectural coatings, 4) pesticides and 5) hot soak from gasoline-powered vehicles.

6.10.2 Chemical Mechanisms

Airshed models are essential for the development of effective control strategies for reducing photochemical air pollution because they provide the only available scientific basis for making quantitative estimates of changes in air quality resulting from changes in emissions. The chemical mechanism is the portion of the model that represents the processes by which emitted primary pollutants, such as TOG, carbon monoxide (CO), and oxides of nitrogen (NO_x), react in the gas phase to form secondary pollutants such as ozone (O_3) and other oxidants.

For State Implementation Plan (SIP) attainment demonstrations and evaluations, the U.S. EPA has approved the California Air Resources Board’s photochemical air quality models. The air quality models used by the ARB for SIP attainment demonstrations use the SAPRC photochemical mechanism. This mechanism is based on extensive scientific research and is documented in the scientific literature (Carter 2000). Table 6.5 shows modeled ROG species (or species categories) for the SAPRC-99 chemical mechanism. Table 6.6 shows modeled species for NOx.

Table 6.6: ARB's SAPRC-99 Emitted Organic Model Species

Model Species	Description
HCHO	Formaldehyde
CCHO	Acetaldehyde
RCHO	Lumped C3+ Aldehydes
ACET	Acetone
MEK	Ketones and other non-aldehyde oxygenated products
PROD	
RNO3	Lumped Organic Nitrates
PAN	Peroxy Acetyl Nitrate
PAN2	PPN and other higher alkyl PAN analogues
BALD	Aromatic aldehydes (e.g., benzaldehyde)
PBZN	PAN analogues formed from Aromatic Aldehydes
PHEN	Phenol
CRES	Cresols
NPHE	Nitrophenols
GLY	Glyoxal
MGLY	Methyl Glyoxal
MVK	Methyl Vinyl Ketone
MEOH	Methanol
HC2H	Formic Acid
CH4	Methane
ETHE	Ethene
ISOP	Isoprene
TERP	Terpenes
MTBE	Methyl Tertiary Butyl Ether
ETOH	Ethanol
NROG	Non-reactive
LOST	Lost carbon

Model Species	Description
ALK1	Alkanes and other non-aromatic compounds that react only with OH, and have kOH <
ALK2	Alkanes and other non-aromatic compounds that react only with OH, and have kOH
ALK3	Alkanes and other non-aromatic compounds that react only with OH, and have kOH
ALK4	Alkanes and other non-aromatic compounds that react only with OH, and have kOH
ALK5	Alkanes and other non-aromatic compounds that react only with OH, and have kOH
ARO1	Aromatics with kOH < 2x10^4 ppm-1 min-1.
ARO2	Aromatics with kOH > 2x10^4 ppm-1 min-1.
OLE1	Alkenes (other than ethene) with kOH < 7x10^4 ppm-1 min-1.
OLE2	Alkenes with kOH > 7x10^4 ppm-1 min-1.

Both U.S. EPA's and ARB's models require estimates of total organic gases, which include the "exempt VOCs", and, to the extent data are available, any low vapor pressure compounds that become airborne. Model results for ozone non-attainment areas have demonstrated that even compounds with low photochemical reactivity or low vapor pressure contribute to photochemical ozone formation. For example, even an "exempt VOC" like ethane has been shown to have a contribution to ozone formation. If all exempt compounds and low vapor pressure compounds were omitted from photochemical model simulations, the ozone attainment demonstration would be compromised. The model takes into account that, individually, compounds with low reactivity or that are present in small amounts have a small impact on ozone formation. However, the cumulative effect of several low reactive compounds or many low emission compounds can be a significant contributor to photochemical ozone formation.

Table 6.7: Model Species for NOx

Model Species Name	Description
HONO	Nitrous Acid
NO	Nitric Oxide
NO2	Nitrogen Dioxide

6.11 Quality Assurance

To facilitate thorough quality assurance (QA), a variety of standardized emission summary reports for the periods simulated will be produced. Some examples of the standardized reports are contained in the sections below.

As indicated in the prior section, day-specific and external baseline adjustments were applied to baseline emission estimates. For the purpose of checking adjustment levels for accuracy, “baseline” and “adjusted” emission summary reports will be generated.

Inventory corrections will be prioritized based on emissions magnitude, schedule, and potential impact on air quality modeling results. As gridded emissions are processed and quality assured, suspect or unresolvable issues that may impact air quality model performance will be summarized and reported.

6.11.1 Examples of Standard Tabular Summaries

This section contains examples of tabular summaries that will be provided for review.

Domain Totals by Pollutant and Time Period for Baseline and Adjusted Emissions

CO	NOX	SOX	TOG	PM	NH3	ROG	PM10	PM25
17,939.63	4,308.18	285.01	7,334.56	4,109.78	762.98	3,620.07	2,472.03	810.70

Totals by Major Category, Pollutant, and Time Period for Baseline and Adjusted Emissions

EIC1	DESCRIPTION	CO	NOX	SOX	TOG	PM	NH3	ROG	PM10	PM25
0	FUEL COMBUSTION	384.18	406.63	48.20	148.62	45.55	5.49	34.17	40.08	37.24
1	WASTE DISPOSAL	2.18	3.02	0.67	1,245.77	1.62	42.56	14.86	0.83	0.73
2	CLEANING AND SURFACE COATINGS	0.15	0.40	0.04	381.17	0.39	2.13	279.20	0.38	0.36
3	PETROLEUM PROD AND MARKETING	10.08	13.97	58.60	536.56	4.90	1.85	219.60	3.05	2.26
4	INDUSTRIAL PROCESSES	53.52	96.16	31.57	95.55	174.20	9.22	79.44	100.22	51.50
5	SOLVENT EVAPORATION	0.00	0.00	0.00	475.95	0.03	37.45	419.42	0.03	0.03
6	MISCELLANEOUS PROCESSES	2,545.81	156.27	9.64	1,811.66	3,726.68	538.27	300.23	2,173.18	586.03
7	ON-ROAD MOTOR VEHICLES	12,726.85	2,315.33	11.27	1,343.71	74.73	75.25	1,233.16	74.09	57.91
8	OTHER MOBILE SOURCES	2,216.86	1,316.41	125.03	484.40	81.69	0.00	431.80	80.18	74.65
9	NATURAL SOURCES	0.00	0.00	0.00	811.17	0.00	50.76	608.19	0.00	0.00

Totals by Summary Category, Pollutant, and Time Period for Baseline and Adjusted Emissions

EIC3	DESCRIPTION	CO	NOX	SOX	TOG	PM	NH3	ROG	PM_{10}	PM_{25}
010	ELECTRIC UTILITIES	56.74	51.52	4.76	30.97	6.82	2.35	4.97	6.35	5.89
020	COGENERATION	49.01	30.87	1.87	17.27	4.43	0.18	4.04	4.03	3.72
030	OIL AND GAS PRODUCTION	22.66	45.18	7.44	26.59	2.09	0.10	4.15	2.08	2.08
040	PETROLEUM REFINING	10.22	46.03	12.75	3.52	4.26	0.61	1.79	4.06	3.98
050	MANUFACTURING AND INDUSTRIAL	52.77	86.07	14.52	20.28	5.92	1.63	3.96	5.71	5.45
052	FOOD AND AGRICULTURAL	111.24	22.60	2.69	7.72	3.02	0.10	6.06	2.94	2.89
060	SERVICE AND COMMERCIAL	71.00	104.86	3.66	35.62	8.31	0.40	6.90	8.24	8.19
099	OTHER (FUEL COMBUSTION)	10.55	19.50	0.50	6.65	10.70	0.11	2.31	6.68	5.05
110	SEWAGE TREATMENT	0.25	0.39	0.28	1.29	0.03	0.25	0.70	0.02	0.02
120	LANDFILLS	0.85	0.67	0.21	1,182.55	0.89	9.78	7.92	0.40	0.35
130	INCINERATORS	1.01	1.77	0.14	0.94	0.23	0.09	0.16	0.11	0.10
140	SOIL REMEDIATION	0.06	0.09	0.03	0.49	0.11	0.00	0.34	0.04	0.03
199	OTHER (WASTE DISPOSAL)	0.01	0.10	0.00	60.49	0.36	32.42	5.74	0.25	0.25
210	LAUNDERING	0.00	0.00	0.00	8.60	0.00	0.00	0.84	0.00	0.00
220	DEGREASING	0.00	0.00	0.00	178.79	0.00	0.00	99.87	0.00	0.00
230	COATINGS AND RELATED PROCESS	0.11	0.16	0.04	122.45	0.32	0.03	114.08	0.30	0.29
240	PRINTING	0.01	0.05	0.00	25.31	0.05	0.04	25.31	0.05	0.04
250	ADHESIVES AND SEALANTS	0.00	0.00	0.00	35.84	0.01	0.00	31.80	0.01	0.01
299	OTHER (CLEANING AND SURFACE	0.03	0.19	0.00	10.17	0.02	2.06	7.30	0.02	0.02
310	OIL AND GAS PRODUCTION	1.91	3.32	0.53	104.11	0.10	0.00	53.90	0.08	0.08
320	PETROLEUM REFINING	6.03	9.85	58.06	49.04	3.99	1.85	38.43	2.54	2.08
330	PETROLEUM MARKETING	2.14	0.80	0.00	382.93	0.81	0.00	126.85	0.43	0.10
399	OTHER (PETROLEUM PROD AND	0.00	0.00	0.00	0.47	0.00	0.00	0.42	0.00	0.00
410	CHEMICAL	0.44	1.82	2.69	34.07	5.99	0.25	27.38	5.09	4.71

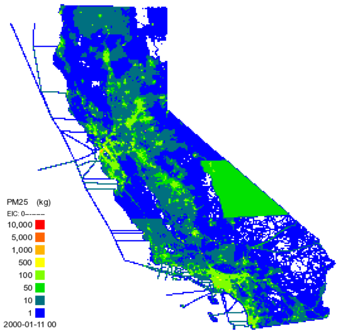
EIC3	DESCRIPTION	CO	NOX	SOX	TOG	PM	NH3	ROG	PM_{10}	PM_{25}
420	FOOD AND AGRICULTURE (Note:	2.71	9.60	2.52	23.33	29.67	0.07	21.15	12.05	2.79
499	OTHER (INDUSTRIAL PROCESSES)	10.37	9.31	0.85	22.72	18.20	8.82	18.42	11.70	7.86
510	CONSUMER PRODUCTS	0.00	0.00	0.00	305.34	0.00	0.00	259.30	0.00	0.00
520	ARCHITECTURAL COATINGS AND	0.00	0.00	0.00	111.39	0.00	0.00	108.74	0.00	0.00
530	PESTICIDES/FERTILIZERS	0.00	0.00	0.00	39.41	0.00	37.45	32.38	0.00	0.00
540	ASPHALT PAVING / ROOFING	0.00	0.00	0.00	19.82	0.03	0.00	19.01	0.03	0.03
610	RESIDENTIAL FUEL COMBUSTION	1,741.05	129.11	8.59	274.46	270.85	12.36	120.38	253.79	244.63
620	FARMING OPERATIONS	0.00	0.00	0.00	1,419.61	147.04	467.32	113.57	72.64	17.07
630	CONSTRUCTION AND DEMOLITION	0.00	0.00	0.00	0.00	415.08	0.00	0.00	203.10	20.30
640	PAVED ROAD DUST	0.00	0.00	0.00	0.00	810.83	0.00	0.00	370.71	55.62
645	UNPAVED ROAD DUST	0.00	0.00	0.00	0.00	235.99	0.00	0.00	140.25	14.02
650	FUGITIVE WINDBLOWN DUST	0.00	0.00	0.00	0.00	1,718.35	0.00	0.00	1,016.94	135.06
660	FIRES	10.14	0.24	0.00	1.01	1.17	0.00	0.71	1.15	1.08
670	WASTE BURNING AND DISPOSAL	793.31	26.85	1.05	107.70	92.67	4.64	59.38	90.31	83.67
690	COOKING	0.16	0.00	0.00	8.77	33.40	0.00	6.13	23.38	14.03
699	OTHER (MISCELLANEOUS	1.15	0.07	0.00	0.10	1.31	53.95	0.07	0.92	0.55
700	On-Road Motor Vehicles	12,726.85	2,315.33	11.27	1,343.71	74.73	0.00	1,233.16	74.09	57.91
710	LIGHT DUTY PASSENGER (LDA)	0.00	0.00	0.00	0.00	0.00	41.86	0.00	0.00	0.00
722	LIGHT DUTY TRUCKS - 1 (LDT1)	0.00	0.00	0.00	0.00	0.00	9.32	0.00	0.00	0.00
723	LIGHT DUTY TRUCKS - 2 (LDT2)	0.00	0.00	0.00	0.00	0.00	15.73	0.00	0.00	0.00
724	MEDIUM DUTY TRUCKS (MDV)	0.00	0.00	0.00	0.00	0.00	5.82	0.00	0.00	0.00
732	LIGHT HEAVY DUTY GAS TRUCKS - 1	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00
733	LIGHT HEAVY DUTY GAS TRUCKS - 2	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00
734	MEDIUM HEAVY DUTY GAS TRUCKS	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
736	HEAVY HEAVY DUTY GAS TRUCKS	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
742	LT HEAVY DUTY DIESEL TRUCKS - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

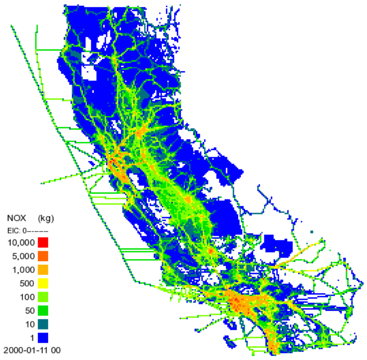
EIC3	DESCRIPTION	CO	NOX	SOX	TOG	PM	NH3	ROG	PM_{10}	PM_{25}
743	LT HEAVY DUTY DIESEL TRUCKS - 2	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
744	MED HEAVY DUTY DIESEL TRUCKS	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
746	HEAVY HEAVY DUTY DIESEL	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
750	MOTORCYCLES (MCY)	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
760	HEAVY DUTY DIESEL URBAN BUSES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
762	HEAVY DUTY GAS URBAN BUSES	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
770	SCHOOL BUSES (SB)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
776	OTHER DIESEL BUSES	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
780	MOTOR HOMES (MH)	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
810	AIRCRAFT	249.71	54.02	2.81	40.28	9.03	0.00	35.91	8.81	8.72
820	TRAINS	28.90	194.16	8.05	13.29	4.40	0.00	11.12	4.40	4.05
830	SHIPS AND COMMERCIAL BOATS	38.84	276.79	109.70	17.62	20.28	0.00	14.77	19.62	18.94
840	RECREATIONAL BOATS	126.38	3.82	0.01	36.92	1.39	0.00	34.86	1.25	0.95
850	OFF-ROAD RECREATIONAL	135.10	1.08	0.25	41.00	0.80	0.00	38.28	0.72	0.54
860	OFF-ROAD EQUIPMENT	1,536.69	680.34	3.49	259.95	39.32	0.00	225.28	38.92	35.52
870	FARM EQUIPMENT	101.24	106.20	0.72	24.87	6.47	0.00	21.29	6.46	5.93
890	FUEL STORAGE AND HANDLING	0.00	0.00	0.00	50.46	0.00	0.00	50.28	0.00	0.00
910	BIOGENIC SOURCES	0.00	0.00	0.00	709.42	0.00	14.54	578.69	0.00	0.00
920	GEOGENIC SOURCES	0.00	0.00	0.00	101.75	0.00	36.22	29.50	0.00	0.00

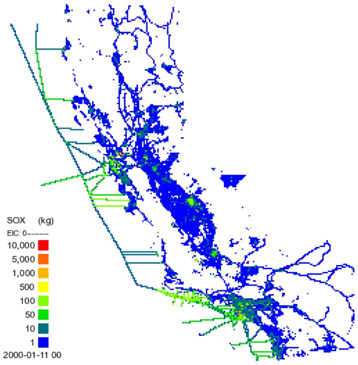
6.11.2 Spatial Plots

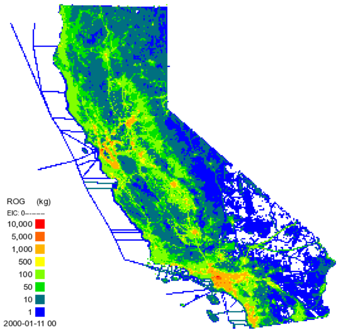
Spatial plots are useful to ensure that emissions are distributed correctly into each grid cell.

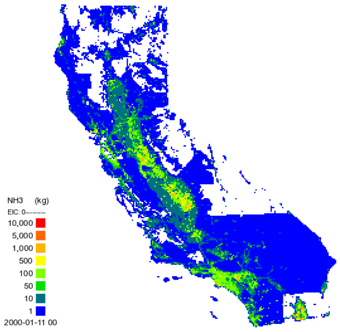
Plots by Pollutant and Time Period for Baseline and Adjusted Emissions

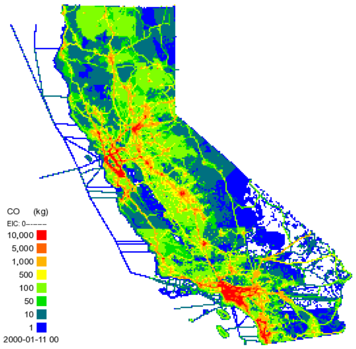








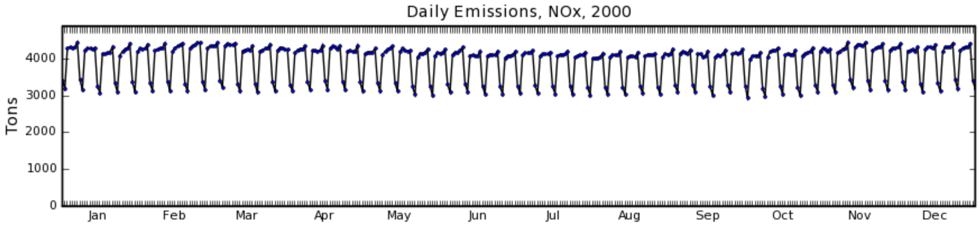


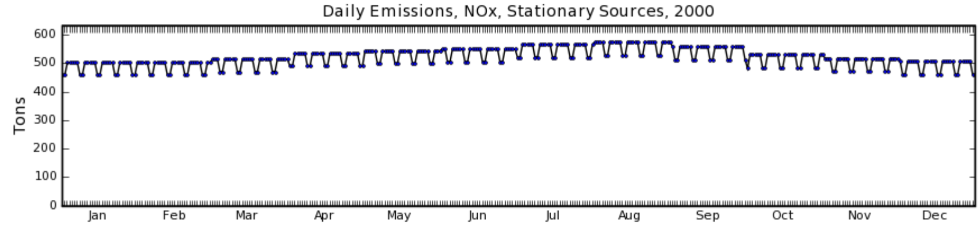


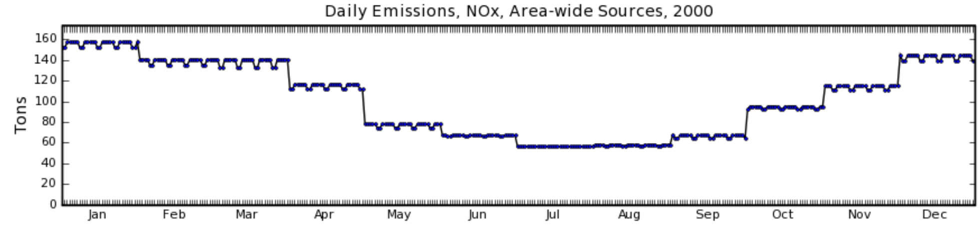
6.11.3 Time Series Plots

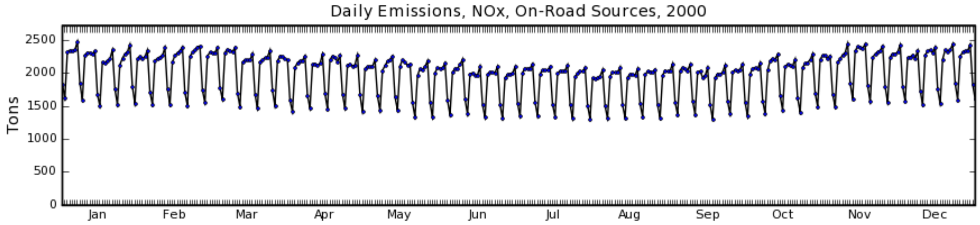
Time series plots are useful to ensure that emissions are distributed correctly in time across the modeling period.

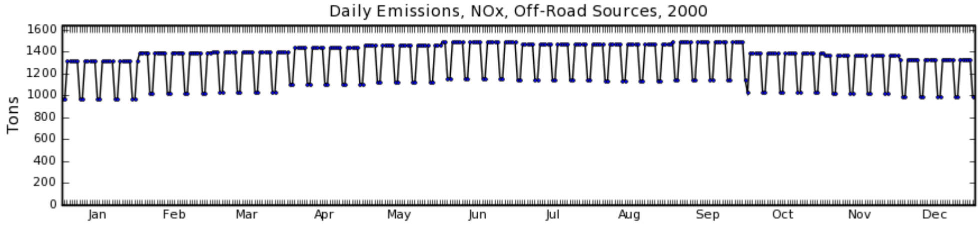
Weekly Time-Series Plots of Emissions by Year

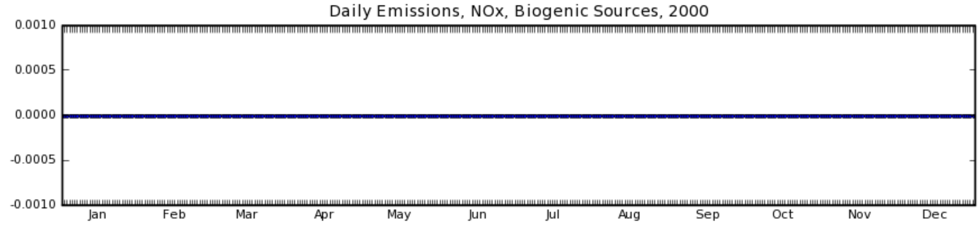




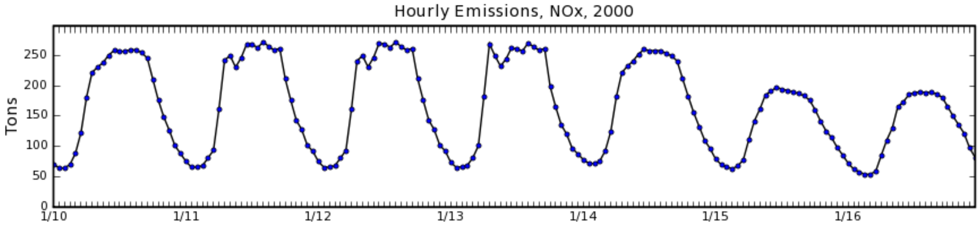


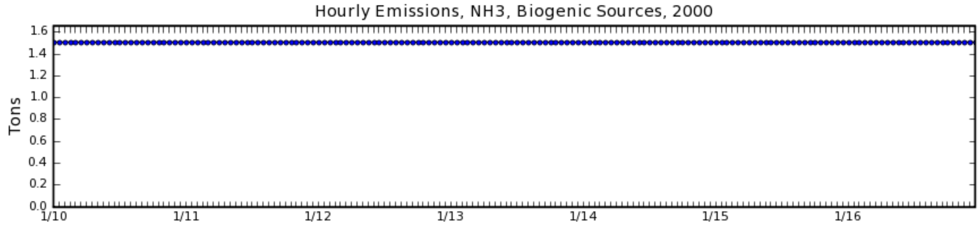


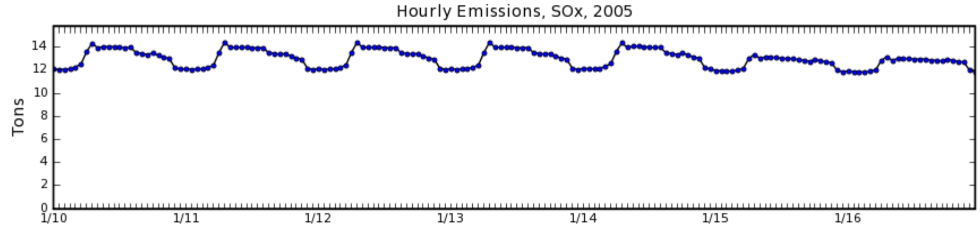




Hourly Time-Series Plots of Emissions by Week







7 MODEL PERFORMANCE EVALUATION

The following subsections summarize the model performance evaluation procedures that will be used for the meteorological and photochemical models (based on: Emery & Tai, 2001; Tesche et al., 2002; U.S. EPA, 1991 & 2005).

7.1 Meteorological Model Performance Evaluation

7.1.1 Known Performance Issues of Meteorological Models in the Complex Terrain of California and Current Attempts to Improve Performance

The San Joaquin Valley is bordered on the west by the Coastal Mountain Range and on the east by the Sierra Nevada range. These ranges converge at the southern end of the basin at the Tehachapi Mountains. West of the Costal Mountain Range is the Pacific Ocean. The SJV is considered to be the most fertile semi-arid region in the world. The ocean-land interface, mountain-valley topography, and the drastic temperature changes make the SJV one of the most challenging areas in the country to simulate using meteorological models.

One can generate meteorological fields using two different methods. First is known as the diagnostic method where observed fields are interpolated. These fields represent the actual meteorological state of the atmosphere where the measurements were made. However, such measurements are sparse and often made at the surface level. Some monitors may have limited spatial representation due to their locations (e.g., in canyons). These diagnostic meteorological fields do not have dynamic consistency among variables (Seaman, 2000) and may not have all the variables required by modern air quality models. However, they have been shown to provide better air-quality model performance during the summer (Jackson et al., 2006) and winter (Hu et al., 2010) in SJV. This may be due to their ability to better represent the wind speeds and temperatures.

When a dense network of representative meteorological measurements are not available, one can use a set of non-linear partial differential equations, known as governing equations, which describe the time evolution of the atmospheric system through space and time. The governing equations are comprised of the equations of conservation of mass, motion, heat, and water (Pielke, 1984). Meteorological models that integrate the set of governing equations through space-time are known as prognostic models. There is a long history of prognostic meteorological model applications in the SJV (Seaman, Stauffer, and Lario-Gibbs, 1995; Stauffer et al., 2000; Tanrikulu et al., 2000; Jackson et al., 2006; Bao et al., 2008; Livingstone et al., 2009; Michelson et al., 2010; Jin et al., 2010; Hu at al., 2010).

The integration of the governing equations requires simplifying assumptions that lend them to numerical integrations methods. These simplifying assumptions can lead to two undesirable consequences. First, they may cause the simulated solution to stray from the ideal solution. To minimize this, four-dimensional data assimilation (FDDA) techniques were developed. While FDDA is known to steer the simulated solution towards the measured fields, the momentum redistribution within the model causes spurious features where no measurements are available. While FDDA is not considered to be a panacea, it is an operational necessity to develop meteorological fields that are accurate enough for the operation of air quality models.

The second undesirable consequence is due to the complex terrain of California itself as shown in Figure 7.1. The centered finite difference scheme used in prognostic models works well when the terrain features are smooth and continuous. However, the SJV is bounded by three steep and rugged mountain ranges. The elevation can change by tens to hundreds of meters in one 4 km grid cell. The Coastal Range on the west is near the ocean-land interface which is also difficult to simulate. This makes the terrain in California complex compared to other parts of the country where the application of prognostic models have been more successful. To overcome this difficulty, the grid sizes were reduced from 4 km to 1.33 km as a test. The minor improvements in the fine-scale meteorological fields did not justify the nine fold increase in the computational time. Another option is to investigate the effect of using different model options, especially those related to sub-grid-scale processes. This is being done now in collaboration with Professor Robert Fovell of the University of California at Los Angeles with funding from the San Joaquin Valley Study Agency.

7.1.2 Ambient Data Base and Quality of Data

The Air Quality and Meteorological Information System (AQMIS) is a web-based source for real-time and official air quality and meteorological data (www.arb.ca.gov/airqualitytoday/). This database contains 1969-2011 meteorological data (partial months for 2011). The data until the end of 2008 are quality assured and deemed official. In addition ARB also has quality-assured upper-air meteorological data obtained using balloons, aircraft, and profilers.

7.1.3 Model Performance Evaluation Procedures and Metrics

While there are several U.S. EPA approved meteorological models that can be used for SIP applications, the MM5 and WRF models have been used most frequently. For the reasons provided in Section 5.1.1, the WRF model will be used here to demonstrate model performance for the year 2007.

Figure 7.1: Terrain height changes along with counties and major rivers and lakes in California (http://geology.com/state-map/california.shtml).

7.1.3.1 Statistical Evaluation

Statistical analyses will be performed to evaluate how well the WRF model captured the overall structure of the observed atmosphere during the five-month simulation period, using wind speed, wind direction, and temperature. Since observed moisture data are very scarce, relative humidity or mixing ratio will not be used in these comparisons. It is quite common to see, especially in such a long numerical simulation period, that observed statistical characteristics of atmospheric flow may be captured well by the model during a certain time period and/or within some sub-domain while the agreement between the model and observations may not be reasonably good at other times and/or locations. As a result, the very first sign that we look for in the model results is whether the model can capture the overall characteristics of the atmosphere in a statistical sense during the entire simulated period and within the entire domain. Then, the same statistical calculations will be repeated within each subregion to find out in which subregions model predictions are good or acceptable and are not acceptable in others, so that the reason for weak model performance issues in a subregion can be investigated.

For this purpose, the performance of the WRF model against observations will be evaluated using the METSTAT analysis tool (Emery et al, 2001). The model output and observations for all five months in 2007 will be read, and data points at each observational site for wind speed, wind direction, temperature, and moisture data will be extracted. Then, the following values will be calculated: Mean values of observations and model estimates, bias error (BE), gross error (GE), root mean square error (RMSE), and the index of agreement (IOA) when applicable.

The mathematical expressions for these quantities are:

$$BE = \frac{\sum_{1}^{N}(Model - Obs)}{N},$$

$$GE = \frac{\sum_{1}^{N}|Model - Obs|}{N},$$

$$MNB = \frac{\sum_{1}^{N}(Model - Obs)}{\sum_{1}^{N}Obs} \times 100\%,$$

$$RMSE = \left(\frac{\sum_{1}^{N} (Model - Obs)^2}{N} \right)^{1/2} ,$$

$$IOA = 1 - \frac{\sum_{1}^{N} (Model - Obs)^2}{\sum_{1}^{N} \left[(Model - Obs) + (Model + Obs) \right]^2},$$

where, “*Model*” is the simulated concentrations, “*Obs*” is the observed value, and *N* is the number of observations. The model performance expectations are shown in Table7.1.

These values will be tabulated and plotted for the entire domain as well as eight subregions (the Mountain Counties; North Central Coast; South Central Coast; San Francisco Bay Area; north, central, and southern San Joaquin Valley; and the Sacramento Valley) to obtain an overall understanding of model performance within each region. Then, model results of the u and v-components of the wind and temperature will be plotted against observations at each station to see the degree of agreement visually, as well.

Another way to quantify the agreement between the simulated and observed quantities is to examine their frequency distributions. Model results and observations of u and v-components of the wind and temperature will be accumulated into several bins and a frequency distribution of each variable will be plotted. The observed and predicted frequency distribution indicates the dominant bins or categories of a particular variable and how the model prediction compares to the observed frequency distribution.

Table 7.1: Model Performance Expectations.

Wind Speed	RMSE	≤ 2 m/s
	Bias	< ±0.5 m/s
	IOA	±0.6
Wind Direction	Gross Error:	≤30 deg
	Bias	≤ ±10 deg
Temperature	Gross Error	≤ 2 K
	Bias	≤ ±0.5 K
	IOA	±0.8
Humidity	Gross Error	≤ 2 g/kg
	Bias	< ±1 g/kg
	IOA	±0.6

Time-history plots reveal information that is not readily apparent from the aforementioned analyses. Thus, a direct comparison of model results using temporal variation of wind speed, wind direction, and temperature at each station, hour-by-hour, for each week in every month will be conducted to study the model performance much more closely than can be done using statistical analyses. Due to the limited availability of continuous hourly relative humidity measurements compared to other meteorological variables, hourly comparison of relative humidity will not be performed. Based on our previous experience with meteorological simulations in California, we expect the analysis to show that wind speed is overestimated at some stations while the difference is small at others. The diurnal variations of temperature and wind direction at most stations would be captured reasonably well. However, we expect the model to underestimate the larger magnitudes of temperature during the day and smaller magnitudes at night.

7.1.3.2 Phenomenological Evaluation

One possible performance evaluation technique is to examine the meteorological observations in relation to ambient air quality values, to determine the relationships between air quality and key meteorological variables. As indicated above, we will examine the simulated results to see if these relationships are also evident in simulated meteorological variables and air quality. This analysis will be conducted at the station/region level.

Another possibility is to generate geopotential height charts at 500 and 850 mb using the simulated results and to compare them to the standard charts. This will reveal if the large-scale weather systems at those pressure levels were adequately simulated by the regional prognostic meteorology model.

Another similar approach is to identify the larger-scale meteorological conditions associated with air quality events using the NCEP Reanalysis dataset. We plan to examine the simulated meteorological fields to see if those large-scale meteorological conditions were accurately simulated. We will then examine if the relationships observed in the NCEP reanalysis were present in the simulated data sets.

7.2 Air Quality Model Performance Evaluation

The U.S. EPA (1991) and ARB (1990) outline a number of procedures for analysis of base year, air quality model performance. These include spatial and time-series plots, statistical analyses, comparing simulated and observed pollutant concentrations, as well as sensitivity analysis of selected input fields. The purpose of the performance analysis is to provide some confidence that the air quality simulations – which are the basis of future-year ozone concentration estimates – are performing properly and for the right reasons.

The application of air quality modeling results to demonstrate attainment of the federal 1-hour ozone standard emphasized the simulated unpaired peak ozone concentration. Three statistical measures were recommended to evaluate model performance: unpaired peak ratio (UPR), paired mean normalized bias (NB), and paired gross error

(GE). These statistical measures were calculated for the modeling domain as a whole, and the NB and GE were calculated from all hourly concentrations in excess of 60 ppb (to avoid biasing the statistical measures with low concentrations). To meet performance guidelines, recommendations were that the UPR should be within ±20%, NB should be within ±15%, and the GE less than 35%. However, California's geography is very complex and modeling domains have evolved to cover large geographic areas. Thus it is recommended that the domains be divided into subregions, and that the performance measures be calculated independently for each subregion. The configuration of these subregions is somewhat arbitrary; however, they should be configured to isolate "common" regions of higher ozone. Figure 7.2 illustrates the proposed subregions for the statewide domain.

Along with the statistical measures discussed above, the graphical and statistical tests recommended by the U.S. EPA (1991 and 2005) and shown in Tables 7.1 and 7.2 will be used to assess overall model performance. Several sensitivity tests recommended by the U.S. EPA (1991) will also be used for qualitative evaluation. While the results of these sensitivity analyses are inherently subjective, they are designed to provide confidence that the air quality model is not only performing well, but is also properly responding to changes in inputs.

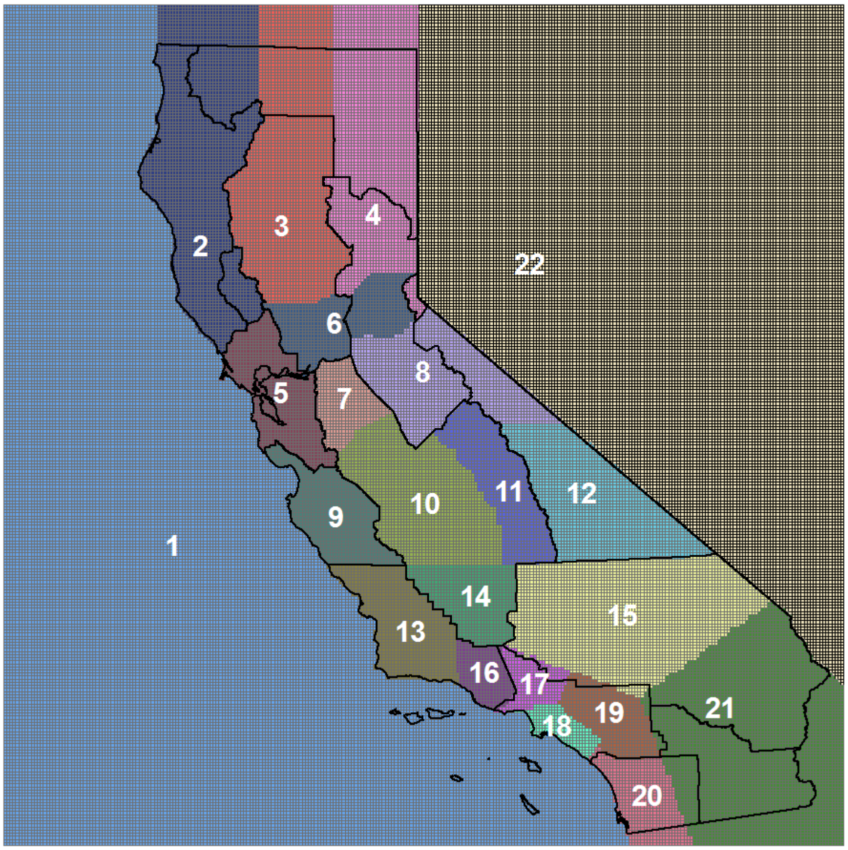


Figure 7.2: Sub-regions of air quality model performance evaluation (7: Northern San Joaquin Valley region, 10: Central San Joaquin Valley region, 11: San Joaquin Valley APCD About 3000 feet region, 14 Southern San Joaquin Valley region).

Table 7.2: Statistics for evaluating base year air quality model performance for all sub-regions.

- Mean normalized bias for all 1-hour ozone concentrations (60 ppb), unpaired in time and space for all sites
- Mean normalized gross error for all 1-hour ozone concentrations (≥60 ppb), unpaired in time and space for all sites
- Peak 1-hour ozone concentration ratio, unpaired in time and space

Table 7.3: Graphical tools for evaluating base year air quality model performance.

- Time-series plots comparing 1-hour measured and simulated concentrations of ozone, NO, NO2, and CO for each site.
- Hourly spatial plots of 1-hour measured and simulated concentrations of ozone, NO, NO2, and CO for the CCOS modeling domain.
- Scatter plot of 1-hour ozone concentrations for each day, and for each subregion of the modeling domain.

8 ATTAINMENT DEMONSTRATION

The U.S. EPA has not issued new guidance that prescribes how attainment for the 1-hour ozone National Ambient Air Quality Standard (NAAQS) should be demonstrated. Therefore, following previous EPA guidance for the 8-hour O_3 NAAQS (U.S. EPA, 2007), we propose to use the modeling results in a relative sense (i.e., using relative response factors or RRFs) to demonstrate attainment of the 1-hour O_3 NAAQS. The RRFs are calculated as the ratio of future-year and reference year ozone concentrations for each site. The RRF is then multiplied by a site-specific design value to estimate the future-year design value.

8.1 Criteria for Use of Modeled Days in RRF Calculations

Adequate model performance is a requirement for use of modeled results. The lack of acceptable performance greatly increases uncertainty in the use of the modeling results, and casts doubt on conclusions based on the modeling. Therefore only those days which satisfy the previously described model performance criteria will be utilized in RRF calculations.

In addition to the issue of model performance, analyses conducted by the U.S. EPA (2005) suggest that air quality models respond more to emission reductions at higher predicted ozone values. Correspondingly, the model predicts less benefit at lower concentrations. This is consistent with preliminary modeling in support of the 1-hour ozone standard conducted by the ARB and the districts. These results imply that RRF calculations should be restricted to days with predicted high ozone concentrations. It is thus reasonable to establish a minimum threshold for predicted peak 1-hour ozone concentrations in the reference year.

Based on the above discussion, we propose the following methodology for determining sites and modeled days to be used in the RRF calculations:

1) The modeled daily 1-hour peak ozone concentration of the site for the base year (model performance year) of the modeling must be within ±20% of the observed value at the site.

2) The modeled daily 1-hour peak ozone concentration of the site in the reference year must be 85 ppb or greater.

3) The sub-regional 1-hour statistical measures of NB and GE must fall within the thresholds of ±15% and 35%, respectively.

8.2 Relative Reduction Factors

As discussed above, the RRF is a monitor-specific value that is calculated based on daily peak 1-hour ozone concentrations simulated in a future year, divided by daily peak concentrations simulated in a reference year. To be consistent with the principle that the modeled attainment test and design values should be robust and stable over a number of different types of meteorology, the RRF should be based on multiple simulated days. The following methodology will be used to calculate site-specific RRFs:

Site-specific RRFs will be calculated as the ratio of the average daily peak 1-hour modeled ozone concentration in the future year, divided by the average daily peak 1-hour modeled ozone concentration in the reference year. Only those days satisfying the model performance and threshold criteria described below shall be included in the RRF calculation.

$$\mathbf{RRF_{AVG}} = \frac{\left(\mathbf{FY_{1-hr}}\right)_{\mathbf{AVG}}}{\left(\mathbf{RY_{1-hr}}\right)_{\mathbf{AVG}}}$$

where RRF_{AVG} = *the average relative reduction factor for a monitor*

$(FY_{1\text{-}hr})_{AVG}$ = *the average future year 1-hour daily maximum concentration predicted near the same monitor, averaged over those days which satisfy model performance and threshold criteria*

$(RY_{1\text{-}hr})_{AVG}$ = *the modeled reference year 1-hour daily maximum concentration predicted near the same monitor, averaged over those days which satisfy model performance and threshold criteria*

As stated in the 8-hour ozone modeling guidance (U.S. EPA, 2007), the U.S. EPA recognizes that higher ozone values are more responsive to emissions controls. To emphasize this observation, we have extended the concept of average RRFs to form band RRFs. Here, we segment the simulated ozone concentrations into several bands that span the range of values. An average RRF is then calculated for each band. These band RRFs are then used to project reference-year design values into the future.

Detailed information on this procedure will be included in the modeling documentation for this SIP. In brief:

- For the days that meet model performance, develop RRFs for bands of concentrations. For example, one can develop RRFs for base-year concentration ranges (bands) of 130-120 ppb, 119-110 ppb, 109-100 ppb, 99-90 ppb, etc. These band-RRFs represent the model’s response to similar concentrations averaged over different meteorological and emissions conditions.
- Select the top N (e.g., 10) 1-hr concentrations during the three years ending in the base year. Using a relatively large (compared to four) number of base-year concentrations will ensure that we fully allow for possible reshuffling in the future year.
- Project each such concentration to the future year using the RRF for the band that concentration falls into. Since the simulated and observed concentrations are not perfectly correlated, use a correlation diagram of simulated to observed values to determine what RRF band a given observation would fall into.
- Re-sort the future-year concentrations and select the fourth highest value. This will be the future 1-hr design value that should be compared with the NAAQS.

9 PROCEDURAL REQUIREMENTS

9.1 How Modeling and other Analyses will be Archived, Documented, and Disseminated

The air quality modeling system covers the central portion of California with 4x4 km^2 grids. In total there are approximately half a million grid cells in each simulation (192 x 192 cells in the lateral direction and 15 levels in the vertical). The meteorological modeling system has roughly double the number of grid cells since it has 30 vertical layers. Archiving of all the inputs and outputs takes several terabytes (TB) of computer disk space (for comparison, one single-layer DVD can hold roughly 5 gigabytes (GB) of data and it would take ~200 DVDs to hold one TB). Please note that this estimate is for simulated surface-level pollutant concentrations only. If three-dimensional pollutant concentrations are needed, it would add a few more TB. Therefore, transferring the modeling inputs/outputs over the internet using file transfer protocol (FTP) is not practical. Interested parties may send a request for model inputs/outputs to Mr. John DaMassa, Chief of the Modeling and Meteorology Branch at the following address.

John DaMassa, Chief
Modeling and Meteorology Branch
Planning and Technical Support Division
Air Resources Board
California Environmental Protection Agency
P.O. Box 2815
Sacramento, CA 95814, USA

The requesting party will need to send an external disk drive(s) to facilitate the data transfer. The requesting party should also specify what input/output files are requested so that ARB can determine the capacity of the external disk drive(s) that the requester should send.

9.2 Specific Deliverables to U.S. EPA

The following is a list of modeling-related documents that will be provided to the U.S. EPA.

- The modeling protocol
- Emissions preparation and results
- Meteorology
    - Preparation of model inputs
    - Model performance evaluation
- Air Quality
    - Preparation of model inputs
    - Model performance evaluation
- Documentation of corroborative and weight-of-evidence analyses
- Predicted Future 1-hour ozone Design Values
- Access to input data and simulated results

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Appendix F

Modeling Approach and Results

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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APPENDIX F: MODELING APPROACH AND RESULTS

Consistent with U.S. EPA guidelines, ARB modeled air quality to predict future 1-hour ozone (O_3) concentrations at each monitoring site in the Valley. This modeling shows attainment of the 1-hour O_3 standard by 2017 based on implementation of the ongoing control program. This section summarizes these efforts and results. Additional information is available in the modeling protocol in Appendix E. Additional technical information can be found on the ARB's website: http://www.arb.ca.gov/planning/sip/planarea/sanjqnvllysip.htm

1.1 Modeling Overview

The modeling analysis includes new emission reductions between now and 2017 from implementation of a combination of adopted ARB and District programs. Based on 2012 data, only three sites in the Valley still exceed the 1-hour O_3 standard. As required by U.S. EPA, the modeling replicates the base year 2007 meteorological conditions for each calendar day in the year 2017. The 2007 meteorological conditions included several periods of time especially conducive to the formation of O_3.

The U.S. EPA has not issued formal guidance that prescribes the attainment test for the revoked 1-hour O_3 standard. Following previous U.S. EPA guidance for the 8-hour O_3 standard (U.S. EPA, 2007), we have used the modeling results in a relative sense (i.e., using Relative Response Factors or RRFs) to demonstrate attainment of the 1-hour O_3 standard.

The traditional RRF-based approach has been to multiply each official site's design value (DV) by an average RRF to determine the future DV for demonstrating attainment. However experience has shown that the higher O_3 values (> 100 ppb) are more responsive to emission controls than the intermediate (between 80-100 ppb) or lower values (< 80 ppb).

A modified approach has been developed to construct RRF's for bands of concentrations and to apply this information in the determination of future DVs. These "band-RRFs" represent the model's response to similar concentrations averaged over different meteorological and emission conditions. Section 1.4.1 describes in detail the procedure implemented to calculate the band-RRFs.

The future DVs calculated based on the band-RRFs are compared with the 1-hour O_3 standard to determine the attainment status for each monitor. The benchmark for attainment is a DV that is equal to or less than 124 ppb.

1.2 Modeling Requirements

Following U.S. EPA guidance and procedures, the attainment demonstration was conducted using a modeled attainment test. A photochemical model simulates the observed O_3 levels, using precursor emissions and meteorology in the region. It also simulates future O_3 levels based on projected changes in emissions, while keeping the meteorology constant. This modeling is used to identify the relative benefits of controlling different O_3 precursor pollutants and the most expeditious attainment date. The following sections provide a brief summary of the meteorological and photochemical modeling performed and the results obtained. For more details on the modeling, the reader is referred to the Modeling Protocol in Appendix E.

1.3 General Methodology and Approach

The modeling approach draws heavily on the products of large-scale, scientific studies in the region, collaboration among technical staff of State and local regulatory agencies, as well as from participation in technical and policy groups within the region. It is also consistent with the modeling approach used for the 2012 24-hour $PM_{2.5}$ SIP that was submitted to the U.S. EPA in early 2013. The modeling period for this plan is from May to September 2007.

1.3.1 Meteorology Modeling

In the past, the ARB has applied prognostic, diagnostic, and hybrid models to prepare meteorological fields for photochemical modeling. Recent O_3 plans for both 1-hour and 8-hour standards were based on the Mesocale Model 5 (MM5)[1]. The ARB has applied the MM5 model over the past two decades, since it has been widely used and tested for various meteorological regimes over the world and has been supported by NCAR. NCAR terminated model development for MM5 in October 2006 and the code was frozen at the minor version of V3-7-4.

Since then NCAR has devoted its resources to the development of the Weather Research Forecast (WRF) model[2], which was designed to be the replacement for MM5. The WRF model is being continually updated, and WRF fields produced by ARB have shown comparable results with MM5. Therefore, the WRF numerical model was chosen to generate meteorological fields for this SIP.

Please see the Modeling Protocol in Appendix E for more details on WRF modeling for this plan.

1.3.2 Air Quality Modeling

The Community Multiscale Air Quality (CMAQ) Modeling System has been selected for modeling ozone in the SJV. The CMAQ model, a state-of-the-science “one-atmosphere” modeling system developed by U.S. EPA, was designed for applications ranging from regulatory and policy analysis to understanding of atmospheric chemistry

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[1] Grell, G. A., J. Dudhia and D. R. Stauffer, 1994: A description of the fifth-generation Penn State/NCAR mesoscale model (MM5). NCAR Technical Note, NCAR/TN-398+STR, 117 pp. National Center for Atmospheric Research. Boulder, CO. June, 1994.

[2] Skamarock, W. C., J. B. Klemp, J. Dudhia, G. O. Gill, D. M. Barker, W. Wang, and J. G. Powers, 2005: A description of the Advanced Research WRF Version 2. NCAR Technical Note NCAR/TN-468+STR, June 2005.

and physics. It is a three-dimensional Eulerian modeling system that simulates ozone, particulate matter, toxic air pollutants, visibility, and acidic pollutant species throughout the troposphere[3].

Staff at CARB has developed significant expertise in applying the CMAQ model, since it has been used at CARB for over a decade. In addition, technical support for the CMAQ model is readily available from the Community Modeling and Analysis System (CMAS) Center[4] established by the U.S. EPA. More information on regulatory applications of the CMAQ model in California and elsewhere can be found in the Modeling Protocol in Appendix E.

Other relevant information, including the modeling domain definition, chemical mechanism, initial and boundary conditions, emissions preparation, etc., can also be found in the Modeling Protocol in Appendix E.

1.4 Modeling results

1.4.1 Development of Relative Response Factors (RRFs) for the 1-hr ozone National Ambient Air Quality Standard (NAAQS):

As described in Section 1.1, there is no formal guidance that prescribes the attainment test for the 1-hour O_3 NAAQS. Following the guidance for the 8-hour O_3 NAAQS, provided by the U.S. EPA previously[5], we have used the modeling results in a relative sense (i.e., using RRFs) to demonstrate attainment of 1-hour O_3 NAAQS. As a result,

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[3] UNC, 2010, Operational Guidance for the Community Multiscale Air Quality (CMAQ) Modeling System Version 4.7.1., available at http://www.cmascenter.org/help/model_docs/cmaq/4.7.1/CMAQ_4.7.1_OGD_28june10.pdf.

[4] http://www.cmascenter.org/

[5] U.S. EPA, 2007, Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze, EPA-454/B07-002.

the following procedure has been implemented to calculate the RRFs. These RRF's are an improvement to the traditional averaged RRFs used in the 8-hour analysis and are constructed for bands of simulated 1-hr daily maximum O_3 concentrations. These band-RRFs were used to determine the future Design Values based on three baseline years (2005-2007).

1. Model Performance Evaluation:
    - For the simulated hourly O_3 data, the model performance criterion threshold was set to 60 ppb along with the following constraints
        - peak prediction accuracy (PPPA) within ±20%
        - unpaired mean normalized bias (NB) within ±15% and
        - unpaired gross error (GE) less than 35%
    - Only the days that meet the model performance criteria were used in the subsequent analysis.
    - The top panel of Figure F-1F-1, which is for the Shafter – Walker Street monitoring site, highlights the subset of days during which the model performance is achieved for the daily maximum 1-hour O_3 concentrations, where the observed and predicted daily maximum concentrations are located at the monitor. For comparison, the maximum O_3 concentration predicted within a 15 km radius of the monitor is also shown.

2. Formation of RRF bands:
    - For the days that met model performance standards, the simulated 1-hr O_3 concentrations were stratified into 10 ppb bins in the 60-130 ppb range to span the entire range of simulated 1-hr daily maximum O_3 concentrations.
    - The average RRF was calculated for each 10 ppb bin for days where the model performance criteria were met.
    - If the RRF value for a given bin was not available from the simulation, the missing RRF bin values were calculated using parameters obtained by using a linear fit of the available RRF's and ozone bins. This procedure is shown on the bottom left panel of Figure F-1F-1. For example, the 110-119 ppb RRF band for Bakersfield – Golden State was missing and we estimated that

using the linear fit parameters. Similar figures for all other sites are shown at the end of this chapter (Figure F-2 to Figure F-19F-19).

3. Application of RRFs to determine the future Design Values:
    - The form of the 1-hour O_3 NAAQS allows three violations at a given monitor within three consecutive years; a fourth violation would make the area represented by that monitor non-attainment.
    - For each monitor, the top 10 observed daily maximum 1-hr O_3 concentrations during the three years starting from 2005 and ending in the base model year of 2007 were selected.
    - To determine which band of RRF would correspond to each of the top observed daily maximum 1-hr O_3 concentrations, we have constructed a correlation diagram of simulated vs. observed 1-hr O_3 concentrations as shown in the bottom right panel of **Error! Reference source not found.**. For this purpose, we have only used simulated days with 1-hr daily maximum O_3 within ±20% of the measured value.
    - The linear fit parameters form the above plot were then used to find the RRF bands that correspond to the top 10 observed values.
    - The new future DVs were calculated by multiplying the top 10 observed 1-hr O_3 concentrations by their corresponding band RRF values. The future year values were then re-sorted and the 4th highest value was selected as the future Design Value for that monitor.
    - The future Design Values were then compared with the 1-hour O_3 NAAQS (124.0 ppb in this case) to determine the attainment status for each monitor.

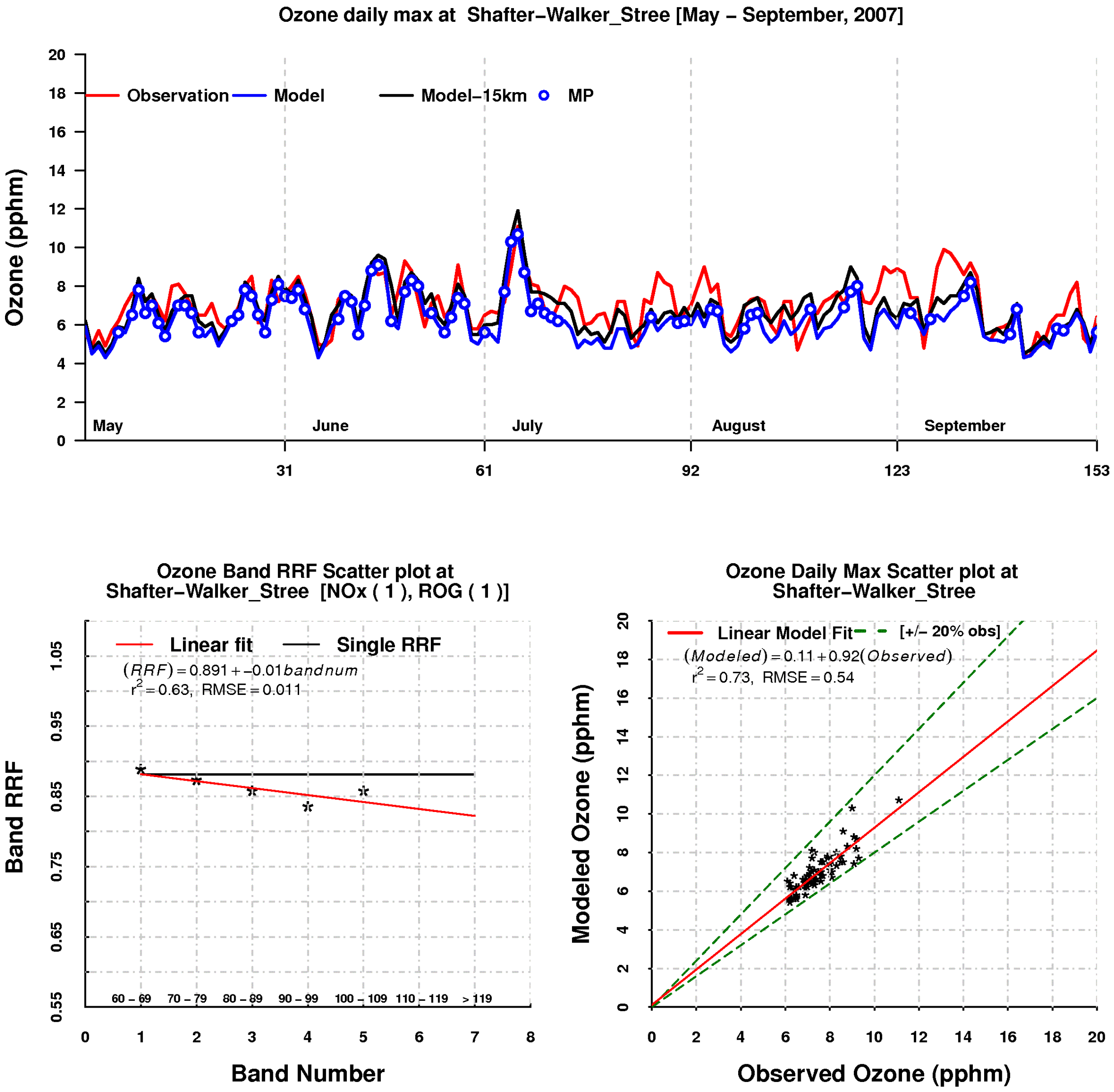

Figure F-1: The Band RRF procedure for Shafter – Walker Street monitoring site.

1.4.2 Attainment Demonstration

Using the above methodology, we have calculated the future DVs for O_3 sites in the San Joaquin Valley. The results are shown in Table F-1, in the descending order of 2007 DVs.

Table F-1: The 2007 and 2017 DVs for monitoring sites in the San Joaquin Valley.

Monitoring Station	**DV (2005-07)**	**DV (2015-17)**
Edison	135	119.3
Arvin-Bear_Mountain_Blvd	131	107.4
Fresno-1st_Street	130	103.7
Clovis-N_Villa_Avenue	125	104.1
Fresno-Sierra_Skypark_#2	124	98.8
Parlier	121	97.4
Sequoia_and_Kings_Canyon	118	102.4
Bakersfield-5558_Califor	117	98.0
Sequoia_Natl_Park-Lower	113	98.5
Visalia-N_Church_Street	112	94.5
Oildale-3311_Manor_Stree	112	95.2
Fresno-Drummond_Street	110	93.0
Hanford-S_Irwin_Street	110	92.6
Modesto-14th_Street	109	95.9
Shafter-Walker_Street	105	87.7
Turlock-S_Minaret_Street	104	91.8
Stockton-Hazelton_Street	101	86.3
Merced-S_Coffee_Avenue	102	85.4
Maricopa-Stanislaus_Stre	100	83.5
Madera-Pump_Yard	95	82.4

Table F-1F-1 shows that each site in the SJV has a future DV less than 124.0 ppb. The highest predicted future site, Edison, is 4.7 ppb below the standard, and other current high sites are 15 to 30 ppb below the standard. Therefore, the air quality simulations predict that the entire Valley will attain the standard by 2017.

1.4.3 Band RRF Figures for All Sites:

In this section, we show the figures comparable to Figure F-1F-1 for all monitoring sites that are listed in Table F-1.

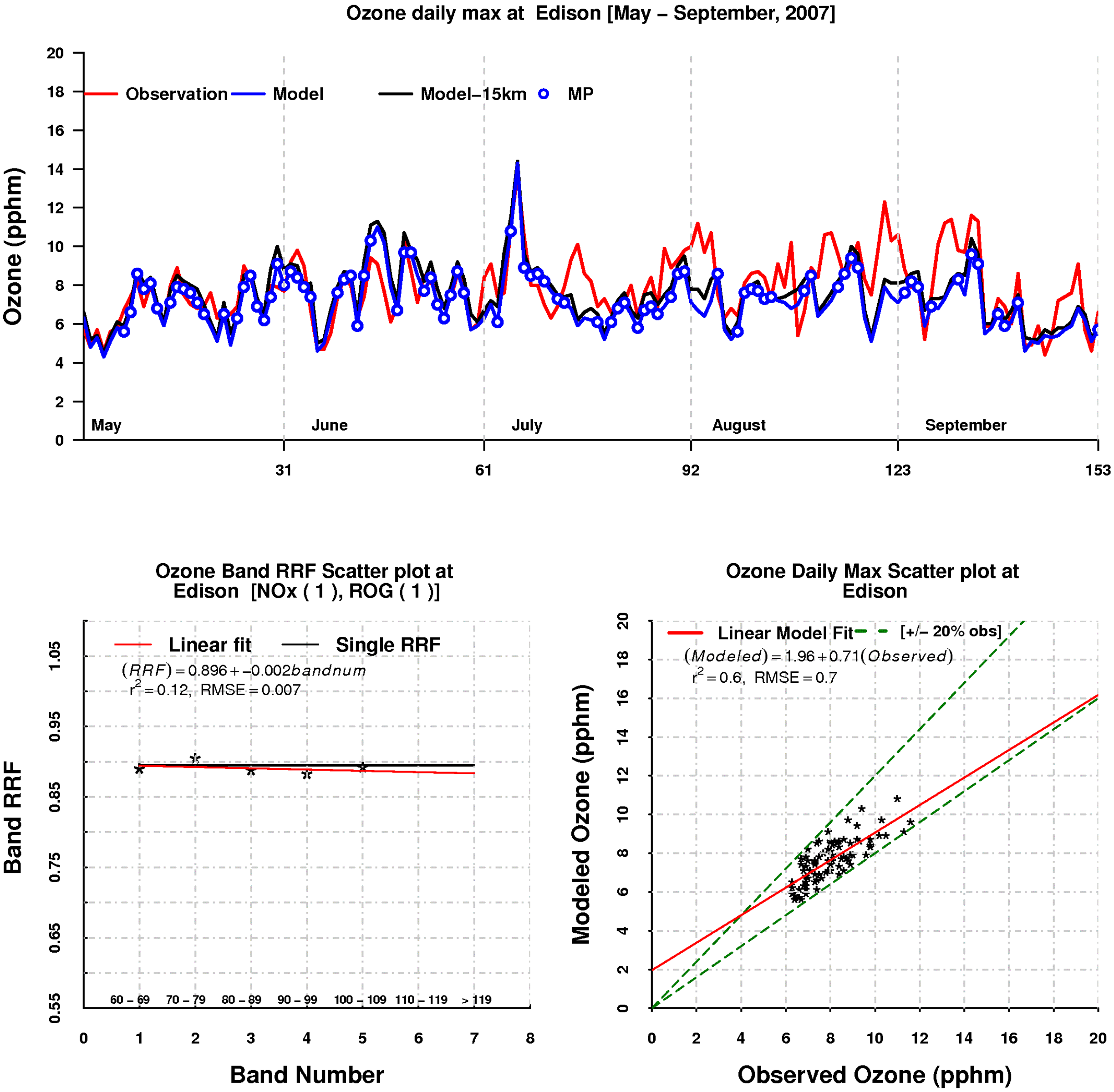

Figure F-2: The Band RRF procedure for Edison monitoring site.

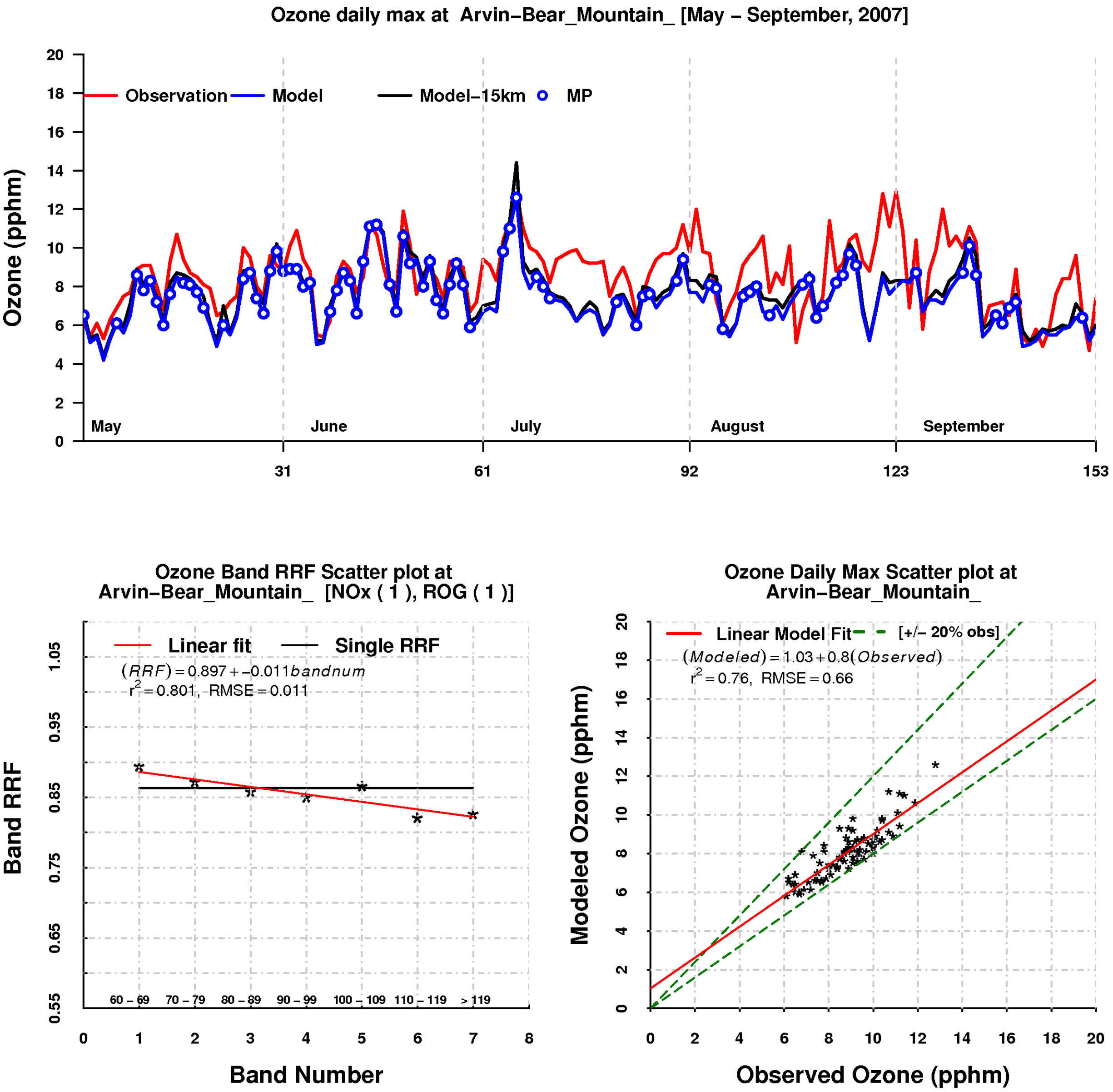

Figure F-3: The Band RRF procedure for Arvin – Bear Mountain monitoring site.

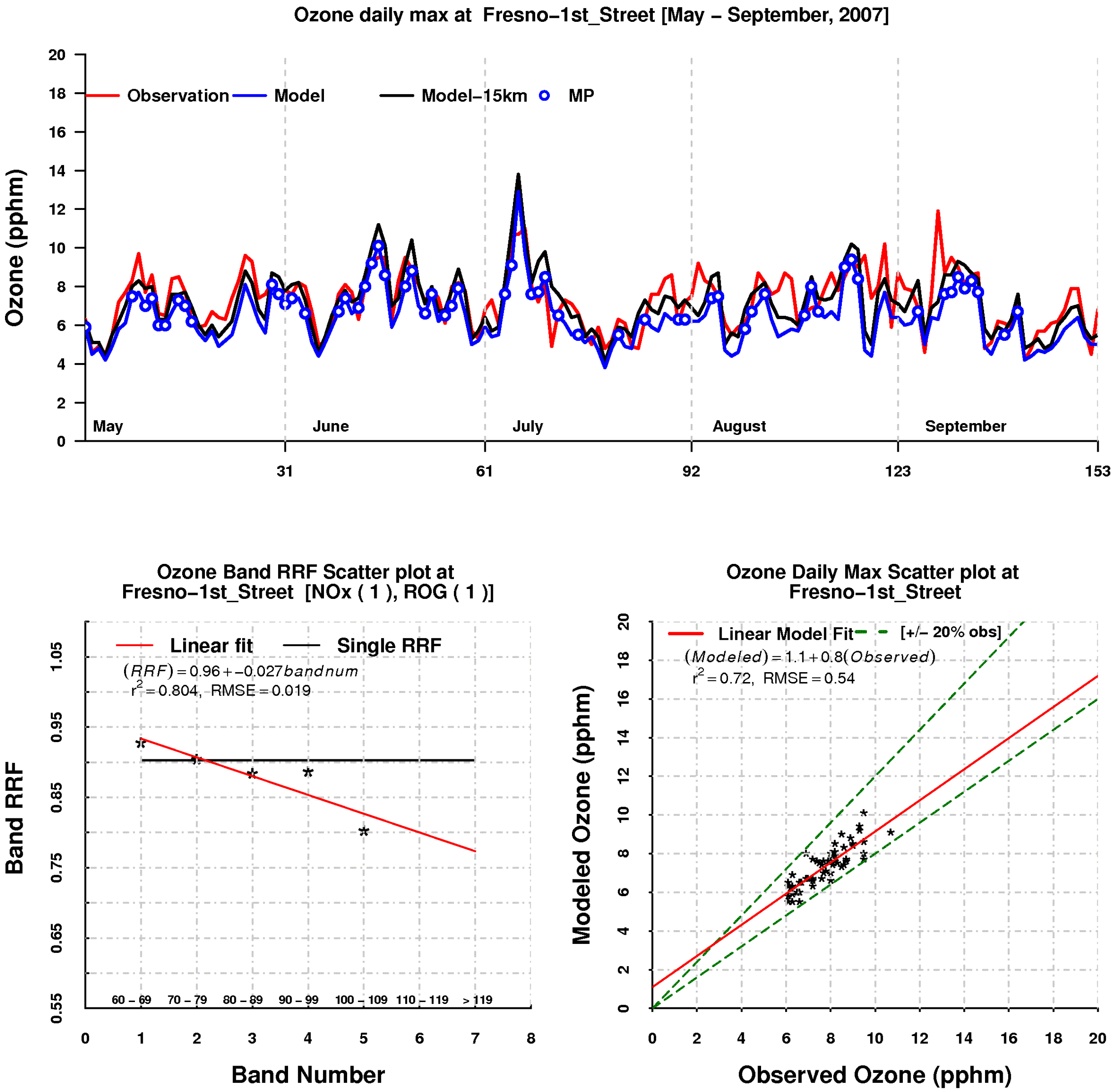

Figure F-4: The Band RRF procedure for Fresno – 1st Street monitoring site.

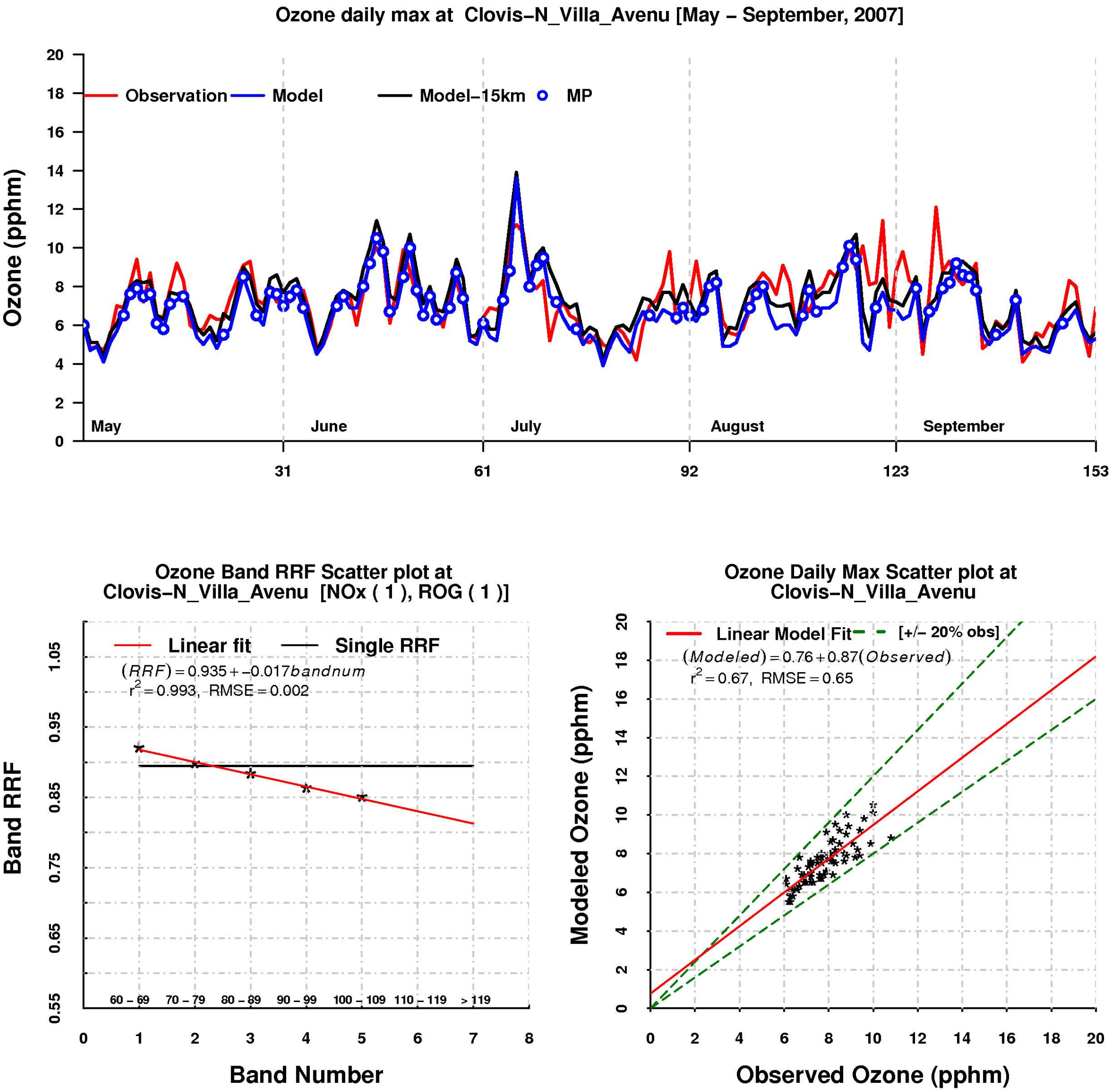

Figure F-5: The Band RRF procedure for Clovis – North Villa Avenue monitoring site.

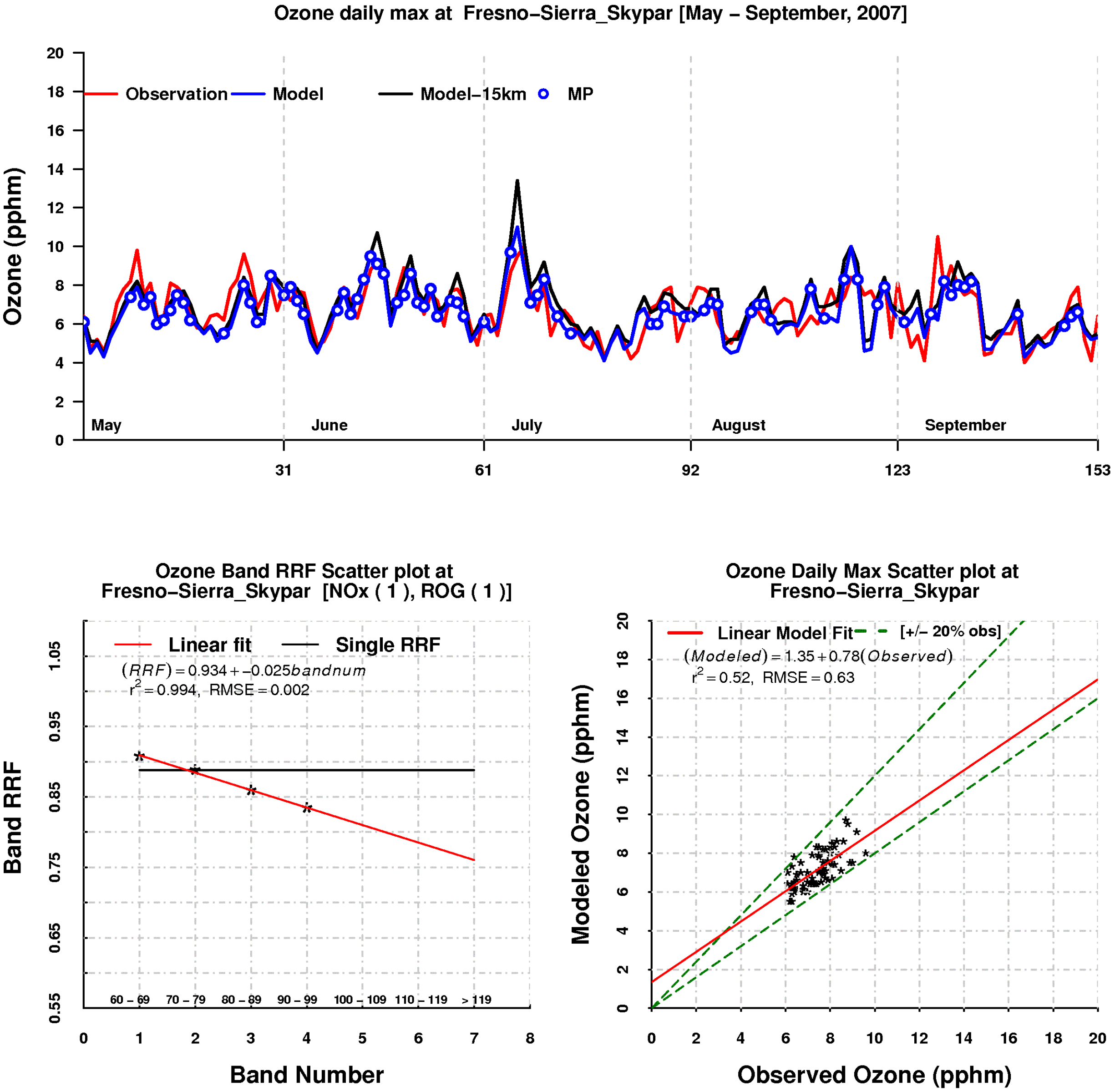

Figure F-6: The Band RRF procedure for Fresno – Sierra Sky Park monitoring site.

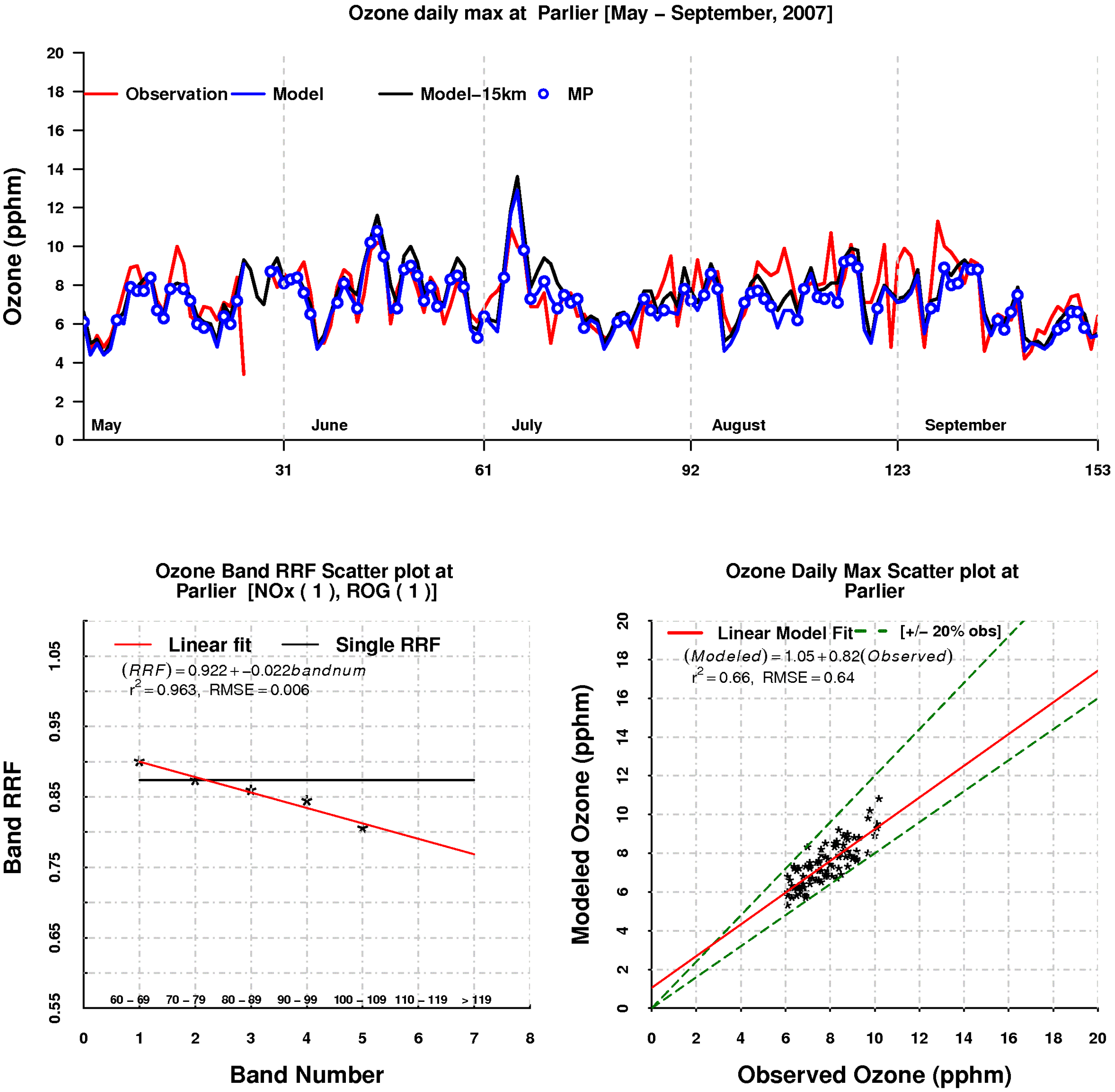

Figure F-7: The Band RRF procedure for Parlier monitoring site.

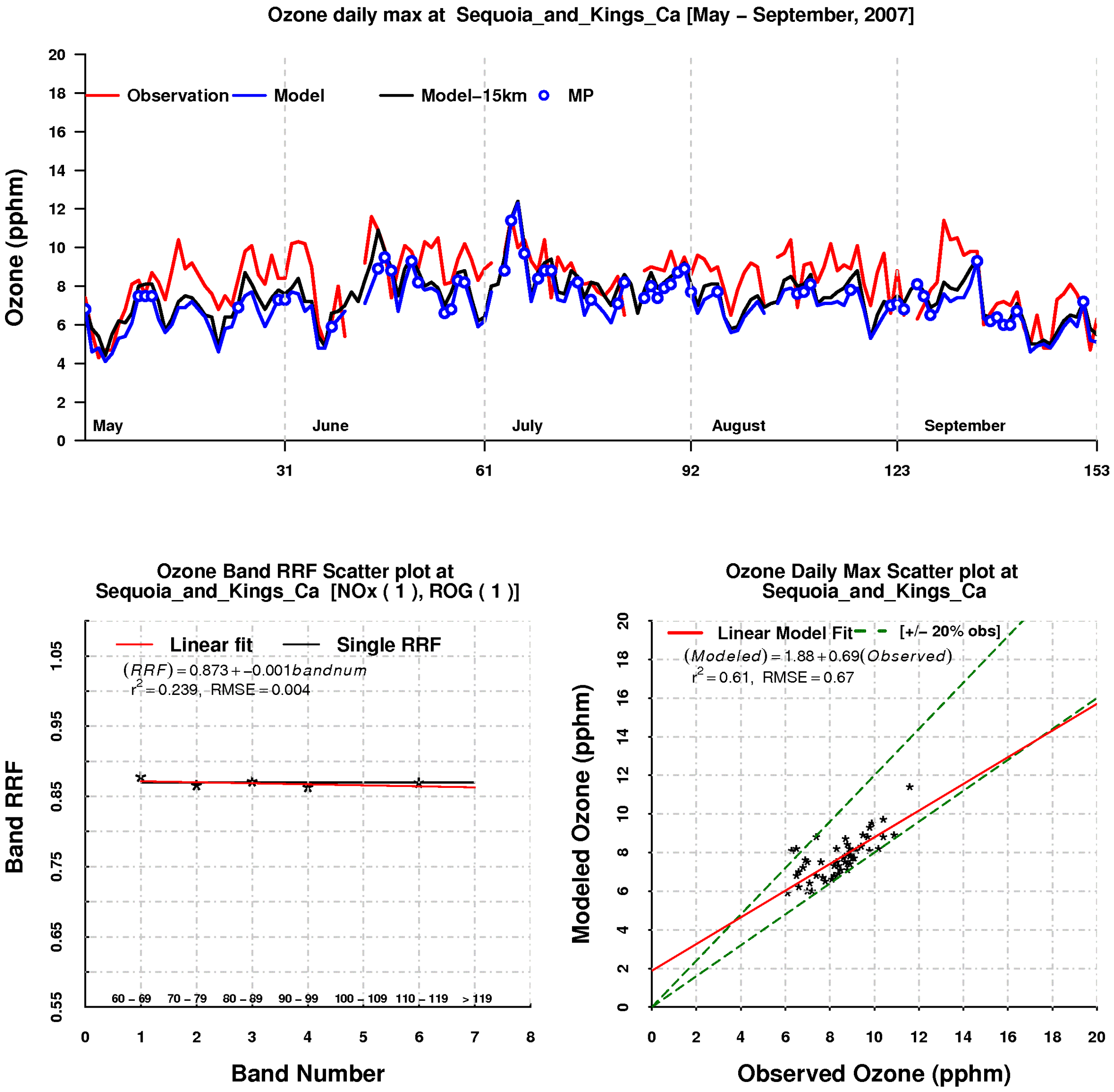

Figure F-8: The Band RRF procedure for Sequoia and Kings Canyon monitoring site.

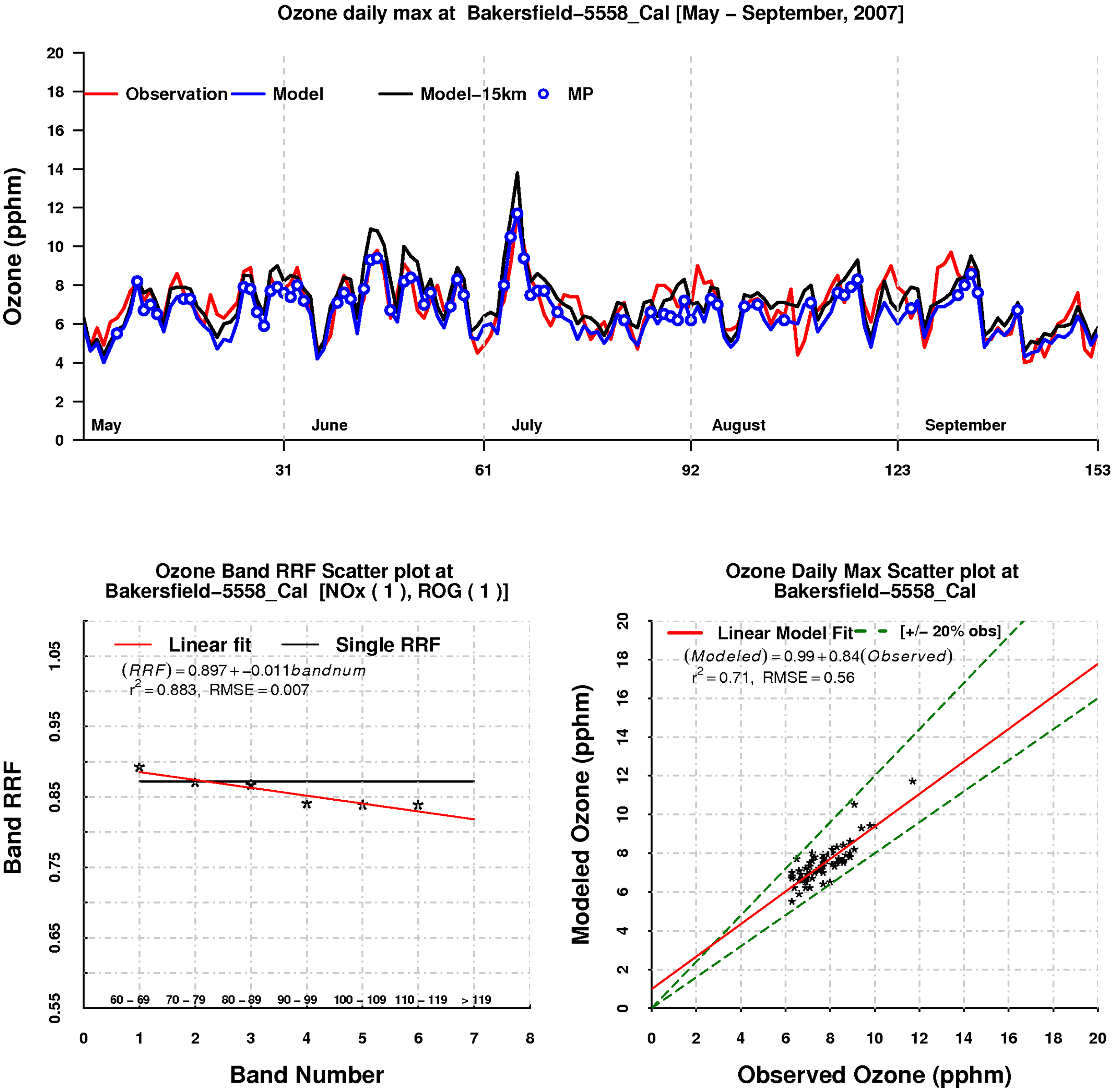

Figure F-9: The Band RRF procedure for Bakersfield – 5558 California Avenue monitoring site.

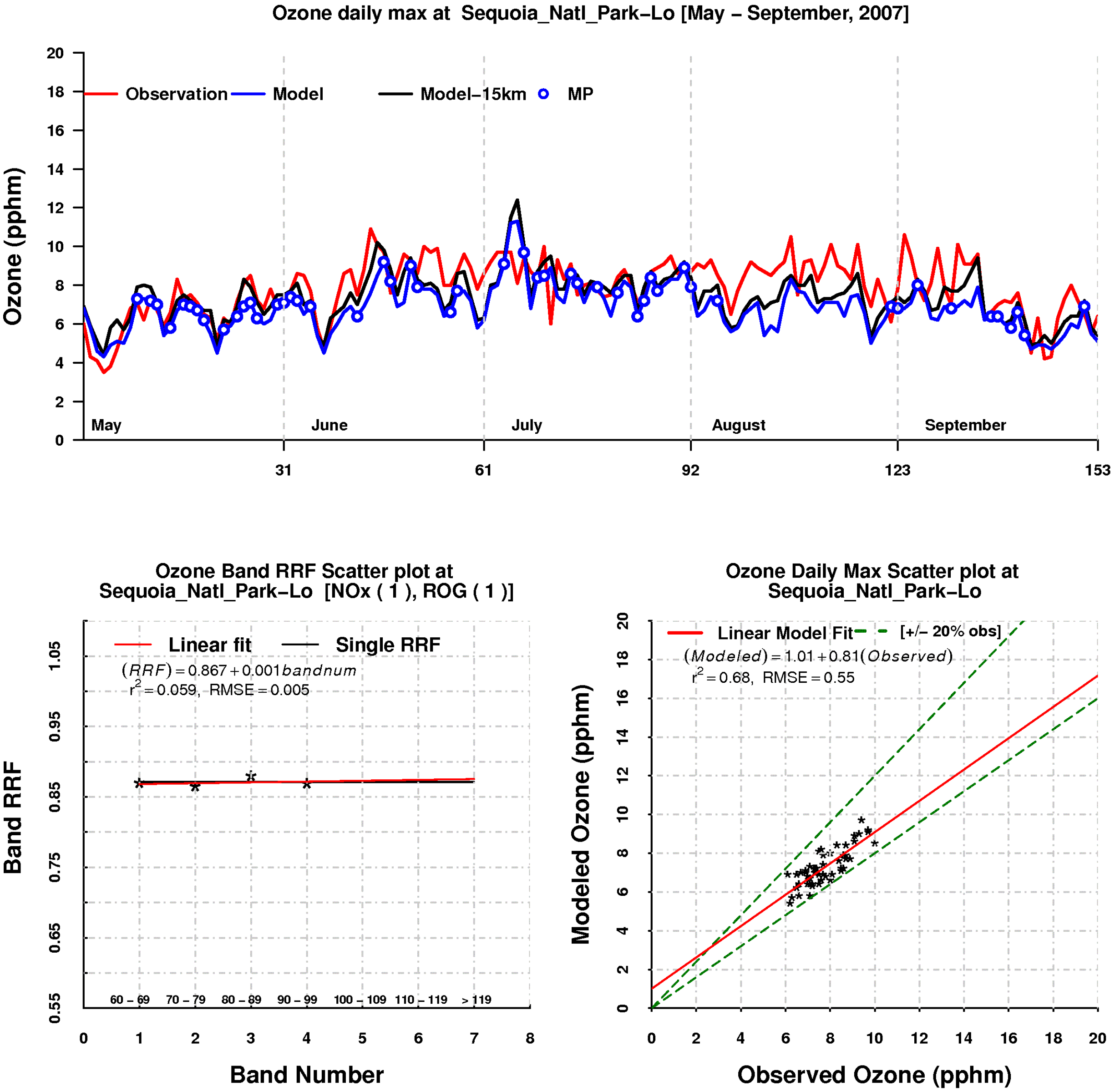

Figure F-10: The Band RRF procedure for Sequoia National Park – Lower Kiawah River monitoring site.

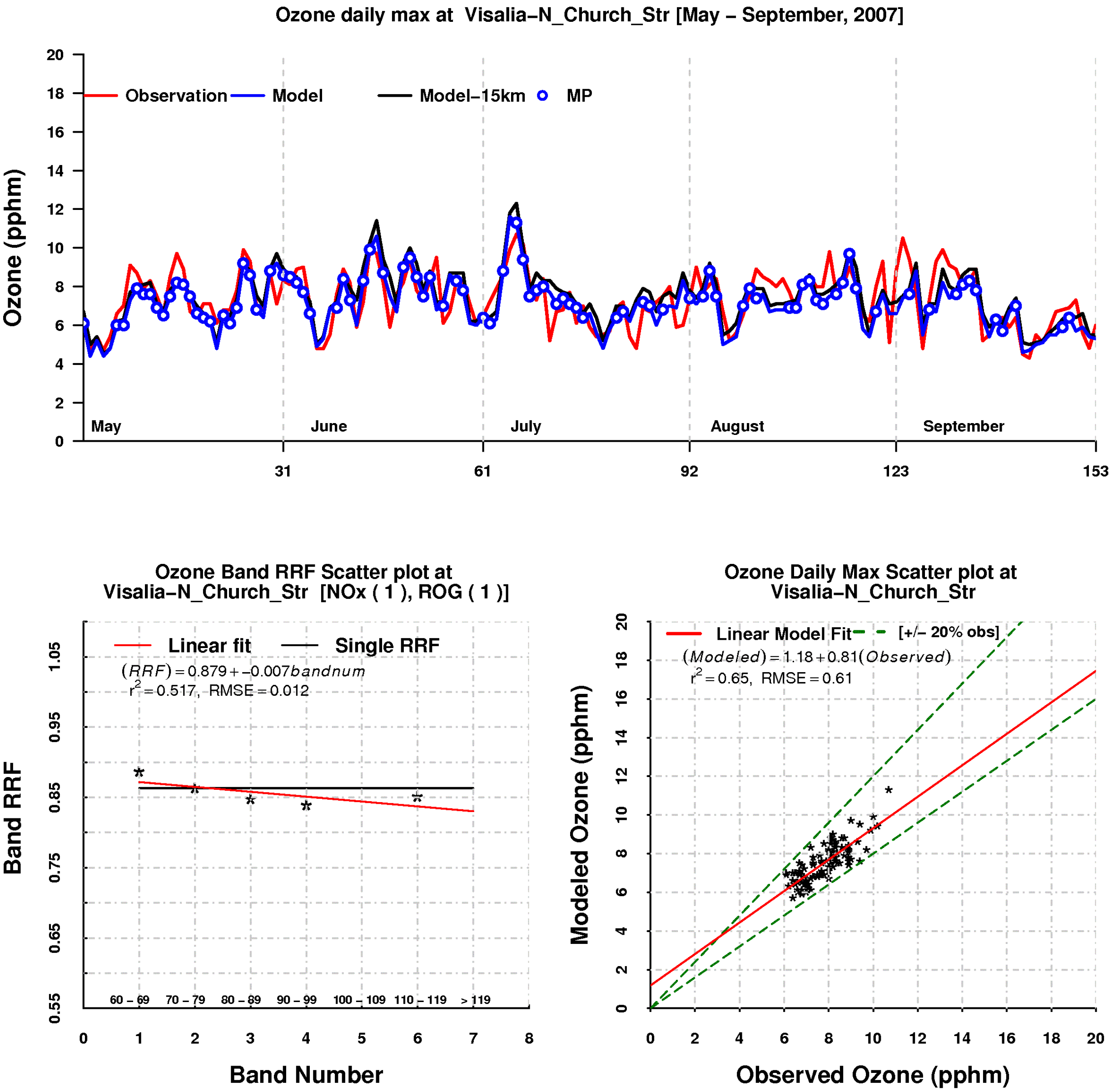

Figure F-11: The Band RRF procedure for Visalia – North Church Street monitoring site.

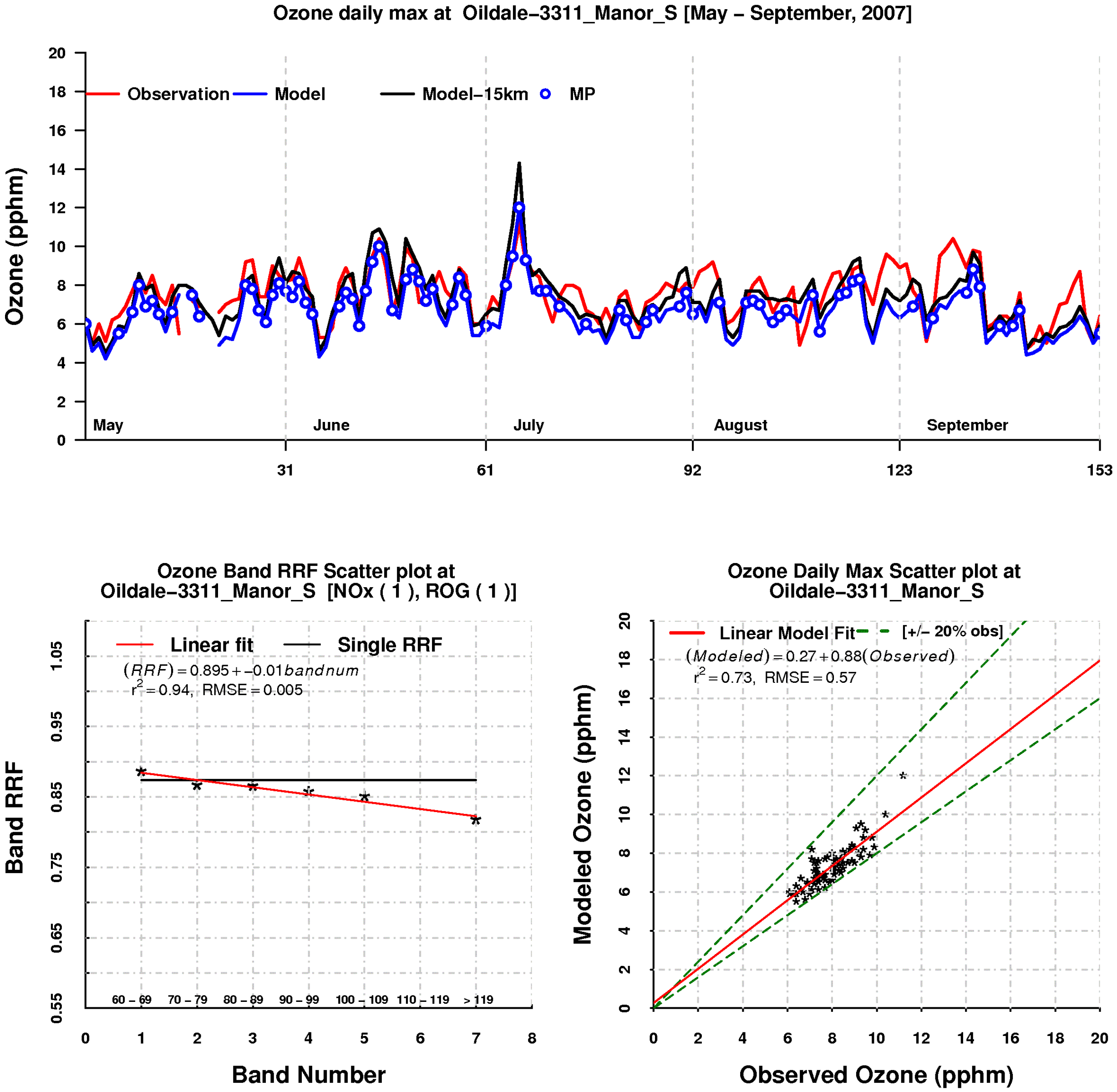

Figure F-12: The Band RRF procedure for Oildale – 3311 Manor Street monitoring site.

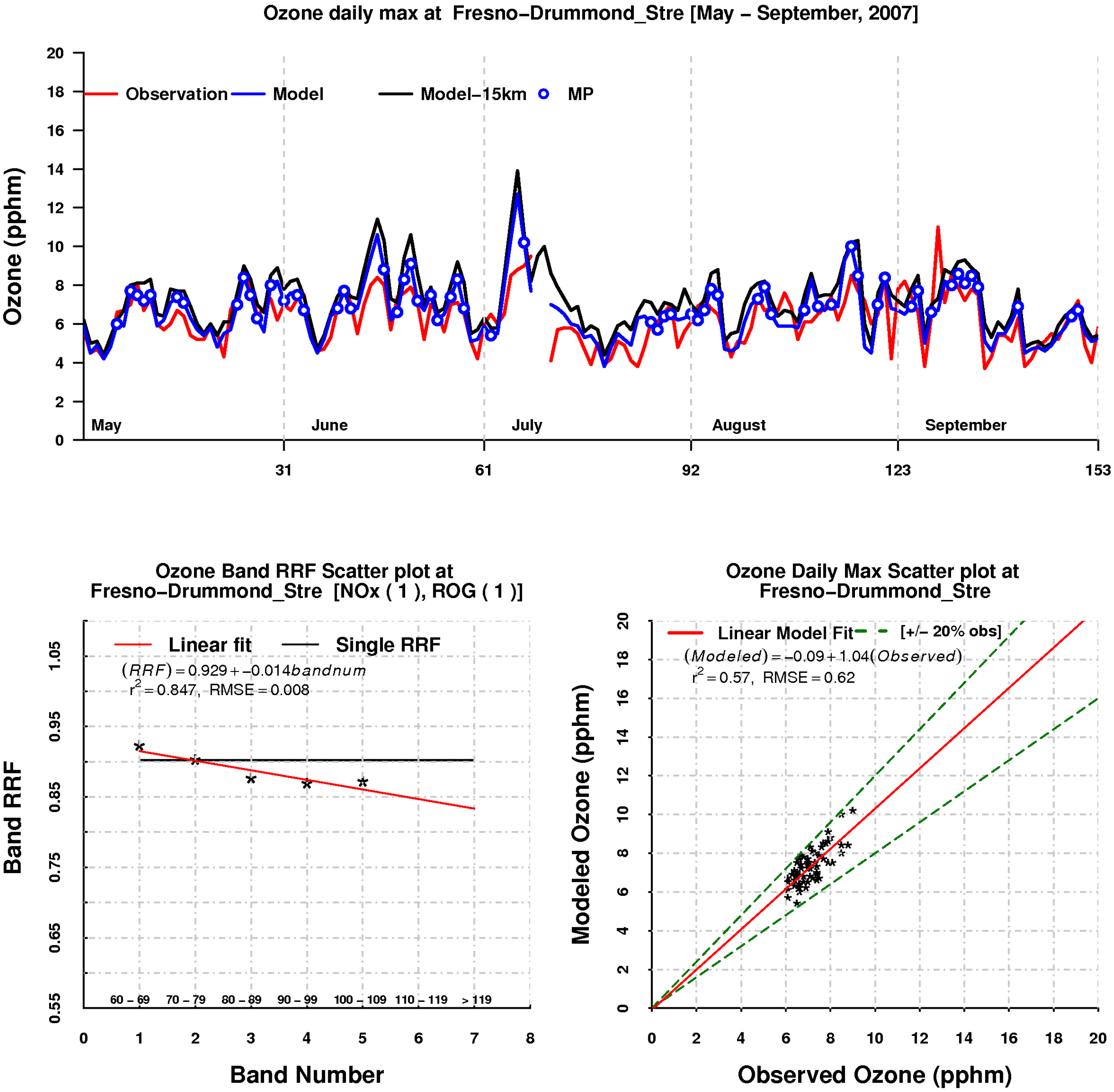

Figure F-13: The Band RRF procedure for Fresno – Drummond Street monitoring site.

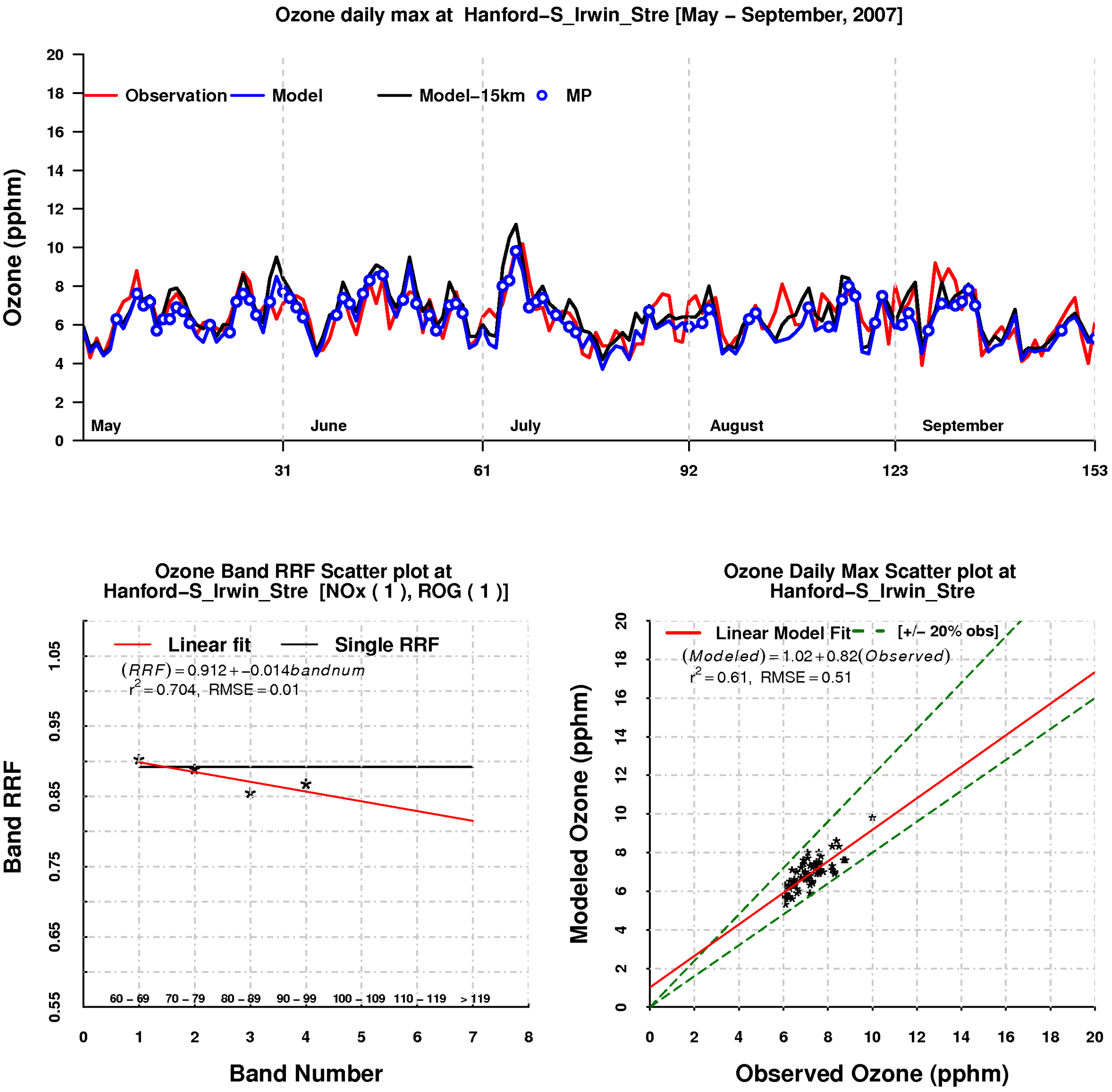

Figure F-14: The Band RRF procedure for Hanford – South Irwin Street monitoring site.

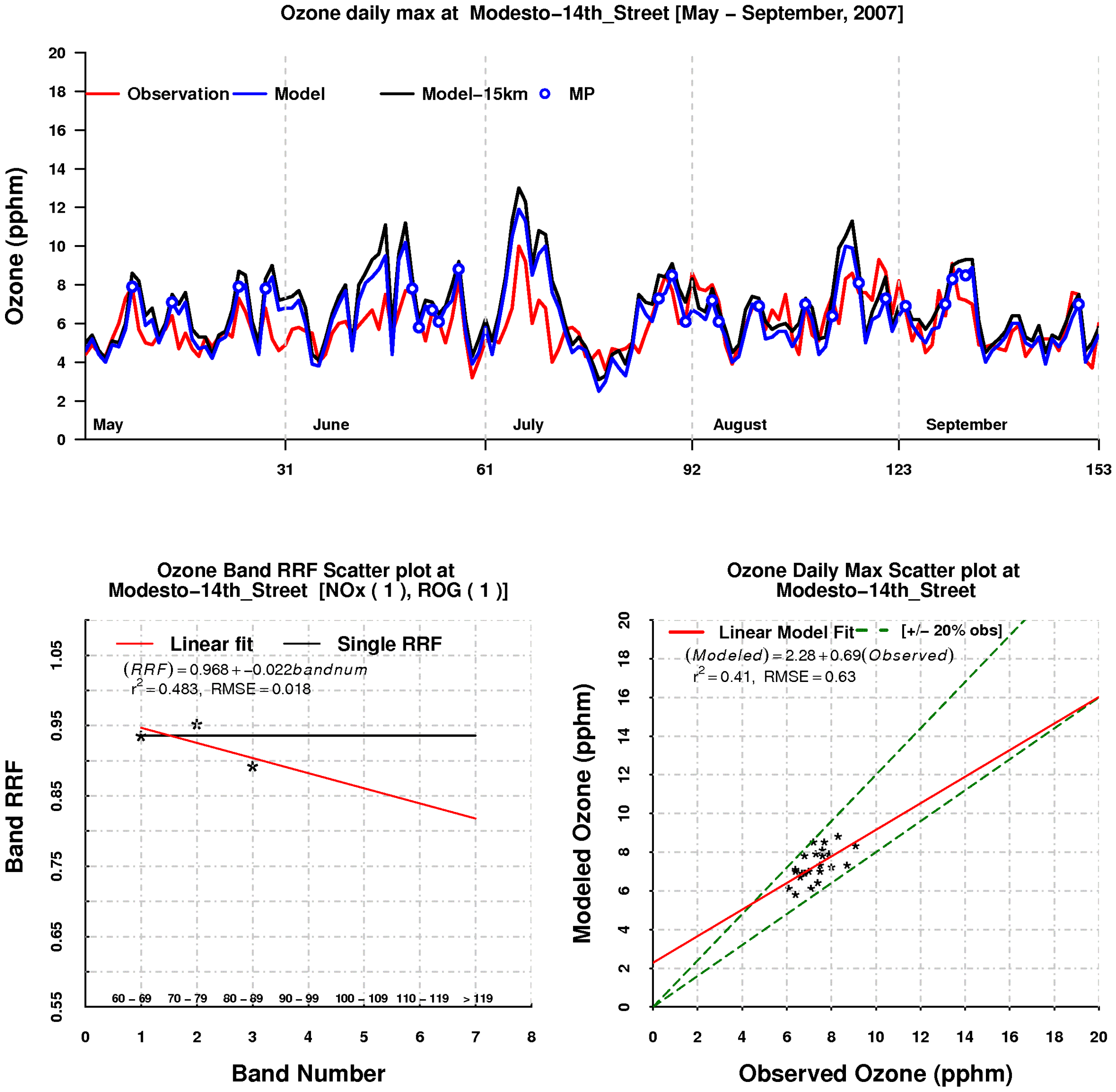

Figure F-15: The Band RRF procedure for Modesto – 14th Street monitoring site.

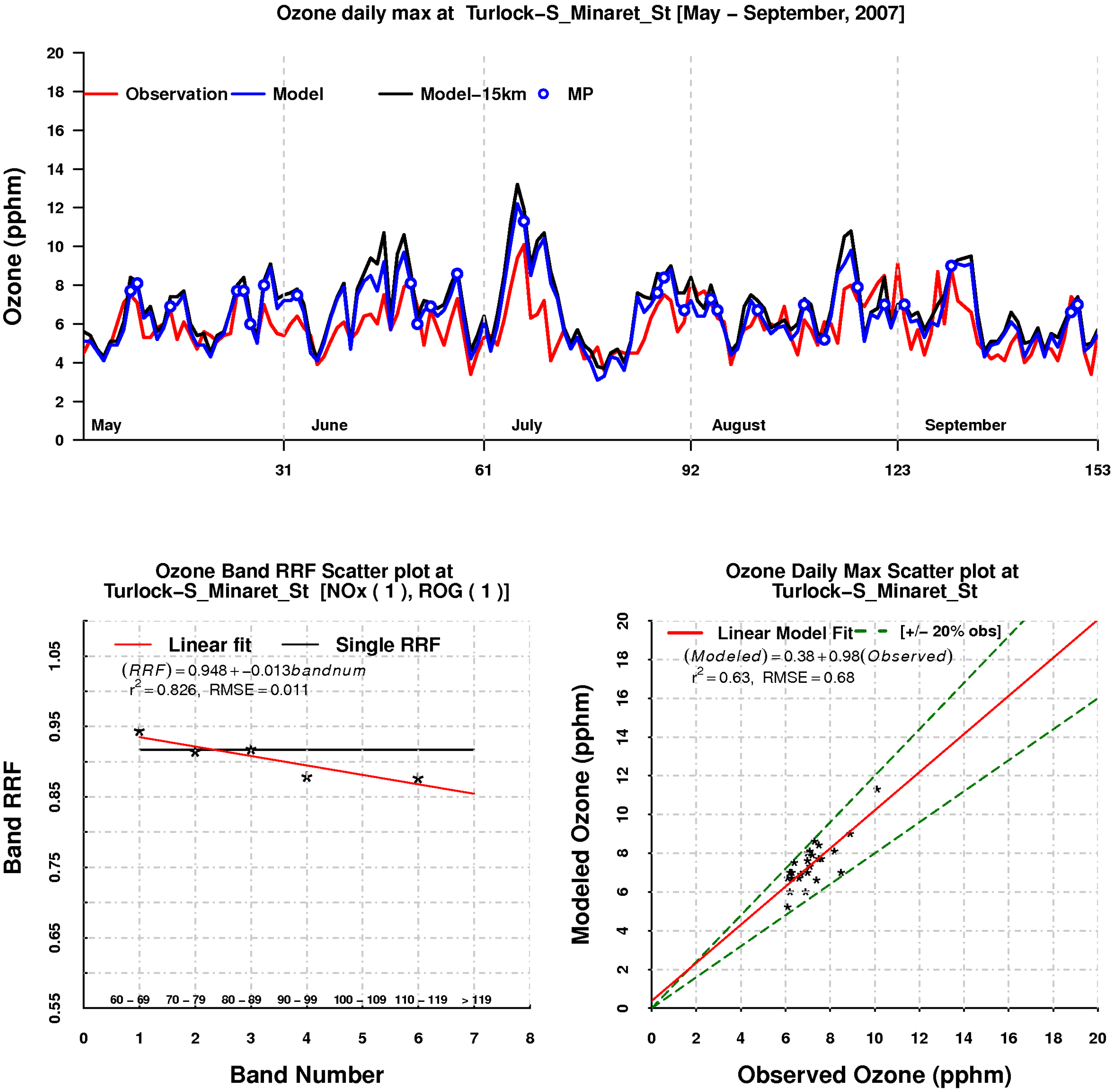

Figure F-16: The Band RRF procedure for Turlock – South Minaret Street monitoring site.

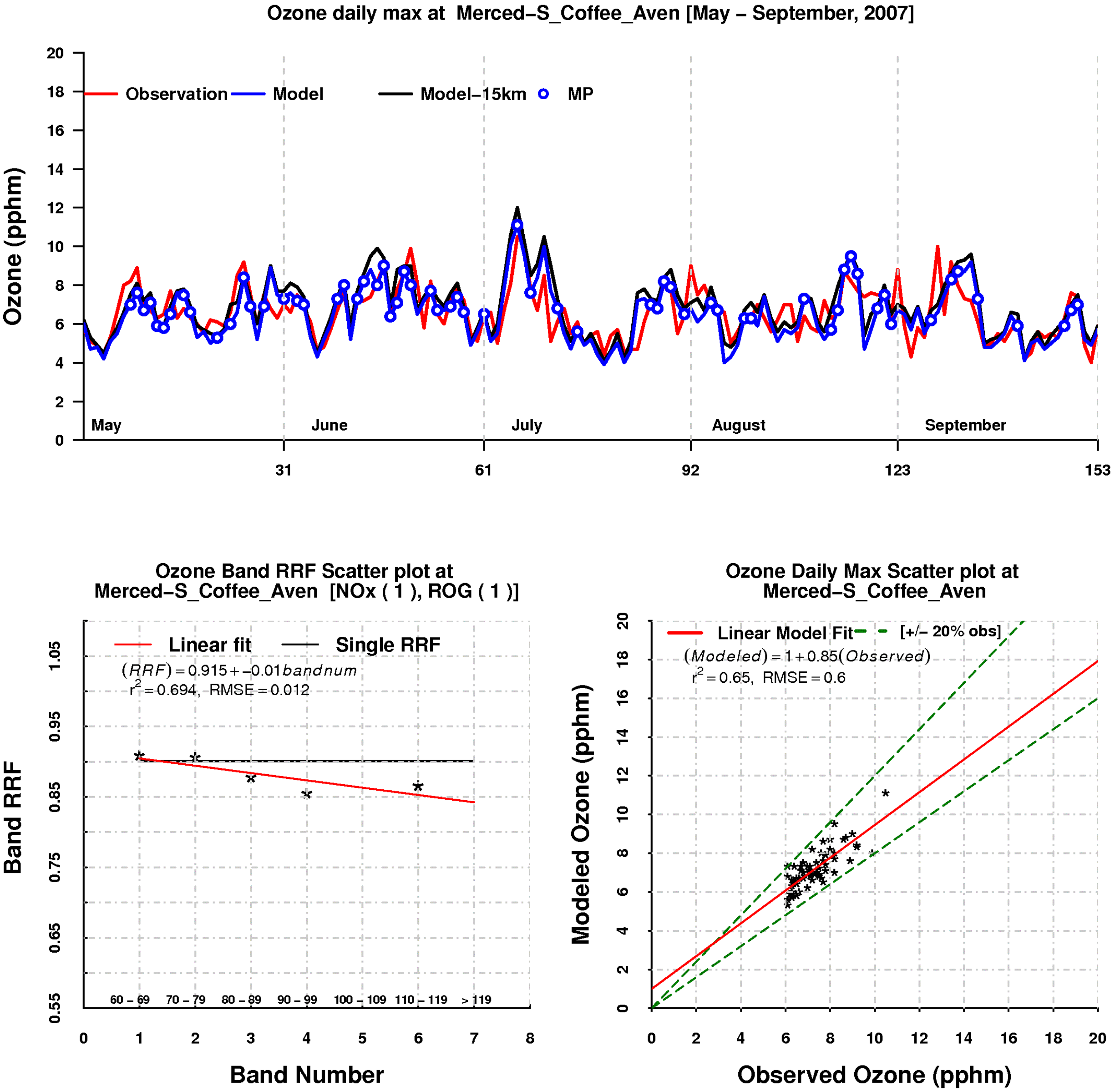

Figure F-17: The Band RRF procedure for Merced – South Coffee Avenue monitoring site.

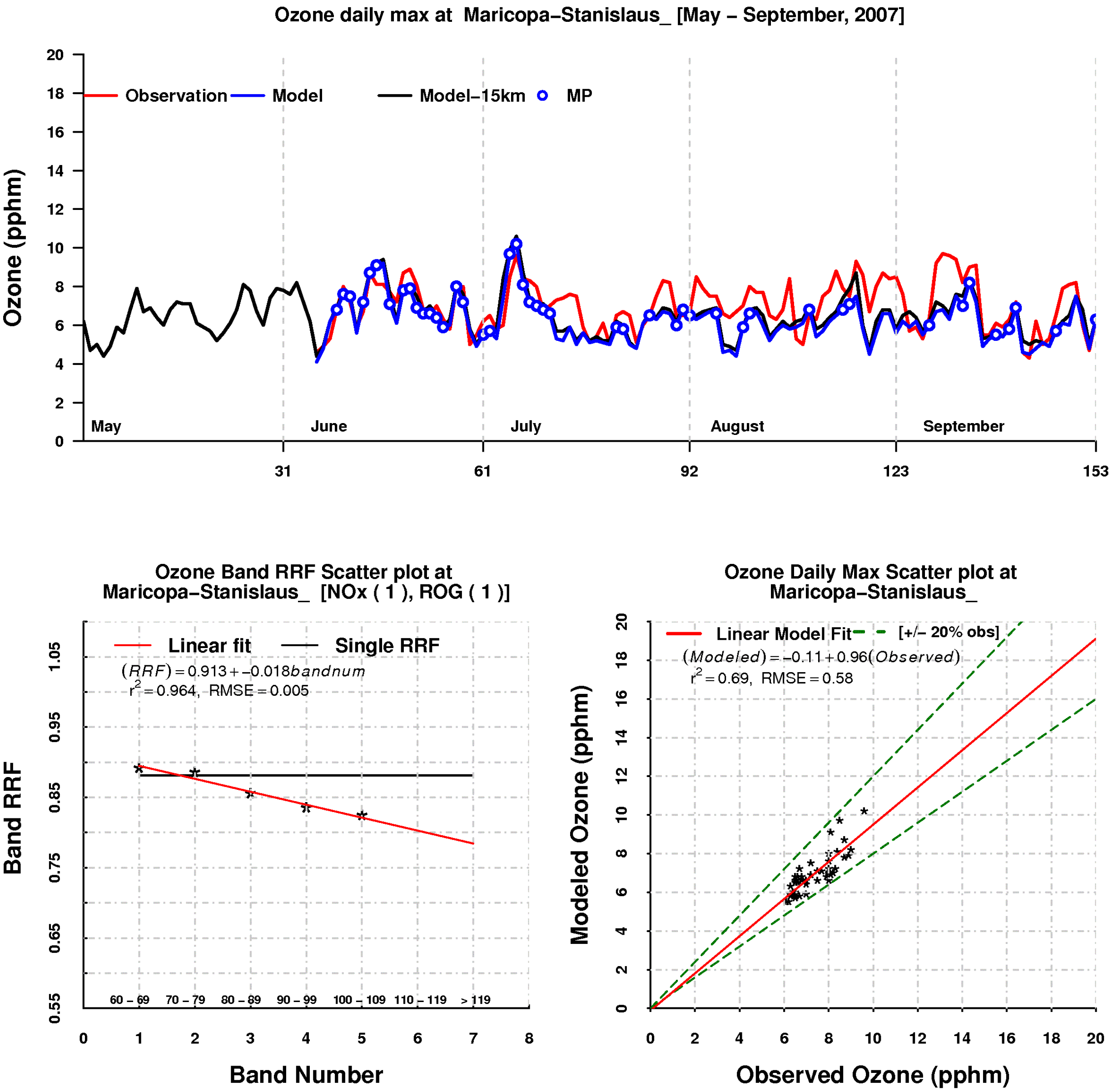

Figure F-18: The Band RRF procedure for Maricopa – Stanislaus Street monitoring site.

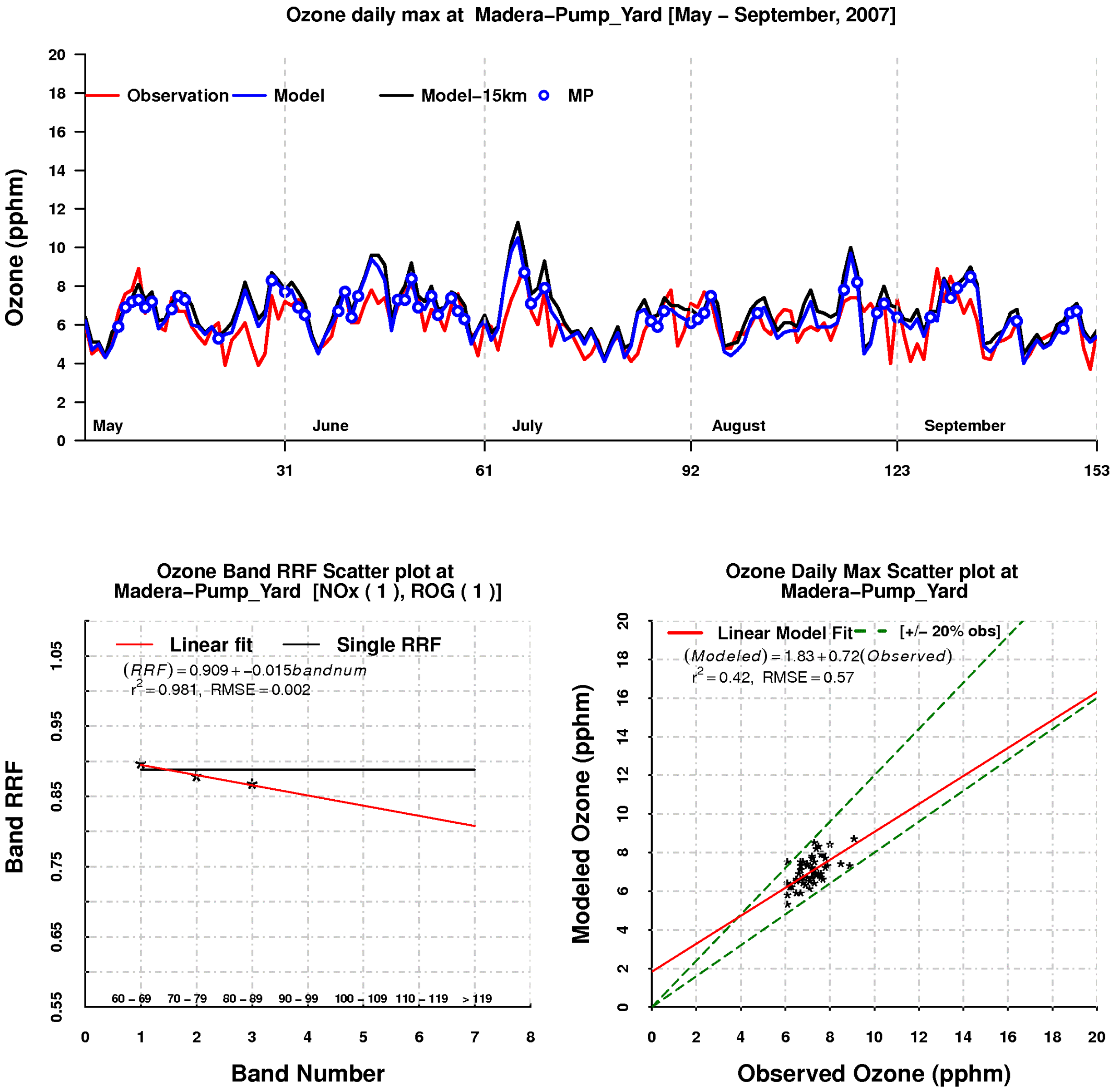

Figure F-19: The Band RRF procedure for Madera – Pump Yard monitoring site.

Appendix G

Weight of Evidence

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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Weight-of-Evidence Analysis San Joaquin Valley Air Basin: National Ambient Air Quality Standard for 1 Hour Ozone

1 INTRODUCTION

This weight-of-evidence document provides support for the modeled attainment demonstration that projects the San Joaquin Valley (SJV) will attain the National Ambient Air Quality Standard (standard) for 1-hour ozone by 2017.

An assessment of ozone air quality from a Valley-wide perspective is provided in this introduction, along with a brief description of the elements of a “weight-of-evidence” analysis. The remainder of the document provides a broad foundation of information that corroborates the modeled attainment demonstration.

1.1 Elements Commonly Included in an Attainment Demonstration

The attainment demonstration portion of a State Implementation Plan (SIP) consists of the analyses used to determine whether a control strategy provides the reductions necessary to meet the federal standard by a specified attainment year. This attainment demonstration includes photochemical modeling which predicts that projected reductions in ozone-forming emissions will result in a high site 1-hour Design Value for the SJV that is below the level of the 1-hour ozone standard by 2017.

Because of the uncertainties inherent in photochemical modeling, the U.S. Environmental Protection Agency (EPA) requires states to supplement the modeling results with a “weight-of-evidence” (WOE) assessment. The WOE assessment provides a set of analyses that complement the photochemical modeling. In this document, these analyses include consideration of measured air quality, emissions inventories, and meteorological data. All analysis methods have inherent strengths and weaknesses, so examining an air quality problem in a variety of ways can help to offset the limitations and uncertainties inherent to individual methods. This approach also provides a better understanding of the overall problem, as well as insight about the level and mix of emissions controls needed for attainment.

The scope of the WOE analysis is different for each nonattainment area, with the level of appropriate detail dependent upon the complexity of the air quality problem, how far into the future the attainment deadline is, and the amount of data and modeling available. In this case, the SJV is approaching attainment of the 1-hour ozone standard, and the projected attainment date (2017) is based on multiple methods to evaluate the modeling results. This document summarizes the analyses that provide a WOE assessment that complement the model results.

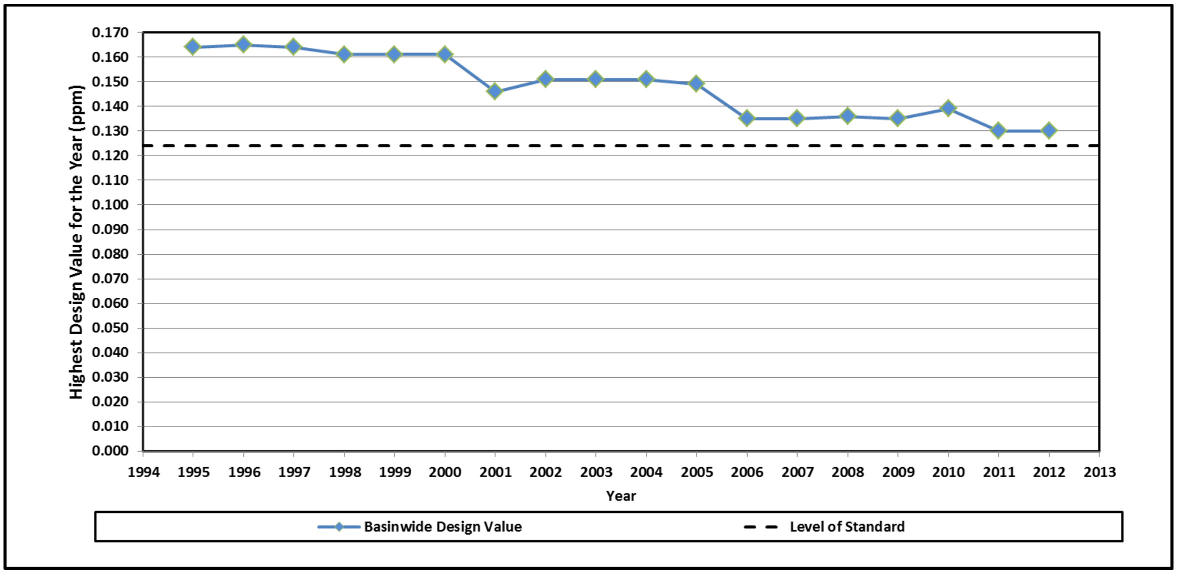
1.2 Assessment of Valley-wide Progress in Ozone Air Quality

The San Joaquin Valley has one of the most challenging ozone problems in the nation. In the early 1990's, much of the Valley exceeded the 1-hour ozone standard, and exceedances of the standard occurred somewhere in the Valley approximately 50 days each summer. However, ozone air quality has improved throughout the region, with the basin-wide Design Value (highest Design Value at any site in the basin) declining by 21% between 1995 and 2012, and basin-wide Exceedance Days declining by more than 90%. Today, only three sites have Design Values that exceed the standard.

Figure 1 shows the trend from 1995 to 2012 for the basin-wide Design Value. The annual values represent four different monitoring sites as the highest Design Value in the Valley has occurred at different locations from year to year. Over the last 18 years, the design site has alternated between the Central sub-region (Clovis or Parlier) and the Southern sub-region (Edison and/or Arvin-Bear Mountain).

Figure 2 illustrates the progress that has been made in reducing the spatial extent of Exceedance Days in the SJV. In 1993-1995, portions of the Central and Southern sub-regions experienced 15 to 25 Exceedance Days and most of the Central and Southern Valley recorded at least one to three Exceedance Days. Today, only a few areas in the Central and Southern sub-regions still experience days when ozone air quality exceeds the level of the standard, and only two sites, Fresno-Drummond and Clovis North Villa measure Design Values above the standard. Current data are not available for the Arvin Bear Mountain site, however the site was also nonattainment at the time of its closure.

Figure 1. Design Value Trend for the San Joaquin Valley Air Basin



* This trend does not include Arvin – Bear Mountain after 2010, as the site closed in 2010.

Trends for three air quality indicators – Design Value, Exceedance Days, and Mean of Top 30 – are provided for the three sites that are still above the standard, as well as two sites that have recently come into attainment (Fresno – 1st Street/Garland and Edison). Data for the Fresno – 1st Street and Fresno – Garland sites have been merged into one data record because the EPA considers Garland an official replacement for the 1st Street monitor. The locations of these monitoring sites are shown in Figures 3 and 7. These three indictors address different aspects of ozone air quality, and together provide information to evaluate overall progress in reducing ozone exposure as well as attaining the standard. The Design Value (DV), EPA's compliance metric, is the 4th highest concentration measured in a three year period. A site meets the standard when its DV is less than or equal to 0.124 ppm, the effective level of the standard. Exceedance Days shows how often ozone was above the standard, providing a measure of the frequency of exposure. Finally, the Mean of Top 30 is a stable and responsive measure of progress as it represents the trend in the upper eight percent (8%) of daily 1-hour ozone levels during the year. Additional analysis of ozone trends is provided in Appendix A of the District plan.

In the Central sub-region, ozone levels at Clovis (Figure 4), Fresno – 1st Street/ Garland (Figure 5), and Fresno – Drummond (Figure 6) clearly tend to be lower after 2003 than before 2003 for all three indicators, and Fresno 1st Street/Garland now meets the standard. Since 2008, the trends have been flat or downward for Clovis, which had no exceedances in 2012. At Fresno-Drummond (Figure 6), some upward movement has occurred in all three indicators since 2007, possibly due to year-to-year variability in meteorology. However, the trends for Exceedance Days and Mean of Top 30 give some indication that ozone levels began turning back down in 2012. Clovis still remains the Design Site for SJV, but Fresno-Drummond has had more exceedances in the most recent years. Fresno-Drummond Street had a large gap in ozone data from 9/3/2010 until 11/17/2010, which made it seasonally incomplete.

In the Southern sub-region, ozone levels have improved at Edison (Figure 8), clearly tending to be lower after 2003 than before 2003 for all three indicators. The ozone indicators at Edison in 2011 and 2012 were generally the lowest recorded since 1995, and this site now meets the standard. This is especially encouraging because Edison set or shared the basin-wide Design Value from 1995 to 1997 and again from 2006 to 2009. Further indication of progress in the Southern sub-region is found at Arvin – Bear Mountain (Figure 9), which recorded new lows for Exceedance Days and Mean of Top 30 in 2010 (the last full season of measured data).

The ozone-monitoring station at Arvin – Bear Mountain was closed on October 31, 2010 as ARB was unable to renew the long-term lease at this location. Values for 2011 in Figure 9 were estimated based on imputed values produced by a program called "I-Bot" that was developed by Air Resources Board staff (ARB) (methodology given in Appendix G-1). The imputed data for 2011 indicate that ozone levels at Arvin – Bear Mountain were the lowest since 1995 for all three indicators: Design Value (0.129 ppm), Exceedance Days (1 day), and Mean of Top 30 (0.107 ppm).

Figure 2. Reductions in spatial extent and number of Exceedance Days in the San Joaquin Valley Air Basin

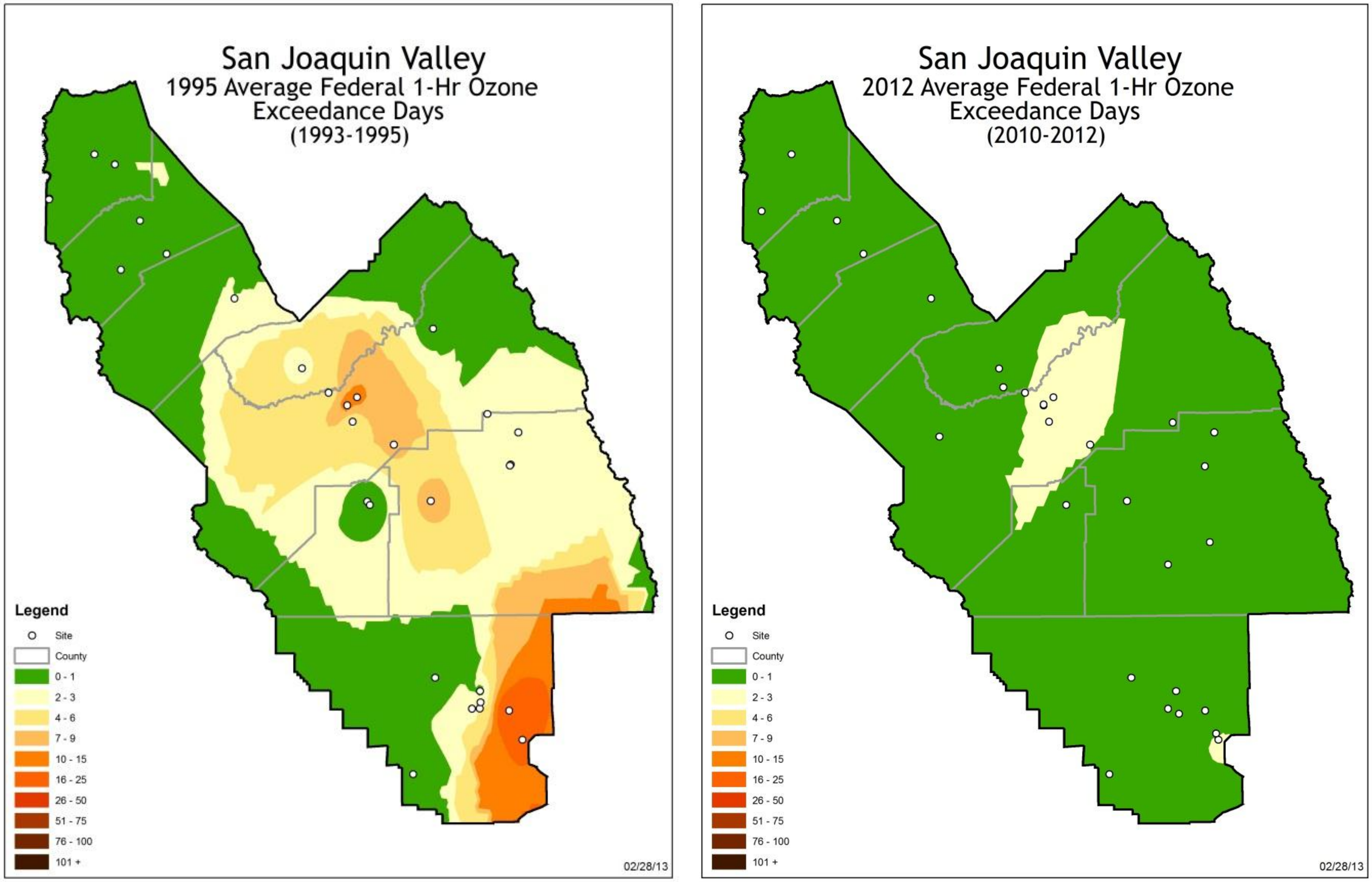


Figure 3. Three High-ozone Sites in the Central SJV

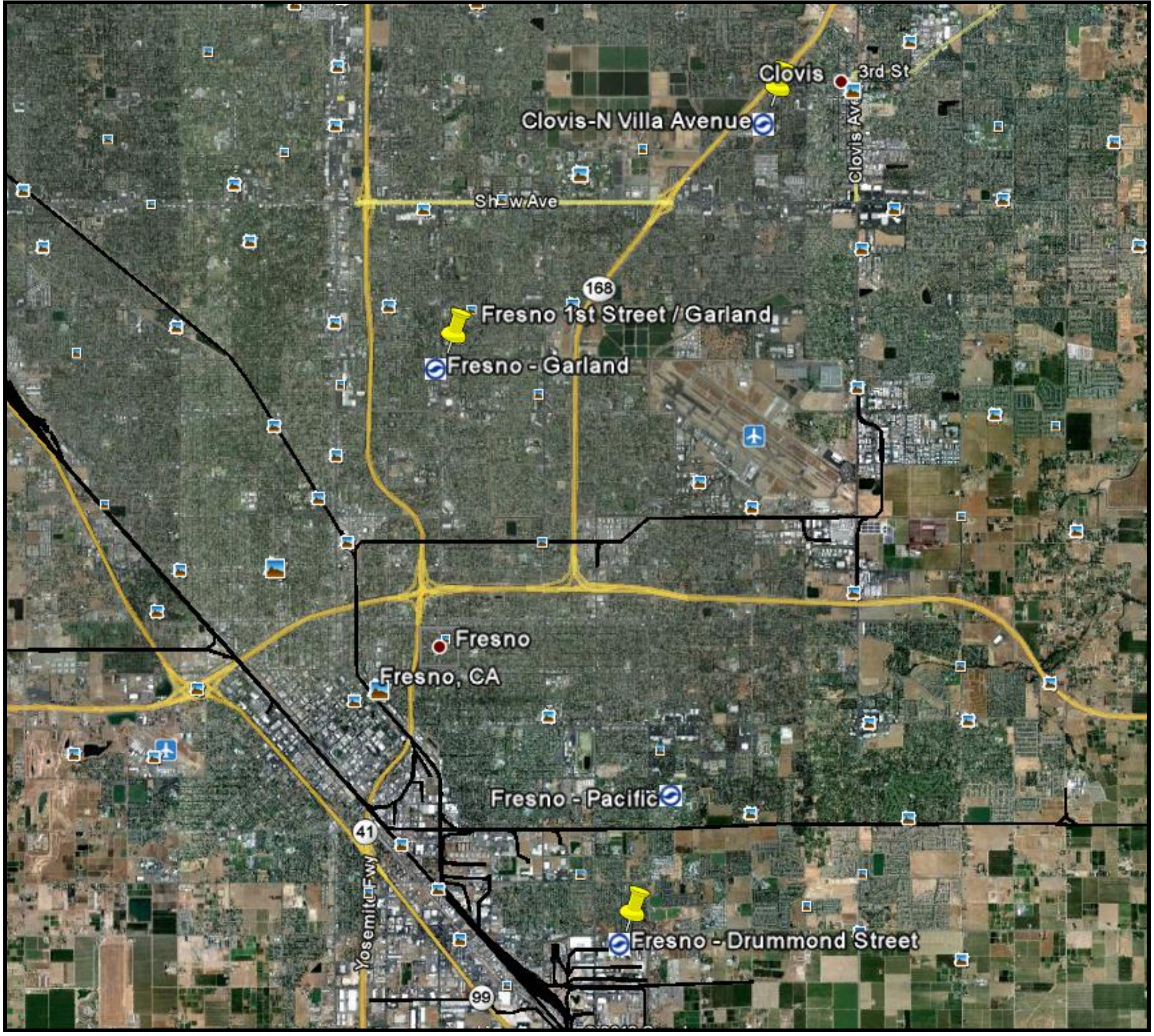


Figure 4. Air Quality Trends for Clovis – N Villa Avenue

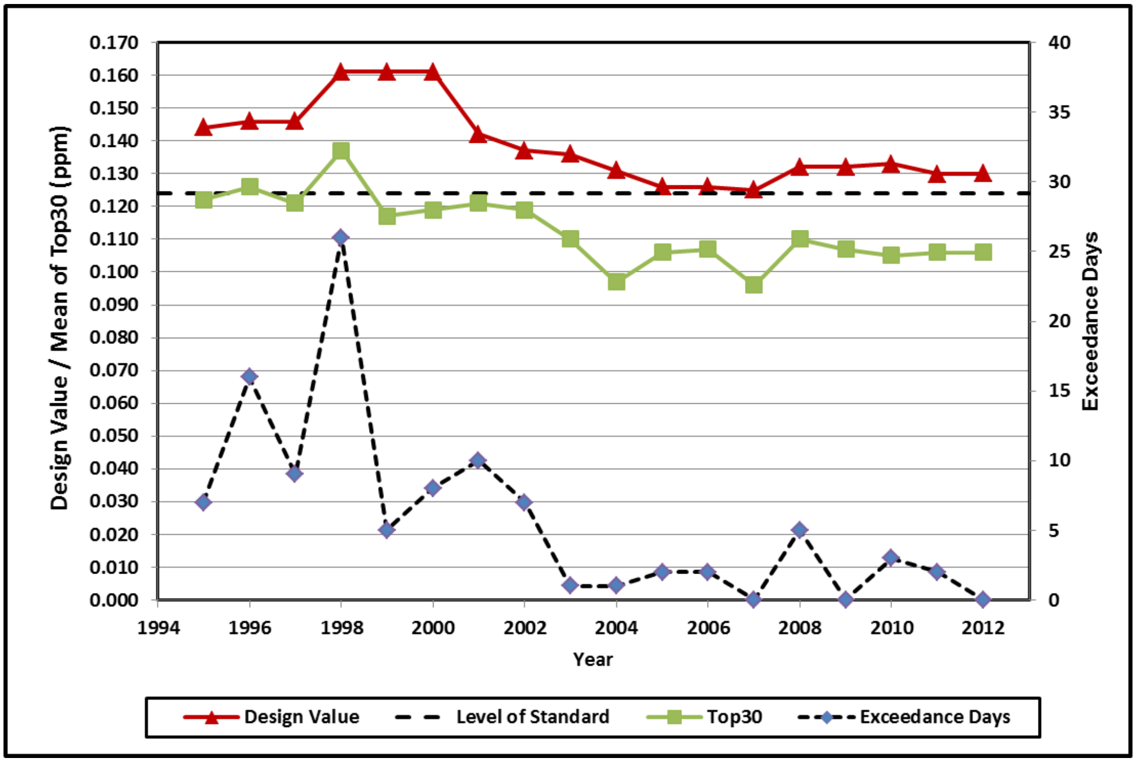


Figure 5. Air Quality Trends for Fresno – 1st Street / Garland

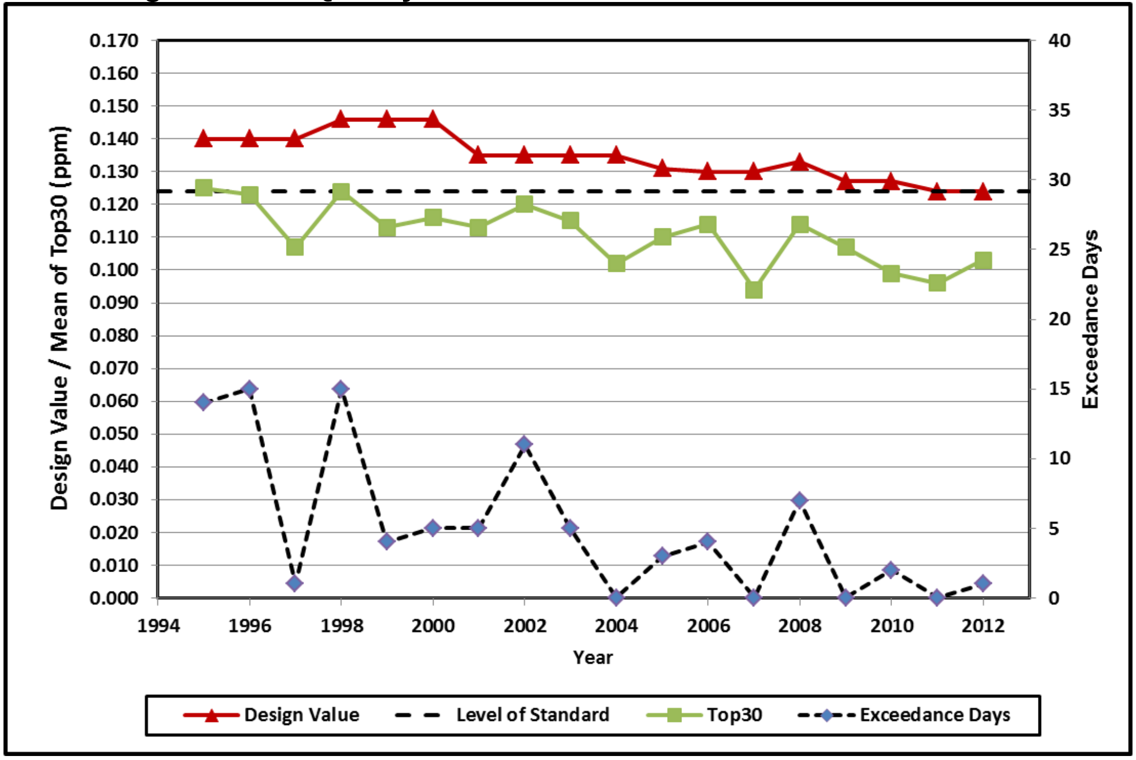


Figure 6. Air Quality Trends for Fresno – Drummond

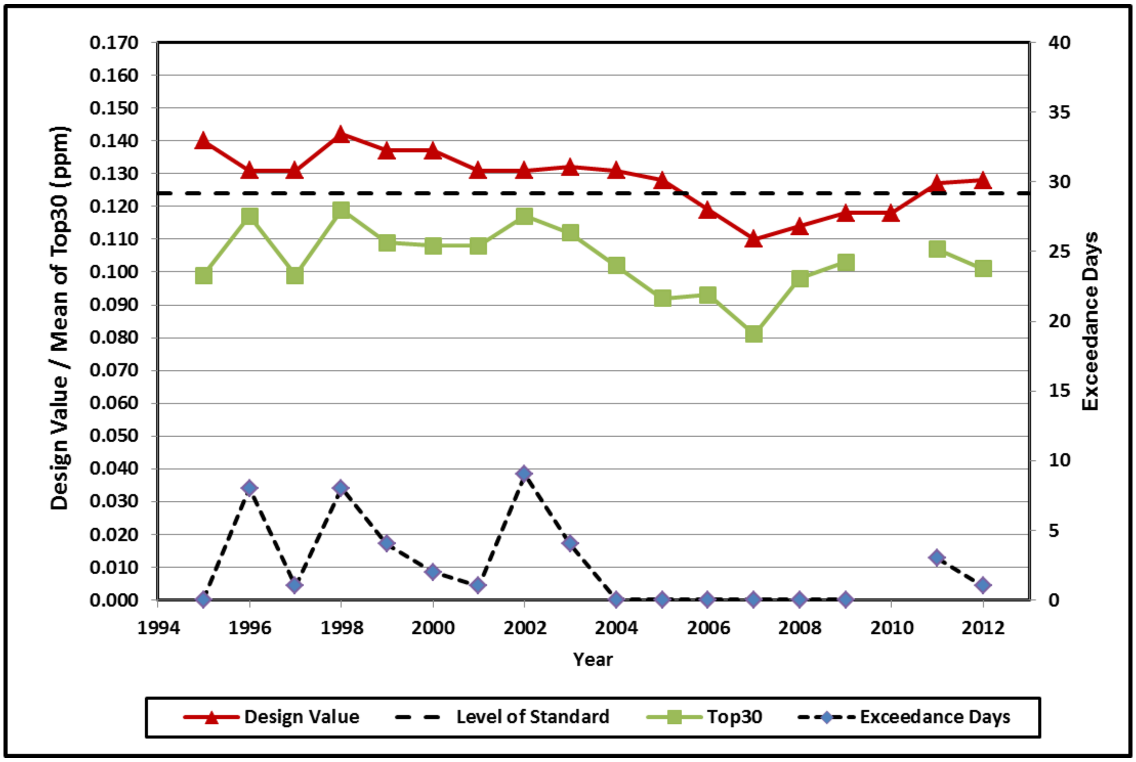


Figure 7. Two High-ozone Sites in the Southern SJV

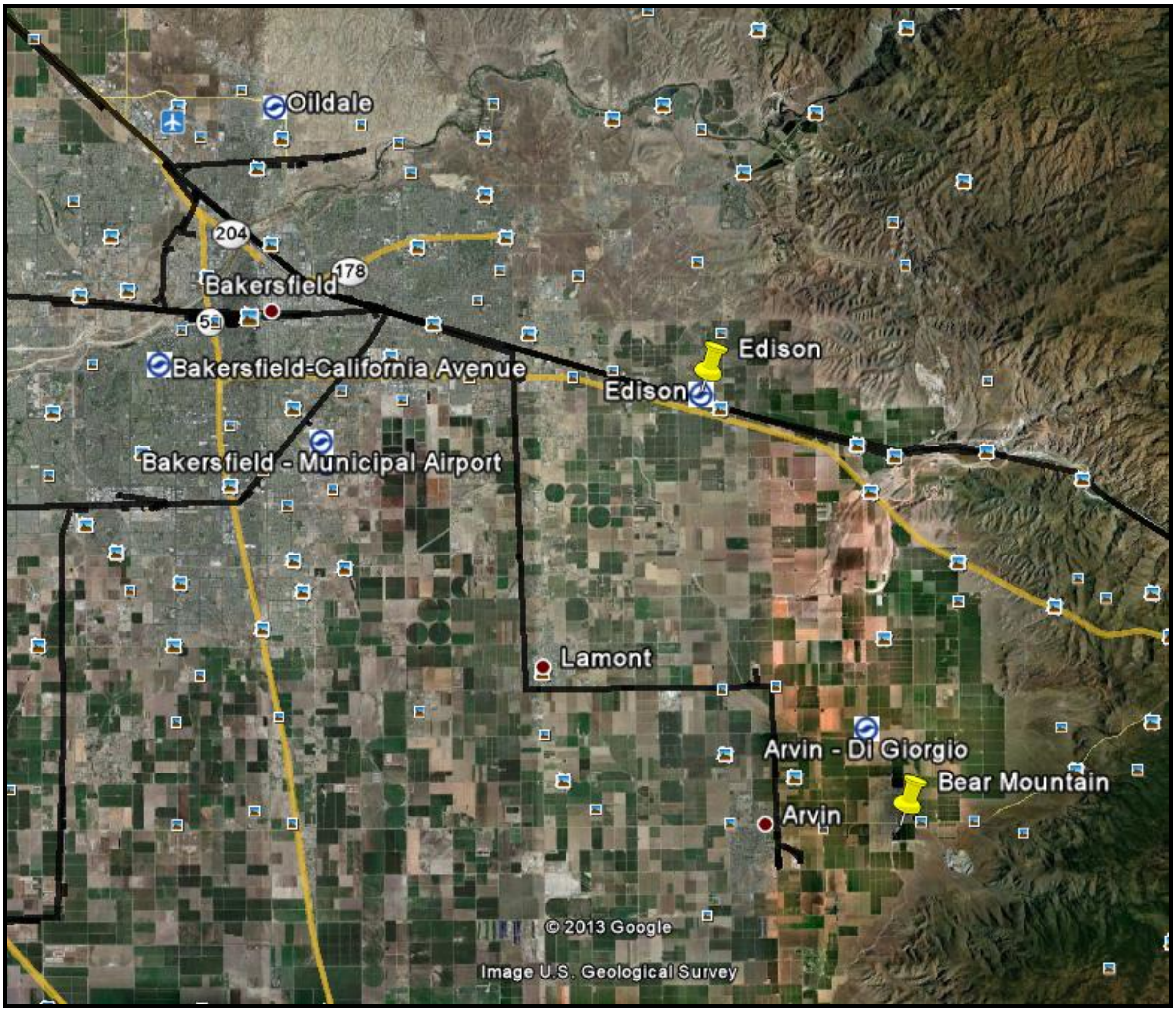


Figure 8. Air Quality Trends for Edison

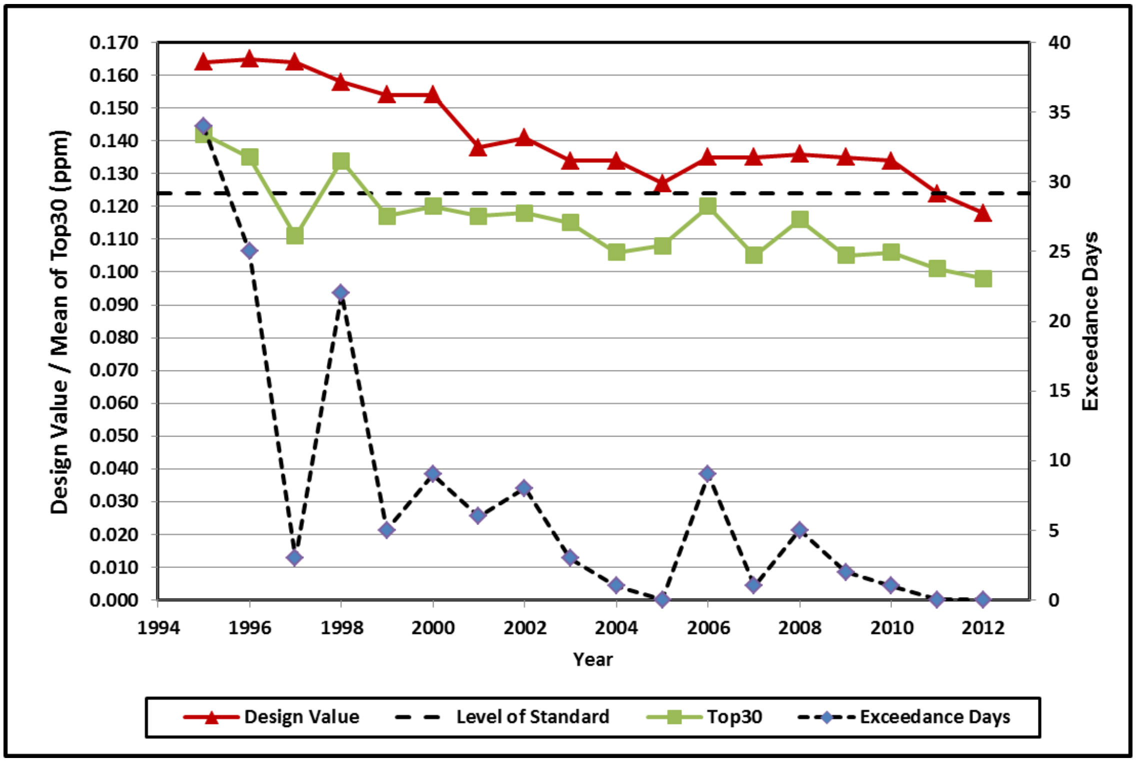
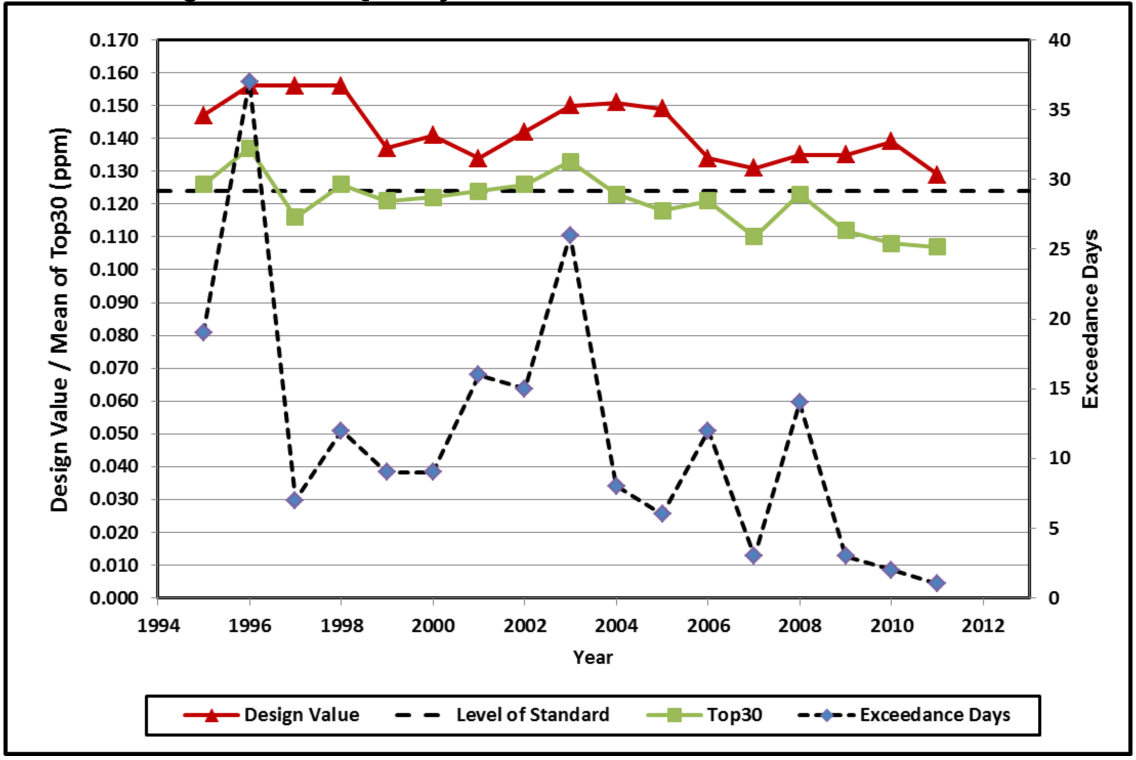


Figure 9. Air Quality Trends for Arvin – Bear Mountain*



* Values for 2011 at Arvin – Bear Mountain are based on imputed data (Appendix G-1).

2 Ozone Air Quality Trends Adjusted to Baseline Meteorology from 2003-2005

Emissions and meteorological conditions are two of the most important factors that determine ozone air quality. If emissions of ozone precursors were to be reduced at a constant rate for many years, year-to-year differences in meteorology would still cause variability in the aggregate downward trend in ozone. The meteorology-induced variability can present the appearance of multi-year ups and downs due to emissions, when no such emissions effects truly occurred. When the trends can be adjusted appropriately to a common baseline for meteorological conditions, the trend due to changes in emissions can be seen more clearly.

2.1 Using Met-Adjusted 8-Hour Ozone Trends to Represent 1-Hour Ozone

For this portion of the WOE analysis, met-adjusted 8-hour ozone trends from 1996 through 2011 were used. The 8-hour trends were developed recently as part of work to understand progress toward the 8-hour ozone standard. These trends are relevant to 1-hour ozone and sufficient for this present work due to the close connection between daily max 1-hour and 8-hour ozone from the same site.

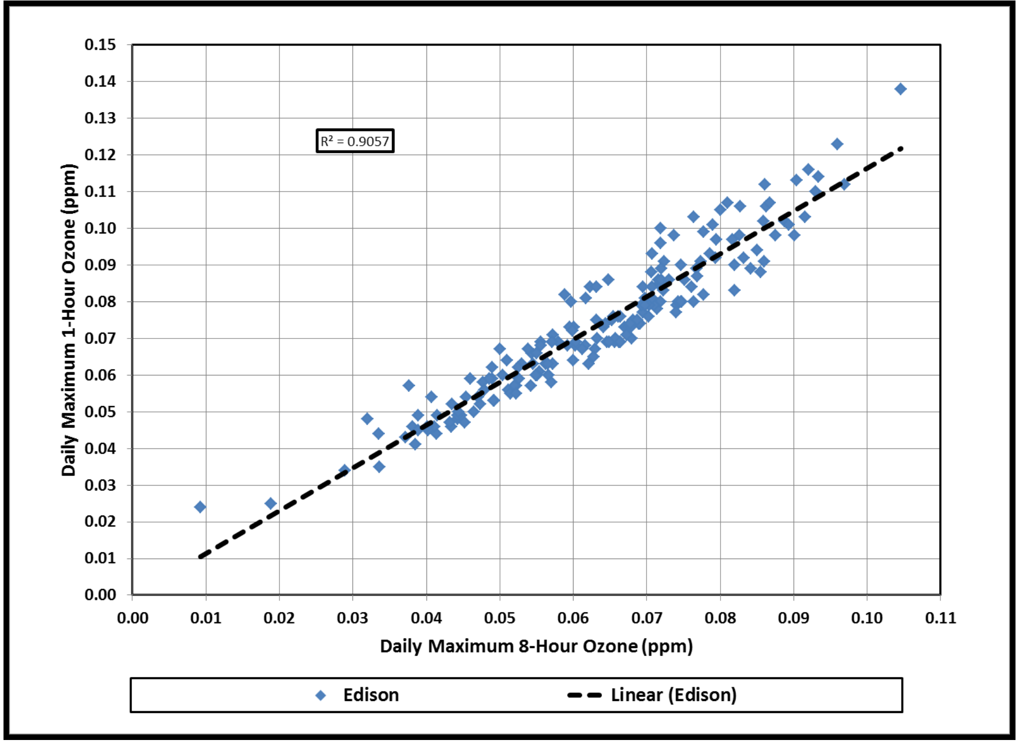
Annual plots for 2006 through 2011 were created for daily maximum 1-hour ozone (Y-axis) versus daily maximum 8-hour ozone (X-axis) during the May-October ozone season for all ozone-monitoring sites in the SJV. Data from 2008 were likely impacted by wildfires; however, no studies have been done to quantify the effects of the wildfire emissions on the concentrations, so no data were excluded on that basis. The smallest correlation between the two variables for all of the site-year plots was 0.95 (r-squared = 0.904).

Scatterplots that show the close connection between daily maximum 1-hour ozone and daily maximum 8-hour ozone at the same monitoring site are given for Edison in Figure 10 and for Fresno – 1st Street / Garland in Figure 11 as examples, with r^2 values ranging from 0.9051 to 0.9623.

The close connection between daily maximum 1-hour and 8-hour ozone means that the two can be expected to track each other as ozone improves. And, if one may improve faster than the other, the widespread expectation is that the 1-hour daily maximum should improve at least as fast as the 8-hour daily maximum. The use of "banded" relative response factors (RRF's) in Section 6.2 is based on this principle. Appendix G-2 presents the methodology used to prepare the met-adjusted trends in this report.

Figure 10. Correlation of Max. 1-hr and 8-hr Ozone at Edison

(a) Data from May – October 2007



(b) Data from May – October 2008

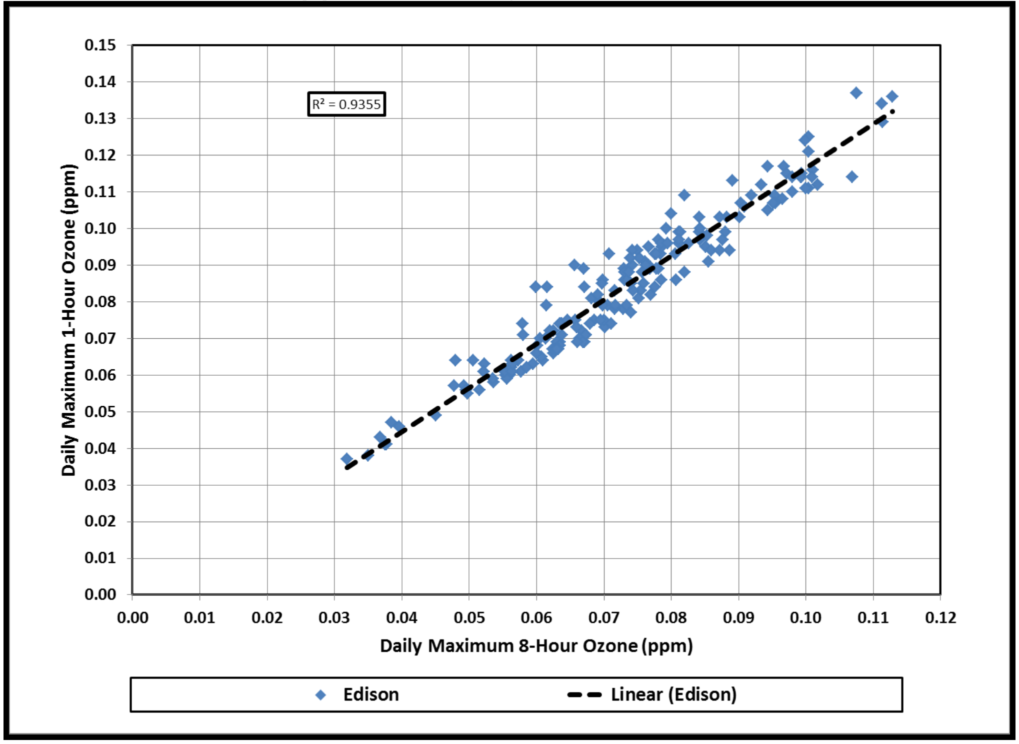
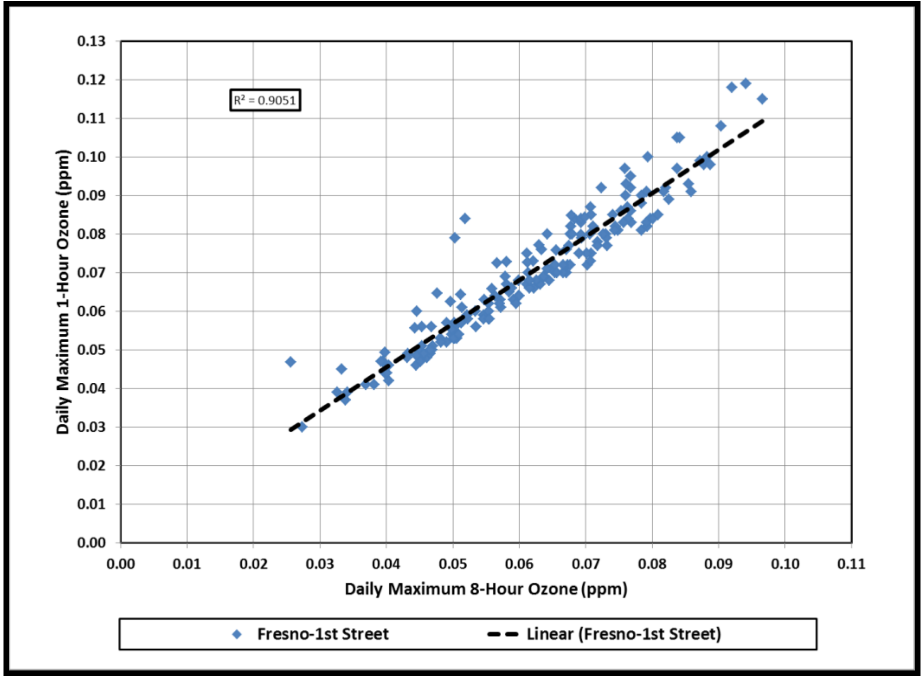
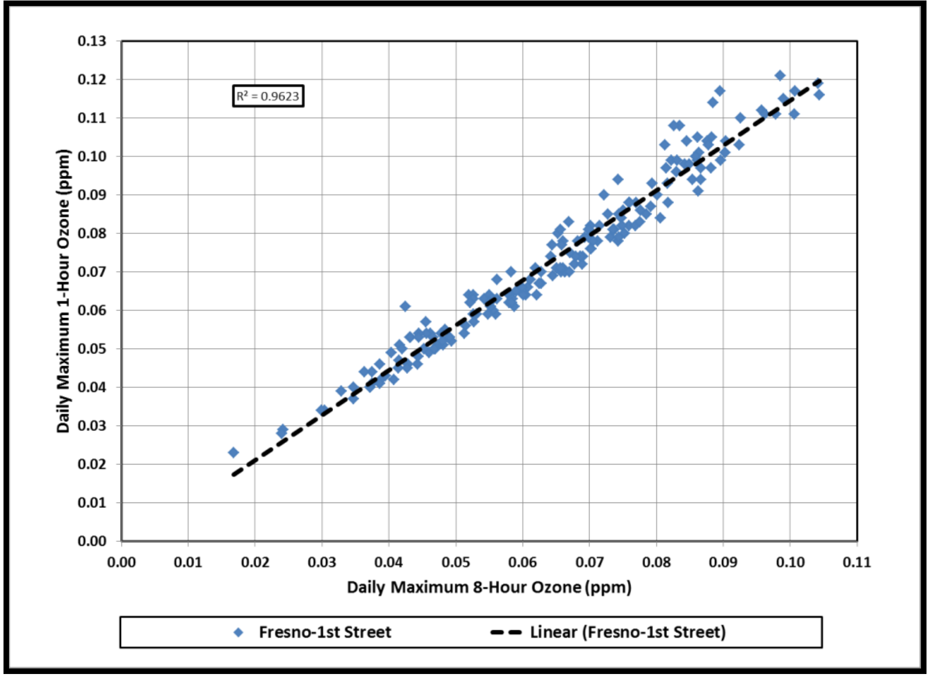


Figure 11. Correlation of Max. 1-hr and 8-hr Ozone at Fresno – 1st Street

(a) Data from May – October 2011



(b) Data from May – October 2009



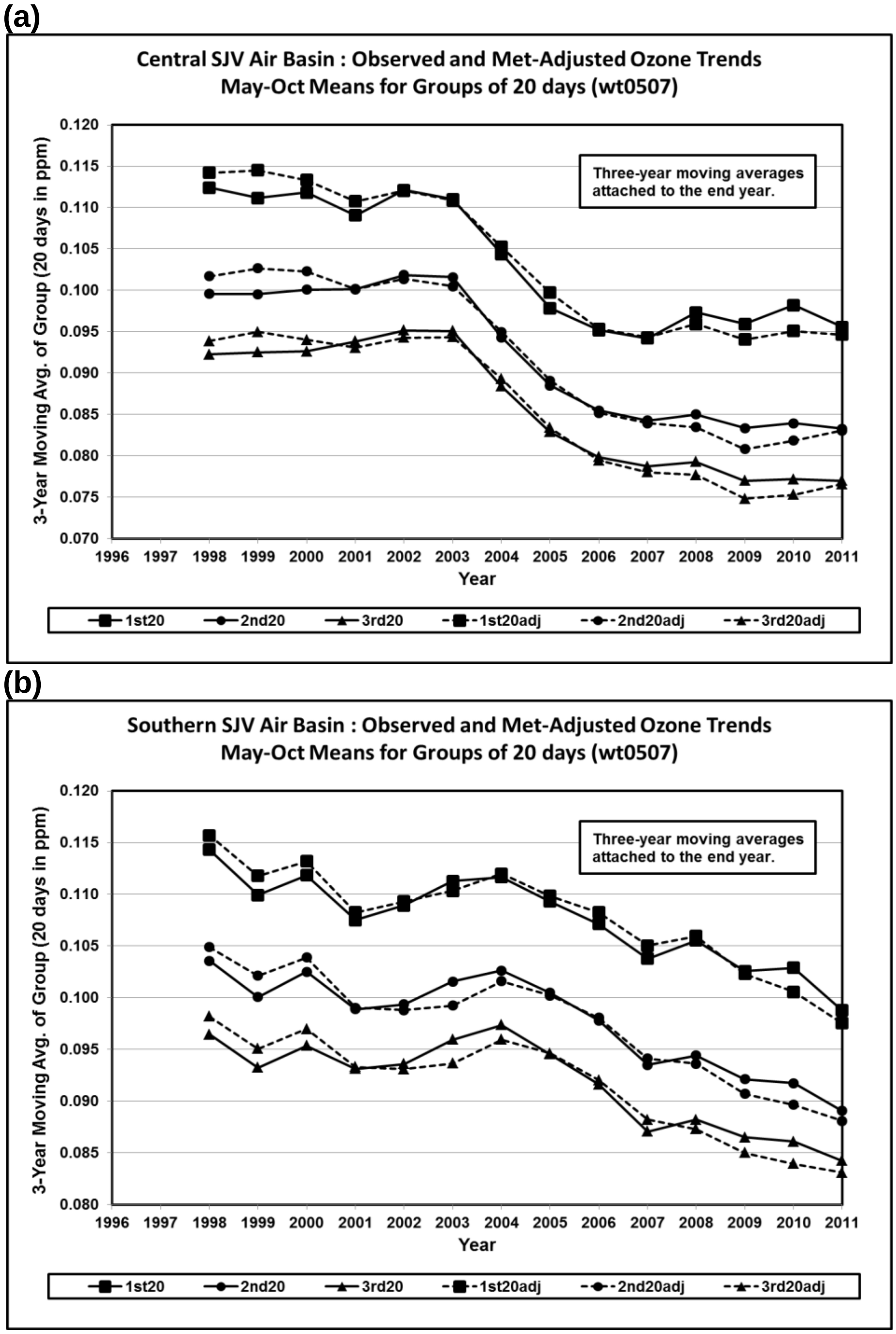
2.2 Met-Adjusted Trends for the Central and Southern Regions of the SJV

Figure 12 displays both unadjusted and met-adjusted trends. The trends represent the highest 60 days (the highest 1/3rd) of the ozone season, in sets of 20 days each. Trends for the means of the Top 20 (1st20), Top 21 to 40 (2nd20), and Top 41 to 60 (3rd20) are shown in Figure 12(a) for the Central sub-region and Figure 12(b) for the Southern sub-region of the SJV. The trends are given as 3-year moving-averages (attached to the end year) of the unadjusted and the met-adjusted results.

From 1996 to 2011, in the Central and Southern sub-regions of the SJV the overall improvement in the observed ozone trends was about 15 ppb (13% to 17%), with intermediate periods of progress and plateau. The met-adjusted trends indicate slightly greater overall progress (15% to 19%), indicating that emissions reductions have been more beneficial than the unadjusted trends suggest. The similarity of the observed and met-adjusted trends indicates that the observed trends represent emissions effects rather than weather effects, so the ozone improvements are likely due to significant ROG and NOx reductions in the SJV (Figure 13 – Figure 18).

The San Joaquin Valley Air Pollution Control District (District) also prepared met-adjusted and unadjusted trends for the seasonal average of daily maximum 1-hour ozone. Though the District used a different adjustment methodology and a different trend indicator, their findings were similar to the 8-hour ozone results presented here.

Figure 12. Met-Adjusted Trends



3 Trends for Ozone Precursors in Ambient Air

This section presents trends in the primary ozone precursors, reactive organic gases (ROG) and oxides of nitrogen (NOx). The data are from a special-purpose network of Photochemical Assessment Monitoring Stations (PAMS) where both ROG and NOx are measured side-by-side. The PAMS network operates during the summer ozone season and collects ROG samples that represent different parts of the day. The work done for this WOE was patterned after previous WOE analyses that focused on the morning hours between 4 am and 7 am.

The ROG data discussed here are the sum of 55 chemical species, sometimes called Non-Methane Organic Compounds (NMOC), an indicator of ROG. These data are known to be lower than total ROG by percentages that differ from place to place. This occurs because ROG includes more than the 55 species, and because only a few of the species – formaldehyde (HCHO), acetaldehyde (CH3COH), and methyl-ethyl-ketone – have oxygen atoms in them when they are emitted. The other species react with OH radicals in the atmosphere and are transformed into oxygenated species that are not included in our ROG data.

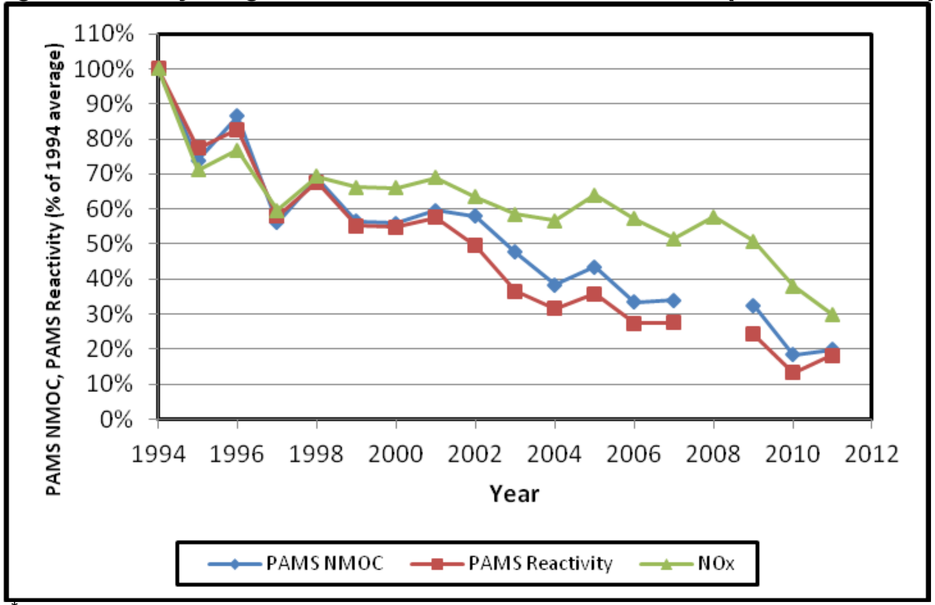
ROG is not measured at many of the monitors in the routine ambient network. The routine network of NOx monitors, however, is extensive. Section 3.2 provides additional NOx trends from this broader network.

3.1 Analysis of PAMS Data

From 1994 to 2011, ambient ROG and NOx concentrations decreased significantly throughout the SJV. Valley-wide trends shown in Figure 13 show some minor peaks within the long term downward trend. This demonstrates that progress has been made in reducing these two key precursors that form ground-level ozone. Since 1994, PAMS data for the SJV indicate that ROG declined by 79%, while NOx decreased by 70%. The trend for reactivity-weighted ROG showed slightly greater progress compared to the un-weighted trend.

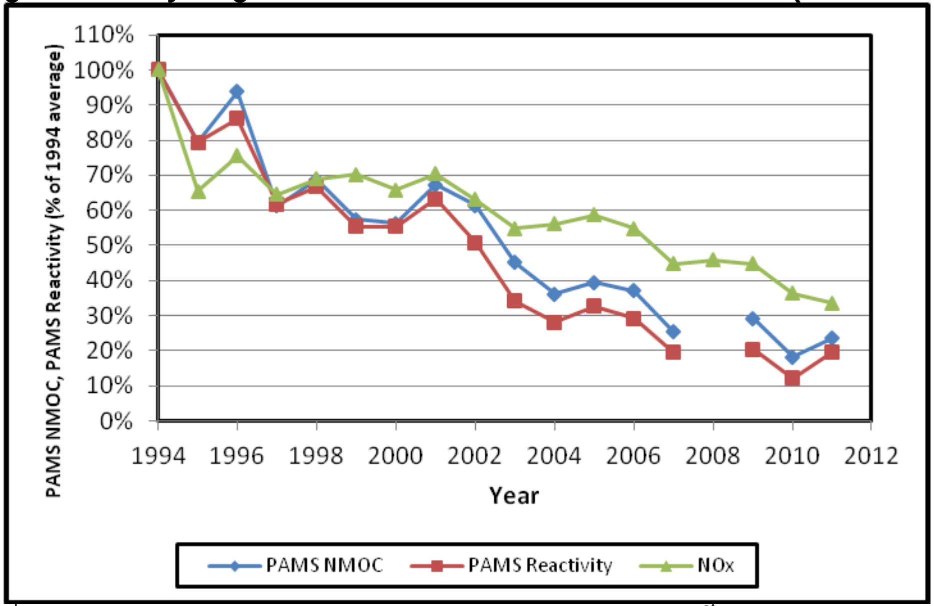
Sub-regional trends in ambient ROG and NOx are shown in Figure 14 for the Central SJV and in Figure 15 for the Southern SJV. The figures show substantial decreases in ROG and NOx for both regions over the trend periods. In the Central SJV, ROG declined 76% and NOx declined 67%. In the Southern SJV, ROG declined 88% and NOx declined 61%. Table 1 provides the data for Figure 13 through Figure 15 in parts per billion instead of percent. Table 1 shows that the levels of ROG and NOx in 2010 remained somewhat higher in the southern region compared to the central region. It should be noted that data after 2009 was unavailable at the Bakersfield – Golden State Highway site and the 2012 PAMS data were not available for any sites at the time this analysis was done.

Figure 13. July-Aug Means at all SJV PAMS Stations (5-7 am/4-6 am)[*]



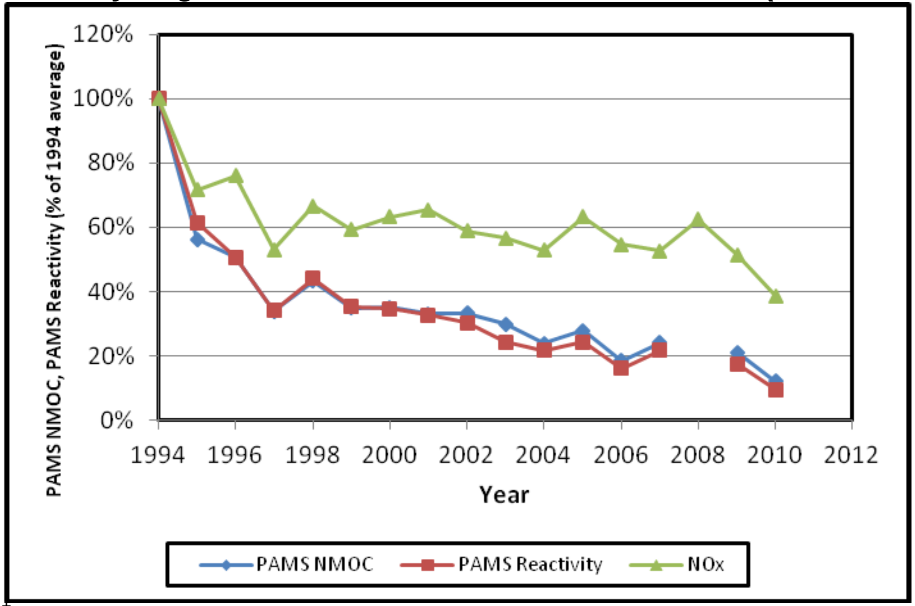
[*] 3-hour NMOC/PAMS samples from 5-7 am or 4-6 am for a standard set of 55 compounds. Some samples with extreme mixing ratios for one or more compounds were identified and excluded. Data for 2008 were not available for this area during the chosen months and hours.

Figure 14. July-Aug Means at Central[†] SJV PAMS Stations (5-7am / 4-6am)



[†] Central San Joaquin Valley sites include Parlier, Fresno-1st Street, Clovis - N. Villa Avenue, and Madera-Pump Yard. Data for 2008 were not available for this area during the chosen months and hours.

Figure 15. July-Aug Means at Southern[‡] SJV PAMS Stations (5-7 am / 4-6 am)



[‡] Southern San Joaquin Valley sites include Arvin-Bear Mountain, Shafter-Walker Street, and Bakersfield-Golden State Hwy. Data for 2008 and 2011 were not available for this area during the chosen months and hours.

Table 1. ROG (ppbC) and NOx (ppb) Concentrations in the SJV

	SJV Basinwide			Central SJV			Southern SJV		
Year	ROG	Reactivity	NOx	ROG	Reactivity	NOx	ROG	Reactivity	NOx
1994	225.4	189.9	53	190.2	178.3	47.5	433.4	320.4	63.8
1995	166.5	147.0	38	150.9	141.4	31.1	244.0	197.1	45.6
1996	194.9	157.0	41	178.6	153.7	35.9	219.3	161.9	48.5
1997	126.5	109.9	32	116.6	110.3	30.7	146.5	109.1	33.8
1998	155.0	128.4	37	130.8	119.0	32.7	187.2	140.9	42.5
1999	127.2	104.9	35	109.3	98.6	33.3	151.0	113.2	37.8
2000	126.2	104.0	35	107.1	98.9	31.3	151.7	110.9	40.3
2001	134.1	109.4	37	128.1	112.7	33.4	143.2	104.6	41.7
2002	130.6	93.9	34	116.9	90.7	30.0	144.3	97.2	37.6
2003	107.4	69.3	31	85.7	60.9	26.1	129.2	77.7	36.2
2004	86.3	59.9	30	68.7	50.2	26.6	103.9	69.6	33.7
2005	97.8	68.1	34	75.2	58.2	27.9	120.5	77.9	40.4
2006	75.4	51.8	30	70.4	52.1	26.1	80.4	51.5	34.9
2007	76.4	52.2	27	48.3	34.9	21.3	104.5	69.5	33.5
2008			31			21.8			39.8
2009	73.4	46.1	27	55.7	36.4	21.3	91.1	55.7	32.9
2010	41.6	25.2	20	34.7	21.8	17.2	52.1	30.2	24.7
2011	44.9	34.7	16	44.9	34.7	15.9			

3.2 Analysis of Routine Ambient NOx Data

The trends in Section 3.1 represent ambient ROG and NOx at sites in the limited PAMS network during July and August for the hours between 4 am and 7 am.

The trends in this section represent ambient NOx for May-October for all hours of the day from 1995 – 2012. Results are shown for the Central SJV (Figure 16) and the Southern SJV (Figure 17). Figures 16 and 17 use 3-year averages, with one year in a 3-year period sufficient to calculate a moving 3-year average. Therefore, the gaps (or missing years) in the annual trends mean NOx data for three consecutive years were not available.

Both figures show strong downward trends in ambient NOx at the more urbanized sites where NOx emissions are highest. These ambient NOx trends are similar to those from the specialized PAMS sites (Section 3.1) and corroborate the emissions data (Section 4) that NOx emissions have decreased substantially.

Figure 16. Central SJV Trends for Ambient 24-hour NOx from May-Oct.

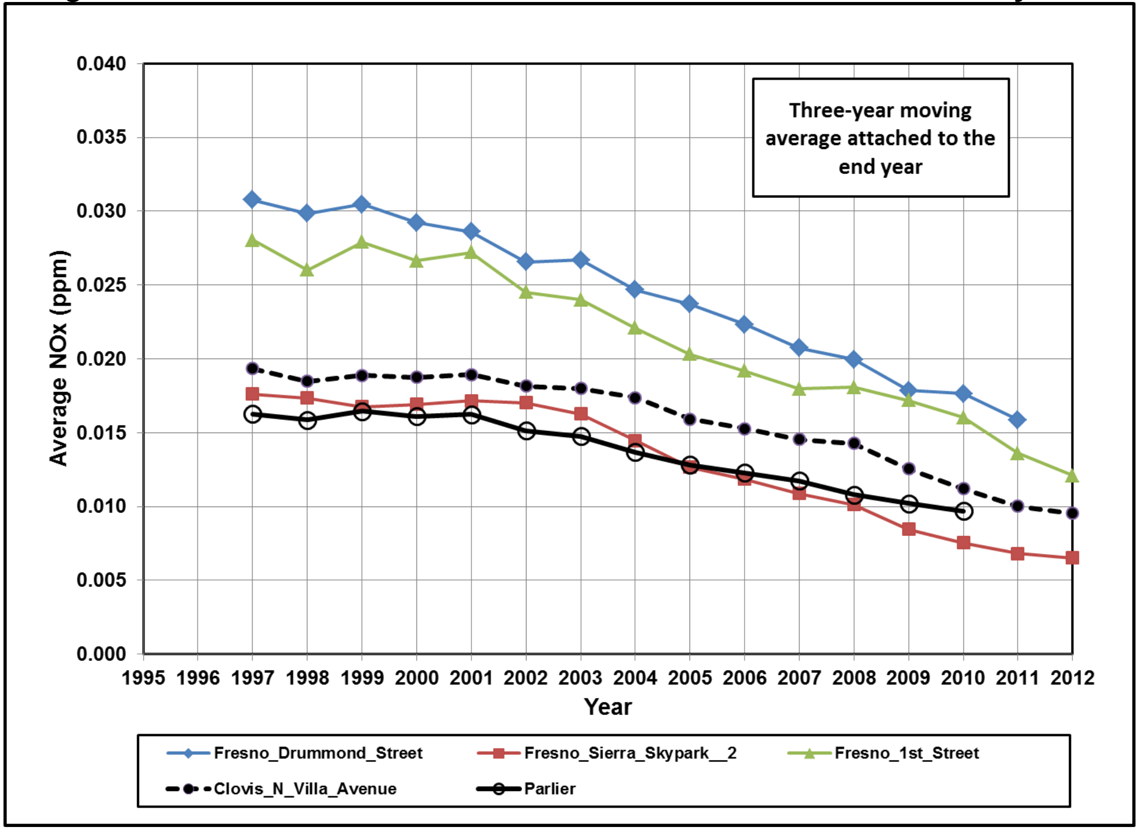
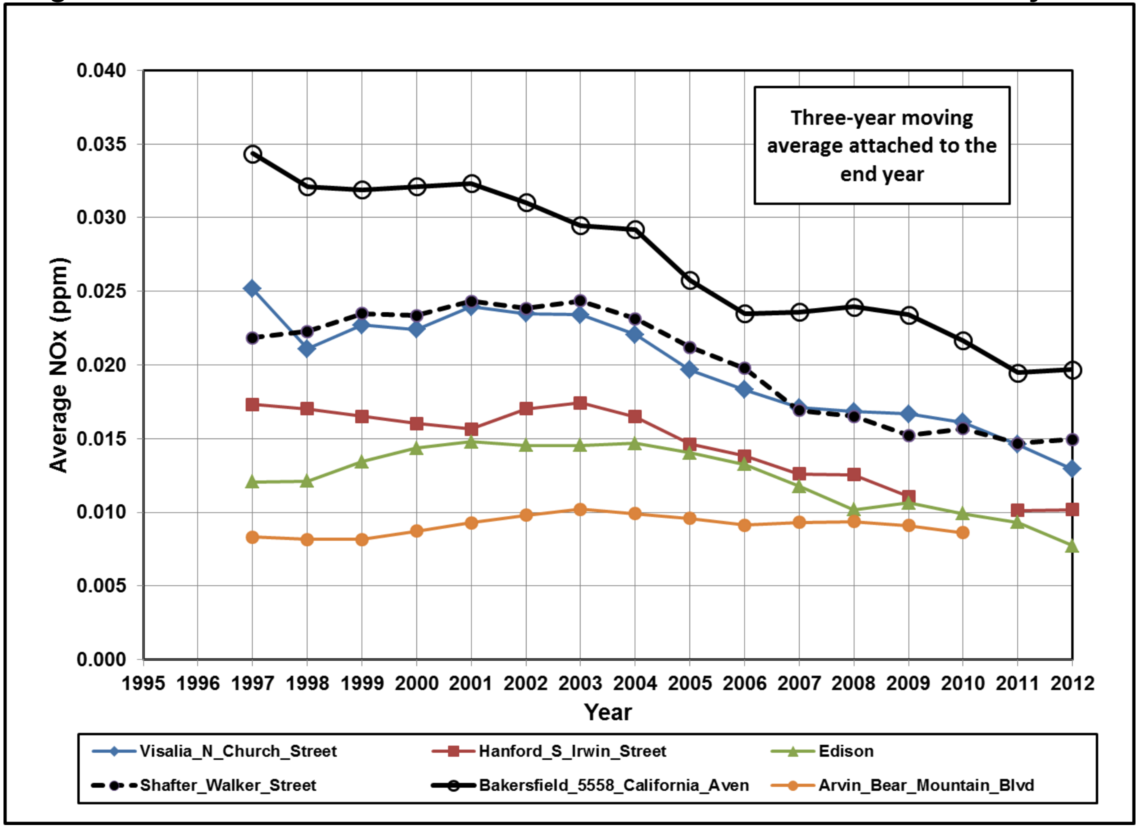


Figure 17. Southern SJV Trends for Ambient 24-hour NOx from May-Oct.

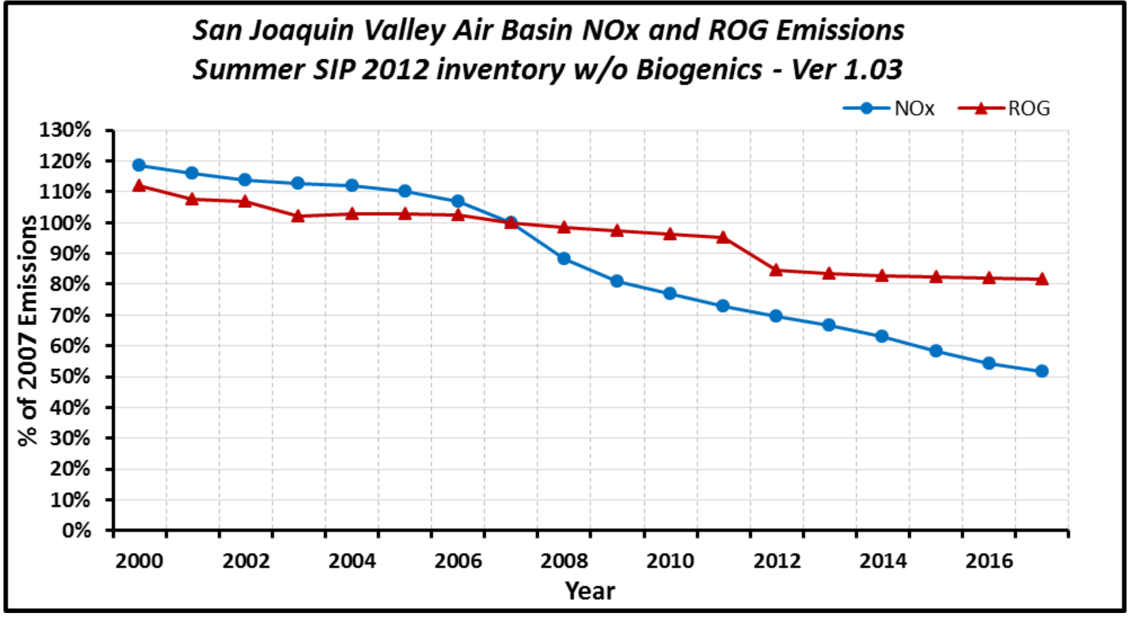


* This trend does not include Arvin – Bear Mountain after 2010, as the site closed in 2010.

4 Trends for Emissions Inventories of Ozone Precursors

Emissions trends for ROG and NOx in the SJV as a whole are shown in Figure 18, excluding emissions from natural sources. The estimates are based on a 2005 emissions inventory together with relative growth and control factors for 2000 – 2017. The figure shows that from 2000 – 2017 anthropogenic NOx is predicted to decrease by 67% and ROG by 30%.

Figure 18. Overall ROG and NOx Emissions Trends for the SJV



The ROG/NOx ratio is an important consideration when planning emissions reduction strategies. A ROG/NOx ratio greater than 1 indicates higher ROG emissions. For higher ROG/NOx ratios ROG emissions reductions will be less effective in lowering ozone while NOx emissions reductions will be more effective. This is known as a NOx limited regime. A ROG limited regime occurs when the ROG/NOx ratios are lower, indicating higher NOx emissions. In this regime, ROG emissions reductions will be more effective than NOx emissions in reducing ozone concentrations.

Figure 18 shows summer emissions of anthropogenic NOx and ROG from 2000 to 2017 as a percent of emissions in 2007, the base year for modeling. With respect to 2007, the 2017 emissions represent a 48% decrease in NOx and a 18% decrease in ROG. Accordingly, the ROG/NOx ratio for anthropogenic emissions in 2017 is expected to be almost 1.6 times the ratio that prevailed in 2007. The ratio of ambient ROG to ambient NOx is likely to increase even more, as non-anthropogenic ROG is the majority of the total ROG inventory in the SJV for most of the ozone season, while non-anthropogenic NOx is a tiny fraction of the total NOx inventory. The trend towards higher ROG/NOx ratios in the SJV indicates that the area will become more NOx limited, thus NOx controls will become increasingly more effective for lowering ozone concentrations.

Trends in summer emissions of anthropogenic NOx and ROG for the Central SJV are shown in Figure 19 and for the Southern SJV in Figure 20. These trends show similarities that reflect the Valley-wide adoption of significant rules regarding control of ROG and NOx emissions. In the Central and Southern sub-regions of the SJV, emissions inventories show greater overall reductions in NOx (55% in Central and 60% in Southern SJV) than ROG (24% in Central and 31% in Southern SJV) from 2000 – 2012, with downward pattern continuing through 2017. The key feature of these trends is the similarity in both regions of the SJV.

Figure 19. ROG and NOx Emissions Trends for the Central SJV

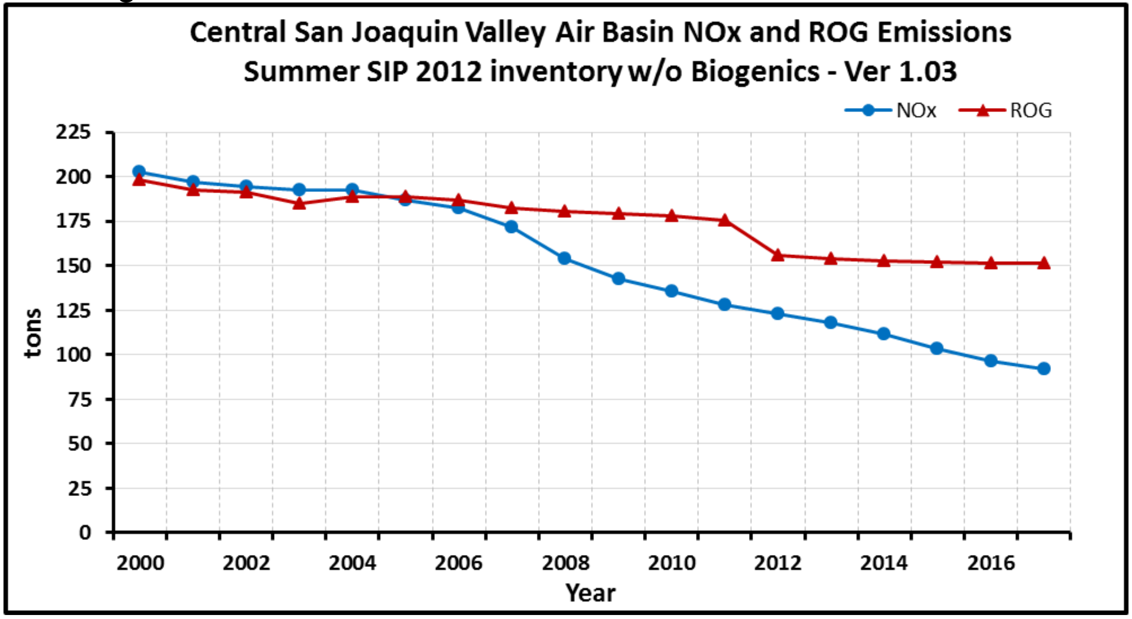
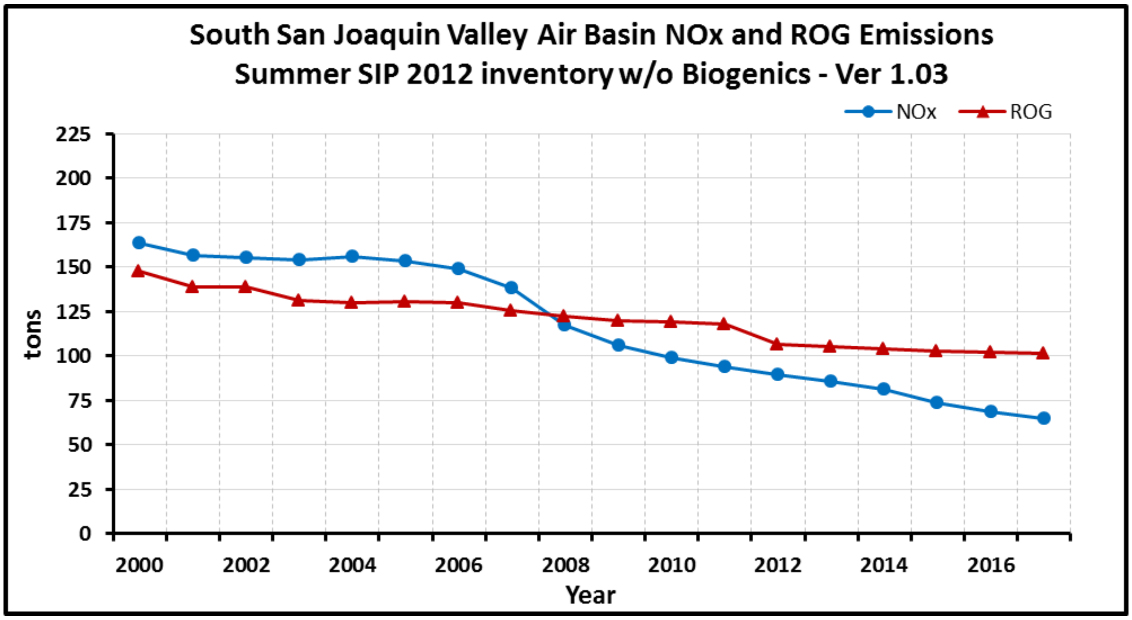


Figure 20. ROG and NOx Emissions Trends for the Southern SJV



The county-by-county trends in Figure 21 and Figure 22 have largely similar shapes but differ in the magnitude of the emissions, with highest NOx and ROG emissions in Kern County.

Figure 21. Summer NOx Emissions by County

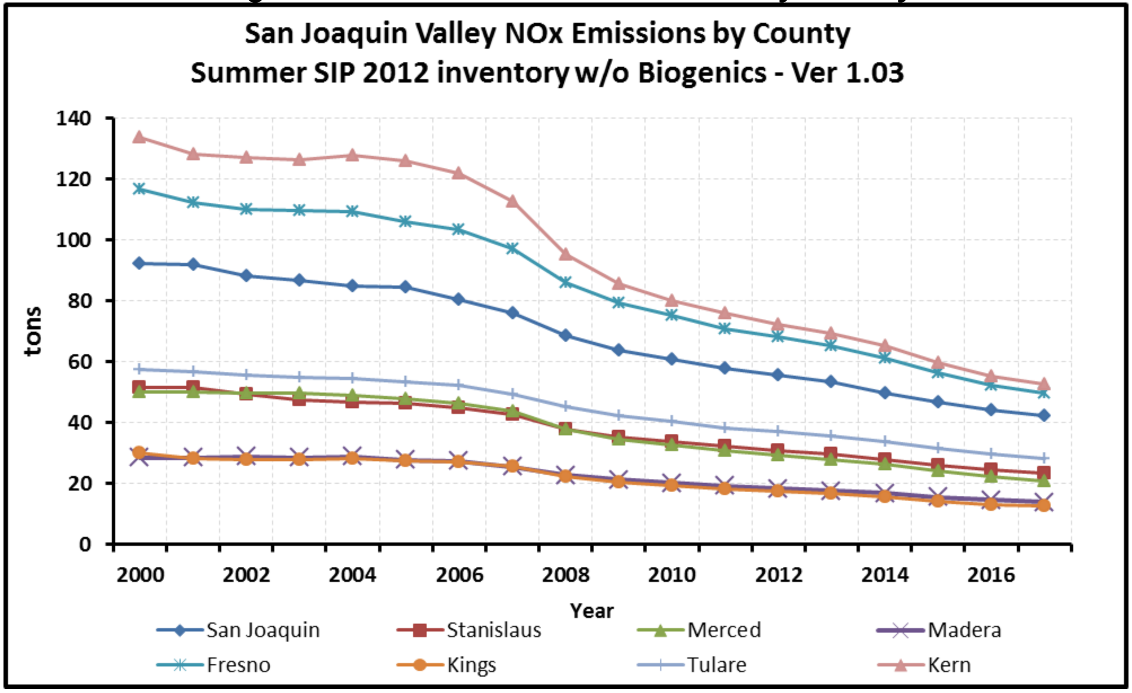
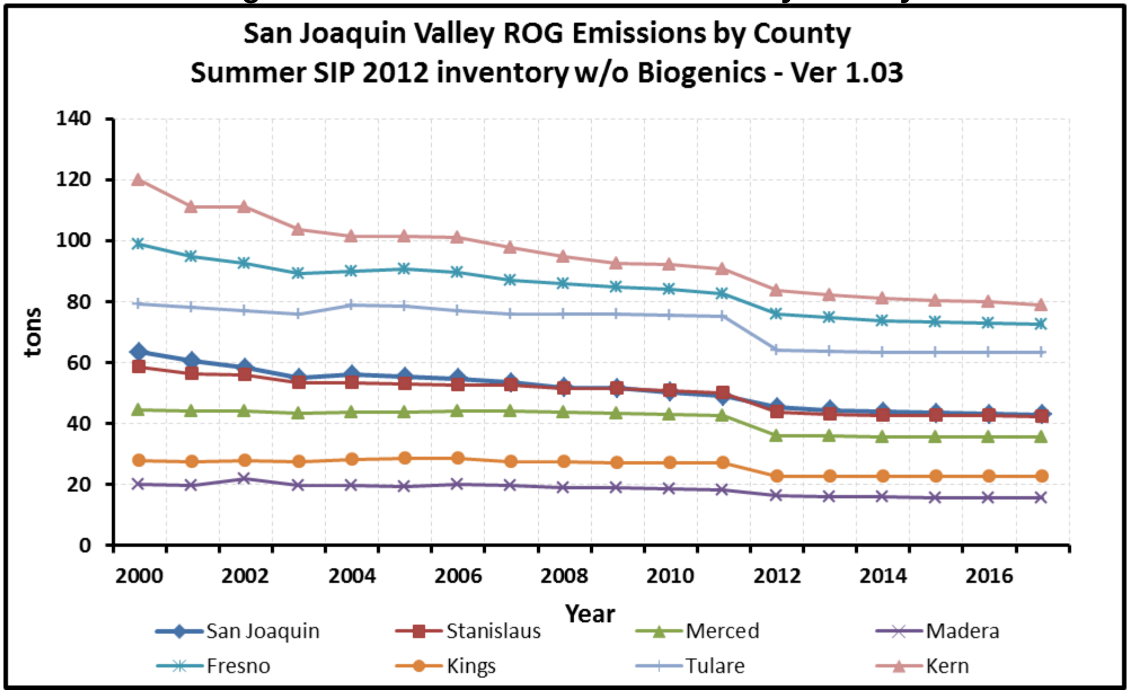


Figure 22. Summer ROG Emissions by County



5 Ambient Analysis of Ozone Sensitivity to ROG and NOx

In addition to both the ambient and emissions ROG/NOx ratio discussed in the previous sections, the sensitivity of ozone to changes in ROG and NOx can be assessed using other patterns in the ambient data. Analysis of indicator species, especially their ratios, has been used in this regard, but the needed data are very limited for the SJV at this time. However, an analysis of ozone on weekdays and weekends provides another indicator that reductions in NOx should be effective in reducing ambient ozone in the SJV.

As discussed in Section 4, substantial reductions in NOx emissions are forecast for the SJV in the coming years. Reductions in ROG emissions are also forecast but at a slower pace, with biogenic ROG emissions remaining unchanged. As a result, the ratio of ROG to NOx in the ambient air is expected to increase markedly.

The modeling exercises summarized in Chapter 2 of the *2013 Plan for the Revoked 1-hour Ozone Standard* and supported by additional modeling analyses in Section 6 of this Appendix provide evidence that the planned emphasis on NOx reductions for the next four years (and beyond) should result in significantly lower ozone levels and attainment of the 1-hour ozone NAAQS by 2017. The models' responsiveness to NOx reductions indicates that the photochemical system in the SJV is NOx-limited now, or very soon will be.

5.1 ROG vs. NOx Sensitivity Based on Weekday vs. Weekend Ozone

The Ozone Weekend Effect (WE) is a well-known phenomenon in some major urbanized areas where emissions of ozone precursors are substantially lower on weekends than on weekdays, but measured levels of ozone are significantly higher on weekends than on weekdays. Though common, the WE is not the same in all urban areas of the state.

The WE has been viewed by some as a demonstration that NOx reductions can cause ozone disbenefits – higher not lower ozone levels – if not coupled with concurrent ROG reductions. If interpreted in this way, the analysis presented in Table 2 would indicate that future NOx reductions in the SJV should be beneficial in reducing ozone levels.

Table 2 presents the average WE based on daily maximum 8-hour ozone at six sites in the Central sub-region and six sites in the Southern sub-region of the SJV. The results are pertinent to the WE for daily maximum 1-hour ozone, which closely tracks the 8-hour maximum as illustrated in Figure 10 (Edison) and Figure 11 (Fresno – 1st Street) shown earlier. The sub-regional averages and site-by-site results are shown in the table for three five-year periods – 1996 to 2000, 2001 to 2005, and 2006 to 2010. For the five-year period from 2006 – 2010, the WE for daily maximum 8-hour ozone averaged <1% in both the Central and Southern sub-regions of the SJV.

Another interesting feature of the results in Table 2 is the WE sequence across the three periods. In the Central sub-region, the decrease went from 9.0 ppb to 4.3 ppb to 0.8 ppb, and in the Southern sub-region the decrease went from 2.7 ppb to 3.5 ppb to 0.0 ppb. These patterns suggest that the decreasing WE is linked to the declining ambient NOx trends shown in Figure 16 and Figure 17. The methodology used in the analysis of the WE is further described in Appendix G-3.

The WE for 1-hour ozone was also analyzed by the District using a different methodology, and they similarly conclude that weekend ozone is not elevated with respect to weekday ozone at this time.

Table 2. Site-by-Site and Regional "Ozone Weekend Effects" (%)* in the Central and Southern Sub-regions of the SJV

Sub-region and Site	1996 to 2000	2001 to 2005	2006 to 2010
SJV – Central			
Clovis	8.8	3.0	1.0
Fresno – Drummond	14.4	6.1	2.4
Fresno – First Street	9.9	4.1	0.5
Fresno – Sierra Sky Park #2	9.6	3.6	-0.4
Parlier	3.6	1.3	-0.7
Visalia	7.7	7.8	2.1
Average for SJV Central	**9.0**	**4.3**	**0.8**
SJV – South			
Arvin – Bear Mtn. Road	0.7	1.4	-3.5
Bakersfield – CA Avenue	2.3	3.7	0.4
Bakersfield – Golden St. Hwy.	10.1	7.9	4.0
Edison	3.8	3.5	-1.1
Maricopa	-1.9	1.5	-0.8
Oildale	1.1	2.9	1.0
Average for SJV South	**2.7**	**3.5**	**0.0**

* (Weekend avg. - Weekday avg.) / Weekday avg. as % change + or -). A positive value means the average Weekend ozone was that % higher with respect to the average Weekday ozone.

6 Modeling Results

This section presents additional modeling results that corroborate what was presented in Chapter 2 of the *2013 Plan for the Revoked 1-hour Ozone Standard*. Multiple modeling metrics were evaluated to determine whether the Valley would attain by 2017. These metrics are briefly described below and in more detail in the Appendix E of *2013 Plan for the Revoked 1-hour Ozone Standard*.

Modeling results began to be used in a relative sense (using Relative Response Factors or RRFs) in the context of the 8-hour ozone standard. Until then, modeling results were used in a direct or deterministic sense, mainly because computing resources were sufficient to simulate very few episodes (one in most cases). From these simulations, a limited number of days were used to determine future-year attainment. For this 1-hour ozone plan, the simulations covered a 5-month period (May-September 2017) of ozone concentrations.

6.1 Single RRF Approach

The first approach was to use the model in a relative sense following the procedure in the 8-hour ozone modeling guidance. Accordingly, a single average RRF was calculated for each site in Table 3, and the 2005-2007 DV was multiplied by that RRF. One modification to the procedure was to use the values simulated in the grid cell containing the monitoring site to calculate RRF, instead of using the maximum value within a radius of 15 km.

The DVs based on the single average RRF approach are shown in the third column (DV-Single (2015-2017)) in Table 3. These future DVs are below the standard for all stations. Therefore, based on a single RRF for each site, the standard will be met at all sites in 2017.

6.2 Comparison of Single vs. Band RRF

The second metric is based on the recognition that higher ozone concentrations are generally more responsive than lower ozone concentrations to the control of precursors. Band RRFs, described in Chapter 2 of the *2013 Plan for the Revoked 1-hour Ozone Standard*, allow this concept to be incorporated in an attainment demonstration. The fourth column of Table 3 lists the DVs calculated using band RRFs.

As described in Chapter 2 of the *2013 Plan for the Revoked 1-hour Ozone Standard*, the top 10 observed ozone concentrations during the 2005-2007 base-case period were projected to 2017 using band RRFs. The fourth highest future value was then selected as the future DV. This is the value that was compared against the standard (124.0 ppb in this case). The other projected values were also compared to the standard, and the results are given in Table 4, which shows that the top 10 values for each site are all projected to be at or below the standard in 2017 with the exception of one value at Edison using the single RRF approach. As demonstrated in this section, the two different attainment tests indicate that all monitoring sites in the Valley will attain the 1-hour ozone standard by 2017.

Table 3. Design Values (in ppb) in 2007 and 2017 for Monitoring Sites in the SJV

Monitoring Station	**DV (2005-07)**	**DV-Single (2015-17)**	**DV-Band (2015-17)**
Edison	135	120	119
Arvin-Bear_Mountain_Blvd	131	113	107
Fresno-1st_Street	130	117	103
Clovis-N_Villa_Avenue	125	111	104
Fresno-Sierra_Skypark_#2	124	110	98
Parlier	121	105	97
Sequoia_and_Kings_Canyon	119	102	102
Bakersfield-5558_Califor	117	102	98
Sequoia_Natl_Park-Lower	113	98	98
Visalia-N_Church_Street	112	96	94
Oildale-3311_Manor_Stree	112	97	95
Fresno-Drummond_Street	110	99	93
Hanford-S_Irwin_Street	110	98	92
Modesto-14th_Street	109	102	95
Bakersfield-Golden	108	97	96
Shafter-Walker_Street	105	92	87
Turlock-S_Minaret_Street	104	95	91
Merced-S_Coffee_Avenue	102	90	85
Stockton-Hazelton_St	101	92	86
Maricopa-Stanislaus_Stre	100	88	83
Madera-Pump_Yard	95	84	82

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

Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Arvin-Bear_Mountain	8/28/2006	135	0.82	110	0.86	116
	6/23/2006	134	0.82	109	0.86	115
	7/18/2005	133	0.82	109	0.86	114
	9/12/2006	131	0.82	107	0.86	113
	7/27/2005	131	0.82	107	0.86	113
	9/5/2006	130	0.82	106	0.86	112
	6/24/2006	130	0.82	106	0.86	112
	5/11/2006	130	0.82	106	0.86	112
	9/13/2006	129	0.82	105	0.86	111
	9/1/2005	129	0.82	105	0.86	111
Bakersfield-5558_Cal	9/13/2006	123	0.84	103	0.87	107
	6/23/2006	120	0.84	100	0.87	104
	8/6/2005	117	0.84	98	0.87	102
	7/5/2007	117	0.84	98	0.87	102
	6/24/2006	117	0.84	98	0.87	102
	9/12/2006	115	0.84	96	0.87	100
	6/22/2006	113	0.84	94	0.87	98
	5/11/2006	112	0.84	93	0.87	97
	8/23/2006	111	0.84	93	0.87	96
	9/29/2006	110	0.84	92	0.87	95
Bakersfield-Golden	7/5/2007	127	0.84	106	0.9	114
	7/17/2005	110	0.89	98	0.9	99
	9/13/2006	108	0.89	96	0.9	97
	6/23/2006	108	0.89	96	0.9	97
	8/6/2005	105	0.89	93	0.9	94
	9/6/2006	103	0.89	91	0.9	93
	8/23/2006	103	0.89	91	0.9	93
	9/12/2006	102	0.9	92	0.9	92
	7/9/2006	102	0.9	92	0.9	92
	7/14/2006	101	0.9	91	0.9	91

Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Clovis-N_Villa_Avenue	9/2/2006	127	0.83	105	0.9	113
	8/27/2005	127	0.83	105	0.9	113
	7/27/2005	127	0.83	105	0.9	113
	7/20/2006	125	0.83	104	0.9	111
	9/6/2007	121	0.83	100	0.9	108
	7/16/2005	117	0.85	99	0.9	104
	6/24/2006	116	0.85	98	0.9	103
	8/10/2006	115	0.85	97	0.9	102
	7/15/2005	115	0.85	97	0.9	102
	9/3/2005	114	0.85	96	0.9	102
Edison	8/28/2006	141	0.88	124	0.9	126
	7/5/2007	138	0.88	122	0.9	123
	6/26/2006	135	0.88	119	0.9	120
	6/24/2006	135	0.88	119	0.9	120
	6/23/2006	134	0.88	118	0.9	119
	8/22/2006	130	0.88	114	0.9	116
	9/6/2006	129	0.88	114	0.9	115
	7/21/2006	129	0.88	114	0.9	115
	9/5/2006	126	0.89	112	0.9	112
	9/13/2006	125	0.89	111	0.9	111
Fresno-1st_Street	6/24/2006	138	0.77	106	0.9	124
	7/27/2005	134	0.8	106	0.9	121
	7/15/2005	131	0.8	104	0.9	118
	7/15/2006	130	0.8	103	0.9	117
	7/16/2005	128	0.8	102	0.9	115
	7/20/2006	127	0.8	101	0.9	114
	6/23/2006	126	0.8	100	0.9	113
	7/26/2006	124	0.8	99	0.9	112
	7/16/2006	123	0.8	98	0.9	111
	7/17/2005	122	0.8	97	0.9	110
Fresno-Drummond_Stre	6/23/2006	121	0.83	100	0.9	109
	7/15/2005	119	0.83	98	0.9	107
	7/20/2006	114	0.84	96	0.9	102
	9/6/2007	110	0.84	93	0.9	99
	7/27/2005	108	0.84	91	0.9	97
	6/24/2006	106	0.87	92	0.9	95
	8/6/2005	105	0.87	91	0.9	94
	7/16/2005	105	0.87	91	0.9	94
	7/24/2005	103	0.87	89	0.9	92
	7/1/2005	103	0.87	89	0.9	92

Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Fresno-Sierra_Skypar	9/2/2005	129	0.78	101	0.89	114
	6/23/2006	129	0.78	101	0.89	114
	7/15/2005	126	0.78	98	0.89	111
	6/24/2006	124	0.78	97	0.89	110
	7/20/2006	123	0.81	99	0.89	109
	7/13/2005	116	0.81	93	0.89	103
	7/16/2005	114	0.81	92	0.89	101
	8/6/2005	112	0.81	90	0.89	99
	9/22/2005	111	0.81	89	0.89	98
	7/27/2005	111	0.81	89	0.89	98
Hanford-S_Irwin_Stre	6/23/2006	127	0.83	105	0.89	113
	7/15/2005	120	0.84	101	0.89	107
	9/2/2005	112	0.84	94	0.89	99
	7/27/2005	110	0.84	92	0.89	98
	7/22/2006	110	0.84	92	0.89	98
	8/6/2005	105	0.87	91	0.89	93
	7/6/2007	102	0.87	88	0.89	91
	9/30/2005	101	0.87	87	0.89	90
	7/5/2007	100	0.87	86	0.89	89
	7/26/2006	99	0.87	85	0.89	88
Madera-Pump_Yard	6/23/2006	113	0.85	95	0.89	100
	6/24/2006	105	0.85	89	0.89	93
	7/10/2006	101	0.85	85	0.89	89
	9/12/2006	95	0.87	82	0.89	84
	9/2/2005	95	0.87	82	0.89	84
	9/7/2006	94	0.87	81	0.89	83
	7/26/2005	92	0.87	79	0.89	81
	7/20/2006	92	0.87	79	0.89	81
	7/6/2007	91	0.87	78	0.89	80
	6/22/2006	91	0.87	78	0.89	80
Maricopa-Stanislaus_	6/24/2006	104	0.83	86	0.88	91
	7/27/2005	102	0.83	85	0.88	89
	6/23/2006	101	0.83	84	0.88	89
	7/15/2005	100	0.83	83	0.88	88
	9/29/2006	98	0.83	81	0.88	86
	7/28/2005	98	0.83	81	0.88	86
	10/1/2005	97	0.83	81	0.88	85
	9/7/2007	97	0.83	81	0.88	85
	9/1/2005	97	0.83	81	0.88	85
	7/16/2005	97	0.83	81	0.88	85

Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Merced-S_Coffee_Aven	7/5/2007	105	0.85	89	0.9	94
	7/6/2007	103	0.85	89	0.9	92
	7/21/2006	102	0.85	87	0.9	91
	9/6/2007	100	0.85	85	0.9	90
	7/14/2005	100	0.85	85	0.9	90
	6/19/2007	99	0.85	84	0.9	89
	8/12/2005	98	0.85	83	0.9	88
	7/20/2006	98	0.85	83	0.9	88
	6/30/2005	98	0.85	83	0.9	88
	7/19/2006	97	0.85	82	0.9	87
Modesto-14th_Street	7/21/2006	120	0.86	103	0.94	112
	7/26/2005	115	0.86	98	0.94	107
	8/10/2006	113	0.86	97	0.94	105
	7/16/2005	109	0.88	95	0.94	102
	6/24/2006	108	0.88	95	0.94	101
	6/30/2005	107	0.88	94	0.94	100
	7/26/2006	106	0.88	93	0.94	99
	7/18/2006	105	0.88	92	0.94	98
	7/14/2005	105	0.88	92	0.94	98
	8/23/2005	103	0.88	90	0.94	96
Oildale-3311_Manor_S	9/13/2006	118	0.85	100	0.87	103
	9/6/2006	117	0.85	99	0.87	102
	6/23/2006	114	0.85	96	0.87	99
	7/14/2006	112	0.85	95	0.87	97
	7/5/2007	112	0.85	95	0.87	97
	7/22/2006	110	0.86	94	0.87	96
	6/24/2006	110	0.86	94	0.87	96
	8/23/2006	109	0.86	93	0.87	95
	7/16/2005	109	0.86	93	0.87	95
	9/12/2006	108	0.86	92	0.87	94
Parlier	6/23/2006	131	0.79	103	0.87	114
	7/27/2005	125	0.79	98	0.87	109
	7/16/2005	124	0.79	98	0.87	108
	9/13/2006	121	0.81	97	0.87	105
	7/19/2006	121	0.81	97	0.87	105
	6/24/2006	121	0.81	97	0.87	105
	7/8/2006	120	0.81	96	0.87	104
	7/26/2006	119	0.81	95	0.87	104
	9/2/2006	118	0.81	95	0.87	103
	7/16/2006	118	0.81	95	0.87	103

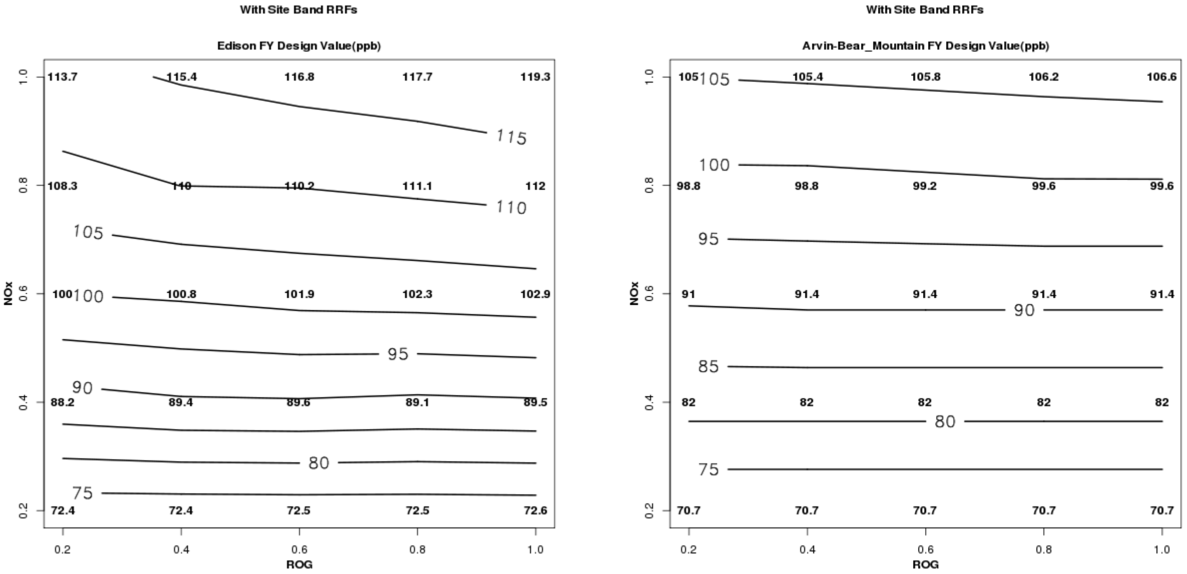
Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Sequoia_and_Kings_C	7/16/2005	127	0.87	110	0.87	110
	7/19/2005	123	0.87	106	0.87	107
	7/18/2005	119	0.87	103	0.87	103
	9/13/2006	118	0.87	102	0.87	102
	6/21/2006	117	0.86	100	0.87	101
	8/23/2006	116	0.86	100	0.87	100
	7/19/2006	116	0.86	100	0.87	100
	7/4/2007	116	0.86	100	0.87	100
	6/13/2007	116	0.86	100	0.87	100
	9/7/2007	114	0.86	98	0.87	99
Sequoia_Natl_Park-Lo	7/16/2005	119	0.87	103	0.87	103
	7/18/2005	115	0.87	100	0.87	100
	6/24/2006	115	0.87	100	0.87	100
	6/23/2006	113	0.87	98	0.87	98
	7/19/2005	112	0.87	97	0.87	97
	7/16/2006	111	0.87	96	0.87	96
	6/21/2006	111	0.87	96	0.87	96
	7/20/2005	109	0.87	94	0.87	94
	6/13/2007	109	0.87	94	0.87	94
	7/21/2005	108	0.87	93	0.87	94
Shafter-Walker_Stre	7/5/2007	111	0.86	95	0.88	97
	6/23/2006	106	0.83	88	0.88	93
	9/13/2006	105	0.83	87	0.88	92
	6/22/2006	105	0.83	87	0.88	92
	7/27/2005	104	0.83	86	0.88	91
	6/14/2005	104	0.83	86	0.88	91
	9/6/2006	103	0.83	86	0.88	90
	7/17/2006	103	0.83	86	0.88	90
	7/20/2006	102	0.83	85	0.88	89
	7/14/2005	101	0.83	84	0.88	89
Stockton-Hazelton_St	7/25/2006	109	0.85	92	0.92	99
	7/21/2006	105	0.85	88	0.92	96
	6/23/2006	102	0.85	86	0.92	93
	7/18/2006	101	0.85	85	0.92	92
	7/4/2005	99	0.87	86	0.92	90
	7/26/2005	97	0.87	84	0.92	88
	7/26/2006	96	0.87	83	0.92	87
	7/13/2005	96	0.87	83	0.92	87
	6/26/2006	95	0.87	82	0.92	87
	7/16/2006	94	0.87	82	0.92	86

Site	Date	Obs	Band RRF	Band RRF 2017 DV	Single RRF	Single RRF 2017 DV
Turlock-S_Minaret_St	7/21/2006	113	0.88	99	0.92	103
	6/24/2006	111	0.88	97	0.92	101
	6/23/2006	106	0.88	93	0.92	97
	7/22/2006	104	0.88	91	0.92	95
	7/25/2006	103	0.88	90	0.92	94
	7/20/2006	103	0.88	90	0.92	94
	7/19/2006	103	0.88	90	0.92	94
	7/26/2006	102	0.88	90	0.92	93
	6/25/2006	102	0.88	90	0.92	93
	7/6/2007	101	0.88	89	0.92	92
Visalia-N_Church_Str	7/27/2005	117	0.84	98	0.86	101
	7/8/2006	116	0.84	97	0.86	100
	7/16/2005	114	0.84	96	0.86	98
	7/15/2005	112	0.84	94	0.86	96
	7/9/2006	112	0.84	94	0.86	96
	8/11/2006	110	0.84	92	0.86	94
	7/16/2006	110	0.84	92	0.86	94
	10/1/2005	109	0.84	92	0.86	94
	7/24/2006	109	0.84	92	0.86	94
	6/14/2005	109	0.84	92	0.86	94

6.3 Carrying Capacity Diagrams

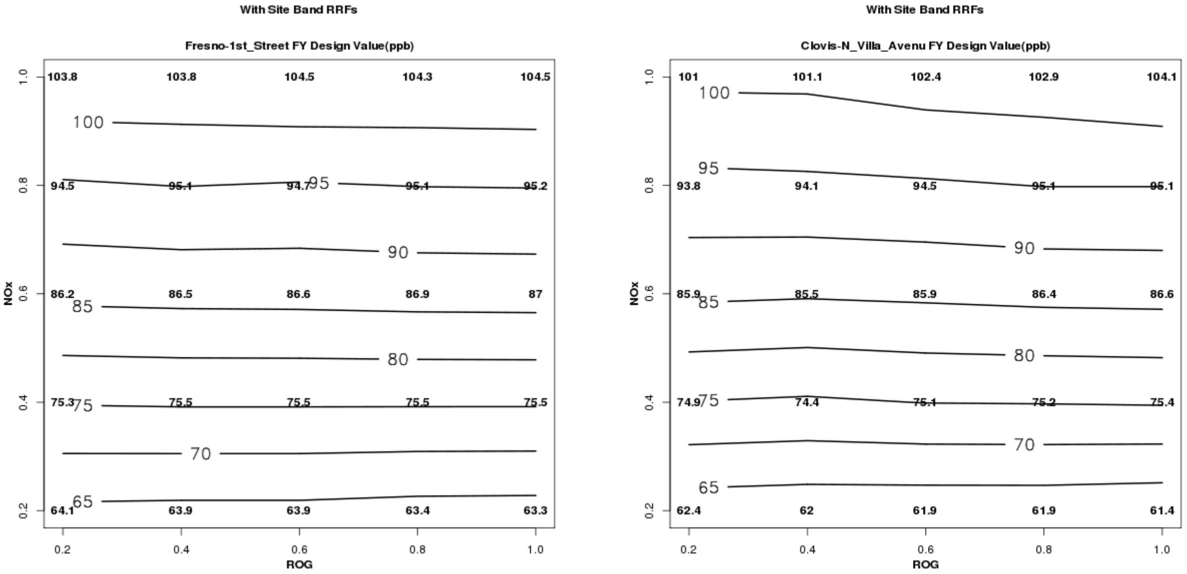
This section presents 2017 carrying capacity diagrams (Figure 23) for the sites listed in **Table 3**. Each plot shows the domain-wide anthropogenic ROG (x-axis) and NOx (y-axis) emissions in 2017 as fractions of the 2007 emissions. It is assumed that biogenic ROG remained constant between 2007 and 2017. Band-RRFs (see Chapter 2 of the *2013 Plan for the Revoked 1-hour Ozone Standard*) were applied to each fractional ROG and NOx combination on the diagram to calculate the future DV for that point. The top right point on each diagram is the projected DV for the attainment demonstration. The isopleths in the diagrams show that future ozone concentrations throughout the SJV are predicted to be strongly sensitive to NOx reductions and negligibly sensitive to ROG reductions.

Figure 23. ROG and NOx Carrying Capacity in 2017 for Sites in the SJV



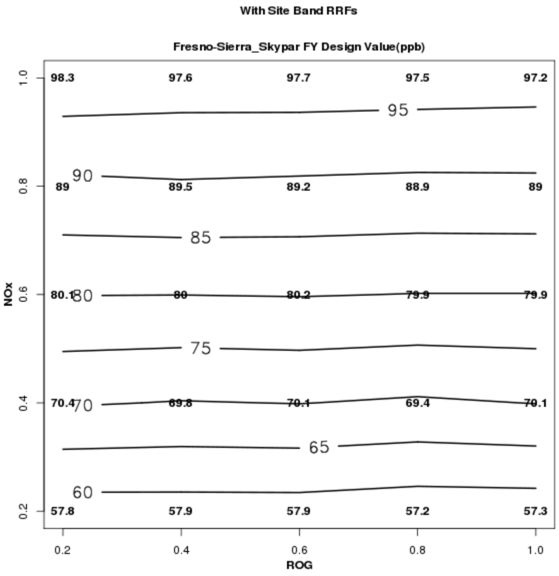
Edison

Arvin – Bear Mountain Blvd

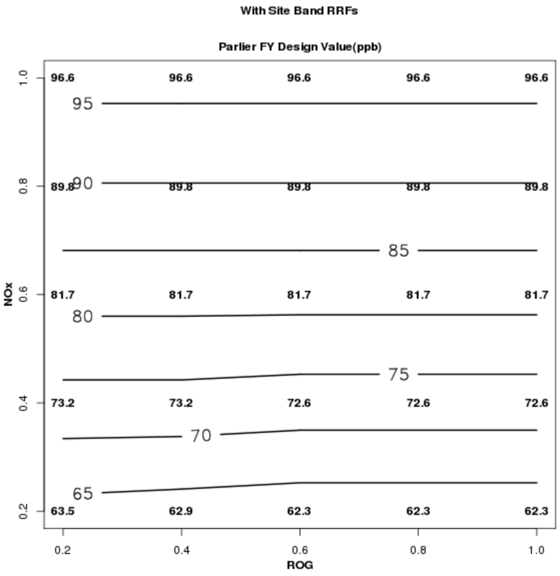


Fresno – 1st Street

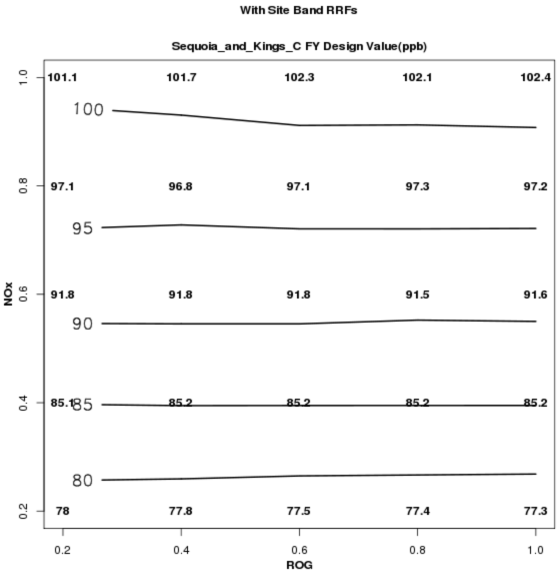
Clovis – North Villa Avenue



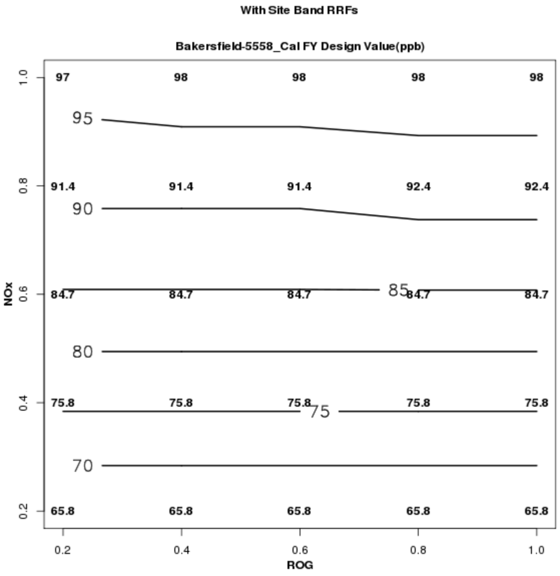
Fresno – Sierra Skypark



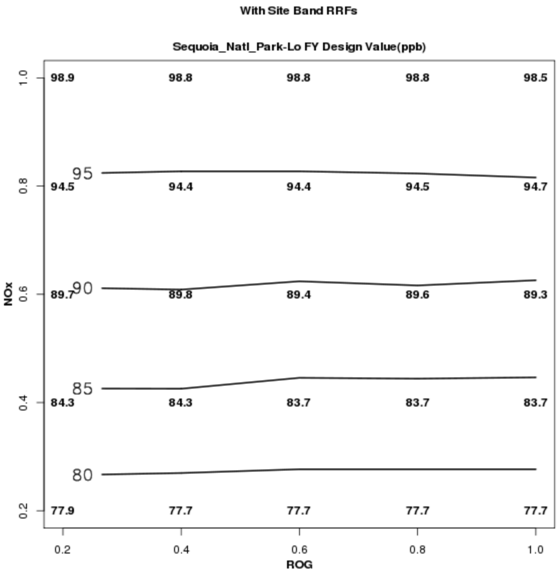
Parlier



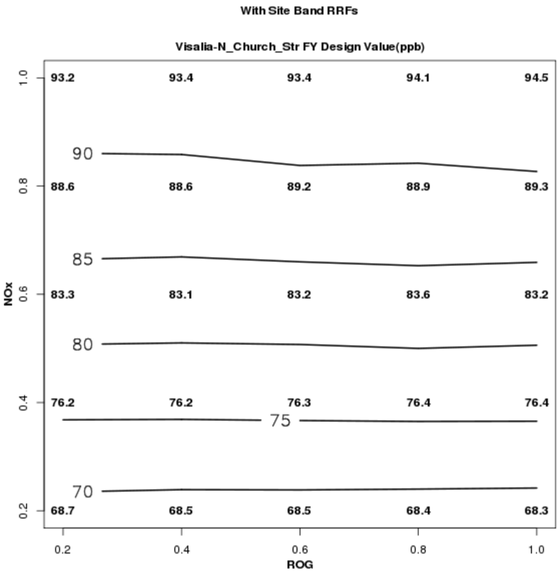
Sequoia and Kings Canyon



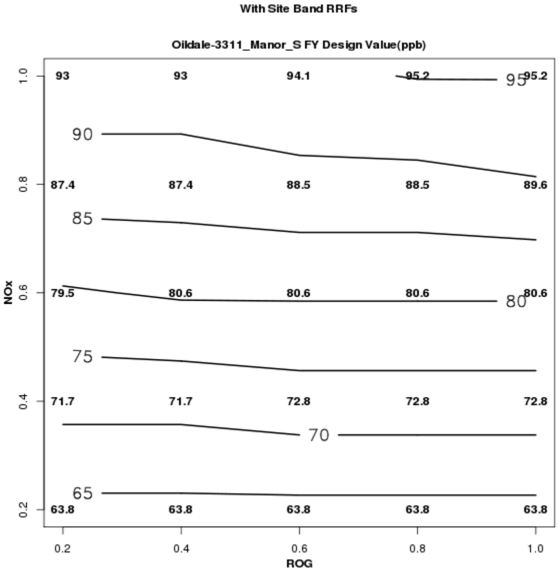
Bakersfield – California Avenue



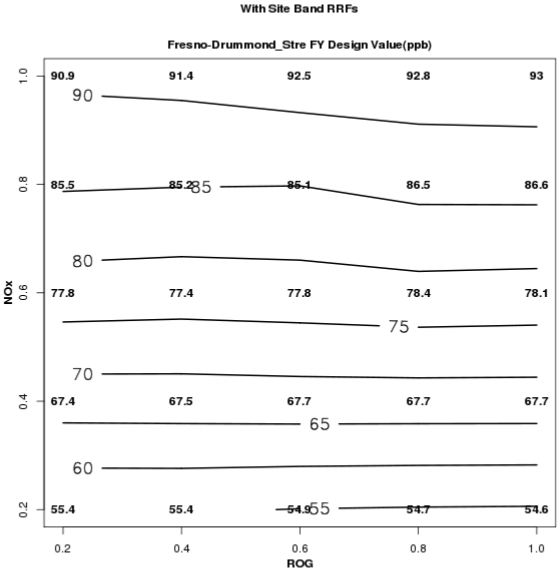
Sequoia Natl Park – Lower Kaweah



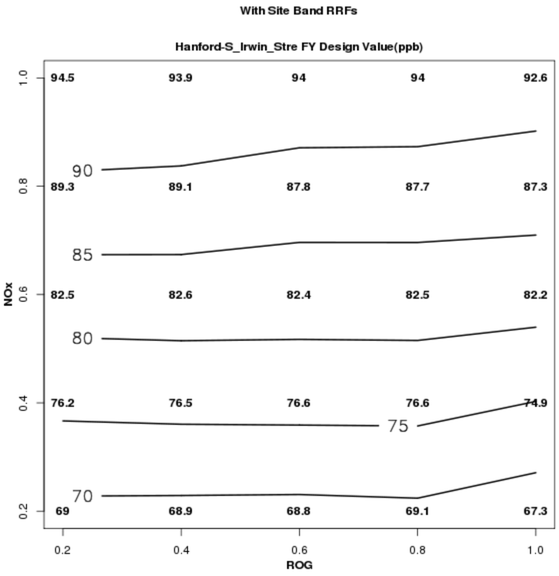
Visalia – North Church Street



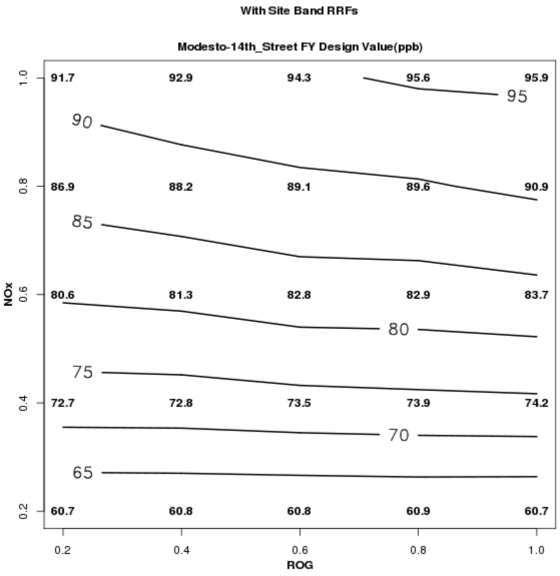
Oildale – Manor Street



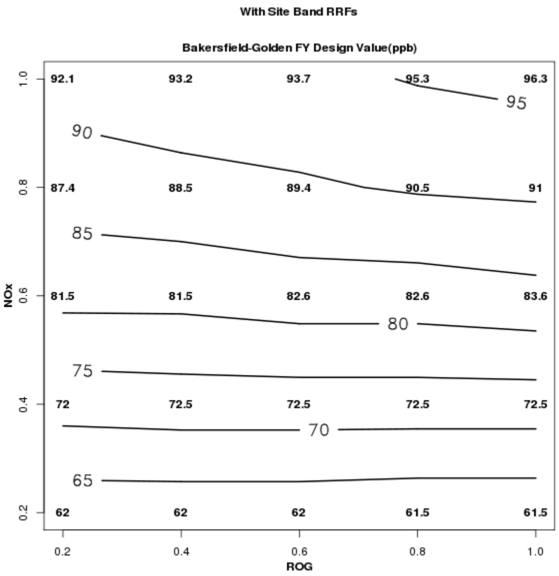
Fresno – Drummond Street



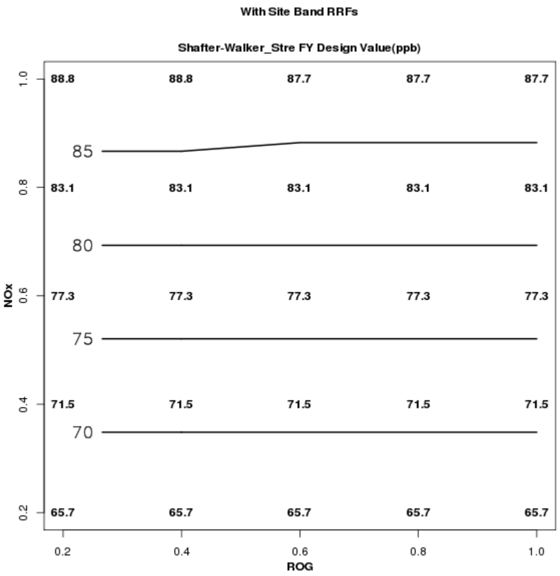
Hanford – S. Irwin Street



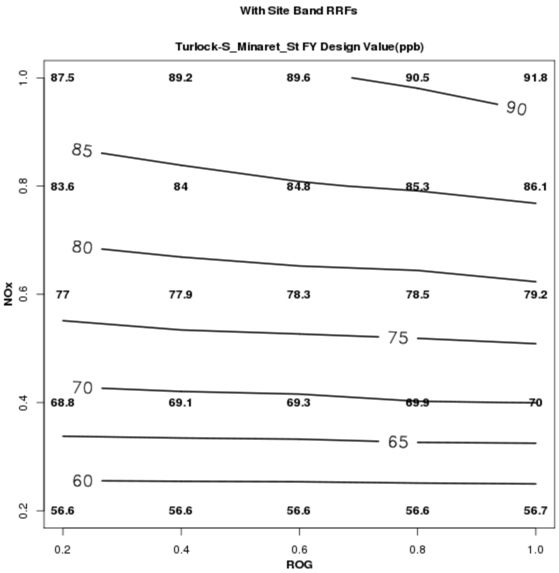
Modesto – 14th Street



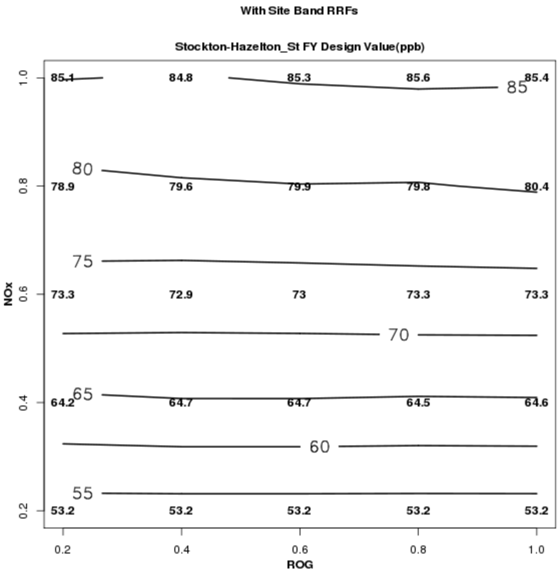
Bakersfield – Golden State Highway



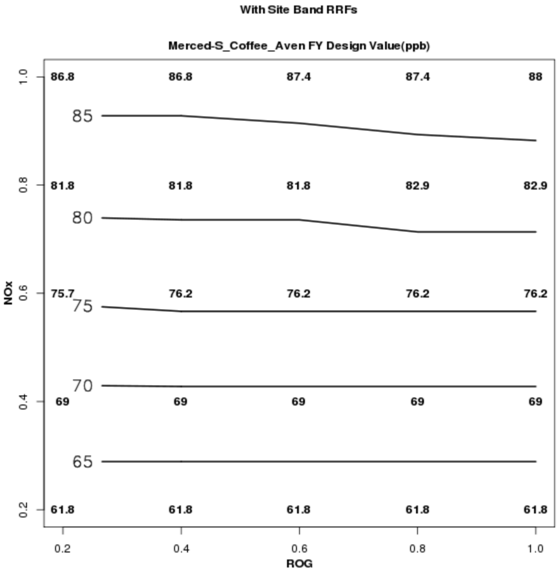
Shafter – Walker Street



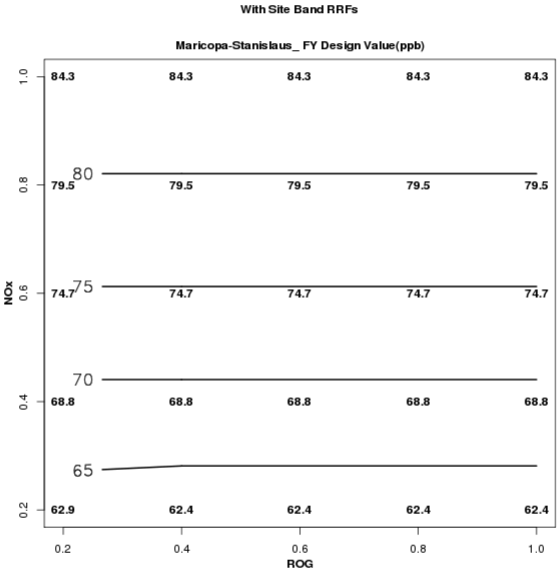
Turlock – S. Minaret Street



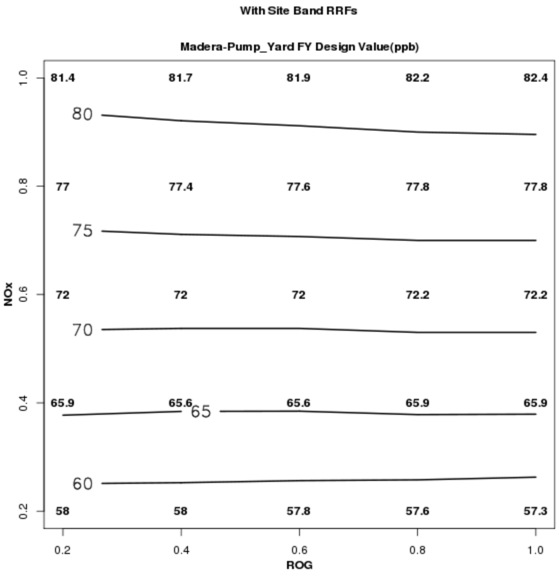
Stockton – Hazelton Street



Merced – S. Coffee Avenue



Maricopa – Stanislaus Street



Madera – Pump Yard

7 Summary

The San Joaquin Valley is nearing attainment of the 1-hour ozone standard. An attainment demonstration based on photochemical simulation modeling and corroborating analyses of ambient air quality and emissions data combine to establish a WOE demonstration that the SJV is predicted to attain the standard by 2017.

Trends for multiple indicators of ozone air quality have shown progress in the SJV, with a decrease in the basin-wide DV of 20% since 1995, and greater than 90% reduction in Exceedance Days. Today, only three sites have DVs above the standard, and these sites have recorded three or fewer exceedances in the last few years.

Of the remaining sites still above the standard, there has been some indication of a plateau in ozone concentrations over the last few years in the Fresno region. Ozone trends in the SJV have included periodic plateaus in the past, embedded within a longer term trend of overall decreases in ozone. These plateaus can occur due to year to year variability in weather conditions, as well the incremental pace of emission reductions in different ozone precursors.

Evaluation of a number of air quality and emissions indicators, however, suggests that ozone levels in the Valley should become increasingly responsive to the NOx reductions that will be occurring between now and 2017. Between 2007 and 2017, NOx reductions are set to decline steadily for a total reduction of more than 50%.

The air quality modeling was evaluated using several different approaches to estimate future 1-hour ozone DVs. Both the single RRF and band RRF approaches predict that the highest basin-wide DV in 2017 will be below the 1-hour standard. The results of modeling carrying capacity diagrams also indicate that ozone in the SJV is NOx-limited, and thus the continuing NOx reductions from ARB and District control programs will be the most important contributor to achieving the 1-hour ozone standard in the SJV.

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Appendix G-1: Methodology Used to Impute Values for Missing Data

INTRODUCTION

The State Implementation Plan for the 1-hour Ozone NAAQS in the San Joaquin Valley Air Basin included a Weight-of-Evidence Analysis that depended in part on imputed values that replaced missing data.

Two key analyses for which imputed data were used are:

1. Estimation of the 2011 design value for the Arvin – Bear Mountain monitoring site, where three months of the 2011 ozone season were missing, and
2. Preparation of met-adjusted ozone trends from 1996 – 2011, where large amounts of missing data for ozone and for several meteorological parameters were imputed.

The performance of the I-Bot method for ozone at Arvin – Bear Mtn. is shown graphically at the end of this document.

The imputation methodology was developed by ARB staff and subjected to expert external review. A limited discussion of the method is given here, and a manuscript for publication is in preparation at this time.

What methodology was used to produce "imputed" values?

ARB staff developed a method of imputing values, called I-Bot, that is tailored to the situation where missing data come from a network of environmental monitors.

The I-Bot method has been reviewed by Dr. Robert Harley (UC Berkeley), Dr. David Rocke (UC Davis), and Dr. Charles Blanchard (ENVAIR) who were engaged through Central California Ozone Study funds for this purpose. Their consensus review was positive, and each offered possible improvements, some of which have already been incorporated. All reviewers suggested that the method be published, and a manuscript is in preparation.

What are imputed values and how are they created?

Every data source is imperfect, so some data are almost always missing for any extended period of time. For example, a monitor may begin operating after the start of the period of interest. A monitor, such as the ozone monitor at Arvin – Bear Mtn., may stop operating before the end of the period of interest. A monitor may collect some bad data that QA/QC checks then delete. Additionally, a power outage may cause hours or days of missing data.

Imputed values are estimates of what should have or would have been measured. Imputed values done well can be very valuable. Many imputation methods have been invented to fit different situations.

The I-Bot method is tailored to impute values for missing data in datasets that come from networks of environmental monitors. Because ARB staff uses data from air monitoring networks and from networks of meteorological instruments, a method (I-Bot) suited to these situations was developed.

Why does the I-Bot method work?

Nearby monitors tend to share a common context, such as meteorological conditions and emissions due to the activities of humanity and of nature. Nearby air quality monitors tend to be receptors for emissions from similar source regions. So, readings of a pollutant or a meteorological parameter at nearby monitors tend to be strongly correlated with each other. These connections are often consistent enough to use data from one site to impute accurate values for missing data at another site.

What is the I-Bot method?

The I-Bot system is "context intensive." That is, an imputed value is based on the relationship between highly relevant data at the target site and highly relevant data at nearby sites. Relevance is usually limited to data within a few years of the current date, in the same season of the year, and around the same time-of-day.

Example context for imputing daily max 1-hour ozone at Fresno – 1st Street on August 1, 2010:

- Consider ozone monitoring sites within 50 km of Fresno – 1st Street
- Consider the season from July 18 to August 15 (+/- 14 days)
- Consider +/- 365 days from each day in the season (+/- 1 year)
- So, there are 86 relevant days (3 years x 29 days/year), less one day, as August 1 is treated as missing = 86 days
- These criteria are defined in a "control" file and can be modified at will

For the 86 days, use the "paired" values at Fresno – 1st Street and at each potential "buddy" site to fit the relationship between them (currently done as a simple linear fit). Pick the strongest linear relationship (largest correlation or smallest uncertainty) and use it together with the measured daily max 1-hour ozone at the corresponding buddy site to impute the missing daily max 1-hour ozone at Fresno – 1st Street on August 1, 2010.

To impute the daily max 1-hour ozone at Fresno – 1st Street on the following day (August 2, 2010), the relevant window moves forward one day and the process starts all over again. Insistence on tight context is what makes the I-Bot method unusual. Results show, for example, that the best buddy site for Fresno – 1st Street can change from one day to the next, and different buddy sites may be preferred during different portions of the ozone season.

Safeguards that minimize unreliable imputations are included in several ways through "control" files. A maximum distance is specified for potential buddy sites. A minimum correlation (or maximum uncertainty) is imposed. A minimum number of data pairs (target with buddy site) must be available. If safeguard limits are not met, the system will not report an imputed value.

What does the I-Bot method produce?

For daily imputations, the I-Bot method produces a dataset that includes the information shown in Table 1. Hourly output includes the hour of the record.

Table 1. Key information contained in I-Bot output

```
YEAR   MONTH DAY   OBS    NAME                IMP   SEP  BUD

2003     7    1    0.075  Fresno-1st Street  0.073 0.003 245
2003     7    2    0.09   Fresno-1st Street  0.088 0.003 2
2003     7    3    0.077  Fresno-1st Street  0.071 0.003 2
2003     7    4    0.082  Fresno-1st Street  0.085 0.005 2
2003     7    5    0.087  Fresno-1st Street  0.089 0.005 2
2003     7    6    0.071  Fresno-1st Street  0.07  0.005 2
2003     7    7    0.076  Fresno-1st Street  0.078 0.005 2
2003     7    8    0.081  Fresno-1st Street  0.084 0.005 2
2003     7    9    0.105  Fresno-1st Street  0.103 0.005 2
2003     7    10   0.093  Fresno-1st Street  0.094 0.005 2
2003     7    11   0.091  Fresno-1st Street  0.095 0.005 2
2003     7    12   0.079  Fresno-1st Street  0.082 0.005 2
2003     7    13   0.069  Fresno-1st Street  0.067 0.005 2
2003     7    14   0.096  Fresno-1st Street  0.093 0.005 2
2003     7    15   0.108  Fresno-1st Street  0.123 0.005 246
2003     7    16   0.131  Fresno-1st Street  0.12  0.005 246
2003     7    17   0.105  Fresno-1st Street  0.102 0.005 246
2003     7    18   0.129  Fresno-1st Street  0.117 0.004 246
2003     7    19   0.082  Fresno-1st Street  0.075 0.005 246
2003     7    20   0.102  Fresno-1st Street  0.102 0.005 246
2003     7    21   0.116  Fresno-1st Street  0.114 0.005 246
2003     7    22   0.107  Fresno-1st Street  0.108 0.005 246
2003     7    23   0.095  Fresno-1st Street  0.093 0.005 246
2003     7    24   0.094  Fresno-1st Street  0.099 0.005 246
2003     7    25   0.094  Fresno-1st Street  0.094 0.005 246
2003     7    26   0.095  Fresno-1st Street  0.1   0.005 246
2003     7    27   0.091  Fresno-1st Street  0.093 0.005 246
2003     7    28   0.098  Fresno-1st Street  0.096 0.005 246
2003     7    29   0.127  Fresno-1st Street  0.128 0.005 246
2003     7    30   0.096  Fresno-1st Street  0.096 0.004 246
2003     7    31   0.078  Fresno-1st Street  0.074 0.006 157
```

```
OBS = observed daily max 1-hour ozone
IMP = imputed daily max 1-hour ozone
SEP = uncertainty (standard error of prediction)
BUD = Index that identifies the “buddy” site used to determine IMP
```

The buddy sites and their distances from Fresno – 1st Street are Fresno – Drummond (#2, 9.0 km), Clovis (#157, 6.6 km), Fresno – Fremont School (#245, 5.1 km), and

Fresno – Mobile (#246, 2.4 km). The I-Bot method automatically selects the best available buddy site. Though more distant, Fresno – Drummond was often selected. On July 31, 2003, both Fresno – Drummond and Fresno – Mobile were missing data and could not be used, and Clovis was selected as the best available buddy site.

How well does the I-Bot method work?

The "standard error of prediction" (SEP) values in Table 1 quantify the uncertainty of the imputed values (IMP) based on the statistical modeling. When SEP is divided by IMP, the result is a type of coefficient of variation (CV). Using this CV approach, the relative uncertainty of the imputed values in the table ranges from ~2% to ~6%. The high values tend to be imputed with relatively greater accuracy (~2.5%) compared to the accuracy of the low values (~4.3%).

Taking the measured values (OBS) as a "gold standard", relative errors can be calculated as (IMP – OBS) / OBS. Using this approach, the imputed values in the table above have relative errors from -6% to +10%. The highest 10 observed values were under-predicted on average by 1.1%, while the middle 10 observed values were over-predicted on average by 1.1%.

Comparisons of observed and imputed values are shown in **Figure 24**and **Figure 25**. **Figure 24** presents observed and imputed values for daily maximum 1-hour ozone at Fresno – 1st Street for 2011. **Figure 25** presents observed and imputed values for daily maximum 1-hour ozone at Arvin – Bear Mountain for May – October 2010.

An unusual benefit of the I-Bot method is seen when entire years of data are treated as missing, values are imputed, and the actual and imputed data are compared to the imputed values. This type of evaluation has been done for a variety of pollutants and meteorological parameters, with largely satisfying results.

Weight-of-Evidence analysis for 1-hour and 8-hour ozone in the San Joaquin Valley, have benefited from the use of imputed values that have filled large gaps in the records for some long-term sites, such as Hanford (2008 and 2009) and Arvin – Bear Mountain (2011 and 2012).

Figure 24. Observed and Imputed Values for Daily Max. 1-Hour Ozone at Fresno – 1st Street in 2011 (Open circle = observed and Dot = imputed).

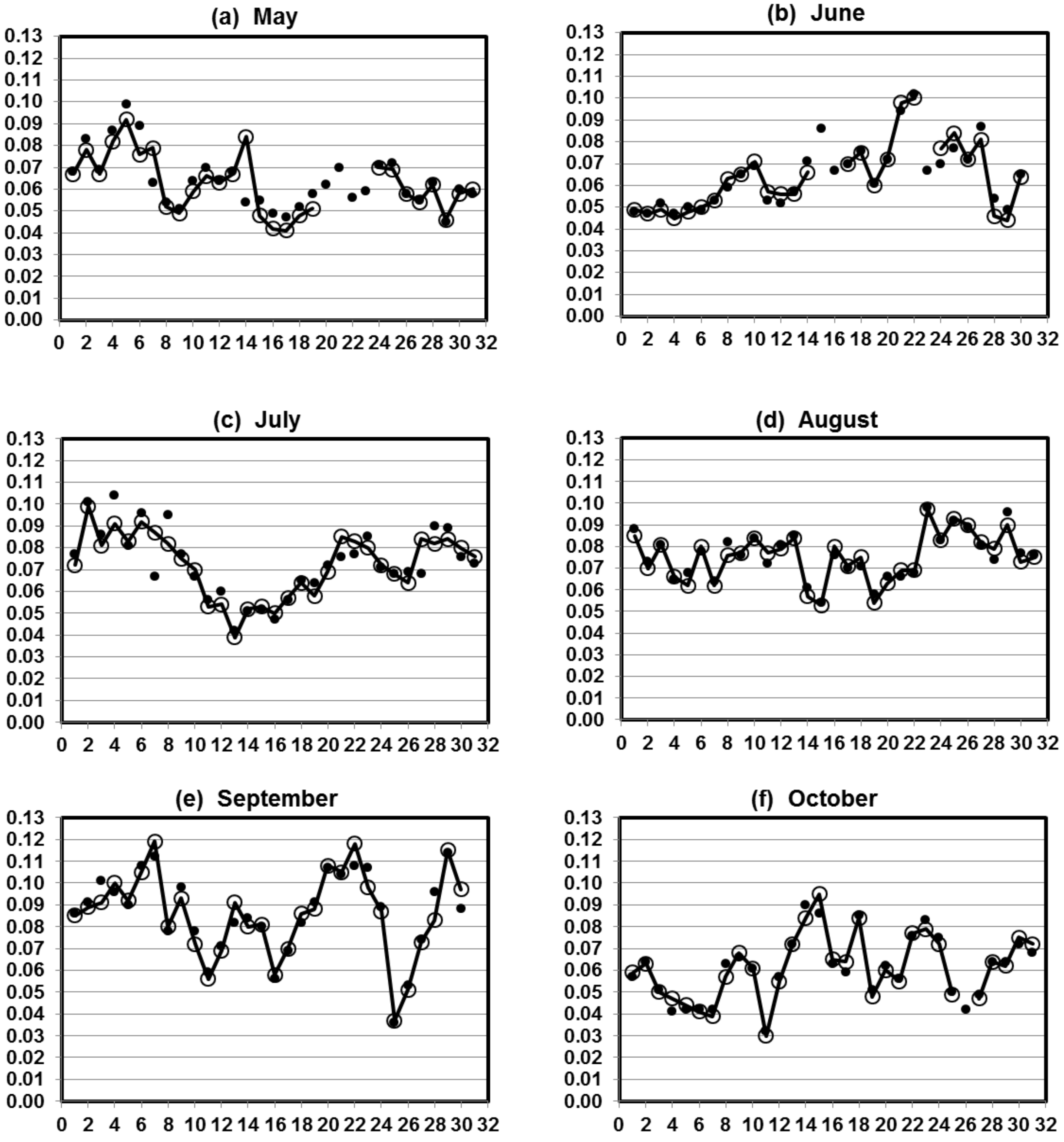
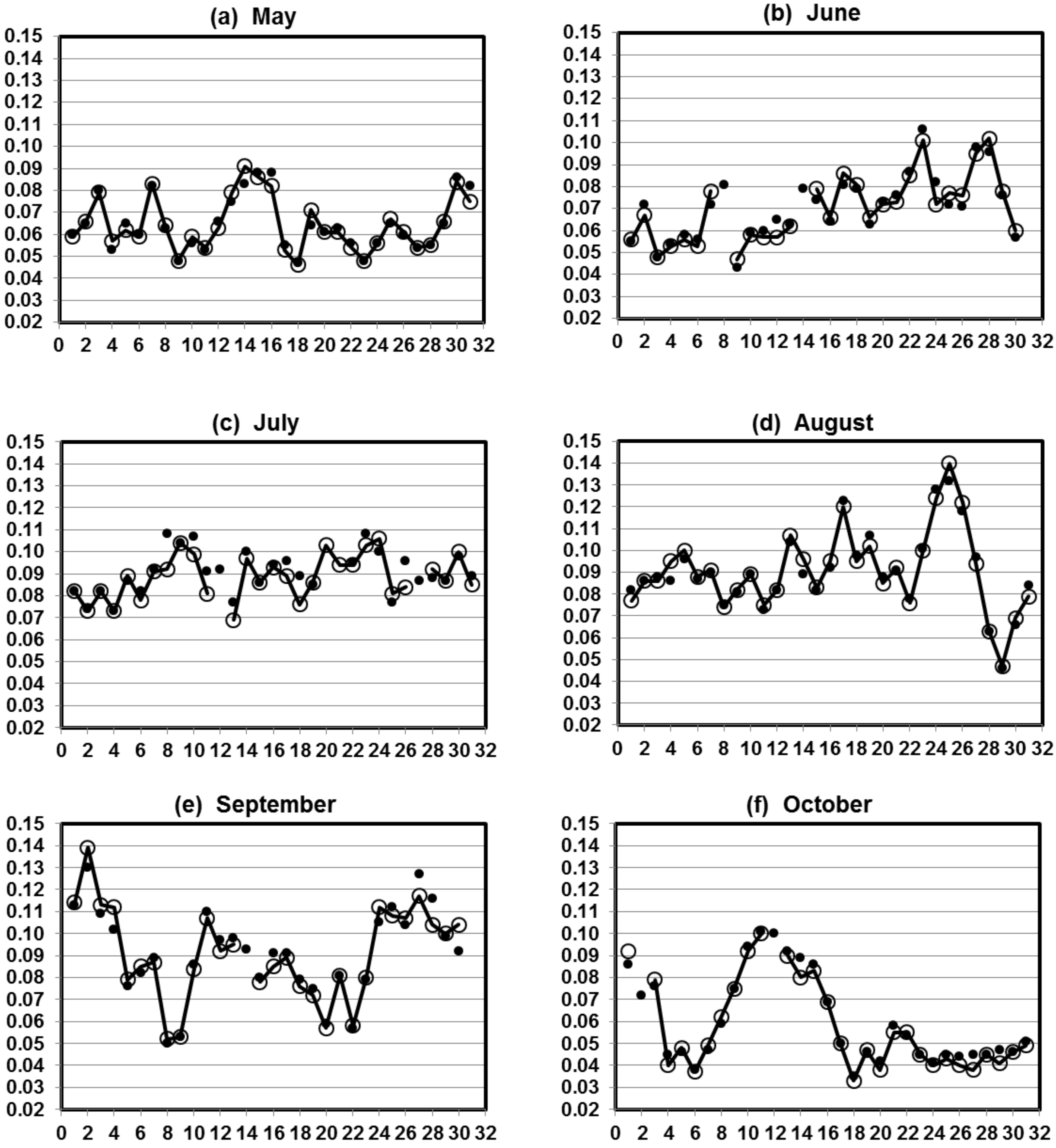


Figure 25. Observed and Imputed Values for Daily Max. 1-Hour Ozone at Arvin – Bear Mountain in 2010 (Open circle = observed and Dot = imputed).



Appendix G-2:
Methodology Used to Prepare Meteorologically Adjusted Ozone Trends for the San Joaquin Valley

Introduction

What methodology was used to prepare met-adjusted trends?

Air quality trends that are adjusted to reduce the effects of meteorology as much as possible can be very valuable. When adjusted trends are similar to raw trends, they indicate that the raw trends are likely to reflect changes in emissions. When adjusted and raw trends differ markedly, however, they indicate that the raw trends are affected by both emissions and weather, in which case the adjusted trends are likely to be the better measure of emissions effects.

The effects of meteorological conditions on ozone forming potential (OFP) can be quantified with a wide variety of statistical methods. ARB is an active participant in testing and developing such methods in California. For this work, OFP was quantified in the Central and Southern sub-regions of the SJV using “multiple regression” models. Because OFP does not respond to meteorological parameters the same way for each month of the May through October ozone season, a separate model was prepared for each month. The combined explanatory power (R^2) of the models-in-months approach is shown in Figure 1 for the Central sub-region and in Figure 2 for the Southern sub-region.

The models-in-months were built using the regression procedure (PROC REG) in SAS statistical software. Six meteorological and day-of-week parameters (T850AM, ST_mid6, stability_PM, wsinv, WD, and Sun) from those listed in Table 2 were used in a stepwise model building process for each month. The following control language is an example for fitting models to the data for 2005 – 2007:

```
proc reg data=sjvc_reg_dataset;
  model sjvc = T850AM ST_mid6 stability_PM WD Sun wsinv /
      selection = stepwise maxstep = 12 sle = 0.25 sls = 0.25;
  by month;
  weight w0507;
  output out=sjvc_reg_dataset
        p=pred_wt0507;
run;
```

Figure 26

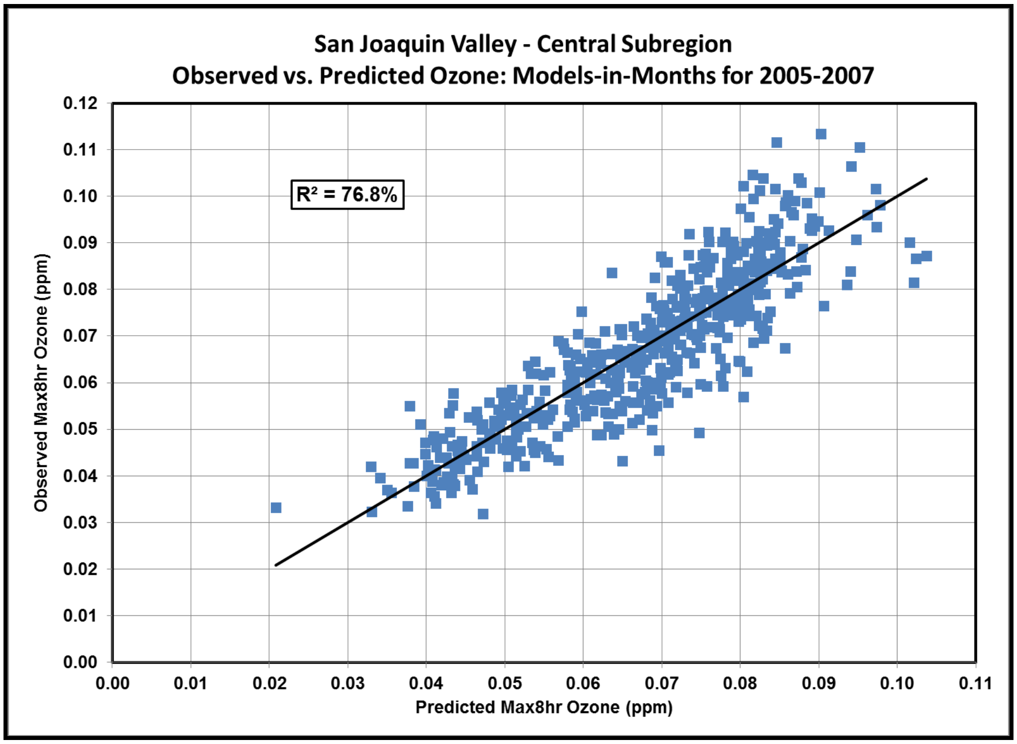


Figure 27

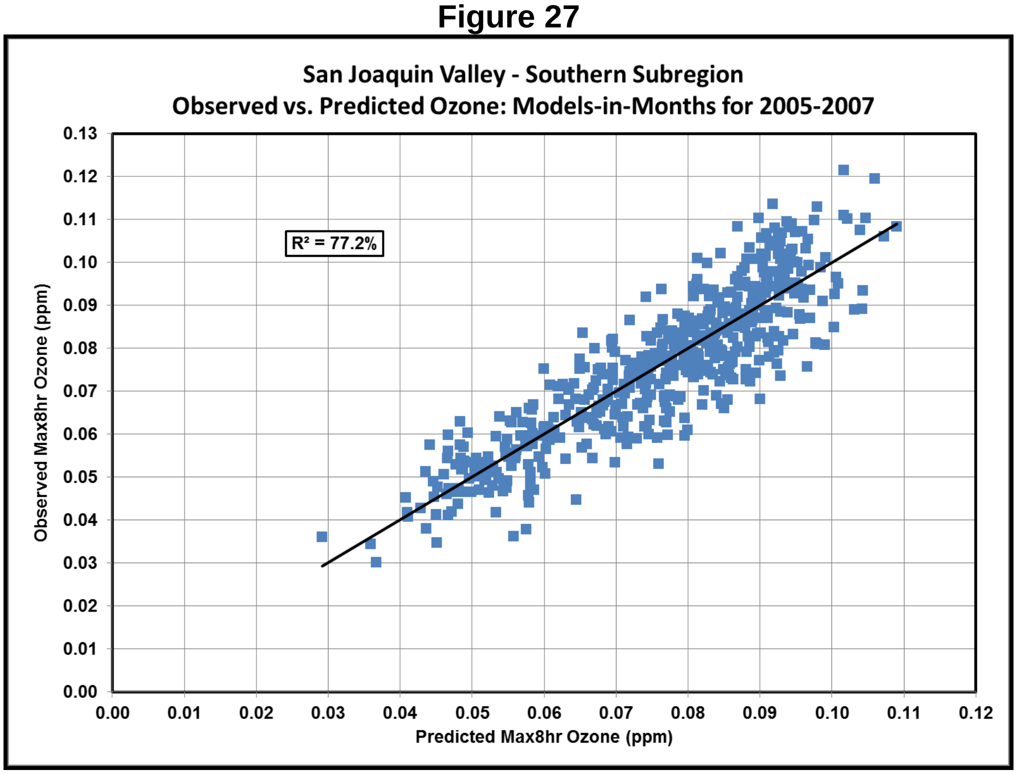


Table 5. Meteorological and day-of-week parameters used in statistical models to quantify daily ozone-forming potential (OFP) in the SJV during selected sets of calibration years.

General category	Particular form of parameter	Identifiers
Surface temperature	**Sub-regional average of site-by-site values for:** **daily minimum temperature** **daily maximum temperature** **average temperature from 10 a.m. to 4 p.m. ***	**ST_min** **ST_max** **ST_mid6**
Temperature aloft	**Oakland Rawinsondes (weather balloons)** **850 mb temperatures at 4 a.m. and 4 p.m.**	**T850AM** **T850PM**
Atmospheric stability	**Temperature difference: Oakland RAOB ** minus Surface** **T850AM - ST_min** **T850PM - ST_mid6**	**stability_AM** **stability_PM**
Wind speed	**Sub-regional average of site-by-site values for:** **average wind speed from 10 a.m. to 4 p.m.** **inverse of (WS_mid6 + 1)**	**WS_mid6** **ws_inv**
Day-of-Week	**Categorical Day-of-Week Average Offsets** **Weekdays (overall average difference)** **Saturday (overall average difference)** **Sunday (overall average difference)**	**WD** **SAT ***** **SUN**

* Indicated times are PST (Pacific Standard Time)
** Rawinsonde (weather ballon)
*** Only WD and SUN were used to avoid numerical instability due to multi-collinearity

Several different sets of years were used to fit the statistical models-in-months. The different sets of years led to similar results, and the years 2005 – 2007 were selected as a recent set of years that were not affected by serious wildfires (2008) and were not affected by serious economic turmoil. The explanatory power of the models-in-months is summarized in Figure 1 (R^2 = 76.8%) for the SJV's Central sub-region and in Figure 2 (R^2 = 77.2%) for the SJV's Southern sub-region. The variables included in the models-in-months are listed in Table 2 in the order of their importance.

Table 6. Variables used for Models-in-Months based on data from 2005 – 2007

Central Sub-region	**May**	**st_mid6, stability_PM, Sunday, wsinv**
	June	**T850AM, wsinv, st_mid6, stability_PM**
	July	**st_mid6, stability_PM, Sunday**
	August	**st_mid6, stability_PM, Weekday, wsinv**
	September	**T850AM, wsinv, st_mid6, stability_PM**
	October	**st_mid6, Weekday, wsinv, T850AM**
Southern Sub-region	**May**	**st_mid6c, T850AM, Sunday, stability_PM, wsinvc, st_mid6** (underlined variables are for the "Central" sub-region)
	June	**st_mid6, wsinvc, stability_PM**
	July	**st_mid6, stability_PM, wsinvc, Sunday**
	August	**st_mid6, stability_PM, wsinv, Sunday, st_mid6c**
	September	**T850AM, wsinv, Weekday, stability_PM, st_mid6, st_mid6c**
	October	**st_mid6, Weekday, wsinvc, wsinv**

The meteorological conditions connected with OFP in each month are summarized in Table 3 for the Central sub-region and in Table 4 for the Southern Sub-region. In each month, the days were split into four "quartile" groups according to increasing OFP, so "ofp1" was the lowest 25% of OFP days, "ofp2" was the next 25% of OFP days, and so on. The average values for the key meteorological variables are given for each OPF group in each month.

Table 7.

OFP Bins for SJV Central: calibrated with 2005 - 2007 Data
Days from 1996 - 2011 (May-Oct) were assigned to the OFP Bins
Bin Means are based on all days (1996 - 2011) that were assigned to the bin

Overall Rank of Bin for OFP	month	OFP Group in Month	OFP (ppm)	ST Central (°C)	Stability PM (°C)	T850 AM (°C)	WS Central (m/s)
2	5	ofp1	0.045	19.8	-14.8	4.5	3.0
8	5	ofp2	0.059	23.8	-13.7	9.5	2.8
12	5	ofp3	0.068	26.9	-13.2	13.3	2.7
20	5	ofp4	0.080	31.5	-12.6	18.3	2.4
5	6	ofp1	0.054	24.3	-13.7	9.8	2.8
11	6	ofp2	0.067	28.3	-13.0	15.1	2.7
16	6	ofp3	0.074	30.7	-12.3	18.1	2.5
21	6	ofp4	0.084	34.1	-12.2	21.7	2.3
7	7	ofp1	0.056	29.1	-12.5	16.4	2.3
13	7	ofp2	0.068	31.6	-11.5	19.8	2.3
17	7	ofp3	0.075	33.3	-11.5	21.9	2.3
24	7	ofp4	0.086	36.0	-11.3	24.6	2.2
10	8	ofp1	0.065	28.5	-12.0	16.0	2.4
15	8	ofp2	0.073	31.1	-12.0	19.1	2.2
19	8	ofp3	0.078	32.8	-11.6	20.7	2.1
22	8	ofp4	0.085	34.9	-11.1	23.5	2.0
4	9	ofp1	0.053	25.1	-12.9	11.7	2.5
14	9	ofp2	0.070	28.8	-11.5	17.2	2.1
18	9	ofp3	0.078	31.3	-11.3	19.7	2.0
23	9	ofp4	0.086	33.2	-10.4	22.5	1.8
1	10	ofp1	0.036	17.8	-9.7	7.4	2.7
3	10	ofp2	0.047	21.7	-10.2	10.9	2.2
6	10	ofp3	0.055	24.6	-9.6	14.8	1.8
9	10	ofp4	0.064	28.3	-10.4	18.2	1.6

ST Surface temperature (average of hours 10 - 16)
WS Wind speed (average of hours 10 - 16)

Table 8.

OFP Bins for SJV South: calibrated with 2005 - 2007 Data
Days from 1996 - 2011 (May-Oct) were assigned to the OFP Bins
Bin Means are based on all days (1996 - 2011) that were assigned to the bin

Overall Rank of Bin for OFP	month	OFP Group in Month	OFP (ppm)	ST Central (°C)	ST South (°C)	Stability PM (°C)	T850 AM (°C)	WS Central (m/s)	WS South (m/s)
2	5	ofp1	0.053	19.9	19.7	-14.8	4.4	3.1	3.0
7	5	ofp2	0.066	24.3	23.9	-14.3	9.6	2.9	2.8
9	5	ofp3	0.075	27.5	27.0	-13.7	13.3	2.9	2.7
18	5	ofp4	0.087	32.1	31.4	-13.2	18.4	2.7	2.4
4	6	ofp1	0.061	24.7	24.2	-14.3	9.9	3.0	2.9
10	6	ofp2	0.075	29.1	28.3	-13.8	15.1	3.0	2.7
15	6	ofp3	0.083	31.6	30.8	-13.1	18.1	2.9	2.5
22	6	ofp4	0.094	35.2	34.0	-13.4	21.5	2.8	2.2
8	7	ofp1	0.074	30.2	29.5	-13.3	16.6	2.7	2.5
13	7	ofp2	0.081	32.7	31.8	-12.8	19.7	2.7	2.3
17	7	ofp3	0.086	34.3	33.2	-12.4	21.7	2.7	2.2
21	7	ofp4	0.093	37.3	35.7	-12.5	24.7	2.8	2.1
12	8	ofp1	0.075	30.0	28.9	-13.7	16.2	2.7	2.3
16	8	ofp2	0.083	32.3	31.3	-13.2	18.7	2.6	2.2
19	8	ofp3	0.089	33.7	32.5	-12.7	20.6	2.5	2.1
23	8	ofp4	0.096	36.4	34.7	-12.3	23.6	2.5	2.0
5	9	ofp1	0.063	25.7	25.2	-13.4	11.8	2.7	2.5
14	9	ofp2	0.082	30.0	29.2	-12.6	17.2	2.4	2.1
20	9	ofp3	0.090	32.0	31.0	-12.1	19.7	2.3	2.0
24	9	ofp4	0.100	34.1	32.9	-11.3	22.4	2.2	1.9
1	10	ofp1	0.043	18.0	17.8	-10.3	6.7	2.9	2.5
3	10	ofp2	0.055	22.3	21.8	-10.6	11.1	2.4	2.2
6	10	ofp3	0.064	25.4	24.6	-10.3	15.0	2.1	1.9
11	10	ofp4	0.075	29.3	28.1	-11.4	18.3	2.0	1.9

ST	Surface temperature (average of hours 10 - 16)
WS	Wind speed (average of hours 10 - 16)

After the models were fitted, every day of the ozone seasons for 1996 through 2011 had a model-predicted value for daily maximum 8-hour ozone along with the measured value. The predicted values represent the ozone that would occur with each day's meteorological conditions if emissions were kept at the levels that prevailed during the calibration years, 2003 – 2005.

For each month, the predicted values for all years were combined to produce a "standardized" set of values for the month, from low to high. For example, June would have 30 values taken at equal intervals through the distribution of the combined set of predicted values for June.

Then for a given year, each month's set of predicted values (sorted from low to high) was compared to that month's respective standardized values. For each pair, the difference between the standardized value and the specific value (standard – specific) was added to the measured daily max 8-hour ozone value to calculate that day's met-adjusted 8-hour ozone.

When met-adjusted daily values had been calculated for all days, trend statistics could be based on the data as measured to produce raw trends and on the data as adjusted to produce met-adjusted trends.

Appendix G-3:
Methodology Used to Evaluate the Ozone Weekend Effect in the San Joaquin Valley

Introduction

This appendix addresses the methodology used to evaluate the ozone weekend effect (WE) in the San Joaquin Valley (SJV).

What is the Ozone Weekend Effect?

The WE is a well-known phenomenon in some major urbanized areas where emissions of ozone precursors are substantially lower on weekends than on weekdays, but measured levels of ozone are significantly higher on weekends than on weekdays. Though common, the WE is not the same in all urban areas of the state. As of 2010, the WE has all but disappeared in the Central and Southern sub-regions of the SJV.

Analytical Method for Ozone Weekend Effect

The analytical method was applied to the ozone data for each site separately. The method was designed to emphasize systematic day-of-week effects and to eliminate some of the values at each end of the distribution of differences from one day to the next, as such differences tend to represent large shifts in meteorology (e.g., passage from low pressure to high pressure, or from one transport direction to a very different direction) rather than systematic day-of-week emissions of ozone precursors. This approach is a special case of the well-known “trimmed mean” concept, adapted to emphasize typical day-of-week differences in measured ozone levels.

Therefore, sequential (day-to-day) differences in daily maximum 1-hour ozone were calculated for each site. The differences were then sorted from smallest to largest (or most negative to most positive). Major holidays were excluded because they do not behave like “normal” days, so Memorial Day, July 4th, and Labor Day were removed from each year before sequential differences were calculated. Within each month and for each day-of-week transition (e.g., Monday to Tuesday), the dates of the lowest 4 and the highest 4 differences were discarded, so the remaining days represented typical behavior with respect to the previous day. Using the typical days, average ozone by day-of-week was calculated for each month, and monthly average ozone was calculated from the day-of-week averages, so each day of the week was equally represented.

For the seasonal, May-October, results shown in Table 2 of Appendix G, day-of-week values were averaged over the six months, and the “ozone weekend effect” is the percent of the weekend average (Sunday and Saturday) with respect to the weekday average (Monday through Friday).

Appendix H

Emission Reduction Credits

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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APPENDIX H: EMISSION REDUCTION CREDITS

H.1 INTRODUCTION

The District requires most new and modified stationary sources that increase emissions in amounts in excess of specific emission offset thresholds to obtain emission reduction credits (ERCs) to offset the growth in emissions. District Rule 2201 (New and Modified Stationary Source Review or “NSR” Rule) contains the offset requirements. Offsets represent either on-site reductions or the use of banked ERCs. The District expects that some pre-baseline credits (pre-2007 for this ozone plan) will be used to mitigate growth from permitted stationary sources during the period of this plan. This Appendix discusses the use of such ERCs for the SJVAB.

H.2 PRE-BASELINE EMISSION REDUCTION CREDITS

The General Preamble to the Federal Clean Air Act (57 FR 13498) states that the pre-baseline ERCs must be reflected as growth and included in the attainment demonstration “*to the extent that the State expects that such credits will be used as offsets or netting prior to attainment of the ambient standards.*” The August 26, 1994 memorandum from John Seitz, EPA’s Director of Office of Air Quality Planning and Standards, to David Howekamp of EPA Region IX, provides two ways for inclusion of these ERCs as growth by stating that “*A state may choose to show that the magnitude of the pre-1990* (pre-baseline) *ERCs (in absolute tonnage) was included in the growth factor, or the state may choose to show that it was not included in the growth factor, but in addition to anticipated general growth.*”

By including the pre-baseline ERCs in the growth factor, the District has selected the first methodology provided in Seitz’s memorandum. However, in either case, the purpose is to show that this plan, by including pre-baseline ERCs as a part of expected growth, will result in a projected inventory adequate to attain the NAAQS and achieve any applicable rate of progress:

projected inventory = baseline inventory + growth + ERCs(pre-baseline) - offsets - reductions

where: growth = non-permitted growth + permitted growth

offsets = ERCs(post-baseline) + ERCs(pre-baseline)

reductions = reductions required by the measures in the Plan

Growth Estimates: The emissions trends and growth estimates in this plan were generated using the reports from the California Emissions Projection Analysis Model (CEPAM). The emissions inventory and associated emissions projections are based on ARB’s latest SIP Planning Projections (Norcal 2012 SIP Ver. 1.04, as of July 31, 2013). CEPAM’s computer tools were used to develop projections and emission estimates based on the most current available growth and control data available at the time of the forecast runs. CEPAM was first developed in the 1990s (called CEFS at the time) to assist in developing air quality plans, determining how and where air pollution can be reduced, tracking progress towards meeting plans goals and mandates, and constructing emission trends, and has been updated regularly since then.

A key component of CEPAM is the growth data. The growth estimates generated by CEPAM include growth in emissions requiring offsets under the New Source Review Rule as well as that which can be accommodated without triggering offsets. Tables 1 and 2 show total projected growth rates of 0.70 tons/day of NOx and 12.85 tons/day of VOCs for the period 2007 to 2017. The CEPAM inventory shows negative growth for some segments of the economy, representing a shrinking emissions inventory even before considering reductions required by District plans. However, for the purposes of this ERC-use analysis, the District did not include these negative growth numbers (by setting negative growth to zero), as only positive growth requires offsetting with ERCs.

The projected inventory for 2017 incorporates the projected growth as well as the expected controls from the measures contained in prior plans. Notwithstanding slight rounding errors, the projected 2017 inventory equals the baseline inventory plus the projected growth minus the expected reductions from the controls contained in previously adopted plans. Reductions due to this ozone plan are not incorporated in these projections, but do not affect the amount of offsets estimated to mitigate the projected growth.

Emission Offsetting Requirements: Under the District’s Rule 2201, new sources with NOx or VOC emissions exceeding 20,000 lb/year must offset their emissions. Additionally, existing facilities with emissions meeting or exceeding these levels must offset any increase in emissions.

Use of Interpollutant Offsets: Under the District’s New Source Review Rule 2201, offsetting emissions increases with reductions in precursor pollutants is allowed, within some specified limitations, and interpollutant offsetting between NOx and VOC is specifically allowed.

As discussed in Chapter 2 of this plan, photochemical modeling for this plan has clearly demonstrated that the Valley continues to be a NOx-limited regime, with NOx a significantly more important driver to the formation of ozone than VOC. For that reason, the District will continue to accept NOx ERCs as valid mitigation of VOC emissions increases, at a very conservative and protective 1-to-1 ratio, but will not accept VOC ERCs as mitigation of NOx increases, unless and until EPA approves into the SIP a specific VOC-for-NOx interpollutant offsetting ratio for the San Joaquin Valley. The District does not anticipate proposing such a ratio, but will review any such proposals presented by interested parties and will forward to EPA for their approval upon District concurrence of the adequacy of the proposed ratio.

Pre-Baseline Offset Usage Estimate: The amount of offsets expected to be consumed during this plan's period was estimated by establishing the percentage of permitting actions for each source category that would be subject to offset requirements under Rule 2201. For each source category, this percentage was established based on past permitting history, the fraction of sources in the category with emissions at or above the offset trigger levels, and the historical permitting activity for the source category. The following factors were used in estimating the potential need for offsets:

- All increases from modifications to existing sources with potential emissions at or above the above offset thresholds would require offsets (District Rule 2201).
- New sources with emissions exceeding the above offset thresholds would require offsets (District Rule 2201).
- The percentage of sources that meet any of the above criteria was estimated by examining past permitting history and by projecting future permitting based on the estimated growth. For instance, the majority of permitting actions with increases in emissions from oil production facilities come from sources with potential emissions in excess of the above offset thresholds. Therefore, for that source category, it was assumed that 80-100% of increases in overall emissions would require offsets.

The quantity of required offsets was then established by multiplying the expected growth in emissions for each source category by this percentage and the expected offset ratio. District Rule 2201 establishes offset ratios ranging from 1.0:1 to 1.5:1 based on the distance from the source of ERCs to the source with increase in emissions. An offset ratio of 1.5:1 applies to all transactions where the distance is greater than 15 miles. For 2005 through July 31, 2013, the average offset ratio for all permitting actions requiring offsets was 1.34:1 for NOx and 1.40:1 for VOC. A conservative average offset ratio of 1.4:1 was used for this plan's calculations for both pollutants. Tables 1 and 2 contain the expected growth, percentage of activities subject to offset requirements, and the expected quantity of offsets for each pollutant.

Although some offsets are expected to come from post-baseline reductions, this plan conservatively assumes that all offsets will be pre-baseline. See Table 3 for a current list of District-issued ERCs, as of July 31, 2013. The expected offset usage for 2007 through 2017, as shown in Tables 1 and 2, has been estimated in this plan as follows:

	Expected ERC Use (tpd)	**Growth (tpd)**
NOx	0.61	0.70
VOC	6.70	12.9

As shown above, the quantity of pre-baseline offsets that are expected to be used between 2007 and 2017 is less than the plan's estimated growth in emissions for each pollutant. Therefore, if growth in new and modified sources occurs at the rate estimated in this plan, the use of offsets as required in Rule 2201 will ensure that permitted increases in emissions will not interfere with progress toward attainment of federal one-hour ozone standards. As discussed in Chapter 4, the District also satisfies the requirement for reasonable further progress with the above-mentioned projected inventories, without taking credit for the ERCs required of and provided by new and modified stationary sources permitted during this period.

<u>Safeguards to assure plan integrity despite the use of pre-baseline credits:</u> In order to assure that the use of pre-baseline ERCs does not interfere with attainment effort and the applicable rate of progress, this plan incorporates the following safeguards:

- The District will place a cap on the amount of pre-baseline credits that can be used. Although the District has relied on a number of conservative assumptions in estimating the usage quantity of pre-baseline credits, some degree of uncertainty exists. For instance, unexpected growth or irregular permitting activity may occur for one or more source categories. The cap on the use of pre-baseline ERCs will be enforced by tracking the permitted growth in emissions and disallowing the use of such credits in permitting actions when the above-specified growth levels are reached. A review of the emissions changes for 2007 through 2012 show that the District's permitting actions have resulted in annual decreases in emissions of both NOx and VOC for all but 2008, in which the overall permitting program resulted in an increase of 0.7 tons of VOC per day. Therefore, the District does not anticipate that the above-specified growth levels will be exceeded.
- Although some ERCs will come from post-baseline reductions, this plan conservatively assumes that all offsets will come from pre-baseline reductions. As discussed earlier, federal law only requires the pre-baseline ERCs to be included in the growth and the attainment demonstration. This plan assumes that all ERCs used to offset emission increases will be pre-baseline ERCs and, therefore, includes them all within the projected inventory as growth. Using this projected inventory leads to conservative conclusions relating to the attainment and rate of progress demonstrations.
- Although permissible, this plan does not take credit for reductions and mitigations required under the District's New and Modified Source Review Rule. In particular, this plan does not reduce future years' emissions by taking credit for the amount of ERCs provided through permitting actions. This conservative approach further assures that the attainment demonstration is not affected by the use of pre-baseline ERCs.

Table H-1 Estimated NOx Growth, Control, and Estimated Offset Use

SUMMARY CATEGORY NAME	2007 Emissions Tons/day	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions Tons/day	Percent Requiring Offsets	Estimated Offsets (tons/day)
FUEL COMBUSTION								
ELECTRIC UTILITIES	7.06	-0.21%	0.00	-28.45%	-2.01	5.50	100	0.00
COGENERATION	2.98	10.86%	0.32	-46.26%	-1.38	1.90	100	0.45
OIL AND GAS PRODUCTION (COMBUSTION)	3.49	-20.93%	0.00	-45.21%	-1.58	1.51	100	0.00
PETROLEUM REFINING (COMBUSTION)	0.71	0.00%	0.00	-29.76%	-0.21	0.50	100	0.00
MANUFACTURING AND INDUSTRIAL	5.12	-2.01%	0.00	-5.63%	-0.29	4.72	40	0.00
FOOD AND AGRICULTURAL PROCESSING	23.98	-0.93%	0.00	-72.77%	-18.26	6.72	30	0.00
SERVICE AND COMMERCIAL	3.24	6.98%	0.23	-15.18%	-0.50	2.86	30	0.09
OTHER (FUEL COMBUSTION)	0.72	6.95%	0.05	-24.90%	-0.18	0.54	25	0.02
TOTAL NOx: FUEL COMBUSTION	**47.29**		**0.60**		**-24.40**	**24.25**		**0.57**
WASTE DISPOSAL								
SEWAGE TREATMENT	0.03	21.21%	0.01	0.00%	0.00	0.04	0	0.00
LANDFILLS	0.12	22.95%	0.03	0.00%	0.00	0.15	30	0.01
INCINERATORS	0.08	16.87%	0.01	0.00%	0.00	0.10	90	0.02
SOIL REMEDIATION	0.02	19.05%	0.00	0.00%	0.00	0.03	0	0.00

SUMMARY CATEGORY NAME	2007 Emissions Tons/day	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions Tons/day	Percent Requiring Offsets	Estimated Offsets (tons/day)
OTHER (WASTE DISPOSAL)	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
TOTAL NOx: WASTE DISPOSAL	**0.26**		**0.05**		**0.00**	**0.31**		**0.03**
CLEANING AND SURFACE COATINGS								
LAUNDERING	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
DEGREASING	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
COATINGS AND RELATED PROCESS SOLVENTS	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
PRINTING	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
ADHESIVES AND SEALANTS	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
OTHER (CLEANING AND SURFACE COATINGS)	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
TOTAL NOx: CLEANING AND SURFACE COATINGS	**0.00**		**0.00**		**0.00**	**0.00**		**0.00**
PETROLEUM PRODUCTION AND MARKETING								
OIL AND GAS PRODUCTION	0.19	-21.05%	0.00	0.00%	0.00	0.15	100	0.00
PETROLEUM REFINING	0.06	0.00%	0.00	0.00%	0.00	0.06	100	0.00
PETROLEUM MARKETING	0.03	33.33%	0.01	0.00%	0.00	0.04	20	0.00

SUMMARY CATEGORY NAME	2007 Emissions Tons/day	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions Tons/day	Percent Requiring Offsets	Estimated Offsets (tons/day)
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
TOTAL NOx: PETROLEUM PRODUCTION AND MARKETING	**0.29**		**0.01**		**0.00**	**0.26**		**0.00**
INDUSTRIAL PROCESSES								
CHEMICAL	0.52	-15.12%	0.00	0.00%	0.00	0.44	50	0.00
FOOD AND AGRICULTURE	0.00	0.00%	0.00	0.00%	0.00	0.00	10	0.00
MINERAL PROCESSES	0.23	15.49%	0.04	-14.86%	-0.03	0.20	25	0.01
METAL PROCESSES	0.00	0.00%	0.00	0.00%	0.00	0.00	10	0.00
WOOD AND PAPER	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
GLASS AND RELATED PRODUCTS	7.75	-9.86%	0.00	-38.89%	-3.01	4.31	100	0.00
ELECTRONICS	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
OTHER (INDUSTRIAL PROCESSES)	0.02	17.65%	0.00	-11.76%	0.00	0.02	25	0.00
TOTAL NOx: INDUSTRIAL PROCESSES	**8.52**		**0.04**		**-3.05**	**4.97**		**0.01**
TOTAL NOx: STATIONARY SOURCES	**56.35**		**0.70**		**-27.45**	**29.79**		**0.61**

Table H-2 Estimated VOC Growth, Control, and Estimated Offset Use

SUMMARY CATEGORY NAME	2007 Emissions (tons/day)	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions (tons/day)	Percent Requiring Offsets	Estimated Offsets (tons/day)
FUEL COMBUSTION								
ELECTRIC UTILITIES	0.27	-17.36%	0.00	0.00%	0.00	0.22	100	0.00
COGENERATION	0.16	13.55%	0.02	0.00%	0.00	0.18	90	0.03
OIL AND GAS PRODUCTION (COMBUSTION)	1.46	-20.94%	0.00	0.00%	0.00	1.16	95	0.00
PETROLEUM REFINING (COMBUSTION)	0.11	0.00%	0.00	0.00%	0.00	0.11	100	0.00
MANUFACTURING AND INDUSTRIAL	0.31	-6.54%	0.00	0.00%	0.00	0.29	25	0.00
FOOD AND AGRICULTURAL PROCESSING	2.23	-2.54%	0.00	-63.75%	-1.42	0.75	10	0.00
SERVICE AND COMMERCIAL	0.50	2.79%	0.01	0.00%	0.00	0.52	25	0.00
OTHER (FUEL COMBUSTION)	0.07	5.41%	0.00	-20.27%	-0.02	0.06	10	0.00
TOTAL VOC: FUEL COMBUSTION	**5.11**		**0.04**		**-1.44**	**3.28**		**0.03**
WASTE DISPOSAL								
SEWAGE TREATMENT	0.03	21.21%	0.01	0.00%	0.00	0.04	25	0.00
LANDFILLS	1.29	16.02%	0.21	0.00%	0.00	1.50	50	0.14
INCINERATORS	0.01	10.00%	0.00	0.00%	0.00	0.01	0	0.00
SOIL REMEDIATION	0.18	17.58%	0.03	0.00%	0.00	0.21	10	0.00

SUMMARY CATEGORY NAME	2007 Emissions (tons/day)	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions (tons/day)	Percent Requiring Offsets	Estimated Offsets (tons/day)
OTHER (WASTE DISPOSAL)	23.10	18.74%	4.33	-25.02%	-5.78	20.57	25	1.52
TOTAL VOC: WASTE DISPOSAL	**24.62**		**4.58**		**-5.78**	**22.33**		**1.67**
CLEANING AND SURFACE COATINGS								
LAUNDERING	0.61	16.23%	0.10	0.00%	0.00	0.71	0	0.00
DEGREASING	1.99	13.05%	0.26	0.00%	0.00	2.25	10	0.04
COATINGS AND RELATED PROCESS SOLVENTS	7.32	25.99%	1.90	-7.18%	-0.53	8.68	50	1.33
PRINTING	4.43	21.32%	0.95	0.00%	0.00	5.38	25	0.33
ADHESIVES AND SEALANTS	0.65	-12.73%	0.00	-0.15%	0.00	0.57	25	0.00
OTHER (CLEANING AND SURFACE COATINGS)	3.65	29.50%	1.08	-0.03%	0.00	4.72	50	0.75
TOTAL VOC: CLEANING AND SURFACE COAT	**18.66**		**4.28**		**-0.53**	**22.31**		**2.45**
PETROLEUM PRODUCTION AND MARKETING								
OIL AND GAS PRODUCTION	28.48	-20.92%	0.00	0.00%	0.00	22.52	80	0.00
PETROLEUM REFINING	1.10	0.82%	0.01	0.00%	0.00	1.11	90	0.01
PETROLEUM MARKETING	6.65	19.89%	1.32	0.00%	0.00	7.97	40	0.74
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.02	14.29%	0.00	0.00%	0.00	0.02	80	0.00

SUMMARY CATEGORY NAME	2007 Emissions (tons/day)	Growth Factor (%)	Estimated Growth (tons/day)	Control Factor (%)	Reductions (tons/day)	2017 Emissions (tons/day)	Percent Requiring Offsets	Estimated Offsets (tons/day)
TOTAL VOC: PETROLEUM PRODUCTION AND MARKETING	**36.25**		**1.34**		**0.00**	**31.63**		**0.76**
INDUSTRIAL PROCESSES								
CHEMICAL	3.56	-15.30%	0.00	0.00%	0.00	3.01	25	0.00
FOOD AND AGRICULTURE	12.44	20.11%	2.50	0.00%	0.00	14.94	50	1.75
MINERAL PROCESSES	0.35	15.47%	0.05	0.00%	0.00	0.40	25	0.02
METAL PROCESSES	0.17	5.36%	0.01	0.00%	0.00	0.18	25	0.00
WOOD AND PAPER	0.01	0.00%	0.00	0.00%	0.00	0.01	25	0.00
GLASS AND RELATED PRODUCTS	0.05	-12.50%	0.00	0.00%	0.00	0.04	100	0.00
ELECTRONICS	0.00	0.00%	0.00	0.00%	0.00	0.00	0	0.00
OTHER (INDUSTRIAL PROCESSES)	0.29	17.01%	0.05	0.00%	0.00	0.34	25	0.02
TOTAL VOC: INDUSTRIAL PROCESSES	**16.86**		**2.61**		**0.00**	**18.92**		**1.79**
TOTAL VOC: STATIONARY SOURCES	**101.49**		**12.85**		**-7.75**	**98.47**		**6.70**

Emission inventory used: Ozone SIP Planning Projections - v1.06 RF980
Offset ratios used: *1.4 for NOx and ROG*

H.3 LIST OF ERCS

Table H-3 Current List of NOx and VOC Emission Reduction Credits, 7/31/2013

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
AER GLAN ENERGY LLC	S	3945	1	VOC	2251	2249	2249	2251
AERA ENERGY LLC	C	219	1	VOC	268	297	324	298
AERA ENERGY LLC	C	679	1	VOC	11014	11468	11508	11211
AERA ENERGY LLC	S	663	1	VOC	544	495	483	454
AERA ENERGY LLC	S	868	1	VOC	724	735	729	672
AERA ENERGY LLC	S	1058	1	VOC	8179	8280	8354	8353
AERA ENERGY LLC	S	1138	1	VOC	162	233	2	25
AERA ENERGY LLC	S	1142	1	VOC	39631	39976	40411	40489
AERA ENERGY LLC	S	1162	1	VOC	713	719	730	730
AERA ENERGY LLC	S	1476	1	VOC	190	0	0	54
AERA ENERGY LLC	S	1477	1	VOC	329	0	0	93
AERA ENERGY LLC	S	1587	1	VOC	26	28	26	26
AERA ENERGY LLC	S	1681	1	VOC	10	10	10	10
AERA ENERGY LLC	S	1874	1	VOC	40	10	1	22
AERA ENERGY LLC	S	1880	1	VOC	360	591	251	0
AERA ENERGY LLC	S	2136	1	VOC	3772	3393	3836	3913
AERA ENERGY LLC	S	2237	1	VOC	5394	5463	5539	5539
AERA ENERGY LLC	S	2361	1	VOC	27	4	0	11
AERA ENERGY LLC	S	2725	1	VOC	65082	65830	66578	66578
AERA ENERGY LLC	S	2774	1	VOC	8176	5745	5185	3973
AERA ENERGY LLC	S	2782	1	VOC	44	43	42	46
AERA ENERGY LLC	S	2939	1	VOC	6264	3536	3647	6483
AERA ENERGY LLC	S	3110	1	VOC	21914	22310	22708	22708
AERA ENERGY LLC	S	3223	1	VOC	16	16	16	17
AERA ENERGY LLC	S	3272	1	VOC	2642	2701	2759	2759
AERA ENERGY LLC	S	3308	1	VOC	2266	1066	1090	2320
AERA ENERGY LLC	S	3434	1	VOC	10466	11528	13111	10396
AERA ENERGY LLC	S	3451	1	VOC	20480	438	2608	1572
AERA ENERGY LLC	S	3687	1	VOC	17245	18573	17870	17768
AERA ENERGY LLC	S	3919	1	VOC	178503	181091	183734	183787
AERA ENERGY LLC	S	3923	1	VOC	123511	124964	126418	126418
AERA ENERGY LLC	S	4041	1	VOC	53123	53552	54696	55663
AERA ENERGY LLC	S	4063	1	VOC	157	140	120	181
AERA ENERGY LLC	S	4064	1	VOC	98	154	184	160
AGRI-CEL INC	S	3631	1	VOC	21495	26078	24122	2902
ALON BAKERSFIELD REFINING	S	3663	1	VOC	38947	38947	38947	38948
ALON BAKERSFIELD REFINING	S	3846	1	VOC	52595	53394	53803	53711
ANDERSEN RACK SYSTEMS, INC	N	950	1	VOC	7335	7335	7335	7335

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
ANDERSON CLAYTON CORP	C	903	1	VOC	0	0	0	4
ANDERSON CLAYTON CORP	S	314	1	VOC	0	0	1	18
ANDERSON CLAYTON CORP	S	471	1	VOC	0	0	0	9
ANDERSON CLAYTON CORP	S	1045	1	VOC	0	0	0	22
ANDERSON CLAYTON CORP	S	1171	1	VOC	3	0	0	24
ANDERSON CLAYTON CORP	S	1262	1	VOC	1	0	0	19
ANDERSON CLAYTON CORP	S	1263	1	VOC	9	0	0	24
ANDERSON CLAYTON CORP.	N	181	1	VOC	0	0	0	6
ANDERSON CLAYTON CORP.	N	499	1	VOC	0	0	0	15
ANDERSON CLAYTON CORP/BURREL	C	806	1	VOC	14	0	0	42
ANDERSON CLAYTON CORP/BUTTE	C	699	1	VOC	0	0	0	19
ANDERSON CLAYTON CORP/CORCORAN	C	81	1	VOC	0	0	0	15
ANDERSON CLAYTON CORP/DAIRYLAN	C	332	1	VOC	0	0	0	7
ANDERSON CLAYTON CORP/DAIRYLND	C	472	1	VOC	0	0	0	13
ANDERSON CLAYTON CORP/EL DORAD	C	427	1	VOC	1	0	0	17
ANDERSON CLAYTON CORP/FIVE PTS	C	78	1	VOC	0	0	0	8
ANDERSON CLAYTON CORP/HANFORD	C	74	1	VOC	0	0	0	5
ANDERSON CLAYTON CORP/HANFORD	C	863	1	VOC	0	0	0	36
ANDERSON CLAYTON CORP/IDRIA #1	C	959	1	VOC	0	0	0	76
ANDERSON CLAYTON CORP/IDRIA #2	C	250	1	VOC	0	0	0	9
ANDERSON CLAYTON CORP/KEARNY	C	75	1	VOC	0	0	0	7
ANDERSON CLAYTON CORP/KERMAN	C	428	1	VOC	0	0	0	11
ANDERSON CLAYTON CORP/KINGSRIV	C	460	1	VOC	2	0	0	31
ANDERSON CLAYTON CORP/MURIT #1	C	334	1	VOC	0	0	0	7
ANDERSON CLAYTON CORP/MURIT #2	C	336	1	VOC	0	0	0	7
ANDERSON CLAYTON CORP/MURRAY	C	234	1	VOC	0	0	0	12
ANDERSON CLAYTON CORP/NAPA GIN	C	335	1	VOC	0	0	0	5
ANDERSON CLAYTON CORP/PLSNT VA	C	326	1	VOC	0	0	0	18
ANDERSON CLAYTON CORP/SAN JOAQ	C	79	1	VOC	0	0	0	5
ANDERSON CLAYTON	C	76	1	VOC	0	0	0	7

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CORP/SETTER								
ANDERSON CLAYTON CORP/STRATFOR	C	56	1	VOC	0	0	0	4
ANDERSON CLAYTON CORP/SUNSET	C	333	1	VOC	0	0	0	5
ANDERSON CLAYTON CORP/TRANQLTY	C	80	1	VOC	0	0	0	12
ANDERSON CLAYTON CORPORATION	N	135	1	VOC	0	0	0	5
ANDERSON CLAYTON CORPORATION	N	737	1	VOC	1	0	0	16
ANDERSON CLAYTON-MARICOPA GIN	S	697	1	VOC	0	0	0	25
APTCO LLC	C	663	1	VOC	0	147	788	148
APTCO LLC	C	664	1	VOC	0	149	796	150
APTCO LLC	C	665	1	VOC	0	141	758	143
APTCO LLC	C	684	1	VOC	0	138	241	139
APTCO LLC	N	390	1	VOC	1370	1266	1618	948
APTCO LLC	N	397	1	VOC	12104	11748	9416	0
APTCO LLC	N	540	1	VOC	5000	5000	5000	5000
APTCO LLC	N	854	1	VOC	3141	4397	2894	0
APTCO LLC	S	872	1	VOC	9	8	9	9
APTCO LLC	S	1990	1	VOC	1306	1709	1829	1157
ARCO PIPELINE FACILITY	C	271	1	VOC	419	417	417	417
ASV WINES	C	1120	1	VOC	0	20	551	21
ASV WINES, INC.	N	892	1	VOC	0	0	189	0
AVENAL POWER CENTER, LLC	C	897	1	VOC	45	45	45	45
AVENAL POWER CENTER, LLC	C	898	1	VOC	5480	6496	4696	6616
AVENAL POWER CENTER, LLC	N	724	1	VOC	0	0	241	0
AVENAL POWER CENTER, LLC	N	725	1	VOC	0	0	709	0
AVENAL POWER CENTER, LLC	S	2951	1	VOC	12500	12500	12500	12500
AVENAL POWER CENTER, LLC	S	2988	1	VOC	0	69	0	0
BAKERSFIELD CITY WOOD SITE	S	2969	1	VOC	46	59	61	52
BAR 20 PARTNERS LTD	S	2593	1	VOC	0	9	345	350
BAR 20 PARTNERS LTD	S	2594	1	VOC	7	15	38	38
BAR 20 PARTNERS LTD	S	2595	1	VOC	873	882	892	892
BAR 20 PARTNERS LTD	S	2915	1	VOC	445	419	50	45
BERRY PETROLEUM COMPANY	N	974	1	VOC	0	1027	0	0
BERRY PETROLEUM COMPANY	N	976	1	VOC	0	0	20	0
BERRY PETROLEUM COMPANY	N	978	1	VOC	157	144	137	134
BERRY PETROLEUM COMPANY	N	1074	1	VOC	1602	1602	1602	1602
BERRY PETROLEUM COMPANY	S	2642	1	VOC	284	0	0	0
BERRY PETROLEUM COMPANY	S	3649	1	VOC	1427	6355	4508	738
BERRY PETROLEUM COMPANY	S	3653	1	VOC	1307	1307	1307	1308
BERRY PETROLEUM COMPANY	S	3958	1	VOC	9428	9428	9428	9428
BERRY PETROLEUM COMPANY	S	4000	1	VOC	8	1433	8	8

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
BIG WEST OF CALIFORNIA LLC	S	4051	1	VOC	698779	691001	721428	721430
BREA OIL COMPANY, INC.	S	3355	1	VOC	149	391	193	112
BREITBURN OPERATING LP	S	4059	1	VOC	15	19	16	13
BRITZ AG FINANCE CO., INC.	C	557	1	VOC	0	0	0	8
BRITZ GIN PARTNERSHIP II	C	871	1	VOC	0	0	0	32
BRITZ INCORPORATED	C	586	1	VOC	0	0	0	21
BRONCO WINE COMPANY	S	3732	1	VOC	125	125	125	125
BROWN SAND INC	N	46	1	VOC	2	2	1	2
BRUCE CARTER INDUSTRIES, INC.	S	4038	1	VOC	10031	12170	11257	1354
BUILDERS CONCRETE, INC.	C	41	1	VOC	35	35	35	35
BUTTONWILLOW GINNING CO	S	2937	1	VOC	0	0	0	40
CALAVERAS MATERIALS INC	C	89	1	VOC	92	83	95	76
CALAVERAS MATERIALS INC.	C	233	1	VOC	148	410	483	300
CALIFORNIA DAIRIES	N	497	1	VOC	33	33	33	33
CALIFORNIA DAIRIES, INC.	C	683	1	VOC	0	0	454	0
CALIFORNIA SPRAY DRY CO	N	904	1	VOC	40	53	55	49
CALIFORNIA-WASHINGTON CAN CO.	N	77	1	VOC	2664	0	0	1583
CALMAT CO.	C	50	1	VOC	2	2	3	3
CALMAT OF FRESNO	C	40	1	VOC	2	11	5	17
CALPINE CORPORATION	C	1080	1	VOC	2235	2037	1988	2251
CALPINE CORPORATION	S	1666	1	VOC	0	0	0	9
CALPINE CORPORATION	S	3116	1	VOC	1440	1546	1621	1621
CALPINE ENERGY SERVICES, L.P.	N	927	1	VOC	10503	10981	11573	11536
CALPINE ENERGY SERVICES, L.P.	S	3261	1	VOC	4454	4972	3890	4155
CALPINE ENERGY SERVICES, L.P.	S	3283	1	VOC	0	150	171	0
CALPINE ENERGY SERVICES, L.P.	S	3292	1	VOC	4804	6146	6632	3338
CALPINE ENERGY SERVICES, L.P.	S	3300	1	VOC	4636	4705	4774	4771
CALPINE ENERGY SERVICES, L.P.	S	3368	1	VOC	1500	1500	1500	1500
CALPINE ENERGY SERVICES, L.P.	S	3503	1	VOC	5500	5500	5500	5500
CALPINE ENERGY SERVICES, L.P.	S	3504	1	VOC	1000	1000	1000	1000
CALPINE ENERGY SERVICES, L.P.	S	3555	1	VOC	5000	5000	5000	5000
CAMPBELL SOUP COMPANY	N	127	1	VOC	84	58	52	61
CANANDAIGUA WINE COMPANY INC	C	1085	1	VOC	21	17	30	15
CANDLEWICK YARNS	C	507	1	VOC	23	20	16	14
CANTUA COOPERATIVE GIN, INC.	C	760	1	VOC	0	0	0	38
CASTLE AIRPORT AVIATION & DEVELOP CENTER	N	523	1	VOC	31801	32175	32549	32549
CE2 ENVIRONMENTAL MARKETS LP	N	1000	1	VOC	2575	2575	2575	2575
CE2 ENVIRONMENTAL MARKETS LP	S	3809	1	VOC	2834	2814	2831	2831
CE2 ENVIRONMENTAL OPPORTUNITIES I LP	N	998	1	VOC	2385	2385	2385	2385

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CE2 ENVIRONMENTAL OPPORTUNITIES I LP	S	3806	1	VOC	2500	2500	2500	2500
CHEMICAL WASTE MANAGEMENT, INC	N	663	1	VOC	7000	0	0	14000
CHEMICAL WASTE MANAGEMENT, INC.	S	2645	1	VOC	1513	2602	2033	2038
CHEVRON U S A INC	S	629	1	VOC	48	42	43	41
CHEVRON U S A INC	S	3404	1	VOC	171	202	232	232
CHEVRON USA INC	C	221	1	VOC	357	395	431	396
CHEVRON USA INC	C	277	1	VOC	2209	2209	2209	2209
CHEVRON USA INC	C	331	1	VOC	1220	1220	1221	1221
CHEVRON USA INC	C	966	1	VOC	6	6	6	6
CHEVRON USA INC	S	77	1	VOC	42	38	36	47
CHEVRON USA INC	S	165	1	VOC	2970	3003	3036	3036
CHEVRON USA INC	S	410	1	VOC	5	7	11	15
CHEVRON USA INC	S	647	1	VOC	235	699	540	95
CHEVRON USA INC	S	703	1	VOC	2084	2107	2130	2130
CHEVRON USA INC	S	1049	1	VOC	3461	0	0	0
CHEVRON USA INC	S	1793	1	VOC	1420	1443	1335	1334
CHEVRON USA INC	S	1878	1	VOC	230	136	143	82
CHEVRON USA INC	S	1912	1	VOC	225	238	250	250
CHEVRON USA INC	S	2107	1	VOC	651	638	666	666
CHEVRON USA INC	S	2373	1	VOC	11698	11110	8970	9796
CHEVRON USA INC	S	2430	1	VOC	2459	2142	1336	1543
CHEVRON USA INC	S	2458	1	VOC	267	270	260	243
CHEVRON USA INC	S	2674	1	VOC	1848	1848	1848	1848
CHEVRON USA INC	S	2675	1	VOC	1835	1835	1835	1835
CHEVRON USA INC	S	2708	1	VOC	1605	1634	1664	1664
CHEVRON USA INC	S	3148	1	VOC	181	163	274	216
CHEVRON USA INC	S	3365	1	VOC	5542	5627	5713	5055
CHEVRON USA INC	S	3400	1	VOC	1903	2425	2836	2947
CHEVRON USA INC	S	3449	1	VOC	578	601	626	626
CHEVRON USA INC	S	3518	1	VOC	1780	1780	1780	1780
CHEVRON USA INC	S	3544	1	VOC	346	378	292	308
CHEVRON USA INC	S	3601	1	VOC	40533	41484	42396	42430
CHEVRON USA INC	S	3604	1	VOC	223	345	388	256
CHEVRON USA INC	S	3701	1	VOC	25142	25559	25976	25976
CHEVRON USA INC	S	3722	1	VOC	127895	129399	130902	130902
CHEVRON USA INC	S	3737	1	VOC	104915	106191	107557	107578
CHEVRON USA INC	S	3811	1	VOC	3947	4032	4121	4125
CHEVRON USA INC	S	3869	1	VOC	40200	41125	42051	42047
CHEVRON USA INC	S	3905	1	VOC	5284	5380	5476	5475
CHEVRON USA INC	S	4004	1	VOC	460	466	471	470
CHEVRON USA INC	S	4066	1	VOC	1281	1477	1673	1673
CHEVRON USA INC	S	4068	1	VOC	522	567	615	615

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CHEVRON USA INC (REFINERY)	S	657	1	VOC	35011	35399	35788	35788
CHEVRON USA INC LOST HILLS GP	S	1847	1	VOC	2764	2793	2825	2825
CHEVRON USA PRODUCTION INC	S	674	1	VOC	5779	5851	5903	5902
CHEVRON USA PRODUCTION INC	S	3533	1	VOC	6	4	9	8
CILION INC.	S	3373	1	VOC	2978	2979	2979	2978
CILION, INC.	S	3132	1	VOC	13000	13000	13000	13000
CITY OF TULARE	C	1063	1	VOC	0	107	678	109
CLARK BROTHERS-DERRICK GIN	C	511	1	VOC	0	0	0	2
CLEAN HARBORS BUTTONWILLOW, LLC	S	685	1	VOC	31195	31541	31888	31888
COALINGA FARMERS CO-OP GIN	C	537	1	VOC	0	0	0	8
COIT RANCH	C	532	1	VOC	0	0	0	8
CONAGRA CONSUMER FROZEN FOODS	N	858	1	VOC	5	0	0	8
CONOCOPHILLIPS COMPANY	N	1058	1	VOC	1624	1124	246	0
CORCORAN IRRIGATION DISTRICT	C	560	1	VOC	154	163	159	90
COTTON ASSOCIATES, INC	S	25	1	VOC	0	0	0	8
CRAYCROFT BRICK COMPANY	C	71	1	VOC	24	20	19	19
CRIMSON RESOURCE MANAGEMENT	S	2161	1	VOC	54	49	31	63
CRIMSON RESOURCE MANAGEMENT	S	3386	1	VOC	67	138	142	94
CRIMSON RESOURCE MANAGEMENT	S	3387	1	VOC	23009	20107	19072	13925
CRIMSON RESOURCE MANAGEMENT	S	3441	1	VOC	13	4	13	22
DART CONTAINER CORPORATION	C	555	1	VOC	30481	26626	14213	50680
DEL MONTE CORPORATION	N	316	1	VOC	82	71	116	28
DELTA TRADING L P	S	3711	1	VOC	8361	8458	8552	8556
DIAMOND FOODS INCORPORATED	N	572	1	VOC	126	45	138	120
DIAMOND FOODS INCORPORATED	N	645	1	VOC	1695	1419	1451	783
DIAMOND FOODS INCORPORATED	N	828	1	VOC	1495	671	1063	1914
DOLE PACKAGED FOODS LLC	N	520	1	VOC	3	11	41	8
DTE STOCKTON, LLC	S	3715	1	VOC	1450	1450	1450	1450
DUNCAN ENTERPRISES	C	33	1	VOC	26	26	27	18
E & J GALLO WINERY	C	1189	1	VOC	9357	9357	9323	9323
E & J GALLO WINERY	N	2	1	VOC	9	9	26	28
E & J GALLO WINERY	S	3805	1	VOC	18000	18000	18000	18000
E & J GALLO WINERY	S	3807	1	VOC	11431	11424	11417	11417
E & J GALLO WINERY	S	3808	1	VOC	8098	8041	8086	8086
E & J GALLO WINERY	S	4025	1	VOC	44473	44472	44465	44397
E & J GALLO WINERY	S	4050	1	VOC	60000	60000	60000	60000

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
E&B NATURAL RESOURCES MGMT	S	2773	1	VOC	7	12	5	9
E&B NATURAL RESOURCES MGMT	S	3791	1	VOC	7500	7500	7500	7500
EAGLE VALLEY GINNING LLC	N	847	1	VOC	0	0	0	23
ECKERT FROZEN FOODS	N	133	1	VOC	3	11	41	8
ELBOW ENTERPRISES INC	S	2535	1	VOC	0	0	0	70
ELEMENT MARKETS LLC	S	3370	1	VOC	5	4	4	4
ENRON OIL & GAS COMPANY	S	1044	1	VOC	5516	5576	5638	5638
EXXON MOBIL CORPORATION	S	645	1	VOC	128	130	131	131
FARMERS COOPERATIVE GIN INC	S	2533	1	VOC	0	0	0	39
FARMERS FIREBAUGH GINNING CO.	C	956	1	VOC	16	0	0	47
FIBREBOARD CORP.	N	209	1	VOC	41	34	16	45
FOSTER FOOD PRODUCTS	S	1501	1	VOC	432	437	442	442
FOSTER FOOD PRODUCTS	S	1502	1	VOC	68	63	58	58
FREEPORT-MC MORAN OIL & GAS	S	3066	1	VOC	840	840	840	840
FREEPORT-MC MORAN OIL & GAS	S	3164	1	VOC	821	821	822	822
FREEPORT-MCMORAN OIL & GAS, LLC	C	1114	1	VOC	2467	2439	2410	2411
FREEPORT-MCMORAN OIL & GAS, LLC	C	1157	1	VOC	892	0	1736	2684
FRESNO/CLOVIS REGIONAL WWTP	C	1211	1	VOC	6	6	5	5
FRITO-LAY, INC.	S	3411	1	VOC	4018	6573	9128	9128
FRITO-LAY, INC.	S	3426	1	VOC	380	474	377	337
FRITO-LAY, INC.	S	3429	1	VOC	55	57	58	58
FRITO-LAY, INC.	S	3430	1	VOC	76	96	74	72
G3 ENTERPRISES	S	4076	1	VOC	183	183	182	182
GENERAL MILLS OPERATIONS, INC	N	139	1	VOC	16	13	13	19
GROWERS COOP	S	88	1	VOC	0	0	1	15
H. J. HEINZ COMPANY	N	60	1	VOC	0	23	129	0
H. J. HEINZ COMPANY	N	694	1	VOC	0	0	701	0
H. J. HEINZ COMPANY, L.P.	N	21	1	VOC	0	60	180	60
HANSEN BROTHERS	C	249	1	VOC	0	0	0	13
HECK CELLARS	S	4053	1	VOC	9715	9715	9715	9715
HERSHEY CHOCOLATE & CONF. CORP	N	42	1	VOC	1	1	1	1
HERSHEY CHOCOLATE & CONF. CORP	N	373	1	VOC	9	11	13	11
HERSHEY CHOCOLATE & CONF. CORP	N	952	1	VOC	5	5	6	6
HOLMES WESTERN OIL CORPORATION	C	823	1	VOC	0	0	0	10
HOLMES WESTERN OIL CORPORATION	N	652	1	VOC	324	326	311	301
HOLMES WESTERN OIL	N	653	1	VOC	30	30	25	24

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CORPORATION								
HOLMES WESTERN OIL CORPORATION	S	4032	1	VOC	216	562	641	200
HUNTER EDISON OIL DEVELOPMENT	S	3723	1	VOC	2186	2256	2234	2282
HYDROGEN ENERGY CALIFORNIA, LLC	S	3305	1	VOC	14625	14625	14625	14625
HYDROGEN ENERGY CALIFORNIA, LLC	S	3557	1	VOC	11437	11438	11438	11437
HYDROGEN ENERGY CALIFORNIA, LLC	S	3605	1	VOC	7937	7938	7938	7937
INERGY WEST COAST LLC	S	3896	1	VOC	197	24	0	1
INERGY WEST COAST LLC	S	3898	1	VOC	1131	1160	1191	1189
INERGY WEST COAST LLC	S	3899	1	VOC	7	22	14	4
INTERNATIONAL PAPER COMPANY	S	2995	1	VOC	875	875	875	875
J.G. BOSWELL CO. (EL RICO)	C	135	1	VOC	1	0	0	1
J.R. SIMPLOT COMPANY	C	44	1	VOC	83	82	70	64
KAWEAH DELTA DISTRICT HOSPITAL	S	2656	1	VOC	460	738	828	938
KERMAN CO-OP GIN & WAREHOUSE 1	C	1002	1	VOC	0	0	0	13
KERN DELTA WEEDPATCH GINNING	S	2062	1	VOC	0	0	0	17
KERN DELTA WEEDPATCH GINNING	S	3199	1	VOC	0	0	0	38
KERN DELTA-WEEDPATCH COTTON GINNING CO	S	2971	1	VOC	4	0	0	1
KERN LAKE COOP GIN	S	2074	1	VOC	0	0	0	134
KERN OIL & REFINING CO.	S	3693	1	VOC	952	966	951	1099
KERN OIL & REFINING CO.	S	3944	1	VOC	2500	2500	2500	2500
KERN OIL & REFINING CO.	S	4023	1	VOC	216	216	216	216
LAND O' LAKES, INC.	C	1044	1	VOC	258	0	0	683
LAND O' LAKES, INC.	S	3284	1	VOC	527	893	642	0
LAND O' LAKES, INC.	S	3625	1	VOC	57	43	59	55
LATON CO-OP GIN, INC.	C	746	1	VOC	0	0	0	8
LAWRENCE LIVERMORE NATL. LAB	N	464	1	VOC	2	1	0	1
LEPRINO FOODS COMPANY	C	60	1	VOC	137	139	136	138
LIDESTRI FOODS, INC	N	391	1	VOC	0	0	389	0
LIVE OAK LIMITED	S	3	1	VOC	198	200	202	202
LOS ANGELES CNTY SANITATION DIST NO.2	N	472	1	VOC	5953	6019	6086	6086
LOS ANGELES CNTY SANITATION DIST NO.2	N	1068	1	VOC	269	1452	271	426
LOS ANGELES COUNTY SANITATION DISTRICT 2	S	2147	1	VOC	12500	12500	12500	12500
LOS BANOS GRAVEL GROUP,	N	125	1	VOC	16	81	258	86

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
ASPHLT								
LOS GATOS TOMATO PRODUCTS	C	1021	1	VOC	0	3	0	0
M CARATAN INC	S	2516	1	VOC	0	0	26	6
MACPHERSON OIL COMPANY	N	1065	1	VOC	0	0	123	0
MACPHERSON OIL COMPANY	S	3942	1	VOC	3075	3075	2952	3075
MADERA CO-OP GIN, INC.	C	943	1	VOC	0	0	0	11
MALIBU BOATS LLC	N	942	1	VOC	13753	22879	14803	14093
MALIBU BOATS LLC	S	2555	1	VOC	5000	5000	5000	5000
MARTIN ANDERSON	C	1051	1	VOC	8699	12348	6585	90
MID-VALLEY COTTON GROWERS INC	S	317	1	VOC	0	0	0	6
MID-VALLEY COTTON GROWERS INC	S	2989	1	VOC	0	0	0	16
MINTURN CO-OP GIN	N	441	1	VOC	0	0	0	20
MODESTO IRRIGATION DISTRICT	C	1109	1	VOC	4342	4331	4373	4371
MODESTO IRRIGATION DISTRICT	N	479	1	VOC	0	0	305	0
MODESTO IRRIGATION DISTRICT	N	739	1	VOC	0	0	27	0
MODESTO TALLOW CO INC	N	599	1	VOC	184	165	202	196
MONTEREY RESOURCES, INC.	S	1983	1	VOC	708	720	557	640
NAS LEMOORE	C	1046	1	VOC	1607	453	1066	59
NORTHERN CALIFORNIA POWER AGENCY	S	3744	1	VOC	240	103	0	0
NUSTAR ENERGY LP	S	3299	1	VOC	1000	1000	1000	1000
O'NEILL VINTNERS & DISTILLERS	S	3886	1	VOC	404	404	404	404
OAKWOOD LAKE RESORT	N	601	1	VOC	0	72	115	0
OCCIDENTAL OF ELK HILLS INC	S	829	1	VOC	57	60	72	58
OCCIDENTAL OF ELK HILLS INC	S	1593	1	VOC	3128	3163	3197	3197
OCCIDENTAL OF ELK HILLS INC	S	1703	1	VOC	394	1333	1998	1038
OCCIDENTAL OF ELK HILLS INC	S	1704	1	VOC	1695	3741	4523	1688
OCCIDENTAL OF ELK HILLS INC	S	1706	1	VOC	2314	5505	6449	2760
OCCIDENTAL OF ELK HILLS INC	S	1708	1	VOC	1664	3970	4474	1890
OCCIDENTAL OF ELK HILLS INC	S	1710	1	VOC	1655	4021	5103	2114
OCCIDENTAL OF ELK HILLS INC	S	1713	1	VOC	1093	2620	3078	1181
OCCIDENTAL OF ELK HILLS INC	S	1714	1	VOC	1290	3038	3527	1472
OCCIDENTAL OF ELK HILLS INC	S	1717	1	VOC	1239	3804	4274	1639
OCCIDENTAL OF ELK HILLS INC	S	1719	1	VOC	928	1948	2037	1118
OCCIDENTAL OF ELK HILLS INC	S	1722	1	VOC	1132	2723	3230	1359
OCCIDENTAL OF ELK HILLS INC	S	1723	1	VOC	1723	4185	4934	2003
OCCIDENTAL OF ELK HILLS INC	S	1725	1	VOC	1169	2764	3251	1348
OCCIDENTAL OF ELK HILLS INC	S	1726	1	VOC	1603	3911	4662	1932
OCCIDENTAL OF ELK HILLS INC	S	1727	1	VOC	1061	2580	3064	1240
OCCIDENTAL OF ELK HILLS INC	S	1728	1	VOC	1692	4025	4596	2098
OCCIDENTAL OF ELK HILLS INC	S	1754	1	VOC	0	653	619	0
OCCIDENTAL OF ELK HILLS INC	S	1773	1	VOC	379	0	0	468
OCCIDENTAL OF ELK HILLS INC	S	1775	1	VOC	604	591	0	577

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
OCCIDENTAL OF ELK HILLS INC	S	1776	1	VOC	594	607	467	614
OCCIDENTAL OF ELK HILLS INC	S	1777	1	VOC	419	454	0	0
OCCIDENTAL OF ELK HILLS INC	S	1778	1	VOC	0	1021	0	0
OCCIDENTAL OF ELK HILLS INC	S	1779	1	VOC	0	656	559	0
OCCIDENTAL OF ELK HILLS INC	S	1780	1	VOC	0	1678	0	0
OCCIDENTAL OF ELK HILLS INC	S	1782	1	VOC	454	464	398	0
OCCIDENTAL OF ELK HILLS INC	S	1783	1	VOC	587	2	35	4
OCCIDENTAL OF ELK HILLS INC	S	2120	1	VOC	55	794	1411	55
OCCIDENTAL OF ELK HILLS INC	S	2301	1	VOC	55	1046	1416	172
OCCIDENTAL OF ELK HILLS INC	S	2488	1	VOC	9	4650	5387	2519
OCCIDENTAL OF ELK HILLS INC	S	2490	1	VOC	0	2806	3570	1534
OCCIDENTAL OF ELK HILLS INC	S	2623	1	VOC	0	895	988	68
OCCIDENTAL OF ELK HILLS INC	S	2625	1	VOC	22	110	96	68
OCCIDENTAL OF ELK HILLS INC	S	2627	1	VOC	52	52	52	52
OCCIDENTAL OF ELK HILLS INC	S	3053	1	VOC	137	139	140	140
OCCIDENTAL OF ELK HILLS INC	S	3077	1	VOC	121	123	124	124
OCCIDENTAL OF ELK HILLS INC	S	3078	1	VOC	81	82	83	83
OCCIDENTAL OF ELK HILLS INC	S	3166	1	VOC	842	2545	2372	659
OCCIDENTAL OF ELK HILLS INC	S	3169	1	VOC	193	2665	3573	520
OCCIDENTAL OF ELK HILLS INC	S	3225	1	VOC	648	1755	1926	805
OCCIDENTAL OF ELK HILLS INC	S	3327	1	VOC	24	24	24	24
OCCIDENTAL OF ELK HILLS INC	S	3379	1	VOC	386	6020	8655	1509
OCCIDENTAL OF ELK HILLS INC	S	3536	1	VOC	44	2319	3256	356
OCCIDENTAL OF ELK HILLS INC	S	3538	1	VOC	0	2333	3325	626
OCCIDENTAL OF ELK HILLS INC	S	3627	1	VOC	3730	3448	3015	3510
OCCIDENTAL OF ELK HILLS INC	S	3947	1	VOC	83	2429	3196	464
OCCIDENTAL OF ELK HILLS INC	S	3951	1	VOC	75129	76311	77494	77493
OCCIDENTAL OF ELK HILLS INC	S	3982	1	VOC	57750	66429	69005	64318
OILDALE ENERGY LLC	S	1096	1	VOC	100	100	100	100
OLAM	N	920	1	VOC	0	0	3	0
OLDUVAI GORGE, LLC	N	794	1	VOC	14089	2531	5512	1043
OLDUVAI GORGE, LLC	N	1113	1	VOC	2798	1495	3722	2705
PACIFIC ETHANOL VISALIA	S	4021	1	VOC	2999	2998	2997	2991
PACIFIC GAS & ELECTRIC CO.	C	280	1	VOC	21981	68020	71348	53244
PACIFIC GAS & ELECTRIC CO.	N	868	1	VOC	926	5826	5035	615
PACIFIC PIPELINE SYSTEM, LLC	S	776	1	VOC	28	67	77	34
PACTIV CORPORATION	N	1062	1	VOC	27192	27192	27192	27192
PACTIV, LLC	C	1182	1	VOC	9986	9206	9494	9041
PACTIV, LLC	C	1183	1	VOC	2001	1688	2462	1110
PACTIV, LLC	C	1184	1	VOC	47518	2227	0	17129
PACTIV, LLC	C	1185	1	VOC	51342	0	0	0
PACTIV, LLC	S	3862	1	VOC	1513	1972	1571	1510
PANOCHE ENERGY CENTER, LLC	S	3128	1	VOC	9877	9878	3774	8656
PANOCHE ENERGY CENTER, LLC	S	3985	1	VOC	8302	8303	8426	8302

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
PANOCHE GINNING CO	C	904	1	VOC	0	0	0	49
PARAMOUNT FARMS, INC.	C	291	1	VOC	0	0	63	12
PELCO INC A DELAWARE CORPORATION	C	1121	1	VOC	374	374	349	349
PELCO INC A DELAWARE CORPORATION	C	1122	1	VOC	1842	2601	2219	1756
PHOENIX BIO INDUSTRIES LLC	C	824	1	VOC	500	500	500	500
PILKINGTON NORTH AMERICA, INC	N	943	1	VOC	234	203	211	182
PLAINS LPG SERVICES, L.P.	S	3367	1	VOC	356	2023	2767	1433
PLAINS LPG SERVICES, L.P.	S	3793	1	VOC	583	583	583	583
PWP INDUSTRIES, INC. DBA PACTIV LLC	N	1059	1	VOC	23529	14812	15264	14520
SAINT-GOBAIN CONTAINERS, INC	C	1082	1	VOC	0	0	0	7
SAINT-GOBAIN CONTAINERS, INC	N	1019	1	VOC	0	0	0	135
SAINT-GOBAIN CONTAINERS, INC	S	3498	1	VOC	0	0	0	34
SAN JOAQUIN FACILITIES MGMT	S	648	1	VOC	116	93	118	120
SAN JOAQUIN FACILITIES MGMT	S	1253	1	VOC	41	46	50	44
SAN JOAQUIN FACILITIES MGMT	S	1509	1	VOC	11	14	14	14
SAN JOAQUIN FACILITIES MGMT	S	3180	1	VOC	34	23	34	39
SAN JOAQUIN FACILITIES MGMT	S	3210	1	VOC	33767	28482	32565	37850
SAN JOAQUIN FACILITIES MGMT	S	3801	1	VOC	228	225	223	223
SAN JOAQUIN REFINING COMPANY	S	4078	1	VOC	25	25	24	23
SC JOHNSON HOME STORAGE INC	C	1173	1	VOC	1055	1415	1403	1447
SEALED AIR CORPORATION	C	851	1	VOC	19000	19000	19000	19000
SEMI TROPIC COOP GIN	S	426	1	VOC	1	0	1	28
SENECA RESOURCES	S	3440	1	VOC	0	0	0	339
SEQUOIA FOREST INDUSTRIES	C	67	1	VOC	2	9	0	6
SEQUOIA FOREST INDUSTRIES	C	72	1	VOC	7	0	1	1
SFPP, L.P.	S	3987	1	VOC	2516	2516	2515	2515
SHAFTER-WASCO GINNING COMPANY	S	3268	1	VOC	0	0	0	13
SHELL CALIFORNIA PIPELINE COMPANY LLC	C	467	1	VOC	185	0	0	0
SHELL PIPELINE COMPANY LP	N	474	1	VOC	400	400	400	400
SHELL PIPELINE COMPANY LP	S	1807	1	VOC	86	58	26	26
SHELL PIPELINE COMPANY LP	S	2303	1	VOC	0	658	431	0
SHELL PIPELINE COMPANY LP	S	3158	1	VOC	98	98	97	97
SILGAN CONTAINERS LODI MFG CORP	N	431	1	VOC	5103	3464	3573	3865
SILGAN CONTAINERS MANUFAC CORP	C	1208	1	VOC	4279	3921	3042	3166
SOUTH KERN INDUSTRIAL CENTER LLC	S	3006	1	VOC	0	190	382	0
SOUTH VALLEY GINS INC	S	3554	1	VOC	0	0	0	10

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
SOUTHERN CALIF GAS CO	S	671	1	VOC	570	576	583	583
SOUTHERN CALIF GAS CO	S	1739	1	VOC	1322	1337	1354	1352
SPRECKELS SUGAR COMPANY	C	1112	1	VOC	0	767	1032	454
STARWOOD POWER-MIDWAY, LLC	S	3095	1	VOC	0	0	0	10
STOCKTON EAST WATER DISTRICT	N	763	1	VOC	1627	2271	2299	2059
TAUBER OIL COMPANY	S	3777	1	VOC	383	508	489	663
TAUBER OIL COMPANY	S	3778	1	VOC	123	57	121	0
TAUBER OIL COMPANY	S	3779	1	VOC	82	82	82	82
TAUBER OIL COMPANY	S	3780	1	VOC	330	398	459	413
TESORO LOGISTICS OPERATIONS LLC	N	1078	1	VOC	1539	1539	1539	1537
TEXACO EXPLOR & PROD INC	S	904	1	VOC	492	551	403	459
THE DOW CHEMICAL COMPANY	N	799	1	VOC	218	212	236	224
THE NESTLE COMPANY INC	N	93	1	VOC	997	1820	1874	1007
THE WINE GROUP LLC	S	3842	1	VOC	500	500	500	500
TKV CONTAINERS, INC.	C	1015	1	VOC	0	83	83	0
TRC CYPRESS GROUP LLC	S	2292	1	VOC	1412	1412	1412	1412
TRC OPERATION COMPANY, INC.	S	767	1	VOC	394	399	403	403
TULARE CITY WASTEWATER PLANT	S	2697	1	VOC	60	60	60	87
TULE RIVER CO-OP GIN INC	S	2682	1	VOC	0	0	0	13
TURLOCK IRRIGATION DISTRICT	C	607	1	VOC	297	297	297	297
TURLOCK IRRIGATION DISTRICT	C	1116	1	VOC	1080	1080	1079	1079
UNITED STATES GYPSUM COMPANY	C	818	1	VOC	0	0	0	40
UNITED STATES GYPSUM COMPANY	N	661	1	VOC	15000	16335	16334	12331
UNITED STATES GYPSUM COMPANY	S	2543	1	VOC	0	0	0	17
UNITED STATES GYPSUM COMPANY	S	2816	1	VOC	20000	20000	20000	20000
UNIVERSITY ENERGY SERVICES	S	561	1	VOC	63	54	59	61
VALERO LP	N	578	1	VOC	2372	2372	2372	2371
VANDERHAM WEST	S	3235	1	VOC	240	240	240	240
VARCO PRUDEN BUILDINGS, INC.	N	898	1	VOC	5404	6473	10921	8632
VECTOR ENVIRONMENTAL, INC.	S	4039	1	VOC	40127	48678	45027	5416
VINTAGE PRODUCTION CALIFORNIA LLC	N	1101	1	VOC	1000	1000	1000	1000
VINTAGE PRODUCTION CALIFORNIA LLC	N	1112	1	VOC	1875	1875	1875	1875
VINTAGE PRODUCTION CALIFORNIA LLC	S	2310	1	VOC	1121	1723	2077	1280
VINTAGE PRODUCTION CALIFORNIA LLC	S	3574	1	VOC	145	2915	4020	260
VINTAGE PRODUCTION CALIFORNIA LLC	S	3577	1	VOC	203	463	491	214

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
VINTAGE PRODUCTION CALIFORNIA LLC	S	3578	1	VOC	1178	4452	6003	1377
VINTAGE PRODUCTION CALIFORNIA LLC	S	3579	1	VOC	1190	4465	5981	1360
VINTAGE PRODUCTION CALIFORNIA LLC	S	3580	1	VOC	540	2873	3896	660
VINTAGE PRODUCTION CALIFORNIA LLC	S	3581	1	VOC	105	1473	2033	152
VINTAGE PRODUCTION CALIFORNIA LLC	S	3582	1	VOC	123	1513	2068	162
VINTAGE PRODUCTION CALIFORNIA LLC	S	4047	1	VOC	349	2693	3723	459
VINTAGE PRODUCTION CALIFORNIA LLC	S	4049	1	VOC	32	796	1783	481
VINTAGE PRODUCTION CALIFORNIA LLC	S	4062	1	VOC	26	178	115	66
VISALIA WASTEWATER TREATMENT	S	1837	1	VOC	5067	2634	4107	4614
WESTERN COTTON SERVICES	S	606	1	VOC	0	0	0	9
WESTERN STONE PRODUCTS, INC.	N	17	1	VOC	6	6	7	7
WESTLAKE FARMS INC	C	645	1	VOC	0	0	0	18
WESTSIDE FARMERS COOP #2 & #3	C	1038	1	VOC	5	0	0	57
WESTSIDE FARMERS COOP GIN #6	C	592	1	VOC	6	0	0	44
WESTSIDE FARMERS COOP. GIN	C	164	1	VOC	0	0	0	31
AERA ENERGY LLC	C	219	2	NOx	1738	1923	2100	1931
AERA ENERGY LLC	C	681	2	NOx	26900	26900	26900	26900
AERA ENERGY LLC	S	133	2	NOx	3203	0	0	0
AERA ENERGY LLC	S	135	2	NOx	5032	1152	0	0
AERA ENERGY LLC	S	137	2	NOx	5115	6792	5437	9206
AERA ENERGY LLC	S	139	2	NOx	11686	11816	11946	11946
AERA ENERGY LLC	S	140	2	NOx	36695	46397	47292	36806
AERA ENERGY LLC	S	158	2	NOx	38057	29690	32405	43791
AERA ENERGY LLC	S	162	2	NOx	128454	152970	128743	130786
AERA ENERGY LLC	S	163	2	NOx	96698	107197	101158	78678
AERA ENERGY LLC	S	470	2	NOx	3478	4930	5390	5212
AERA ENERGY LLC	S	662	2	NOx	9433	18919	3766	817
AERA ENERGY LLC	S	784	2	NOx	7140	3993	228	0
AERA ENERGY LLC	S	838	2	NOx	442	218	338	338
AERA ENERGY LLC	S	865	2	NOx	6713	6788	6863	6863
AERA ENERGY LLC	S	883	2	NOx	632	160	2073	2061
AERA ENERGY LLC	S	1030	2	NOx	93295	83665	32600	77083
AERA ENERGY LLC	S	1061	2	NOx	8071	8777	10695	9555
AERA ENERGY LLC	S	1062	2	NOx	8530	9784	10046	9903
AERA ENERGY LLC	S	1063	2	NOx	9423	10057	12159	9776
AERA ENERGY LLC	S	1064	2	NOx	5126	5705	5881	6709

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
AERA ENERGY LLC	S	1065	2	NOx	10366	10483	11017	8841
AERA ENERGY LLC	S	1066	2	NOx	5542	7367	5038	6117
AERA ENERGY LLC	S	1067	2	NOx	1255	893	2650	4592
AERA ENERGY LLC	S	1068	2	NOx	7648	9620	6968	8415
AERA ENERGY LLC	S	1069	2	NOx	4713	5029	4352	2082
AERA ENERGY LLC	S	1070	2	NOx	495	4228	2744	99
AERA ENERGY LLC	S	1092	2	NOx	348	242	246	236
AERA ENERGY LLC	S	1270	2	NOx	4586	4637	4688	4688
AERA ENERGY LLC	S	1437	2	NOx	42372	49588	46800	43954
AERA ENERGY LLC	S	1476	2	NOx	1242	0	0	350
AERA ENERGY LLC	S	1477	2	NOx	2153	0	0	607
AERA ENERGY LLC	S	1821	2	NOx	5974	7291	7466	4158
AERA ENERGY LLC	S	1851	2	NOx	914	455	0	1154
AERA ENERGY LLC	S	1935	2	NOx	474	508	543	543
AERA ENERGY LLC	S	2023	2	NOx	1108	636	737	993
AERA ENERGY LLC	S	2361	2	NOx	30	4	0	12
AERA ENERGY LLC	S	2774	2	NOx	5817	4899	4757	8181
AERA ENERGY LLC	S	2782	2	NOx	329	323	318	341
AERA ENERGY LLC	S	3267	2	NOx	5519	3439	0	2156
AERA ENERGY LLC	S	3312	2	NOx	2432	4568	1346	162
AERA ENERGY LLC	S	3689	2	NOx	76465	88497	87135	83102
AERA ENERGY LLC	S	3831	2	NOx	8498	5583	30	1326
AERA ENERGY LLC	S	4043	2	NOx	9103	6918	7765	11184
AERA ENERGY LLC	S	4063	2	NOx	573	515	438	663
AERA ENERGY LLC	S	4064	2	NOx	359	564	674	586
AGRI-CEL INC	S	3631	2	NOx	54	67	63	8
ALON BAKERSFIELD REFINING	S	3459	2	NOx	99200	101589	104030	104030
ALON BAKERSFIELD REFINING	S	3460	2	NOx	4645	5658	5190	4325
ALON BAKERSFIELD REFINING	S	3461	2	NOx	1425	1689	1612	1776
ANDERSON CLAYTON CORP/IDRIA #1	C	959	2	NOx	0	0	0	2122
AVENAL POWER CENTER, LLC	C	899	2	NOx	2243	2243	2243	2243
AVENAL POWER CENTER, LLC	C	902	2	NOx	13879	6131	1086	8539
AVENAL POWER CENTER, LLC	N	720	2	NOx	0	9	1255	437
AVENAL POWER CENTER, LLC	N	722	2	NOx	0	1166	88317	1422
AVENAL POWER CENTER, LLC	N	726	2	NOx	0	0	4728	0
AVENAL POWER CENTER, LLC	N	728	2	NOx	10542	3731	2487	5171
AVENAL POWER CENTER, LLC	S	2814	2	NOx	6121	13869	18914	11461
AVENAL POWER CENTER, LLC	S	2955	2	NOx	51000	51000	51000	51000
BAKER COMMODITIES INC	N	482	2	NOx	1194	1194	1196	1194
BAKERSFIELD CITY WOOD SITE	S	2969	2	NOx	1564	2135	2265	1857
BERRY PETROLEUM COMPANY	N	980	2	NOx	0	0	5529	581
BERRY PETROLEUM COMPANY	N	981	2	NOx	177	172	1273	128
BERRY PETROLEUM COMPANY	S	3256	2	NOx	239	239	239	239
BERRY PETROLEUM COMPANY	S	3656	2	NOx	12976	0	0	0

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
BERRY PETROLEUM COMPANY	S	3913	2	NOx	416	833	0	417
BERRY PETROLEUM COMPANY	S	3915	2	NOx	1751	0	0	0
BERRY PETROLEUM COMPANY	S	3962	2	NOx	121	121	0	119
BERRY PETROLEUM COMPANY	S	3970	2	NOx	26672	26672	26672	26672
BERRY PETROLEUM COMPANY	S	4015	2	NOx	0	0	121	0
BGC ENVIRONMENTAL BROKERAGE SERVICES, LP	N	1045	2	NOx	66981	66981	66981	66981
BREITBURN OPERATING LP	S	4057	2	NOx	7	9	7	6
BRITZ AG FINANCE CO., INC.	C	557	2	NOx	0	0	0	232
BRITZ GIN PARTNERSHIP II	C	871	2	NOx	0	0	0	585
BRITZ INCORPORATED	C	586	2	NOx	0	0	0	381
BROWN SAND INC	N	46	2	NOx	90	98	46	83
BRUCE CARTER INDUSTRIES, INC.	S	4038	2	NOx	25	31	29	4
BUILDING MATERIALS MFG. CORP. (DBA GAF)	S	1662	2	NOx	5832	5840	5848	5848
CALAVERAS MATERIALS INC	C	89	2	NOx	284	257	294	236
CALAVERAS MATERIALS INC.	C	233	2	NOx	1265	3371	3913	2469
CALIFORNIA DAIRIES	N	836	2	NOx	2298	1078	961	841
CALIFORNIA DAIRIES, INC	S	2731	2	NOx	50	0	24	1282
CALIFORNIA DAIRIES, INC.	C	635	2	NOx	22	22	22	22
CALIFORNIA DAIRIES, INC.	C	658	2	NOx	0	0	102	75
CALIFORNIA DAIRIES, INC.	C	677	2	NOx	450	126	472	315
CALIFORNIA DAIRIES, INC.	N	707	2	NOx	0	1270	1363	226
CALIFORNIA DAIRIES, INC.	S	2293	2	NOx	32	33	32	32
CALIFORNIA SPRAY DRY CO	N	904	2	NOx	267	353	369	328
CALIFORNIA STATE PRISON - CORCORAN	S	3112	2	NOx	135	137	137	138
CALMAT CO.	C	50	2	NOx	104	111	154	159
CALMAT OF FRESNO	C	40	2	NOx	74	355	163	547
CALNEV PIPE LINE LLC	S	2553	2	NOx	1886	1886	1886	1886
CALPINE CORPORATION	S	3298	2	NOx	2103	9681	19140	9076
CALPINE CORPORATION	S	3541	2	NOx	0	242	0	0
CALPINE ENERGY SERVICES, L.P.	C	1014	2	NOx	302	0	0	852
CALPINE ENERGY SERVICES, L.P.	C	1040	2	NOx	0	0	0	684
CALPINE ENERGY SERVICES, L.P.	N	845	2	NOx	4089	4089	4089	3093
CALPINE ENERGY SERVICES, L.P.	N	846	2	NOx	4429	4429	4429	3353
CALPINE ENERGY SERVICES, L.P.	N	903	2	NOx	5833	5834	5834	5833
CALPINE ENERGY SERVICES, L.P.	S	3138	2	NOx	0	0	0	760
CALPINE ENERGY SERVICES, L.P.	S	3277	2	NOx	6400	0	3870	1876
CAMPBELL SOUP COMPANY	N	127	2	NOx	1515	454	409	924
CANANDAIGUA WINE COMPANY INC	C	1203	2	NOx	354	358	380	334
CANDLEWICK YARNS	C	507	2	NOx	90	77	63	58
CASTLE AIRPORT AVIATION & DEVELOP CENTER	N	109	2	NOx	38954	39386	39819	39819

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CHEMICAL WASTE MANAGEMENT, INC	N	687	2	NOx	7	7	6	6
CHEVRON U S A INC	S	629	2	NOx	2316	2041	2088	1975
CHEVRON U S A INC	S	1325	2	NOx	260	118	276	211
CHEVRON U S A INC	S	1428	2	NOx	1968	1990	2011	2011
CHEVRON U.S.A. INC.	N	1051	2	NOx	15566	8173	19366	19259
CHEVRON U.S.A. INC.	N	1052	2	NOx	0	0	8139	0
CHEVRON U.S.A. INC.	N	1053	2	NOx	0	0	9120	180
CHEVRON U.S.A. INC.	N	1054	2	NOx	500	500	500	500
CHEVRON USA INC	C	221	2	NOx	2311	2557	2792	2567
CHEVRON USA INC	C	331	2	NOx	23739	23739	23740	23740
CHEVRON USA INC	C	364	2	NOx	30130	29673	29217	29217
CHEVRON USA INC	C	966	2	NOx	2	2	2	2
CHEVRON USA INC	C	1158	2	NOx	0	0	0	132
CHEVRON USA INC	C	1159	2	NOx	0	0	0	137
CHEVRON USA INC	C	1160	2	NOx	175	0	0	1230
CHEVRON USA INC	C	1161	2	NOx	0	0	0	846
CHEVRON USA INC	S	77	2	NOx	2038	1840	1733	2274
CHEVRON USA INC	S	436	2	NOx	12891	9861	9530	10101
CHEVRON USA INC	S	496	2	NOx	5160	233	1734	4212
CHEVRON USA INC	S	909	2	NOx	3990	3412	3474	3072
CHEVRON USA INC	S	1100	2	NOx	62167	62857	63548	63548
CHEVRON USA INC	S	1102	2	NOx	57160	57795	58430	58430
CHEVRON USA INC	S	1106	2	NOx	11814	11942	12075	12075
CHEVRON USA INC	S	1256	2	NOx	45238	45741	46244	46244
CHEVRON USA INC	S	1419	2	NOx	4875	4928	4983	4983
CHEVRON USA INC	S	1445	2	NOx	17602	20114	20328	15867
CHEVRON USA INC	S	1487	2	NOx	11663	11793	11923	11923
CHEVRON USA INC	S	1605	2	NOx	5672	7143	7028	6447
CHEVRON USA INC	S	1967	2	NOx	973	955	855	984
CHEVRON USA INC	S	2031	2	NOx	5694	4723	4406	0
CHEVRON USA INC	S	2111	2	NOx	7823	15506	21032	12182
CHEVRON USA INC	S	2456	2	NOx	32003	32799	31884	32561
CHEVRON USA INC	S	3156	2	NOx	12415	12563	12710	12710
CHEVRON USA INC	S	3544	2	NOx	3027	3303	2542	2691
CHEVRON USA INC	S	3604	2	NOx	1948	3037	3398	2243
CHEVRON USA INC	S	3735	2	NOx	43881	44422	44964	44964
CHEVRON USA INC	S	3784	2	NOx	47002	47880	48758	48758
CHEVRON USA INC	S	3817	2	NOx	0	0	9568	154
CHEVRON USA INC	S	3818	2	NOx	0	6312	0	5064
CHEVRON USA INC	S	3819	2	NOx	6000	6000	6000	6000
CHEVRON USA INC	S	4006	2	NOx	139557	139557	139557	139557
CHEVRON USA INC	S	2E+07	2	NOx	3806	3765	3765	3848
CHEVRON USA INC	S	4E+07	2	NOx	20385	20612	20838	20838
CHEVRON USA INC (REFINERY)	S	3208	2	NOx	28667	29255	29842	29842

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
CHEVRON USA INC LOST HILLS GP	S	704	2	NOx	5564	5626	5687	5687
CHEVRON USA INC LOST HILLS GP	S	1470	2	NOx	780	789	797	797
CHEVRON USA PRODUCTION INC	S	674	2	NOx	507	781	226	485
CHEVRON USA PRODUCTION INC	S	3228	2	NOx	139	161	275	104
CHEVRON USA PRODUCTION INC	S	3533	2	NOx	181	188	224	219
CITY OF TULARE	N	902	2	NOx	0	436	436	471
CITY OF TULARE	S	3398	2	NOx	501	0	0	0
CITY OF VISALIA	N	317	2	NOx	0	0	7160	0
CLARK BROTHERS-DERRICK GIN	C	511	2	NOx	0	0	0	43
CON AGRA FOOD INGREDIENTS, CO	S	2201	2	NOx	6	6	5	5
CONAGRA CONSUMER FROZEN FOODS	N	487	2	NOx	356	163	243	300
CONAGRA CONSUMER FROZEN FOODS	N	856	2	NOx	0	0	1749	0
CORCORAN IRRIGATION DISTRICT	C	560	2	NOx	352	356	321	209
COTTON ASSOCIATES, INC	S	25	2	NOx	0	0	0	157
CRAYCROFT BRICK COMPANY	C	71	2	NOx	417	336	328	332
CRIMSON RESOURCE MANAGEMENT	S	2251	2	NOx	316	272	186	375
CRIMSON RESOURCE MANAGEMENT	S	3388	2	NOx	4704	3393	3449	2696
CRIMSON RESOURCE MANAGEMENT	S	3389	2	NOx	95	299	319	166
CRIMSON RESOURCE MANAGEMENT	S	3441	2	NOx	5	4	4	5
DAIRY FARMERS OF AMERICA, INC.	C	689	2	NOx	0	0	253	0
DARLING INTERNATIONAL INC.	C	859	2	NOx	0	0	0	270
DARLING INTERNATIONAL INC.	N	674	2	NOx	0	51	107	0
DARLING INTERNATIONAL INC.	S	2635	2	NOx	911	860	804	641
DIAMOND FOODS INCORPORATED	N	573	2	NOx	1	1	0	0
DIAMOND FOODS INCORPORATED	N	826	2	NOx	4443	2607	2618	0
E & J GALLO WINERY	N	2	2	NOx	2587	2434	7175	7642
E & J GALLO WINERY	N	849	2	NOx	0	14	111	0
E & J GALLO WINERY	N	1010	2	NOx	2500	2500	2500	2500
E & J GALLO WINERY	N	1011	2	NOx	625	625	625	625
E & J GALLO WINERY	N	1012	2	NOx	545	545	545	545
E & J GALLO WINERY	N	1061	2	NOx	9980	9980	10939	9979
E&B NATURAL RESOURCES MANAGEMENT CORP.	C	1141	2	NOx	1632	1632	1632	0
E&B NATURAL RESOURCES MGMT	S	2773	2	NOx	454	689	275	487

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
E&B NATURAL RESOURCES MGMT	S	3785	2	NOx	0	3296	538	2636
E&B NATURAL RESOURCES MGMT	S	3786	2	NOx	0	2971	2714	2156
E&B NATURAL RESOURCES MGMT	S	3787	2	NOx	0	3374	5552	6708
E&B NATURAL RESOURCES MGMT	S	3788	2	NOx	0	0	1064	0
E&B NATURAL RESOURCES MGMT	S	3789	2	NOx	7208	0	0	0
E&B NATURAL RESOURCES MGMT	S	3790	2	NOx	2660	227	0	0
EAGLE VALLEY GINNING LLC	N	847	2	NOx	0	0	0	427
ECKERT FROZEN FOODS	N	133	2	NOx	146	545	2047	395
ELBOW ENTERPRISES INC	S	2535	2	NOx	0	0	0	1168
ELEMENT MARKETS LLC	S	3821	2	NOx	830	830	830	830
ELEMENT MARKETS LLC	S	3941	2	NOx	3548	3548	3548	3548
ELK HILLS POWER LLC	S	1622	2	NOx	1373	1389	1404	1404
ELK HILLS POWER LLC	S	1994	2	NOx	12485	12624	12762	12762
EVOLUTION MARKETS INC.	C	944	2	NOx	0	298	1590	300
EVOLUTION MARKETS INC.	C	945	2	NOx	0	286	1530	289
EVOLUTION MARKETS INC.	N	776	2	NOx	875	927	771	876
EVOLUTION MARKETS INC.	S	2738	2	NOx	1696	3526	1536	1221
EVOLUTION MARKETS INC.	S	2740	2	NOx	0	27355	0	0
EVOLUTION MARKETS INC.	S	2896	2	NOx	130	131	132	132
EVOLUTION MARKETS INC.	S	2899	2	NOx	1313	1378	1443	1443
EVOLUTION MARKETS INC.	S	2908	2	NOx	1500	1500	1500	1500
EXXON MOBIL CORPORATION	S	84	2	NOx	1648	1666	1685	1685
EXXON MOBIL CORPORATION	S	188	2	NOx	5175	5197	5494	4871
EXXON MOBIL CORPORATION	S	301	2	NOx	3010	2818	2052	3565
FARMERS COOPERATIVE GIN INC	S	2533	2	NOx	0	0	0	598
FREEPORT-MC MORAN OIL & GAS	S	2092	2	NOx	10010	10691	10155	6716
FREEPORT-MC MORAN OIL & GAS	S	2093	2	NOx	13229	10050	6765	15163
FREEPORT-MC MORAN OIL & GAS	S	3227	2	NOx	4812	4814	4815	4815
FREEPORT-MC MORAN OIL & GAS	S	3613	2	NOx	1411	73	1449	2071
FRESNO/CLOVIS REGIONAL WWTP	C	1211	2	NOx	65	65	65	65
FRITO-LAY, INC.	S	3763	2	NOx	287	442	182	53
FRITO-LAY, INC.	S	3765	2	NOx	7432	7619	7790	7789
G.I.C. FINANCIAL SERVICES, INC.	C	1059	2	NOx	21900	21900	21900	21900
GALLO GLASS COMPANY	N	768	2	NOx	14634	12268	15814	10504
GALLO GLASS COMPANY	N	900	2	NOx	63691	64821	66246	61340
GALLO GLASS COMPANY	N	966	2	NOx	63525	46849	57176	61929
GENERAL MILLS OPERATIONS, INC	N	610	2	NOx	52	3	0	100
GENERAL MILLS, INC	S	3217	2	NOx	0	0	0	30
GLOBAL AMPERSAND LLC	S	2976	2	NOx	239	239	239	239

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
GROWERS COOP	S	88	2	NOx	0	0	22	406
GUARDIAN INDUSTRIES CORP	C	1225	2	NOx	38346	38346	38346	38346
GWF ERC LLC	S	3529	2	NOx	0	0	3	0
H. J. HEINZ COMPANY	N	534	2	NOx	0	360	3207	0
H. J. HEINZ COMPANY	N	694	2	NOx	0	43	2570	0
H. J. HEINZ COMPANY, L.P.	N	21	2	NOx	0	1026	3112	1060
HANFORD L P	C	1191	2	NOx	3081	4129	2703	716
HANSEN BROTHERS	C	249	2	NOx	0	0	0	256
HERSHEY CHOCOLATE & CONF. CORP	N	952	2	NOx	114	106	125	125
HILMAR CHEESE COMPANY	S	2138	2	NOx	0	0	0	1070
HOLMES WESTERN OIL CORPORATION	S	3377	2	NOx	1633	1632	1632	1632
HYDROGEN ENERGY CA LLC	C	1058	2	NOx	10100	10100	10100	10100
HYDROGEN ENERGY CALIFORNIA, LLC	S	3273	2	NOx	120500	120500	120500	120500
INERGY WEST COAST LLC	S	3893	2	NOx	14	14	14	14
INERGY WEST COAST LLC	S	3895	2	NOx	125	125	125	125
INERGY WEST COAST LLC	S	3900	2	NOx	47	137	86	23
J.G. BOSWELL CO. (EL RICO)	C	135	2	NOx	14	4	0	40
J.R. SIMPLOT COMPANY	C	44	2	NOx	3942	3873	3402	2891
JOHN T HOPPER	C	712	2	NOx	0	55	295	56
KAWEAH DELTA DISTRICT HOSPITAL	S	2657	2	NOx	100	441	536	667
KERN DELTA WEEDPATCH GINNING	S	3199	2	NOx	0	0	0	622
KERN LAKE COOP GIN	S	2074	2	NOx	0	0	0	309
KERN OIL & REFINING CO.	S	2653	2	NOx	94	277	91	215
KERN OIL & REFINING COMPANY	N	878	2	NOx	24	19	32	24
KERN OIL & REFINING COMPANY	N	879	2	NOx	156	188	224	202
KINGS RIVER CONSERVATION DISTRICT	C	647	2	NOx	0	0	1029	0
KRAFT FOODS GROUP INC	S	4027	2	NOx	0	0	3425	1107
KRAFT FOODS GROUP INC	S	4028	2	NOx	2070	0	0	94
KRAFT FOODS GROUP INC	S	4035	2	NOx	0	0	0	24
KRAFT FOODS GROUP INC	S	4036	2	NOx	0	0	165	0
KRAFT FOODS GROUP INC	S	4037	2	NOx	1227	3443	0	733
KRAFT FOODS INC	C	149	2	NOx	284	284	284	284
KRAFT FOODS INC	C	386	2	NOx	9774	9883	9992	9992
KRAFT FOODS INC	C	387	2	NOx	5	5	4	4
KRAFT FOODS INC	C	1138	2	NOx	0	0	0	1632
LA PALOMA GENERATING COMPANY	N	514	2	NOx	0	9612	22455	0
LAND O' LAKES, INC.	S	3326	2	NOx	214	166	214	214
LAND O' LAKES, INC.	S	3625	2	NOx	618	473	646	602

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
LAWRENCE LIVERMORE NATL. LAB	N	464	2	NOx	83	31	0	61
LEPRINO FOODS	N	108	2	NOx	2335	2529	2412	2143
LEPRINO FOODS COMPANY	C	60	2	NOx	7878	7985	7810	7898
LIBERTY COMPOSTING INC	S	3855	2	NOx	925	925	925	925
LIDESTRI FOODS, INC	N	391	2	NOx	0	0	1527	0
LOCKHEED MARTIN	S	2990	2	NOx	3000	3000	3000	3000
LOCKHEED MARTIN	S	3079	2	NOx	1160	1840	1500	1500
LOS BANOS GRAVEL GROUP, ASPHLT	N	125	2	NOx	23	113	359	120
LOS GATOS TOMATO PRODUCTS	C	1021	2	NOx	0	4	0	0
LOVELACE & SONS FARMING	C	807	2	NOx	0	0	0	257
M CARATAN INC	S	2516	2	NOx	0	0	189	46
MACPHERSON OIL COMPANY	C	1195	2	NOx	73	73	73	73
MACPHERSON OIL COMPANY	S	3940	2	NOx	4055	4055	4055	4055
MARTIN ANDERSON	C	1051	2	NOx	52	77	45	3
MEMORIAL MEDICAL CENTER	S	2268	2	NOx	2550	2550	2550	2550
MODESTO IRRIGATION DISTRICT	C	1111	2	NOx	0	0	74	5923
MODESTO IRRIGATION DISTRICT	N	430	2	NOx	0	0	273	0
MODESTO TALLOW CO INC	N	599	2	NOx	364	328	400	391
MONTEREY RESOURCES, INC.	S	432	2	NOx	2053	2081	1707	1898
NAS LEMOORE	C	1048	2	NOx	26	26	25	25
NORTHERN CALIFORNIA POWER AGENCY	C	1129	2	NOx	0	6728	3983	1831
NORTHERN CALIFORNIA POWER AGENCY	C	1132	2	NOx	0	137	122	117
NORTHERN CALIFORNIA POWER AGENCY	N	751	2	NOx	0	0	10015	0
NORTHERN CALIFORNIA POWER AGENCY	N	752	2	NOx	0	791	835	0
NORTHERN CALIFORNIA POWER AGENCY	N	1028	2	NOx	0	274	790	147
NORTHERN CALIFORNIA POWER AGENCY	S	2854	2	NOx	0	1437	0	0
NORTHERN CALIFORNIA POWER AGENCY	S	2857	2	NOx	0	0	0	1031
NORTHERN CALIFORNIA POWER AGENCY	S	2895	2	NOx	0	0	0	3406
NORTHERN CALIFORNIA POWER AGENCY	S	3746	2	NOx	0	1432	15919	10487
NORTHROP GRUMMAN CORPORATION	N	992	2	NOx	2000	2000	2000	2000
OAKWOOD LAKE RESORT	N	601	2	NOx	0	117	188	0
OCCIDENTAL OF ELK HILLS INC	S	826	2	NOx	6684	6259	5625	6369
OCCIDENTAL OF ELK HILLS INC	S	2629	2	NOx	1735	1846	2330	1762
OCCIDENTAL OF ELK HILLS INC	S	3249	2	NOx	89	208	73	157

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
OCCIDENTAL OF ELK HILLS INC	S	3953	2	NOx	20254	20799	21346	21347
OCCIDENTAL OF ELK HILLS INC	S	3984	2	NOx	16562	17298	18037	18035
OLAM WEST COAST, INC	C	1006	2	NOx	1188	1163	1138	1137
OLDUVAI GORGE, LLC	C	998	2	NOx	0	0	0	815
OLDUVAI GORGE, LLC	N	769	2	NOx	2154	2045	2093	1783
OLDUVAI GORGE, LLC	N	782	2	NOx	1085	1097	1109	1109
OLDUVAI GORGE, LLC	N	805	2	NOx	14	0	0	296
OLDUVAI GORGE, LLC	N	824	2	NOx	0	0	0	396
OLDUVAI GORGE, LLC	N	1104	2	NOx	2792	2878	2965	2965
OLDUVAI GORGE, LLC	S	2802	2	NOx	3233	0	0	5000
OLDUVAI GORGE, LLC	S	2806	2	NOx	2306	290	2534	2070
OLDUVAI GORGE, LLC	S	2865	2	NOx	1126	0	0	0
OLDUVAI GORGE, LLC	S	3032	2	NOx	0	0	0	296
OLDUVAI GORGE, LLC	S	3034	2	NOx	0	0	0	321
OLDUVAI GORGE, LLC	S	3139	2	NOx	0	0	0	290
OLDUVAI GORGE, LLC	S	4074	2	NOx	18763	5129	6680	8512
PACIFIC COAST PRODUCERS	N	753	2	NOx	195	605	3088	312
PACIFIC GAS & ELECTRIC CO.	N	1076	2	NOx	0	904	248	0
PACIFIC PIPELINE SYSTEM, LLC	S	575	2	NOx	0	4693	10418	3569
PACIFIC PIPELINE SYSTEM, LLC	S	1099	2	NOx	0	13703	12649	0
PACIFIC PIPELINE SYSTEM, LLC	S	2286	2	NOx	1278	2194	2438	2438
PACTIV, LLC	S	3863	2	NOx	233	199	51	109
PARAMOUNT FARMS INTERNATIONAL LLC	C	1205	2	NOx	18029	18029	18029	18029
PARAMOUNT FARMS INTERNATIONAL LLC	C	1224	2	NOx	1000	1000	1000	1000
PARAMOUNT FARMS, INC	N	284	2	NOx	3670	3580	3488	3488
PARAMOUNT FARMS, INC.	C	497	2	NOx	1000	2000	4000	3000
PARAMOUNT FARMS, INC.	C	1035	2	NOx	0	0	155	334
PASTORIA ENERGY FACILITY, LLC	S	1543	2	NOx	10354	8381	11018	11467
PASTORIA ENERGY FACILITY, LLC	S	3114	2	NOx	178929	181004	183080	184561
PASTORIA ENERGY LLC	C	755	2	NOx	2525	1011	0	2038
PHILLIPS 66 PIPELINE LLC	C	1163	2	NOx	0	0	17	0
PILKINGTON NORTH AMERICA, INC	N	410	2	NOx	272	4	43	275
PILKINGTON NORTH AMERICA, INC	S	2970	2	NOx	1500	1500	1500	1500
PLAINS LPG SERVICES, L.P.	C	717	2	NOx	1024	1024	1023	1023
R F MACDONALD	C	579	2	NOx	0	8	0	0
R M WADE & COMPANY	C	152	2	NOx	326	373	379	370
SAN JOAQUIN FACILITIES MGMT	S	1253	2	NOx	459	509	544	481
SAN JOAQUIN FACILITIES MGMT	S	1509	2	NOx	34	45	45	45
SAN JOAQUIN FACILITIES MGMT	S	1735	2	NOx	9	8	6	4
SAN JOAQUIN FACILITIES MGMT	S	2537	2	NOx	71	0	0	0

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
SAN JOAQUIN FACILITIES MGMT	S	2539	2	NOx	597	0	0	307
SAN JOAQUIN REFINING COMPANY	S	3549	2	NOx	201	202	202	201
SAPUTO CHEESE USA INC.	N	834	2	NOx	1810	1810	1810	1810
SENECA RESOURCES	N	906	2	NOx	183	517	517	517
SENECA RESOURCES	S	1427	2	NOx	88	57	76	98
SENECA RESOURCES	S	3718	2	NOx	0	118	0	0
SHAFTER-WASCO GINNING COMPANY	S	3268	2	NOx	0	0	0	232
SIERRA POWER CORPORATION	S	2910001	2	NOx	2115	2138	2162	2162
SOUTH VALLEY GINS INC	S	3554	2	NOx	0	0	0	192
SOUTHERN CALIF GAS CO	S	1016	2	NOx	283	288	289	289
SOUTHERN CALIFORNIA GAS CORPORATION	N	299	2	NOx	0	1311	1415	0
SPRECKELS SUGAR COMPANY	C	1112	2	NOx	0	3701	5023	2200
STARWOOD POWER-MIDWAY, LLC	S	3676	2	NOx	283	283	496	354
STOCKTON EAST WATER DISTRICT	N	763	2	NOx	2654	3705	3750	3359
STRATAS FOODS LLC	C	1020	2	NOx	0	0	0	108
SUN GARDEN-GANGI CANNING CO LL	N	222	2	NOx	0	0	12886	540
TEXACO EXPLOR & PROD INC	S	2E+07	2	NOx	7037	7356	6314	6778
THE BEVERAGE SOURCE	N	92	2	NOx	220	800	520	900
THE NESTLE COMPANY INC	N	508	2	NOx	2975	2444	1853	3352
TKV CONTAINERS, INC.	C	1015	2	NOx	0	13	14	0
TRIANGLE PACIFIC CORPORATION	N	18	2	NOx	187	54	54	161
TURLOCK IRRIGATION DISTRICT	S	3707	2	NOx	3442	2862	2277	2277
UNITED STATES GYPSUM COMPANY	C	818	2	NOx	0	0	0	734
UNITED STATES GYPSUM COMPANY	N	662	2	NOx	308	36838	15649	308
UNITED STATES GYPSUM COMPANY	S	2543	2	NOx	0	0	0	311
UNITED STATES GYPSUM COMPANY	S	2815	2	NOx	39560	6703	27282	33352
VALLEY AIR CONDITIONING & REPAIR INC	C	693	2	NOx	0	0	108	0
VECTOR ENVIRONMENTAL, INC.	S	4039	2	NOx	102	125	117	15
VINTAGE PETROLEUM	N	346	2	NOx	0	165	1432	14
VINTAGE PRODUCTION CALIFORNIA LLC	C	1221	2	NOx	346	346	346	346
VINTAGE PRODUCTION CALIFORNIA LLC	C	1226	2	NOx	0	0	0	242
VINTAGE PRODUCTION CALIFORNIA LLC	N	945	2	NOx	2384	0	0	0

Current ERC Certificate Holder	ERC Number			Pollutant	Emissions (lb/qtr)			
					1st qtr	2nd qtr	3rd qtr	4th qtr
VINTAGE PRODUCTION CALIFORNIA LLC	N	946	2	NOx	4686	0	0	0
VINTAGE PRODUCTION CALIFORNIA LLC	N	947	2	NOx	1825	0	0	0
VINTAGE PRODUCTION CALIFORNIA LLC	N	1090	2	NOx	275	275	275	275
VINTAGE PRODUCTION CALIFORNIA LLC	N	1103	2	NOx	5000	5000	5000	5000
VINTAGE PRODUCTION CALIFORNIA LLC	S	3038	2	NOx	417	345	508	572
VINTAGE PRODUCTION CALIFORNIA LLC	S	3585	2	NOx	0	9294	4654	9859
VINTAGE PRODUCTION CALIFORNIA LLC	S	3586	2	NOx	0	1512	6228	0
VINTAGE PRODUCTION CALIFORNIA LLC	S	3588	2	NOx	1847	0	0	0
VINTAGE PRODUCTION CALIFORNIA LLC	S	3592	2	NOx	1283	275	1967	1412
VINTAGE PRODUCTION CALIFORNIA LLC	S	4073	2	NOx	550	550	550	308
WELLHEAD POWER PANOCHE, LLC.	C	874	2	NOx	0	3	3	0
WESTERN STONE PRODUCTS, INC.	N	17	2	NOx	543	543	619	619
WESTLAKE FARMS INC	C	645	2	NOx	0	0	0	498
WESTSIDE FARMERS COOP #2 & #3	C	1038	2	NOx	109	0	0	1122

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Appendix I

Triennial Progress Report and Plan Update for State Ozone Standards

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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APPENDIX I TRIENNIAL PROGRESS REPORT AND PLAN UPDATE FOR STATE OZONE STANDARDS

I.1 INTRODUCTION

The California Clean Air Act (CCAA) requires areas that have not attained state ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide to prepare plans to attain these standards by the earliest practicable date.[1] The San Joaquin Valley Air Pollution Control District (District) has attained each of these standards with the exception of ozone for the San Joaquin Valley (Valley) air basin. The California Air Resources Board (ARB) has designated the Valley as severe nonattainment of the state 1-hour ambient air quality standard for ozone.[2]

The California Health & Safety Code (CH&SC) further requires all districts designated as nonattainment of state ambient air quality standards to prepare and submit a plan for attaining and maintaining the standard to ARB.[3] Subsequent to the approval of such plans, the CH&SC requires air districts to prepare a report every three years summarizing progress in meeting the schedules for developing, adopting, and implementing the air pollution control measures contained in each district's plan.[4] In addition to assessing the progress made in the reporting period, the CH&SC also requires air districts designated as nonattainment to submit attainment plan revisions to correct for deficiencies in meeting the air quality standard and to incorporate new data and projections into the attainment plan.[5]

This triennial assessment and plan update is included as an appendix to the *2013 Plan for the Revoked 1-Hour Ozone Standard* to satisfy requirements of the CH&SC with respect to ozone and documents progress toward attainment through requirements stipulated in the District's *1991 Air Quality Attainment Plan* (adopted by the District in January 1992). This appendix also documents that the *2013 Plan for the Revoked 1-Hour Ozone Standard* meets the requirements for the triennial plan update, thus preventing backsliding and reflecting updated emissions and attainment projections based on the District's multi-faceted control strategies.

This appendix demonstrates the District's continued compliance with state requirements for continued progress toward the state ozone standards and related triennial progress report requirements over the course of two three-year reporting periods, 2006 through 2008 and 2009 through 2011.

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[1] California Health and Safety Code (CH&SC) §40911(a)

[2] The State 1-hour ozone standard is 0.09 parts per million averaged over one hour. The standard is attained when each monitor in the region has no exceedances during the previous three calendar years.

[3] CH&SC §40911

[4] CH&SC §40924(b)

[5] CH&SC §40925

Following ARB guidance,[6,7] triennial progress reports document the overall effectiveness of air quality programs, the quantity of emissions reductions achieved in the preceding three-year period, the rate of emissions growth, and projected rate of emissions growth, and air quality improvement. As such, this appendix includes air quality indicators (provided by ARB); emissions reductions of control measures adopted during the reporting period; incentive program information; mobile source control measures, including vehicle miles traveled offset thresholds; and emissions projections through 2020.

Based on the information and analysis herein, the District continues to make progress toward attainment of the state 1-hour ambient air quality standard for ozone.

I.2 OZONE AIR QUALITY INDICATORS

There are a number of ways to evaluate how ozone levels have changed over time and to assess progress in attaining the state ozone standard. ARB identified three air quality indicators for air districts to use in their triennial updates to ozone attainment plans. These indicators included *expected peak day concentration* (EPDC), *area-weighted exposure* (AWE), and *population-weighted exposure* (PWE). General descriptions of all three indicators, as well as the calculation procedures, are provided below.

I.2.1 Expected Peak Day Concentration (EPDC)

The EPDC represents the maximum ozone concentration expected to occur once per year, on average. The EPDC is based on a statistical calculation and uses ambient ozone data collected at each monitoring site in the San Joaquin Valley (Valley) air basin. The EPDC is useful for tracking air quality progress at individual monitoring locations. Because it is based on a robust statistical calculation, it is relatively stable, thereby providing a trend indicator that is not highly influenced by year-to-year changes in meteorology.

The EPDC calculation uses daily maximum 1-hour ozone observations for a three-year period (the summary year and the two prior years); however, if three years of data are not available, an EPDC can be calculated using only one or two years of data. The EPDC is computed using a statistical procedure that fits an exponential-tail model to the upper tail of the distribution of concentrations. The fitted distribution then is used to analytically determine the concentration that is expected to recur once per year, on average.

An EPDC labeled as *valid* reflects data that are both complete and representative. An EPDC labeled as *invalid* reflects data that are not complete and therefore, the calculated EPDC may be unrepresentative. While an invalid EPDC can provide useful

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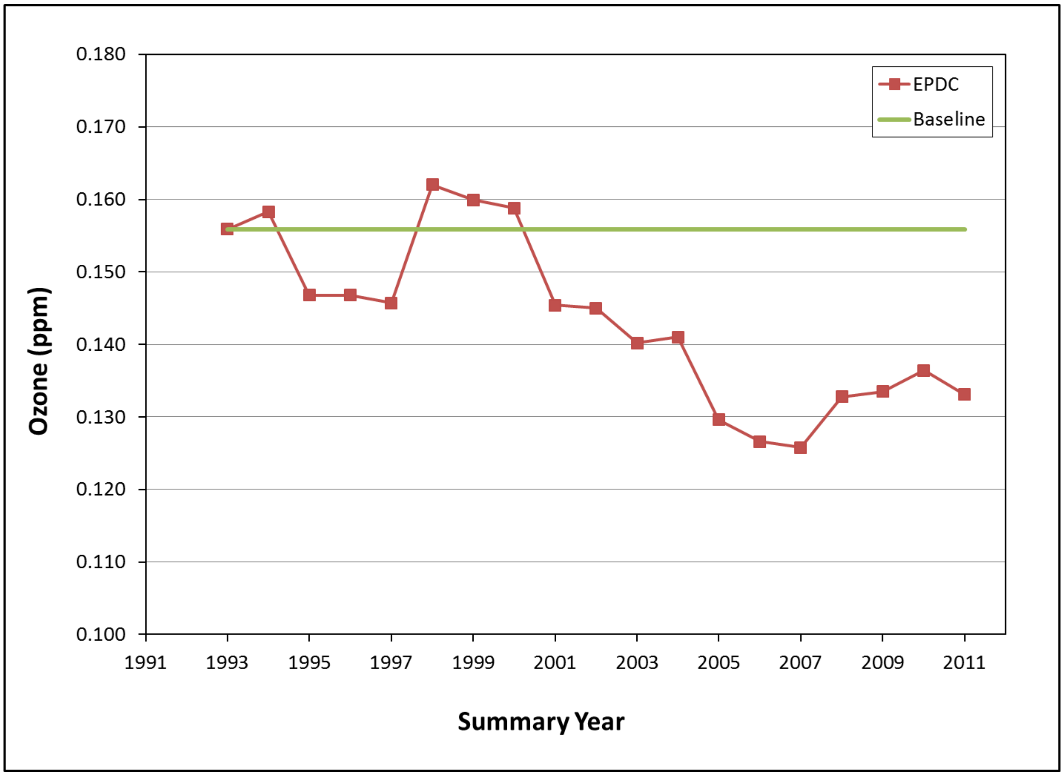
[6] California Air Resources Board (1993, August). *Guidance for Annual and Triennial Progress Reports under the California Clean Air Act.* Sacramento, CA.

[7] California Air Resources Board (2003, December), *2003 Triennial Assessment and Plan Revisions.* Included as an e-mail sent to air districts as staff recommendations for preparing CCAA triennial assessments and plan revisions.

information for evaluating long-term air quality trends at individual sites, it cannot be used for determining attainment status. For this progress report, *invalid* EPDC values were not used in the graphic representations of air quality trends; hence, EPDC trends (Figures I-1 through I-4) depicted for some sites are truncated relative to the time period of 1990 through 2011 (at the time of preparation, data for 2012 was not finalized and is not included in these analyses).

Figures I-3 through I-6 show EPDC trends for select sites in the Valley. Per ARB guidance[8] the selected sites include data from the two monitor sites with the highest EPDC values at the end of the reporting period, as well as other sites that have EPDC values within 10% of the highest value in 2011. Only sites with continued valid EPDC values from at least 1996 through 2011 are shown.

Figure I-1 EPDC at the Clovis-N. Villa Avenue Monitor



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[8] California Air Resources Board (1993, July 8). *Guidance for using Air Quality-Related indicators in Reporting Progress in Attaining the State Ambient Air Quality Standards,* pp.22–23.

Figure I-2 EPDC at the Fresno-1st Street Monitor

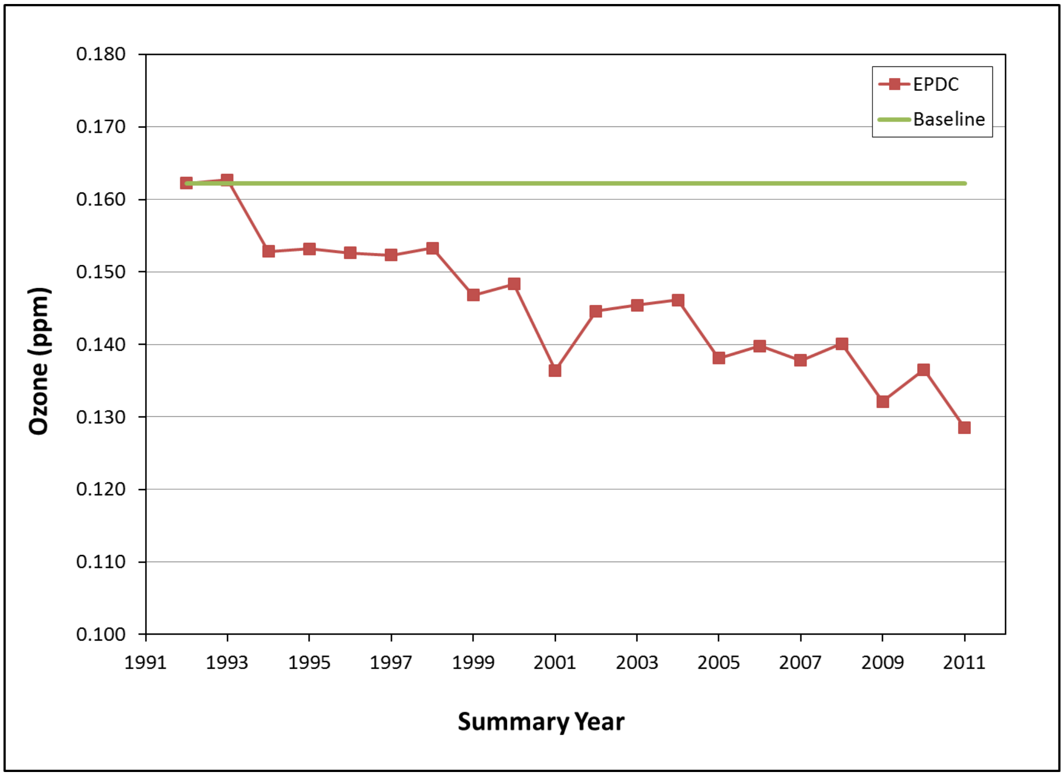


Figure I-3 EPDC at the Fresno-Sierra Skypark Monitor

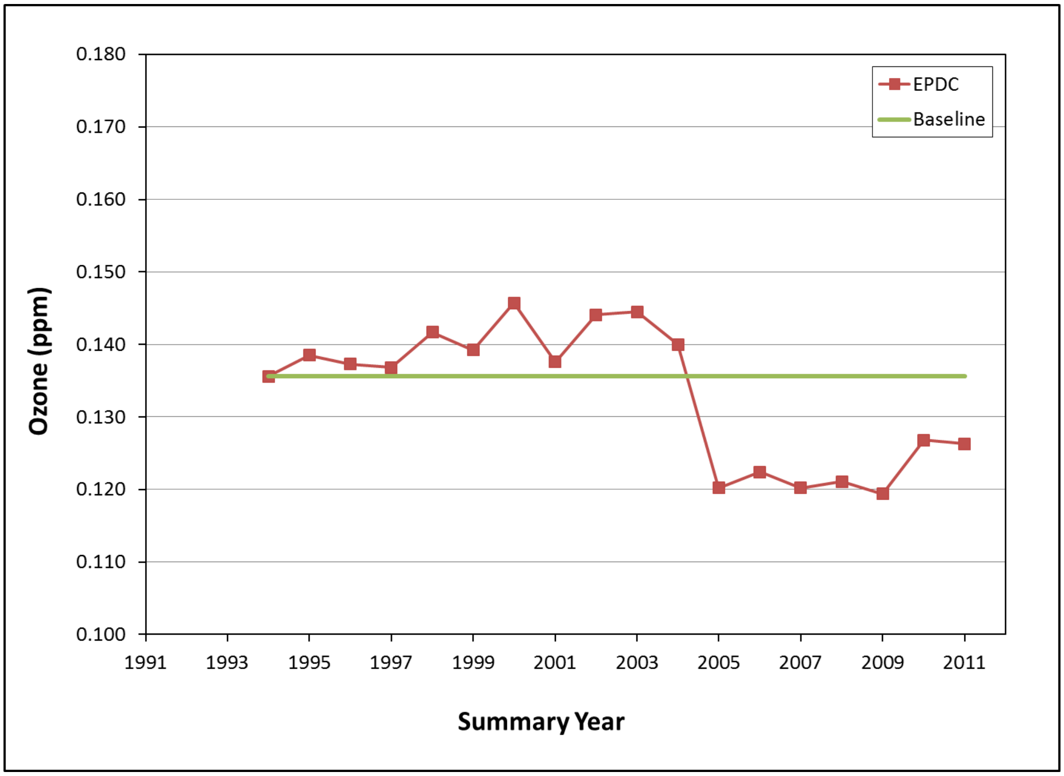
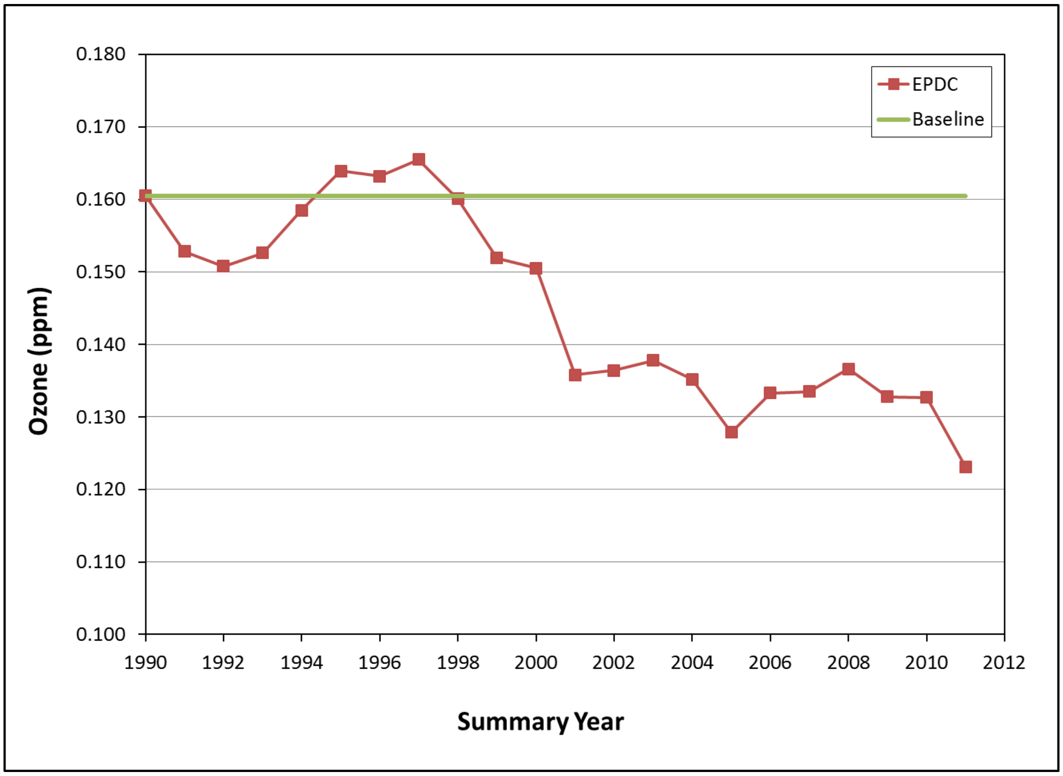


Figure I-4 EPDC at the Edison Monitor



I.2.2 Exposure Indicators

Exposure indicators identify the potential for chronic adverse health impacts, either by population, **population-weighted exposure (PWE)**, or by area, **area-weighted exposure (AWE)**. Unlike the EPDC, which tracks progress at individual locations, the PWE and AWE indicators consolidate hourly ozone measurements from all sites within the district into a single exposure value. The resulting value represents the average potential exposure within the Valley. The term *potential* is used because daily activity affects an individual's exposure. For example, being indoors during the hours of peak ozone concentration will decrease a person's exposure to outdoor concentrations.

The PWE exposure indicator characterizes the potential average annual outdoor exposure per person to concentrations above the level of the state ozone standard. The PWE exposure indicator represents a composite of exposures at individual locations that have been weighted to equally emphasize the potential exposure for each individual in the Valley. In contrast, the AWE indicator characterizes the potential average annual outdoor exposure per square kilometer. The AWE indicator also represents a composite of exposures at individual locations weighted to equally emphasize the potential exposure in all parts of the Valley.

Both exposure indicators are based solely on ambient (outdoor) ozone data. The calculation method assumes that an exposure occurs when a 1-hour ozone measurement is higher than 0.09 ppm, the level of the state 1-hour ozone standard.

The PWE and AWE consider both the level and the duration of hourly ozone concentration above the state standard. The resulting annual exposure indicator is the sum of all the hourly exposures during the year represents an average per exposed person (PWE indicator) or average per exposed square kilometer (AWE indicator).

I.2.2.1 Exposure Indicator Calculations, Generally

As stated above, the PWE and AWE indicators are calculated as an annual value for each year. Hourly ozone concentration data are used from all available sites in the Valley, regardless of whether the data are complete and representative. Because individual exposure values are interpolated from data for several monitoring sites, having complete data from all sites for all hours is not critical for meaningful results.

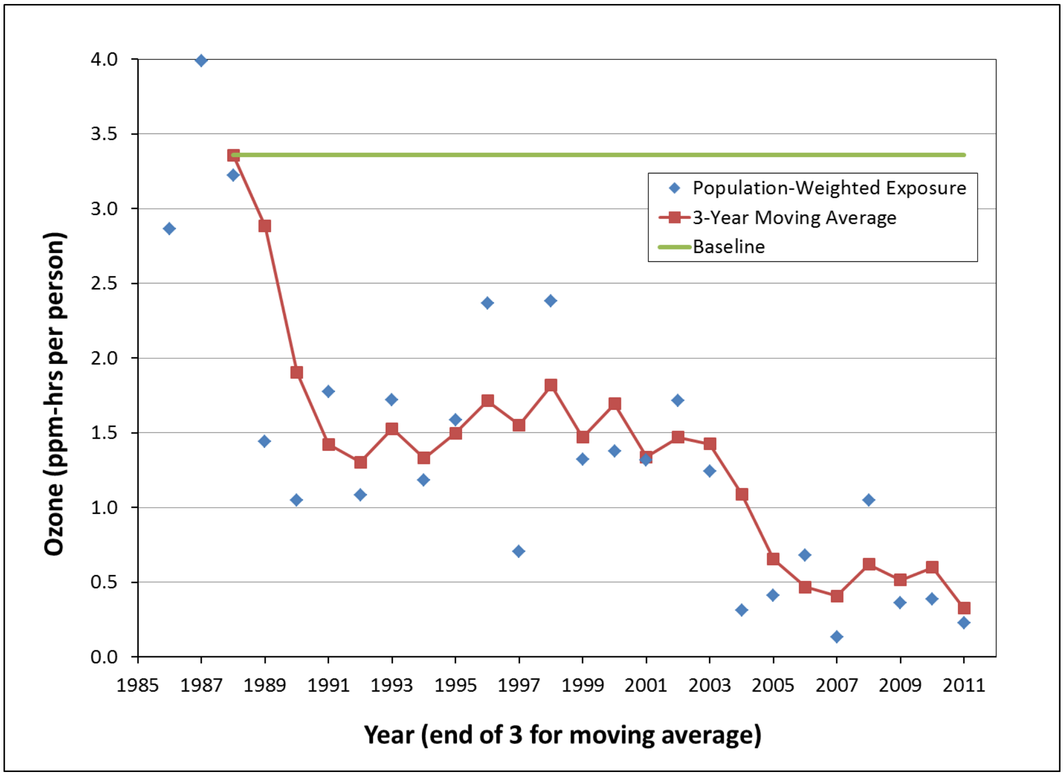
Calculation of the PWE and AWE relies on federal census data. Indicator values for 1999 and earlier reflect 1990 census data, indicator values for 2000 through 2009 reflect 2000 census data, and indicator values for 2010 and 2011 reflect 2010 census data. The federal government divides the nation into census tracts for the purpose of counting population and obtaining demographic information. Each of these census tracts has the following associate data: the centroid of the census tract, the population residing within the census tract, and the land area of the census tract. The population within each census tract is used to compute the PWE and the land area of the census tract is used to compute the AWE. The centroid of the census is used in both calculations.

I.2.2.2 Population-Weighted Exposure Calculation

Hourly ozone concentrations are interpolated to each census tract centroid. Hourly ozone exposures are then calculated for each centroid by subtracting the value of the state 1-hour ozone standard (0.09 ppm) from each interpolated hourly concentration. If negative, the result is set equal to zero and there is no exposure. The hourly exposures are multiplied by the number of people residing in the census tract. These hourly exposures are then added together and divided by the total population of all census tracts for which interpolated exposure values are available. The result represents and hourly PWE for the Valley. The hourly exposures are aggregated into daily PWE. The daily exposures are then aggregated into an annual PWE.

Figure I-5 shows that Valley residents are exposed to decreasing levels of harmful ozone, which is consistent with the previous progress report (2003–2005).

Figure I-5 Valley Population-Weighted Exposure per Person

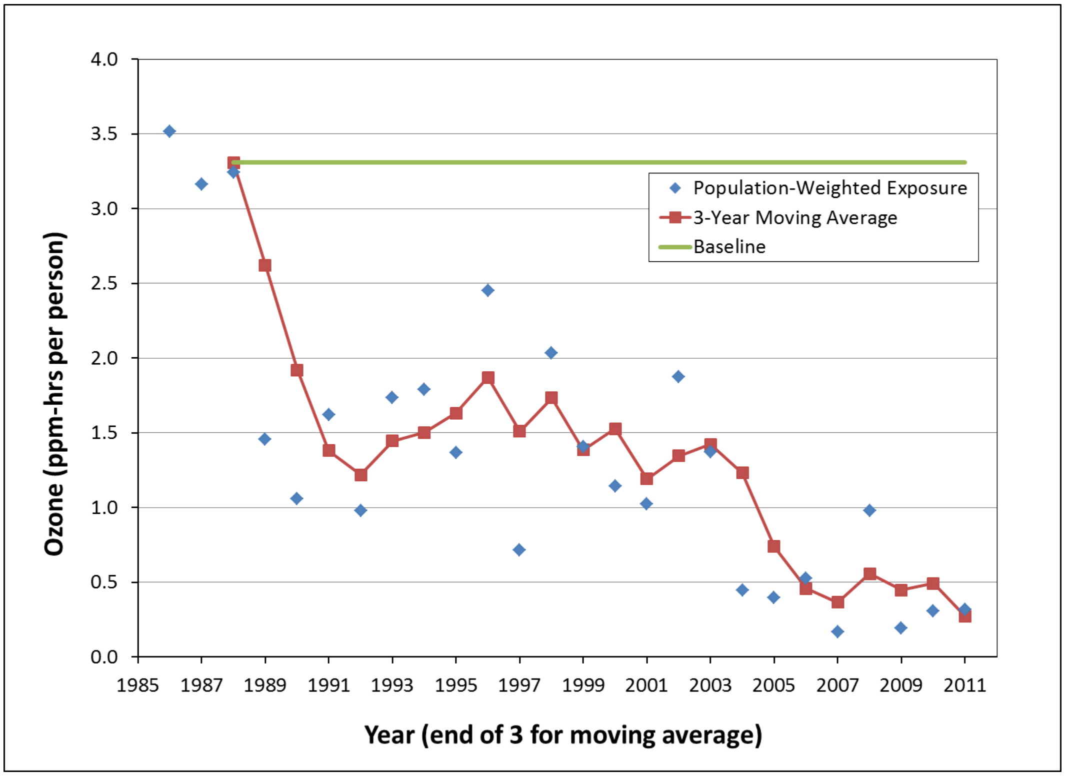


I.2.2.3 Area Weighted Exposure Calculation

The procedure for calculating the AWE is similar to the calculation for the PWE. For the AWE, the hourly exposures for each census tract are multiplied by the square kilometer land area of the census tract. Again, exposures below the level of the state 1-hour ozone standard are set to zero. The hourly exposures are added together and divided by the total land area of all census tracts for which interpolated exposure values are available. The result represents an hourly AWE for the Valley. The hourly exposures are aggregated into a daily AWE. The daily AWEs are then aggregated into an annual AWE, which is done for each year for which data are available.

Figure I-6 shows general improvement in air quality since 1996, with continued improvement in the most recent reporting periods (2006–2011).

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



I.3 DISTRICT CONTROL MEASURES

The CH&SC[9] and ARB's guidance for triennial progress reports and plan revisions directs districts to report actual emissions reductions achieved for each measure scheduled for adoption in the three-year period addressed by each progress report and plan revision. Table I-1 includes this information for the District for the 2006 through 2011 reporting period.

The CCAA, through ARB, requires upwind transport district, such as the District, to apply best available retrofit control technology (BARCT). Also, to ensure that upwind district minimize their impact on downwind district, ARB requires upwind district to adopt all feasible measures and put no-net-increase thresholds for new source review permitting programs. The District already has such provisions in place in accordance with other CH&SC requirements. The rules shown in Table I-1—as well as all District stationary source rules—meet requirements for BARCT, at a minimum.

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[9] CH&SC §40924(b)(2)

Table I-1 Ozone Precursor Emissions Reductions (VOC and NOx) from District Rules (2006–2011)[10,11]

Rule #	Rule Title	Date	Pollutant	Actual Reductions (tpd)
4301	Open Burning	04/15/2010	NOx VOC	7.43 9.64
4307	Boilers, Steam Generators, and Process Heaters 2 to 5 MMBtu/hr	05/19/2011	NOx	1.2
4308	Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	12/17/2009	NOx	2.77
4306 4320	Boilers, Steam Generators, and Process Heaters >5 MMBtu/hr	10/16/2008	NOx	3.3
4352	Solid Fuel Fired Boilers, Steam Generators, and Process Heaters >5 MMBtu/hr	12/15/2011	NOx	0.0
4354	Glass Melting Furnaces	05/19/2011	NOx	7.47
4565	Biosolids, Animal Manure, and Poultry Litter Operations	03/15/2007	VOC	3.92
4566	Organic Material Composting Operations	08/18/2011	VOC	19.2
4570	Confined Animal Facilities	10/21/2010	VOC	58.2
4601	Architectural Coatings	12/17/2009	VOC	2.7
4603	Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts	09/20/2007	VOC	0.0
4604	Can and Coil Coating Operations	09/20/2007	VOC	0.0
4605	Aerospace Assembly and Component Coating Operations	09/20/2007	VOC	0.0
4606	Wood Products and Flat Wood Paneling Products	09/20/2007	VOC	0.0
4607	Graphic Arts and Paper, Film, Foil, and Fabric Coatings	12/18/2008	VOC	0.05
4612	Motor Vehicle and Mobile Equipment Coating Operations	09/20/2007	VOC	0.0
4621	Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants	12/20/2007	VOC	1.42
4622	Gasoline Transfer into Motor Vehicle Fuel Tanks	12/20/2007	VOC	
4624	Transfer of Organic Liquid	12/20/2007	VOC	
4653	Adhesives and Sealants	09/16/2010	VOC	0.12
4661	Organic Solvents	09/20/2007	VOC	0.91
4662	Organic Solvent Degreasing Operations	09/20/2007	VOC	0.52
4663	Organic Solvent Cleaning, Storage, and Disposal	09/20/2007	VOC	0.21
4682	Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	09/20/2007	VOC	0.4
4684	Polyester Resin Operations	09/20/2007	VOC	0.0
4695	Brandy Aging and Wine Aging Operations	09/17/2009	VOC	0.13
4702	Internal Combustion Engines	08/18/2011	NOx	1.43
4703	Stationary Gas Turbines	09/20/2007	NOx	2.2
4902	Residential Water Heaters	03/19/2009	NOx	0.85
9310	School Bus Fleets	09/21/2006	NOx	0.77
9410	Employer-based Trip Reduction	12/17/2009	NOx VOC	0.6 0.6
9610	State Implementation Plan Credit for Emission Reductions Generated Through Incentive Programs	6/20/2013	NOx	varies

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[10] This time period also included reductions of other pollutants (e.g. particulate matter), but are not included here.

[11] Reductions listed for informational purposes only. Data is based on varying years and inventories and should not be used for further computations.

I.4 MOBILE SOURCE CONTROL MEASURES

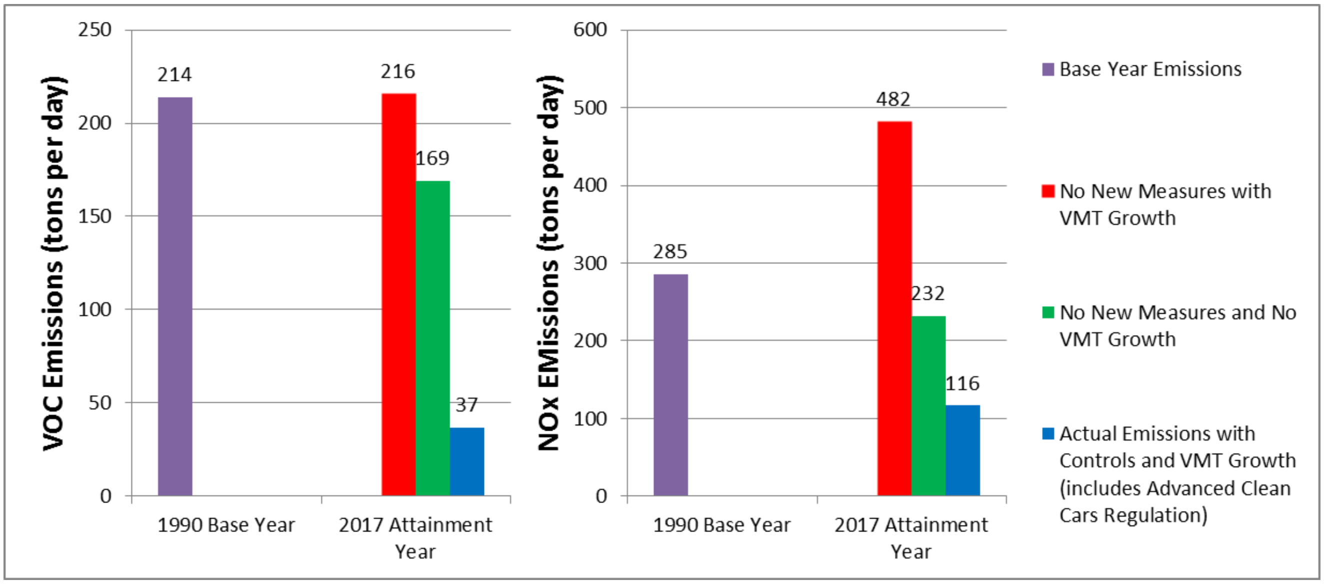
Under the CCAA's severe nonattainment classification for the state ozone standard, the District is required to include reasonably available transportation control measures sufficient to substantially reduce the rate of increase in passenger vehicle trips and miles traveled per trip in its state air quality plans. The District coordinates with the Valley Metropolitan Planning Organizations (MPOs) to ensure that such measures are in place and accounted for in each attainment plan. In addition to transportation control measures, the District effectively uses incentives and land use programs to reduce emissions from mobile sources.

I.4.1 District Transportation Strategies

The District continues to work with MPOs to implement previously committed measures and develop new measures for State Implementation Plan (SIP) submittals. District and MPO staffs are working on specific actions and programs to reduce vehicle miles traveled (VMT) or to reduce emissions through other activities.

Appendix D to the *2013 Plan for the Revoked 1-Hour Ozone Standard* demonstrates that attainment year emissions for both VOC and NOx emissions, accounting for controls and VMT growth (tied to population growth), are less than hypothetical future-year emissions that do not include new controls or VMT growth. Therefore, the identified transportation control strategies and measures are sufficient to offset the growth in emissions attributable to VMT growth. The summary of that analysis is shown graphically in Figure I-7.

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



I.4.2 District Incentive Programs

The District continued to implement successful voluntary mobile source emissions reductions programs in the 2006–2011 reporting period, including incentive programs for on-road heavy-duty trucks, agricultural equipment, school buses, and public and private vehicles.

The District administers several incentive programs that target on-road heavy-duty trucks, which are one of the biggest sources of NOx emissions in the Valley. Through the Proposition 1B Goods Movement Emission Reduction Program, the Carl Moyer Voucher Incentive Program (VIP) and other District-operated voucher incentive programs the District has replaced hundreds of older, high-polluting trucks with cleaner trucks certified to meet the latest ARB emissions standards.

Off-road agricultural equipment replacements and repowers play a crucial role in reducing emissions. These equipment units, including tractors, backhoes, wheel loaders, and other off-road farming vehicles are widely used in the Valley, and are essentially uncontrolled and unregulated. Eligible projects are funded with local, state, and federal sources, including but not limited to ISR, Carl Moyer funding, AB923 funding, federal designated funding, and federal Diesel Air-Shed Grant funding. The District has funded the repower or replacement of over 1,017 off-road agricultural vehicles, with more projects in the queue.

The District's School Bus Replacement and Retrofit programs provide grant funding for new, safer school buses and air pollution control equipment for existing buses. California public school districts that own their own buses are eligible to receive funding using local, state, and federal funds, including the Lower-Emission School Bus Program (Proposition 1B), DERA funding, and the American Reinvestment and Recovery Act. The District has provided funding to retrofit 1,879 school buses and replace 432 school buses.

The District also provides incentive programs that allow the general public the opportunity to contribute to the Valley's clean air goals. The Polluting Automobile Scrap and Salvage (PASS) program offers a cash incentive for participants to retire or repair their older vehicle. This program has replaced 202 high-emitting vehicles, retired 504 additional vehicle through a cash incentive, screened nearly 5,000 vehicles for high emissions, and provided nearly 3,000 vouchers for emissions-related repairs. The Drive Clean! Rebate Program provides incentives to Valley residents who want to purchase an electric or other alternative-fuel vehicle. The REduce MOtor Vehicle Emissions (REMOVE) program provides incentives for specific projects to reduce vehicle emissions including e-mobility, bicycle infrastructure, alternative-fuel-vehicle mechanic training, and public transportation and commuter vanpool subsides. The latest addition to the District's community incentives program is the Public Benefit Grants Program. This program provides funding to Valley cities, counties, and other public agencies for a variety of clean-air, public-benefit programs.

I.4.3 District Land Use Programs

In addition to transportation strategies and innovative incentive programs that achieve emissions reductions, the District gains further emissions reductions through its land use programs.

The District reviews city, county, and other agency California Environmental Quality Act (CEQA) and development proposals. During review, the District evaluates potential sources of emissions, including traffic-generating sources. The District developed two resource documents to help other agencies evaluate potential air quality impacts. The *Air Quality Guidelines for General Plan* document, which was revised in 2005, encourages cities and counties to include air quality elements or air quality goals and policies in their general plans to reduce mobile- and area-source emissions and help attain state and federal air quality standards. The *Guide for Assessing and Mitigating Air Quality Impacts* is an advisory document that provides lead agencies, consultants, and project applicants with uniform procedures for addressing air quality in environmental documents.

In addition to providing guidance to local and regional agencies, the District developed a first-of-its-kind rule to reduce projected emissions from new development in the Valley. The Indirect Source Rule (ISR), adopted by the District Governing Board in December 2005, requires proponents of new development to reduce NOx and PM emissions to mitigate a portion of the expected emissions with onsite mitigation or by contributing to a mitigation fund, which would be used to pay for cost-effective emissions reductions off site. As reported in the 2011-2012 ISR annual report, ISR achieved 898.8 tons of projected NOx emission reductions for ISR projects approved between July 1, 2011 and June 30, 2012.[12]

I.5 POLLUTANT TRANSPORT MITIGATION

Primary and secondary pollutants are transported across jurisdictional boundaries through normal atmospheric processes. Under the CCAA, ARB, in cooperation with local air districts, is required to evaluate intrastate transport and suggest mitigation for such transport.

ARB issued an assessment of ozone transport in California in April 2001 and concluded that transport from the San Francisco Bay Area Air Basin and the broader Sacramento area contributes to some exceedances of the state 1-hour ozone standard in the Valley. The degree of contribution ranges from overwhelming to inconsequential, depending on weather conditions and time of year. ARB also found that the Valley contributes overwhelmingly to ozone exceedances in the Mojave Desert, Mountain Counties, and Great Basin Valley air basins; significantly to the North Central Coast; and significantly to inconsequentially to the broader Sacramento area and South Central Coast.

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[12] San Joaquin Valley APCD. *2012 Annual Report: Indirect Source Review Program,* p. 7. Available at http://www.valleyair.org/ISR/Documents/ISRAnnualReport2011-2012.pdf.

ARB, as required by the CCAA, established mitigation requirements in 1990, which are contained in title 17, California Code of Regulations, sections 70600 and 70601. These regulations were amended in 1993 and 2003, the latest of which became effective on January 3, 2004. The 2003 amendments added two new requirements for upwind districts, requiring them to consult with their downwind neighbors and adopt “all feasible measures” for ozone precursors and amend their “no net increase” thresholds for permitting sot that they are equivalent to those of their downwind neighbors no later than December 31, 2004.

As demonstrated in the past, the District is committed to reviewing feasible measures adopted across California to obtain future emissions reductions. ARB in conjunction with the California Air Pollution Control Officer Association (CAPCOA) has published documents that include feasible control measures for certain sources addressing pollutants of concern. The District continually reviews these documents, as well as state and federal clearing houses, to determine if additional control measures are achievable. Decisions regarding all feasible measures are based on meeting any shortfall identified in rule commitments, the economic impact of measures recommended, and the District’s progress toward meeting attainment goals.

The District has taken a proactive role in characterizing transport of pollutants within the Valley and across District boundaries through strong support of and participation in the Central California Ozone Study (CCOS). ARB and the District continue to analyze data from the Central California Ozone Study (CCOS) to better understand transport and to develop improved techniques for quantifying mitigation needs.

The District is also coordinating with other agencies (National Oceanic and Atmospheric Administration and University of California at Davis) to investigate and document trans-boundary ozone flow from Asia. The District awarded UC Davis $130,000 for the installation of a trans-boundary ozone and PM2.5 monitoring station on Chews Ridge, east of Big Sur, California. Data from this research will contribute to the overall understanding and mitigation needs throughout California.

I.6 PLAN REVISION

The CCAA requires the District to establish a strategy that will achieve an annual average 5% reduction in ozone precursor emissions, or alternatively, to commit to taking all feasible measures to reduce emissions within its boundaries as expeditiously as possible. The District’s adopted strategy is based on the latter alternative. In fact, in December 2010, ARB determined that, based on the District’s SIP and the evaluation of control feasibility in all rulemaking actions, the District has undertaken *all feasible measures* to reduce nonattainment air pollutants from sources within the District’s jurisdiction and regulatory control.[13]

During the 2006–2011 reporting period, the District continued to implement its original control strategy of adopting rules to fulfill the District’s SIP commitments and then to

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[13] ARB Executive Order G-10-126. (2010, December 10), required under California Health and Safety Code §40612.

address additional measures needed for attainment of the federal and state ozone standards. The District met all its federally required emission reduction rates (3% per year) for 8-hour ozone precursors for the 2006–2011 reporting period addressed in this progress report.

In future reporting periods, the District will continue its efforts to improve its emissions inventory with in-house efforts, joint efforts with ARB, and with outside contractors when evaluating specific sources. The District continues to participate with ARB and other districts in the evaluation of CCOS data and development of modeling tools to improve ozone standard attainment planning.

I.6.1 Control Strategy

The District's strategy for reducing ozone pollution to attain the state ozone standard and the revoked 1979 1-hour ozone standard includes adopted strategies from previous District plans (*2007 Ozone Plan, 2008 PM2.5 Plan, 2012 PM2.5 Plan*) and strategies implemented by ARB. The District's multi-faceted strategy uses a combination of conventional and innovative control strategies. This comprehensive strategy includes regulatory actions; incentive programs; technology advancement programs; policy and legislative activities; public outreach, participation, and communication; and other innovative strategies.

The District's thorough evaluation of potential control measure emissions reductions for the *2012 PM2.5 Plan* resulted in several commitments for future regulatory actions. The measures identified in Table I-2 reduce ozone precursors, so were also included in the *2013 Plan for the Revoked 1-Hour Ozone Standard*.

Table I-2 Regulatory Control Measure Commitments

Rule		Amendment Date	Compliance Date	Emissions Reductions*
4308	Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	2013	2015	TBD
4905	Natural Gas-Fired, Fan-Type Residential Central Furnaces	2014	2015	TBD
* Based on full implementation and best available information as of this plan. A more thorough evaluation of control techniques and feasibility will be conducted at the time of rule development.				

Similarly, the District's review of potential control measure opportunities that required additional information and study regarding current emissions inventories, the effectiveness of current controls, and future technologies. The District identified these commitments as *further study measures* in the *2012 PM2.5 Plan,* and continued that commitment of applicable measures in the *2013 Plan for the Revoked 1-Hour Ozone Standard* (Table I-3).

Table I-3 Further Study Measures

Control Measure		Description	Completion Date
Rule 4103*	Open Burning	Evaluate the feasibility of postponed burning activities every 5 years, as outlined in the current rule.	2015
Rule 4106*	Prescribed Burning	Examine the feasibility of implementing a biomass removal program similar to one in Placer County.	2013
Rule 4311*	Flares	Review of flare minimization plans and annual reports for further emission reduction opportunities.	2013
Rule 4601	Architectural Coatings	Further evaluate potential opportunities for future emission reductions as adopted in the SCAQMD rule during the development of the next ozone plan.	2014
Rule 4623	Storage of Organic Liquids	Evaluate the potential of lowering the leak detection limit to be consistent with the NSPS and SCAQMD Rule 463 (amended November 2011) limits during the development of the next ozone plan.	2014
Rule 4624	Transfer of Organic Liquids	Evaluate the opportunity to lower the VOC limit in the rule to match the BAAQMD Regulation 8 Rule 33 limit of 0.04 lb VOC/1,000 gallons.	2014
Rule 4693	Bakery Ovens	Evaluate the feasibility and potential for emission reductions from implementing a 30 ppmv @3% O_2 NOx emission limit.	2014
Lawn Care Equipment*		Evaluate emissions inventory and technology demonstration efforts to identify potential emission reduction opportunities.	2013
Asphalt & Concrete Operations*		Examine feasibility of warm-mix asphalt as a potential emission reduction opportunity.	2013
Ongoing Study & Research		Conduct and support ongoing research that continues to enhance the District's understanding of ozone concentrations and formation, including further health research.	Ongoing

* Also included in *2012 PM2.5 Plan*

I.6.2 Cost-Effectiveness Ranking

The CCAA requires that each plan revision includes an assessment of the cost-effectiveness of available and proposed control measures. Table I-4 provides a list of stationary source control measures for ozone precursors ranked by cost-effectiveness. In developing an adoption and implementation schedule for a specific control measure, the District considers the relative cost-effectiveness of the measure as well as other factors including, but not limited to, technological feasibility, total emission reduction potential, the rate of reduction, public acceptability, and enforceability, per CH&SC §40922.

Table I-4 Control Measure Cost-Effectiveness Rankings

Rule Number	Rule Name	Amendment Date	Compliance Date	Reduction Start	Cost Effectiveness Ranking
4308†	Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	2013	2015	2015	Low
4905†	Natural Gas-Fired, Fan-Type Residential Central Furnaces	2014	2015	2015	Low

Cost-Effectiveness Key:
High: Require capital investment to purchase & Install controls. May also be reflective the lack of surplus reductions available
Medium: Control measure requires capital investment, but measure has potential for significant emission reductions
Low: Control measure is a management practice or low cost control option

I.6.3 Emissions Trends

The emissions inventory is an estimate of ozone precursor pollutants (ROG and NOx) emitted into the air by sources. Emissions inventory trends can be used to assess progress a region is making toward attaining the California ambient ozone standard—reducing precursor emissions lowers ambient ozone levels.

The emissions inventory represents estimates of actual emissions calculated using reported or estimated process rates and emission factors. To derive future-year emissions inventories, emissions from a base year are projected forward in time based on expected growth rates of population, travel, employment, industrial and commercial activity, energy use, as well as reductions from control measures in effect. Appendix B of the *2013 Plan for the Revoked 1-Hour Ozone Standard* details the emissions inventory for each source category within each primary source sector. Tables I-5 and I-6 summarize the primary source sector totals for 5-year increments beginning in 2000 for ROG and NOx.

Table I-5 ROG Emissions Trend (average summer tons per day)

Source Category	2000		2005		2010		2015		2020	
	tpd	**%**	**tpd**	**%**	**tpd**	**%**	**tpd**	**%**	**tpd**	**%**
Stationary Sources	114.0	22	102.1	22	100.1	23	98.01	27	100.7	28
Area-Wide Sources	220.0	43	223.3	48	220.2	51	188.0	51	196.8	54
On-Road Motor Vehicles	105.4	21	76.8	16	62.4	14	37.2	10	29.0	8
Other Mobile Sources	70.6	14	67.0	14	52.8	12	42.8	12	38.3	10
Total	**510.0**	100	**469.2**	100	**435.5**	100	**366.0**	100	**364.8**	100

Table I-6 NOx Emissions Trend (average summer tons per day)

Source Category	2000		2005		2010		2015		2020	
	tpd	**%**	**tpd**	**%**	**tpd**	**%**	**tpd**	**%**	**tpd**	**%**
Stationary Sources	84.0	15	66.3	13	46.4	13	32.4	13	29.1	15
Area-Wide Sources	11.8	2	12.8	2	11.0	3	11.0	4	11.0	5
On-Road Motor Vehicles	305.6	55	293.5	57	194.0	55	130.6	50	87.9	45
Other Mobile Sources	156.6	28	143.4	28	101.8	29	84.0	33	68.6	35
Total	**558.0**	100	**516.0**	100	**353.2**	100	**258.0**	100	**196.6**	100

I.6.4 Meeting State Requirements for Plan Revisions

The *2013 Plan for the Revoked 1-Hour Ozone Standard*, including appendices, meets the requirements of CCAA §40925 for plan revisions required to show continued progress in attainment of state 1-hour ambient standard for ozone. Table I-7 identifies each of the CCAA requirements and the chapter or appendix in which the information or analyses are located.

Table I-7 CCAA §40925 Requirements for Triennial Plan Revisions

Mandate for Severe Areas	Source of Requirement (CH&SC Sections)	Submittal in *2013 Plan for the Revoked 1-Hour Ozone Standard*
Emissions Inventory	40913(a)(4-5)	Appendix B
Air Quality Analysis, including population exposure	40913(a)(1-2)	Chapter 2, Appendix A, and Appendix I
Control Measures, including Reasonably Available Control Technology (RACT), Best Available Retrofit Control Technology (BARCT), area and indirect source controls	40913(a)(6-7), 40920(a)(1), 40918(3-4)	Chapters 3 and 4, Appendix C Appendix I
Emission Reductions/All Feasible Measures	40913(a)(6-7), 40914(b)(2)	Chapters 3 and 4 Appendix C Appendix I
Cost-Effectiveness, including a list which ranks the control measures from least to most cost-effective	40922(a-b)	Appendix I
Reasonably available transportation control measures, reducing passenger vehicle trips and miles traveled	40918(3)	Appendix D
Transport	40912 40913(a)(3)	Chapter 2 and Appendix I
Contingency Measures	40915	Chapter 4
Public Education	40918(6)	Chapter 3

Appendix J

Summary of Significant Comments and Responses

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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SUMMARY OF SIGNIFICANT COMMENTS FOR THE AUGUST PROPOSED PLAN FOR THE REVOKED 1-HOUR OZONE STANDARD

WRITTEN COMMENTS, AUGUST 20, 2013 PROPOSED PLAN

1 comment letter was received following the posting of the *Proposed 2013 Plan for the Revoked 1-Hour Ozone Standard* from the Air Coalition Team (ACT).[1]

1. **COMMENT:** ACT urges the District to adopt this plan for the revoked 1-hour ozone standard, as it represents a well-balanced approach to control emissions in the Valley. However, ACT is concerned that a great deal of effort has been spent drafting a plan for attaining an air quality standard that was revoked in 2005, as a result of EPA's failure to act timely on the original 2004 1-hour ozone plan. This 2013 1-hour ozone plan is largely duplicative of the District's efforts to achieve the newer, 8-hour ozone standard. These federal regulatory procedures create uncertainty for the public and industry groups.

RESPONSE: Comment noted.

2. **COMMENT:** The 2017 attainment deadline is reasonable, within legal requirements, and is conservative while at the same time being expeditious. Based on photochemical modeling for this plan, the 2017 date is reasonably achievable with the District's currently adopted emission reduction strategies. In addition, the 2017 date is fully authorized by sections 172(a)(2)(A) and 179(d)(3) of the federal Clean Air Act (CAA). However, ACT is concerned that EPA is requiring an attainment demonstration for this plan after revoking the 1-hour ozone standard and previously announcing attainment findings would no longer be made for this standard. This creates further uncertainty in federal regulatory procedures for the public.

RESPONSE: Comment noted.

3. **COMMENT:** ACT agrees that reliance on existing measures to attain the revoked 1-hour ozone standard is fully authorized by the federal CAA. The only requirements upheld after the revocation of the 1-hour ozone standard were anti-backsliding provisions, which require nonattainment areas to have emission control strategies in place that are at least as stringent as they were before the standard was revoked. EPA does not have the authority to require additional

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[1] The following groups are represented in the ACT comment letter: California Cotton Ginners and Growers Association, county farm bureaus from Kings, Fresno, Madera, Merced, Kern, Stanislaus, and Tulare Counties, and various agricultural trade associations and industries.

controls for the attainment of this revoked standard and the current plan demonstrates attainment can be reached with existing control strategies.

It is questionable that the District could legally adopt additional controls because California Health and Safety Code Section 39602 states that state implementation plans shall only include provisions necessary to meet the requirements of the CAA. Also, as discussed in this plan, there are no additional feasible control measures that could be adopted, as all District rules already meet federal reasonably available control technology (RACT), best available retrofit control technology (BARCT), and/or best available control technology (BACT) requirements.

RESPONSE: Comment noted.

4. **COMMENT:** ACT strongly supports the District’s use of incentive programs to achieve emission reductions. These programs have resulted in significant emission reductions, especially from sources that the District has no direct regulatory authority over, such as mobile sources, and are a major reason why the Valley is close to attaining the revoked 1-hour ozone standard.

RESPONSE: Comment noted.

SUMMARY OF SIGNIFICANT COMMENTS FOR THE APRIL DRAFT OF THE REVOKED 1-HOUR OZONE PLAN

VERBAL COMMENTS, APRIL 16, 2013 PUBLIC WORKSHOP

Approximately 10 people (non-District, non-ARB) in attendance (5 Fresno, 5 Bakersfield, 0 Modesto)

Aera Energy (Aera)
Association of Irritated Residents (AIR)
Earthjustice (EJ)
Southern California Gas Company (SCGC)
West Kern Water (WKW)

5. **COMMENT:** Mobile sources contribute to 80% of pollution in the Valley. ARB should be enforcing more stringent mobile source regulations to achieve necessary emissions reductions for the Valley to come into attainment of the federal standards. (WKW)

RESPONSE: The District recognizes the tremendous commitment the Valley's stationary sources have made to reduce emissions. ARB has adopted numerous regulations for mobile sources that are contributing to improved air quality in the Valley. The District will continue to work with ARB and EPA to find regulatory opportunities to reduce emissions from mobile sources.

6. **COMMENT:** What progress has been made on a study to determine the levels of naturally occurring ozone in the Valley? EPA should not lower the ozone standard if it goes below the naturally occurring ozone levels. (WKW)

RESPONSE: Studies have been conducted to examine naturally occurring ozone levels in the Valley. In 2011, the American Chemical Society published a paper entitled "Establishing Policy Relevant Background (PRB) Ozone Concentrations in the United States", which examined the concentrations of ozone that would occur in the U.S. in the absence of anthropogenic emissions from North America. In addition, the District is taking a close look at transboundary ozone emissions, which are pollutants traversing from sources within other countries and settling in the Valley. In 2011, the District awarded the University of California at Davis funding for the installation of a transboundary ozone and PM2.5 monitoring station to build evidence that transported pollutants from Asia may be entering the Valley. Monitoring and data collection is slated to continue through June 2013. See Chapter 2 for additional information regarding this study.

Given the complexity of this measurement, it is difficult to draw definite conclusions. As EPA continues to lower the national ozone standards, this issue will become increasingly important for the Valley's attainment efforts.

7. **COMMENT:** Will affected stakeholders be involved in the further study measure for flares - Rule 4311? (Aera)

RESPONSE: The further study measure for Rule 4311 is a commitment to review the Flare Minimization Plans and Annual Monitoring Reports recently submitted to the District by affected facilities. If any potential opportunities to amend this rule are identified as a result of the further study, then the District will work closely with affected stakeholders through a rule development process before any amendments to the rule would be adopted.

8. **COMMENT:** How is EPA's Vehicle Miles Traveled (VMT) Offset Demonstration requirement related to Senate Bill 375 (SB-375)? (SCGC)

RESPONSE: SB-375 is a state regulation focused on achieving greenhouse gas reductions through transportation control strategies that will reduce VMT. However, those strategies are still being developed by Metropolitan Planning Organizations, and the District can only rely on adopted control strategies for the VMT Offset Demonstration. Once the transportation control strategies for SB-375 are approved, the District would then be able to account for those VMT reductions in the emission inventories and VMT Offset Demonstrations of future plans.

9. **COMMENT:** Are relative response factor (RRF) models more accurate than deterministic models? (SCGC)

RESPONSE: Yes, the RRF method is better because air quality models do not exactly replicate the measurements. For that reason, RRF method is much more scientifically defensible than the absolute deterministic method.

10. **COMMENT:** Do other air districts throughout the state, including the South Coast Air Quality Management District (SCAQMD), utilize "band" RRFs rather than "single" RRFs like the District did in this plan? (SCGC)

RESPONSE: EPA did not provide specific modeling guidance for RRFs for the 1-hour ozone standard since the District and SCAQMD were the only two air districts required to submit a new 1-hour ozone plan. As a result, ARB worked with EPA, the District, and SCAQMD to develop the modeling protocol for RRFs for this 1-hour ozone plan. For the 8-hour ozone and 24-hour/Annual PM2.5

standards, EPA recommended a “single” RRF approach; however, for the 1-hour ozone standard ARB, the District, and EPA determined that utilizing RRFs for bands of ozone concentrations (high, medium, and low) was a more thorough approach. SCAQMD had a shorter timeline for their 1-hour ozone plan so they ended up using “single” RRFs instead of “band” RRFs.

11. **COMMENT:** How can the District estimate that Arvin-Bear Mountain will be in compliance with the 1-hour ozone standard and later verify that the region is in attainment without the monitor being operational? (EJ, AIR)

RESPONSE: ARB was able to use the 2005-2007 data from the Arvin monitoring site to model attainment for future years since 2007 is the base modeling year. As noted in Chapter 2 of the plan, the District is sponsoring a saturation study in Arvin to measure relative differences in ozone concentrations in the Arvin area in August and September 2013.

12. **COMMENT:** How will the District’s legislative strategy result in improved air quality? (EJ)

RESPONSE: The District has a robust legislative platform built upon significant collaboration with the state and federal government. Through the legislative strategy, the District has secured additional incentive funding, pushed for legislative changes that resulted in reduced emissions, and challenged legislative actions that may be detrimental to the Valley’s air quality.

13. **COMMENT:** In Appendix A (Ambient 1-hour Ozone Data Analysis), the District states that only Clovis has 1-hour ozone violations from 2009-2011 and only Clovis and Fresno had violations for 2010-2012. The District left out the Arvin-Bear Mountain site, which had 5 violations over the 2009-2011 period. (AIR)

RESPONSE: Appendix A has been clarified. Since the Arvin-Bear Mountain site was closed in December 2010, complete 3-year averages for 2009-2011 and 2010-2012 are not available. However, as shown in Table A-1, Arvin Bear Mountain had 3 exceedances in 2009 and 2 in 2010, for a total of 5 in 2009-2011. So the 3-year average of 2009-2011 had two sites that failed the attainment test, those being Clovis and Arvin-Bear Mountain. The average during the 3-year timeframe of 2010-2012 had only the Clovis and Fresno-Drummond sites fail the attainment test.

14. **COMMENT:** Does the Valley have a 1-hour ozone violation for the 2011-2013 period at the Fresno-Drummond monitor? (AIR)

RESPONSE: One of the 4 exceedances for the Fresno-Drummond Monitor is currently being evaluated as a possible exceptional event. Upon formal documentation of the event and concurrence by EPA, this data point would be removed from attainment calculations for the District.

15. **COMMENT:** Fresno-Drummond originally had two 1-hour ozone violations in 2012. Why does the violation on August 10, 2012 have an asterisk? Also, why was the violation on August 11, 2012 adjusted downward from 125 ppb to 124 ppb? (AIR)

RESPONSE: As noted at the bottom of page A-9 of Appendix A, the asterisk means that the August 10, 2012 1-hour ozone exceedance has been flagged as an exceptional event, and would thus not be used towards the District's attainment determination upon the District's submittal of supporting documentation and concurrence by EPA. The August 11, 2012 exceedance was attributable to a preliminary value of 125 ppb (parts per billion); however, after accounting for equipment bias and completing the quality assurance procedures, the final concentration was determined to be 124 ppb (below the exceedance threshold).

WRITTEN COMMENTS, APRIL 16, 2013 PUBLIC WORKSHOP

Two comment letters were received after the public comment period following the public workshop on April 16, 2013, but before posting of the proposed plan. One comment letter was submitted by Earthjustice[2] (May 6, 2013), and the other was submitted by the Central Valley Air Quality Coalition (CVAQ)(August 7, 2013).

16. **COMMENT:** The April draft Plan states that the Valley will achieve attainment of the 1-hour ozone standard by 2019. EPA published its determination of the Valley's failure to attain on December 30, 2011 so the District's attainment deadline should be December 30, 2016. (Earthjustice)

RESPONSE: Under CAA §172(a)(2)(A), the initial attainment deadline is five years from the finding of failure to submit (2012). Additional modeling and other analysis has been added to the plan to show that the Valley will attain the 1-hour ozone standard by 2017. Refer to Chapter 2 (Scientific Foundation, Trends, and Modeling Results) and related appendices for the updated modeling and attainment information.

17. **COMMENT:** The Plan should note that replacement of the Arvin Bear Mountain monitor is necessary to show attainment of the 1-hour ozone standard, and that the number of exceedances recorded over the last two years is likely low because of the removal of the Arvin monitor. (Earthjustice)

RESPONSE: It has not been determined that the Arvin Bear Mountain monitor must be replaced to demonstrate attainment of the 1-hour ozone standard. As seen in Appendix A, 1-hour ozone exceedances throughout the Kern County area continue to decrease as ozone precursor emissions are further reduced. However, as noted in Chapter 2 of the plan, removal of the Arvin Bear Mountain monitor was unforeseen, as the property owner declined to renew the lease for the monitoring site and continues to decline requests to allow the site to be reinstalled. A new Arvin monitoring site was established just 2.2 miles away, in an area that is more representative of population exposure. The District is sponsoring a saturation study in Arvin to measure relative differences in ozone concentrations in the Arvin area in August and September 2013.

18. **COMMENT:** The Plan should state that the Section 185 Ozone Fee provides for deposit in the federal treasury only when EPA is forced to collect the nonattainment fees because the District refuses to do so. Where the District

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[2] The following groups are represented in the Earthjustice comment letter: Sierra Club California, Medical Advocates for Healthy Air, National Parks Conservation Association, Association of Irritated Residents, Global Community Monitor, Center on Race, Poverty & the Environment, and the Central Valley Air Quality Coalition Watchdog Committee.

collects fees, that money belongs to the District and can be used as the District sees fit. (Earthjustice)

RESPONSE: The discussion on Section 185 fees in Chapter 3 has been updated to provide further detail.

19. **COMMENT:** The Plan should provide emission targets for advancing attainment and an analysis of the available and feasible air pollution controls that could be adopted to meet these targets. (Earthjustice)

RESPONSE: Chapter 4 includes discussion of what it would take to achieve 2017 emissions levels (i.e., projected attainment emissions levels) in 2016. The plan concludes that there are no unused reasonable control measures, and there would not be sufficient additional NOx emission reductions available to formally demonstrate attainment in 2016.

This is not to say that attainment before 2017 is not possible. In fact, the San Joaquin Valley's 1-hour ozone air quality has greatly improved over the past several years through the implementation of already-adopted control measures. As of the posting of this plan, attainment could be possible as early as 2013. On the other hand, it takes as little as four hours over a three-year period (where those four hours occur on four separate days at a single air monitoring site) to keep an area out of attainment, and a single episode of ozone build up could prolong nonattainment past 2013. Therefore, 2017 is the official attainment year for this plan, per the modeling and other analyses conducted as part of this planning effort. The 2017 attainment year is consistent with the five-year attainment timeframe of CAA §172(a)(2)(A); in addition, this plan is not using the full 10-year attainment timeframe allowed under CAA §172(a)(2), nor does it rely on yet-to-be-identified "black box" emission reductions under CAA §182(e)(5).

20. **COMMENT:** The Plan should include sufficient information for the emissions inventory to demonstrate what the assumptions are for economic growth, how subsidy programs such as the Carl Moyer program are accounted for in projections of future emissions, and the control effectiveness of various control measures. Stakeholders should be able to confirm that the emission inventory does not include credit for the District's Indirect Source Review Rule, AERO, or "black box" emission reductions. (Earthjustice)

RESPONSE: The emissions inventory does not account for ISR, AERO, or "black box" emission reductions. The District and ARB recently met with CVAQ members, per their request, to answer questions regarding growth assumptions. The District and ARB continue to be available to answer questions related to the emissions inventory.

21. **COMMENT:** Removing exemptions for agricultural burning could provide significant VOC and NOx reductions. The Plan says that the District will review Rule 4103 (Open Burning) in 2015, and that burning is managed to ensure that it does not occur on days that might cause or contribute to a violation of any NAAQS. Rule 4103 should be evaluated for this Plan. (Earthjustice)

RESPONSE: Rule 4103 is evaluated on pages C-94 to C-95 of Appendix C (Stationary and Area Source Control Strategy Evaluation). As discussed in that evaluation, RACT is already in place for this source category and there are no additional feasible emission reduction opportunities. Under the District's Smoke Management System (SMS), agricultural burning is prohibited on days when an exceedance of a federal standard is forecast to occur. The District evaluated the feasibility and cost effectiveness of alternatives to burning in the *2010 Final Staff Report and Recommendations for Agricultural Burning* (*2010 Report*). The District determined, and ARB concurred, that there were no economically feasible alternatives to open burning of certain crop categories as outlined in the *2010 Report*; this conclusion was reaffirmed in the *2012 Update: Recommendations on Agricultural Burning* (*2012 Report*) and the analysis for Rule 4103 in Appendix D of the *2012 PM2.5 Plan*. The District will reevaluate the exemptions in Rule 4103 in 2015, as planned. Refer to the analysis for Rule 4103 in Appendix C of this plan for additional information.

22. **COMMENT:** The District should target VOC emission reductions from sources such as dairies, consumer products, and coatings. (Earthjustice)

RESPONSE: Modeling for this plan and other District ozone State Implementation Plans shows that the Valley is a NOx-limited area, and that additional VOC emission reductions will not advance the District's attainment of the 1-hour ozone standard.

However, the District did evaluate its dairy rule, Rule 4570 (Confined Animal Facilities), and each of the 10 District coatings regulations in Appendix C of this plan. The District discusses the following findings:

- **Rule 4570 (Confined Animal Facilities)**: The District did not identify any cost effective or technologically feasible emission reduction opportunities at this time. This rule is already the most stringent in the nation, and has been approved as at least meeting RACT for this source category. This determination has also been upheld by the courts. Refer to the analysis for Rule 4570 on pages C-100 to C-101 of Appendix C for additional information.

- **District Coatings Rules**: Each of the Districts' coating rules meet or exceed RACT guidelines and no technologically feasible or cost effective emission reduction opportunities were identified at this time. The District did include a recommendation to evaluate some of SCAQMD's new architectural coatings emissions limits that exceed RACT requirements during the development of the next ozone plan. Refer to pages C-44 through C-63 of Appendix C for the full analyses of the District's coating regulations.

- ARB regulates consumer products and has numerous VOC-reducing rules in place.

23. **COMMENT:** ARB and the District should revise the in-use (off-road) fleet rules to require more zero-emitting electric equipment. The revised standards could establish a future compliance date and the District could continue to use incentive funding to subsidize early replacement of technologies, such as forklifts. (Earthjustice)

RESPONSE: As discussed in Chapter 3, ARB has several regulations in place for off-road equipment, and implementation of these regulations is phased in to reduce emissions through 2017 and beyond. These rules are the most stringent in the nation, and will be implemented at a great cost to the state's and Valley's economies. The District has not identified any additional feasible regulatory measures to accelerate compliance. In addition to the reductions being achieved by these rules, the District continues to achieve significant emissions reductions through its various incentive programs for the replacement and retrofit of forklifts, off-road vehicle engines, and agricultural pump engines.

24. **COMMENT:** The District and ARB should adopt standards that require the retrofit and replacement of agricultural equipment where replacement, especially to zero-emitting equipment, has been demonstrated through the District's incentive programs. (Earthjustice)

RESPONSE: ARB is in the process of developing a rule to implement emissions standards for agricultural equipment. Concurrently, the District and United States Department of Agriculture Natural Resources Conservation Service incentive programs, combined with agricultural sector investments, continue to accelerate the replacement or retrofit of agricultural equipment. As documented in the District's 2013 Annual Demonstration Report under recently adopted Rule 9610 (SIP-Creditability of Emissions Reductions Generated through Incentive Programs), these combined efforts to date will result in 7.11 tons per day of NOx reductions in 2017.

25. **COMMENT:** The District should explore the conversion of off-road equipment, besides forklifts, to electric equipment for categories that have limited range and operational requirements for its potential to reduce emissions. (Earthjustice)

RESPONSE: The District welcomes feedback on any specific electric off-road equipment available to offset emissions from current technologies. The District has supported a number of projects involving the demonstration of zero/near-zero off-road technologies through its Technology Advancement Program, and will continue to promote the deployment of such technologies as they become commercially available and feasible.

26. **COMMENT:** The discussion of the District's political agenda (i.e., the District's discussion of its legislative strategy in Chapter 3) is not relevant to attainment of the 1-hour ozone standard. (Earthjustice)

RESPONSE: The commenter does not appear to understand that the District's legislative strategy is one component of the District's innovative, multi-faceted emission reduction strategy. Through the legislative platform, the District has secured additional incentive funding, pushed for legislative changes that resulted in reduced emissions, and challenged legislative actions that may be detrimental to the Valley's air quality. As such, the legislative platform is extremely relevant to the attainment of the 1-hour ozone standard and the District's attainment goals for other federal air quality standards.

27. **COMMENT:** Rule 4311 (Flares) should be strengthened. In particular, Rule 4311 allows emergency flares for economic reasons and other broadly interpreted situations. In addition, the flare minimization component is extremely weak and lacks detail. In contrast, Santa Barbara APCD Rule 359 has far stricter definitions of what would constitute an emergency, and has a very specific flare minimization target of 5% of the total gas produced. District Rule 4311 should be at least as strict as similar rules found elsewhere in the state to help reduce NOx emissions. (CVAQ)

RESPONSE: The District performed a thorough analysis of flare rules in other air districts in California during the development of the District's *2012 PM2.5 Plan*, and this plan. Both analyses concur with the conclusion reached by staff during the 2009 rule-amending project, that District Rule 4311 is as stringent as or more stringent than flare rules in other air districts. EPA concurs with this assessment, as illustrated by the approval of the rule as a State Implementation Plan revision in 2011. The District has analyzed Santa Barbara APCD Rule 359, and has found while it appears to include a performance standard restricting the use of flaring, it actually allows flaring under broad conditions, and the District's rule is at least as stringent. That said, in the *2012 PM2.5 Plan* the District committed to a further study of the flare rules to continue to evaluate potential opportunities for additional emission reductions from these sources. This further study is also a proposed commitment in this plan. This further study is an ongoing work in progress and will be completed by the end of 2013, consistent with District commitments. Because flares are a relatively small source of ozone precursor emissions, attempting to expedite this further study would not affect the Valley's projected 1-hour ozone attainment year.

28. **COMMENT:** Under California Health and Safety Code Section 40914(a)(4), the District could, like South Coast, adopt rules to reduce emissions from government owned, licensed, or subcontracted vehicle fleets (not exclusive to refuse/garbage trucks). South Coast has approved rules for street sweepers, public fleet vehicles, transit buses, airport ground access vehicles, school buses, and refuse trucks. (CVAQ)

RESPONSE: Advancing the turnover of fleets is a critical component of reducing emissions. ARB has adopted fleet rules that have greatly reduced emissions from public fleet vehicles, and have superseded efforts at local levels to reduce emissions from those same fleets. The District also operates some of the most effective and robust vehicle grant programs in the nation. The District will continue to look into opportunities for new fleet rules, but at this time the District advances the turnover of fleets through the use of incentive funds.

29. **COMMENT:** The District should do more to support alternative fueling infrastructure, and should add something to the plan about this. (CVAQ)

RESPONSE: The District has undertaken a variety of efforts to support alternative fuel infrastructure. The District is currently participating in three committees aimed at promoting, developing, and supporting alternative fuel technology and infrastructure. In addition to these committees, the District currently offers incentive funding for Alternative Fuel Mechanic Training and for Alternative Fuel Infrastructure projects, and the District's Technology Advancement Program has awarded funding to innovative projects that advance alternative fuel infrastructure technologies. See Chapter 3 for further discussion on the District's efforts to support alternative fueling infrastructure.

The District continues to look for additional opportunities to launch incentive programs and contribute to other efforts to expand the Valley's alternative fuel infrastructure.

30. **COMMENT:** The District's Indirect Source Review (ISR) rule is good, but doesn't go far enough. The District should expand ISR to:

- Improve the connection between ISR fees and actual emissions reductions achieved
- Make sure mitigation measures are actually implemented
- Work to improve communications among land use, transportation, and other agencies that have roles in approving or rejecting a development

- Provide advanced credit for projects that go beyond minimum requirements. (CVAQ)

RESPONSE: This comment does not include any specific suggestions, and are generally already included in the ISR. The District is the first air agency to adopt an indirect source rule regulating new development projects. The District's rule is recognized as the benchmark, or best available control, for regulating indirect sources. The legal issues associated with adopting and implementing indirect source regulations are numerous and complex, as is evidenced by the fact that the District has spent over five years successfully defending its existing rule in state and federal court. The following provides additional insight into the broad issues included in this comment:

- The District produces an annual report of District ISR activities and makes this report available on the District web page (http://www.valleyair.org/ISR/ISRResources.htm#ISRReports). This annual report details the connection between ISR fees and emission reductions achieved.
- District rules define the regulatory standards, and then District's Permit Services and Compliance Departments act to ensure compliance with said rule requirements.
- The District regularly communicates with agencies and the public regarding ISR via public meetings, trainings, and the District's ListServe. The District welcomes suggestions for additional outreach methods.
- The District provides advanced credit for projects that go beyond minimum requirements for large projects that commit to five-year fleet turnovers, as this goes well beyond the minimum requirements. The District welcomes suggestions for additional ways to provide advanced credit for projects that go beyond minimum requirements.

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