# 2015 Plan for the 1997 PM2.5 Standard

San Joaquin Valley Unified Air Pollution Control District

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# Executive Summary

*2015 Plan for the 1997 PM2.5 Standard*
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# Executive Summary

This plan addresses the federal mandates related to the 1997 PM2.5 National Ambient Air Quality Standard (NAAQS, or standard). Building on decades of developing and implementing active and effective air pollution control strategies, this plan contains Most Stringent Measures (MSM), Best Available Control Measures (BACM), additional enforceable commitments for further reductions in emissions, and ensures expeditious attainment of the 1997 standard. However, the tortured path that has led to this juncture where the San Joaquin Valley has to rewrite the attainment plan for an old standard illustrates the need for modernizing the antiquated provisions of the federal Clean Air Act (CAA).

On April 30, 2008, the District adopted the *2008 PM2.5 Plan* satisfying all federal implementation requirements for the 1997 federal PM2.5 standard. Per guidance from EPA, this plan addressed the 1997 PM2.5 standard under Subpart 1 of CAA Title 1, Part D. Subsequently, in 2013, the D.C. Circuit Court ruled that EPA erred by solely using Clean Air Act Subpart 1 in establishing its PM2.5 implementation rule, without consideration of the PM-specific provisions in Subpart 4. In June 2014, EPA then classified the Valley as a Moderate nonattainment area under Subpart 4 with an attainment date of April 5, 2015.

In 2012, after implementing much of the commitments in the *2008 PM2.5 Plan*, the Valley was on the verge of attaining the 1997 PM2.5 standard with an average annual concentration of 14.7 $\mu g/m^3$ and an average 24-hour concentration of 56.4 $\mu g/m^3$ at the Valley's historic peak PM2.5 sites in Bakersfield. However, due to the extreme drought, stagnation, strong inversions, and historically dry conditions experienced over the winter of 2013-2014, attainment was impossible even if the Valley experienced zero PM2.5 pollution for the last three quarters of 2014. The CAA includes provisions for excluding uncontrollable "exceptional events" from a region's attainment determination, but the current EPA framework specifically excludes stagnation and drought conditions. Given that attaining the standard in 2015 was physically impossible, the District was compelled to submit a formal request for reclassification to Serious nonattainment with a new attainment date of December 31, 2015. Unfortunately, the exceptional weather conditions experienced in 2013-2014 has also made it impossible to meet the new attainment deadline of December 31, 2015. Therefore, this plan also contains a request for a one-time extension of the attainment deadline for the 24-hour standard to 2018 and the annual standard to 2020.

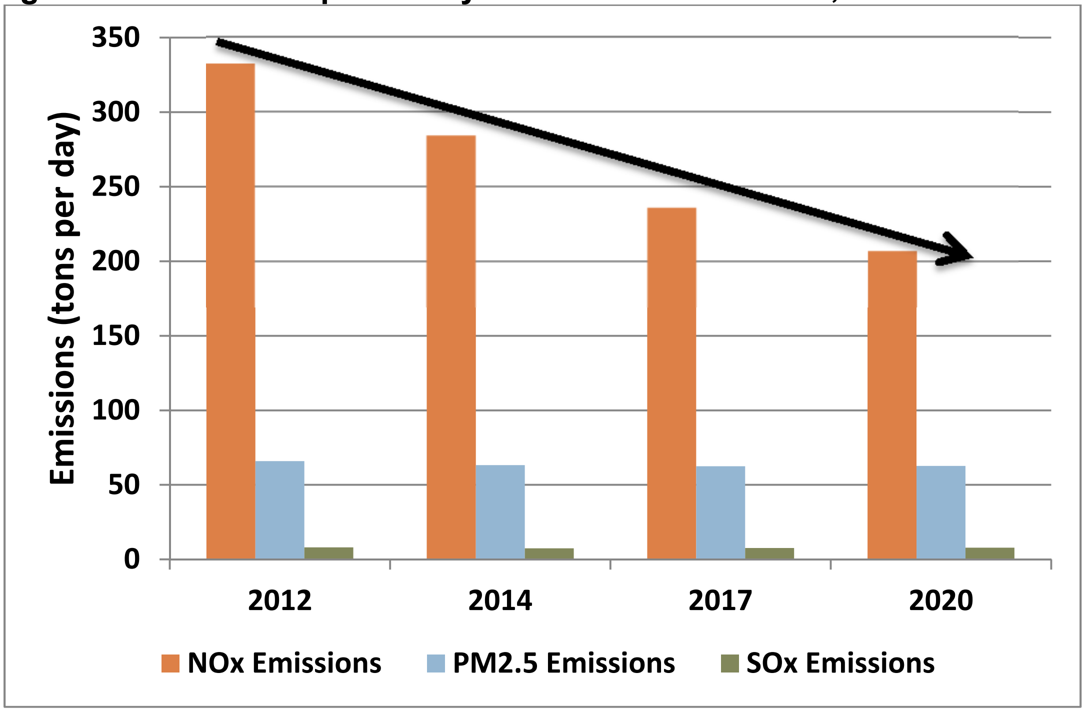
Adding further confusion, in accordance with federal mandates, in December 2012, the District adopted the *2012 PM2.5 Plan* to address the 2006 federal PM2.5 standard. This plan was also adopted under Subpart 1 of the Clean Air Act based on EPA's guidance at the time. To further complicate matters, a few days before the District adopted the *2012 PM2.5 Plan*, EPA proposed a new PM2.5 standard, which was finalized in January 2013 (2012 PM2.5 Standard, 12 $\mu g/m^3$ annual).

The above actions trigger additional federal mandates that can best be described as chaotic, with multiple attainment plans required for the same pollutant with each standard requiring a separate attainment plan, leading to multiple overlapping requirements and deadlines. These mandates are summarized below:

- EPA classified the District as a Moderate nonattainment area under Subpart 4 for the 2006 federal PM2.5 standard in June 2014.
- EPA proposed approval of the District's *2012 PM2.5 Plan* as a Moderate area plan under Subpart 4 in January 2015.
- EPA proposed to reclassify the District as a Serious nonattainment area under Subpart 4 for the 2006 federal PM2.5 standard in January 2015.
- District must submit a new attainment plan under a Serious classification for the 2006 federal PM2.5 standard within 18 months from EPA's final action to classify the District as Serious nonattainment.
- EPA designated the Valley as a Moderate nonattainment area for the 2012 federal PM2.5 standard effective April 15, 2015.
- District must first submit a Moderate plan for the 2012 federal PM2.5 standard to justify and request reclassification to Serious nonattainment classification within 18 months of nonattainment designation by EPA.
- District must then submit a new attainment plan under a Serious classification for the 2012 federal PM2.5 standard within 18 months from EPA's final action to classify the District as Serious nonattainment.
- For each of the standards, the District would have federally mandated attainment deadlines of 6 years from designation as a Moderate area, or 10 years from designation as a Serious area, and may need to request an extension depending on the timing of actions by EPA and mandated deadlines.

Through the comprehensive attainment strategy included in this *2015 Plan for the 1997 PM2.5 Standard (2015 PM2.5 Plan)*, the Valley will reduce NOx emissions by 38% between 2012 and 2020 (see Figure ES-1). In addition to these much-needed NOx reductions, the District's strategy also reduces direct PM2.5 emissions that not only assist the Valley in attaining the standard as expeditiously as possible, but also reduce the PM2.5 emissions that pose the greatest health impacts to Valley residents. These strategies, including upcoming measures to further reduce emissions from commercial charbroilers, reduce highly health-impactful PM2.5 emissions where and when they matter most in Valley neighborhoods, and provide health benefits beyond simply attaining the federal standard.

**Figure ES-1 San Joaquin Valley Emissions Reductions, 2015 PM2.5 Plan**




In developing this plan, the District and the California Air Resources Board (ARB) took full advantage of the extensive scientific research and knowledge that has been developed to characterize the Valley's unique air quality chemistry and challenge. The District, through the San Joaquin Valleywide Air Pollution Study Agency, participated in and contributed to the expenditure of nearly $30 million to support the California Regional Particulate Air Quality Study (CRPAQS). This study, and the subsequent research built on its foundation, has shed light on the complexity of PM2.5 in the Valley. Additionally, recent health studies highlight the associated risks inherent in the complex components of PM2.5. Acknowledgement and understanding of this complexity is central to the *2015 PM2.5 Plan* and was used to form the scientific foundation of this plan.

Using the extensive body of knowledge regarding formation of PM2.5 in the Valley, ARB performed Relative Response Factor (RRF) modeling to predict future PM2.5 concentrations throughout the Valley based on previous methodologies in the *2008 PM2.5 Plan*. This modeling was performed consistent with EPA guidance, and involved sophisticated computer modeling and review by a team of technical staff, including close coordination with the District. In addition to the modeling by ARB, the District has also performed extensive analysis that provides additional supporting evidence that the plan will effectively bring the Valley into attainment. Overall, the modeling and supporting technical analysis demonstrate that the emissions reductions achieved through the plan's control strategy bring the entire Valley into attainment of the 1997 federal 24-hour PM2.5 standard by 2018 and annual PM2.5 standard by 2020.

The *2015 PM2.5 Plan* was prepared through an involved public process that provided multiple opportunities for the general public and interested stakeholders to offer suggestions and comments for improving and strengthening the plan. The District has worked closely with these various stakeholders, including its partner agencies ARB and EPA, environmental and community advocacy groups, and business representatives to share information regarding the plan, and to receive comments and suggestions.

Numerous opportunities were provided for public input in 2014 during District Governing Board public hearings, Citizen's Advisory Committee public meetings, and Environmental Justice Advisory Group public meetings. The District also met with interested advocacy and industry representatives throughout the plan development process to address specific questions and comments, and solicit further suggestions for control strategies. The District held a public workshop for this plan on March 4, 2015 that outlined the air quality challenges faced by the Valley and potential strategies for responding to the challenge. The workshop was held at the District's offices in Modesto, Fresno, and Bakersfield and by webcast, with many participants attending and providing feedback during the workshop.

All of these meetings have provided opportunities for the public to provide verbal comments, and written comments have also been accepted throughout development of this plan. These comments have been integral to the development of this plan, and have been incorporated as appropriate. All significant comments and responses are summarized and posted on the District's website.

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# Appendices

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[1] Appendix D was provided by ARB; the tables are not labeled with the appendix prefix (i.e. D-XX) as in other appendices.

# Acronyms

## 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 Emission Reduction Options
AFO: animal feeding operation
AIP: achieved in practice
AMI: acute myocardial infarction
AMP: air monitoring program
AMR: annual monitoring report
AO: agricultural operations
APCD: Air Pollution Control District
APCO: Air Pollution Control Officer
AQ: air quality
AQI: Air Quality Index
AQIP: Air Quality Improvement Program
AQMD: Air Quality Management District
AQS: Air Quality System
ARB: California Air Resources Board
ATCM: Airborne Toxic Control Measure
BACM: Best Available Control Measure
BACT: Best Available Control Technology
bhp: brake horsepower
BMP: best management practice
BTU: British Thermal Units
CAA: Clean Air Act
CCAQS: Central California Air Quality Studies
CCDAQ: Clark County Department of Air Quality
CDFA: California Department of Food and Agriculture
CE: cost effectiveness
CEC: California Energy Commission
CE-CERT: University of California, Riverside College of Engineering - Center for Environmental Research and Technology
CEIDARS: California Emission Inventory Development and Reporting System
CEMS: Continuous Emissions Monitoring System
CEPAM: California Emissions Projection Analysis Model
CFR: Code of Federal Regulations
CGYM: Clean Green Yard Machine

CH&SC: California Health and Safety Code
CM: control measures
CMAQ: Community Multi-Scale Air Quality
CMP: Conservation Management Practice
CNG: compressed natural gas
CO: carbon monoxide
CO2: carbon dioxide
CPRC: California Public Resources Code
CRF: capital recovery factor
CRPAQS: California Regional Particulate Air Quality Study
CSUF: California State University, Fresno
CTG: Control Techniques Guidelines
CVP: Central Valley Project
CVRP: Clean Vehicle Rebate Project
DAC: direct annual costs
DC: direct capital (costs)
DERA: Diesel Emission Reductions Act
DI: direct installation (cost)
DF: deposition fraction
District: San Joaquin Valley Air Pollution Control District
DMV: Department of Motor Vehicles
DOF: Department of Finance
DOGGR: California Department of Conservation's Division of Oil, Gas, and Geothermal Resources
DPR: Department of Pesticide Regulation
DV: design value
e-AIM: extended aerosol inorganics model
EC: elemental carbon
EF: emission factor
EFMP: Enhanced Fleet Modernization Program
EMFAC: Emission Factors Model
EPA: U.S. Environmental Protection Agency
ER: emergency room
ERC: emission reduction credits
ESP: electrostatic precipitator
FAF: freight analysis framework
FDEP: Florida Department of Environmental Protection
FEM: federal equivalent method
FG: flare gas
FHWA: Federal Highway Administration
FMMP: Farmland Mapping and Monitoring Program
FMP: Flare Minimization Plan
FR: Federal Register

FRM: Federal Reference Method
FY: fiscal year
GHG: greenhouse gas
GIS: geographic information system
GVWR: gross vehicle weight rating
HC: hydrocarbon
HD: heavy duty
HEPA: high-efficiency particulate arresting (filtration systems)
HHDV: heavy heavy-duty vehicles
HMA: hot-mix asphalt
HRRS: Heath Risk Reduction Strategy
HVIP: Hybrid Truck and Bus Voucher Incentive Program
IAC: indirect annual costs
IC: internal combustion
IEPR: Integrated Energy Policy Report
IMPROVE: Interagency Monitoring of Protected Visual Environments
ISR: indirect source review
kW: kilowatt
kWH: kilowatt-hour
LAER: Lowest Achievable Emission Rate
lb/MMBtu: pounds per million British thermal units of heat output
LDT: light-duty trucks
LHDV: light heavy-duty vehicles
LMA: Land Management Agency
LPG: liquefied petroleum gas
LTO: low temperature oxidation
MACT: maximum achievable control technology
MCF: thousand cubic feet
MCSF: thousand cubic standard feet
MCY: motorcycles
MH: motor homes
MHDV: medium heavy-duty vehicles
MMBtu/hr: million British thermal units per hour
MOZART: Model for Ozone and Related Chemical Tracers
MPO: Metropolitan Planning Organization
MSM: Most Stringent Measure
MSW: municipal solid waste
MW: megawatt
NAAQS: National Ambient Air Quality Standards
NASS: National Agriculture Statistics Service
NESHAP: National Emission Standards for Hazardous Air Pollutants
NG: natural gas
ng/J: nanograms per Joule of heat output

NO: nitrogen oxide
NOx: oxides of nitrogen
NRCS: Natural Resources Conservation Service
NSCR: non-selective catalytic reduction
NSPS: New Source Performance Standard
NSR: New Source Review
NTE: not-to-exceed
OAQPS: Office of Air Quality Planning and Standards (EPA)
OB: other buses
OBD: on board diagnostics
OC: organic carbon
OFP: ozone forming potential
OGV: ocean-going vessels
OMP: operator management plan
OH: hydroxyl radicals
PAH: polycyclic aromatic hydrocarbons
PAN: peroxy acetyl nitrate
PASS: Polluting Automobile Scrap and Salvage
PBW: particle bound water
PCAPCD: Placer County Air Pollution Control District
PEC: purchased equipment costs
PEER: Permit-Exempt Equipment Registration
PERP: Portable Equipment Registration Program
PM: particulate matter
PM0.1: ultrafine particles
PM10: particulate matter that is 10 microns or less in diameter
PM2.5: particulate matter that is 2.5 microns or less in diameter
POA: primary organic aerosols
PPN: particulate protein nitrogen
PSD: particle size distribution
PST: Pacific Standard Time
PTFE: poly tetra fluoro ethylene
PUC: Public Utilities Commission
QA: quality assurance
QC: quality control
RAAN: Real-Time Air Quality Advisory Network
RAP: reclaimed asphalt pavement
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

RFQ:  Request for Qualifications
RFP:  Reasonable Further Progress
RH:  relative humidity
ROAR:  Real-time Outdoor Activity Risk
ROS:  reactive oxygen species
RRD:  respirable road dust
RRF:  relative response factors
RTO:  regenerative thermal oxidizer
RV:  recreational vehicles
SA:  stationary aggregated
SANDWICH:  sulfate, adjusted nitrate, derived water, inferred carbonaceous material balance approach
SB:  school buses
SB:  Senate Bill
SBA:  small business assistance
SBCAPCD:  Santa Barbara County Air Pollution Control District
SC:  source category
SCAQMD:  South Coast Air Quality Management District
SCR:  selective catalytic reduction
SIP:  State Implementation Plan
SJV:  San Joaquin Valley
SJVAPCD:  San Joaquin Valley Air Pollution Control District
SJVUAPCD:  San Joaquin Valley Unified Air Pollution Control District
SMAQMD:  Sacramento Metropolitan Air Quality Management District
SMAT:  Speciated Modeled Attainment Test
SMS:  Smoke Management System
SNCR:  selective non-catalytic reduction
SOA:  secondary organic aerosol
SORE:  small off-road engines
SOx:  oxides of sulfur
TAC:  toxic air contaminant
TCI:  total capital investments
TOC:  total organic compounds
TOG:  total organic gases
Tpd:  tons per day
Tpy:  tons per year
TRU:  transport refrigeration unit
TSD:  technical support document
TSM:  total selective metals
UB:  urban buses
UCSF:  University of California, San Francisco
UFP:  ultrafine particles
US:  United States

USDA: United States Department of Agriculture
USDA-ARS: United States Department of Agriculture-Agricultural Research Service
USG: unhealthy for sensitive groups
Valley: San Joaquin Valley
VCAPCD: Ventura County Air Pollution Control District
VDE: visible dust emissions
VMT: vehicle miles traveled
VOC: volatile organic compounds
WAAQS: web-based archived air quality system
WOE: Weight of Evidence
WMA: warm-mix asphalt
WWTP: wastewater treatment plan
XRF: X-ray fluorescence
ZEV: zero-emission vehicle
$\mu g/m^3$: micrograms per cubic meter

# Chapter 1

Air Quality Standards and Requirements

*2015 Plan for the 1997 PM2.5 Standard*

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# Chapter 1: Air Quality Standards and Requirements

Pursuant to the federal Clean Air Act (CAA) Section (§)108 and §109, the U.S. Environmental Protection Agency (EPA) periodically reviews and establishes health-based air quality standards (often 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. For over twenty years, the San Joaquin Valley Air Pollution Control District (District) has implemented several generations of emissions control measures for those stationary and area sources under its regulatory jurisdiction. Similarly, the California Air Resources Board (ARB) has adopted regulations for mobile sources. Together, these efforts represent the nation's toughest air pollution regulations 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.

## 1.1 1997 PM2.5 AIR QUALITY STANDARD

EPA adopted the first NAAQS for particulate matter that is 2.5 microns or less in diameter (PM2.5) in July 1997[1] setting the annual PM2.5 standard at 15 micrograms per cubic meter (µg/m$^3$) and the 24-hour PM2.5 standard at 65 µg/m$^3$. States and air districts addressed this standard under CAA Title 1, Part D, Subpart 1[2] (Subpart 1) following guidance provided by EPA. As a result of a court ruling in 2013, EPA now requires the 1997 PM2.5 standard be addressed by states and air districts under the requirements of CAA Subpart 1 and CAA Title 1, Part D, Subpart 4 (Subpart 4). This *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5* Plan) addresses the 1997 standard for PM2.5 under Subpart 1 and Subpart 4. Until the exceptional weather conditions experienced due to the recent drought, the District was on track to attain the 1997 annual PM2.5 standard before the federally mandated attainment deadline.

## 1.2 DISTRICT'S *2008 PM2.5 PLAN* FOR THE 1997 PM2.5 STANDARD

Pursuant to Subpart 1 requirements, on January 5, 2005, EPA promulgated air quality designations for all areas for the 1997 PM2.5 standard.[3] EPA designated the Valley as a nonattainment area based on ambient air quality data collected in the area from 2001 through 2003. The District adopted an air quality attainment plan (*2008 PM2.5 Plan*) to address the 1997 PM2.5 standard. At the time of the development of the *2008 PM2.5 Plan*, the Valley was already projected to attain the 1997 24-hour standard based on air quality data collected during the period of 2004 through 2006. As such, the focus of the *2008 PM2.5 Plan* was to address the 15 µg/m$^3$ annual PM2.5 standard.

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[1] 62 FR 38651-38701
[2] EPA. Clean Air Act. Retrieved on 11/5/2014 from http://www.epw.senate.gov/envlaws/cleanair.pdf.
[3] 70 FR 943-1019

The District's Governing Board adopted the *2008 PM2.5 Plan* in April 2008[4] to address EPA's 1997 annual PM2.5 standard for PM2.5, and directed staff to forward the adopted *2008 PM2.5 Plan* to the ARB for approval and submittal to EPA. EPA approved the *2008 PM2.5 Plan* on November 9, 2011, effective January 9, 2012.[5]

## 1.3 TRANSITION FROM SUBPART 1 TO SUBPART 4 OF THE CLEAN AIR ACT

In January 2013, the D.C. Circuit Court found that EPA erred in implementing the federal PM2.5 standard pursuant solely to the general implementation provisions of Subpart 1 without also considering the particulate matter-specific provisions of Subpart 4. Subpart 4 requires a nonattainment area classification system (i.e., moderate and severe classifications) and contains requirements specific to particulate matter. As a result of the court ruling, on June 2, 2014, EPA classified the Valley (and all other PM2.5 nonattainment areas) as a Moderate nonattainment area by order of law under Subpart 4 and required all nonattainment areas to submit additional documentation, as needed, to fulfill all Subpart 4 requirements.[6]

The EPA guidance interpreting the Subpart 4 requirements for particulate matter nonattainment areas in the General Preamble[7] discusses the relationship of Subpart 1 and Subpart 4 SIP requirements, and notes that SIPs for Moderate nonattainment areas must meet the general provisions in Subpart 1 to the extent that these provisions are not otherwise "subsumed by, or integrally related to, the more specific Subpart 4 requirements." Some Subpart 1 provisions have no Subpart 4 equivalent (e.g., the emissions inventories (CAA section 172(c)(3)) and contingency measures (CAA section 172(c)(9)) and for these provisions, Subpart 1 continues to govern. Other provisions of Subpart 1 are subsumed or superseded by more specific requirements in Subpart 4 (e.g., certain provisions concerning attainment dates). Additionally, EPA guidance provides different requirements for areas of different classifications of nonattainment, as discussed below.

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[4] SJVAPCD. *2008 PM2.5 Plan.* Retrieved on 11/24/14 from http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm.
[5] EPA. Approval and Promulgation of Implementation Plans; California; 2008 San Joaquin Valley PM2.5 Plan and 2007 State Strategy; Final Rule. 76 Fed. Reg. 217, pp. 69896 – 69926. (2011, November 9). (to be codified at 40 CFR Part 52). Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2011-11-09/pdf/2011-27232.pdf
[6] All areas designated nonattainment for PM2.5 are classified as Moderate by order of law (CAA §188(a))
[7] EPA. General Preamble for Title I of the Clean Air Act Amendments of 1990 Appendix. p. 13538. (57 FR 13498, April 16, 1992)

## 1.4 REQUEST FOR RECLASSIFICATION TO SERIOUS NONATTAINMENT

In accordance with Subpart 4 §188(b), the District submitted an official request to EPA for reclassification from Moderate nonattainment to Serious nonattainment. Included with this request was a demonstration that attainment by the April 5, 2015 deadline under the current Moderate nonattainment classification is impracticable. As discussed in the demonstration of impracticability,[8] the Valley was on track to attain the 1997 PM2.5 standard until the extreme weather conditions over the winter of 2013-2014 overwhelmed emissions controls and led to abnormally high PM2.5 levels making attainment of the 1997 annual PM2.5 standard based on 2012-2014 data impossible. In January 2015, EPA proposed to reclassify the Valley as a Serious nonattainment area.

### 1.4.1 Demonstration of Impracticability of Attainment as a Moderate Nonattainment Area by April 5, 2015

In its September 25, 2014 letter to EPA, the District provided ambient air quality data demonstrating that the Valley cannot attain the 1997 PM2.5 standard by April 5, 2015. Data supporting the request for reclassification and EPA's analysis of said data and conclusions are presented below.

#### *1.4.1.1 1997 Annual PM2.5 Standard (15 µg/m$^3$)*

The District provided annual average PM2.5 concentrations recorded at monitoring sites in the Valley for 2012 and 2013, and then calculated the maximum 2014 annual average PM2.5 concentrations for each monitoring site that would result in a 3-year average PM2.5 concentration of 15 µg/m$^3$ or less at that site. Through this analysis, the District demonstrated that the maximum 2014 annual average concentration at the Bakersfield-Planz air monitoring site would have to be 7.5 µg/m$^3$ for 2014 in order for the design value to be at or below 15 µg/m$^3$. The average PM2.5 concentration measured at the Bakerfield-Planz site in the first quarter of 2014 was 29.7 µg/m$^3$. Thus the average PM2.5 concentrations at this monitoring site for the remaining three quarters of 2014 would have to be zero in order to result in a design value at or below 15 µg/m$^3$ for 2014.

In EPA's evaluation of the request for reclassification, EPA independently evaluated preliminary 2014 air quality data available in EPA's Air Quality System (AQS) as of August 2014 to assess the District's representations.[9] Preliminary 2014 AQS data for four monitoring locations in the Valley demonstrate that the 3-year average PM2.5 concentration for 2012-2014 will likely be well above 15 µg/m$^3$. Because a determination of attainment requires that each eligible monitoring site in the area show a design value at or below the level of the PM2.5 standard, a 2014 design value above this level at one eligible monitor would render attainment by April 5, 2015 impossible. EPA's analysis is summarized in the following table.

[8] SJVAPCD. *Item Number 9: Review and Approve Actions to Address Air Quality Impacts Resulting from the Exceptional Weather Conditions Caused by the Recent Drought*. (2014, August 21) Retrieved on 12/02/2014 from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2014/August/final/09.pdf

[9] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp. 1482-1491. (2015, January 12). (to be codified 40 CFR Part 81) http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

**Table 1-1 Preliminary Recorded Annual Average PM2.5 Concentrations (in μg/m$^3$) for Selected Sites in the Valley and Comparison to Lowest Recorded**[10]

| Monitor | Average Recorded 2014 | EPA estimate for Max 2014 Annual Average Allowed to Attain | Lowest Recorded Annual Average (year) | Percent Difference Between Max 2014 and Lowest Recorded Annual Average |
|---|---|---|---|---|
| Bakersfield – Planz | 29.7 | 7.7 | 14.5 (2011) | 47 |
| Visalia | 27.9 | 11.4 | 13.6 (2010) | 16 |
| Corcoran | 22.9 | 13.0 | 15.6 (2013) | 18 |
| Hanford | 18.7 | 12.1 | 14.8 (2012) | 18 |

### *1.4.1.2 1997 24-hour PM2.5 Standard (65 μg/m$^3$)*

EPA also reviewed ambient air quality data in the AQS to determine whether the Valley can practicably attain the 24-hour standard by April 5, 2015. The 24-hour PM2.5 design value is determined by taking the 98$^{th}$ percentile value for each year over a consecutive three year period and averaging the three 98$^{th}$ percentile values. The resulting value is then rounded to the nearest 1.0 μg/m$^3$ and compared to the standard. The 98$^{th}$ percentile 24-hour average PM2.5 concentrations recorded in 2012 and 2013 at selected monitoring sites were analyzed for this purpose. The 98$^{th}$ percentile 24-hour concentrations in 2013 were higher than in 2012, and in some cases the 2013 value was significantly higher than the 2012 value. Based on these observed 98$^{th}$ percentile values in 2012 and 2013, EPA calculated for each of these monitoring sites the maximum 98$^{th}$ percentile 24-hour concentration in 2014 that would enable the site to show a 2014 24-hour PM2.5 standard design value at or below 65 μg/m$^3$.

EPA also calculated a low estimate of the 98$^{th}$ percentile 24-hour concentration for 2014 at each of these sites, based on preliminary data reported to AQS for the first quarter of 2014 and a conservative assumption that 24-hour PM2.5 concentrations remain below these levels for the remainder of the year at each monitoring site. EPA's low estimates for the 98$^{th}$ percentile concentrations for 2014 at the two monitoring sites in Bakersfield (Planz and California Avenue) already exceed the maximum 2014 values that would enable these two sites to show a 24-hour PM2.5 standard design value for 2014 at or below 65 μg/m$^3$. These two sites in Bakersfield cannot practicably show a 24-hour PM2.5 standard design value at or below 65 μg/m$^3$ by April 5, 2015 as summarized in the following table.

[10] Table 3 from Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp. 1482-1491. (2015, January 12). (to be codified 40 CFR Part 81) http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

**Table 1-2 Preliminary Recorded 2014 24-hour PM2.5 Concentrations (in µg/m³) for Selected Sites in the Valley and Calculation of 98th Percentile Values**[11]

| Monitoring Site | 98th Percentile in 2012 | 98th Percentile in 2013 | Low Estimate of 98th Percentile in 2014 | Max 98th Percentile allowed in 2014 to attain |
|---|---|---|---|---|
| Bakersfield-Planz | 40.6 | 96.7 | 64.4 | 58.9 |
| Bakersfield – CA Ave | 56.4 | 71.8 | 72.6 | 68.0 |
| Hanford | 48.3 | 67.6 | 76.7 | 80.3 |
| Fresno-Pacific | 51.3 | 71.6 | 61.8 | 73.3 |
| Fresno-Garland | 52.6 | 63.8 | 65.5 | 79.8 |

### 1.4.2 EPA Action on Impracticability

EPA analysis of air quality data from 2012 through 2014 resulted in the determination that attainment by April 5, 2015 as a Moderate nonattainment area is impracticable. EPA proposed to reclassify the Valley as a Serious Nonattainment area under CAA Subpart 4. EPA published this proposed action in the Federal Register on January 12, 2015 and received comments on the proposal through February 11, 2015.[12] EPA finalized the Valley's reclassification to Serious Nonattainment in the Federal Register on April 7, 2015, effective May 7, 2015.[13]

## 1.5 FEDERAL REQUIREMENTS FOR A SERIOUS NONATTAINMENT AREA

In their proposal to reclassify the Valley from a Moderate nonattainment area to a Serious nonattainment area for the 1997 PM2.5 standard, EPA identified specific statutory requirements applicable to Serious nonattainment areas that upon reclassification as a Serious nonattainment area for the 1997 PM2.5 standard, California is required to submit.[14] These additional SIP revisions will satisfy the statutory requirements that apply to Serious nonattainment areas, including the requirements of Subpart 4. The Serious area SIP elements that California will be required to submit are summarized in Table 1-3.

On March 23, 2015, EPA issued proposed requirements in the Federal Register for implementing the NAAQS for PM2.5 in areas that are designated nonattainment for

[11] Table 4 from Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp. 1482-1491. (2015, January 12). (to be codified 40 CFR Part 81) http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

[12] Designation of Areas for AQ Planning Purposes; Ca; SJV; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp.1482-1491. (2015, January 12). http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

[13] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standard. 80 Fed. Reg. 66. Pp. 18528-18535. (2015, April 7). http://www.gpo.gov/fdsys/pkg/FR-2015-04-07/pdf/2015-07765.pdf

[14] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp. 1482-1491. (2015, January 12). (to be codified 40 CFR Part 81) http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

these standards.[15] The proposed requirements would apply to state, local, and tribal air agencies developing plans that outline how nonattainment areas will meet and maintain fine particle standards. The District is reviewing this proposed implementation rule and will follow it as it goes through the public review and comment process, which concludes on May 29, 2015. Once published in the Federal Register as a final rule the District will use this guidance in development of future attainment plans to address PM2.5 standards.

**Table 1-3 Statutory Requirements Applicable to Serious Nonattainment Areas**

| Requirement | Federal CAA | Description | *2015 PM2.5 Plan* |
|---|---|---|---|
| BACM and BACT | Subpart 4 §189(b)(1)(B) | Provisions to assure that the best available control measures (BACM), including best available control technology (BACT) for stationary sources, for the control of direct PM2.5 and PM2.5 precursors shall be implemented no later than four years after the area is reclassified. | Chapter 5, Appendix C |
| Attainment Demonstration | Subpart 4 §188(c)(2) and §189(b)(1)(A) | A demonstration that the plan provides for attainment as expeditiously as practicable but no later than December 31, 2015, or where the State is seeking an extension of the attainment date under Section 188(e), a demonstration that attainment by December 31, 2015 is impracticable and that the plan provides for attainment by the most expeditious alternative date practicable. | Chapter 1, Chapter 4, Appendix A |
| Reasonable Further Progress | Subpart 1 §172(c)(2) | Plan provisions that require reasonable further progress (RFP). | Chapter 6 |
| Quantitative Milestones | Subpart 4 §189(c) | Quantitative milestones which are to be achieved every three years until the area is redesignated attainment and which demonstrate RFP toward attainment by the applicable date. | Chapter 6 |
| PM2.5 Precursors | Subpart 4 §189(e) | Provisions to assure that control requirements applicable to major stationary sources of PM2.5 also apply to major sources of PM2.5 precursors, except where the State demonstrates to EPA's satisfaction that such sources do not contribute significantly to PM2.5 levels that exceed the standard in the area. | Appendix A |
| Emissions Inventory | Subpart 1 §172(c)(3) | A comprehensive, accurate, current inventory of actual emissions from all sources of PM2.5 and PM2.5 precursors in the area. | Appendix B |
| Contingency Measures | Subpart 1 §172(c)(9) | Contingency measures to be implemented if the area fails to meet RFP or to attain by the applicable attainment date. | Chapter 6 |

[15] Fine Particlate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements http://www.epa.gov/airquality/particlepollution/pdfs/20150311proposal.pdf

| Requirement | Federal CAA | Description | *2015 PM2.5 Plan* |
|---|---|---|---|
| New Source Review Program Major Source Thresholds | Subpart 4 §189(b)(3) | A revision to the nonattainment new source review (NSR) program to lower the applicable "major stationary source" thresholds from 100 tons per year (tpy) to 70 tpy. | Chapter 6 |

## 1.6 1997 PM2.5 STANDARD TIMELINE

The timeline below illustrates actions related to the 1997 PM2.5 standard, District Actions, EPA actions, and Valley events affecting attainment.

### Figure 1-1 1997 PM2.5 Standard Timeline

1997
- EPA sets first standard for PM2.5[16,17,18]
  - o 24-hr: 65 µg/m$^3$ (based on 3-year average of 98$^{th}$ percentile 24-hr PM2.5 concentrations)
  - o Annual: 15 µg/m$^3$ (based on 3-year average annual mean PM2.5 concentrations)

2005
- EPA finalizes attainment designations[19]; designates Valley as "nonattainment"

2007
- EPA issues *Clean Air Fine Particle Implementation Rule*[20]; directs states to adopt attainment plans under Subpart 1 requirements

2008
- District adopts *2008 PM2.5 Plan* per EPA guidance[21] to address annual standard (Valley already in attainment of 24-hr standard)

2011
- EPA approves District's *2008 PM2.5 Plan*[22] except for the contingency measures, which EPA disapproved
- EPA grants California's request for an extension of the attainment date for the Valley to April 5, 2015

2013
- A revised PM2.5 contingency measure plan for the Valley is submitted to EPA

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[16] NAAQS for Particulate Matter, 52 Fed. Reg. 119, pp. 24634-24669. (1987, July 1). http://www.regulations.gov/#!documentDetail;D=EPA-R08-OAR-2012-0446-0004

[17] NAAQS for Particulate Matter, 62 Fed. Reg. 138, pp. 38702-38752. (1997, July 18). http://www.epa.gov/fedrgstr/EPA-AIR/1997/July/Day-18/a18577b.htm

[18] NAAQS for Particulate Matter, 62 Fed. Reg. 138, pp. 38753-38760. (1997, July 18). http://www.epa.gov/fedrgstr/EPA-AIR/1997/July/Day-18/a18577c.htm

[19] Air Quality Designations and Classifications for the Fine Particles (PM2.5) NAAQS, 70 Fed. Reg. 3, pp. 944-1019. (2005, January 5). http://www.epa.gov/fedrgstr/EPA-AIR/2005/January/Day-05/a001.pdf

[20] Clean Air Fine Particle Implementation Rule, 72 Fed. Reg, 79, pp. 20586-20667. (2007, April 25). http://www.epa.gov/fedrgstr/EPA-AIR/2007/April/Day-25/a6347.pdf

[21] San Joaquin Valley Air Pollution Control District [SJVAPCD]. (2008, April 30). 2008 PM2.5 Plan. Fresno, CA. http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm

[22] Approval and Promulgation of Implementation Plans; California; 2008 San Joaquin Valley PM2.5 Plan and 2007 State Strategy, 76 Fed. Reg. 217, pp. 69896-69926. (2011, November 9). http://www.gpo.gov/fdsys/pkg/FR-2011-11-09/pdf/2011-27232.pdf

- U.S. Court of Appeals for the D.C. Circuit rules that EPA erred by not using Subpart 4 in addition to Subpart 1 in establishing its PM2.5 implementation rule
- The District is on track to attain the 1997 annual PM2.5 standard
- (Winter 2013-2014) The Valley experiences extreme drought and exceptional weather conditions.

2014
- EPA approves the revised PM2.5 contingency plan for the Valley
- EPA classifies Valley as a Moderate nonattainment area (by order of law) under Subpart 4 with an attainment date of April 5, 2015
- District submits formal request for reclassification of Valley to a Serious nonattainment area with a demonstration that the Valley cannot practicably attain the 1997 annual PM2.5 standard by the April 5, 2015 attainment date due to extreme weather during the winter of 2013-2014

2015
- EPA proposes to reclassify the Valley as a Serious nonattainment area thus extending the attainment date to no later than December 31, 2015[23]
- District to submit an attainment plan to EPA satisfying Subpart 1 and Subpart 4 requirements with attainment as expeditious as practicable but no later than December 31, 2015. (Plan submittal to include a demonstration that attainment by December 2015 is impracticable and a request for an attainment deadline extension to no later than 2020)

2020
- Attainment date (after extension): as expeditiously as practicable but no later than December 31, 2020

## 1.7 IMPRACTICABILITY OF ATTAINMENT BY DECEMBER 31, 2015 AND REQUEST FOR EXTENSION OF ATTAINMENT DATE FOR A SERIOUS NONATTAINMENT AREA

Until the exceptional weather conditions experienced due to the recent drought, the Valley was on the verge of attaining the 1997 federal PM2.5 standard (15 μg/m$^3$ for annual, 65 μg/m$^3$ for 24-hour) with an average annual concentration of 14.7 μg/m$^3$ and average 24-hour concentration of 56.4 μg/m$^3$ at the Valley's historic peak PM2.5 sites in Bakersfield in 2012. Due to the extreme drought, stagnation, strong inversions, and historically dry conditions experienced over the winter of 2013-2014, analysis showed that the Valley could not reach attainment even if the Valley experienced zero PM2.5 pollution for the last three quarters of 2014. In this plan, the District requests a one-time extension of the attainment deadline for the 24-hour standard to 2018 and the annual standard to 2020. Refer to Chapter 4 of this *2015 PM2.5 Plan* for a full explanation of the Subpart 4 section that allows for a one time extension of the attainment date, supporting analysis behind the request, and requirements and demonstration of said requirements.

[23] Designation of Areas for AQ Planning Purposes; Ca; SJV; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp.1482-1491. (2015, January 12). http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf

## 1.8 PUBLIC PROCESS FOR PLAN DEVELOPMENT

The District used the following public process timeline for the development of this plan.

**Table 1-4 *2015 PM2.5 Plan* Development and Public Workshop Timeline**

| | |
|---|---|
| **August 2014 – ongoing** | Monthly updates on the progress and development of the plan at public meetings such as the District's Governing Board meetings, Citizen Advisory Committee meetings, and Environmental Justice Advisory Group meetings. |
| **February 2015** | Draft plan documents available for public review and comment. |
| **March 4, 2015** | Public workshop to present and receive comments on the draft plan documents with an associated comment period. |
| **March 17, 2015** | Proposed Plan available for public review and comment 30-days prior to the Governing Board public hearing. |
| **April 16, 2015** | District Governing Board public hearing to hear and adopt the Proposed Plan. |

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# Chapter 2

PM2.5 Challenges and Trends in the San Joaquin Valley

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Chapter 2: PM2.5 Challenges and Trends in the San Joaquin Valley

Despite the unique geographical and meteorological challenges, the San Joaquin Valley (Valley) has made significant progress in reducing total emissions of directly emitted emissions of particulate matter that is 2.5 microns or less in diameter (PM2.5) and PM2.5 precursor emissions and in improving air quality for Valley residents. Through progressively more stringent regulations, improved control technologies, and innovative non-regulatory measures such as incentive programs, the annual average amount of directly emitted PM2.5 emissions has been steadily decreasing. Similarly, the overall amount of oxides of nitrogen (NOx) and oxides of sulfur (SOx) emissions continue to decrease.

Achieving PM2.5 reductions has been challenging given frequent meteorological conditions conducive to PM2.5 formation that are characteristic of the Valley, and which are outside human (and regulatory) control. Annual fluctuations in weather patterns affect the Valley's carrying capacity (the ability to disperse pollutants), which is reflected in long and short-term ambient air quality trends. Until the exceptional weather conditions experienced due to the recent drought, the Valley was on track to attain the 1997 annual PM2.5 standard before the federally mandated deadline of December 2014.

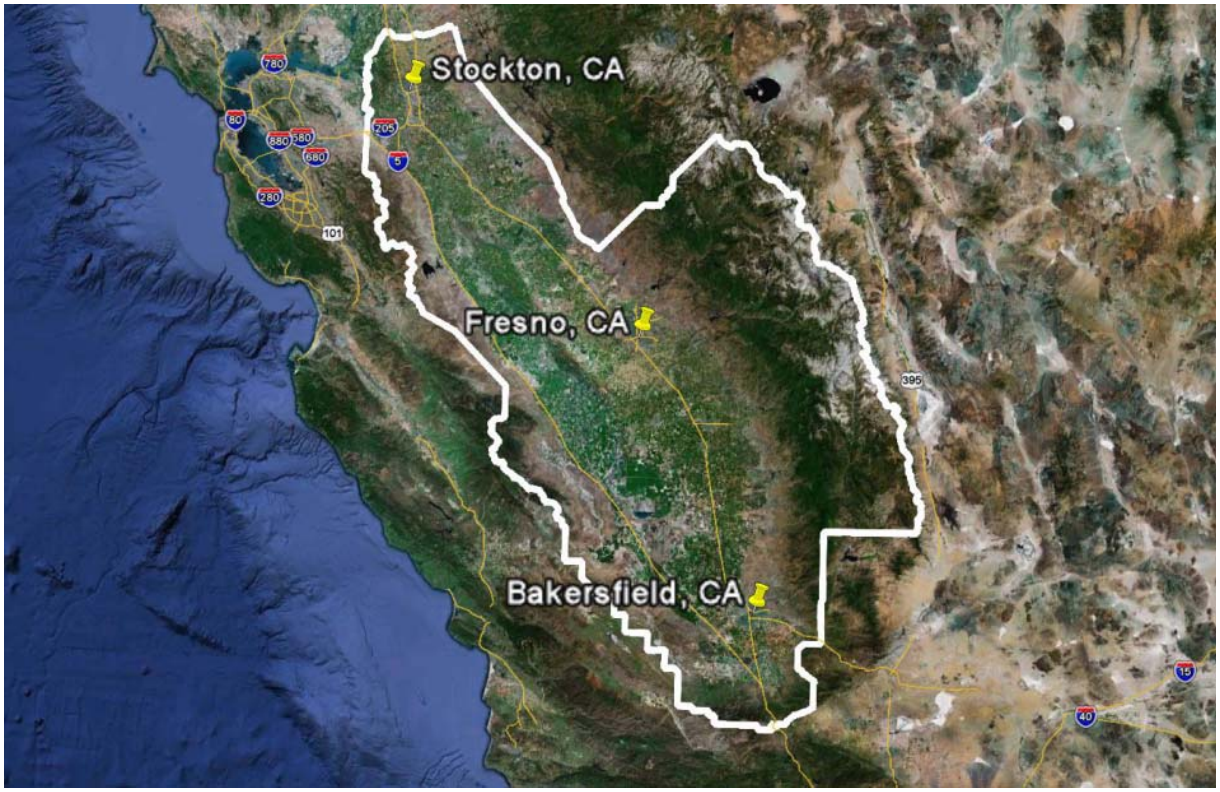
## 2.1 CHALLENGES OF THE NATURAL ENVIRONMENT

The Valley's natural environment supports one of the most productive agricultural regions in the country: the Sierra Nevada provides the necessary water for growing the abundance of crops, and a temperate climate provides a long growing season. However, these same natural factors present significant challenges for air quality: the surrounding mountains trap pollution and block air flow, and the mild climate keeps pollutant-scouring winds at bay most of the year. Despite the challenges, the San Joaquin Valley Air Pollution Control District (District) and the Valley are making progress in attaining the national ambient air quality standards (NAAQS) and improving public health for Valley citizens.

### 2.1.1 Unique Climate and Geography

The challenge of PM2.5 NAAQS attainment in the Valley is grounded in the unique topographical and meteorological conditions found in the region. The Valley, as seen in Figure 2-1, is an inter-mountain valley encompassing nearly 25,000 square miles. Surrounded by mountain ranges to the west, east, and south, the air flow through the Valley can be blocked, leading to severely constrained dispersion. During the winter, high-pressure systems can cause the atmosphere to become stagnant for longer periods of time, where wind flow is calm and air movement is minimal. These stagnant weather systems can also cause severe nighttime temperature inversions, which exacerbate the build-up of PM2.5 and related precursors both beneath and above the evening inversion layer.

**Figure 2-1 San Joaquin Valley Air Basin**




Under normal conditions, temperature decreases with increasing altitude, but during temperature inversions the normal temperature gradient is reversed, with temperatures *increasing* with altitude, causing warmer air to be above cooler air. Figure 2-2 shows that this reversal of the "normal" pattern impedes the upward flow of air, causes poor dispersion, and traps pollutants near the earth's 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 emissions near the surface. When horizontal dispersion (transport flow) and vertical dispersion (rising air) are minimized, PM2.5 concentrations can build quickly, especially in the winter. These naturally occurring meteorological conditions have the net effect of spatially concentrating direct PM2.5 concentrations near their sources; promoting the formation and regional buildup of secondary species, particularly ammonium nitrate; and chemically aged organic carbon species, resulting in an increase in their relative toxicity. Given these challenges, the Valley needs even more effective emissions reductions to attain the PM2.5 NAAQS; and the District continues to pursue these reductions through its numerous air quality attainment plans, prohibitory regulatory control strategy and innovative non-regulatory emission reduction strategy, which includes a robust incentive program, a comprehensive legislative platform, and rigorous outreach and education efforts.

**Figure 2-2 Atmosphere with and without a Temperature Inversion**

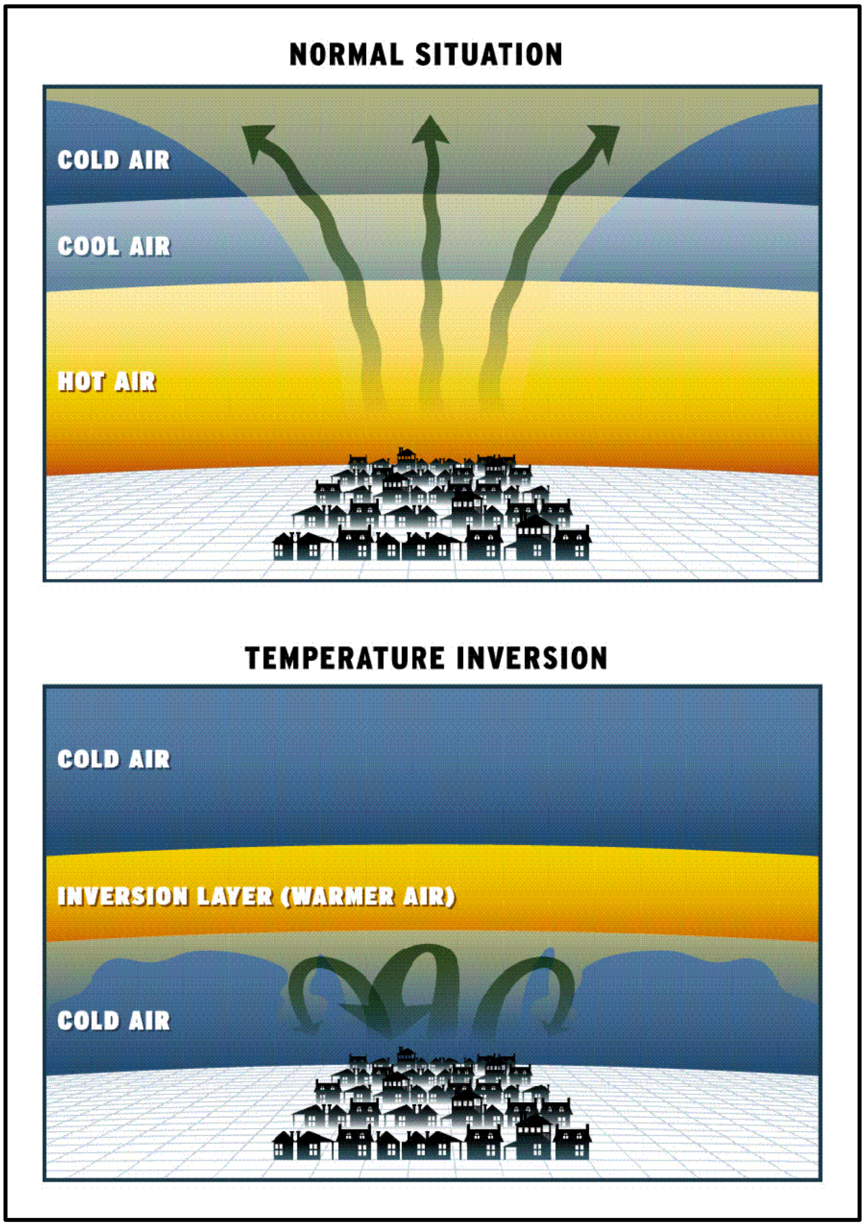



Image source: http://ffden-2.phys.uaf.edu/212_spring2007.web.dir/Amber_Smith/Effects_of_Inversions.htm

### 2.1.2 The Valley's Carrying Capacity

In the context of air quality, carrying capacity refers to the density of emissions that an air basin can "absorb" or "carry" and still meet ambient air quality standards for a given pollutant. The key factors that shape variations in a regional carrying capacity include meteorology, climate, and the topography. Some air basins may have a high total pollutant emission rate (emissions per person or area), but if those emissions are easily dispersed or removed from the basin, that basin is much more likely to meet air quality standards despite the high emission rate. On the other hand, an air basin may have a lower emission rate, but because of unfavorable environmental factors (low air flow, stagnant air, inversions) those pollutant concentrations typically accumulate (possibly above the standard) and remain in the air basin until weather patterns change. The latter scenario describes the Valley, and the first scenario is analogous to the Los Angeles (L.A.) air basin, especially for NOx emissions and the formation of ozone.

As an example, total NOx emissions for the L.A. basin were 754 tons per day (tpd) in 2008. During that year, the L.A. basin recorded 80 days above the 1997 national 8-hour ozone standard. For the same year, the total NOx emissions for the Valley air basin were 409 tpd (over a much larger area), yet the Valley recorded 82 days above the standard. NOx dispersal is primarily dependent on summertime weather patterns. The L.A. basin experiences regular coastal winds through much of the summer that not only disperse pollutants from the air basin, but also moderates temperatures. Conversely, the Valley, surrounded by mountain ranges, routinely experiences stagnant weather patterns (less wind) and extended periods of high temperatures, both of which build and concentrate ozone to levels above the standard. In this real example, it is obvious that the Valley has a much lower carrying capacity than the L.A. basin for NOx, a precursor to ozone formation.

While not as drastic as the NOx-ozone example above (in terms of emission rate), the Valley's carrying capacity for PM2.5, when compared to the L.A. basin, is greatly affected by prevailing weather during the winter months and the region's topography (surrounding mountains). For 2008, the annual average direct PM2.5 emission rate for the L.A. basin was 80 tpd; during that year, that basin recorded 19 days above the national PM2.5 24-hour standard. For the same year, the Valley's annual average direct PM2.5 emission rate was 82 tpd; however, the Valley recorded 66 days above the 24-hour standard. During this same time period, the NOx and SOx emissions, which are also precursors to PM2.5, were significantly lower in the Valley compared to the L.A. Basin (NOx—409 tpd and 754 tpd, respectively, as stated above; and SOx—13 tpd and 54 tpd, respectively). As noted in Section 2.2.1, temperature inversions are common during the winter months in the Valley. During these sometimes lengthy stagnant air episodes, PM2.5 emissions from daily activities rapidly build up to levels above the standard. It is during these events (or anticipation of these events) that the District's Check-Before-You-Burn program and Real-time Air Advisory Network (RAAN) system intervene to inform (or require) the public to limit activity that generates PM2.5 emissions.

The District uses quantitative carrying capacity analysis in its modeling of attainment demonstrations. Such analyses can determine which combinations of PM2.5 and PM2.5 precursor emissions reductions can contribute to future attainment given anticipated population and activity growth, potential regulations or control measures, and the unchanging natural physical constraints.

## 2.2 THE VALLEY'S UNIQUE CHALLENGES

In addition to the climate and geography challenges discussed above, the Valley also has multiple other unique challenges that continue to impact the Valley's progress toward attainment of air quality standards. 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 is also one of the fastest growing regions in the state. From 2010 to 2020, the Valley's population is expected to increase by 18% (Table 2-1). 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%,[1] consistent with the Valley's population growth. The Valley is also home to the state's major arteries for goods and people movement, which adds to the increase in vehicular traffic.

**Table 2-1 Estimated Valley Population by County (2010-2020)[2]**

| 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 the Valley-portion of Kern 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, which are regulated by the U.S. Environmental Protection Agency (EPA) and California Air Resources Board (ARB). The District must collaborate with interagency partners and use innovative approaches to reduce mobile source emissions.

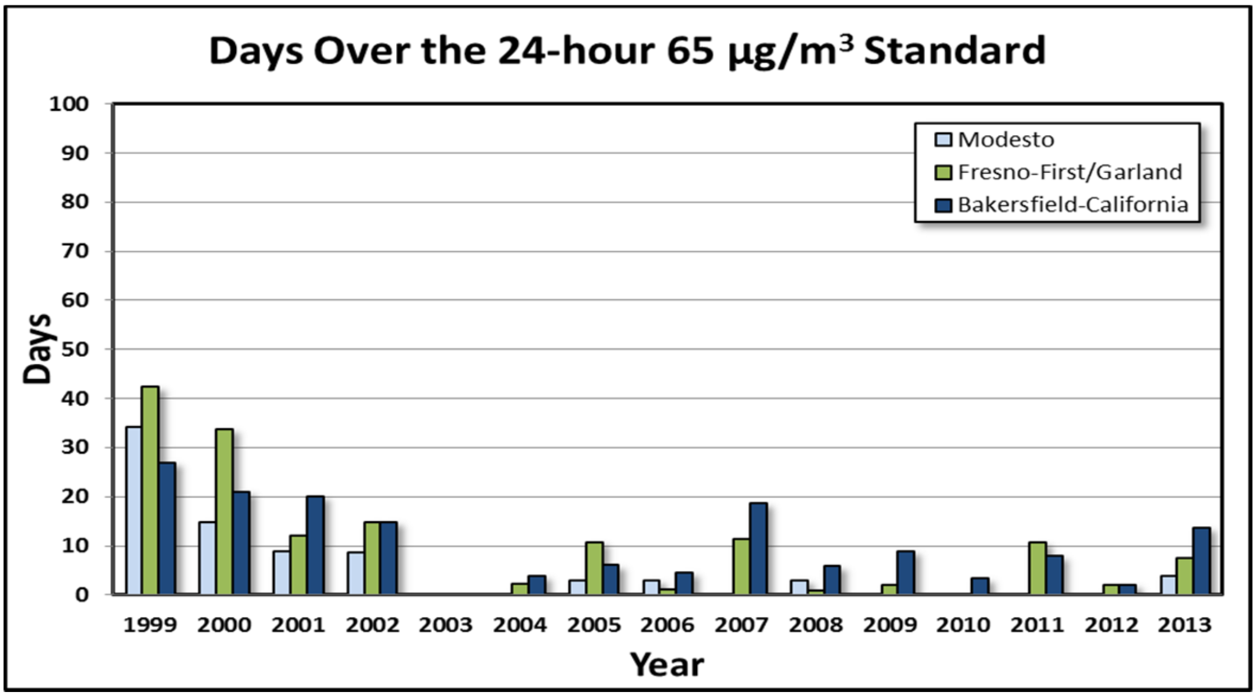
As Chapter 3 of this plan details, the formation and composition of PM2.5 can be complex, with some species impacting health more than others. Long-term trends show that PM2.5 concentrations throughout the Valley have declined since monitoring of this pollutant first began and are projected to continue on that trend. In addition to declining

[1] 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
[2] 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

PM2.5 concentrations, most emissions inventories of PM2.5 precursors are also projected to decrease despite future population growth.

The District also assesses long-term trends of PM2.5 concentrations by looking at the number of days per year that a monitoring site measures concentrations over the 1997 24-hour PM2.5 NAAQS limit of 65 µg/$m^3$. Figure 2-3 shows the trend in numbers of days that air monitoring sites recorded 24-hour PM2.5 averages over 65 µg/$m^3$ at the Modesto (Stanislaus County), Fresno-First/Garland (Fresno County), and Bakersfield-California (Kern County) air monitoring sites. An overall downward trend is apparent when comparing the early years of 1999 and 2000 to recent years. The current pattern shows generally that the northern Valley has the fewest days over the standard, that the southern Valley has the most days over the standard, and that the central Valley registers somewhere between the two.

**Figure 2-3 Trend in Days over the 24-hour PM2.5 Standard**



## 2.3 PM2.5 EMISSIONS INVENTORY TRENDS

The emissions inventory is the foundation for the attainment planning process. The District and ARB maintain an accounting of PM2.5 and precursor emissions for the Valley based on known sources within the Valley and those sources outside the Valley that influence Valley air quality (inter-region transport). The District requires detailed accounting of emissions from regulated sources throughout the Valley. ARB makes detailed estimations of emissions from mobile, area, and geologic sources using known emissions factors for each source or activity and accounting for relevant economic and population data. Together, these feed into the emissions inventory that represents an estimate of how much direct pollution is going into the Valley air basin as a result of the cumulative pollutant-generating activities and sources.

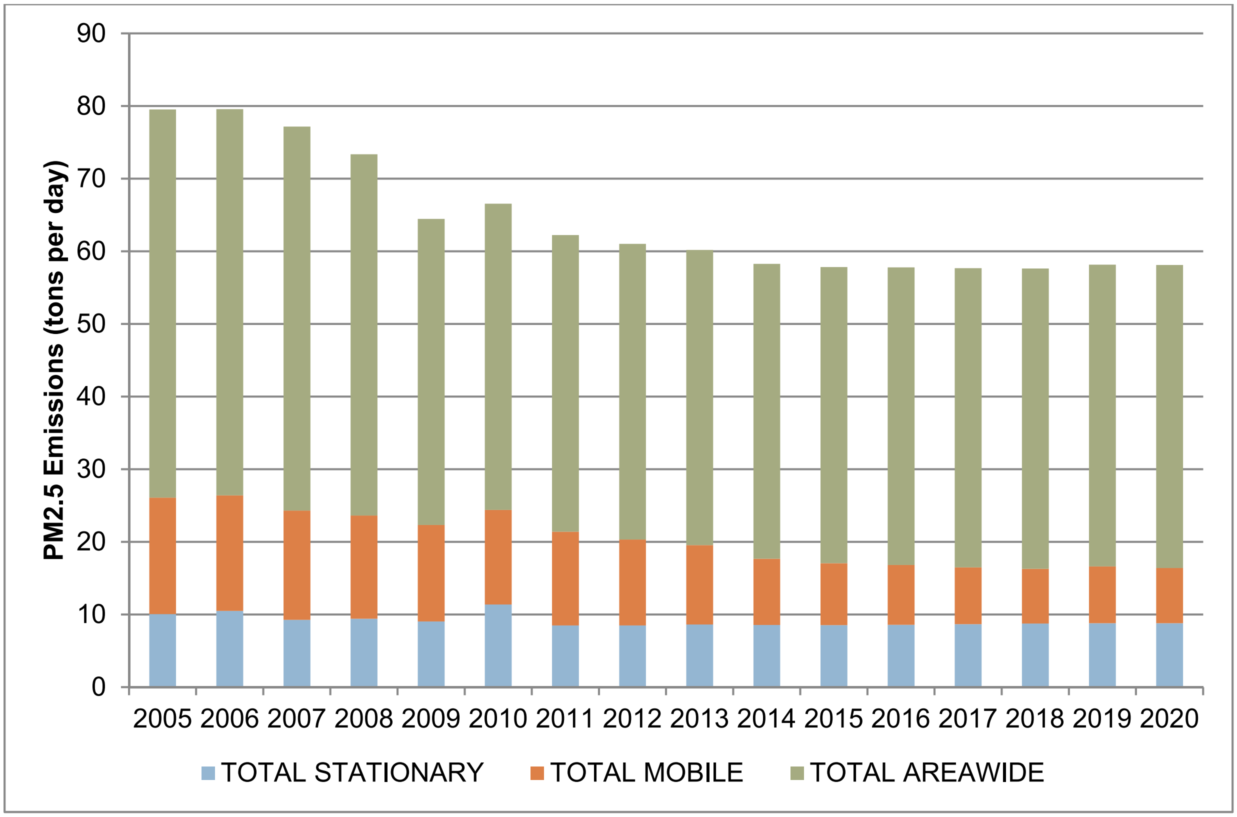
The District uses the emissions inventory to develop control strategies, to determine the effectiveness of permitting and control programs, to provide input into air quality modeling, to fulfill reasonable further progress requirements, and to screen regulated sources for compliance investigations.

The following general list represents the major inventory categories for which emissions are recorded and tracked. Appendix B to this plan contains the detailed accounting of the emissions inventory with projected emissions based on anticipated growth of each source and the anticipated control (regulatory or non-regulatory) of each source, if applicable.

- **Mobile sources** – motorized vehicles
    - On-road sources include automobiles, motorcycles, buses, and trucks
    - Other or off-road sources include farm and construction equipment, lawn and garden equipment, forklifts, locomotives, boats, aircraft, and recreational vehicles
- **Stationary sources** – fixed sources of air pollution
    - Power plants, refineries, and manufacturing facilities
    - Aggregated point sources, i.e. facilities (such as gas stations and dry cleaners) that are not typically inventoried individually, but are estimated as a group and reported as a single source category
- **Area sources** – human activity that takes place over a wide geographic area
    - Includes consumer products, residential wood burning, controlled burning, tilling, and unpaved road dust
- **Natural sources** – naturally occurring emissions
    - Geologic sources, such as petroleum seeps
    - Biogenic sources, such as emissions from plants
    - Wildfire sources

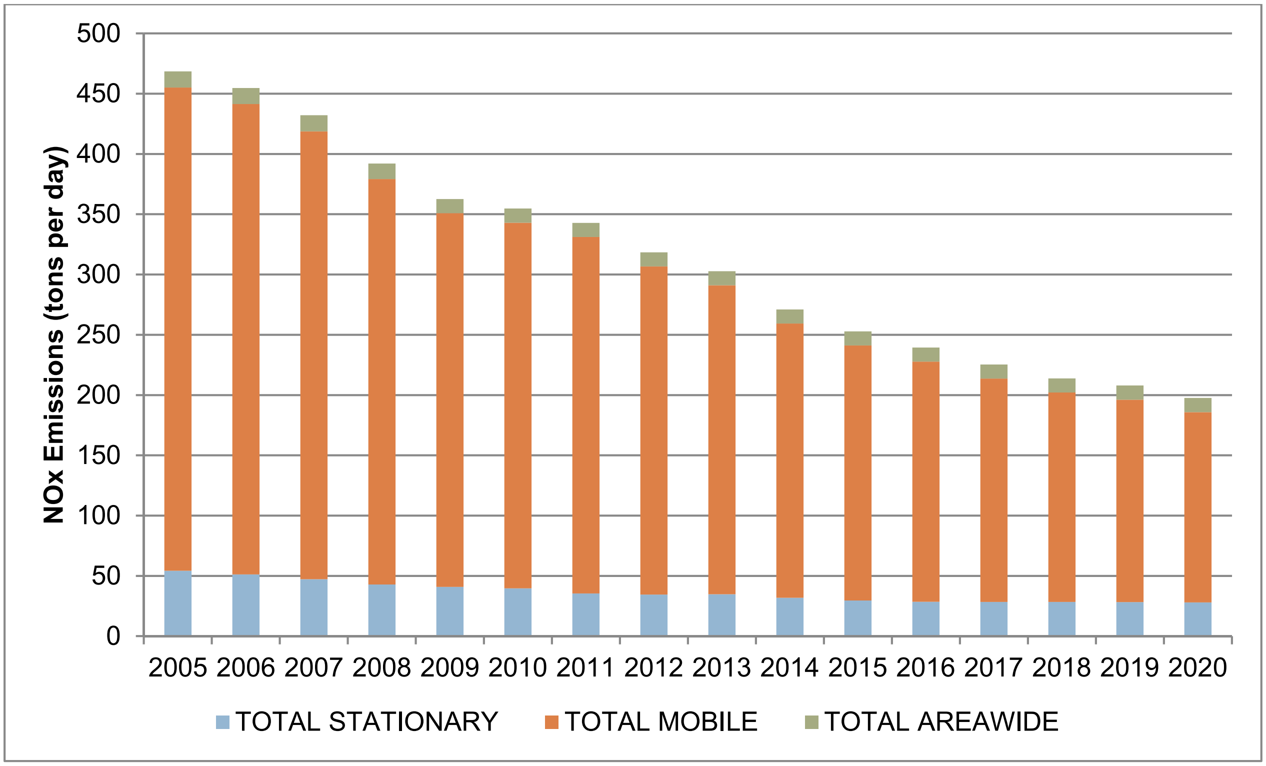
Figure 2-4 shows the PM2.5 emissions inventory trend for the mobile, stationary, and area source categories.

**Figure 2-4 Valley PM2.5 Winter Emissions Inventory Trend**



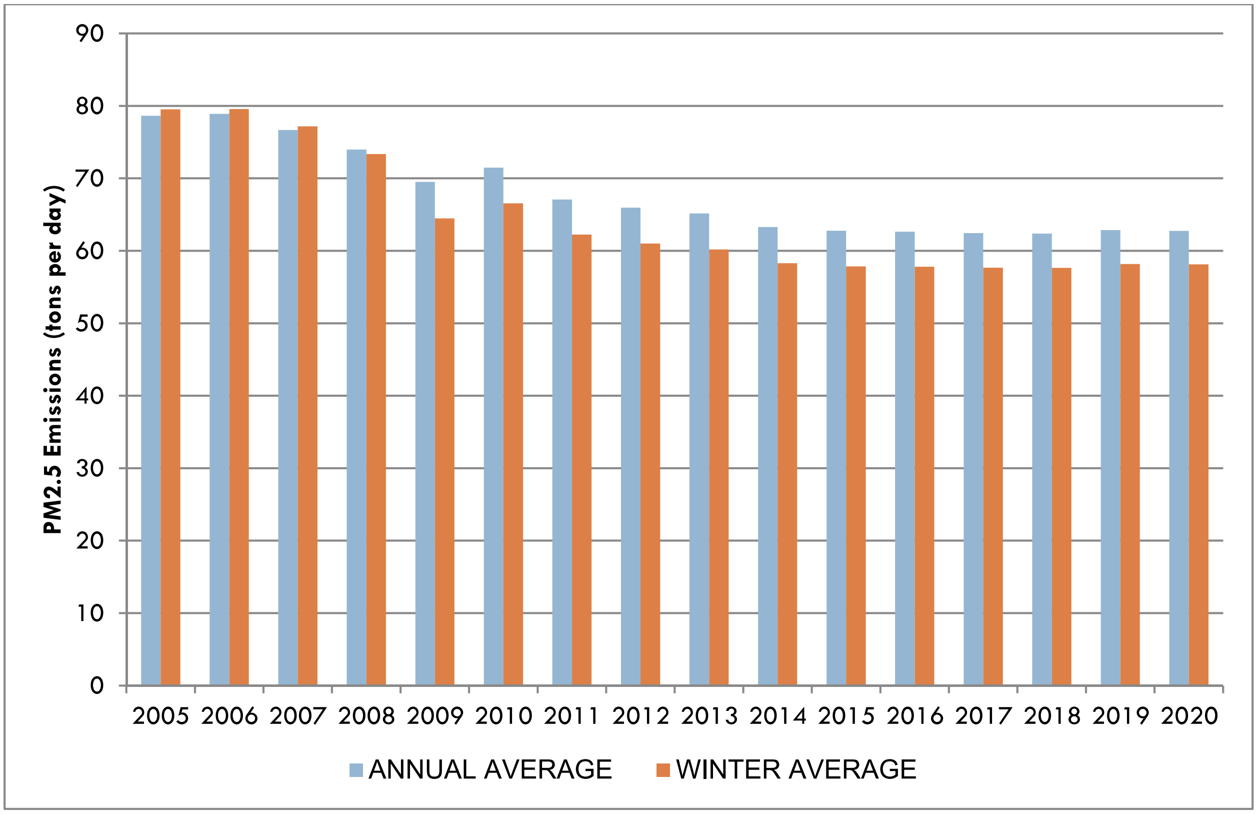

Because NOx is a significant PM2.5 precursor, the District relies heavily on NOx emissions to also reduce PM2.5 emissions. Figure 2-5 summarizes the NOx emissions inventory trends for the mobile, stationary, and area source categories. District and ARB control strategies for NOx play a significant role in reducing both ozone and PM2.5 emissions.

**Figure 2-5 Valley Winter NOx Emissions Inventory Trend**




Emissions inventory trends show the progress made through progressive regulatory and non-regulatory activities, e.g. as rules are amended with tighter emission limits, or as reduction technologies improve, overall emissions decrease. Figure 2-6 shows how the overall tons of PM2.5 emissions per day have decreased in the past and are anticipated to continue decreasing in the future based on anticipated growth and controls. Figure 2-6 also shows the comparative emissions inventory reduction of winter PM2.5. Winter PM2.5 emissions have decreased significantly, in large part due to the effectiveness of Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters). Continued emissions reductions are based on current control strategies that will continue to take effect into the future. In light of the Valley's projected increase in population, the projected emissions reductions highlight the success of the control measures adopted and enforced by the District, ARB, and other regulatory agencies.

**Figure 2-6 Valley PM2.5 Annual and Winter Inventory Trends**



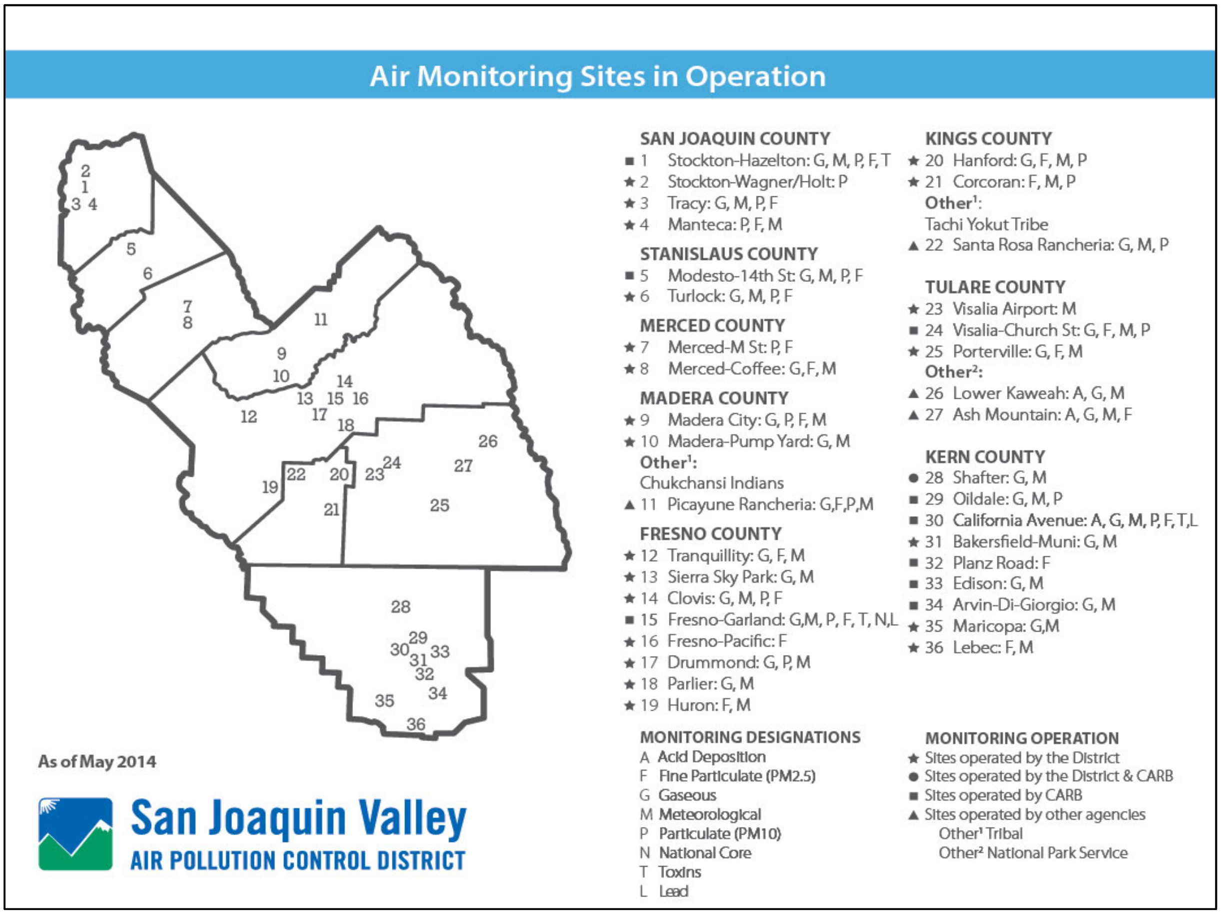

## 2.4 PM2.5 AIR QUALITY TRENDS

As a public health agency charged with monitoring Valley air quality and ensuring progress toward meeting national air quality standards, the District has established an extensive air monitoring network that provides ongoing data for evaluating such progress. Information from this extensive monitoring network, which began measuring PM2.5 concentrations in 1999, allows the District to track air quality trends that show progress toward attainment and inform the planning process for reaching attainment.

### 2.4.1 Air Monitoring Network

Numerous pollutants and meteorological parameters are measured throughout the Valley on a daily basis using an extensive air monitoring network managed by the District, ARB, and other agencies. This network measures pollutant concentrations necessary to show progress toward compliance with the NAAQS. The network also provides real-time air quality measurements used for daily air quality forecasts, residential wood-burning declarations, Air Alerts, and RAAN. Air quality 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. Together, the District and the ARB operate 33 air monitoring stations throughout the Valley; 20 of these sites measure PM2.5, either through the use of filter-based monitors that measure each 24-hour period or hourly monitors that use light energy to provide near-continuous concentration levels. Figure 2-7 shows the Valley's network of air monitoring sites.

**Figure 2-7 Air Monitoring Sites in the Valley**




PM2.5 is measured and expressed as the mass of particles contained in a cubic meter of air (micrograms per cubic meter, or $\mu g/m^3$). The data collected from the District's network of PM2.5 monitors is used to calculate design values for the 24-hour and annual PM2.5 standards, as outlined in EPA guidance and regulations.[3,4]

### 2.4.2 Air Quality Progress

Air quality progress can be assessed in several ways. The calculation of *design values* is the official method used to determine whether an area is in attainment of a standard; however, other indicators can reveal more about the progress being made toward attaining that standard. Comparing the days per year when each monitor exceeded the PM2.5 24-hour NAAQS threshold from year to year shows the progress in reducing the

[3] Environmental Protection Agency [EPA]: Office of Air Quality Planning and Standards. (1999, April). *Guideline on Data Handling Conventions for the PM NAAQS* (EPA-454/R-99-008). Retrieved from http://www.epa.gov/ttn/oarpg/t1/memoranda/pmfinal.pdf

[4] Interpretation of the National Ambient Air Quality Standards for PM2.5, 40 C.F.R. Pt. 50 Appendix N (2012).

number of days with the highest concentrations, while quarterly averages can help to show progress with respect to seasonal peaks in concentration levels. Some of the conclusions from these analyses are included below, followed by a more detailed discussion in Appendix A, which also provides analysis results for a number of other air monitoring sites in the Valley.

Rather than using yearly maximum concentrations for the PM2.5 standards, EPA requires the use of design values for the attainment metric. Design values represent a three-year average and help to smooth out outlier years with exceptional meteorology or exceptional events. Details on how PM2.5 design values are calculated are provided in Appendix A of this plan. As seen in Figure 2-8, the Valley maximum 24-hour and annual average PM2.5 design value trends show that although there is some year-to-year variation significant progress has been made in reducing long-term PM2.5 concentrations. Valley 24-hour design value maximums have decreased by 40% over the 1999–2013 time period.

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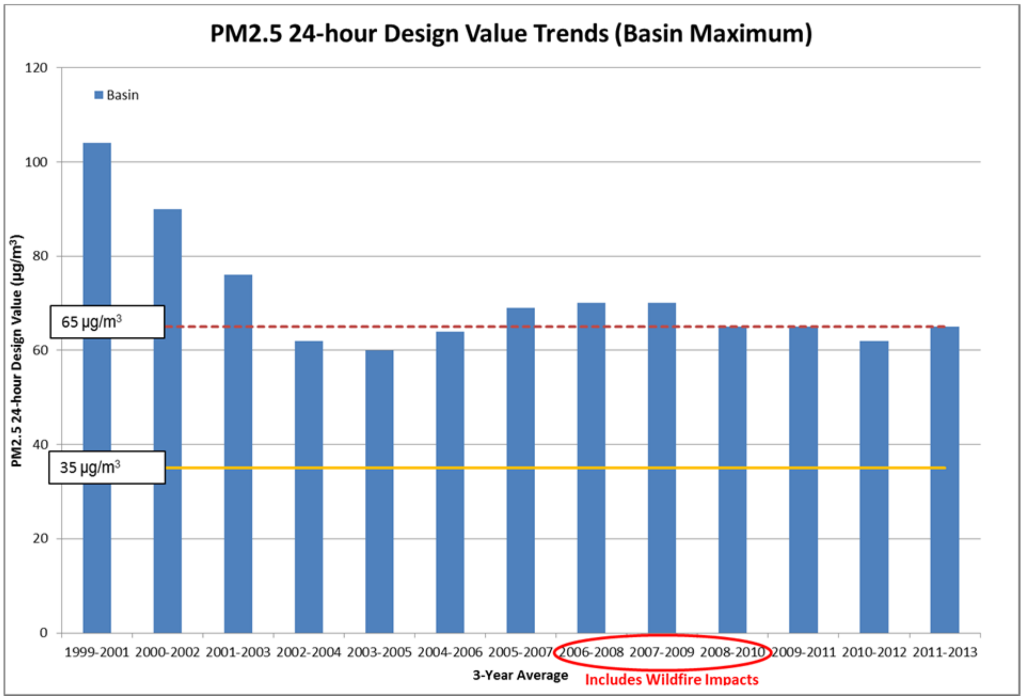
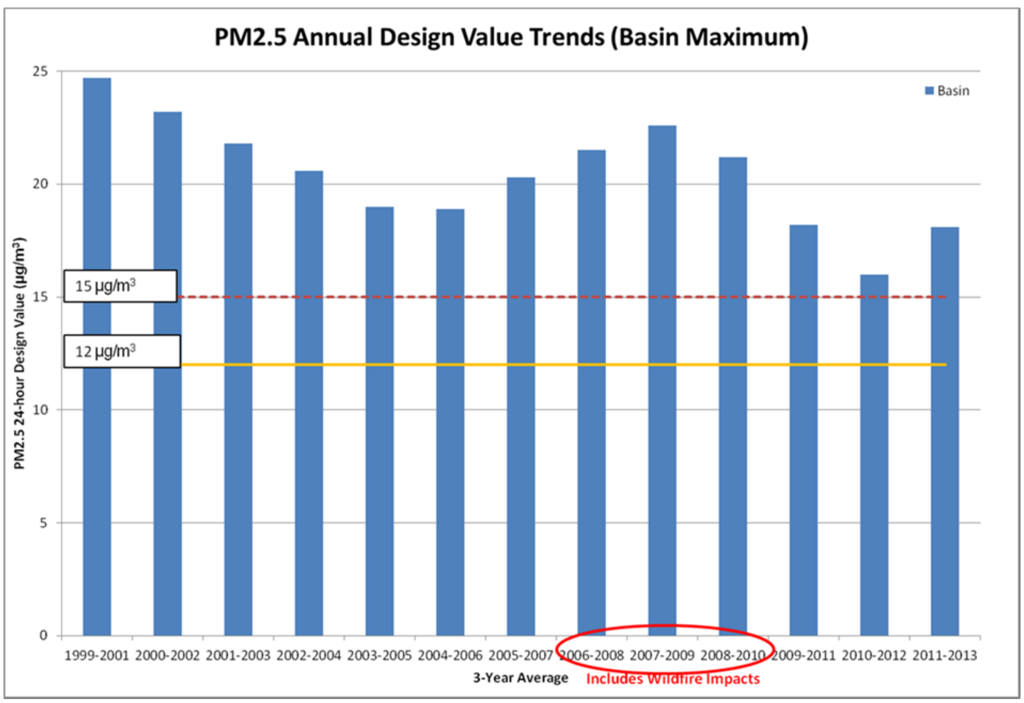
**Figure 2-8 Historical PM2.5 24-hour and Annual Design Value Trends**




Since monitoring began, the Bakersfield-California and Bakersfield-Planz air monitoring sites in Kern County have consistently been among the highest PM2.5 design values in the Valley. Figure 2-9 shows the trend of the 24-hour average design value at Bakersfield-California through 2013, as demonstrated with the 2011-2013 design value (3-year average). Figure 2-10 shows the trend of the annual average design value at

Bakersfield Planz through 2013, as demonstrated with the 2011–2013 design value (3-year average).

**Figure 2-9 Trend of 24-Hour Average PM2.5 Design Values at Bakersfield-California**

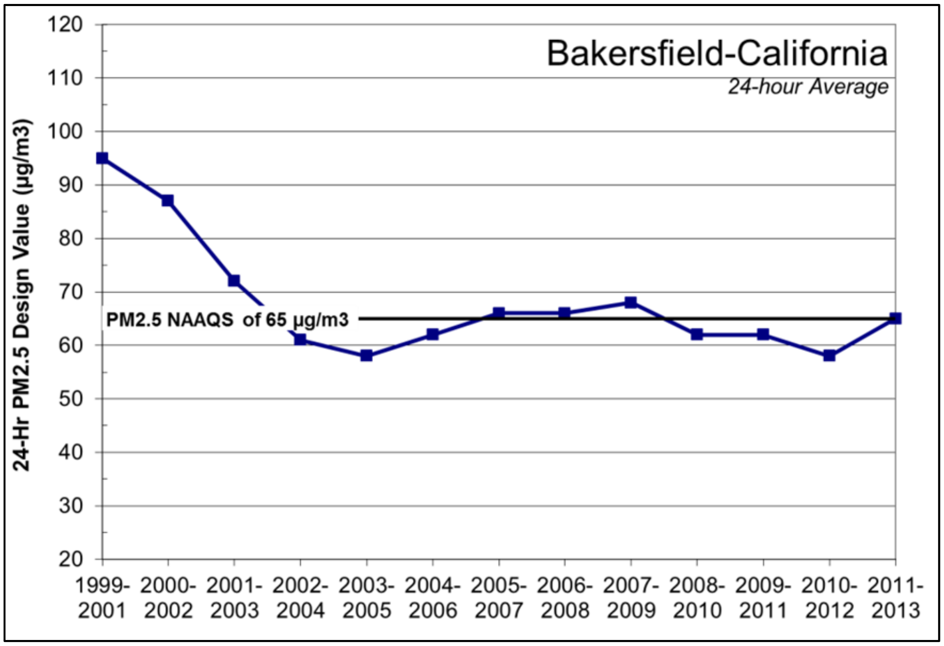
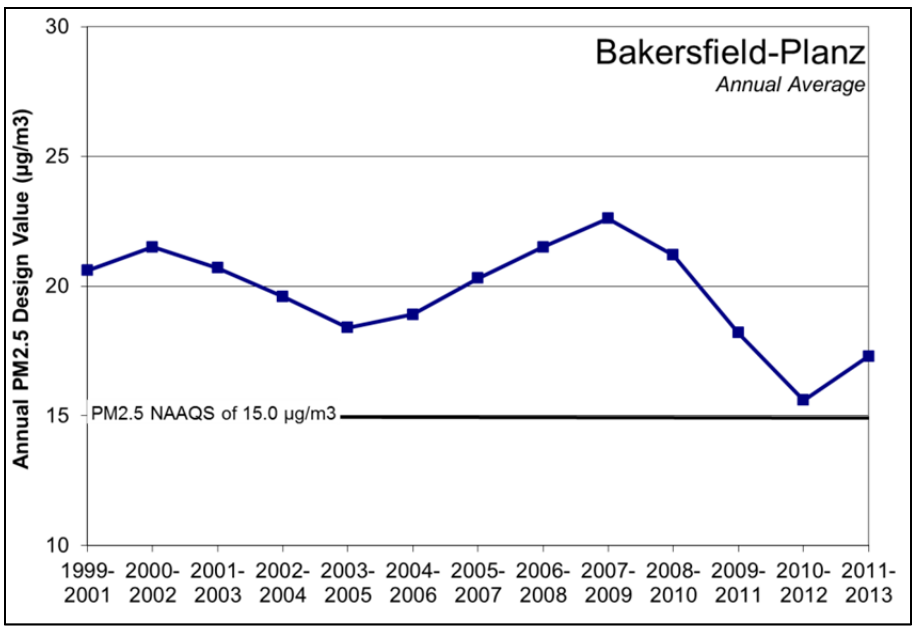



**Figure 2-10 Trend of Annual Average PM2.5 Design Values at Bakersfield-Planz**



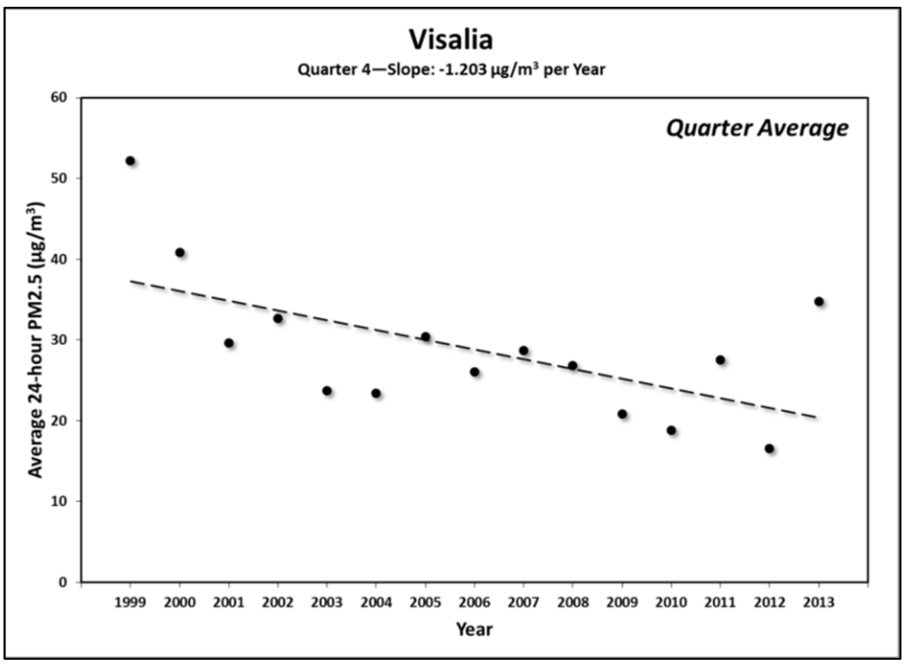

Overall decreasing PM2.5 concentrations at the Bakersfield-California and Bakersfield-Planz air monitoring sites are shown in the design value trends for those sites. The Bakersfield-California site now has a 24-hour design value at or below the 1997 24-hour

PM2.5 standard of 65 µg/m$^3$ (see Figure 2-9). The annual average design value for 2011–2013 continues to trend lower for Bakersfield-Planz at 17.3 µg/m$^3$ (see Figure 2-10). This downward trend will need to continue at all sites within the Valley as the Valley strives for attainment of increasingly stringent air quality standards.

Since the Valley's highest PM2.5 concentrations occur during the fall and winter months, the first (January through March) and fourth (October through December) quarters tend to have the highest average concentrations. Observing the trend in these quarterly averages can shed light on how the peak of the PM2.5 season is changing over time.

Data from the Visalia monitoring site (Figure 2-11) is representative of fourth-quarter averages among the PM2.5 sites in the Valley. This data also shows a downward trend of 1.20 µg/m³ per year. The District anticipates continuation of this trend as the Valley gets closer to attaining the annual average PM2.5 standard. Refer to Appendix A for the detailed results of this analysis.

**Figure 2-11 Trend of Fourth-Quarter Average at Visalia**




### 2.4.3 Impact of Exceptional Drought-Related Weather Conditions on Valley PM2.5 Concentrations

In 2012, the Bakersfield-Planz air monitoring site, which is the current peak PM2.5 site in the District, recorded an annual average value of 14.7 µg/m$^3$, below the standard of 15.0 µg/m$^3$. This site, along with the rest of the District's PM2.5 air monitoring sites, was making significant progress towards attaining the 1997 annual PM2.5 standard. However, due to the exceptional weather conditions experienced during the winter of

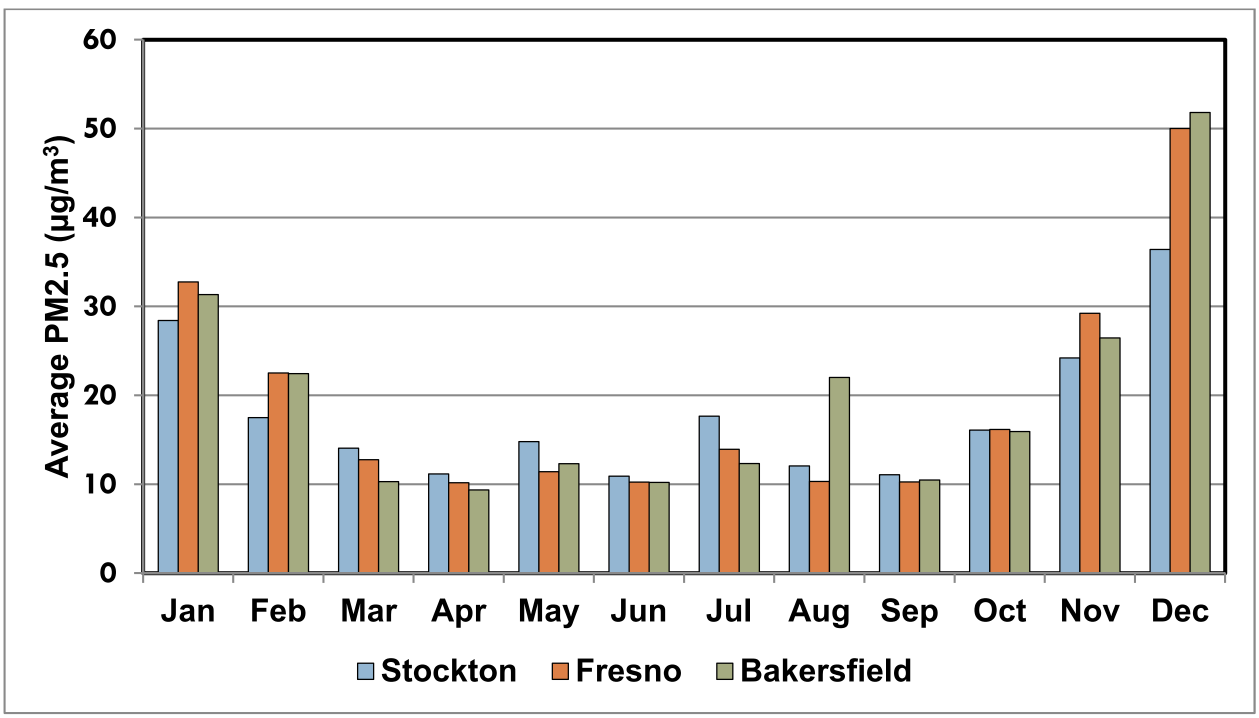
2013-2014, exceedingly high PM2.5 concentrations were experienced, causing a 2013 annual average of 22.8 µg/m$^3$ for the Bakersfield-Planz site, and an annual design value (2011-2013) of 17.3 µg/m$^3$ (see Figure 2-10 above).

Due to the extreme weather and high values already experienced at this site in the 1$^{st}$ quarter of 2014, the averages for the 2$^{nd}$, 3$^{rd}$, and 4$^{th}$ quarters of 2014 would need to be zero for Bakersfield-Planz to reach attainment for the 2012-2014 period (see Chapter 1). In addition, with the high values recorded in 2013 and 2014, attainment during the 2013-2015 period is also impossible (see Chapter 4). The following discusses the magnitude of the weather conditions experienced during the winter of 2013-14, and its impact on the Valley's ability to attain the 1997 annual PM2.5 standard.

<u>Meteorology during the Winter Season of 2013-2014</u>
This past winter, California Governor Jerry Brown declared a state of emergency due to extreme drought conditions in the state. This emergency declaration was based on record-low precipitation in 2013 and snow pack levels at only 20 percent of the normal amount of snow to provide water for the year. Specifically in the Valley, 2013 represented the driest year since the start of recordkeeping in 1895. The Valley is currently experiencing an exceptional level of drought not seen in at least 119 years.

Although the Valley has experienced reductions in PM2.5 concentrations over the last 15 years since the pollutant first began to be measured, the winter months of November through February continue to record the peak levels of each year. The following figure displays the relative comparison between the lower concentrations in March through October, and the higher concentrations experienced during the winter.

**Figure 2-12 Average PM2.5 by Month in 2013 in Stockton, Fresno, Bakersfield**



Stable meteorology during the winter season can increase PM2.5 concentrations to high levels by providing strong temperature inversions and low wind speeds. When this occurs, the PM2.5 concentrations during the winter months of November to February can climb to very high levels. As seen in Figure 2-13, the winter of 2013-2014 experienced the strongest average atmospheric stability over the last 15 years (period during which PM2.5 concentrations have been recorded), creating conducive conditions for the formation and retention of high PM2.5 concentrations. This was a result of a persistent, strong high pressure ridge over the eastern Pacific that effectively blocked weather disturbances from entering California, which inhibited dispersion during November, December, and January.

In addition to the historically strong atmospheric stability, the winter of 2013-2014 also experienced record low precipitation totals, with some locations breaking records over 100 years old (see Table 2-2). These unprecedented dry conditions exacerbated the air quality challenge during the winter of 2013-2014. As a result of the extreme meteorology experienced in the Valley, PM2.5 concentrations reached peak levels that had not been recorded in over a decade, which in turn has increased the Valley's PM2.5 design values, making the journey to attainment of the PM2.5 standards even more challenging.

**Figure 2-13 Average Atmospheric Stability per Winter Season**

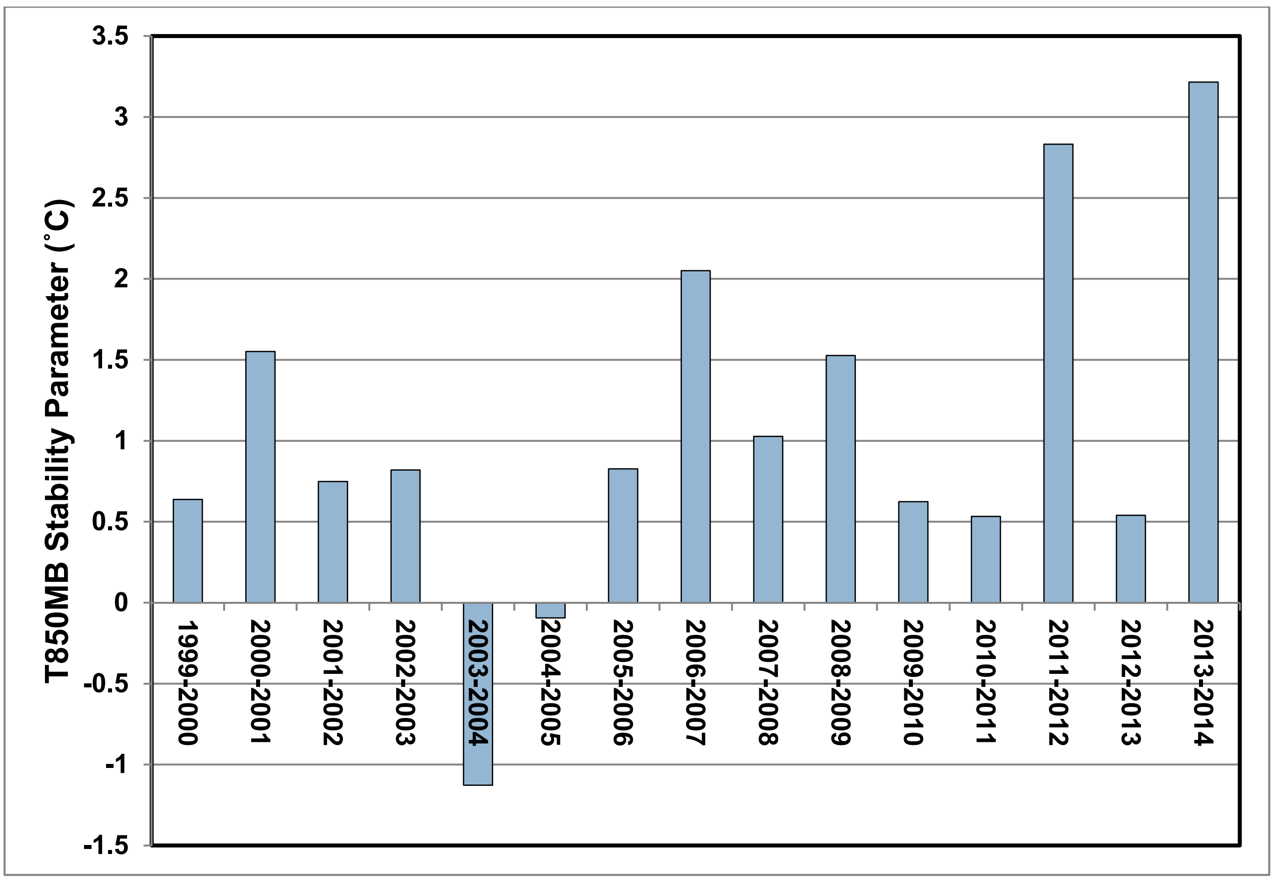


**Table 2-2 Calendar Year Rainfall Totals for Select California Cities**

| City | 1981-2010 Average (inches) | 2013 Total (inches) | Previous Record Low (inches) | Previous Record Year |
|---|---|---|---|---|
| Modesto | 13.11 | 4.70 | 5.70 | 1929 |
| Merced | 12.50 | 3.79 | 6.00 | 2007 |
| Fresno | 11.50 | 3.01 | 3.55 | 1947 |
| Visalia | 10.93 | 3.47 | 4.10 | 1910 |
| Bakersfield | 6.47 | 3.43 | 1.87 | 1959 |
| Sacramento | 18.52 | 5.81 | 6.67 | 1976 |
| San Francisco | 23.65 | 5.59 | 9.00 | 1917 |
| San Jose | 14.90 | 3.80 | 6.04 | 1929 |
| Los Angeles | 12.82 | 3.65 | 4.08 | 1953 |
| San Diego | 10.34 | 5.57 | 3.41 | 1953 |

## 2.5 CONDENSABLE PARTICULATES

Certain high-temperature processes emit gaseous pollutants that rapidly condense into particle form in the ambient air. After January 1, 2011, PM2.5 nonattainment areas are to consider these condensable particulates for purposes of establishing the emissions limits for Reasonable Further Progress (RFP), Reasonably Available Control Technology (RACT), and Reasonably Available Control Measures (RACM).[5] In December 2010, EPA revised its "Method 202" stationary source test method to measure condensable particulate matter.[6]

While this issue may be new and more relevant to other regions, the District has historically included condensable particulate emissions in its definition of total particulate emissions, well ahead of federal and other states' efforts to address this issue. This has included instituting permit requirements for various emissions sources that include condensable particulates as part of total particulate emissions limitations, and associated emissions testing requiring that condensable particulates be measured (including utilizing an EPA-approved modified test method ahead of EPA's official test method, Method 202). Condensable particulates are thus a part of the total PM2.5 inventory, and reductions in condensable particulate matter emissions were included in the District's evaluation of various emission reduction opportunities for directly emitted PM2.5.

## 2.6 INSIGNIFICANT PRECURSORS TO PM2.5 CONCENTRATIONS IN THE VALLEY

The switch from CAA Subpart 1 to Subpart 4 (see Chapter 1) for PM2.5 implementation shifts the precursor presumption for planning purposes. Pursuant to Subpart 1, areas

[5] 40 CFR 51.1002(c)
[6] http://www.epa.gov/ttn/emc/methods/method202.html

were not required to address volatile organic compounds (VOCs) [7] and ammonia unless technical demonstration shows that VOC reductions or ammonia reductions contribute to PM2.5 attainment. Now, pursuant to Subpart 4 §189(e), areas must address potential precursors of PM2.5, including VOCs and ammonia, unless it is shown that they do not contribute to attainment.

In the Valley, there is extensive scientific research and technical analysis demonstrating that VOC reductions and ammonia reductions do not contribute to PM2.5 attainment. As such, the Valley's VOC emissions and ammonia emissions do not need to be reduced to address the federal PM2.5 standard. EPA concurs with the conclusion that VOC emissions do not contribute significantly to the formation of PM2.5 as stated in their proposed approval of the District's plan to address the 2006 PM2.5 standard: "*Based on a review of the information provided by the District and other information available to EPA, we propose to determine that at this time VOC emissions do not contribute significantly to ambient PM2.5 levels*..."[8]

Modeling shows that NOx controls are the most effective approach to reduce PM2.5 nitrate concentrations, and once NOx controls are taken into consideration, VOC emissions reductions produce essentially no benefit. In fact, in some instances, VOC emissions reductions may actually lead to an increase in PM2.5 nitrate formation. Nitrogen-containing molecules can act as temporary sinks for NO2. When VOCs are controlled, the reduced availability of certain radicals which are generated from VOCs reduces the amount of NO2 that is sequestered, thereby increasing the availability of NO2 and enhancing ammonium nitrate formation.[9]

The extensive research mentioned above and summarized below demonstrates that there is a relative abundance of ammonia compared to nitric acid, and that the amount of nitric acid drives the ultimate formation of ammonium nitrate. Because of this regional surplus in ammonia, even substantial ammonia emissions reductions yield a relatively small reduction in nitrate. Reductions in nitrate concentrations of 30% to 50% were realized through a 50% reduction in NOx. Modeling a 50% reduction in ammonia, while unrealistic because it's not technologically achievable, would only realize less than a 5% reduction in nitrate concentrations. Due to the extensive body of science that clearly shows the much greater efficacy of reducing NOx emissions relative to ammonia, ammonia reductions have not historically been considered a significant precursor to PM2.5 formation in the Valley.

[7] EPA defines VOCs as any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, that participates in atmospheric photochemical reactions to form ozone or particulates. A subset of non-reactive VOCs does not contribute to ozone or particulates and are exempt from regulatory controls. Many VOCs are human-made chemicals used and produced in the manufacture of paints, adhesives, petroleum products, pharmaceuticals. The full EPA definition is available at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div8&view=text&node=40:2.0.1.1.2.3.8.1&idno=40

[8] Approval and Promulgation of Implementation Plans; Designatio of Areas for Air Quality PlanningPurposes; California; San Joaquin Valley Moderate Area Plan and Reclassification as Serious Nonattaiemtn for the 2006 PM2.5 NAAQS; Proposed Rule, 80 Fed. Reg. 8. pp. 1816-1846. (p. 1826) (2015, January 13).

[9] Meng, Z., Dabdub, D., and Seinfeld, J.H., 1997, Chemical Coupling Between Atmospheric Ozone and Particulate Matter, Science, 277, 116-119.

### 2.6.1 VOC Contribution to PM2.5 Concentrations

VOC emissions have the potential to contribute to the formation of two different PM2.5 components: secondary organic aerosols (SOAs) and ammonium nitrate (nitrate). While these components contribute to observed PM2.5 concentrations in the Valley, their contribution is minimal. The anthropogenic VOC contribution (those not from biogenic sources) to both components is so minimal, that invoking a VOC-centric control strategy is much less effective than primary PM2.5 controls or NOx controls, as shown through the recent research and modeling.

#### *2.6.1.1 VOC Contribution to SOA Formation*

Secondary organic aerosols form when intermediate molecular weight VOCs emitted by anthropogenic and biogenic sources react and condense in the atmosphere to become aerosols. Lighter VOCs also participate in the formation of atmospheric oxidants, which then participate in the formation of SOA. SOAs derived from anthropogenic VOC emissions account for only 1% to 2% of the annual total PM2.5 concentrations throughout the Valley.

As part of the attainment demonstration for the District's *2008 PM2.5 Plan*, ARB used the Community Multi-scale Air Quality (CMAQ) model to show that primary PM2.5 emissions are the main contributor to organic aerosols, with SOAs being a small fraction of the total organic aerosol concentration. Furthermore, SOAs are mostly formed during the summer and from predominantly biogenic sources, when total PM2.5 concentrations are low. As such, SOAs derived from anthropogenic VOC emissions make up only 3% to 5% of the annual average organic aerosol concentrations.

Related to this finding, the California Regional Particulate Air Quality Study (CRPAQS) also found that because of the dominance of primary PM2.5 organic matter, overall, a 50% reduction in anthropogenic VOC emissions has limited effect on the modeled PM2.5 organic matter.[10] Together, these study results show that for SOAs, further VOC reductions would have very limited effectiveness in reducing PM2.5 concentrations.

#### *2.6.1.2 VOC Contribution to Nitrate Formation*

Nitrate forms by means of two primary chemical pathways: during the day, $NO_2$ is oxidized to nitric acid, some of which then reacts with ammonia to form nitrate through interactions with sunlight, VOCs, and background ozone; and during the night, when nitric acid is formed through oxidation of $NO_2$ (via $N_2O_5$) by background ozone, which then reacts with ammonia to form nitrate. Several modeling studies[11,12,13,14] have

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[10] Pun, B.K., Balmori R.T.F, & Seigneur, C. (1998). Modeling Wintertime Particulate Matter Formation in Central California, *Atmospheric Environment, 43*, 402-409.

[11] Pun, B.K., & Seigneur, C. (1998) *Conceptual Model of Particulate Matter Pollution in the California San Joaquin Valley.* Prepared for Pacific Gas & Electric, Document CP045-1-98.

[12] Pun, B.K. (2004). *CRPAQS Task 2.7 when and where does high O3 correspond to high PM2.5? How much PM2.5 corresponds to photochemical end products?* Prepared for the San Joaquin Valleywide Air Pollution Study Agency.

[13] Lurmann, F.W., Brown, S.G., McCarthy, M.C., & Roberts, P.T. (2006). Processes Influencing Secondary Aerosol Formation in the San Joaquin Valley during Winter. *Journal of Air and Waste Management Association, 56*, 1679-1693.

investigated the relative veracity of these two mechanisms within the Valley and attempted to determine the specific role and contribution of VOCs on Valley nitrate concentrations. While the specific conclusions were mixed, there was general agreement that the nighttime formation of nitrate in the Valley would not be sensitive to VOC reductions.

Further modeling studies[15,16,17,18,19,20] evaluated the significance of VOC controls in reducing nitrate concentrations in the Valley. ARB evaluated each of these studies in the context of two key considerations: whether further VOC reduction would provide significant benefits to expedite attainment beyond the District's existing NOx control program, and what would be the feasible magnitude of any potential VOC reductions beyond the existing and already rigorous VOC control program. Nitrate was only responsive to a 50% reduction in VOCs at very high PM2.5 concentrations, concentrations that are no longer reached in the Valley. In contrast, a 50% reduction in NOx can reduce significantly more nitrate at current PM2.5 concentrations, one study[21] reporting a 38% reduction in nitrate.

Despite the insignificance of VOC emissions with regard to PM2.5 concentrations in the Valley, VOC emissions have been reduced and will continue to be reduced through implementation of the *2007 Ozone Plan* and the *2013 Plan for the Revoked 1-Hour Ozone Standard.* A more detailed discussion of the VOC influences on PM2.5 concentrations can be found in the *2012 PM2.5 Plan*.[22]

### 2.6.2 Ammonia Contribution to PM2.5 Concentrations

Early air quality research in the Valley identified ammonium nitrate (nitrate) as a predominant secondary PM2.5 species in the region, with high concentrations forming during the winter months.[23] Studies have continued to show that ammonium nitrate is a primary component of wintertime PM2.5 in the Valley, followed by other species, such

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[14] Ying, Q., Lu, J., & Kleeman, M. (2009). Modeling Air Quality during the California Regional PM10/PM2.5 Air Quality Study (CRPAQS) Using the UCD/CIT Source-Oriented Air Quality Model – Part III Regional Source Apportionment of Secondary and Total Airborne Particulate Matter. *Atmospheric Environment, 43*, 419-430.
[15] Stockwell, W.R., Watson, J.G., Robinson, N.F., Steiner, W., & Sylte, W.W. (2000). The Ammonium Nitrate Particle Equivalent of NOx Emissions for Wintertime Conditions in Central California's San Joaquin Valley, *Atmospheric Environment, 34*, 4711-4717.
[16] Pun, B.K., & Seigneur, C. (2001). Sensitivity of Particulate Matter Nitrate Formation to Precursor Emissions in the California San Joaquin Valley. *Environmental Science and Technology, 35*, 2979-2987.
[17] Kleeman, M.J., Ying, Q., & Kaduwela, A. (2005). Control Strategies for the Reduction of Airborne Particulate Nitrate in California's San Joaquin Valley. *Atmospheric Environment, 39*, 5325-5341.
[18] Meng, Z., Dabdub, D., & Seinfeld, J.H. (1997) Chemical Coupling Between Atmospheric Ozone and Particulate Matter. *Science, 277,* 116-119. DOI:10.1126/science.277.5322.116
[19] Livingstone, P.L., Magliano, K., Gürer, K., Allen, P.D., Zhang, K.M., Ying, Q., … Byun, D. (2009). Simulating PM Concentrations during a Winter Episode in a Subtropical Valley: Sensitivity Simulations and Evaluation Methods. *Atmospheric Environment, 43*, 5971-5977.
[20] Pun, B.K., Balmori R.T.F, & Seigneur, C. (2009). Modeling Wintertime Particulate Matter Formation in Central California. *Atmospheric Environment, 43*, 402-409.
[21] *Ibid.* 25
[22] SJVAPCD. *2012 PM2.5 Plan* (2013) http://www.valleyair.org/Air_Quality_Plans/PM25Plans2012.htm
[23] Smith, T.B.; Lehrman, D.E.; Reible, D.D.; and Shair, F.H. (1981). The origin and fate of airborne pollutants within the San Joaquin Valley: Extended summary and special analysis topics. Report No. 2. Prepared for the California Air Resources Board, and by the California Institute of Technology, Pasadena, CA.

as organic carbon, ammonium sulfate, and geologic material.[24] In addition, PM2.5 speciation data, collected for many years at four Valley urban monitoring locations, also shows nitrate's substantial contribution to the Valley's total PM2.5 concentrations, especially on days when peak 24-hour average concentrations are experienced.

#### 2.6.2.1 Ammonium Nitrate Formation and Precursors

Formation of ammonium nitrate is described by Kleeman et al. (2005, pp. 5326-7):[25]

> Particulate ammonium nitrate ($NH_4NO_3$) forms when the concentration product of gas-phase ammonia ($NH_3$) and nitric acid ($HNO_3$) exceeds a saturation point dependent on temperature, relative humidity, and the composition of the pre-existing particles that act as condensation substrate (Wexler and Seinfeld, 1991).[26] Ammonia is a relatively stable compound directly emitted to the atmosphere that does not undergo significant chemical reaction on the time scale of interest to regional air quality problems. Nitric acid is an end product of the photochemical transformation of NOx (NO + $NO_2$). The majority of the NOx in the SJV is emitted as NO that is then transformed into various species including $NO_2$, $NO_3$, $HNO_2$, $HNO_3$, $HNO_4$, Peroxy Acetyl Nitrate (PAN), Particulate Protein Nitrogen (PPN), particulate nitrate, etc. The sum of NOx and the entire family of NOx reaction products is called "reactive nitrogen" (NOy). The fraction of reactive nitrogen that forms $HNO_3$ and/or nitrate depends on the concentration of NOx and VOC as well on meteorological conditions such as temperature, relative humidity, and solar intensity (Aw and Kleeman, 2003; Nguyen and Dabdub, 2002).[27] [28] Measurements taken at the remote Kern Wildlife Station in the San Joaquin Valley show that approximately 22% of the reactive nitrogen exists as particulate (ammonium) nitrate during typical winter conditions (Chow and Egami, 1997).[29]

Nitrate buildup is a signature outcome of multi-day stagnation periods during the winter (similar buildup is not observed during warmer seasons). The modeled regional variation of nitrate concentrations is shown in Figure 2-14. Higher concentrations of nitrate occur in the southernmost Valley as a result of slower wind speeds and higher levels of reactive nitrogen and ammonia.

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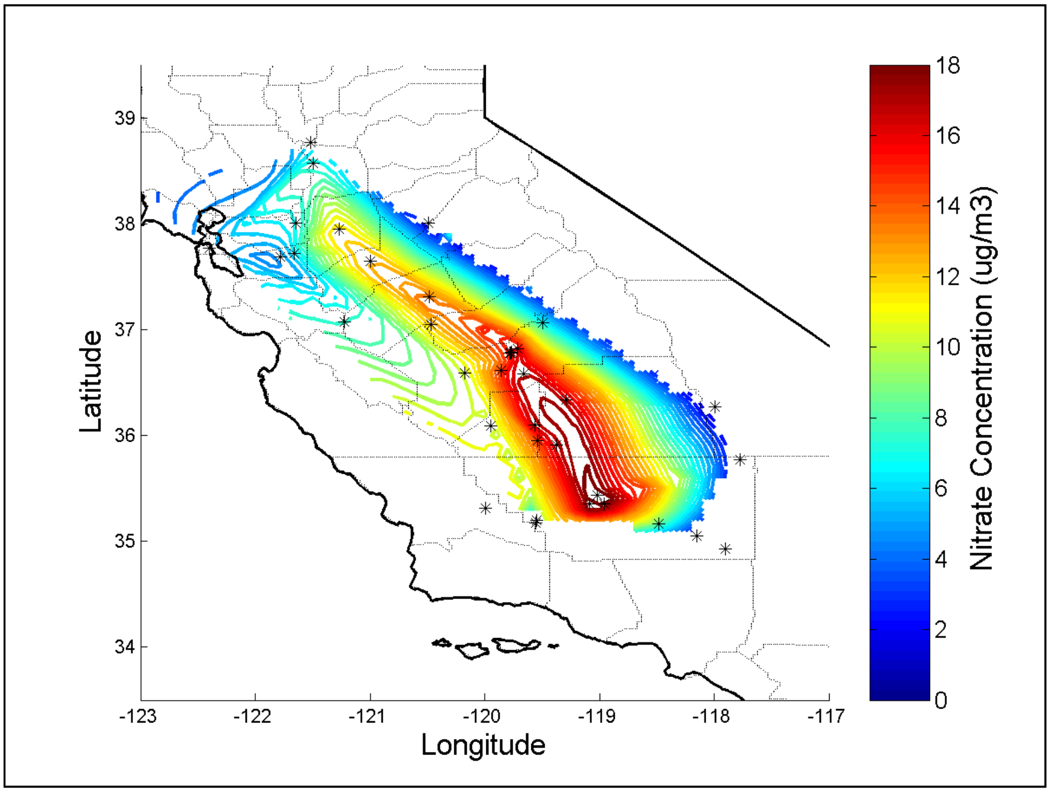
[24] Ying, Q. & Kleeman, M.J., (2009). Regional Contributions to Airborne Particulate Matter in Central California during a Severe Pollution Episode. *Atmospheric Environment, 43*, 1218–1228.
[25] Kleeman, M.J., Ying, Q., & Kaduwela, A. (2005). Control Strategies for the Reduction of Airborne Particulate Nitrate in California's San Joaquin Valley. *Atmospheric Environment, 39*, 5325–5341.
[26] Wexler, A.S., Seinfeld, J.H. (1991). 2nd-Generation inorganic aerosol model. *Atmospheric Environment Part a-General Topics 25 (12),* 2731–2748.
[27] Aw, J., Kleeman, M.J. (2003). Evaluating the First-Order Effect of Intra-Annual Temperature Variability on Urban Air Pollution. *Journal of Geophysical Research-Atmospheres 108 (D12).*
[28] Nguyen, K. & Dabdub, D. (2002). NOx and VOC Control and Its Effects on the Formation of Aerosols. *Aerosol Science and Technology 36 (5)*, 560–572.
[29] Chow, J.C. & Egami, R.T. (1997). San Joaquin Valley Integrated Monitoring Study: Documentation, Evaluation, and Descriptive Analysis of PM10 and PM2.5, and Precursor Gas Measurements. Technical support studies No. 4 and No. 8. Final Report prepared for the California Air Resources Board, Sacramento, CA. Desert Research Institute, Reno, NV.

**Figure 2-14 Modeled Regional Distribution of Ammonium Nitrate[30]**

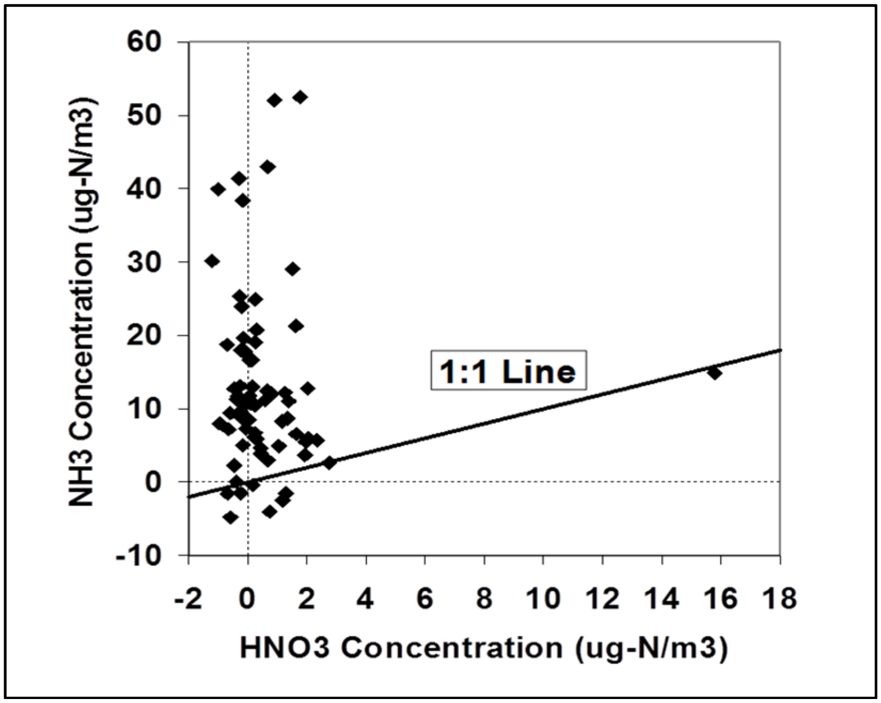



Both nitric acid and ammonia are needed to form ammonium nitrate. The extensive research conducted through California Regional Particulate Air Quality Study (CRPAQS) and subsequent studies, as well as ongoing evaluation and modeling demonstrates that there is a relative abundance of ammonia ($NH_3$) compared to nitric acid ($HNO_3$), and that the amount of nitric acid (resulting from NOx emissions) drives the ultimate formation of ammonium nitrate. Figure 2-15 illustrates this ammonia abundance at the rural Angiola (Fresno County) air monitoring site in the Valley during the CRPAQS field study. Ammonia concentrations are considerably higher than nitric acid concentrations throughout the Valley, including urban areas with concentrated NOx emissions.[31] See Appendix G to the *2012 PM2.5 Plan* for more information.

[30] Chow, J.C., Chen, L.-W.A., Lowenthal, D.H., Doraiswamy, P., Park, K., Kohl, S., Trimble, D.L., & Watson, J.G. (2005). California Regional PM10/PM2.5 Air Quality Study (CRPAQS) – Initial Data Analysis of Field Program Measurements. Report No. 2497. Prepared for California Air Resources Board, Sacramento, CA, by Desert Research Institute, Reno, NV.

[31] Magliano, K. L. (2009) Science-Based Policies for Particulate Matter Air Quality Management in California. *International Aerosol Modeling Algorithms Conference.* Davis CA.

**Figure 2-15 Ammonia versus Nitric Acid Measurements at Angiola**[32]




### *2.6.2.2 Reducing Ammonium Nitrate*

Because of the regional surplus in ammonia, even substantial ammonia emissions reductions yield a relatively small reduction in nitrate. Figures 2-16 and 2-17 provide a simplified illustration of this situation. As seen in Figure 2-18, a comparable modeling analysis based on CRPAQS observational data found a higher disparity between the efficiency of NOx versus ammonia controls. Reductions in nitrate concentrations of 30% to 50% were realized through a 50% reduction in NOx. Modeling a 50% reduction in ammonia, while unrealistic because it is not technologically achievable, would only realize less than a 5% reduction in nitrate concentrations. Finally, Figure 2-19 provides clear correlative evidence from observed data that NOx controls are effectively reducing ammonium nitrate, despite an increase in the regional ammonia inventory over the same time period.

[32] McCarthy, M. (2005) *The Role of Nighttime Chemistry in Winter Ammonium Nitrate Formation in the San Joaquin Valley*. American Association for Aerosol Research (AAAR), Supersites Conference, February 2005, Atlanta, GA.

**Figure 2-16 Abundance of Ammonia in the San Joaquin Valley**[33]

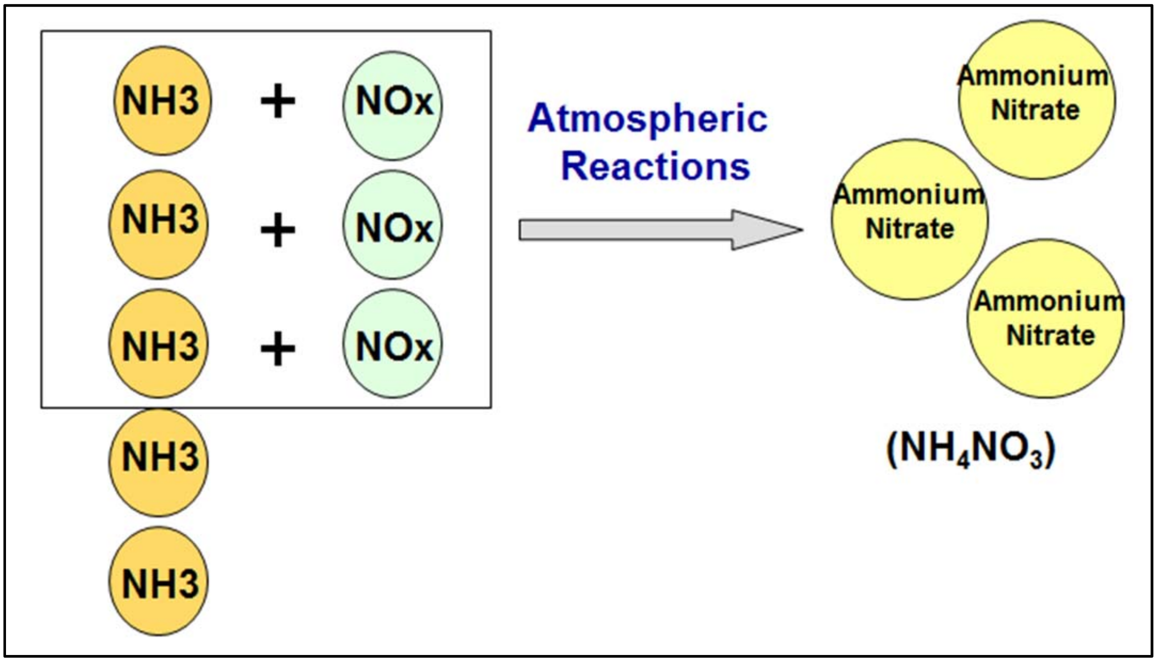
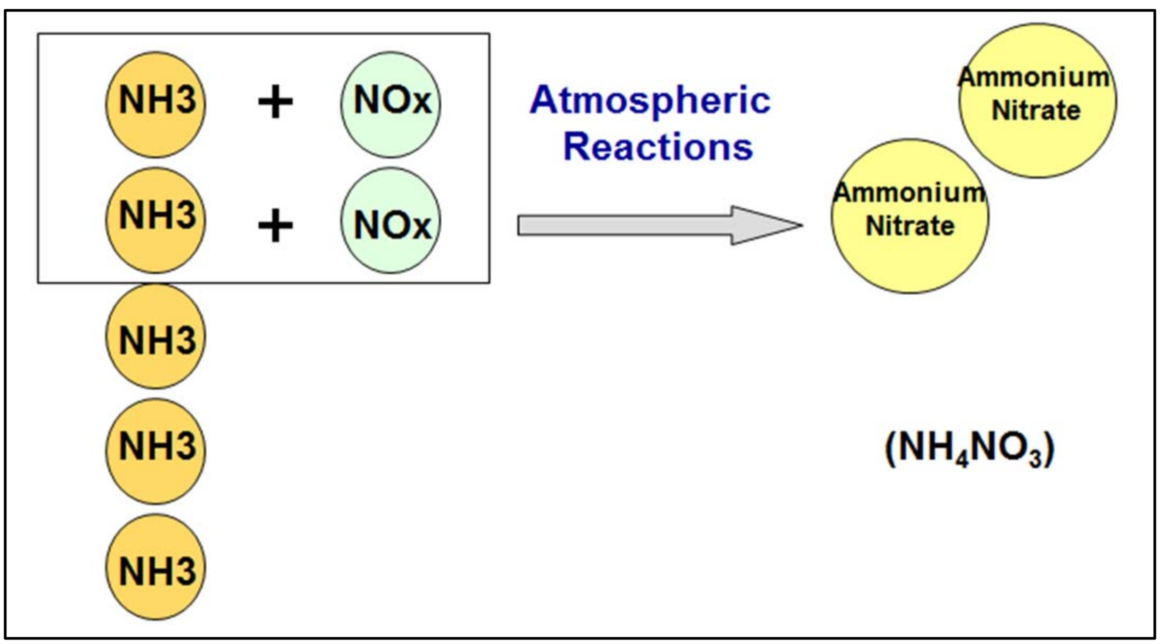



**Figure 2-17 NOx Control Reduces Ammonium Nitrate Most Efficiently**




[33] Stockwell, W.R., Watson, J.G., Robinson, N.F., Steiner, W., & Sylte, W.W. (2000). The Ammonium Nitrate Particle Equivalent of NOx Emissions for Wintertime Conditions in Central California's San Joaquin Valley, *Atmospheric Environment, 34*, 4711-4717.

**Figure 2-18 Modeled Ammonium Nitrate Response to Ammonia vs. NOx Controls**[34]

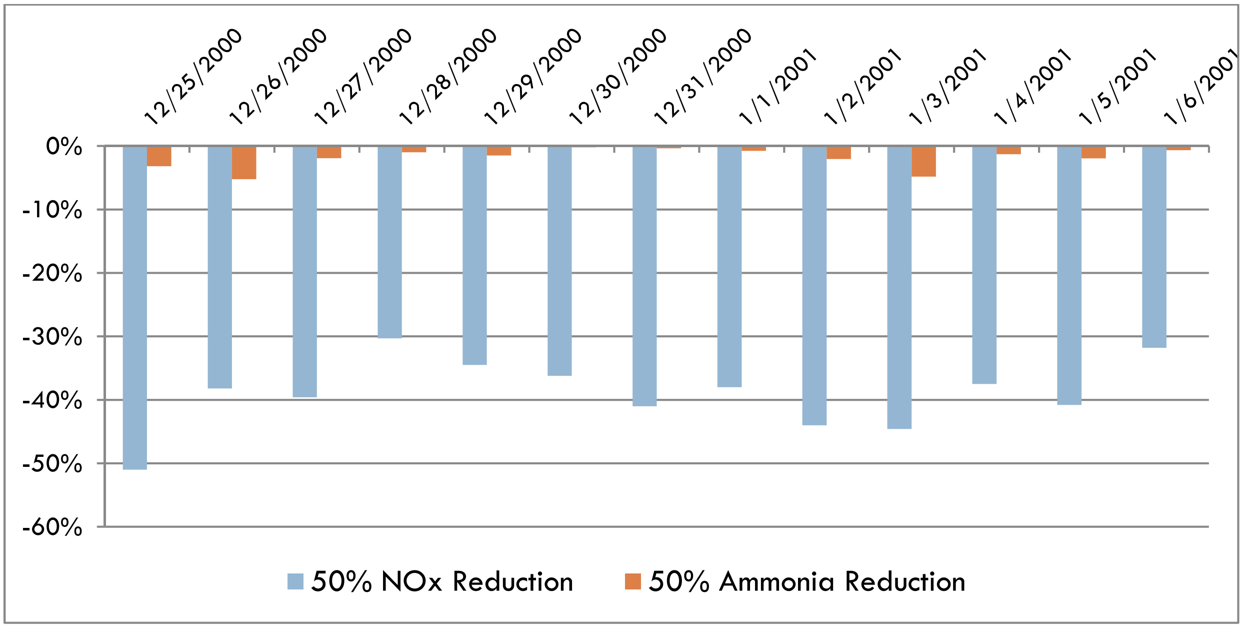
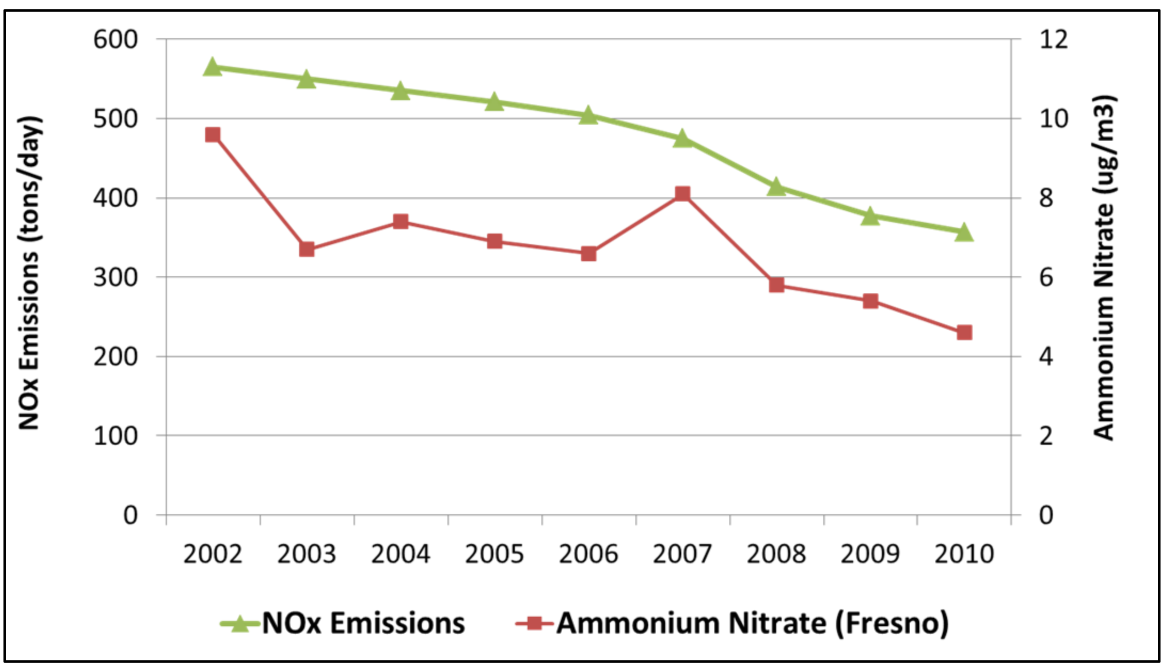



**Figure 2-19 Correlation between NOx Reductions and Observed Ammonium Nitrate in Fresno**[35]

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[34] Stockwell, W.R., Watson, J.G., Robinson, N.F., Steiner, W., & Sylte, W.W. (2000). The Ammonium Nitrate Particle Equivalent of NOx Emissions for Wintertime Conditions in Central California's San Joaquin Valley, *Atmospheric Environment, 34*, 4711-4717.

[35] Stockwell, W.R., Watson, J.G., Robinson, N.F., Steiner, W., & Sylte, W.W. (2000). The Ammonium Nitrate Particle Equivalent of NOx Emissions for Wintertime Conditions in Central California's San Joaquin Valley, *Atmospheric Environment, 34*, 4711-4717.

Due to this extensive body of science that clearly shows the much greater efficacy of reducing NOx emissions relative to ammonia, ammonia reductions have not historically been considered a significant precursor to PM2.5 formation in the Valley. However, the District and ARB have continued to examine the potential role of ammonia with regard to PM2.5 formation (see Appendices F and G of the *2012 PM2.5 Plan*).

The modeling sensitivity analysis shows that reductions in ammonia emissions achieve insignificant reductions in the PM2.5 design values compared to reductions of direct PM2.5 and NOx emissions. Relative to the other pollutants, ammonia reductions at the Bakersfield-California site are only 2.3% as effective as direct PM2.5 reductions, and only 10% as effective as NOx reductions. Ammonia is not a significant precursor to PM2.5 values in the Valley.

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# Chapter 3

## Health Impacts and the Health Risk Reduction Strategy

*2015 Plan for the 1997 PM2.5 Standard*
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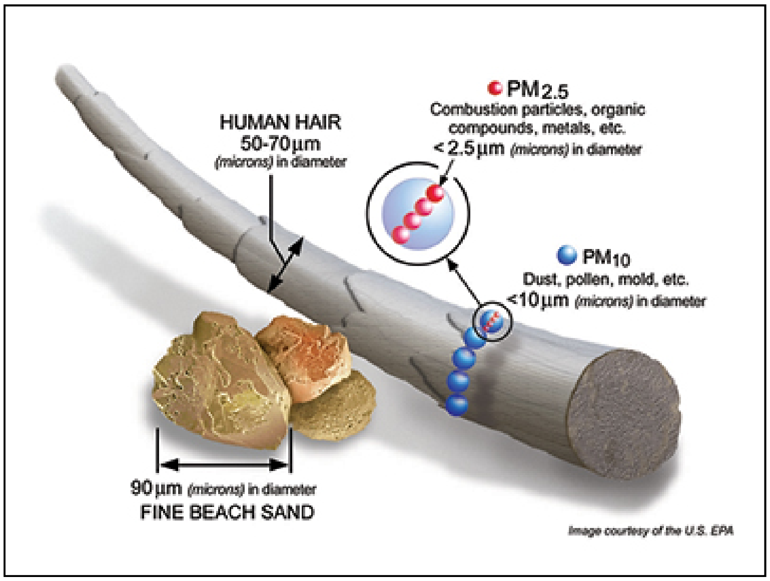
## Chapter 3: Health Impacts and the Health Risk Reduction Strategy

Particulate matter (PM) is a mixture of solid particles and liquid droplets in the air. PM can be emitted directly into the atmosphere (primary PM), or can form as secondary particulates in the atmosphere through the photochemical reactions of precursors (when precursors are energized by sunlight). Thus, PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. PM10 is particulate matter that is 10 microns or less in diameter, and the PM2.5 subset includes smaller particles that are 2.5 microns or less in diameter (Figure 3-1).

**Figure 3-1 Visual Comparison of PM10, PM2.5, Human Hair, and Fine Beach Sand**




### 3.1 PM2.5 AND ASSOCIATED HEALTH IMPACTS

Any particles 10 microns or less are considered respirable, meaning they can be inhaled into the body through the mouth or nose. PM10 can generally pass through the nose and throat and enter the lungs. PM2.5 can be inhaled more deeply into the gas exchange tissues of the lungs, where it can be absorbed into the bloodstream and carried to other parts of the body.

The potential health impacts of particle pollution are linked to the size of the particles, with the smaller particles having larger impacts. Numerous studies link PM2.5 to a variety of health problems, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5. Many studies have quantified and documented the health benefits of attaining the U.S. Environmental Protection Agency (EPA) air quality standards for PM. For example, one 2008 study used the Regional Human Exposure Model (REHEX) to evaluate potential San Joaquin Valley (Valley) health benefits.[1]

In addition to particle size, the chemical composition of PM2.5 is a primary factor in the type and severity of health impacts. There are several PM2.5 species or chemical compounds, as summarized in the following table.

**Table 3-1 Summary of PM2.5 Species**

| PM2.5 Species | Description |
|---|---|
| Organic carbon | Directly emitted, primarily from combustion sources (e.g. residential wood combustion). Also, smaller amounts attached to geologic material and road dusts. May also be emitted directly by natural/biogenic sources. |
| Elemental carbon | Also called soot or black carbon; formed during incomplete combustion of fuels (e.g. diesel engines). |
| Geologic material | Road dust and soil dust that are entrained in the air from activity, such as soil disturbance or airflow from traffic. |
| Trace metals | Identified as components from soil emissions or found in other particulates having been emitted in connection with combustion from engine wear, brake wear, and similar processes. Can also be emitted from fireworks. |
| Sea salt | Sodium chloride in sea spray where sea air is transported into the Valley. |
| Secondary organic aerosol | Secondary particulates formed from photochemical reactions of organic carbon. |
| Ammonium nitrate | Reaction of ammonia and nitric acid, where the nitric acid is formed from nitrogen oxide emissions, creating nitric acid in photochemical processes or nighttime reactions with ozone. |
| Ammonium sulfate | Reaction of ammonia and sulfuric acid, where the sulfuric acid is formed primarily from sulfur oxide emissions in photochemical processes, with smaller amounts forming from direct emissions of sulfur. |
| Combined water | A water molecule attached to one of the above molecules. |

Understanding various PM2.5 species, including how each species is formed, how much each contributes to the Valley's total PM2.5 concentrations, and how each is linked to different public health impacts, is of the utmost importance for the development of an effective, health-protecting control strategy. For example, ammonium nitrate is estimated to comprise about 40% of the Valley's annual average PM2.5 concentrations, but it is generally regarded as having relatively low toxicity as compared to other types of PM2.5 species. In contrast, metals have greater health impacts, but are found in relatively low concentrations in the Valley. Bioaerosols, such as mold spores, bacteria, pollen, and endotoxins, carry significant health risks for sensitive individuals. Ultrafine

[1] Hall, J.V., Brajer, V., Lurmann, F.W. (November 2008). *The Benefits of Meeting Federal Clean Air Act Standards in the South Coast and San Joaquin Valley Air Basins.* Institute for Economic and Environmental Studies, California State University, Fullerton. Retrieved from http://business.fullerton.edu/centers/iees/reports/Benefits_of_Meeting_Clean_Air_Standards_11-13-08.pdf

particles, or those particles 0.1 microns or less in diameter (PM0.1), are small enough to effectively deliver harmful chemicals into the lungs, bloodstream, and the brain, but typically comprise a very small portion of the Valley's total airborne PM mass.

In addition to affecting human health, air pollution also affects the health of the natural environment. PM2.5 can be transported from sources hundreds of miles away to contribute to visibility problems at remote locations, such as the Sierra Nevada mountain range and associated national parks. As PM settles out of the air, it can make lakes and streams acidic, change an ecosystem's nutrient balance, and affect ecosystem diversity. PM can affect vegetation by damaging foliage, disrupting the chemical processes within plants, reducing light adsorption, and disrupting photosynthesis. This can impact green spaces as well as crops. PM can also stain and damage stone and other materials. As the Valley progresses toward attainment of EPA's human-health-based PM2.5 standards, there will also be less harmful impacts to the surrounding natural environment.

## 3.2 WHAT IS THE HEALTH RISK REDUCTION STRATEGY?

The EPA National Ambient Air Quality Standards (NAAQS) are the primary driving force for new emissions controls that result in air quality improvements and health benefits to Valley residents. In the conventional planning process for attaining these standards, success in protecting public health is defined by whether the standards are met at all air monitors. In effect, the reduction in PM2.5 mass, which shows progress toward attainment of the standard, serves as the surrogate for population exposure and risk.

Attaining these standards will result in clear and significant health benefits. However, NAAQS, as currently established, are essentially *mass-based* standards. In the case of PM2.5, the current standards do not account for particle size distribution, chemical species composition, surface area, and other factors of health risk. There is inherent complexity in documenting the health risks associated with exposure to particles (which have a wide range of characteristics) as compared to pollutants like ozone (which has more consistency between molecules).

In contrast, recent health-science research has substantially deepened our knowledge of air pollutant health risk beyond the current Clean Air Act (CAA) framework and EPA standards. There is a growing recognition within the scientific community that the NAAQS alone can be incomplete measures of public exposure to air pollution. Thus, while the CAA NAAQS and state implementation plan (SIP) process is motivated by public health, the process alone does not fully address public health impacts of ambient air pollution. To fully address potential public health benefits, an attainment strategy can use a more comprehensive, multidimensional population exposure assessment approach that goes beyond ambient mass measurements.[2]

[2] Lippman, M. (2012, April 16). Presentation: Results from National Particle Component Toxicity (NPACT) Program and NYU: Toxicology Findings, Integration, and implications. Presented at the Annual Meeting of the Health Effects Institute (HEI) in Chicago, IL, April 15–17, 2012. Presentation retrieved from http://www.healtheffects.org/Slides/AnnConf2012/Lippmann-MonPM.pdf

EPA policy directly acknowledges the importance of a health risk reduction-based strategy to maximize public health benefits within a region's efforts to attain the NAAQS. EPA's March 2012 PM2.5 implementation guidance memo states, "…it is likely that SIPs for the 2006 24-hour PM2.5 NAAQS may need to include greater emphasis on reducing emissions from local sources…"[3] EPA's memo further encourages that states consider evidence from published literature indicating that reductions of direct PM2.5 have a greater health benefit per ton than reductions of other criteria pollutants, such as SO2 and NOx,[4] and providing methods to maximize health benefits and minimize risk inequality.[5]

The San Joaquin Valley Air Pollution Control District (District) Governing Board adopted a research-driven Risk-based Strategy (RBS) designed to maximize public health improvements resulting from the District's attainment strategies and related initiatives. The overall goal of the RBS was to minimize cumulative population exposure to air pollution and corresponding health risks in the region. In May 2013, the District Governing Board rebranded this strategy as the Health Risk Reduction Strategy (HRRS) in response to criticisms and skepticism by a number of air quality advocates, even though the air quality advocates did not put forward any scientific or policy-relevant evidence to refute the RBS, and the fact that the RBS had been steadily gaining support from both the EPA and the scientific community. Even industry representatives largely embraced the RBS, even though it targets certain sources for new air pollution control strategies. This is largely due to the fact that the RBS provides an assurance of effective controls that produce real air quality benefits. The District has integrated the HRRS into the development of air quality attainment plans.

## 3.3 BACKGROUND FOR THE HEALTH RISK REDUCTION STRATEGY

As a response to mounting epidemiological evidence that PM2.5 was more harmful than PM10, EPA established a PM2.5 NAAQS in 1997 to accompany the previously established PM10 NAAQS. PM10 occurs at larger mass concentrations than PM2.5, so the shift to PM2.5 somewhat conflicted with the time-tested toxicological precept of "the dose (mass) makes the poison." Particulate inhalation studies found that the smaller PM2.5 particles penetrate more deeply into the lungs, where particles more effectively avoid immune system defenses. Toxicological analyses of PM2.5 identified chemical species that acted differentially to promote respiratory and cardiovascular inflammation. While it was unclear at that time which PM2.5 chemicals were the most harmful, the scientific consensus was that the health risks stemmed from the chemicals rather than the particles themselves.

[3] U.S. Environmental Protection Agency (2012, March 2). Memorandum from the Office of Air Quality Planning and Standards: Implementation Guidance for the 2006 24-Hour Fine Particle (PM2.5) National Ambient Air Quality Standards (NAAQS). Retrieved from http://www.epa.gov/ttn/naaqs/pm/pdfs/20120302_implement_guidance_24-hr_pm2.5_naaqs.pdf

[4] Fann, N., Fulcher, C.M., & Hubbell, B.J. (2009). The Influence of Location, Source, and Emission Type in Estimates of the Human Health Benefits of Reducing a Ton of Air Pollution. *Air Quality, Atmosphere & Health, 2(3)*, 169–176. doi: 10.1007/s11869-009-0044-0

[5] Fann, N., Roman, H.A., Fulcher, C.M., Gentile, M.A., Hubbell, B.J., Wesson, K., & Levy, J.I. (2011). Maximizing Health Benefits and Minimizing Inequality: Incorporating Local-Scale Data in the Design and Evaluation of Air Quality Policies. *Risk Analysis, 31(6)*, 908–922. doi: 10.1111/j.1539-6924.2011.01629.x

In the years since the first PM2.5 NAAQS was established, scientists have conducted numerous studies that have identified which chemical species of PM2.5 are most harmful and have pinpointed their sources.[6] Health researchers have also documented the negative cardiovascular and immune system effects of ultrafine particles, or particles that are 0.1 microns or smaller (PM 0.1), based on these particles' ability to penetrate the alveolar region of the lungs and deliver chemicals into the bloodstream. This smaller-is-more-dangerous phenomenon parallels the previous discovery regarding the higher toxicity of PM2.5 particles compared to larger and heavier PM10 particles. In each case, the dose-makes-the-poison assumption governing the NAAQS for carbon monoxide, lead, ozone, and the other criteria pollutants does not apply to particulates.

Addressing the complexity of health risks posed by particulate pollution has been a motivating factor in the development and application of the HRRS. Rather than ignore this growing body of scientific knowledge, the District's HRRS seeks to embrace it to the extent possible within the current CAA to maximize public health benefits. In practice, this knowledge provides the District with the necessary scientific foundation for justifying and prioritizing the pollution control measures that are necessary for demonstrating attainment of federal standards. The outcome is stronger, more health-protective plans that reflect the current trajectory of scientific knowledge toward a more complete understanding of population risk from PM2.5 particles.

The NAAQS-SIP process and the HRRS are complimentary strategies, not an either-or scenario. The HRRS should not be interpreted as a zero-sum tradeoff that emphasizes controls on certain forms and sources of high-risk PM2.5 while ignoring others. The current mass-based indicator (micrograms per cubic meter of air) will continue to serve as the final yardstick for PM2.5 attainment and as a surrogate for achieving significant health benefits.

A number of the District programs have been influenced by the underlying principles and goals of the HRRS and provide a model of the success and added potential benefits possible under this strategy.

- **District Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters) and the District's corresponding Check-Before-You-Burn program** have both been reducing harmful species of PM2.5 where and when those reductions are most needed—in impacted urbanized areas when the local weather is forecast to hamper PM dispersion. By decreasing emissions from residential wood burning, Rule 4901 decreases directly emitted PM2.5, as well as carbon monoxide, formaldehyde, sulfur dioxide, irritant gases, and known and suspected carcinogens, such as polycyclic aromatic hydrocarbons (PAH). In 2008, the Central Valley Health Policy Institute found that District wood burning curtailments on days with high PM concentrations reduced annual PM exposure

[6] U.S. Environmental Protection Agency [EPA]. (2009). Integrated Science Assessment for Particulate Matter: Final Report. Washington, D.C.: EPA/600/R-08/139F. Available at http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=216546

by about 13% in Bakersfield and Fresno, resulting in an estimated 59 to 121 avoided cases of annual premature mortality.[7]

Even though the *2008 PM2.5 Plan* was developed per EPA requirements for the 1997 PM2.5 standard (with a 24-hour standard of 65 µg/m³), the 2008 plan included a commitment to amend Rule 4901 in 2009 (with implementation in 2010) to align the wood-burning curtailment threshold with the newer 2006 PM2.5 standard (with a 24-hour standard of 35 µg/m³). Then, based on research reiterating the effectiveness of Rule 4901 in protecting public health, as well as public support for a stronger rule, the District amended and implemented Rule 4901 in 2008—one year ahead of the scheduled rule development and two years ahead of scheduled implementation. The amended rule also set the curtailment level lower than initially planned (to 30 µg/m³) to provide an extra margin of safety and to address air quality forecast uncertainties.

Similarly, the District's *2012 PM2.5 Plan* committed to amend the District Rule 4901 in 2016 with compliance beginning the winter season of 2016-2017 with an estimated 1.5 tons per day (tpd) of PM2.5 emission reductions. When the District Governing Board adopted the *2012 PM2.5 Plan,* guided by the HRRS*,* they directed the District to amend Rule 4901 in 2014. As a result, the District's residential wood burning program was amended in September 2014 with implementation in the winter season of 2014-2015, two years ahead of the SIP commitment. The rule was further strengthened and the curtailment threshold lowered to 20 µg/m$^3$. The combination of the lowered curtailment threshold, tiered curtailments, increased public outreach and education, and increased incentive amounts and allocations result in a much greater estimated reduction of directly emitted PM2.5 emissions during the winter season than the previously estimated amount of 1.5 tpd.

The significant increase in the number of curtailment days resulting from the lower threshold has resulted in a parallel reduction in nighttime neighborhood exposure to PM 0.1, including exposure that has been shown to occur as a result of indoor infiltration. This aspect of Rule 4901, i.e. reducing the frequency of elevated exposure to PM0.1 that induces immune system sensitization and cardiovascular inflammation, has been carried forward into the HRRS. The District's prioritization of Rule 4901 is one of the best examples of a District policy aimed at maximizing public health benefits based on a rigorous assessment of population exposure and risk.

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[7] Lighthall, D., Nunes, D., & Tyner, T.R. (2009). Environmental Health Evaluation of Rule 4901: Domestic Wood Burning. Fresno, CA: Central Valley Health Policy Institute for the San Joaquin Valley Air Pollution Control District. Retrieved from http://www.fresnostate.edu/chhs/cvhpi/documents/wood-burning-report.pdf

- **District grant programs** reach beyond the current CAA NAAQS-SIP process to reduce emissions in advance of or beyond regulations. For example, through the District's popular Clean-Green-Yard-Machine grant program, the District has replaced close to 4,000 high-polluting gas-powered lawn mowers with clean electric mowers, and through the Burn Cleaner Incentive Program, the District has replaced over 6,000 high-polluting wood burning devices with cleaner alternatives. These grant programs result in a decrease in urban, localized health risks associated with the use of gas-powered equipment and wood burning devices.

- **The District's information and educational programs, such as the Real-Time Air Quality Advisory Network (RAAN),** also contribute to the HRRS. RAAN uses real-time data from air monitoring stations throughout the Valley to provide hour-by-hour air quality updates to schools and other subscribers. Subscribers can use this information to make informed decisions and plan outdoor activities for times with the best air quality, reducing potential air quality health risks. Reflecting the latest science on PM2.5 exposure risk for sensitive individuals, ambient concentrations of PM2.5 that are used to trigger RAAN health risk warnings are more health protective than those used in the EPA's Air Quality Index.

- **The District tracks and sponsors health research.** As part of the District's HRRS, the District is playing an active role in funding leading edge health research focusing on the Valley population. In 2010–2011, the District sponsored the first major epidemiological investigation of health effects of air pollution in the Valley, focusing on the populations of Modesto, Fresno, and Bakersfield.[8] The study found that daily exposure to high PM2.5 concentrations was significantly correlated with increased daily hospital and emergency room admission rates for asthma and other respiratory and cardiovascular diseases. In 2012, the District sponsored a follow-up epidemiological study to examine which of the chemical species found in Valley PM2.5 are most highly correlated with elevated ER and hospital admission rates. Results are expected to be published in the near future. In 2010, the District sponsored a pilot study of PM 0.1 aka ultrafine particles in Fresno. UCSF-Fresno investigated the quantity and spatial distribution of PM 0.1 plumes from motor vehicles, lawn care equipment, wood burning, and restaurants. Currently the District is funding a UC Davis research project to develop a model of PM0.1 population exposure in the Valley based on previous Valley observational research. PM0.1 exposure will be correlated with short- and long-term health effects by making use of the large body of Valley epidemiological data that has been generated by the previous studies described above. The District will continue to seek out and fund research opportunities that further the understanding of PM-related impacts on public health.

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[8] Capitman, J.A., & Tyner, T.R. (2011). *The Impacts of Short-Term Changes in Air Quality on Emergency Room and Hospital Use in California's San Joaquin Valley*. Fresno, CA: Central Valley Health Policy Institute for the San Joaquin Valley Air Pollution Control District. Retrieved from http://www.fresnostate.edu/chhs/cvhpi/publications/index.html

## 3.4 FIVE-FACTOR EXPOSURE ASSESSMENT METHODOLOGY

To qualitatively evaluate the potential risk reduction benefits from various sources, the HRRS is implemented in air quality attainment plans employing a scientifically based exposure characterization methodology that draws on the latest scientific understanding about health risk from PM2.5 exposure.

The District uses a five-factor exposure assessment methodology under the HRRS:

1. **Relevance to attainment**
2. **Toxicity of chemical species**
3. **Particle size and deposition**
4. **Proximity to PM 0.1**
5. **Population intake fraction**

The qualitative exposure assessment employed is different than a formal risk assessment. Risk assessment requires the quantification of key elements relating to emission levels, particle or chemical toxicity, dose-response relationships, and total population exposure. The primary drawback for formal risk assessment models in a SIP context is pervasive empirical uncertainty regarding the values of the different elements listed above. Even if the chemical composition, geographic pattern and volume, and spatial distribution of emissions from a given source are known, it is very difficult to isolate and quantify the regional health impacts of emissions from that source because many other sources are also contributing to PM2.5 exposure. In addition, PM2.5 aerosols undergo photochemical aging over time and space, often resulting in new secondary organic and inorganic species generated by variable regional source loads and meteorological conditions. Despite these limitations, it is possible to use a simple but robust exposure characterization tool for making important qualitative and categorical distinctions regarding the relative contribution and associated of a given source to population exposure.

### 3.4.1 Relevance to Attainment

An important element of the HRRS is the relevance of the emissions reductions to the Valley's attainment of EPA's health-based standards. This portion of the analysis considers emissions type (such as PM2.5, NOx, or SOx), seasonality of the emissions, and the percent contribution of that source's emissions relative to the Valley's total emissions inventory. For example, NOx is the limiting factor for ammonium nitrate and therefore reductions of NOx emissions in the Valley will provide a greater impact to achieving attainment than reductions of ammonia emissions.

### 3.4.2 Toxicity of Chemical Species

PM2.5 particles vary in their toxicity depending on their chemical composition. PM2.5 particles are characterized by a widely diverse combination of chemicals depending on unique regional combinations of meteorology, topography, and pollution sources. In addition to experimental and clinical research that has identified these toxicity differences, epidemiological studies have found regional differences in health impacts despite comparable regional PM2.5 mass exposure.[9] Beyond the intrinsic toxicity of individual chemicals, the unique combinations of chemicals generated by some sources can actually magnify health risk above and beyond what their mass concentrations would suggest.[10]

Many emissions sources evaluated in this plan are sources of direct (primary) PM2.5 emissions characterized by a unique combination of chemical species. Other sources emit chemical species such as ammonia and nitrogen oxides (NOx), precursors that contribute to the formation of secondary PM2.5 species. The PM2.5 chemical species categories adopted in the exposure characterization model include elemental carbon (carbon black), organic carbon compounds (OC), metals (elements), ammonium nitrate, ammonium sulfate, and geological. PM2.5 is regularly speciated at several Valley monitoring sites. The following discussion provides an overview of PM2.5 species and their associated health impacts.

**Organic carbon (OC):** OC species found in PM2.5 aerosol are generated as primary organic aerosol (POA), predominantly through the combustion of hydrocarbons. Key POA sources include cooking, industrial processes, mobile source exhaust, prescribed burning, tire wear, and wood burning.[11] Secondary organic aerosols (SOA) are formed from the oxidation of motor vehicle hydrocarbons, prescribed burning, wood burning, solvent use, and industrial processes.

OC is recognized as one of the most biologically reactive of PM2.5 chemical species categories, with ample evidence of high toxicity found in experimental, clinical, and epidemiological studies. OC, often in combination with metals such as iron, has been shown to generate reactive oxygen species (ROS) that drive several different mechanisms of pulmonary inflammation, including disruption of normal immune system functioning.[12] In addition, OC and metals have been shown to indirectly stimulate ROS production by macrophages, which are cells responsible for defending the lungs from pathogens and aerosols.

One of the primary OC species categories is polycyclic aromatic hydrocarbons (PAH). PAH species fall into two categories: a high molecular weight fraction and a low molecular weight fraction. The former is found in diesel exhaust and engine oil and is a significant risk factor for lung cancer.[13] Low molecular weight PAH is found in other

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[9] Bell, M.L. (2012). *Assessment of the Health Impacts of Particulate Matter Characteristics*. Research Report 161. Boston: MA. Health Effects Institute. Retrieved from http://pubs.healtheffects.org/getfile.php?u=685

[10] Kelly, F.J. (2006). Oxidative Stress: Its Role in Air Pollution and Adverse Health Effects. *Occupational Environmental Medicine, 60,* 612–616. Retrieved from http://oem.bmj.com/content/60/8/612.full doi: doi:10.1136/oem.60.8.612

[11] U.S. Environmental Protection Agency [EPA]. (2004, October). *Air Quality Criteria for Particulate Matter: Final Report*. Washington, D.C.: EPA 600/P-99/002aF-bF. Available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=87903

[12] Ayres, J.G., Borm, P., Cassee, F.R., Castranova, V., Donaldson, K., Ghio, A. … Froines, J. (2008) Evaluating the Toxicity of Airborne Particulate Matter and Nanoparticles by Measuring Oxidative Stress Potential—A Workshop Report and Consensus Statement. *Inhalation Toxicology 20,* 75–99. Retrieved from http://faculty.unlv.edu/buckb/scanned%20pfd/Ayres%20et%20al%202008.pdf

[13] Landvik, N.E., Gorria, M., Arlt, V.M., Asare, N., Solhaug, A., Lagadic-Gossmann, D., & Holme, J.A. (2007). Effects of Nitrated-Polycyclic Aromatic Hydrocarbons and Diesel Exhaust Particle Extracts on Cell Signalling Related to

hydrocarbon combustion particles and serves as a precursor to the formation of an important OC species category known as quinones. Formed from atmospheric processing of PAH or within the body (in vivo), quinones have been shown to be one of the most important drivers of pulmonary oxidative stress, resulting in a host of negative spillover effects on immune system functioning.[14] Quinone formation via chemical aging of PAH occurs during multi-day winter stagnation events in the Valley. A District-funded clinical study of asthmatic patients in Fresno found that quinone levels in urine correlated with sustained (multi-day) high ambient concentrations of PM2.5 and was accompanied by decreased lung function.[15]

**Elemental carbon (EC):** Elemental carbon is found in combustion-based aerosols produced by mobile exhaust (mainly diesel), wood burning, and cooking (especially charbroiling). Compared to OC species, there is limited evidence of comparable impacts on ROS production, pulmonary inflammation, and immune system disruption. For example, EC appears not to be a significant agent for the induction of inflammation in macrophage cells, indicating a significantly lower toxicity level relative to OC species.[16] A recent study of PM 0.1-based exposure of EC in mice found modest cardiovascular effects. Pulmonary inflammation was noted but only at high doses beyond normal ambient concentrations.[17] A recent study in Mexico City found an association between exposure levels of EC and lung function decrements among asthmatic and non-asthmatic children.[18]

Characterization of health effects of elemental carbon from human exposure studies is complicated by the high correlation between EC, OC, and metals emitted by diesel exhaust. Exposure to EC is a PM2.5 risk factor, although there is more evidence to date that other chemical species, e.g. metals and OC, found in these particles are the primary drivers of negative health effects.

**Metals:** A combination of clinical, experimental, and epidemiological studies have implicated several of the metals found in PM2.5 with negative respiratory or cardiovascular outcomes, sometimes in conjunction with the action of OC species. One of the most important is iron because of its ability to catalyze the production of hydrogen peroxide, leading to highly reactive hydroxyl radicals (OH). In turn, these highly reactive chemicals stimulate the production and action of cytokines by macrophages. Cytokines

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Apoptosis:Possible Implications for their mutagenic and Carcinogenic Effects. Toxicology, 231, 159–174. doi:10.1016/J.tox.2006.12.009

[14] Bolton, J., Trush, M.A., Penning, T.M., Dryhurst, G., & Monks, T.J. (2000). Role of Quinones in Toxicology. *Chemical Research in Toxicology, 13(3)*, 135–160. doi: 10.1021/tx99

[15] Ikeda, A., Vu, K.K.-T., Lim, D., Tyner, T.R., Krishnan, V.V., & Hasson, A.L. (2012). An Investigation of the Use of Urinary Quinones as Environmental Biomarkers for Exposure to Ambient Particle-Borne Pollutants. *Science of the Total Environment* (submitted).

[16] Vogel, C.F., Sciullo, E., Wong, P., Kuzmicky, P., Kado, N. & Matsumura, F. (2005). Induction of Proinflammatory Cytokines and C-Reactive Protein in Human Macrophage Cell Line U937 Exposed to Air Pollution Particulates. *Environmental Health Perspectives 113(11)*, 1536–1541.

[17] Vesterdal, L.K., Folkmann, J.K., Jacobsen, N.R., Sheykhzade, M., Wallin, H., Loft, S., & Møller, P. (2010). Pulmonary Exposure to Carbon Black Nanoparticles and Vascular Effects. *Particle and Fibre Toxicology 7:33*. Retrieved from http://www.particleandfibretoxicology.com/content/7/1/33 doi: 10.1186/1743-8977-7-33

[18] Barraza-Villarreal, A., Escamilla-Nuñez M.C., Hernández-Cadena L., Texcalac-Sangrador. J.L., Sienra-Monge, J.J., Del Río-Navarro, B., Cortez-Lugo, M., Sly, P.D., & Romieu, I. (2011). Elemental Carbon Exposure and Lung Function in Schoolchildren from Mexico City. *European Respiratory Journal, 38,* 548–552.

are cell-signaling molecules that are critical to normal functioning of the immune system. A recent experimental study examined the impact of iron in silica particles in triggering respiratory toxicity.[19] Compared to silica particles with no iron, silica particles with iron were found to have a significantly greater effect on oxidative stress via hydrogen peroxide production with subsequent stimulus of cytokines by macrophages.

Extensive research relates exposure in metals (particularly nickel and vanadium) in PM2.5 to cardiovascular effects. A national epidemiological study recently found that communities with higher fractions of nickel, vanadium, and EC in their PM2.5 also had higher risk of cardiovascular and respiratory hospitalization.[20] Specifically, cardiovascular hospitalizations were 26% higher in counties with a nickel fraction in the 75$^{th}$ percentile versus counties with nickel in the 25% percentile. In an investigation of the relatively higher association between PM2.5 daily concentrations and daily rates of cardiovascular mortality in New York City, the exceptionally high level of nickel and vanadium resulting from residual oil fly ash used for heating and as fuel for ships were identified as a principle cardiovascular risk factor.[21] In a related study, rats exposed to PM2.5 with high fractions of chromium, iron, and nickel fractions responded with significantly reduced heart rate variability and increased heart rates, each being an indicator of cardiovascular disruption and risk.[22]

In conclusion, metals found in PM2.5 produced from combustion of coal, residual oil, diesel fuel, and motor oil are recognized as chemical drivers of cardiovascular and respiratory morbidity and mortality. This has led some researchers to conclude that regional differences in U.S. cardiovascular mortality that cannot be explained by differences in average daily PM2.5 concentrations are likely to be caused by regional differences in coal combustion and resultant exposure to metals and OC.[23]

**Ammonium nitrate:** Ammonium nitrate (nitrate) is classified as a secondary inorganic species (not directly emitted) primary source of PM2.5, and it does not contain carbon. Nitrate is formed by atmospheric reactions between two precursors: ammonia and nitric acid. Prior to this reaction, nitric acid generally originates from the chemical processing of nitrogen oxides (NOx), largely from fuel combustion during multiday stagnation events. As seen in the following figure, nitrate is significant because it can contribute up to almost 40% of PM2.5 mass on an annual average day basis.

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[19] Premasekharan, G., Nguyen, K., Contreras, J., Ramon, V., Leppert, V.J. & Forman, H.J. (2011). Iron-Mediated Lipid Peroxidation and Lipid Raft Disruption in Low-Dose Silica-Induced Macrophage Cytokine Production. *Free Radical Biology and Medicine, 51(6)*, 1184–1194. doi: 10.1016/j.freeradbiomed.2011.06.018

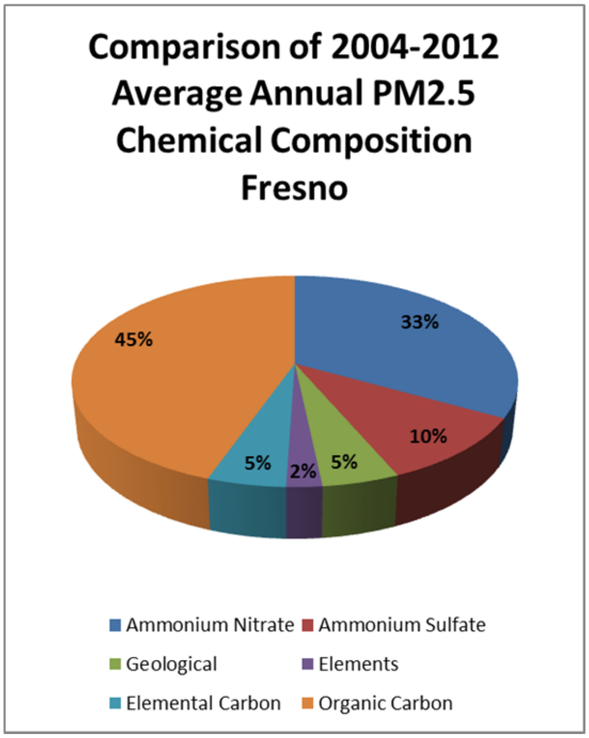
[20] Bell, M.L., Ebisu, K., Peng, R.D., Samet, J.M. & Dominici, F. (2009). Hospital Admissions and Chemical Composition of Fine Particle Air Pollution. *American Journal of Respiratory Critical Care, 179*, 1115–1120. Retrieved from http://ajrccm.atsjournals.org/content/179/12/1115.full.pdf+html

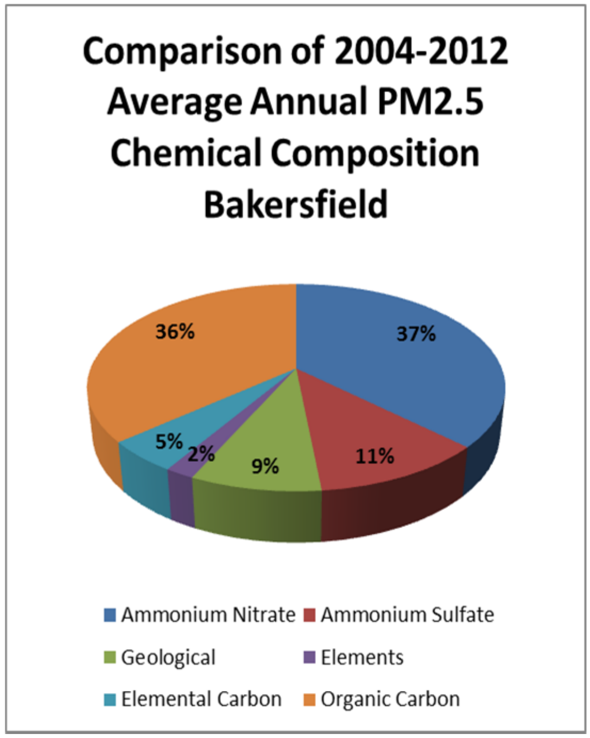
[21] Lippmann, M., Ito, K., Hwang, J-S., Maciejczyk, P., & Chen, L-C. (2006). Cardiovascular Effects of Nickel in Ambient Air. *Environmental Health Perspectives*, *114(11)*, 1662–1669. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1665439/

[22] Chen, L.C., & Lippmann, M. (2009). Effects of Metals within Ambient Air Particulate Matter (PM) on Human Health. *Inhalation Toxicology, 21(1),* 1–31. Retrieved from http://faculty.unlv.edu/buckb/scanned%20pfd/Chen%20and%20Lippmann%202009.pdf

[23] Lippman, M. (2012, April 16). Presentation: Results from National Particle Component Toxicity (NPACT) Program and NYU: Toxicology Findings, Integration, and implications. Presented at the Annual Meeting of the Health Effects Institute (HEI) in Chicago, IL, April 15–17, 2012. Presentation retrieved from http://www.healtheffects.org/Slides/AnnConf2012/Lippmann-MonPM.pdf

**Figure 3-2 Annual Average PM2.5 Chemical Composition**




The relative toxicity of ammonium nitrate is an important issue given its substantial mass contribution to regional PM2.5. The oral toxicity of nitrate is very low, with an LD50 (dose causing death for 50% of the exposed subjects) reported to be two thirds that of table salt. This raises the question as to whether other factors intrinsic to inhalation could lead to health effects at considerably lower exposure concentrations. As seen in the case of OC species, the most compelling evidence of species toxicity is built on a foundation of experimental, clinical, and epidemiological research. In particular, epidemiological studies draw their inferences from statistical associations between exposure variables and health outcomes only. Uncovering the actual mechanisms of harm, therefore, requires further isolation of mechanisms through experimental and clinical research.

In the case of ammonium nitrate, evidence of toxicity is largely limited to epidemiological research alone. For example, a recent epidemiological study of traffic air toxics and pre-term birth in Los Angeles found statistical associations between nitrate mass, PAH, and several other air pollutants and the increased likelihood of pre-term birth.[24] The authors point to other experimental studies that identified very high oxidative stress potential resulting from PAHs, metals, and other OC species collected from Los Angeles traffic sources as being the likely mechanism for pre-term birth. They conclude by emphasizing the need to further study the links between pre-term birth and PAH exposure.

[24] Wilhelm, M., Ghosh, J.K., Su, J., Cockburn, M., Jerrett, M. & Ritz, B. (2011). Traffic-Related Air Toxics and Preterm Birth: A Population-Based Case-Control Study in Los Angeles County, California. *Environmental Health 10: 89*. Available at http://www.ehjournal.net/content/10/1/89/ doi: 10.1186/1476-069X-10-89

One experimental study was found that explicitly looked for toxic mechanisms driven by ammonium nitrate.[25] The study exposed rats to high concentrations of nitrate (70 to 420 μg/$m^3$) in combination with EC. After exposure, animals were sacrificed and a necropsy was performed, followed by a range of tests for pathological impacts between the control (non-exposed) and exposed groups. The authors did not find abnormalities that could be tied to the experimental exposure to nitrate alone or in combination with EC. This absence of experimental evidence for mechanisms of pathology for inhaled ammonium nitrate is consistent with its low oral toxicity.

**Ammonium sulfate**: Ammonium sulfate (sulfate) is also classified as a secondary inorganic species. It is formed when sulfuric acid, itself a product of oxidation of sulfur, reacts with ammonia. Mass concentrations of sulfate are significantly lower than for nitrate in the Valley, averaging from 10% to 11% of PM2.5 mass on an annual average basis. Fossil fuel combustion is the primary source of sulfate in the Valley, but globally, coal combustion is the primary source. Unlike nitrate, mass concentrations of sulfate are not appreciably different in cold and hot seasons.

Research findings regarding the toxicity of sulfate are comparable to that of nitrate. Oral toxicity is low and it is approved as a food additive by the US Food and Drug Administration and the European Union. One study[26] examined the response of 20 non-smoking subjects to four-hour exposure sessions in chambers containing 500 μg/$m^3$ of sulfate aerosol, a concentration over two orders of magnitude above ambient levels in the Valley. Pulmonary function tests were performed to assess the response of these exposures. No significant changes in pulmonary function or bronchial reactivity were observed immediately after the individual exposures or 24 hours after exposure. In an experimental study that also exposed rats to 500 μg/$m^3$ of sulfate for four to eight months, modest pulmonary impacts were noted.[27] After four months, cellular immunologic responsiveness was not impaired, but physiologic changes were detected, including enlargement of bronchial epithelial (surface) cells and in alveolar size.

For each of these studies, the modest health impacts observed at very high exposure levels are consistent with the low intrinsic toxicity of sulfate. This is consistent with results of a review of the epidemiological and toxicological research on sulfate.[28] Researchers found that PM sulfate was a weaker indicator of health risk than PM2.5 mass. Because sulfate is correlated with PM2.5 mass, this result is inconsistent with sulfate having a strong health influence. The study concluded that the epidemiologic

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[25] Cassee, F., Arts, J.H., Fokkens, P.H., Spoor, S.M., Boere, A.J., van Bree, L., & Dormans, J.A. (2002). Pulmonary Effects of Ultrafine and Fine Ammonium Salts Aerosols in Healthy and Monocrotaline-Treated Rats Following Short-Term Exposure. *Inhalation Toxicology, 14(12)*, 1215–1229. doi: 10.1080/08958370290084872

[26] Kulle, T.J., Sauder, L.R., Shanty, F., Kerr, H.D., Ferrell, B.P., Miller, W.R., & Milman, J.H. (1984). Sulfur Dioxide and Ammonium Sulfate Effects on Pulmonary Function and Bronchial Reactivity in Human Subjects. *American Industrial Hygiene Association Journal, 45(3)*, 156–161. ISSN:1542-8125

[27] Smith, L.G., Busch, R.H., Buschbom, R.L., Cannon, W.C., Loscutoff, S.M., & Morris, J.E. (1989). Effects of Sulfur Dioxide or Ammonium Sulfate Exposure, Alone or Combined, for 4 or 8 Months on Normal and Elastase-Impaired Rats. *Environmental Research 49(1)*, 60-78. doi: 10.1016/S0013-9351(89)80022-2

[28] Reiss, R., Anderson, E.L., Cross, C.E., Hidy, G., Hoel, D., McClellan, R., Moolgavkar, S. (2007). Evidence of Health Impacts of Sulfate-and Nitrate-Containing Particles in Ambient Air. *Inhalation Toxicology, 19(5),* 419-449. doi:10.1080/08958370601174941

and toxicologic evidence provide little or no support for a causal association of sulfate and health risk at ambient concentrations.

**Geological:** Winter season and annual average PM2.5 found in the Valley contains a very small fraction of species that are termed *crustal*, i.e. having their origins in the earth's crust. This coarse fraction—PM 2.5-10—contains a much higher fraction, as do particles beyond the PM10 size category. Suspended dust consists mainly of oxides of aluminum, silicon, calcium, titanium, iron, and other metal oxides. The precise combination of these components depends on the geology, industrial, and agricultural processes of the area. Geological material typically consists of 5% to 15% PM particles.

Other researchers examined the respiratory inflammation potential of PM2.5 soil dust from windblown dust and vehicle-generated particles from unpaved roads, taken from nine different sites in the western U.S.[29] None of the sites were located in the Valley. Cultured human epithelial cells were exposed and then were assessed for their release of cytokines known to be triggered by oxidative stress. PM2.5 from five of the sites was found to be benign, three of the sites demonstrated measurable cytokine response, and PM2.5 from one site was found to be highly reactive. Endotoxin, a potentially reactive bio-aerosol that is often found in PM, was not found to be a contributing factor to the variations in inflammatory potential.

Although not technically a geologic species, respirable road dust (RRD) has been recognized and analyzed as a separate form of PM2.5 that has relevance to exposure characterization. In this context, RRD is defined as PM less than 2.5 microns in diameter that is deposited along paved roadways as a result of roadway breakdown, tire wear, brake wear, deposition of exhaust-related particles, and other anthropogenic sources. Speciation analysis[30] of RRD in southern California identified over 100 organic compounds including n-alkanes, n-alkanoic acids, n-alkenoic acids, n-alkanals, n-alkanols, benzoic acids, benzaldehydes, polyalkylene glycol ethers, PAH, oxy-PAH, steranes, hopanes, natural resins, and other compound classes. This relatively toxic mix of OC species is coincident with a range of metals associated with motor vehicle exhaust and component wear. RRD particles are re-suspended by passing traffic, leaf blowers, and other sources for possible inhalation by individuals in or near the roadway.

To conclude, the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass and, by itself, has relatively low toxicity. RRD, while not of geologic origins, has been reviewed here because of its relevance to subsequent exposure characterization of sources.

[29] Veranth, J., Rielly, C.A., Veranth, M.M., Moss, T.A., Langelier, C.R., Lanza, D.L., & Yost, G.S. (2004). Inflammatory Cytokines and Cell Death in BEAS-2B Lung Cells Treated with Soil Dust, Lipopolysaccharide, and Surface-Modified Particles. *Toxicological Science 82(1)*, 88–96. Retrieved from http://toxsci.oxfordjournals.org/content/82/1/88.full.pdf+html doi: 10.1093/toxsci/kfh24

[30] Rogge, W. F., Hildemann, L. M., Mazurek, M. A., Cass, G. R. and Simoneit, B. R. T. (1993). Sources of Fine Organic Aerosol—3. Road Dust, Tire Debris, and Organometallic Brake Lining Dust—Roads As Sources and Sinks. *Environmental Science & Technology 27(9),* 1892-1904.

### 3.4.3 Particle Size and Deposition

Particle size has a significant bearing on bodily deposition, net exposure, and corresponding health risk, even within the PM2.5 size fraction. Key metrics for deposition assessment include the percentage of inhaled particles that remain deposited and not exhaled (known as the deposition fraction) and the location where particles are deposited within the body).[31] Within the PM2.5 size range, particles less than 0.1 microns (PM 0.1) and greater than 10 microns are least likely to be exhaled, and thus have higher deposition fractions.[32]

The relationship between particle size, zone of deposition, and deposition fraction are depicted in the following figure and is summarized as follows:

- **Nasal, pharyngeal, laryngeal:** The uppermost segment of the respiratory tract is the primary zone of deposition for the smallest and largest particles. Approximately 80% of extremely small particles of one nanometer (0.001 micron) diameter or less are retained here with a comparable deposition fraction in the 10 micron diameter.

- **Tracheobronchial:** The deposition fraction in this zone peaks at nearly 40% for particles with diameters between 1 and 10 nanometers. Almost 100% of the particles above the PM 0.1 size cut are either deposited in the other two deposition zones or exhaled.

- **Alveolar:** Deposition in the gas exchange zone of the lungs peaks in the 10 nanometer size with a gradual dissipation of deposition beyond the PM 0.1 size.

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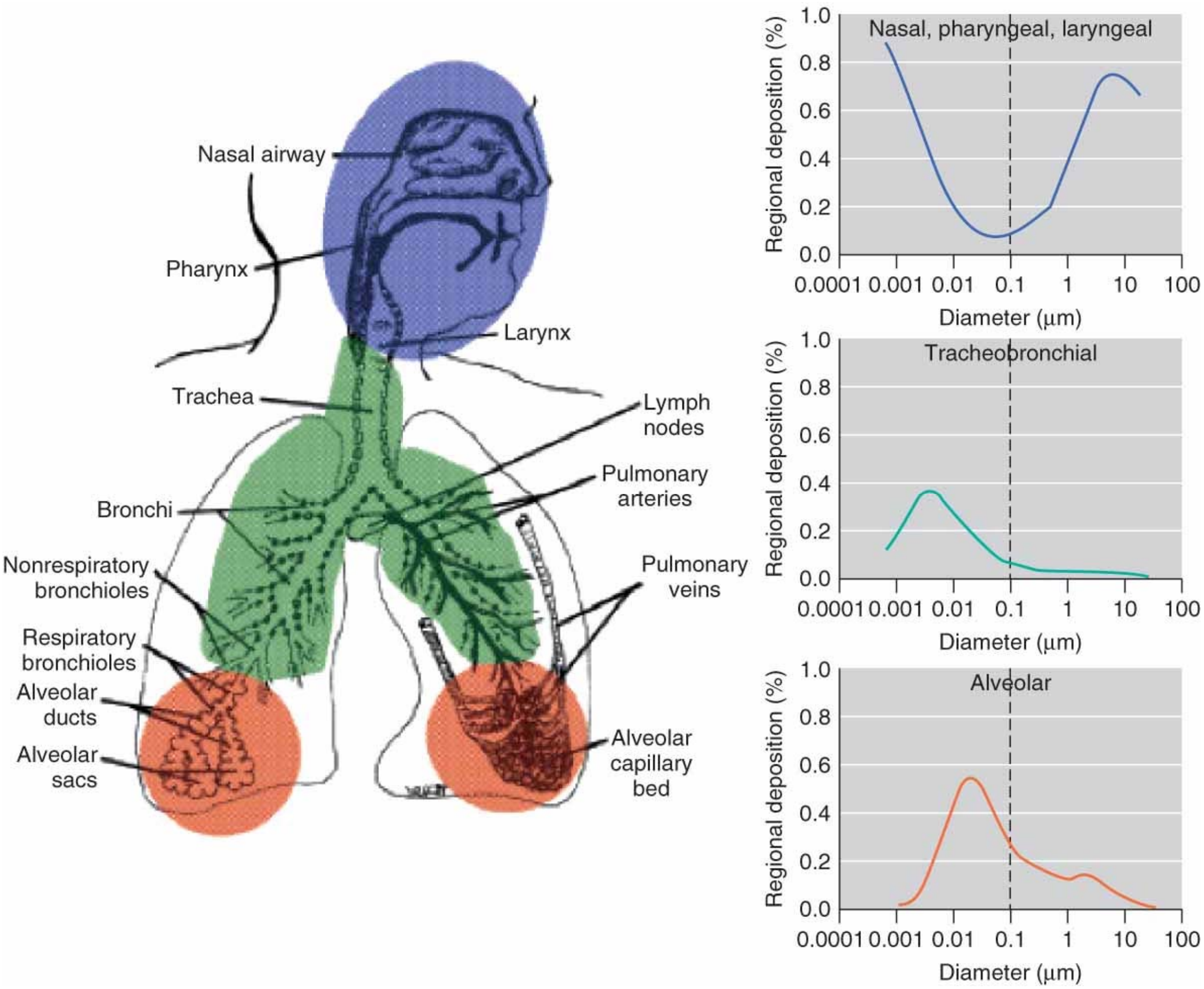
[31] International Commission on Radiological Protection [ICRP]. (1995). Human Respiratory Tract Model for Radiological Protection. ICRP Publication 66.. *Annals of the ICRP 24,* 1–3.
[32] U.S. Environmental Protection Agency [EPA]. (2004, October). *Air Quality Criteria for Particulate Matter: Final Report*. Washington, D.C.: EPA 600/P-99/002aF-bF. Available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=87903

**Figure 3-3 Relationships between Particle Size Distribution and Respiratory Deposition Zones**




Deposition of very small particles in the alveolar region of the lungs results in the delivery of their chemicals into the bloodstream where they promote cardiovascular disruption and immune system sensitization.[33] These chemicals can trigger heart attacks and premature death among individuals with pre-existing heart conditions.[34] Extremely small particles can also be absorbed into the brain via the nasal tract, bypassing the protection provided by the blood-brain barrier.[35] The effects of particles deposited primarily in the tracheobronchial region center on respiratory function.[36]

[33] Delfino, R.J., Sioutas, C., & Malik, S. (2005). Potential Role of Ultrafine Particles in Associations between Airborne Particle Mass and Cardiovascular Health. *Environmental Health Perspectives 113(8),* 934–946. Retrieved from http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.7938

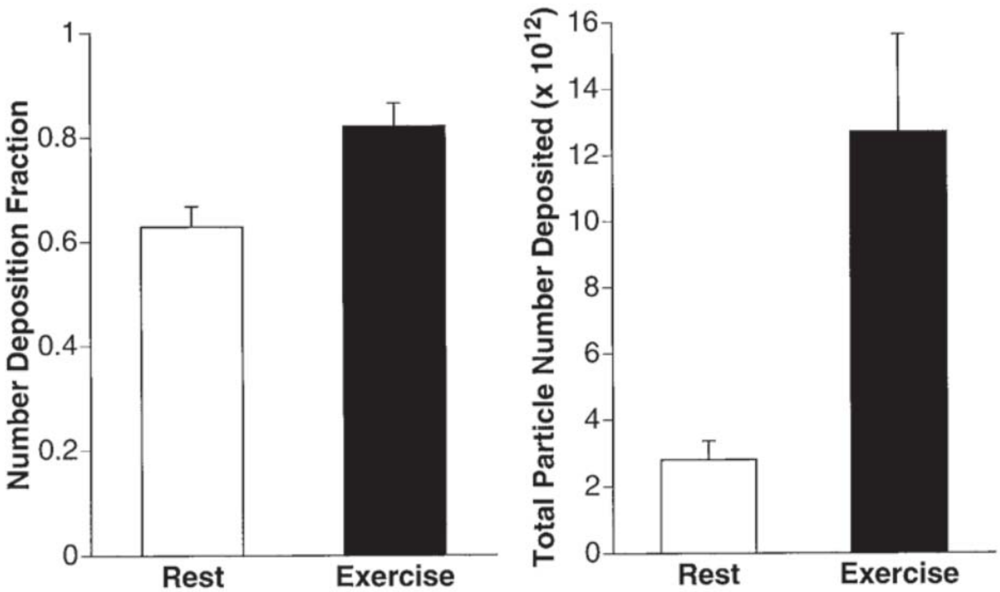
[34] Nel A. (2005). Air Pollution-Related Illness: Effects of Particles. *Science, 308(5723),* 804–806. doi: 10.1126/science.1108752

[35] Oberdorster, G., Sharp, Z., Atudorei, V., Elder, A., Gelein, R., Kreyling, W., & Cox, C. (2004). Translocation of Inhaled Ultrafine Particles to the Brain. *Inhalation Toxicology, 16(6-7)*, 437–445.

[36] U.S. Environmental Protection Agency [EPA]. (2009). *Integrated Science Assessment for Particulate Matter: Final Report*. Washington, D.C.: EPA/600/R-08/139F. Available at http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=216546

As depicted in Figure 3-4, particle deposition and associated health risk is magnified by exercise in several ways. First, the amount of inhaled air per minute rises substantially when breathing faster and more deeply. Second, breathing harder means that particles, especially PM 0.1, are more likely to penetrate the alveolar region of the lungs where absorption into the bloodstream occurs. A 2003 study[37] found that during moderate exercise 80% of inhaled PM 0.1 was deposited in the lungs, compared with 60% lung retention while at rest (see left panel in Figure 3-4). However, because the volume of air exchanged per minute increases substantially during exercise, overall PM 0.1 deposition increased by 450% (right panel). This phenomenon underscores the health risk posed to individuals who work or exercise in areas where sources of hydrocarbon combustion result in very high PM 0.1 particle concentrations.

**Figure 3-4 Particle Number Deposition Fraction (DF) and Total Particle Deposition of PM0.1 at Rest and Exercise**




### 3.4.4 Exposure to Ultrafine Particles (PM 0.1)

Elevated exposure to freshly emitted PM 0.1 is a critical health risk factor that often does not correspond to ambient PM2.5 concentrations at local monitors. PM 0.1 are formed through nucleation and gas-to-particle reactions and grow (or shrink) through a number of mechanisms including condensation, coagulation, and volatilization.[38] High concentrations of primary (directly emitted) PM 0.1 are typically found near fresh sources of hydrocarbon combustion, including coal plants, charbroiled meat, diesel and gasoline vehicles, wood combustion, and lawn care equipment. These combustion

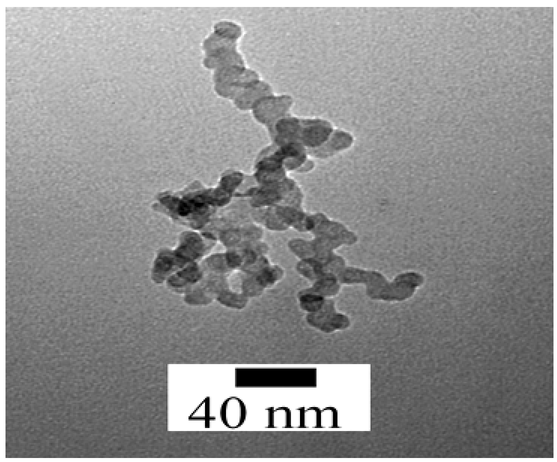
[37] Daigle, C., Chalupa, D.C., Gibb, F.R., Morrow, P.E., Oberdörster, G., Utell, M.J., & Frampton, M.W. (2003). Ultrafine Particle Deposition in Humans during Rest and Exercise. *Inhalation Toxicology, 15(6)*, 539–552. doi: 10.1080/08958370304468

[38] Solomon, P. (2012). An Overview of Ultrafine Particles in Ambient Air. *EM: Journal of the Air & Waste Management Association, May,* 18–26.

particles start out very small, grow larger over time and space, and evolve chemically at the same time. Secondary PM 0.1 typically is formed via particle nucleation from gas or liquids and is characterized by larger geographic scales and more uniform population exposure.

Despite being extremely small, PM 0.1 has an extremely high surface area, as seen in Figure 3-5. Compared to an equal mass of particles of two microns (PM 2.0) in diameter, ultrafine particles that are 1,000 times smaller (20 nanometers or PM 0.02) nonetheless have 125 times the surface area.[39] In addition, PM 0.1 produced by hydrocarbon combustion typically contain a rich mixture of chemicals with potential health effects, including nickel, iron, vanadium, PAH, and others.[40] Chemical potency, very high surface area, and alveolar deposition are signal characteristics of PM 0.1 from hydrocarbon combustion that result in significant health risks from chronic exposure.

**Figure 3-5 Electron Micrograph of an Ultrafine Particle**[41]




Sub-populations who live or work near sources of primary PM 0.1 from hydrocarbon combustion are particularly at risk. Health scientists have generated an overwhelming body of epidemiological (statistical) evidence that individuals near freeways (less than 300 meters) are being harmed via chronic inhalation of PM 0.1 from vehicles.[42] Similarly, a 2011 study of residential wood burning in Cambria, California found very high neighborhood concentrations of PM 0.1 from wood smoke even though concentrations of PM2.5 at the nearby ambient monitor met the federal health

[39] Donaldson, K., Stone, V., Clouter, A., Renwick, L., & MacNee W. (2001). Ultrafine Particles. *Occupational Environmental Medicine 58*, 211–216.Retrieved from http://oem.bmj.com/content/58/3/211.short doi: 10.1136/oem.58.3.21

[40] Morawska, L., Ristovski, Z., & Jayaratne, E.R. (2008). Ambient Nano and Ultrafine Particles from Motor Vehicle Emissions: Characteristics, Ambient Processing and Implications on Human Exposure. *Atmospheric Environment, 42(35)*, 8113–8138. doi: 10.1016/j.atmosenv.2008.07.050

[41] Nel A. (2005). Air Pollution-Related Illness: Effects of Particles. *Science, 308(5723),* 804–806. doi: 10.1126/science.1108752

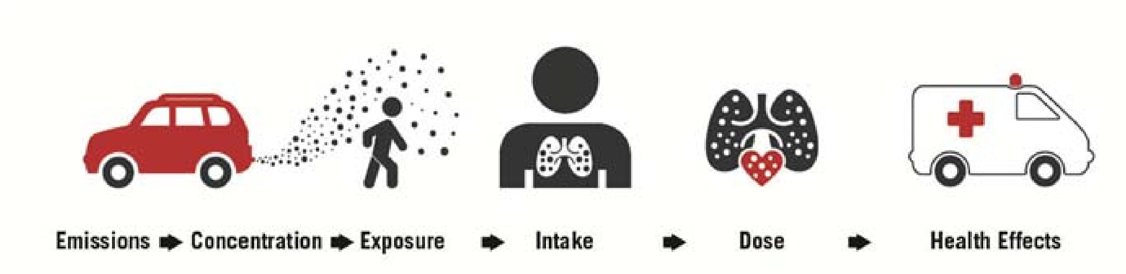
[42] Gauderman, W., Vora, H., McConnell, R., Berhane, K., Gilliland, F., Thomas, … Peters, J. (2007). Effect of Exposure to Traffic on Lung Development from 10 to 18 Years of Age: A Cohort Study. *The Lancet 369*(*9561*), 571–577. Retrieved from http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)60037-3/fulltext#article_upsell

standard.[43] The health risk from fresh sources of PM 0.1 has important environmental justice implications to the extent that elevated exposure to near-source PM 0.1 is concentrated in communities that already face sources of risk related to race or socioeconomic status.[44] Chronic exposure to near-source PM 0.1 commonly occurs in locations where local monitors are in attainment for PM2.5 standards and during seasons when ambient PM2.5 concentrations are below the annual daily standard.

### 3.4.5 Population Proximity and Intake Fraction

Estimating total exposure and net health risk from a given source of PM2.5 requires that population proximity and population density be considered in addition to the source's contribution to the regional PM2.5 emissions inventory and its toxicity. In addition to factors governing net deposition of inhaled particles reviewed above, net population exposure from the source in question is also shaped by the number of exposed individuals who inhale the emissions and the duration of exposure in conjunction with aerosol concentration levels (see Figure 3-6). Known as the intake fraction, this measure of population exposure is defined empirically as the pollutant mass inhaled divided by the mass emitted.[45] Intake fraction is useful in connecting emissions to health risk because the mass inhaled is a better indicator of health risk than the mass emitted or airborne concentration. Two different pollutant sources with very comparable emission rates of the same pollutant can nonetheless have significantly different intake fractions depending on the surrounding population density. For example, sources of PM2.5 located in rural areas may have an intake fraction that is 10 to 100 times smaller than a comparable source located within a densely populated city.

**Figure 3-6 Simplified Intake Fraction Model**




The relevance of the intake fraction concept can be seen in a recent study of neighborhood variability in wood smoke concentrations in Cambria, California.[46] The

[43] Thatcher, T. & Kirchstetter, T. (2011). *Assessing Near-Field Exposures from Distributed Residential Wood Smoke Combustion Sources*. Report prepared for the California Air Resources Board. Retrieved from http://www.arb.ca.gov/research/rsc/10-28-11/item2dfr07-308.pdf

[44] London, J., Huang, G., & Zagofsky, T. (2011). *Land of Risk, Land of Opportunity: Cumulative Environmental Vulnerabilities in California's San Joaquin Valley*. Davis, CA: University of California, Davis, Center for Regional Change. Retrieved from http://regionalchange.ucdavis.edu/publications/Report_Land_of_Risk_Land_of_Opportunity.pdf

[45] Marshall, J.D., & Nazaroff, W.W. (2004, October). *Using Intake Fraction to Guide ARB Policy Choices: The Case of Particulate Matter*. Unpublished California Air Resources Board Report.

[46] Thatcher, T. & Kirchstetter, T. (2011). *Assessing Near-Field Exposures from Distributed Residential Wood Smoke Combustion Sources*. Report prepared for the California Air Resources Board. Retrieved from http://www.arb.ca.gov/research/rsc/10-28-11/item2dfr07-308.pdf

winter study found very high concentrations of PM 0.1 on a neighborhood scale that were often not reflected in PM2.5 concentrations measured by local air quality monitors. In effect, a single wood-burning household had the effect of enveloping the adjacent and downwind homes with a PM 0.1 plume. Furthermore, the study also found that wood smoke PM 0.1 was infiltrating adjacent homes that were not burning, with an average indoor concentration found to be 74% as high as immediately outside the homes. Taking into consideration the length of PM 0.1 inhalation during sleeping hours, the relatively high concentration of PM 0.1 found in the plume, and the number affected of individuals in an urban neighborhood, the intake fraction resulting from the source of the wood smoke would be very high. Assuming that this nightly exposure occurred over the course of a season, the cumulative health risk to the neighborhood would be considerable and would almost certainly exceed the risk indicated by daily concentrations of PM2.5 measured by ambient monitors.

## 3.5 HEALTH BENEFITS ACHIEVED BY REDUCING PM2.5 EMISSIONS

Understanding the results of any HRRS strategy is critical to assessing the overall value and success of that strategy. Over the course of the past decade, ongoing progress in the fields of epidemiology and geographic information systems (GIS) have resulted in the development of computer models that are capable of estimating the health benefits of improved air quality with reasonable accuracy when properly applied. These models estimate the number of avoided cases of certain diseases and other health impairment categories, known as health endpoints, which result from a specified reduction in exposure to criteria air pollutants.

EPA developed a sophisticated computer software model called BenMAP that is well-suited for estimating health benefits and that can therefore be employed in order to estimate the annual reductions in morbidity (disease) and mortality (premature death) attributable to improved air quality due. As the District continues to develop air quality attainment plans in future years to address the increasingly stringent NAAQS, the District will evaluate health benefits for Valley residents resulting from adopted air quality attainment plans.

# Chapter 4

Classification and Attainment

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Chapter 4: Classification and Attainment

Until the exceptional weather conditions experienced due to the recent drought, the San Joaquin Valley (Valley) was on track to attain the 1997 annual PM2.5 standard before the federally mandated deadline of December 2014. As discussed earlier in Chapter 1 and Appendix F, the Valley was on the verge of attaining the 1997 federal PM2.5 national ambient air quality standard (15 $\mu g/m^3$ for annual, 65 $\mu g/m^3$ for 24-hour) with an average annual concentration of 14.7 $\mu g/m^3$ and average 24-hour concentration of 56.4 $\mu g/m^3$ in 2012 at the Valley's historic peak PM2.5 sites in Bakersfield. The San Joaquin Valley Air Pollution Control District's (District's) *2008 PM2.5 Plan* satisfied all federal implementation requirements for the 1997 PM2.5 standard at the time of adoption and demonstrated attainment based on projected 2012-2014 PM2.5 levels. All emission reduction commitments under that plan have been fulfilled. Due to the extreme drought, stagnation, strong inversions, and historically dry conditions experienced over the winter of 2013-2014, analysis showed that the Valley could not reach attainment even if the Valley experienced zero PM2.5 pollution for the last three quarters of 2014. Since the U.S. Environmental Protection Agency's (EPA) policy does not allow for drought and stagnation to qualify as "exceptional events" under the Clean Air Act, the District was left with no choice but to request a bump-up in classification from Moderate nonattainment to Serious nonattainment, which was finalized for approval by EPA on April 7, 2015.

## 4.1 REQUEST FOR ATTAINMENT EXTENSION

As a Serious nonattainment area, the Valley would have until December 31, 2015 to attain the 1997 PM2.5 national ambient air quality standards (NAAQS) as determined using air monitoring data collected in calendar years 2013 through 2015.[1] Under federal Clean Air Act (CAA) Title 1, Part D, Subpart 4 (Subpart 4) Section (§) 188(e), upon application by any State, the EPA may grant one extension of the attainment date of up to five years for a Serious nonattainment area beyond the date specified under CAA §188(c)(2). To be granted an extension, an area must show that it cannot attain by December 2015, but will attain as expeditiously as possible and no later than 2020.

In this plan, the District requests a one-time extension of the attainment deadline for the 24-hour standard to 2018 and the annual standard to 2020, based on the following findings:

### 4.1.1 Attainment by the December 31, 2015 Deadline is Impracticable

Design values (DV) represent the official metric for assessing air quality improvements and attainment of the NAAQS per the federal CAA and EPA regulations. Design value calculations are three-year averages that follow EPA protocols for rounding, averaging conventions, data completeness, sampling frequency, data substitutions, and data validity. The results provide consistency and transparency to determine basin-wide

[1] U.S. Environmental Protection Agency (2012, March 2). Memorandum from the Office of Air Quality Planning and Standards: Implementation Guidance for the 2006 24-Hour Fine Particle (PM2.5) National Ambient Air Quality Standards (NAAQS). Pages 14-15. Retrieved from http://www.epa.gov/ttn/naaqs/pm/pdfs/20120302_implement_guidance_24-hr_pm2.5_naaqs.pdf

attainment for both components of the 1997 PM2.5 NAAQS, including the 24-hour PM2.5 standard of 65 µg/m³ and the annual PM2.5 standard of 15.0 µg/m³. If any monitoring site within the air basin has either a 24-hour or annual PM2.5 design value higher than the respective standard, then the entire air basin is designated nonattainment. EPA provides detailed guidelines and standards for the calculation[2] and data handling[3] methodologies.

For the Valley to attain the 1997 NAAQS for the years 2013-2015, the monitoring data for this period would need to satisfy both the 24-hour average and annual average attainment tests, which are based on 98th percentile values and calendar year averages, respectively. Since the PM2.5 monitoring data during this period was heavily influenced by the extreme drought conditions, long periods of stagnation, and strong inversions experienced during the winter of 2013-2014, as described in more detail below, the Valley cannot demonstrate attainment of either component of the 1997 NAAQS by December 2015.

**Meteorology during the Winter Season of 2013-2014**

In 2013, California experienced record-low precipitation and snow pack levels at only 20 percent of the normal amount of snow to provide water for the year. Specifically, in the Valley, 2013 represented the driest year since the start of record keeping in 1895.

Extreme weather conditions over the winter of 2013-2014 overwhelmed emissions controls and led to abnormally high PM2.5 levels. Because of this, attainment of the 1997 annual and 24-hour PM2.5 standards based on 2012-2014 data is impossible. Furthermore, reclassification to Serious will not initially provide an attainment deadline that the Valley can meet, since the Serious deadline is based on 2013-2015 data, which is also heavily affected by the high PM2.5 values recorded during the winter period of 2013-2014.

Stable meteorology during the winter season can increase PM2.5 concentrations to high levels by providing strong temperature inversions and low wind speeds (see Chapter 2). When this occurs, the PM2.5 concentrations during the winter months of November to February can climb to very high levels. The winter of 2013-2014 experienced the strongest average atmospheric stability over the last 15 years creating conducive conditions for the formation and retention of high PM2.5 concentrations. This was the result of a persistent strong high pressure over the eastern Pacific that effectively blocked weather disturbances from entering California, which inhibited dispersion during November, December, and January.

In addition to the historically strong atmospheric stability, the winter of 2013-2014 also experienced record low precipitation totals, with some locations breaking records over 100 years old. These unprecedented dry conditions exacerbated the air quality

[2] Interpretation of the National Ambient Air Quality Standards for PM2.5, 40 C.F.R. Pt. 50 Appendix N (2012). Available at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=9bdb7a34dcb75892aef9ee60b74da642&rgn=div9&view=text&node=40:2.0.1.1.1.0.1.18.15&idno=40

[3] Environmental Protection Agency [EPA]: Office of Air Quality Planning and Standards. (1999, April). *Guideline on Data Handling Conventions for the PM NAAQS* (EPA-454/R-99-008). Retrieved from http://www.epa.gov/ttn/oarpg/t1/memoranda/pmfinal.pdf

challenge during the winter of 2013-2014. As a result of the extreme meteorology, the PM2.5 concentrations experienced in the Valley were the highest recorded in over a decade.

**1997 Annual PM2.5 NAAQS**

As background, the 1997 annual average PM2.5 standard was set at 15.0 μg/$m^3$. The design value (DV) for the annual PM2.5 standard, which is the official EPA metric used to determine whether an area is in attainment of a standard, is defined as the 3-year average of annual averages over three consecutive years. Each individual annual average is calculated as the average among the four quarterly averages throughout the year. For example, the 2015 design value would be calculated as the average among the annual averages for the years 2013, 2014, and 2015, where the average of each of these individual years is calculated as the average among their respective quarterly averages. If the final annual average DV for all of the regulatory PM2.5 monitoring sites for the 3-year period is less than or equal to 15.0 μg/$m^3$, then the area would be in attainment of the standard.

Because both 2013 and 2014 PM2.5 concentrations were influenced by the extreme weather of the 2013-14 winter season, the 2015 annual averages would have to be improbably low in the southern portion of the Valley in order for the 2013-2015 period to satisfy the annual average attainment test. To show this improbability, the District determined the maximum annual PM2.5 average needed in 2015 to bring each air quality monitoring site into attainment during the 2013-2015 period. This determination was made by first estimating the 2014 values with the best available information. On January 16, 2015 the District pulled data from the EPA Air Quality System (AQS) to estimate the 2014 values. Most values in the “2014 Estimated” column of Table 4-1 were determined using 2014 AQS data when available, and preliminary data was used for the remainder of the year. Sites marked with an asterisk were calculated using 4$^{th}$ Quarter 2013 PM2.5 Data because 4$^{th}$ Quarter 2014 filter data was unavailable at the time of this *2015 PM2.5 Plan*. The maximum annual PM2.5 average in 2015 needed to bring each site into attainment during the 2013-2015 period was then subsequently calculated. These results are displayed in Table 4-1.

The sites in Hanford, Visalia-Church, and Bakersfield-California would all have to have a 2015 annual average under 10 μg/$m^3$ (historical data demonstrates that the Valley is not likely to achieve these annual averages). With the 2013 and 2014 PM2.5 data from Bakersfield-Planz, the site is already out of attainment of the annual standard, without including the 2015 data. Based on this impossibility, the Valley cannot reach attainment of the annual average portion of the 1997 PM2.5 standard during the 2013-2015 period. This demonstrates the long reaching ramifications that one season of unusually high values due to the extreme weather can have on a region’s ability to reach attainment.

**Table 4-1 Maximum Allowable PM2.5 Annual Averages Needed in 2015 to Reach Attainment of Annual Standard in 2013-2015**

| Site | 2013 Measured Actuals | 2014 Estimated | 2015 Max Allowable for Attainment |
|---|---|---|---|
| Stockton-Hazelton | 17.7 | 12.3 | 15.0 |
| Manteca | 11.6 | 9.9 | 23.5 |
| Modesto | 14.3 | 11.6 | 19.1 |
| Turlock | 15.0 | 12.6 | 17.4 |
| Merced-M* | 13.5 | 13.6 | 17.9 |
| Merced-Coffee | 13.3 | 10.9 | 20.8 |
| Madera-City | 17.8 | 14.2 | 13.0 |
| Clovis | 15.9 | 15.3 | 13.8 |
| Fresno-Garland | 16.8 | 15.3 | 12.9 |
| Fresno-Winery* | 15.9 | 16.8 | 12.3 |
| Tranquility | 8.3 | 7.9 | 28.8 |
| Corcoran* | 15.6 | 16.6 | 12.8 |
| Hanford | 18.2 | 17.2 | 9.6 |
| Visalia-Church | 18.9 | 16.7 | 9.4 |
| Bakersfield-California | 20.0 | 17.9 | 7.1 |
| Bakersfield-Planz* | 22.8 | 24.6 | **-2.4** |

*Calculated using 4$^{th}$ Quarter 2013 PM2.5 Data, 2014 4$^{th}$ Quarter filter data unavailable at this time.
All other sites, used 2014 AQS data when available, preliminary data was used for the remainder of the year.

### 1997 24-Hour PM2.5 NAAQS

The 1997 24-hour average PM2.5 standard was set at 65 µg/m$^3$. The DV for the 24-hour average PM2.5 standard, is defined as the 3-year average of annual 98$^{th}$ percentile values over three consecutive years. Each individual annual 98$^{th}$ percentile value is calculated by ranking the 24-hour average values within a year and selecting the value corresponding with the 98$^{th}$ percentile. The 98$^{th}$ percentile values for each individual year over the 3-year period are averaged to produce the final DV. For example, the 2015 design value would be calculated as the average among the 98$^{th}$ percentile values for the years 2013, 2014, and 2015. If the final annual average DV for all of the regulatory PM2.5 monitoring sites for the 3-year period is less than or equal to 65 µg/m$^3$, then the area would be in attainment of the standard.

The maximum 98$^{th}$ percentile 24-hour average PM2.5 concentrations in 2015 needed to bring each air quality monitoring site into attainment during the 2013-2015 period were calculated using a methodology similar to that discussed above. First, the 2014 values were estimated using data pulled from the EPA AQS on January 16, 2015. Most values in the “2014 Estimated” column of Table 4-2 were determined using 2014 AQS data when available, and preliminary data was used for the remainder of the year. Sites marked with an asterisk were calculated using 4$^{th}$ Quarter 2013 PM2.5 Data because 4$^{th}$ Quarter 2014 filter data was unavailable at the time of this *2015 PM2.5 Plan*. The maximum 98$^{th}$ percentile 24-hour average PM2.5 concentrations in 2015 need to bring each site into attainment during the 2013-2015 period was then subsequently calculated. Refer to Table 4-2 for the results of this analysis.

As with the annual average data, because both 2013 and 2014 were influenced by the extreme weather of 2013-2014, the 2015 averages would have to be improbably low in the southern portion of the Valley. The Bakersfield-Planz air monitoring site would need to have a 98th percentile 24-hour PM2.5 concentration of 15.9 µg/m$^3$ for 2015 to show attainment for the three year average. Historical data demonstrates that the Valley is extremely unlikely to achieve these averages for 2015. Based on this impossibility, the Valley cannot reach attainment of the 24-hour average portion of the 1997 PM2.5 standard during the 2013-2015 period.

**Table 4-2 Maximum Allowable 98th Percentile 24-Hour Average PM2.5 Concentrations Needed in 2015 to Reach Attainment of 24-Hour Standard**

| Site | 2013 Measured Actuals | 2014 Estimated | 2015 Max Allowable for Attainment |
|---|---|---|---|
| Stockton-Hazelton | 56.3 | 44.5 | 95.4 |
| Manteca | 40.2 | 40.0 | 116.0 |
| Modesto | 56.4 | 49.5 | 90.3 |
| Turlock | 55.4 | 51.0 | 89.8 |
| Merced-M* | 67.3 | 57.2 | 71.7 |
| Merced-Coffee | 42.3 | 43.9 | 110.0 |
| Madera-City | 54.6 | 56.1 | 85.5 |
| Clovis | 56.2 | 59.0 | 81.0 |
| Fresno-Garland | 63.8 | 65.5 | 66.9 |
| Fresno-Winery* | 71.6 | 71.6 | 53.0 |
| Tranquility | 35.7 | 31.2 | 129.3 |
| Corcoran* | 66.0 | 71.0 | 59.2 |
| Hanford | 67.6 | 82.0 | 46.6 |
| Visalia-Church | 62.5 | 74.0 | 59.7 |
| Bakersfield-California | 71.8 | 80.0 | 44.4 |
| Bakersfield-Planz* | 96.7 | 83.6 | **15.9** |

*Calculated using 4th Quarter 2013 PM2.5 Data, 2014 4th Quarter filter data unavailable at this time.
All other sites used 2014 AQS data when available, preliminary data was used for the remainder of the year.

### 4.1.2 All Requirements and Commitments in the Implementation Plan Have Been Met

As detailed in Chapter 6, the District has met or exceeded all requirements contained in the *2008 PM2.5 Plan* and the emissions reductions achieved exceed the emission reduction commitments in the plan.

ARB has also met or exceeded all requirements and emission reduction commitments contained in the *2008 PM2.5 Plan,* and a detailed description will be included in ARB's supporting documentation for the plan's adoption by ARB, scheduled in May.

### 4.1.3 The *2015 PM2.5 Plan* Contains Best Available Control Measures (BACM)

Chapter 5 and Appendix C contain detailed analyses of all potential measures for all source categories consistent with federal guidance and past precedents. Going beyond applicable federal requirements, this analysis even examined the application of BACM to source categories that were found to be below federal de minimis thresholds. This analysis indicates that the District meets or exceeds BACM requirements for all source categories.

### 4.1.4 The *2015 PM2.5 Plan* Contains Most Stringent Measures (MSM)

Chapter 5 and Appendix C contain detailed analyses of all potential measures for all source categories consistent with federal guidance and past precedents. Going beyond applicable federal requirements, this analysis even examined the application of MSM to source categories that were found to be below federal de minimis thresholds. This analysis indicates that the District meet or exceeds MSM requirements for all source categories.

### 4.1.5 The *2015 PM2.5 Plan* Includes a Demonstration of Attainment by the Most Expeditious Alternative Date Practicable

Attaining federal health-based air quality standards is an important milestone for improving public health. As detailed in Appendix F, this *2015 PM2.5 Plan* demonstrates that the Valley will attain the federal 1997 PM2.5 standard as expeditiously as possible, with all feasible measures and strategies being implemented to accomplish this goal. Through ongoing implementation of the control strategy contained in the *2015 PM2.5 Plan*, the Valley will come into attainment of the 24-hour standard by 2018, and the annual standard by 2020.

**The Role of NOx Reductions in Assisting Valley Reach Attainment**
Given the significant contribution of ammonium nitrate to the Valley's PM2.5 concentrations, reductions in NOx emissions are particularly important. To achieve the NOx reductions critical for reaching attainment in the Valley, ARB has adopted regulations that will significantly reduce NOx emissions from various mobile sources. Achieving this level of emissions reductions requires adequate time and carries a tremendous cost.

The District's "no stone unturned" evaluation of emissions sources and emissions controls demonstrate that the most stringent measures, which includes all reasonably available emission reduction opportunities and best available control measures, are in place in the Valley.

The attainment demonstration for this *2015 PM2.5 Plan* includes the benefits of ARB and District control programs that provide ongoing emission reductions. Continued implementation of these control programs provides new emission reductions each year, resulting in a forecasted 38 percent decrease in NOx emissions and a five percent decrease in PM2.5 emissions between 2012 and 2020.

The NOx reductions result from ongoing implementation of both new vehicle standards for passenger and heavy-duty diesel vehicles and equipment, as well as rules accelerating the turnover of legacy diesel fleets. Implementation of stringent requirements for new off-road engines and in-use off road equipment lead to further NOx reductions, along with District rules addressing stationary source NOx emissions. PM2.5 emission reductions result from ongoing implementation of diesel on- and off-road equipment measures as well as the District's recently strengthened rule for wood-burning fireplaces and heaters.

**Attainment Demonstration Modeling**

The attainment demonstration approach for this *2015 PM2.5 Plan* is based on modeling conducted for the 2008 PM2.5 Plan, which also addressed the 1997 annual and 24-hour PM2.5 standards. The atmospheric dynamics and associated response to emission reductions represented in this modeling, coupled with 2013 design values (DV) and chemical composition, was used to project future (2020 for the annual standard and 2018 for the 24-hour standard) design values.

To assess the representativeness of the 2008 SIP modeling for capturing the dynamics and response to emission reductions for the updated attainment demonstration, ARB evaluated both the meteorological characteristics, as well as the chemical composition used in the two modeling efforts and found that they are very similar. Therefore, the 2008 $PM_{2.5}$ SIP modeling response to emission reduction, applied to 2013 DVs, provides a suitable basis for the updated attainment demonstration.

To ensure consistency with the approved 2008 PM2.5 SIP modeling, the current effort uses a single DV representing 2013 based on ambient measurements during 2011-2013. The base emission year is the middle year of 2012, with future emission years of 2020 for the annual standard attainment demonstration, and 2018 for the 24-hour standard demonstration.

Due to the differences in base years (2005 for the *2008 PM2.5 Plan* vs. 2012 for the *2015 PM2.5 Plan*) and future years (2014 vs. 2018 or 2020), the RRFs calculated for the 2008 modeling cannot be used directly in the current Plan. Thus, the updated modeling uses scaled RRFs presented in the following equation.

$$RRF_{12-20} = \left[1 - (1 - RRF_{05-14}) \times \frac{\%\Delta E_{12-20}}{\%\Delta E_{05-14}}\right]$$

Here,

$$\%\Delta E_{12-20} = \frac{E_{12} - E_{20}}{E_{12}} \times 100\% \; and \; \%\Delta E_{05-14} = \frac{E_{05} - E_{14}}{E_{05}} \times 100\%,$$

where, $E_j$ is the total emissions for a given emissions component for year j ( = 2005, 2012, 2014, and 2020). That is, quantities in the above equation represent percent emissions changes for the current and 2008 Plans. Similarly, $RRF_{i-k}$ represents RRF values for the current (2012-2020) and 2008 Plans (2005-2014).

**Modeling Results**

Eight of the fifteen sites in the Valley recorded 2013 DVs over the annual $PM_{2.5}$ standard of 15 μg/m$^3$. The higher DVs occurred in the Valley's southern region (including the Bakersfield and Visalia as well as Hanford) and the central region (around the Fresno urban area and Madera). Only one site in the northern region (Turlock) measured a 2013 DV over the standard. All sites in the SJV recorded 2013 DVs at or below the 24-hour standard of 65 μg/m$^3$. In 2020, all sites in the Valley are projected to attain the annual standard. For those sites that exceeded the standard, the projected 2020 DVs range from 12.5 μg/m$^3$ to 15.0 μg/m$^3$.

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### Table 4-3 Projected 2020 Annual and 2018 24-hour Design Values

| Monitoring Site | AQS Site ID | Type | Speciation | 2013 Ann. DV[1] | 2020 Ann. DV with Rules[1] | 2013 24-hr DV[2] | 2018 24-hr DV with Rules[2] |
|---|---|---|---|---|---|---|---|
| Bakersfield - California Street | 060290014 | FRM | Bakersfield-California | 16.4 | 13.7 | 64.6 | 51.6 |
| Bakersfield - 410 E Planz | 060290016 | FRM | Bakersfield-California | 17.0[3] | 14.3 | 55.8[3] | 44.9 |
| Clovis - N Villa Avenue | 060195001 | FRM | Fresno-1st | 16.4[4] | 13.3 | 57.6[4] | 45.3 |
| Fresno - 1st Street/Garland[5] | | FRM | Fresno-1st | 15.4[5] | 12.5 | 62.0[5] | 49.3 |
| Fresno - Hamilton and Winery | 060195025 | FRM | Fresno-1st | 14.7 | 12.0 | 63.5 | 50.3 |
| Hanford-S Irwin Street | 060311004 | FEM-BAM | Visalia - N Church | 17.0 | 13.9 | 60.2 | 45.8 |
| Madera | 060392010 | FEM-BAM | Fresno-1st | 18.1 | 15.0 | 52.3 | 41.4 |
| Manteca-530 Fishback Rd | 060772010 | FEM-BAM | Modesto 14th | 10.2 | 8.7 | 36.7 | 32.1 |
| Merced - 2334 M Street | 060472510 | FRM | Modesto 14th | 11.1 | 9.2 | 49.2 | 40.3 |
| Merced – S Coffee Ave | 060470003 | FEM | Modesto 14th | 13.3 | 11.0 | 41.8 | 34.8 |
| Modesto - 14th Street | 060990005 | FRM | Modesto 14th | 13.6 | 11.5 | 50.6 | 42.2 |
| Stockton - Hazelton Street | 060771002 | FRM | Modesto 14th | 13.8 | 12.0 | 45.0 | 39.0 |
| Tranquility | 060192009 | FEM-BAM | Fresno-1st | 7.9 | 6.6 | 30.0 | 23.9 |
| Turlock-S Minaret Street | 060990006 | FEM-BAM | Modesto 14th | 15.7 | 13.2 | 52.7 | 43.8 |
| Visalia - N Church Street | 061072002 | FRM | Visalia - N Church | 16.6 | 13.5 | 55.7 | 42.5 |

1. Design values equal to or less than 15.0 μg/m$^3$ attain the annual $PM_{2.5}$ standard
2. Design values equal to or less than 65.4 μg/m$^3$ attain the 24-hour $PM_{2.5}$ standard
3. Does not include 167.3 μg/m$^3$ measured on May 05, 2013 (supporting documentation provided in Attachment B)
4. Clovis 2013 DV is based on combined FRM/FEM BAM data
5. 2013 DV is based on 2011 data for Fresno-1st (060190011) and 2012/2013 data for Fresno-Garland (060190008)

## 4.2 COMMITMENT TO ACHIEVE EXTRA REDUCTIONS IN EMISSIONS

As discussed earlier, the 2015 PM2.5 Plan contains Most Stringent Measures, Best Available Control Measures, and ensures expeditious attainment. However, the District and the California Air Resources Board are committed to leaving no stone unturned to ensure attainment of this important health-based standard as rapidly as possible. Towards that end, this plan contains commitments for the following additional reductions in emissions:

1. **Replace Heavy Duty Trucks** – Using motor vehicle surcharge funds generated by the District under AB 2522, the District commits to allocating $10,000,000, for the period of 2016 through 2020. These funds will be used towards the replacement of heavy duty trucks in the San Joaquin Valley through the District's truck replacement incentive program, achieving emissions reductions surplus to the State Truck and Bus Regulation.

    a. **Amount of Funding:** $10,000,000; for period of 2016 through 2020
    b. **Number of Trucks Replaced:** 152 - 200
    c. **Surplus Emissions Reductions Achieved:** 0.25 – 0.33 tons NOx/day

2. **Replace Residential Wood burning Devices** – Through the use of locally-generated funding, the District commits to allocating $7,500,000, for the period of 2016 through 2020. These funds will be used towards the replacement of old high polluting residential wood burning devices in the San Joaquin Valley through the District's Burn Cleaner Incentive Program, achieving emissions reductions surplus to District Rule 4901.

    a. **Amount of Funding:** $7,500,000; for period of 2016 through 2020
    b. **Number of Devices Replaced:** 4,000 – 7,500
    c. **Surplus Emissions Reductions Achieved:** 0.1 – 0.4 tons of PM2.5 per day

3. **ARB Commitments for Additional Reductions** – In addition to the above commitments by the District for additional reductions in emissions, ARB has also committed to do their part by committing to provide additional reductions in emissions for sources under their control. ARB staff will propose a commitment on actions for key truck sectors in the Valley to:

    a. Better ensure benefits from the Truck and Bus regulation, and
    b. Pursue opportunities for the replacement of trucks certified to the State's optional low NOx standard.

# Chapter 5

Best Available Control Measures and Most Stringent Measures

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Chapter 5: Best Available Control Measures and Most Stringent Measures

The best available control measures (BACM) and most stringent measures (MSM) analyses conducted for this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan*) are the first such analyses performed for PM2.5 and its precursors in the nation. Maricopa County in Arizona is the only other area that has conducted BACM and MSM demonstrations to comply with federal Clean Air Act (CAA) Title 1, Part D Subpart 4 (Subpart 4) requirements as a Serious PM10 nonattainment area.

PM2.5 and its precursors are already being extensively controlled in the San Joaquin Valley (Valley); every feasible opportunity identified to reduce these emissions is already being implemented as soon as practicable. While the District already implements the most stringent control program in the nation through its existing planning and regulatory efforts, this plan leaves no stone unturned in evaluating additional emissions reductions opportunities that might qualify as BACM and MSM.

## 5.1 BACM DEFINED

As discussed in Chapter 1 of this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan)*, one of the requirements for a Serious nonattainment area attainment plan under CAA Subpart 4 is to demonstrate, "*Provisions to assure that the best available control measures (BACM), including best available control technology (BACT) for stationary sources, for the control of direct PM2.5 and PM2.5 precursors shall be implemented no later than four years after the area is reclassified*."[1] As such, this *2015 PM2.5 Plan* demonstrates that the District's regulatory control measures satisfy the U.S. Environmental Protection Agency (EPA) BACM requirements.

EPA defines a BACM-level of control as:

- The maximum degree of emissions reductions achievable from a source or source category, which is determined on a case-by-case basis considering energy, economic and environmental impacts.[2]
- More stringent than reasonably available control measure (RACM) standards, but less stringent than the lowest achievable emission rate (LAER), which doesn't take into consideration the cost effectiveness of implementing a particular control measure.[3]
- Additive to RACM, as BACM will generally consist of a more extensive implementation of RACM measures (i.e. paving more unpaved roads, strengthening components of a smoke management system (SMS) program, etc.)[4]

[1] Clean Air Act Subpart 4 Section 189(b)(1)(B).
[2] Environmental Protection Agency (EPA). 1994 Addendum to the General Preamble, p. 42010.
[3] EPA. 1994 Addendum to the General Preamble, p. 42010.
[4] EPA. 1994 Addendum to the General Preamble, p. 42013.

- Inclusive of BACT. EPA defines BACT similarly to BACM as an emission limitation based on the, "maximum degree of reduction of each pollutant emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques." BACT is also at least as stringent as new source performance standards (NSPS) and national emissions standards for hazardous air pollutants (NESHAPs).[5]

BACM must be implemented within 4 years after an area is reclassified as Serious nonattainment, with the exception of source categories that EPA has determined do not contribute significantly to exceedances of the federal PM2.5 standards. [6]

## 5.2 MSM DEFINED

As a Serious nonattainment area, the Valley would have until December 31, 2015 to attain the 1997 PM2.5 air quality standards. As demonstrated in Chapter 4 and Appendix A of this *2015 PM2.5 Plan*, the Valley will not attain the standard by December 31, 2015; as such, the District is requesting an extension of the attainment date with this *2015 PM2.5 Plan*. Pursuant to CAA Subpart 4, EPA may grant one extension of the attainment date of up to five years for a Serious nonattainment area, provided certain criteria are met. One of those criteria requires the District to, *"Demonstrate to the satisfaction of the Administrator that the plan for the area includes the most stringent measures (MSM) that are included in the implementation plan of any State, or are achieved in practice in any State, and can feasibly be implemented in the area."* [7] EPA further clarifies that, similarly to BACM, the definition of a MSM is the maximum degree of emission reduction that has been required or achieved from a source or source category in other SIPs or in practice in other states and can be feasibly implemented in the area.[8] Unlike BACM, the CAA does not specify an implementation deadline for MSM; EPA states that all MSM should be implemented as expeditiously as practicable.[9]

## 5.3 BACM/MSM EVALUATION PROCESS

As previously discussed, the Maricopa County PM10 Serious nonattainment area is the only other area in the nation that has conducted a BACM and MSM analysis to comply with Subpart 4 requirements. Within EPA's Technical Support Document (TSD) for

[5] EPA. 1994 Addendum to the General Preamble, p. 42009.
[6] EPA. Proposed Approval and Promulgation of Implementation Plans; Arizona—Maricopa County PM-10 Nonattainment Area; Serious Area Plan for Attainment of the 24-Hour PM-10 Standard and Contingency Measures. 66 FR 50255.
[7] Clean Air Act Subpart 4 Section 189(b)(1)(B).
[8] EPA TSD for Maricopa County PM10 Nonattainment Area. 2001, p. 31.
[9] EPA TSD for Maricopa County PM10 Nonattainment Area. 2001, p. 237.

evaluation of the Maricopa County Serious Area Nonattainment Plan,[10] EPA defined the processes for evaluating whether an attainment plan satisfies BACM and/or MSM requirements. Recognizing the similarity between the BACM and MSM requirements, EPA defines the MSM evaluation process as the same as the BACM evaluation process, but with one additional step, to compare the potential MSM against the measures already adopted in the area to determine if the existing measures are most stringent. The process is as follows:[11]

1. Develop a detailed emissions inventory of PM2.5 sources and source categories (Appendix B).

2. Model to evaluate the impact of various source categories on PM2.5 concentrations over the air quality standard to determine which sources are significant and which sources are de minimis (less than significant) for the purposes of adopting BACM and MSM.

   More source categories should be subject to the MSM analysis than those subject to a BACM analysis by lowering the threshold for what is considered a de minimis source category.[12] What constitutes a de minimis source category for BACM is dependent upon the specific facts of the nonattainment problem under consideration. According to EPA, one means of determining an appropriate de minimis level is to determine if applying MSM to the proposed de minimis source categories would meaningfully expedite attainment. If it does, then the established de minimis level is too high, and if it does not, then the de minimis level is appropriate.

   Section 5.4 presents the calculations for determining the de minimis thresholds for sources of PM2.5, NOx, and SOx emissions.

3. Identify potential BACM and MSM in other implementation plans or used in practice in other states for each significant source category, and for each measure evaluate the technological and economic feasibility for the area, as necessary (Appendix C).

   a. **Technological feasibility**[13] – This analysis determines if the new control can be integrated with the existing controls without reducing or delaying the emission reductions from the existing control. If it cannot, then it would not be considered to be technologically feasible for the area unless the emission benefit of the new measure is substantially greater than the existing measure.

[10] EPA. Technical Support Document (Notice of Proposed Rulemaking on the Serious Area PM-10 State Implementation Plan for the Maricopa County PM-10 Nonattainment Area Provisions for Attaining the 24-Hour Standard and Contingency Measures). (2001, September 14).
[11] EPA Technical Support Document for Maricopa County PM10 Nonattainment Area. 2001, pp. 237-238
[12] EPA. Technical Support Document (Notice of Proposed Rulemaking on the Serious Area PM-10 State Implementation Plan for the Maricopa County PM-10 Nonattainment Area Provisions for Attaining the 24-Hour Standard and Contingency Measures). (2001, September 14).
[13] EPA. Technical Support Document for Maricopa County PM10 Nonattainment Area. 2001, p. 34.

b. **Economic feasibility**[14] – If the potential control is determined to be technologically feasible, it is then evaluated for economic feasibility.

The District has evaluated the economic feasibility of various control measures by conducting cost effectiveness analyses within Appendix C of this *2015 PM2.5 Plan*. 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. Within the Maricopa County TSD, EPA cautions that they have not established a general guide for evaluating when a measure is economically infeasible, but will instead address the issue on a case-by-case basis as needed.

4. Compare potential BACM/MSM for each significant source category against the control measures, if any, already adopted for that source category (Appendix C).

5. Provide for the adoption of any BACM/MSM that is more stringent than existing similar local measures and provide for implementation as expeditiously as practicable or, in lieu of adoption, provide a reasoned justification for rejecting the potential MSM, i.e., why such measures cannot be feasibly implemented in the area (Appendix C).

Using the EPA defined BACM/MSM process above, emission control requirements for stationary and area source categories were evaluated in Appendix C to determine if they satisfy both BACM and MSM requirements or if there are any technologically and economically feasible technologies or practices that could further reduce PM2.5 and precursor emissions for sources in the Valley.

## 5.4 DE MINIMIS THRESHOLD FOR DETERMINING SIGNIFICANT SOURCE CATEGORIES

As described in the previous section, BACM and MSM are required for all categories of sources in Serious nonattainment areas unless the State adequately demonstrates that a particular source category does not contribute significantly to nonattainment of the PM2.5 NAAQS. Using modeling data from this *2015 PM2.5 Plan*, the calculations below were used to quantify the impact of various source categories on PM2.5 concentrations over the federal air quality standards to determine which sources are significant and which sources are de minimis for the purposes of adopting BACM and MSM. The sections below outline the significance determination approach used and summarize which source categories are considered significant based on the de minimis thresholds.

[14] EPA. Technical Support Document for Maricopa County PM10 Nonattainment Area. 2001, p. 34.

### 5.4.1 Significance Determination Approach

#### *5.4.1.1 U.S. EPA Guidance*

For PM2.5 implementation, EPA has directed states to follow guidance that was used to implement the PM10 standard. For the PM10 standard, guidance specifies that sources are considered significant and are required to have BACM and MSM controls if they contribute 1 μg/$m^3$ PM10 out of an annual PM10 standard of 50 μg/$m^3$. Applying this guidance to PM2.5, the PM10 significance ratio is applied to the annual PM2.5 standard to estimate the level considered significant requiring BACM and MSM controls.

$$1\ \mu g/m^3 / 50\ \mu g/m^3 = X\ \mu g/m^3 / 15\ \mu g/m^3$$

$$X = 0.3\ \mu g/m^3$$

PM2.5 is very complex with many species and associated emissions contributing to its formation. A first step is to determine whether an individual species is significant. If a species is determined to be significant, then a de minimis threshold needs to be established for the pollutant.

#### *5.4.1.2 Significant Species*

Available speciation data collected from 2011 through 2013 was used to determine which PM2.5 species are significant. In the Valley, four speciation sites are operated, one each in Bakersfield, Visalia, Fresno and Modesto. The composition for each site was applied to the highest design value in the area related to that speciation site. The highest concentration from all the sites was used to establish the significance level. As shown in Table 5-1, all species are considered significant in relationship to the 0.3 μg/m3 threshold established above.

**Table 5-1 PM2.5 Significance Thresholds (μg/$m^3$)**

| | Bakersfield | Visalia | Clovis | Modesto | Significant level |
|---|---|---|---|---|---|
| 2013 DV | 17.3 | 16.6 | 16.4 | 13.3 | n/a |
| Ammonium Nitrate | 7.1 | 7.6 | 6.4 | 5.0 | 7.6 |
| Ammonium Sulfate | 2.4 | 2.1 | 1.9 | 1.6 | 2.4 |
| Organic Carbon | 4.1 | 4.7 | 5.5 | 4.5 | 5.5 |
| Elemental Carbon | 1.0 | 0.7 | 1.1 | 0.8 | 1.1 |
| Dust | 2.4 | 1.1 | 1.1 | 0.8 | 2.4 |
| Elements | 0.4 | 0.4 | 0.4 | 0.6 | 0.6 |

The next step is to establish a significant emission level for each pollutant associated with the species using the 2012 baseline emission inventory. Any source that exceeds the significance emission level is assumed to contribute 0.3 μg/m$^3$ of PM2.5 and would need to be evaluated for BACM and MSM controls. The equation to establish the significant emission level is as follows:

Significant emissions level = (0.3 μg/m$^3$ / significant level in μg/m$^3$) x Basin-wide 2012 emissions

The above PM2.5 species will be correlated to the following emission inventory categories:

- 5% of organic carbon (OC) will be considered secondary organic aerosols-volatile organic carbon (VOC) emissions
- Am Sulfate-SOx and ammonia emissions
- Am Nitrate-NOx and ammonia emissions
- Dust-directly emitted PM2.5 from dust sources
- Elemental Carbon (EC) + OC & elements-directly emitted PM2.5 combustion emissions

**Sulfur Oxide (SOx) Emissions**
SOx emissions contribute to the formation of ammonium sulfate. Per the equation below, the amount of emissions that cause at least a 0.3 μg/m$^3$ impact on air quality for SOx is 1.0 tpd.

Significant SOx emissions level = (0.3 μg/m$^3$ / 2.4 μg/m$^3$) x 8.1 tpd SOx
= <u>1.0 tpd SOx</u>

**Nitrogen Oxide (NOx) Emissions**
NOx emissions contribute to the formation of ammonium nitrate. Per the equation below, the amount of emissions that cause at least a 0.3 μg/m$^3$ impact on air quality for NOx is 13.1 tpd.

Significant NOx emissions level = (0.3 μg/m$^3$ / 7.6 μg/m$^3$) x 332 tpd NOx
= <u>13.1 tpd NOx</u>

**PM2.5 Emissions**
PM2.5 emissions contribute to the remaining species, dust, OC, EC, and element species. It is appropriate to separate the dust and combustion emissions. Per the equation below, the amount of emissions that cause at least a 0.3 μg/m$^3$ impact on air quality for PM2.5 dust is 4.0 tpd PM2.5 dust emissions. Also, per the equation below, the amount of emissions that cause at least a 0.3 μg/m$^3$ impact on air quality for PM2.5 combustion is 1.4 tpd PM2.5 combustion emissions.

Significant PM2.5 dust level = (0.3 μg/m$^3$ / 2.4 μg/m$^3$) x 32.3 tpd PM2.5 dust
= <u>4.0 tpd PM2.5 dust emissions</u>

Significant PM2.5 combustion level = (0.3 μg/m$^3$ / 7.2 μg/m$^3$) x 33.7 tpd PM2.5 combustion emissions
= <u>1.4 tpd PM2.5 combustion emissions</u>

### 5.4.2 De Minimis Thresholds

Table 5-2 below demonstrates which source categories in the Valley are above and which source categories in the Valley are below de minimis based on the de minimis thresholds calculated above and the emissions inventories presented in Appendix B. There are only six source categories that exceed the de minimis thresholds for PM2.5, NOx, or SOx emissions in the Valley. The CAA does not require a control measure evaluation for the remaining de minimis source categories for the purpose of satisfying BACM/MSM requirements. However, within Appendix C of this *2015 PM2.5 Plan,* the District has still conducted full control measure evaluations for all of the rules and source categories listed in Table 5-2.

**Table 5-2 Valley Source Category De Minimis Determinations (using 2012 data)**

| Source Category | Rule Number (if any) | Emissions of Qualifying Pollutant(s) (tpd) | | | Above de minimis? |
|---|---|---|---|---|---|
| | | PM2.5 | NOx | SOx | |
| **Open Burning** | 4103 | 2.27 | 1.61 | 0.05 | Yes |
| **Reduction of Animal Matter** | 4104 | 0.03 | 0.00 | 0.00 | No |
| **Prescribed Burning and Hazard Reduction Burning** | 4106 | 0.76 | 0.07 | 0.03 | No |
| **Particulate Matter Emissions from the Incineration of Combustible Refuse** | 4203 | 0.00 | 0.00 | 0.00 | No |
| **Cotton Gins** | 4204 | 0.22 | 0.00 | 0.00 | No |
| **Fuel Burning Equipment** | 4301 | N/A | N/A | N/A | N/A |
| **Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr** | 4306/4320 | 1.27 | 1.93 | 0.60 | No |
| **Boilers, Steam Generators, and Process Heaters—2.0 to 5.0 MMBtu/hr** | 4307 | 0.32 | 0.49 | 0.15 | No |
| **Boilers, Steam Generators, and Process Heaters—0.075 to less than 2.0 MMBtu/hr** | 4308 | 0.61 | 0.92 | 0.28 | No |
| **Dryers, Dehydrators, and Ovens** | 4309 | 0.85 | 0.20 | 0.47 | No |
| **Flares** | 4311 | 0.16 | 0.56 | 0.33 | No |
| **Lime Kilns** | 4313 | 0.00 | 0.00 | 0.00 | No |
| **Solid Fuel Fired Boilers, Steam Generators, and Process Heaters** | 4352 | 0.62 | 2.69 | 0.56 | No |
| **Glass Melting Furnaces** | 4354 | 0.33 | 6.04 | 1.96 | Yes |
| **Conservation Management Practices** | 4550 | | | | Yes |

| Source Category | Rule Number (if any) | Emissions of Qualifying Pollutant(s) (tpd) | | | Above de minimis? |
|---|---|---|---|---|---|
| | | PM2.5 | NOx | SOx | |
| • *Tilling Dust* | | 5.17 | 0.00 | 0.00 | |
| • *Harvest Operations Dust* | | 7.28 | 0.00 | 0.00 | |
| • *Dust from Ag Lands (non-pasture)* | | 6.15 | 0.00 | 0.00 | |
| • *Dust from Pasture Lands* | | 1.09 | 0.00 | 0.00 | No |
| **Commercial Charbroiling** | 4692 | 2.84 | 0.00 | 0.00 | Yes |
| **Internal Combustion Engines** | 4702 | 0.49 | 13.06 | 0.12 | No |
| **Stationary Gas Turbines** | 4703 | 1.22 | 3.09 | 0.22 | No |
| **Sulfuric Acid Mist** | 4802 | 0.00 | 0.00 | 0.75 | No |
| **Wood Burning Fireplaces and Wood Burning Heaters** | 4901 | 4.48 | 0.50 | 0.08 | Yes |
| **Residential Water Heaters** | 4902 | 0.21 | 2.21 | 0.06 | No |
| **Natural Gas-Fired, Fan-Type Central Furnaces** | 4905 | 0.20 | 2.46 | 0.06 | No |
| **General Requirements** | 8011 | N/A | N/A | N/A | N/A |
| **Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities** | 8021 | 1.46 | 0.00 | 0.00 | No |
| **Bulk Materials** | 8031 | 0.04 | 0.00 | 0.00 | No |
| **Carryout and Trackout**[15] | 8041 | N/A | N/A | N/A | N/A |
| **Open Areas** | 8051 | 0.34 | 0.00 | 0.00 | No |
| **Paved and Unpaved Roads** | 8061 | 7.59 | 0.00 | 0.00 | Yes |
| **Unpaved Vehicle/Equipment Traffic Areas** | 8071 | 0.59 | 0.00 | 0.00 | No |
| **Agricultural Sources** | 8081 | 1.21 | 0.00 | 0.00 | No |
| **Lawn and Garden Equipment** | SC 001 | 0.04 | 0.58 | 0.00 | No |
| **Energy Efficiency** | SC 002 | N/A | N/A | N/A | N/A |
| **Fireworks** | SC 003 | N/A | N/A | N/A | N/A |
| **Sand and Gravel Operations** | SC 004 | 0.09 | 0.00 | 0.00 | No |
| **Asphalt/Concrete Operations *(Mineral Processes)*** | SC 005 | 0.82 | 0.20 | 0.36 | No |
| **Almond Hulling/Shelling Operations** | SC 006 | 0.38 | 0.00 | 0.00 | No |
| **Pistachio Hulling/Shelling Operations**[16] | SC 007 | N/A | N/A | N/A | N/A |
| **Agricultural Material Screening/Shaking Operations**[17] | SC 008 | N/A | N/A | N/A | N/A |
| **Tub Grinding**[18] | SC 009 | N/A | N/A | N/A | N/A |
| **Abrasive Blasting** | SC 010 | 0.33 | 0.00 | 0.00 | No |

[15] Emissions from Rule 8041 are included in Rule 8061 (Paved and Unpaved Roads).
[16] The emissions inventory for SC 007 (Pistachio Hulling/Shelling Operations) is included as part of the emissions inventory for SC 006 (Almond Hulling/Shelling Operations).
[17] The emissions inventory for SC 008 (Agricultural Material Screening/Shaking Operations) is accounted for in other control measure source categories.
[18] The emissions generated by the engines of the tub grinders are accounted for in the the emissions inventory for Rule 4702 (Internal Combustion Engines). The fugitive particulate emissions from these units are accounted for as a part of the stationary and area inventory.

## 5.5 DISTRICT BACM AND MSM

Based on the analyses conducted in Appendix C, the District currently has in place the Best Available Control Measures and Most Stringent Measures feasible and did not identify any additional technologically feasible and cost effective control measures. Therefore, the District meets or exceeds both BACM and MSM requirements for all stationary and area source categories.

## 5.6 ARB BACM AND MSM

Based on the analysis conducted in Appendix D, ARB did not identify any additional technologically feasible and cost effective control measures that would qualify as BACM or MSM. The ARB currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for mobile source categories.

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# Chapter 6

Demonstration of Federal Requirements

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Chapter 6: Demonstration of Federal Requirements

The federal Clean Air Act (CAA), Title 1, Part D Subpart 1 (Subpart 1) and CAA Title 1, Part D Subpart 4 (Subpart 4) requires California to submit documentation to EPA that is specific to the San Joaquin Valley (Valley) to address the 1997 National Ambient Air Quality Standards (NAAQS) for PM2.5. This *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan)* fulfills requirements for the Valley as an area classified as a Serious nonattainment area under Subpart 4 with an additional request for an extension of the attainment deadline. Attainment of the 1997 PM2.5 NAAQS by the Serious nonattainment deadline (December 31, 2015) is impracticable and pursuant to Subpart 4 Section (§) 188(e) the District is also applying for a one-time extension of the attainment date for up to five years (see Chapter 4).

This chapter demonstrates that this *2015 PM2.5 Plan* satisfies the following federal requirements:

1. Fulfillment of commitments from the District's plan to address the 1997 PM2.5 standard[1]
2. Reasonably Available Control Measures (RACM)[2]
3. Quantitative Milestones which demonstrate Reasonable Further Progress (RFP)[3]
4. Contingency measures[4]
5. Transportation Conformity[5]
6. Serious nonattainment area permitting requirements[6]

## 6.1 FULFILLMENT OF COMMITMENTS FROM THE DISTRICT'S *2008 PM2.5 PLAN*

The State does not have an adopted air quality attainment plan currently in place that addresses Subpart 4 requirements for multiple reasons as discussed in Chapter 1. The adopted plan currently in place to address the 1997 PM2.5 standard is the *2008 PM2.5 Plan,*[7] approved by EPA in November 2011.[8] The District and the California Air Resources Board (ARB) each committed to specific actions to address the 1997 NAAQS. The following write-up demonstrates that the District commitments included in the *2008 PM2.5 Plan* have been fulfilled. Additionally, ARB has also fulfilled their

[1] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards. 80 Fed. Reg. 7, pp. 1482-1491. (2015, January 12). http://www.gpo.gov/fdsys/pkg/FR-2015-01-12/pdf/2015-00309.pdf
[2] CAA Subpart 1 Section 172(c)(1). PM2.5 Implementation Rule 72 FR 20609-20633.
[3] Federal CAA Subpart 1, Section 172(c)(2). PM2.5 Implementation Rule 72 FR 20633-20642.
[4] Federal CAA Subpart 1, Section 172(c)(9). PM2.5 Implementation Rule 72 FR 20642-20645.
[5] Federal CAA Subpart 1, Section 176. Also, Federal transportation conformity regulations are found in 40 CFR Part 51, subpart T – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. of the Federal Transit Laws. Part 93, subpart A of this chapter was last revised by the EPA in the August 15, 1997 Federal Register.
[6] Federal CAA Subpart 4, Section 189(b)(3).
[7] SJVAPCD. *2008 PM2.5 Plan.* http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm
[8] Approval and Promulgation of Implementation Plans; California; 2008 San Joaquin Valley PM2.5 Plan and 2007 State Strategy; Final Rule, 76 Fed. Reg. 217, pp. 69896-69926. (2011, November 9). (to be codified at 40 CFR Part 50) http://www.gpo.gov/fdsys/pkg/FR-2011-11-09/pdf/2011-27232.pdf

commitments contained in the *2008 PM2.5 Plan,* and a detailed description will be included in ARB's supporting documentation for this plan's adoption by ARB, scheduled in May.

### 6.1.1 District *2008 PM2.5 Plan* Regulatory Commitments

The District committed to amending and/or adopting 13 emission reducing control measures for stationary and area sources within the Valley. The following table summarizes these commitments and the completion date of such commitment.

**Table 6-1 *2008 PM2.5 Plan* Stationary Source Regulatory Commitments**

| 2008 Plan CM# | Measure Name | Amendment/ Adoption Date | Plan Commitment Met? |
|---|---|---|---|
| S-AGR-1 | Open Burning | 05/15/2010 | Yes |
| S-COM-1 | Boilers, Steam Generators and Process Heaters (>5 MMBtu/hr) | 10/16/2008 | Yes |
| S-COM-2 | Boilers, Steam Generators and Process Heaters (2 to 5 MMBtu/hr) | 05/19/2011 | Yes |
| S-COM-3 | Boilers, Steam Generators and Process Heaters (0.075 to <2 MMBtu/hr) | 12/17/2009 | Yes |
| S-COM-5 | Stationary Gas Turbines | 09/20/2007 | Yes |
| S-COM-6 | Reciprocating Internal Combustion Engines | 08/18/2011 | Yes |
| S-COM-7 | Glass Melting Furnaces | 05/19/2011 | Yes |
| S-COM-9 | Residential Water Heaters | 03/19/2009 | Yes |
| S-COM-10 | Natural Gas-Fired, Fan Type Residential Central Furnace | 01/22/2015 | Yes |
| S-COM-14 | Wood Burning Fireplaces and Wood Burning Heaters | 10/16/2008 | Yes |
| S-IND-9 | Commercial Charbroiling | 09/17/2009 | Yes |
| S-IND-21 | Flares | 06/18/2009 | Yes |
| M-TRAN-1 | Employer Based Trip Reduction Programs | 06/20/2013 | Yes |

### 6.1.2 District *2008 PM2.5 Plan* Emission Reduction Commitments

In the *2008 PM2.5 Plan,* the District committed to achieve the total quantity of emission reductions identified in Table 6-2: 8.98 tons NOx/day, 6.7 tons PM2.5/day, and 0.92 tons SOx/day. These emission reductions were to be achieved by the above-mentioned stationary source regulatory commitments, but the commitment can be fulfilled with alternative SIP-creditable methods if necessary.

The analysis to determine if the *2008 PM2.5 Plan* emission reductions commitments were met included the following steps:

1. Comparison of the emission reduction commitments from the *2008 PM2.5 Plan* to the actual emission reductions achieved through prohibitory rule adoption/amendment actions as shown in Table 6-2. In addition to the measures

included in the *2008 PM2.5 Plan* the District adopted amendments to Rule 4901[9] in 2014 that significantly strengthened the rule requirements. These amendments achieved a minimum of 0.5 tpd of directly emitted PM2.5 reductions in 2014 for the two months of wintertime implementation at the end of 2014.

**Table 6-2 Summary Comparison of Plan Commitments to Actual Emission Reductions (Annual Average Emissions (tpd))**

| 2008 Plan CM# | Rule # | Measure/Rule Name | Plan Projected Reductions (tpd) | | | Actual Emission Reductions (tpd) | | |
|---|---|---|---|---|---|---|---|---|
| | | | NOx | PM2.5 | SOx | NOx | PM2.5 | SOx |
| S-AGR-1 | 4103 | Open Burning | 2.65 | 3.49 | 0.14 | 1.87 | 2.91 | 0.05 |
| S-COM-1 | 4306 | Boilers, Steam Generators and Process Heaters (>5 MMBtu/hr) | 1.52 | 0.24 | 0.76 | 3.3 | 0.24 | 3.60 |
| S-COM-2 | 4307 | Boilers, Steam Generators and Process Heaters (2 to 5 MMBtu/hr) (Rule 4307) | 0 | 0 | 0 | 1.2 | 0 | 0 |
| S-COM-3 | 4308 | Boilers, Steam Generators and Process Heaters (0.075 to <2 MMBtu/hr) | 0.55 | 0 | 0 | 2.77 | 0 | 0 |
| S-COM-5 | 4703 | Stationary Gas Turbines | 2.21 | 0 | 0 | 2.20 | 0 | 0 |
| S-COM-7 | 4354 | Glass Melting Furnaces | 1.58 | 0 | 0 | 1.12 | 0 | 0 |
| S-COM-9 | 4902 | Residential Water Heaters | 0.40 | 0 | 0 | 0.50 | 0 | 0 |
| S-COM-14 | 4901 | Wood Burning Fireplaces and Wood Burning Heaters | 0.07 | 0.69 | 0.02 | 0.12 | 2.40 | 0.02 |
| n/a | 4901 | Wood Burning Fireplaces and Wood Burning Heaters (adopted 9/2014) | --- | --- | --- | 0 | 0.5 | 0 |
| S-IND-9 | 4692 | Commercial Charbroiling | 0 | 2.28 | 0 | 0 | 0.02 | 0 |
| M-TRAN-1 | 9410 | Employer Based Trip Reduction Programs | 0 | 0 | 0 | 0.05 | 0 | 0 |
| | | **TOTAL** | **8.98** | **6.7** | **0.92** | **13.13** | **6.07** | **3.67** |

2. Application of trading ratios for direct PM2.5, NOx, and SOx were applied as shown in Table 6-3. According to the Weight of Evidence (WOE) for the development of the plan to address the 1997 PM2.5 Standard, 1 ton of direct PM2.5 reductions is equivalent to 9 tons of NOx reductions (1:9 trading ratio).[10] In addition to the trading ratio developed for the plan to address the 1997 PM2.5 Standard, extensive modeling conducted for the District's *2012 PM2.5 Plan* addressing the 2006 federal PM2.5 standard demonstrated that one ton of direct PM2.5 reductions is equivalent to 4 tons of SOx reductions (1:4 trading ratio).[11]

[9] SJVAPCD. Rule 4901 Final Draft Staff Report. http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2014/September/final/07.pdf
[10] SJVAPCD. 2008 PM2.5 Plan. Appendix H: Weight of Evidence. (2008, April 30) http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm
[11] SJVAPCD. 2012 PM2.5 Plan. Appendix G: Weight of Evidence. (2012, December 20) http://www.valleyair.org/Air_Quality_Plans/PM25Plans2012.htm

These ratios are conservative estimates summarizing the plan as a whole, not reflecting ratios for New Source Review (NSR).

3. Comparison of the *2008 PM2.5 Plan* emission reduction commitment to actual emissions reduced through the District's adopted control strategies (including application of trading ratios for PM2.5 precursors). Overall, the District's adopted control strategies achieve emissions reductions in excess of the PM2.5 emission reduction commitment included in the *2008 PM2.5 Plan*.

**Table 6-3 Demonstration of Sufficient Emissions Reductions (Annual Average)**

| | Pollutant | Emissions Reductions (tpd) | Data reference |
|---|---|---|---|
| | **PM2.5** | | |
| A | *Actual Emissions Reduced* | *6.1* | Table 6-2 |
| B | *Add PM2.5 reductions, traded from SOx* | *0.7* | 1:4 trading ratio |
| C | *Add PM2.5 reductions, traded from NOx* | *0.5* | 1:9 trading ratio |
| D | Total emissions reductions achieved | 7.3 | (A+B+C)=D |
| E | Emissions Reduction Commitment | 6.7 | Table 6-2 |
| F | ***Emission Reduction Commitment met?*** | ***Yes*** | D–E=F |
| | | | |
| | **NOx** | | |
| G | *Actual Emissions Reduced* | *13.1* | Table 6-2 |
| H | *Subtract NOx reductions, trade for PM2.5* | *4.2* | 1:9 trading ratio |
| I | Total emissions reductions achieved | 8.9 | (G–H)=I |
| J | Emissions Reduction Commitment | 8.9 | Table 6-2 |
| K | ***Emission Reduction Commitment met?*** | ***Yes*** | I–J=K |
| | | | |
| | **SOx** | | |
| L | *Actual Emissions Reduced* | *3.7* | Table 6-2 |
| M | *Subtract SOx reductions, trade for PM2.5* | *2.8* | 1:4 trading ratio |
| N | Total emissions reductions achieved | 0.9 | (L–M)=N |
| O | Emissions Reduction Commitment | 0.9 | Table 6-2 |
| P | ***Emission Reduction Commitment met?*** | ***Yes*** | (N–O)=P |

As demonstrated in Table 6-3, the District exceeded its *2008 PM2.5 Plan* emissions reductions commitments. Furthermore, the District also achieved significant SIP-creditable emissions reductions in 2014 that are not included in the above determination, including 1.03 tons NOx/day of emissions reduced through on-site mitigation measures under the Indirect Source Review rule (District Rule 9510), and 14.72 tons NOx/day and 0.56 tons PM2.5/day of emissions reduced through SIP-creditable incentive programs (as documented through District Rule 9610, more information at http://www.valleyair.org/MOP/mop9610_idx.htm).

## 6.2 REASONABLY AVAILABLE CONTROL MEASURES (RACM)

A PM2.5 attainment plan must demonstrate implementation of RACM (reasonably available control measures), summarized as the collection of reasonable emissions reductions that, taken as a group, advance attainment of an air quality standard by at least one year. In other words, 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 Reasonable Further Progress (RFP) 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 2020 emissions levels by 2019 in the Valley.

The majority of NOx emissions reductions are occurring as adopted regulations are fully implemented through fleet turn-over and normal equipment replacement. As demonstrated in Appendix B, 93% of NOx reductions from the 2012 base emission inventory to attainment in 2020 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 2019 and 2020 emissions levels shown in the following table, unused control measures would have to achieve 10.7 tons per day (tpd) of NOx 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 and the most stringent measures possible are currently in place in the Valley. There are no emissions reductions associated with unused regulatory control measures.

**Table 6-4 Emissions Reductions Needed to Advance Attainment by One year**

| Pollutant | 2019 Emissions (tpd) | 2020 Emissions (tpd) | Emissions Reductions Needed to Advance Attainment by One Year (tpd) (2019-2020) |
|---|---|---|---|
| PM2.5 | 62.9 | 62.8 | 0.1 |
| NOx | 217.6 | 206.9 | 10.7 |
| SOx | 7.8 | 7.8 | 0.0 |

RACM are, by definition, reasonable. Although an air quality attainment plan must include a thorough analysis of reasonably available measures, 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:

- **District:** 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.

- **ARB:** all reasonable control measures under ARB's jurisdiction for mobile sources are being implemented. Given the significant emission 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.

- **Metropolitan Planning Organizations (MPOs):** 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.

## 6.3 QUANTITATIVE MILESTONES AND REASONABLE FURTHER PROGRESS (RFP)

CAA Subpart 4 §189(c)(1) requires plans submitted to EPA to contain quantitative milestones which are to be achieved every three years until the area is re-designated attainment and which demonstrate reasonable further progress as defined in §171. CAA Subpart 1 §171(1) defines reasonable further progress (RFP) as incremental emission reductions leading to the attainment date. EPA's interpretation of the RFP requirement for federal PM2.5 standards is "generally linear progress" from the base year to the attainment year, demonstrated at RFP milestone years.[12] "Generally linear progress" is calculated in an exactly linear fashion.

Analyses for this plan demonstrate that 2020 is the most expeditious attainment date practicable for the Valley. The baseline year for this *2015 PM2.5 Plan* is 2012. For the 1997 federal PM2.5 standard, the RFP milestone years are 2014 and 2017.[13] RFP is demonstrated for the nonattainment area as a whole. RFP requirement targets and attainment demonstrations are as follows:

[12] 72 FR 20633, codified at 40 CFR 51 Subpart Z Section 51.1000 (Definitions)
[13] U.S. Environmental Protection Agency (2012, March 2). Memorandum from the Office of Air Quality Planning and Standards: Implementation Guidance for the 2006 24-Hour Fine Particle (PM2.5) National Ambient Air Quality Standards (NAAQS). Page 16. Retrieved from http://www.epa.gov/ttn/naaqs/pm/pdfs/20120302_implement_guidance_24-hr_pm2.5_naaqs.pdf

1. Determine the Emissions Inventory of the Valley with the Plan control strategy for the baseline year, the RFP years, and the attainment year.

**Table 6-5 Emissions Inventory with Plan Control Strategy (tpd)**

| Pollutant | 2012 | 2014 | 2017 | 2020 |
|---|---|---|---|---|
| **Direct PM2.5** (Table B-1) | 66.0 | 63.3 | 62.5 | 62.8 |
| **NOx** (Table B-2) | 332.2 | 284.2 | 235.7 | 206.9 |
| **SOx** (Table B-3) | 8.1 | 7.4 | 7.6 | 7.8 |

2. Determine the total reductions from the 2012 baseline emission inventory that must be achieved to reach attainment.

**Table 6-6 Total Reductions Necessary to Reach Attainment (tpd)**

| Pollutant | 2012 Baseline Emissions Inventory | Attainment Emissions Level | Reductions Needed |
|---|---|---|---|
| Direct PM2.5 | 66.0 | 62.8 | 3.2 |
| NOx | 332.2 | 206.9 | 125.3 |
| SOx | 8.1 | 7.8 | 0.3 |

3. Determine the fraction of reductions that are achieved in each RFP milestone year (as per EPA guidance regarding demonstrating RFP). The base year of 2012 and attainment year of 2020 span an 8-year period.
    - 2014 occurs at year two of eight (2/8), so **25.0%** of the needed emissions reductions should occur by 2014.
    - 2017 occurs at year five of eight (5/8), so **62.5%** of the needed emissions reductions should occur by 2017.

4. Determine the RFP target emissions levels using reduction fractions.

**Table 6-7 Target Emissions Levels for RFP Milestone Years (tpd)**

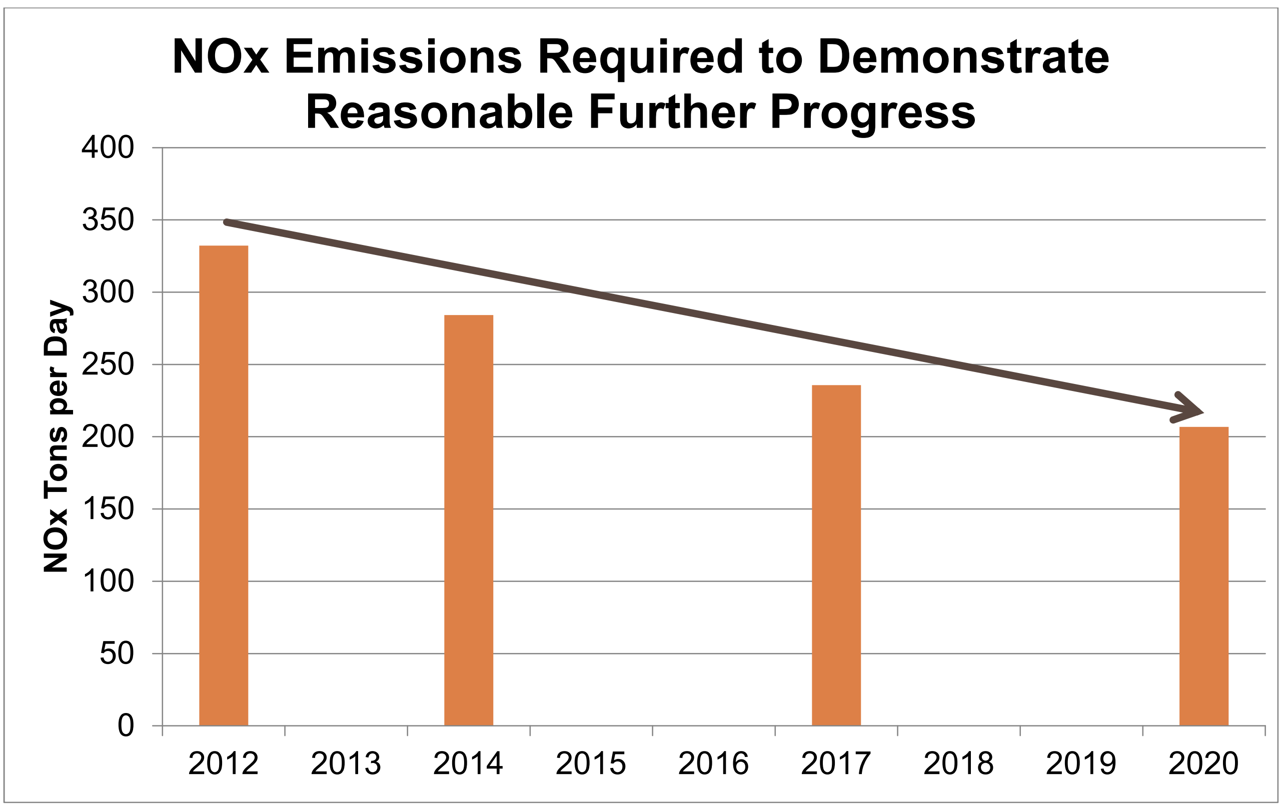
| Pollutant | 2012 Emissions Inventory | Reductions Needed | 2014 | | 2017 | |
|---|---|---|---|---|---|---|
| | | | Tons to be reduced *(B x 25.0%)* | RFP target emissions level *(A-C)* | Tons to be reduced *(B x 62.5%)* | RFP target emissions level *(A-E)* |
| | *A* | *B* | *C* | *D* | *E* | *F* |
| Direct PM2.5 | 66.0 | 3.2 | 0.8 | 65.2 | 2.0 | 64.0 |
| NOx | 332.2 | 125.3 | 31.3 | 300.9 | 78.3 | 253.9 |
| SOx | 8.1 | 0.3 | 0.1 | 8.0 | 0.2 | 7.9 |

5. Compare RFP target emissions level (Table 6-7) to the projected emissions inventory (Table 6-5) to determine compliance with RFP targets.

**Table 6-8 RFP Target Demonstration (2014 and 2017)**

| | 2014 | | | 2017 | | |
|---|---|---|---|---|---|---|
| | RFP target emissions level | Projected emissions inventory | RFP target met? | RFP target emissions level | Projected emissions inventory | RFP target met? |
| Direct PM2.5 | 65.2 | 63.3 | Yes | 64.0 | 62.5 | Yes |
| NOx | 300.9 | 284.2 | Yes | 253.9 | 235.7 | Yes |
| SOx | 8.0 | 7.4 | Yes | 7.9 | 7.6 | Yes |

**Figure 6-1 NOx RFP Demonstration – Linear Progress Toward Attainment**



## 6.4 CONTINGENCY MEASURES

Contingency measures are extra emissions reductions 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 RFP or in the attainment demonstration. Contingency reductions must start occurring automatically, without any further regulatory action, in the following scenarios:

- **RFP contingencies:** Used if planned emissions controls fail to reach the emissions targets specified in the attainment plan for RFP. The need to implement RFP contingencies is based on the emissions inventory in the RFP 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. An area often must adopt a new attainment plan, and sometimes other penalties apply as well, depending on the requirements associated with the standard in question.

The contingency years for this plan are the RFP milestone years (2014 and 2017) and the attainment year (2020). The total emissions reductions available from contingency measures should be equivalent to about one year of reductions needed for RFP[14]. This is based on the overall level of reductions needed to demonstrate attainment (see Table 6-6) divided by the number of years between the base year and the attainment year (8 years). Table 6-9 shows the resulting contingency need for each pollutant.

**Table 6-9 Contingency Emissions Reductions Target (tpd)**

| | Contingency Need = "One year's worth of RFP" |
|---|---|
| Direct PM2.5 | 0.4 |
| NOx | 15.7 |
| SOx | 0.0 |

Interpollutant trading can be used to demonstrate equivalent emissions reductions levels between PM2.5 and NOx reductions strategies. The current modeling using Valley-wide emissions reductions demonstrates that the greatest benefits are achieved from reductions in directly emitted PM2.5, followed by NOx (based on EPA's relative response factor procedures (RRF)). RRF results show that directly emitted PM2.5 emission reductions are approximately nine times more effective than NOx reductions. Refer to Appendix A for the complete analysis and discussion.

[14] 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

### 6.4.1 What Qualifies as a Contingency Measure?

Contingency measures must be fully adopted rules or control measures that are ready to be implemented quickly without significant additional action by the state or local agency or by EPA[15]. The plan should contain trigger mechanisms and a schedule for the contingency measure implementation. Contingency measures can include measures already adopted and scheduled for implementation, as long as these measures are not relied on to provide emissions reductions needed to provide for RFP or expeditious attainment.

Based on these general contingency requirements, the District is utilizing two types of contingency measures:

A. Surplus reductions from implementation of traditional regulations
B. SIP-creditable incentive-based emissions reductions

### 6.4.2 Surplus Reductions from Implementation of Traditional Regulations

Although contingency measures must be surplus to RFP and attainment calculations, areas are not required to wait until there is an RFP or attainment failure to implement the measures. As shown in the RFP demonstration in this chapter, significant regulatory emissions reductions are being achieved by 2014 and 2017 – more than the minimum needed to demonstrate RFP in those years. As such, the difference between the RFP target emissions level and the actual projected emissions level can serve as contingency reductions in 2014 and 2017. Using the data in Table 6-8, Table 6-10 shows amount of reductions available in 2014 and 2017.

**Table 6-10 Reductions Surplus to RFP for Contingency (tpd)**

| Year | 2014 | | | 2017 | | |
|---|---|---|---|---|---|---|
| | RFP target emissions level | Projected emissions inventory | Contingency | RFP target emissions level | Projected emissions inventory | Contingency |
| PM2.5 | 65.2 | 63.3 | 1.9 | 64.0 | 62.5 | 1.5 |
| NOx | 300.9 | 284.2 | 16.7 | 253.9 | 235.7 | 18.2 |

As the 2020 attainment contingency need would not occur until 2021 (since attainment would be based on air quality data collected through the end of 2020), the additional PM2.5 and NOx reductions occurring between 2020 and 2021 can serve as attainment contingencies (Table 6-11). Additionally, the District recently adopted amendments to Rule 4901 in September 2014 that significantly strengthened the rule requirements and achieve a minimum of 1.1 tons of PM2.5 per day in 2020 (not assuming any transition to cleaner wood burning devices under the rule).

[15] Clean Air Act Section 172(c)9, 40 CFR 51.1012.

**Table 6-11 Attainment Contingencies Traditional Regulatory Reductions (tpd)**

| Emission | | 2020 emissions | 2021 emissions | Attainment Contingency |
|---|---|---|---|---|
| PM2.5 | Adopted Measures | 62.8 | 62.3 | **0.5** |
| | Additional Surplus Reductions from September 2014 Amendments to Rule 4901 | | | **1.1** |
| | Total | | | **1.6** |
| NOx | Adopted Measures | 206.9 | 194.9 | **12.0** |

The control measures achieving the contingency reductions in Tables 6-10 and 6-11 are as follows:

- **Adopted stationary and area source measures for NOx and PM2.5 contingency**: The NOx and PM2.5 contingency reductions are from adopted District rules:
  - Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters
  - Rule 4306 (Boilers, Steam Generators and Process Heaters (>5 MMBtu/hr))
  - Rule 4308 (Boilers, Steam Generators and Process Heaters (0.075 to <2 MMBtu/hr))
  - Rule 4905 (Natural Gas-Fired, Fan-Type Central Furnaces)

- **Adopted mobile source measures for NOx and PM2.5 contingency:** Most of the total NOx contingency reductions are from adopted mobile source control measures for the following sources:
  - Passenger cars, light-duty vehicles, and medium-duty vehicles
  - Heavy-duty trucks
  - Buses
  - Commercial harbor craft
  - Motor homes
  - Off-road equipment

### 6.4.3 SIP-Creditable Incentive-Based Emissions Reductions

As discussed in Appendix E of this plan, voluntary incentive programs achieve emissions reductions beyond those achieved by regulations alone. Incentive programs accelerate the adoption of cleaner technologies and encourage the use of cleaner 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 financial hardship would otherwise prevent traditional control strategies from being implemented. As discussed in Appendix E, the District adopted new Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs) in 2013, providing an administrative mechanism for the state to take credit for incentive based emissions reductions in the SIP.

### 6.4.4 Sufficient Contingency Reductions

Areas like the Valley that have significant nonattainment challenges have developed several generations of aggressive and far-reaching emission reduction measures to meet various Clean Air Act requirements. The result of this "no stone left unturned" policy is that when viable emission reductions are identified, they are implemented to contribute to expeditious attainment. Reductions are not usually held in reserve to be used only if an area fails to meet a milestone. As a result, contingency measure demonstrations in the Valley have been a challenge, historically. Towards that end, this chapter has outlined two types of contingency measures that could be used to meet the contingency reductions required for this plan:

- Surplus from traditional regulations
- SIP-creditable incentives

Table 6-12 shows how this approach generates enough emissions reductions to meet the contingency reductions required for this plan. The below demonstration focuses on direct PM2.5 and NOx since contingencies are only required for these pollutants (see Table 6-9).

**Table 6-12 Demonstration of Sufficient Contingency Reductions**

| | 2014 | 2017 | 2020 | Data reference |
|---|---|---|---|---|
| **PM2.5** | | | | |
| *Surplus from traditional regulations* | *1.9* | *1.5* | *1.6* | Tables 6-10, 6-11 |
| *Subtract PM2.5 reductions, trade for NOx* | *0.0* | *0.0* | *-1.2* | 1:9 trading ratio* |
| Total contingency reductions achieved | 1.9 | 1.5 | 0.4 | |
| Contingency reductions required | 0.4 | | | Table 6-9 |
| Contingency need met? | *Yes* | *Yes* | *Yes* | |
| | | | | |
| **NOx** | | | | |
| *Surplus from traditional regulations* | *16.7* | *18.2* | *12.0* | Tables 6-10, 6-11 |
| *Substitute PM2.5 reductions* | *0.0* | *0.0* | *+10.8* | Above, with 1:9 trading ratio* |
| Total contingency reductions achieved | 16.7 | 18.2 | 22.8 | |
| Contingency reductions required | 15.7 | | | Table 6-9 |
| Contingency need met? | *Yes* | *Yes* | *Yes* | |
| * 1 ton of direct PM2.5 emissions reductions is equivalent to 9 tons of NOx reductions as demonstated in the WOE. These ratios are conservative estimates summarizing the plan as a whole, not reflecting ratios appropriate for New Source Review (NSR) | | | | |

## 6.5 TRANSPORTATION CONFORMITY

Section 176(c) of the Federal Clean Air Act (CAA) establishes transportation conformity requirements which are intended to ensure that transportation activities do not interfere with air quality progress. The CAA requires that transportation plans, programs, and projects that obtain federal funds or approvals *conform to* applicable state implementation plans (SIP) before being approved by a Metropolitan Planning Organization (MPO). Conformity to a SIP means that proposed activities must not:

(1) Cause or contribute to any new violation of any standard,
(2) Increase the frequency or severity of any existing violation of any standard in any area, or
(3) Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

A SIP analyzes the region's total emissions inventory from all sources for purposes of demonstrating RFP, attainment, or maintenance. The portion of the total emissions inventory from on-road highway and transit vehicles in these analyses becomes the "motor vehicle emissions budget."[16] Motor vehicle emissions budgets are the mechanism for ensuring that transportation planning activities conform to the SIP.

[16] Federal transportation conformity regulations are found in 40 CFR Part 51, subpart T – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. of the Federal Transit Laws. Part 93, subpart A of this chapter was revised by the EPA in the August 15, 1997 Federal Register.

Budgets are set for each criteria pollutant or its precursors, and it is set for each RFP milestone year and the attainment year. Subsequent transportation plans and programs produced by transportation planning agencies are required to conform to the SIP by demonstrating that the emissions from the proposed plan, program, or project do not exceed the budget levels established in the applicable SIP.

### 6.5.1 PM2.5 Requirements for Conformity

On April 25, 2007 EPA published in the Federal Register the *Clean Air Fine Particle Implementation Rule* (Final Rule) implementing the 1997 PM2.5 NAAQS (see 72 FR 20586). The Final Rule addresses the types of motor vehicle emissions that must be addressed when setting transportation conformity budgets. In the Final Rule, EPA notes that: "RFP plans, attainment demonstrations, and maintenance plans must include a budget for direct PM2.5 emissions, except for certain cases as described below. All PM2.5 SIP budgets would include directly emitted PM2.5 motor vehicle emissions from tailpipe, brake wear, and tire wear. States should also consider whether re-entrained road dust or highway and transit construction dust are significant contributors and should be included in the PM2.5 budget." (72 FR 20645) The rule goes on to state that: 'Under certain circumstances, directly emitted PM2.5 from on-road mobile sources may be found an insignificant contributor to the air quality problem and NAAQS.'

The conformity rule applies for particles with aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM2.5). NOx must also be addressed as a precursor unless there is a finding of insignificance.

Section 93.102(b)(2)(iv and v) of the conformity rule also identifies Volatile Organic Compounds (VOC), SOx, and/or ammonia as PM2.5 precursor pollutants that must also have a motor vehicle emissions budget if that precursor is deemed significant. In addition, Section 93.102(b)(3) identifies re-entrained road dust from paved and unpaved roads as PM2.5 emissions that must also have a motor vehicle emissions budget if deemed significant. While the applicability section of the rule does not address fugitive dust from road construction specifically, the rule does indicate that the interagency consultation process should be used during the development of PM2.5 SIPs to determine when construction emissions are a significant contributor.

### 6.5.2 Factors for Determining Significance

The conformity rule states that the following factors will be considered in making significance or insignificance findings for PM2.5 precursors: the contribution of on-road emissions of the precursor to the total 2012 baseline SIP inventory; the current state of air quality for the area; the results of speciation monitoring for the area; the likelihood that future motor vehicle control measures will be implemented for a given precursor; and projections of future on-road emissions of the precursor.

Significance findings for re-entrained road dust emissions will be based on a review of the following factors: the contribution of road dust to current and future PM2.5 nonattainment; an area's current design value for the PM2.5 standard; whether control of road dust appears necessary to reach attainment; and whether increases in re-entrained dust emissions may interfere with attainment. Such a review would include consideration of local air quality data, air quality modeling results, or emissions modeling results.

### 6.5.3 Assessment of Significance

This plan establishes motor vehicle emission budgets for primary emissions of PM2.5 from vehicle exhaust, tire and brake wear, and the precursor NOx. Other precursors are not considered significant for the reasons discussed in the following sections.

**VOC:** On-road mobile emissions account for approximately 10 percent of the Valley's total VOC emissions in the budget years. Air quality modeling for this plan indicates that control of VOC is generally ineffective in the control of PM2.5 and in some cases may actually result in increases in PM2.5 levels. Therefore, on road VOC emissions are considered insignificant and this plan does not establish VOC motor vehicle emissions budgets for conformity purposes.

**SOx:** On road mobile exhaust estimates are less than 1 ton per day Valley-wide in the budget years which equates to less than 10 percent of the total SOx emissions inventory. SOx controls are focused on industrial sources, which contribute almost 80 percent of the total inventory. Therefore, on road SOx emissions are considered insignificant and this plan does not establish SOx motor vehicle emissions budgets for conformity purposes.

**Paved Road Dust:** Paved road dust PM2.5 emissions account for approximately 10 percent of the Valley's total direct PM2.5 emissions in the budget years. As noted in Chapter 3 and Appendix A, all geologic and construction source categories combined represent no more than 9 percent of the peak PM2.5 concentrations measured in the Valley. While there are no additional fugitive dust controls included in the attainment demonstration for this plan, paved road dust is controlled via the PM10 Plan and is evaluated as part of PM10 conformity determinations. Therefore, paved road dust emissions are considered insignificant and this plan does not establish paved road dust motor vehicle emissions budgets for conformity purposes.

**Unpaved Road Dust:** Total unpaved road dust is less than 10 percent of the Valley's total direct PM2.5 emissions inventory in the budget years. Local roads are one of seven subcategories of unpaved road dust, and therefore considered insignificant. While there are no additional fugitive dust controls included in the plan, unpaved road dust is controlled via the PM10 Plan, (including the prohibition of any new local unpaved roads), and unpaved road dust is evaluated as part of PM10 conformity determinations. Therefore unpaved road dust emissions are considered insignificant, and this plan does not establish unpaved road dust emission budgets for conformity purposes.

**Construction Dust:** Total construction and demolition dust is less than 5 percent of the Valley's total direct PM2.5 emissions inventory in the budget years. Road construction is one of five subcategories of construction dust and is therefore considered insignificant.

While there are no additional fugitive dust controls included in the plan, road construction dust is controlled extensively via the PM10 Plan and is evaluated as part of PM10 conformity determinations. Therefore, construction dust emissions are considered insignificant, and this plan does not establish construction dust emission budgets for conformity purposes.

**Ammonia:** The contribution of ammonia from on-road motor vehicles is approximately 1 percent of the total valley-wide ammonia inventory and is therefore considered insignificant. This plan also establishes ammonia is not a limiting precursor in the formation of PM2.5. Therefore, ammonia on road emissions budgets are not established by this plan.

### 6.5.4 Conformity Budgets

This plan includes reasonable further progress demonstrations for 2014 and 2017, and an attainment demonstration for 2020. Annual average daily emissions are used in the plan consistent with the way the standard is measured. Consequently, conformity budgets have been set with EMFAC 2014 for annual average daily emissions in the analysis years 2014, 2017, and 2020.

Section 93.124(e) of the federal conformity rule states that nonattainment areas with more than one MPO may establish motor vehicle emission budgets for each MPO in the non-attainment area. This plan establishes county-level emission budgets for each MPO in the Valley.

The transportation conformity budgets developed for this plan include more recent travel activity projections provided by the Valley MPOs. This travel activity is consistent with the 2015 Federal Transportation Improvement Plan (2015 FTIP) for each of the eight Valley MPOs. The emissions impact of this more recent activity data is reflected in the attainment demonstration.

The budgets have been constructed to be consistent with the on-road emissions inventory using the following method:

1) Sum the county-by-county emissions results to get a Valleywide total
2) Round the Valley-wide totals up to:
    a. NOx- the nearest whole ton
    b. PM2.5 – the nearest tenth of a ton
3) Disaggregate the rounded values proportional to each county's emissions
4) Calculate the budget by rounding each county's values to the nearest tenth ton (for both NOx and PM2.5) using conventional rounding.

This plan establishes subarea county emission budgets for PM2.5 and NOx for the horizon years 2014, 2017, and 2020 and are summarized in Table 6-12. The attachment on the following page provides more detailed calculations.

**Table 6-13 San Joaquin Valley Transportation Conformity Budgets (tpd, annual average)**

| County | 2014 | | 2017 | | 2020 | |
|---|---|---|---|---|---|---|
| | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx |
| **Fresno** | 1.2 | 41.2 | 1.0 | 31.2 | 0.9 | 25.3 |
| **Kern (SJV)** | 1.0 | 36.5 | 0.8 | 28.0 | 0.8 | 23.3 |
| **Kings** | 0.2 | 7.6 | 0.2 | 5.7 | 0.1 | 4.8 |
| **Madera** | 0.2 | 7.8 | 0.2 | 5.8 | 0.2 | 4.7 |
| **Merced** | 0.4 | 13.9 | 0.3 | 10.7 | 0.3 | 8.9 |
| **San Joaquin** | 0.7 | 19.6 | 0.6 | 14.9 | 0.6 | 11.9 |
| **Stanislaus** | 0.5 | 15.6 | 0.4 | 11.9 | 0.4 | 9.6 |
| **Tulare** | 0.5 | 14.9 | 0.4 | 10.8 | 0.3 | 8.4 |

### 6.5.5 Emissions Trading Mechanism

Section 93.124(b) of the federal conformity rule allows for the SIP to establish emissions trading mechanisms between budgets for pollutants or precursors, or among budgets allocated to mobile and other sources. The *2008 PM2.5 Plan* (as revised in 2011) included a emissions trading mechanism, which was approved by EPA effective January 9, 2012, to be used for analysis years after 2014. This SIP allows trading from the motor vehicle emissions budget for the PM2.5 precursor NOx to the motor vehicle emissions budget for primary PM2.5 using a 9 to 1 ratio (the modeling document that discusses this ratio will be included in the staff report taken to the ARB Governing Board for adoption and included in the full *2015 PM2.5 Plan* package that will be submitted to EPA).

The NOx emissions reductions available for trading are only those remaining after the NOx budget is met. For example, for a proposed plan that has a total of 7 tons of NOx, and a NOx budget of 10 tons, there are 3 tons of NOx available to meet the PM2.5 emissions budget. Each agency responsible for demonstrating transportation conformity shall clearly document the calculations used in the trading, along with any additional reductions of NOx or PM2.5 emissions in the conformity analysis.

**San Joaquin Valley Annual PM2.5 Motor Vehicle Emissions Budgets**

**2015 FSTIP MPO activity data**

(tons per annual average day)

**2014 Motor Vehicle Emissions Budgets**

| County | Fresno | | Kern | | Kings | | Madera | | Merced | | San Joaquin | | Stanislaus | | Tulare | | San Joaquin Valley Air Basin | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx |
| Baseline EMFAC2014 V1.0.2 | 1.23 | 40.93 | 1.04 | 36.25 | 0.20 | 7.53 | 0.23 | 7.73 | 0.38 | 13.86 | 0.70 | 19.49 | 0.49 | 15.47 | 0.48 | 14.81 | | |
| Total | 1.23 | 40.93 | 1.04 | 36.25 | 0.20 | 7.53 | 0.23 | 7.73 | 0.38 | 13.86 | 0.70 | 19.49 | 0.49 | 15.47 | 0.48 | 14.81 | 4.75 | 156.07 |
| Air Basin Total | | | | | | | | | | | | | | | | | 4.8 | 157 |
| Disaggregated County Totals | 1.244 | 41.172 | 1.047 | 36.464 | 0.203 | 7.579 | 0.233 | 7.780 | 0.382 | 13.942 | 0.711 | 19.606 | 0.496 | 15.559 | 0.485 | 14.897 | | |
| Budget* | 1.2 | 41.2 | 1.0 | 36.5 | 0.2 | 7.6 | 0.2 | 7.8 | 0.4 | 13.9 | 0.7 | 19.6 | 0.5 | 15.6 | 0.5 | 14.9 | 4.8 | 157.0 |

**2017 Motor Vehicle Emissions Budgets**

| County | Fresno | | Kern | | Kings | | Madera | | Merced | | San Joaquin | | Stanislaus | | Tulare | | San Joaquin Valley Air Basin | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx |
| Baseline EMFAC2014 V1.0.2 | 0.94 | 31.14 | 0.80 | 27.97 | 0.15 | 5.72 | 0.18 | 5.79 | 0.29 | 10.68 | 0.60 | 14.88 | 0.39 | 11.88 | 0.37 | 10.79 | | |
| Total | 0.94 | 31.14 | 0.80 | 27.97 | 0.15 | 5.72 | 0.18 | 5.79 | 0.29 | 10.68 | 0.60 | 14.88 | 0.39 | 11.88 | 0.37 | 10.79 | 3.71 | 118.84 |
| Air Basin Total | | | | | | | | | | | | | | | | | 3.8 | 119 |
| Disaggregated County Totals | 0.961 | 31.186 | 0.814 | 28.002 | 0.151 | 5.723 | 0.185 | 5.795 | 0.292 | 10.695 | 0.618 | 14.895 | 0.403 | 11.899 | 0.376 | 10.805 | | |
| Budget* | 1.0 | 31.2 | 0.8 | 28.0 | 0.2 | 5.7 | 0.2 | 5.8 | 0.3 | 10.7 | 0.6 | 14.9 | 0.4 | 11.9 | 0.4 | 10.8 | 3.8 | 119.0 |

**2020 Motor Vehicle Emissions Budgets**

| County | Fresno | | Kern | | Kings | | Madera | | Merced | | San Joaquin | | Stanislaus | | Tulare | | San Joaquin Valley Air Basin | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx | PM2.5 | NOx |
| Baseline EMFAC2014 V1.0.2 | 0.84 | 25.26 | 0.73 | 23.26 | 0.14 | 4.82 | 0.17 | 4.65 | 0.26 | 8.85 | 0.58 | 11.89 | 0.36 | 9.57 | 0.33 | 8.41 | | |
| Total | 0.84 | 25.26 | 0.73 | 23.26 | 0.14 | 4.82 | 0.17 | 4.65 | 0.26 | 8.85 | 0.58 | 11.89 | 0.36 | 9.57 | 0.33 | 8.41 | 3.42 | 96.72 |
| Air Basin Total | | | | | | | | | | | | | | | | | 3.5 | 97 |
| Disaggregated County Totals | 0.860 | 25.297 | 0.752 | 23.292 | 0.142 | 4.831 | 0.173 | 4.652 | 0.269 | 8.866 | 0.593 | 11.909 | 0.370 | 9.580 | 0.341 | 8.419 | | |
| Budget* | 0.9 | 25.3 | 0.8 | 23.3 | 0.1 | 4.8 | 0.2 | 4.7 | 0.3 | 8.9 | 0.6 | 11.9 | 0.4 | 9.6 | 0.3 | 8.4 | 3.5 | 96.8 |

* Established by conventional rounding.

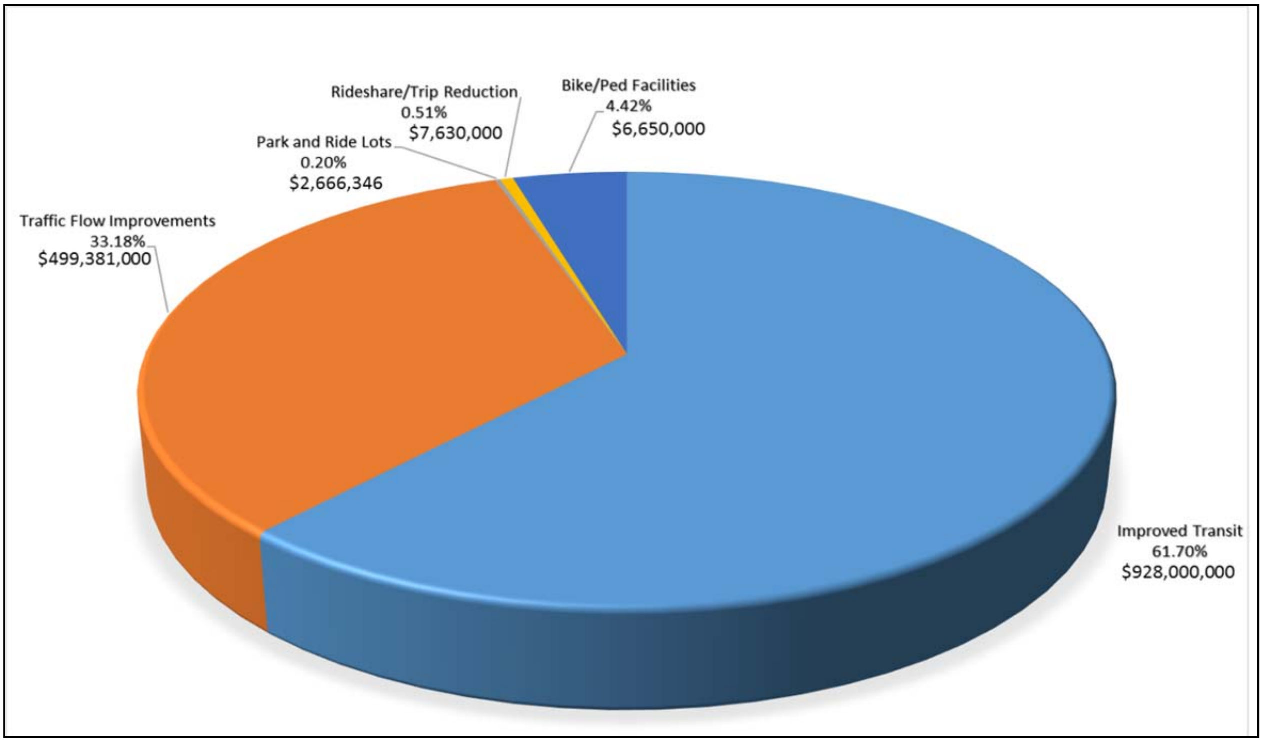
### 6.5.6 Local Transportation Control Measures

Transportation Control Measures (TCMs) in CAA §108(f) are currently being implemented by the Valley MPOs as part of the adopted Congestion Mitigation and Air Quality (CMAQ) cost effectiveness policy and in the development of each Regional Transportation Plan (RTP). In addition, new transportation legislation (MAP-21) includes enhanced emphasis on funding PM2.5 projects.

Valley MPOs continue to implement the adopted San Joaquin Valley CMAQ Policy, which was included in the District's *2007 Ozone Plan* and *2008 PM2.5 Plan*. The CMAQ policy includes a standardized process for distributing 20 percent of the CMAQ funds to projects that meet a minimum cost effectiveness beginning in fiscal year 2011. This policy focuses on achieving the most cost effective emissions reductions, while maintaining flexibility to meet local needs. The policy feasibility and minimum cost effectiveness standard was revisited in 2013 as part of the 2013 Federal Transportation Improvement Program (FTIP) development; the minimum cost effectiveness standard was also revisited in 2015 as part of the 2015 FTIP development.

Figure 6-2 provides an illustration of funding allocated valley-wide in the 2015 FTIPs for a sample of TCM categories: improved transit; high occupancy vehicle lanes; traffic flow improvements; park and ride lots; ridesharing/trip reduction programs; bicycle/pedestrian facilities. These tables demonstrate the eight SJV MPOs' commitment to the implementation of TCMs throughout the Valley. As the Valley MPOs implement TCMs through the current policies, all reasonable transportation control measures are being implemented.

**Figure 6-2 Illustration of Valley MPO Funding for Sample TCM Categories**




Each Valley MPO is required to update its RTP every four years. The RTP is a long-term regional transportation plan that provides a vision for transportation investments throughout the Valley. The 2014 RTPs integrate land use and transportation planning to achieve, where feasible, regional greenhouse gas (GHG) targets set by ARB pursuant to Senate Bill 375 (SB-375).

To further illustrate the eight SJV MPOs commitment to the implementation of TCMs throughout the Valley, the RTPs contains a host of improvements to every component of the regional multimodal transportation system including:

- Active transportation (non-motorized transportation, such as biking and walking)
- Transportation demand management (TDM)
- Transportation system management (TSM)
- Transit
- Passenger rail
- Goods movement
- Aviation and airport ground access
- Highways
- Arterials
- Operations and maintenance

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

- Improved Transit
- High Occupancy Vehicle Lanes
- Traffic Flow Improvements
- Park and Ride Lots
- Ridesharing/Trip Reduction Programs
- Bicycle/Pedestrian Facilities

### 6.5.7 SB-375

The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities, SB-375) enhances California's strategy to reduce GHG emissions through the coordination of transportation and land-use to reduce vehicle miles traveled per person through the development of a Sustainable Community Strategy. SB-375 identifies specific reduction goals for each of California's MPOs in 2020 and 2035 which the Sustainable Community Strategy must meet, if feasible. For the Valley, the SB-375 target reductions are a 5% per capita GHG emissions reductions from 2005 by 2020 and a 10% per capita GHG emissions reductions from 2005 by 2035. The strategies contained in the RTP/SCS produce benefits for the region far beyond simply reducing GHG emissions. The SCS integrates the transportation network and related strategies with an overall land use pattern that responds to projected growth, housing needs, changing demographics, and transportation demands. As a result, Sustainable Community Strategy development is anticipated to complement the reduction strategies outlined in the *2015 PM2.5 Plan*.

## 6.6 FULFILLMENT OF SERIOUS AREA PERMITTING REQUIREMENTS

Pursuant to Subpart 4 §189(b)(3) the District must provide a revision to the nonattainment new source review (NSR) program to lower the applicable "major stationary source" thresholds from 100 tons per year (tpy) to 70 tpy. In EPA's proposed approval of the District adopted *2012 PM2.5 Plan* and reclassification of the Valley to Serious Nonattainment for the 2006 PM2.5 NAAQS, EPA proposes to require that NSR amendments to lower the PM2.5 major source threshold from 100 to 70 tpy shall be submitted within twelve months of EPA's final action on the reclassification.

The District's New and Modified Stationary Source Review Rule (Rule 2201) identifies the major source emission thresholds for each pollutant. Currently, through Rule 2201, the District already identifies the major source emission threshold for volatile organic materials (VOCs) and NOx major sources at 10 tpy and PM10 and SOx at 70 tpy. The major source emissions threshold for PM2.5 is currently set at 100 tpy. Consistent with CAA requirements, the District will amend Rule 2201 to lower the major source emission limit threshold from 100 to 70 tpy within twelve months of EPA's final action to reclassify the Valley as a Serious nonattainment area.

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# Chapter 7

## Attainment Strategy

*2015 Plan for the 1997 PM2.5 Standard*
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# Chapter 7: Attainment Strategy

## 7.1 COMPREHENSIVE REGULATORY CONTROL STRATEGY

The San Joaquin Valley Air Pollution Control District (District) has implemented a comprehensive regulatory control strategy for over twenty years. Since 1992, the District has adopted over 600 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.

Air quality improvements in the San Joaquin Valley (Valley) document the success of the District's innovative and effective rules. The District's regulatory authority is limited to 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, unlike the District, have the authority to directly regulate tailpipe emissions from mobile sources. California Air Resources Board (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 the Indirect Source Review and Employer-based Trip Reduction rules to reduce emissions from mobile sources within the District's limited jurisdiction over these sources.

The District's and ARB's rules already guarantee that emissions will continue to be reduced over the coming years. New commitments identified in this plan combined with other control strategies discussed in Appendices C through E will provide necessary emissions reductions to complement those already being achieved and contribute to PM2.5 air quality improvements in the Valley.

### 7.1.1 District Regulations Contributing to Continued PM2.5 Improvement

The District's current rules and regulations reflect technologies and methods that are far beyond minimum required control levels. In December 2010, ARB determined that, based on the District's State Implementation Plans (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.[1] 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.[2]

The aggressive regulations already adopted under previous attainment plans also serve as control measures for this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5*

[1] ARB Executive Order G-10-126. (2010, December 10), required under California Health and Safety Code §40612.
[2] California Administrative Code, Title 17 §70600(a)(1). (2012)

*Plan*). These adopted regulations will dramatically reduce directly emitted PM2.5 and PM2.5 precursor (NOx and SOx) emissions as they are fully implemented over the next few years, greatly contributing to the Valley's progress toward attainment of the 1997 PM2.5 standard.

EPA prefers reliance on control measures that have already been adopted over ones that have yet to be approved. EPA 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.

Table 7-1 and the discussion that follows summarizes adopted District rules achieving new emissions reductions after 2012, the base year for this plan. However, even pre-2012 emissions reductions, such as those achieved through the District's Conservation Management Practices (CMP) rule (Rule 4550) and Regulation VIII (Fugitive PM10 Prohibitions) will continue to contribute to the Valley's progress toward attainment of the 1997 PM2.5 standard.

**Table 7-1 District Regulations Contributing to Attainment of PM2.5 NAAQS**

| Rule # | Adopted District Rule | Last Adoption/ Amendment Date |
|---|---|---|
| **4307** | Boilers, Steam Generators, and Process Heaters—2.0 MMBtu/hr to 5.0 MMBtu/hr | 5/19/11 |
| **4308** | Boilers, Steam Generators, and Process Heaters—0.075 MMBtu/hr to less than 2.0 MMBtu/hr | 11/14/13 |
| **4311** | Flares | 6/18/09 |
| **4320** | Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr | 10/16/08 |
| **4354** | Glass Melting Furnaces | 5/19/11 |
| **4702** | Internal Combustion Engines | 8/18/11 |
| **4703** | Stationary Gas Turbines | 9/20/07 |
| **4901** | Wood Burning Fireplaces and Wood Burning Heaters | 9/18/14 |
| **4902** | Residential Water Heaters | 3/19/09 |
| **4905** | Natural Gas-Fired, Fan-Type Central Furnaces | 1/22/15 |
| **9310** | School Bus Fleets | 9/21/06 |
| **9410** | Employer-based Trip Reduction | 12/17/09 |

**Rule 4307 Boilers, Steam Generators, and Process Heaters 2 to 5 MMBtu/hr**
Rule 4307 is the most stringent rule in the country for controlling emissions from fuel combustion-producing heat and energy for manufacturing and processing purposes. Emissions from these units are generally controlled through either combustion modification or exhaust gas treatment. Recent amendments strengthened the rule by removing some exemptions, imposing NOx limits of 9 or 12 ppmv for new and replacement units, and adding a menu approach for particulate matter control that includes SOx controls. While offering affected businesses cost-effective compliance

options, this rule will generate 3.36 tpd of NOx reductions by the final compliance deadline in 2015.

**Rule 4308 Boilers, Steam Generators, and Process Heaters 0.075 to < 2 MMBtu/hr**

Adopted in 2005 and amended in 2009 and 2013 to include more stringent NOx limits, Rule 4308 controls emissions from boilers, steam generators, and process heaters in the size range of 0.075 to less than 2 MMBtu/hr. The District amended this rule through an extensive public process involving the public and other air districts to receive feedback on what emissions limits were feasible and would provide for the greatest emissions reductions. As a point-of-sale rule, emissions are reduced when consumers replace older units with new, low-NOx units as of the January 1, 2015, compliance date.

**Rule 4311 Flares**

Amended on June 18, 2009, Rule 4311 controls emissions from industrial flares used at oil and gas production facilities, sewage treatment plants, waste incineration and petroleum refining operations. The 2009 amendments require flare operators to submit flare minimization plans, perform additional monitoring and record keeping, submit reports of planned and unplanned flaring activities to the District, and meet petroleum refinery SO2 performance targets. When fully implemented in 2017, this rule is expected to reduce SOx emissions by 0.06 tpd. The District completed a further study that analyzed data from FMPs, annual monitoring reports, reportable flaring events reports, and made that study available on the District web page. The District continues to review research literature, federal regulations and guidance information, flare minimization plans, and emissions data to continue to search for potential opportunities to reduce emissions from these control and safety devices.

**Rule 4320 Boilers, Steam Generators, and Process Heaters > 5 MMBtu/hr**

The District adopted Rule 4320 in 2008, with multiple generations of Rules 4305 and 4306 preceding this rule to regulate this source category. This rule is the most stringent rule in the nation for controlling emissions from fuel combustion-producing heat and energy for manufacturing and processing purposes, and it is equivalent to BACT standards for this source category. Facilities generally control emissions from these sources through combustion modification or exhaust gas treatment. This rule and the 2005 amendment of Rule 4306 will reduce 3.5 tpd of NOx and 3.6 tpd of SOx as of the final implementation date in 2014. Rule 4306 generated 0.2 tpd of NOx reductions with the 2005 rule amendment, assuming 25% of the food industry took advantage of the enhanced NOx limits option put into the rule. The remaining 3.3 tpd of NOx reductions and 3.6 tpd of SOx reductions are achieved from the 2008 adoption of Rule 4320.

**Rule 4354 Glass Melting Furnaces**

District Rule 4354, adopted in 1994 and subsequently amended six times, is one of the most stringent rules in the nation for controlling NOx, SOx, and PM emissions from industrial glass manufacturing plants that make flat glass (window and automotive windshields), container glass (bottles and jars), and fiberglass (insulation). Recent amendments include more stringent NOx emission limits based on BACT level controls for container glass, fiberglass, and flat glass. The rule gives special consideration to container glass and fiberglass manufacturers who use 30% post-consumer materials under the state glass recycling regulations. The rule also includes a technology forcing limit for flat glass furnaces. As a result of this stringent prohibitory rule and continuing efforts on behalf of this industry to reduce emissions, the Valley's glass melting furnaces use low-NOx firing technology. With compliance deadlines through January 1, 2014, this rule reduced an additional 3.28 tpd of NOx emissions, 1.12 tpd of SOx emissions, and 0.11 tpd of PM2.5 emissions.

**Rule 4702 Internal Combustion Engines**

The District has amended Rule 4702 four times since 2005 to implement stringent NOx limits for agricultural operations engines, implement more stringent NOx limit for non-agricultural operations engines, and to extend rule applicability to units with 25–50 brake horsepower (bhp). With multiple generations of rule amendments, Rule 4702 is the most stringent rule in the nation for this source category. Facilities generally control NOx emissions that result from the fuel combustion of internal combustion engines with advanced technologies, such as selective non-catalytic reduction and selective catalytic reduction.

**Rule 4703 Stationary Gas Turbines**

The District last amended Rule 4703 in September 2007 to reduce the NOx limits for existing stationary gas turbines that are 10 megawatts (MW) or less. This amendment achieved additional NOx emissions reductions from turbines used for cogeneration of electrical energy and steam for thermally enhanced oil recovery operations in the Valley. This rule equals or exceeds the most stringent source control of any air district in California by requiring BACT at these facilities. The District designed compliance schedules to allow reasonable time for completing modification and retrofit actions during scheduled overhauls of the gas turbines. The latest rule amendment achieves an additional 2.2 tpd of NOx reductions as of January 2012, the full implementation and compliance deadline.

**Rule 4901 Wood-Burning Fireplaces and Wood-Burning Heaters**

The District amended Rule 4901 in September 2014, two years ahead of the deadline in the *2012 PM2.5 Plan* commitment to reduce the wood-burning curtailment threshold, and provide public health benefits where they are needed most, in neighborhoods. Through this rule and the District's corresponding Check-Before-You-Burn program, the District prohibits use of wood-burning fireplaces and wood-burning heaters in areas with natural gas service when air quality is forecast to be above 20 $\mu g/m^3$ of PM2.5. The District's Burn Cleaner incentive program combined with the tiered compliance thresholds in Rule 4901 allowing additional burn days for homes with District registered EPA-certified devices encourage the transition from high-polluting devices and open hearth fireplaces to cleaner alternatives. Rule amendments will reduce PM2.5 emissions beyond those committed to in the District's *2012 PM2.5 Plan.*

**Rule 4902 Residential Water Heaters**
The District adopted Rule 4902 on July 17, 1993 to control NOx emissions from natural gas-fired residential water heaters with heat input rates less than or equal to 75,000 Btu/hr by enforcing NOx emissions limit of 40 nanograms of NOx per Joule of heat output (ng/J). The District amended Rule 4902 in 2009 to strengthen the rule by lowering the limit to 10 ng/J for new or replacement water heaters and to a limit of 14 ng/J for instantaneous water heaters. Retailer compliance dates ranged from 2010 to 2012, depending on the unit type. On and after the applicable compliance date, retailers have been required to sell only units complying with the new limits. As a point-of-sale rule, compliant units will be installed as the older units are replaced through attrition. The rule has controlled NOx emissions by approximately 88% for this source category. The 2009 amendments reduced an additional 0.5 tpd of NOx.

**Rule 4905 Natural Gas-Fired, Fan-Type Residential Central Furnaces**
Rule 4905 was adopted in 2005 to establish NOx limits for residential central furnaces supplied, sold, or installed in the Valley with a rated heat input capacity of less than 175,000 Btu/hour. The rule was most recently amended on January 22, 2015 to lower the NOx emission limit for residential units from 40 ng/J to 14 ng/J and to expand the applicability to include NOx emission limits of 14 ng/J for non-residential units and 40 ng/J for units installed in manufactured homes. The NOx emission limit for units installed in manufactured homes will be lowered to 14 ng/J in 2018. As a point-of-sale rule, emissions are reduced when consumers replace older units with newer, low-NOx units as of the compliance dates corresponding to each unit type: February 1, 2015 for units installed in manufactured homes; April 1, 2015 for all other condensing units; October 1, 2015 for non-condensing units; October 1, 2016 for weatherized units; and October 1, 2018 for the 14 ng/J limit for units installed in manufactured homes. Rule 4905 will achieve 1.87 tpd of NOx reductions by 2020 and 3.65 tpd of NOx reductions by full implementation in 2036, based on an average equipment life of 20 years.

**Rule 9310 School Bus Fleets**
The District adopted Rule 9310 in September 2006 to limit NOx, PM, and diesel toxic air contaminants from school bus fleets. Diesel-fueled school bus fleet operators must replace or retrofit all of their school buses to meet the applicable ARB and EPA emission standards for engines by 2016. The rule also requires all existing gasoline or alternative-fueled school buses and any diesel school buses manufactured after October 1, 2002 to be operated according to manufacturer specifications and, if replaced, shall meet all applicable ARB and EPA current-year emissions standards for the year of delivery of that school bus engine and fuel type.

**Rule 9410 Employer-Based Trip Reduction (eTRIP Rule)**
The goal of the eTRIP Rule is to reduce single-occupancy-vehicle work commutes. The eTRIP Rule requires the Valley's larger employers, representing a wide range of locales and sectors, to select and implement workplace measures that make it easier for their employees to choose ridesharing and alternative transportation. Because of the diversity of employers covered by the eTRIP Rule, the rule was built with a flexible, menu-based approach. Using the Employer Trip Reduction Implementation Plan

(eTRIP), employers choose from a list of measures, each contributing to a workplace that encourages employees to reduce their dependence on single-occupancy vehicles. Each eTRIP measure has a point value, and employer eTRIPs must reach specified point targets for each strategy over a phased-in compliance schedule (2010 – 2015). The District has continually provided employer assistance through training, guidance materials, promotional information, and online reporting options. Upon full implementation, the eTRIP Rule will reduce NOx and VOC emissions from passenger vehicle commute trips by approximately 1.2 ton per day.

### 7.1.2 Commercial Charbroiler Commitment in *2012 PM2.5 Plan*

Through this *2015 PM2.5 Plan* the District has evaluated and determined that the most stringent measures and best available control measures feasible to implement in the Valley are in place with one exception. The District identified an opportunity to reduce emissions from its Commercial Charbroiling rule (Rule 4692) during the development of the *2012 PM2.5 Plan* and as such, committed to amend Rule 4692 in 2016 in that plan.

**Charbroiling**

Existing Rule 4692 (Commercial Charbroiling) achieves significant emissions reductions from chain-driven charbroilers; however, the rule does not require emissions controls for under-fired charbroilers. Analyses indicate that extending the applicability of the rule to include under-fired units could further reduce PM2.5 emissions by as much as 20% (0.4 tpd PM2.5) from the baseline inventory for under-fired charbroilers upon implementation in 2017 thus providing significant health benefits Valley-wide per the District's Health Risk Reduction Strategy. Research and demonstration projects are underway to evaluate emission control technologies for under-fired charbroilers in support of this measure. As included in the *2012 PM2.5 Plan*, the District plans to amend Rule 4692 in 2016 to add requirements for under-fired charbroilers, with an anticipated compliance date of 2017. The District will also consider development of a new incentive program to assist in the deployment of new technologies upon their development and commercial availability.

### 7.1.3 ARB Regulations Contributing to Attainment

Since 1989, ARB has adopted and amended a number of regulations aimed at reducing exposure to diesel 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. These regulations have significantly reduced PM2.5 precursors and direct PM2.5 emissions throughout the Valley.

Table 7-2 below includes a list of all the regulations adopted or amended by ARB from 2000 to 2013. Phased implementation of these regulations are producing increasing emission reduction benefits until 2020 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 Cleaner In-Use Heavy Duty Trucks, Cleaner In-Use Off-Road Equipment, Advanced Clean Car Program, Enhanced Fleet Modernization Program, and the Enhanced Smog Check Program, will be achieving significant emissions reductions critically needed to attain the standard under this plan.

In addition, ARB and the District are working closely to identify and distribute incentive funds to accelerate dirty engine replacements. Key programs include the Carl Moyer Program, the Goods Movement Program, the Lower-Emission School Bus Program, and the Air Quality Improvement Program (AQIP). These incentive-based programs work in tandem with regulations to accelerate deployment of cleaner technology.

### Table 7-2 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 |
| 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 |
| In-Use Heavy-Duty Trucks Regulation | 12/11/2008 | On-road |
| On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities | 12/6/2007 | On-road |
| In-Use Off-Road diesel Equipment Regulation | 07/26/2007 | Off-road |
| Clean Up Existing Harbor Craft | 11/15/2007 | Other |
| Voluntary Accelerated Retirement Regulation | 12/07/2006 | On-road |
| 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 Sterndrive 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 |

| ARB Regulation | Adoption Date | Category |
|---|---|---|
| 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 |
| 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 |

| ARB Regulation | Adoption Date | Category |
|---|---|---|
| Light-and Medium Duty Low Emission Vehicle Alignment with Federal Standards. Exhaust Emission Standards for Heavy Duty Gas Engines | 12/07/2000 | On-road |
| Air Toxic Control Measure for Chlorinated Toxic Air Contaminants from Automotive Maintenance and Repair Facilities | 04/27/2000 | Other |
| 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.

The following summaries highlight ARB's most recent key regulations, the roll out of their phased implementation deadlines and corresponding emission reduction schedule, and supporting outreach and enforcement efforts.

#### *7.1.3.1 Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Regulation)*

One of the most significant rules adopted by ARB within the past five years is the Truck and Bus Regulation, adopted in December 2008. In December 2010, ARB revised specific provisions of the in-use heavy-duty truck rule, in recognition of the deep economic effects of the recession on these businesses and the corresponding decline in their emissions. This rule represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available.

Starting in 2012, the Truck and Bus Regulation phases in requirements applicable to an increasingly larger percentage of the truck and bus fleet over time, so that by 2023, nearly all older vehicles will need to be upgraded to have exhaust emissions meeting

2010 model year engine emissions levels. Replacing older, high polluting trucks sooner than they otherwise would have been retired results in lower NOx and PM2.5 emissions.

The regulation applies to nearly all privately and federally owned diesel-fueled trucks and buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds, including on-road and off-road agricultural yard goats, and privately and publicly owned school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases, or rents affected vehicles. The regulation also establishes requirements for any in-state or out-of-state motor carrier, California-based broker, or any California resident who directs or dispatches vehicles subject to the regulation. Finally, California sellers of a vehicle subject to the regulation would have to disclose the regulation's potential applicability to buyers of the vehicles. Approximately 170,000 businesses in nearly all industry sectors in California, and almost a million vehicles that operate on California roads each year, are affected. Some common industry sectors that operate vehicles subject to the regulation include for-hire transportation, construction, manufacturing, retail and wholesale trade, vehicle leasing and rental, bus lines, and agriculture.

In addition to the Truck and Bus Regulation, separate regulations reduce emissions from other public fleets, solid waste collection trucks, and transit buses. Trucks that transport marine containers must comply with the drayage truck regulation.

ARB compliance assistance and outreach activities in support of the Truck and Bus Regulation include the following:

- The Truck Regulations Upload and Compliance Reporting System, an online reporting tool developed and maintained by ARB staff
- The Truck and Bus regulation's fleet calculator, a tool designed to assist fleet owners in evaluating various compliance strategies
- Targeted training sessions all over the State
- Out-of-state training sessions conducted by a contractor

ARB and District enforcement provides a level playing field for the regulated entities and ensures the emission reduction benefits are achieved. ARB staff enforce diesel regulations addressing idling, transport refrigeration units (TRU) and drayage trucks, and recently began enforcing the Truck and Bus regulation as it came up to its first compliance deadline in 2012.

In general, enforcement is conducted by doing unscheduled roadside inspections. An inspection team may typically focus on truck stops, rest stops, industrial areas, ports, environmental justice areas, and cold storage facilities. Vehicles are audited for all applicable requirements, including smoke, emission control labels, and diesel particulate filters. To expand enforcement capabilities, ARB contracts with the District and the Bay Area Air Quality Management District to conduct inspections in their respective jurisdictions.

### *7.1.3.2 Cleaner In-Use Off-Road Equipment (Off-Road Regulation)*

Another significant rule adopted by ARB within the past five years is the Off-Road Regulation, which was first approved in 2007 and amended in 2010 in response to the economic recession. These off-road vehicles are used in construction, manufacturing, the rental industry, road maintenance, airport ground support, and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines.

The Off-Road Regulation will significantly reduce emissions of diesel PM and NOx from the over 150,000 in-use off-road diesel vehicles that operate in California by requiring their owners to modernize their fleets and install exhaust retrofits. The regulation affects dozens of vehicle types used in thousands of fleets by requiring owners to modernize their fleets by replacing older engines or vehicles with newer, cleaner models; retiring older vehicles or using them less often; or by applying retrofit exhaust controls.

The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The regulation also requires that all vehicles be reported to ARB and labeled; restricts the addition of older vehicles into fleets; and requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing verified exhaust retrofits. The requirements and compliance dates of the Off-Road Regulation vary by fleet size.

The regulation also sets performance requirements. While the regulation has many specific provisions, in general, by each compliance deadline, a fleet must demonstrate that it has either met the fleet average target for that year, or has completed BACT requirements. The performance requirements of the Off-Road Regulation will be phased in from January 1, 2014, through January 1, 2019. The combined impact of the performance requirements results in steady declines in NOx and PM2.5 emissions from 2014 to 2019 and beyond.

Compliance assistance and outreach activities in support of the Off-Road Regulation include the following:

- The Diesel Off-Road On-Line Reporting System, an online reporting tool developed and maintained by ARB staff
- The Diesel Hotline (866-6DIESEL), which provides regulated operators with answers (in English, Spanish, and Punjabi) about the regulations and access to ARB staff
- The Off-road Listserv, providing equipment owners and dealerships with timely announcement of regulatory changes, regulatory assistance documents, and reminders for deadlines

### *7.1.3.3 Advanced Clean Cars (ACC)*

Many gasoline engines now emit at near-zero emission levels of smog-forming emissions. Conventional hybrid electric vehicles have been commercialized, and the number of models offered for sale is quickly expanding. Recently, battery-electric

vehicles and plug-in hybrid-electric vehicles have been introduced for sale, and fuel cell electric vehicles are expected to be sold beginning in 2015. This movement towards commercialization of advanced clean cars has occurred because of ARB's Zero Emission Vehicle (ZEV) regulation, which affects passenger cars and light-duty trucks. Continuing its leadership role in developing innovative and ground-breaking emission control programs, ARB's ACC Program, approved in January 2012, is a pioneering *package* of regulations, that although separate in construction, each regulation is related in terms of the synergy developed to address both ambient air quality needs and climate change. The ACC program combines the control of smog, soot-causing pollutants, and greenhouse gas emissions into a single, coordinated package of requirements for model years 2015 through 2025. The program assures the development of environmentally superior cars that will continue to deliver the performance, utility, and safety vehicle owners have come to expect.
The ACC program approved by ARB in January 2012 included amendments affecting the current ZEV regulation through the 2017 model year in order to enable manufacturers to successfully meet 2018 and subsequent model-year requirements. The ZEV amendments for 2018 and subsequent model years in the ACC program approved by ARB in January 2012 are intended to achieve commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions.

The ACC Program will produce increasing benefits over time as new cleaner cars enter the fleet, displacing older and dirtier vehicles. In this manner, the benefits will be realized through the cumulative reduction in emissions achieved by new cars entering the fleet in 2017 through 2019. This program will continue to provide benefits well after 2025 as vehicles meeting the new standards replace older, higher-emitting vehicles.

#### *7.1.3.4 Expanded Passenger Vehicle Retirement*

Voluntary accelerated vehicle retirement or car scrap programs provide monetary incentives to vehicle owners to retire older, more polluting vehicles. The purpose of these programs is to reduce fleet emissions by accelerating the turnover of the existing fleet and subsequent replacement with newer, cleaner vehicles. Reducing emissions from the existing fleet is a component of California's SIP, which outlines the State's strategy for meeting health-based ambient air quality standards. Both State and local vehicle retirement programs are available.

California's updated voluntary vehicle retirement program is administered by the Bureau of Automotive Repair (BAR) and provides $1,000 per vehicle, and $1,500 for low-income consumers, for unwanted vehicles that have either failed or passed their last Smog Check Test and that meet certain eligibility guidelines. This program is referred to as the Consumer Assistance Program.

The Enhanced Fleet Modernization Program (EFMP) was approved by the AB 118 legislation to augment the State's existing vehicle retirement program. Approximately $30 million is available annually through 2015 to fund the EFMP via a $1 increase in vehicle registration fees. ARB developed the program in consultation with BAR, and based on the District's experience in running vehicle retirement programs. The program is jointly administered by both BAR (for vehicle retirement) and local air districts (for vehicle replacement).

Other programs, in addition to vehicle retirement programs, help to clean up the light-duty fleet. The AQIP, established by AB 118, is an ARB voluntary incentive program to fund clean vehicle and equipment projects. The Clean Vehicle Rebate Project (CVRP) is one of the current projects under AQIP. CVRP, started in 2009, is designed to accelerate widespread commercialization of zero-emission vehicles and plug-in hybrid electric vehicles by providing consumer rebates up to $2,500 to partially offset the higher cost of these advanced technologies. These vehicles are a key element of California's strategy for meeting health based air quality standards and climate change goals.

#### *7.1.3.5 Improvements and Enhancements to California's Smog Check Program*

The following requirements were added to improve and enhance the Smog Check Program, making it more inclusive of motor vehicles and effective on smog reductions:

- Low pressure evaporative test;
- More stringent pass/fail cutpoints;
- Visible smoke test; and
- Inspection of light- and medium-duty diesel vehicles.

AB 2289, adopted in October 2010, is a new law restructuring California's Smog Check Program, streamlining and strengthening inspections, increasing penalties for misconduct, and reducing costs to motorists. This new law, sponsored by ARB and BAR, promises faster and less expensive Smog Checks by taking advantage of diagnostic software installed on all vehicles since 2000. The new law also directs vehicles without this equipment to high-performing stations, helping to ensure that these cars comply with current emission standards.

This program will reduce consumer costs by having stations take advantage of diagnostic software that monitors pollution-reduction components and tailpipe emissions. This technology, known as On-Board Diagnostics (OBD), has been required on all new vehicles since 1996. Under the new law, testing of passenger vehicles using OBD began in 2013 on all vehicles model years 2000 or newer. This technology results in reduced consumer costs by up to $180 million annually.

## 7.2 INCENTIVES

Incentive programs are an integral part of the efforts to reduce emissions; 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. The District operates one of the largest and most well-respected voluntary incentive programs in the state. 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, grant recipients have provided $526,600,794 in matching funds, with a combined District and grant recipient funding investment of $1.2 Billion.

### 7.2.1 Funding Sources

The District is engaged at every level of state and federal government to craft policy and funding targets that account for the Valley's unique challenges and need to accelerate emissions reductions, particularly from sources not under the District's regulatory authority. Toward that end, the District is working closely with the Valley's legislative delegation to ensure that the Valley's needs are well represented in discussions of where to focus funding throughout the state and the region as a whole. In addition, the District is focused on how to effectively allocate the limited funding received for its incentive programs.

The District continues to dedicate significant effort to ensure that the Valley receives its share of state and federal incentive funds through a variety of sources. In addition to aggressively pursuing funding from state funding sources such as the Carl Moyer Program and Lower-Emission School Bus Program, the District has been very successful in securing grants from the highly-competitive federal Diesel Emissions reductions Act (DERA) and the state Assembly Bill (AB) 118 Air Quality Improvement Program (AQIP). Currently, the District is actively engaged with ARB and the California Energy Commission (CEC) to ensure that the Valley is well represented in projects selections from the Greenhouse Gas Reduction Fund totaling over $1 billion per year.

The District derives its current incentive funding from a range of local, state and federal funding sources. These funding sources contain restrictions on the types of projects that may be funded, funding limitations, expenditure deadlines, and administrative approach for distribution. These requirements vary significantly from one funding source to another, resulting in a complex matrix of funding categories and program requirements. Some of the key funding sources currently available to the District include:

**Carl Moyer Funding -** The Carl Moyer program has been an on-going and reliable source of funding since 1998. The Carl Moyer program was established in 2004 with the adoption of AB 923 and Senate Bill (SB) 1107; the latter provided increased and continued funding through 2014 and expanded the program to include light-duty vehicle projects and agricultural sources of air pollution. In total, the District receives approximately $9 million per year in Carl Moyer funding. Recent legislation extended Carl Moyer funding until 2024.

**State AB 118 Funding -** In 2007, the California legislature approved AB 118: the California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007. AB 118 provides approximately $200 million annually through 2015 for three new programs to fund air quality improvement projects and develop and deploy technology and alternative and renewable fuels. The bill creates a dedicated revenue stream for the programs through increases to the smog abatement, vehicle registration, and vessel registration fees. AB 118 is designed to reduce emissions of criteria pollutants and greenhouse gas emissions and to deploy advanced technology. Most AB 118 programs are administered on a statewide basis. While the District has administered some of the AB 118 programs for the state, these programs have not been a significant portion of the District's incentive program revenue. However, in the future, these funds may be more important, particularly as the District becomes more involved in technology advancement projects. Recent legislation extended AB 118 funding until 2024.

**Proposition 1B Goods Movement Emission Reduction Program -** The single largest source of funding for the District's incentive programs is the Proposition 1B program, which uses bond funds for a variety of state transportation priorities. The District aggressively pursued its share of Proposition 1B funding, and the Valley will receive approximately $250 million over the life of the program. The District will receive its last allocation of Proposition 1B funding in fiscal year 2015-2016.

**Local Motor Vehicle Surcharge Fees –** Through the passage of Assembly Bill 2522 in 2008 and in recognition of the need for additional funding to assist the Valley attain federal ambient air quality standards, the District was provided with the authority to generate grant revenues through the adoption of motor vehicle surcharges for the purpose of funding emission reduction projects. In October 2010, the District acted on this authority and adopted a $12 per motor vehicle surcharge. This revenue source was then targeted to address the Valley's unmatched challenges in meeting ever-tightening federal standards as well as providing a more equitable manner to satisfy the federal mandates for ozone nonattainment penalties under section 185. These revenues have been reinvested in the Valley to reduce emissions through a variety of incentive grant programs that have replaced or retrofitted trucks, passenger vehicles, school buses, transit buses, and other mobile sources of emissions.

The District has now had two consecutive years of no violations of the 1-hour ozone standard, and has requested that EPA find the Valley in attainment and lift the section 185 penalties. If successful, this would return local control over the decision relating to the need and quantity of motor vehicle surcharges under AB 2522. Given the identified need for continued incentive funding as a means for expediting attainment of the 1997 federal PM2.5 standard and garnering the needed attainment extension, the District is proposing to use a portion of these motor vehicle surcharge revenues to fund an emission reduction commitment in the plan. Therefore, it is recommended that the AB 2522 motor vehicle surcharge be discontinued if and when the Governing Board makes a decision that such revenues are no longer necessary to meet the federal mandates for attaining the national ambient air quality standards.

### 7.2.2 Incentive Strategy

Each of the funding sources administered by the District includes different guidelines and statutory requirements for using the funds. Beyond the specific guidelines of each funding source, the District considers the following common factors when deciding how and where to spend incentive funds (see Appendix E for the full description of the following):

- Cost-effectiveness
- Inventory of available projects
- Required expenditure timeframes
- Upcoming regulatory deadlines
- Health benefits
- Promoting technology advancement
- Environmental Justice
- Community involvement/benefits

### 7.2.3 SIP Creditability of Incentive Programs (Rule 9610)

Historically, states and local air agencies have not been able to obtain SIP credit for incentive-based emissions reductions. When given SIP credit, incentive-based emissions reductions can be used alongside regulatory-based emissions reductions to meet federal Clean Air Act (CAA) requirements, such as demonstrating attainment with federal air quality standards at a future date or demonstrating that emissions reductions meet federal SIP reasonable further progress requirements. Given the heavy investment from the public and private sectors in replacing equipment under these voluntary incentives, establishing a general framework to receive SIP credit for these emissions reductions was critical for ensuring the continued success of these programs. Working together with EPA, ARB, and the USDA-NRCS, the District adopted Rule 9610 (State Implementation Credit for Emission Reductions Generated Through Incentive Programs) on June 20, 2013. District Rule 9610 establishes the administrative mechanism through which the District and ARB take SIP credit for emissions reduced through incentives.

## 7.3 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 emissions in the Valley. Meeting EPA's increasingly stringent ozone and PM2.5 air quality standards will require 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 District's ozone and PM2.5 attainment plans.

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 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.

### 7.3.1 Technology Focus Areas

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

I. **Renewable Energy**. Renewable energy projects will focus on overcoming the barriers that prevent the use or adoption of zero-emission renewable energy sources or reduce emissions from renewable energy systems to make them cleaner than comparable non-renewable alternatives.

II. **Waste Solutions**. Waste solutions will 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.

III. **Mobile Sources**. Mobile source projects will demonstrate zero- or near-zero-emissions solutions to mobile source categories with emphasis on goods and people movement, off-road equipment, or agricultural equipment.

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. Throughout implementation of this PM2.5 plan and future air quality plans, the District will continue to evaluate and, if necessary, update these technology focus areas to address to the Valley's air quality challenges.

### 7.3.2 Demonstration Projects

The District's Technology Advancement Program has had four rounds of funding and received over 130 proposals for clean technology projects. As of 2013, the District selected 27 of the proposed projects for funding, for over $7 million in support of clean technology demonstrations.

During the latest round of solicitations, in 2014, the District received 35 proposals and expects the total funding for selected projects to be approximately $4 million. 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 than those that do not.

### 7.3.3 Interagency Collaborative Demonstration Projects

In addition to projects selected through the request-for-proposals process, the District has partnered with other air quality agencies in the state to demonstrate new and emerging technologies. Examples include the following:

- ***Under-fired Charbroiler Emission Control Demonstration***
  South Coast Air Quality management District (SCAQMD) is currently conducting a demonstration project focused on control technology for under-fired charbroilers. South Coast released a program opportunity notice for this demonstration project in October 2011 to solicit proposals from control device manufacturers. District staff assisted in reviewing the submitted proposals and provided recommendations. This technology demonstration effort is testing promising prototype emission control devices, which will support future regulatory efforts at both South Coast and the District.

- ***Zero-Emission Commercial Lawn and Garden Equipment Demonstration***
  The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program will provide eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals (participants) who conduct business within the Valley. The cordless zero-emission lawn and garden equipment must be designated commercial-grade and used by commercial landscape professionals to complete multiple small to large gardening tasks over an eight-hour workday period. Eligible equipment may include, but is not limited to, lawn mowers, edgers, trimmers/brush cutters, hedge clippers, blowers/vacuums, sweepers, and chainsaws.

  The District, working with the California Air Resources Board on this demonstration project, opened a Request for Applications on August 20, 2012. The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program successfully ended in June 2013 with a total of 4 technology demonstrators, 60 participants and 445 pieces of equipment for in-use testing. The program demonstrated the performance and durability of electric equipment in non-residential applications to accelerate marked acceptance and build upon the progress already made in the residential sector.

- ***Natural Gas-Fired, Fan-Type Central Furnaces with Reduced $NO_X$ Emissions***
  South Coast conducted a demonstration project focused on prototype natural gas-fired fan-type central furnaces with reduced $NO_X$ 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. The

District co-funded this technology assessment with the SCAQMD and Southern California Gas Company (SoCal Gas). The technology assessment project was completed in the first quarter of 2014. Results of the furnace demonstration project show that the technology required to meet new NOx standards will be available by 2015. As a result of the study findings, the District amended Rule 4905 in January 2015 and incorporated more stringent NOx emissions limits for units subject to the rule and expanded applicability to include units installed in commercial buildings and in manufactured homes.

- ***Vision for Clean Air: A Framework for Air Quality and Climate Planning***
  In 2011, ARB, with the assistance of the District and South Coast AQMD, developed 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 GHG goals, and the need to reduce public exposure to toxics (e.g. diesel particulates). Through the *Vision for Clean Air* effort, the ARB, the SCAQMD, and the District have been evaluating pollutant reductions needed to meet overlapping air quality requirements for 2019, 2023, 2035, and 2050. These 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.

## 7.4 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. With persistence, the District has secured support and additional incentive funding for programs critical to emissions reductions in the Valley. The legislative platform includes both legislative priorities and positions on anticipated federal legislation. The following is a summary of the legislative priorities and District positions on anticipated federal legislation. For complete details, refer to the District's legislative strategy, adopted in January 2015.[3]

### Streamline Implementation of the Clean Air Act

Since its adoption, the Clean Air Act has led to significant improvements in air quality and public health benefits throughout the nation. However, as an area in the nation with mature local air quality management programs, the Valley has reached the point of diminishing returns. After more than 20 years since the last amendments to the CAA, many well-intentioned provisions are leading to unintended adverse consequences.

[3] SJVAPCD. *Item Number 10: Approve the District's 2015 Legislative Platform and take positions on anticipated federal air quality legislative proposals.* (22, January 2015). Available at: http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2015/January/final/10.pdf

The antiquated provisions of the Clean Air Act are now leading to confusion, and lack of updated congressional directive has rendered courts as policy makers.

The District recommends the CAA be amended to allow for consideration of the following critical factors:

- Upcoming health standards and associated deadlines are impossible to meet.
- The current five year review of standards is too short and has led to overlapping requirements and chaotic transitions between standards.
- Requiring contingency measures in extreme nonattainment areas is irrational and unnecessary.
- CAA Section 185 requirements for businesses in “Severe” and “Extreme” non-attainment areas to pay non-attainment penalty fees, is unfair and ineffective.
- The CAA requirements for Severe and Extreme ozone nonattainment areas to address vehicle-related emissions growth must be clarified.
- Transition to health risk-based approach in lieu of the current mass based approach.

**Increase State Subvention Funding to Provide More Support for Unfunded Mandates**

Local air pollution control and air quality management districts receive funds to support important local air program activities. These funds are allocated from the Motor Vehicle Account through the budget of the California Environmental Protection Agency, under the Air Resources Board section have not been adjusted for inflation or added responsibilities for over twenty years. The District supports an increase in subvention funds to help offset increases in costs and responsibility. The District currently receives $900,000 per year which is less than 2% of the District’s annual operating budget.

**Policies/Guidelines for the Carl Moyer Program**

The Carl Moyer Program has been a valuable source of incentive funds to obtain voluntary emissions reductions from mobile sources of emissions; funding has recently been extended through 2023. The following policies should guide the state as new guidelines/requirements are developed for the program through the new sunset date:

- The focus of the Carl Moyer Program should continue to be the reduction of criteria pollutants. Efforts to include GHG emissions projects should only be considered as co-benefits to projects that are principally designed for the reduction of criteria pollutant emissions.
- Regional funding formulas should continue to utilize a region’s non-attainment status, and the severity of the air quality problem, as the primary factor in determining the regional breakdown of statewide Carl Moyer funding.
- With respect to regulatory deadlines, incentive funding should be decoupled from regulatory enforcement. Projects that provide cost-effective and surplus emission reductions should be eligible for funding regardless of compliance status with respect to regulatory deadlines.

### Cap and Trade Revenues

The cap and trade program implemented by ARB sets up a mechanism by which affected sources can procure allowances or offsets to meet specified and declining caps on their GHG emissions. This scenario can potentially lead to adverse impacts in areas that are already disproportionately impacted by criteria pollutant emissions. The Cap and Trade Program generates in excess of $1 billion annually. The state allocates these funds to programs across a number of state agencies. The following overarching policies should be applied as the state considers funding projects and programs from the Greenhouse Gas Reduction Fund:

- Projects funded with Cap and Trade revenues should achieve GHG reductions, with priority given to projects that achieve reductions in criteria pollutants as well.
- A portion of Cap and Trade revenues should be directed to projects in areas that are already disproportionately impacted by air pollution.
- Policies should be put in place to ensure that programs funded with Cap and Trade revenues meet or exceed the provisions of Senate Bill 535 that require a minimum of 25% of the Cap and Trade revenue be spent to benefit disadvantaged communities and that 10% of the revenue be spent in those communities.

### Oppose Climate Change Measures that Result in Public Health Detriment Due to Increases in Criteria or Toxic Air Emissions

Although climate change measures provide for many co-benefits in reducing both GHGs and criteria pollutant emissions, there are some measures that may lead to increases in criteria pollutant or toxic emissions. Therefore the District will support reasonable climate protection measures that reduce GHG emissions as well as toxic and criteria pollutants. The District will oppose climate change measures that are detrimental to public health by leading to increases in toxic or criteria pollutant emissions in already impacted areas.

### Disadvantaged Community Policies

The Valley is home to a number of disadvantaged communities that deserve care and attention. The District will adhere to the following principles in pursuing efforts to identify and address the needs of these communities:

- Support measures that improve quality of life and economic welfare. In identifying communities of need, both socioeconomic and environmental impacts should be considered. The District supports CalEPA’s California Communities Environmental Health Screening tool (CalEnviroScreen) as the appropriate tool for identifying disadvantaged communities.
- The District considers poverty as a key factor contributing to diminished public health and will oppose efforts that lead to “redlining” these communities and inhibit economic growth.
- The District will support efforts to target additional state and federal resources to mitigate issues faced in disadvantaged communities.
- The District will oppose measures that dilute local control by diverting local revenues or the authority over the expenditure of local resources to the state or federal government. Reduced local control will weaken local enforcement

programs. Local agencies are better suited to efficiently and effectively identify and address community needs.

**Seek funding and other support from ARB and EPA to install and operate additional air quality monitoring instruments throughout the Valley**
The District operates one of the most extensive air monitoring networks in the nation. Data from these monitors is utilized to measure progress and assess the need for further reductions needed to attain National Ambient Air Quality Standards (NAAQS) established by EPA. The District is also committed to providing accurate and timely air quality information to educate and empower the public to protect themselves during poor air quality episodes. This is accomplished utilizing the air monitoring data through the District's first-in-the-nation Real-Time Air Advisory Network (RAAN).

Installation, operation and maintenance of the Districts air monitoring network is resource intensive. The District's annual operating appropriation for air monitoring is approximately $2.9 million. The increase in federal mandates relating to air monitoring (more monitors and more labor intensive QA/QC and reporting procedures for existing monitors) combined with the need for more monitoring capabilities to satisfy the District's initiative to provide neighborhood by neighborhood air quality information require additional resources.

**Support efforts that provide for cost-effective alternatives to open burning of agricultural waste**
Given current energy policy in California, biomass power facilities, which are one of the primary alternatives to agricultural burning, are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking and that the prices being offered for new contracts are too low to support their operations. The District will support efforts to help level the playing field and provide fair competition between biomass plants and other renewable sources of power. The District will also support research and development of alternatives to the open burning of agricultural waste.

**Technology Advancement**
Meeting the newest air quality standards will require transformative measures and technologies to achieve near zero emissions. In order to further develop technology to close the gap in required emissions reductions, the District operates a Technology Advancement Program. Along with its own resources, the District is seeking state and federal assistance to advance technology in the following areas:

- Mobile sources projects that demonstrate zero- or near-zero-emissions solutions to mobile source categories with emphasis on goods and people movement, off-road equipment, or agricultural equipment.
- Renewable energy projects that focus on overcoming the barriers that prevent the use or adoption of zero-emission renewable energy sources or reduce emissions from renewable energy systems to make them cleaner than comparable non-renewable alternatives.

- Waste solutions projects that 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.

**Support adequate resources and policies to reduce the impact of wildfires and their attendant public health impact**
Wildfires result in significant loss of life and property and the associated air pollution well exceeds the total industrial and mobile source emissions in the Valley. These emissions result in significant adverse public health impacts in the Valley and in many regions throughout California. Reducing wildfires and the resulting air pollutants requires a sustained and multi-faceted approach that employs effective measures to reduce fuel supplies and adequate resources to manage fires when they occur. The District supports policies and initiatives that would encourage rapid disposal of the fuel supply, including the following:

- Additional financial and staffing resources for public and private land managers to conduct prescribed burning as an effective means for reducing fuel supplies that lead to large and uncontrollable wildfires.
- Additional resources to manage wildfires when they occur.
- 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.
- 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.

## 7.5 PUBLIC OUTREACH

The District's outreach programs are integral to the development, implementation, and success of attaining federal air quality standards. In addition, engaging the public in efforts to reduce emissions is a key element of the District's attainment strategy. Education increases public support for new and controversial regulations. The District's education and information program has expanded and evolved over the years. The following outreach programs are some examples of District programs related to health-based PM2.5 control measures and strategies.

**Real-Time Air Advisory Network (RAAN)**
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 air basin. 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 it is now available to all Valley residents.

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. The knowledge that exercise magnifies the health risks of PM2.5 exposure motivated the District to develop the RAAN program. Anyone can subscribe to RAAN at no charge through the District's website (www.valleyair.org); 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.

**Real-Time Outdoor Activity Risk (ROAR)**

To support the expanded RAAN program, the District developed the Real-time Outdoor Activity Risk (ROAR) scale. The levels of this scale provide 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 that is 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.

**Web-based Archived Air Quality System (WAAQS)**

Following-up on the success of the RAAN program, the District develop a system that would provide air quality conditions on a neighborhood by neighborhood scale as opposed to being limited to only the readings from monitors. This project was organized through a three phase approach as described in the following table.

### Table 7-3 Phased Implementation of WAAQS

| Phase | Date | Description |
|---|---|---|
| **I** | Completed in 2014 | This phase established a modeling technique for quantifying neighborhood level ozone and PM2.5 concentrations. The District has already used this modeling technique to generate neighborhood level ozone and PM2.5 concentrations for each of the approximately 3,600 grid cells (4 km x 4 km) that make up the Valley dating back to 1990. This data is being used as the foundation for providing historical air quality information under Phase II of this project |
| **II** | Beta version released on 3/1/2015 | The District committed to provide an online tool to the public that will allow residents to view historical air quality information for their neighborhood by simply entering an address of their choosing. This newly developed system has been named the Web-Based Archived Air Quality System (WAAQS).<br><br>The neighborhood level air quality statistics that will be provided to the public consist of the following:<br>• Number of days with Good air quality<br>• Number of days with Unhealthy air quality<br>• Days over federal standards for ozone and PM2.5<br>• Neighborhood air quality compared to trends for the County and San Joaquin Valley<br>The District will accept and consider in a continuous effort to improve the information provided on the web page. |
| **III** | Launching in 2016 | This phase will give the public access to real-time air quality information on a neighborhood by neighborhood basis and ensure that Valley residents have the most detailed and accurate information with which to make decisions regarding outdoor activity. |

### Check Before You Burn

The Check-Before-You-Burn outreach program is critical to the implementation of District Rule 4901—Wood Burning Fireplaces and Wood Burning Heaters. Rule 4901 and the Check-Before-You-Burn program are credited with reducing levels of PM2.5 emissions during the winter season to historically low levels. The rule and outreach program together have achieved the highest level of public recognition and compliance of any District program, with 80% of Valley residents professing awareness of it based on a 2014 public survey.[4]

Annual Check-Before-You-Burn outreach campaigns feature District Governing Board members in outdoor, radio, and video media speaking to the public about how to get involved in clean air activities. The District also uses extensive social media posts (Facebook and Twitter) to reach even more segments of the Valley's population. In addition, the District's toll-free information line and website receives thousands of "hits"

[4] San Joaquin Valley Air Pollution Control District: Memorandum to SJVUAPCD Governing Board, District's Public Opinion Survey Relating to Residential Wood Burning and Other Habits of Valley Residents. Fresno, CA: Public Governing Board Meeting, March 20, 2014. Available at http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2014/march/final/09.pdf

during the wood-burning season, specifically to access wood-burning forecast information.

### 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. Many of the 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). Components of the Health Air Living message include *Blue Sky, Brown Sky; It's Up To You* kids activity kits aimed at elementary school students and their parents; 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.

## 7.6 ADDITIONAL STRATEGIES

Non-regulatory strategies help accelerate attainment and have been an important part of recent District air quality attainment plans. The following strategies are supported by the District as alternative methods to reduce emissions in the Valley.

### Energy Efficiency

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. 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.

### 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 informational

[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

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

**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.

The District has created the guideline: *Green Purchasing and Contracting: A guide to reducing environmental impacts through the procurement process*.[6] 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 adopting policies and practices to make green purchasing and contracting a routine part of their operations.

**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*[7] 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. Some examples of alternative energy options include solar energy, wind turbines, biomass, dairy digesters, and electric irrigation pumps.

[6] SJVAPCD. *Green Purchasing and Contracting: A guide to reducing environmental impacts through the procurement process.* Available at http://www.valleyair.org/Programs/FastTrack/2011/GreenPurchasingReport4-6-11%20_2_.pdf.
[7] SJVAPCD. *Alternative Energy: On the Fast Track to Clean Air. A Guide for Considering Clean Energy Options in the San Joaquin Valley.* Available at http://www.valleyair.org/Programs/FastTrack/2011/Alternative%20Energy.pdf

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# Chapter 8

Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Chapter 8: Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities

As discussed earlier, this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan)* contains Most Stringent Measures, Best Available Control Measures, and ensures expeditious attainment. Furthermore, under Section 4.2 of Chapter 4, this plan commits to producing additional reductions in emissions to further expedite attainment. Despite the fact that this plan contains all the necessary elements for approval, the District is fully aware that meeting the tougher newer National Ambient Air Quality Standards require additional efforts and further reductions in emissions.

Over the next year, the District must adopt State Implementation Plans (SIP) to address the 2006 PM2.5 Standard (of 15 $\mu g/m^3$ annual and 35 $\mu g/m^3$ 24-hr) and the 2012 PM2.5 Standard (of 12 $\mu g/m^3$ annual and 35 $\mu g/m^3$ 24-hr). Additionally, the District must also develop a SIP for the 2008 Ozone Standard (of 75 ppb) by July 2016. As always, the District will leave no stone unturned to evaluate and identify further opportunities to advance attainment of the ever-tightening National Ambient Air Quality Standards. Of course, the opportunities identified to reduce emissions towards meeting these tougher standards may also help expedite attainment with the 1997 PM2.5 standard addressed by this plan. In developing these plans, the District will reevaluate all of its existing regulations and will explore all potential measures for all source categories. However, in the short term, the District commits to conduct the evaluations described below and to include any identified additional actions for reducing emissions and implementation schedules in the District's attainment plan submission for the 2012 PM2.5 NAAQS in Fall 2016. Upon full approval of the *2015 PM2.5 Plan* by EPA, these commitments will be enforceable by EPA as provided for under the Clean Air Act.

## 8.1 Rule 4311—Flares

As demonstrated in Appendix C, District Rule 4311 already meets BACM and MSM requirements. However, due to the need to demonstrate attainment for multiple federal ozone and PM2.5 standards in the coming years and need to search for all available emissions reductions, the District commits to undertaking a comprehensive review of FMPs submitted under Rule 4311. The District commits to conduct the evaluation and have a draft report available for public review and commenting by December 1, 2015. After addressing public comments, the District commits to finalize this report by March 31, 2016. This evaluation will be conducted in close coordination with flare operators in the Valley and will include the following elements:

1. The District will review submitted FMPs to identify the most effective flare minimization practices utilized by operators to reduce flaring in various source categories and applications. Upon completion of review, the District commits to working closely with affected operators to evaluate and implement, when feasible, the most effective flare minimization practices through the FMP submittal and approval process under Rule 4311.

2. The District will evaluate the technological achievability and economic feasibility of implementing new/additional minimization practices or technologies at affected facilities.

## 8.2 Warm Mix Asphalt

Emissions from asphalt usage are extremely small and do not significantly contribute to elevated PM2.5 levels in the Valley. However, due to the need to demonstrate attainment for multiple federal ozone and PM2.5 standards in the coming years and need to search for all available emissions reductions, the District commits to a number of actions to evaluate and promote the use of WMA in the Valley. The District commits to conduct the evaluation and have a draft report available for public review and commenting by December 1, 2015. After addressing public comments, the District commits to finalize this report by March 31, 2016. This evaluation will be conducted in close coordination with stakeholders (asphalt plant operators, Caltrans, city and county planning departments, ARB, EPA, and others) and will include the following elements:

1. The District will evaluate opportunities to further encourage transportation and county agencies to continue transitioning from HMA to WMA as feasible. As part of this evaluation, the District will explore the potential feasibility of additional control measures and granting mitigation credits for WMA usage through the District's Indirect Source Review (ISR) program.

2. The District will evaluate potential outreach and education opportunities for encouraging project developers/construction managers to increase their adoption and implementation of WMA.

## 8.3 Rule 4550—Conservation Management Practices

As documented in Appendix C, District Rule 4550 already meets BACM and MSM requirements. It is also questionable that further opportunities for reducing PM2.5 emissions exist. However, as stated earlier, in developing plans for the new and existing National Ambient Air Quality Standards, the District will reevaluate all existing regulations including Rule 4550 to evaluate all feasible opportunities for additional emissions reductions, if any. The District commits to conduct the evaluation and have a draft report available for public review and commenting by May 31, 2016. After addressing public comments, the District commits to finalize this report by October 15, 2016. This evaluation will be conducted in close coordination with stakeholders (agricultural industry representatives, ARB, EPA, NRCS, farm bureaus, and others).

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# Appendix A

Ambient PM2.5 Data Analysis

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix A: Ambient PM2.5 Data Analysis

The concentration of ambient of particulate matter that is 2.5 microns or less in diameter (PM2.5) at any given location in the San Joaquin Valley (Valley) is a function of meteorology, the natural environment, atmospheric chemistry, and emissions of directly emitted PM2.5 and PM2.5 precursors from regulated and unregulated sources. The San Joaquin Valley Air Pollution Control District (District), the California Air Resources Board (ARB), and other agencies[1] monitor PM2.5 concentrations throughout the Valley,[2] using filter-based monitoring (starting in 1999) and real-time concentration monitoring (starting in 2002). The U.S. Environmental Protection Agency (EPA) serves as the official repository of ambient PM2.5 data and analysis.[3]

The District uses the collected data to show air quality improvement through the standardized design value 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 (DV) data show steady, long-term air quality improvement that will lead to the attainment of the 1997 PM2.5 Standard.

The District also uses the data to evaluate the impact of changing daily, quarterly, and annual PM2.5 concentrations on public health. These trend analyses provide the District with critical information about how to develop control measures and incentive programs that provide the most impact to public health improvements, as guided by the District's Health Risk Reduction Strategy (see Chapter 3).

This appendix provides the technical details used to evaluate and analyze the District's PM2.5 concentration data as summarized in Chapters 2 of this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan*). It also shows the multiple factors that affect ambient PM2.5 concentrations in the Valley (e.g. meteorology, exceptional events) and the evidence for air quality improvement through District regulatory actions, including the District's highly successful Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters).

## A.1 PM2.5 CONCENTRATIONS—MEASUREMENT AND INFLUENCES

The District, ARB, and other agencies manage an extensive air monitoring network throughout the Valley. The information obtained from the PM2.5 monitors within this network provide the District with necessary information for demonstrating attainment of the NAAQS and valuable information for protecting public health throughout the year. The monitoring network captures the spatial, seasonal, daily, weekly, and annual variations in PM2.5 concentrations throughout the Valley that result from changing meteorology, the occurrence of exceptional events (e.g. high winds and wildfires), and PM2.5 emissions from regulated and unregulated sources.

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[1] Other agencies include the Chukchansi and Tachi Yokut Tribe and the National Park Service.
[2] *San Joaquin Valley Air Pollution Control District Air Monitoring Network Plan*: January 28, 2015 submittal to EPA. Available at http://www.valleyair.org/aqinfo/Docs/2014-Air-Monitoring-Network-Plan.pdf
[3] 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/

### A.1.1 PM2.5 Monitor Types

The District and ARB use three types of PM2.5 monitors in the Valley:

- Filter-based Federal Reference Method (FRM) monitors, defined as the standard for data collection;
- Real-time beta-attenuation method (BAM) monitors designated as federal equivalent method (FEM) monitors, and hereafter referred to as BAM/FEM monitors;
- Ordinary BAMs, not designated FEM, and hereafter referred to as BAM; and
- Filter-based speciation monitors, similar to FRM monitors.

Only FRM and BAM/FEM monitors produce data that is suitable for comparison with the NAAQS, and are therefore used for design value calculations. Real-time monitors (BAM/FEM and BAM) produce hourly measurements that the District uses every day to produce daily air quality forecasts, wood burning declarations, public health notifications, and Real-time Air Advisory Network (RAAN) notifications for schools.

The filter-based speciation monitors operate similarly to the standard FRM monitors; however, because of the specific analysis requirements for the different PM2.5 species (e.g. metals, silicon, chlorine, organics) multiple filter media are required, hence a multi-filter collection system. The evaluation and analysis of multiple PM2.5 species is critical to the development of an effective attainment strategy.

### A.1.2 Meteorological Influences on PM2.5 Concentrations

Particulates in the atmosphere are dispersed by horizontal and vertical mixing within an air mass. Wind flow (horizontal mixing) and temperature instability (decreasing temperature with height leading to vertical mixing) provides the strongest mechanisms for dispersing pollutants. Wind speed can greatly influence the pollutant concentrations by horizontally mixing and dispersing pollutants over a large area. Generally, the higher the wind speed the lower the PM2.5 concentrations; however, in some cases, excessive winds may cause elevated PM2.5 levels as high winds entrain PM10 as well as PM2.5.

Vertical mixing of the air mass can result from atmospheric instability. A temperature inversion, or increasing temperature with increasing height, can inhibit the vertical mixing of an air mass, and create a situation in which pollutants remain trapped near the surface. Prolonged periods of high pressure and stable conditions with low wind speeds can cause stagnant conditions that trap pollutants near the surface. PM2.5 concentrations increase during these poor dispersion periods. During low pressure events, unstable conditions and stronger wind speeds occur. PM2.5 concentrations can decrease or increase depending on the strength and characteristics of the low pressure system.

Atmospheric weather patterns influence climate conditions, local meteorology, and PM2.5 concentrations. The next section describes the air quality impacts from the extreme drought.

### A.1.2.1 Valley Drought

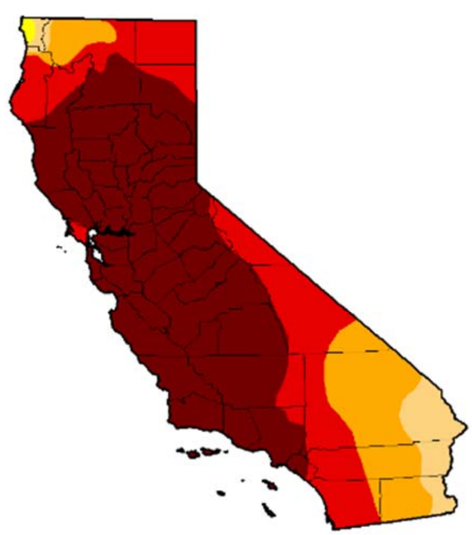
According to the United States Geologic Survey, California is experiencing its worst drought in over a century. The 2013-2014 Winter represented the third consecutive year of drought conditions in the Valley, and was by far the driest winter of the three years. On January 17, 2014, the Governor of California declared a drought emergency for all of California. Figure A-1 is a map produced by the National Drought Mitigation Center depicting the extent and severity of the drought affecting California as of November 4, 2014.

**Figure A-1 Drought Extent and Severity in California**

Home 〉 State Drought Monitor

**U.S. Drought Monitor**

**California**



**November 4, 2014**

*(Released Thursday November 6, 2014)*

Valid 7 a.m. EST

Statistics type: Traditional (D0-D4, D1-D4, etc.) Categorical (D0, D1, etc.)

*Drought Condition (Percent Area):*

| Week | Date | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|---|
| Current | 2014-11-04 | 0.00 | 100.00 | 99.71 | 94.42 | 79.69 | 55.08 |
| Last Week | 2014-10-28 | 0.00 | 100.00 | 100.00 | 95.04 | 81.92 | 58.41 |
| 3 Months Ago | 2014-08-05 | 0.00 | 100.00 | 100.00 | 99.80 | 81.92 | 58.41 |
| Start of Calendar Year | 2013-12-31 | 2.61 | 97.39 | 94.25 | 87.53 | 27.59 | 0.00 |
| Start of Water Year | 2014-09-30 | 0.00 | 100.00 | 100.00 | 95.04 | 81.92 | 58.41 |
| One Year Ago | 2013-11-05 | 2.62 | 97.38 | 95.98 | 84.12 | 11.36 | 0.00 |

Population Affected by Drought: **37,240,921** View More Statistics

Download:

**Intensity:**

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

**Author(s):**

Matthew Rosencrans, NOAA/NWS/NCEP/CPC

**The National Drought Mitigation Center** | 3310 Holdrege Street | P.O. Box 830988 | Lincoln, NE 68583–0988
phone: (402) 472–6707 | fax: (402) 472–2946 | Contact Us

A persistently strong high pressure ridge over the eastern Pacific Ocean and the western United States effectively blocked weather disturbances from entering California. The historic strength and longevity of this high pressure resulted in a lack of rainfall throughout the Valley, and California as a whole (Table A-1).

Many cities in California, including those in the Valley, had record low rainfall totals during 2013 calendar year, with some records that have stood for over 100 years being broken.

**Table A-1 2013 Calendar Year Rainfall Totals for Select Valley and California Cities**

| Region | City | 1981-2010 Average (inches) | 2013 Total (inches) | Previous Record Low (inches) | Previous Record Year |
|---|---|---|---|---|---|
| Valley | Modesto | 13.11 | 4.70 | 5.70 | 1929 |
| | Merced | 12.50 | 3.79 | 6.00 | 2007 |
| | Fresno | 11.50 | 3.01 | 3.55 | 1947 |
| | Visalia | 10.93 | 3.47 | 4.10 | 1910 |
| | Bakersfield | 6.47 | 3.43 | 1.87 | 1959 |
| Other parts of California | Sacramento | 18.52 | 5.81 | 6.67 | 1976 |
| | San Francisco | 23.65 | 5.59 | 9.00 | 1917 |
| | San Jose | 14.90 | 3.80 | 6.04 | 1929 |
| | Los Angeles | 12.82 | 3.65 | 4.08 | 1953 |
| | San Diego | 10.34 | 5.57 | 3.41 | 1953 |

### *A.1.2.2 Exceptional Event Influences on PM2.5 Concentrations*

Valley PM2.5 concentrations are also affected by exceptional events such as wildfires, high winds, and fireworks. An exceptional event is defined as that affects air quality; is not reasonably controllable or preventable; is caused by either a human activity that is unlikely to recur at a particular location or a natural event; and is determined by EPA to be an exceptional event.[4] Such events can result in PM2.5 concentration peaks, or even extended high-concentration episodes such as summertime wildfires.

Since exceptional events are not reasonably preventable or controllable, it is inappropriate to use data influenced by these events. With proper documentation and EPA concurrence, data influenced by exceptional events can be excluded from official attainment demonstration design value calculations. Design values, which will be discussed fully in Section A.2, represent a three-year average of 24-hour and annual mean PM2.5 concentrations.

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 PM2.5 concentrations and attainment progress. The District has experienced fireworks activity, high wind events, and wildfire events in the past that caused PM2.5 concentrations to exceed the PM2.5 Standard. Two examples include a fireworks event in July 2007 and a summertime wildfire event in 2008. Analyses presented in the *2012 PM2.5 Plan* illustrated how fireworks and wildfire events can also influence the design value calculations and whether or not an area may achieve attainment of the PM2.5 Standard.

[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), (40 CFR 50.14)

## A.2 ATTAINMENT DEMONSTRATION—DESIGN VALUES

Design values represent the official metric for assessing air quality improvements and attainment of the NAAQS per the Federal Clean Air Act and EPA regulations. Design value calculations are three-year averages that follow EPA protocols for rounding, averaging conventions, data completeness, sampling frequency, data substitutions, and data validity. The results provide consistency and transparency to determine basin-wide attainment for both components of the 1997 PM2.5 Standard, including the 24-hour PM2.5 standard of 65 µg/m³ and the annual PM2.5 standard of 15.0 µg/m³. If any monitoring site within the air basin has either a 24-hour or annual PM2.5 design value higher than the respective standard, then the entire air basin is designated nonattainment.

Table A-2 provides the generalized descriptions of how the 24-hour average and annual average design values are calculated for PM2.5. EPA provides detailed guidelines and standards for the calculation[5] and data handling[6] methodologies.

**Table A-2 General PM2.5 Design Value Calculation Methods**

| Averaging Period | Level | Calculation Method |
|---|---|---|
| 24-hour | 65 µg/m³ | **Step 1:** *Determine the 98th percentile value for each year over a consecutive three year period.*<br>**Step 2:** *Average the three 98th percentile values.*<br>**Step 3:** *Round the resulting value to the nearest 1.0 µg/m³.*<br>**Step 4:** *Compare the result to the standard.* |
| Annual | 15.0 µg/m³ | **Step 1:** *Calculate the average of each quarter of each year over a three year period.*<br>**Step 2:** *Average the four quarters in a calendar year to determine the average for each year.*<br>**Step 3:** *Average the three annual values.*<br>**Step 4:** *Round the resulting value to the nearest 0.1 µg/m³.*<br>**Step 5:** *Compare the result to the standard.* |

Tables A-3 through A-6 show the trend of the 24-hour average and annual average values for each PM2.5 monitoring site in the Valley by year as well as the three-year average design values for these metrics through the year 2013.

24-hour single-year 98$^{th}$-percentile averages (Table A-3) are used to generate the three-year average 24-hour design values (Table A-4). Single-year average PM2.5 concentrations (Table A-5) are used to generate the three-year average annual design values (Table A-6). These data are also shown graphically in Figures A-2.1 through A-

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[5] Interpretation of the National Ambient Air Quality Standards for PM2.5, 40 C.F.R. Pt. 50 Appendix N (2012). Available at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=9bdb7a34dcb75892aef9ee60b74da642&rgn=div9&view=text&node=40:2.0.1.1.1.0.1.18.15&idno=40

[6] Environmental Protection Agency [EPA]: Office of Air Quality Planning and Standards. (1999, April). *Guideline on Data Handling Conventions for the PM NAAQS* (EPA-454/R-99-008). Retrieved from http://www.epa.gov/ttn/oarpg/t1/memoranda/pmfinal.pdf

2.32 for a number of monitoring sites in the Valley. Note that the Fresno-First monitoring site was closed in early 2012 and its nearby replacement site of Fresno-Garland was opened soon after. To form a continuous data record, these two sites were combined to create a Fresno-First/Garland historical record.

Average ambient PM2.5 concentrations vary by monitoring site within the Valley. In general, monitoring sites in the northern part of the Valley record the lowest ambient PM2.5 concentrations. Currently more Valley air monitoring sites meet the 1997 24-hour average standard of 65 $\mu g/m^3$ than the annual average standard of 15.0 $\mu g/m^3$. For 2013, all District sites have met the 1997 24-hour PM2.5 Standard. For the annual average PM2.5 Standard, most monitoring sites are showing a downward trend; however, the concentrations remain above the annual mean NAAQS.

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**Table A-3 Single Year 24-hour Average PM2.5 98th Percentile Values (µg/m$^3$)**

| SJV Monitoring Site | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stockton | 79.0 | 55.0 | 58.0 | 50.0 | 41.0 | 36.0 | 44.0 | 42.0 | 48.0 | 61.6 | 40.4 | 29.7 | 44.8 | 33.9 | 56.3 |
| Manteca | | | | | | | | | | | | | 38.9 | 30.9 | 40.2 |
| Modesto | 100.0 | 71.0 | 69.0 | 69.0 | 47.0 | 45.0 | 55.0 | 52.0 | 57.4 | 53.9 | 54.5 | 37.3 | 54.7 | 40.8 | 56.4 |
| Turlock | | | | | | | | | | | 53.1 | 43.5* | 57.4 | 45.4 | 55.4 |
| Merced-Coffee | | | | | | | | | | | | 39.9 | 47.4 | 35.6 | 42.3 |
| Merced-M | 91.9 | 60.0 | 49.3 | 55.1 | 44.2 | 43.0 | 48.3 | 43.8 | 52.7 | 54.0 | 45.2 | 35.5 | 38.5 | 41.8 | 67.3 |
| Madera-City | | | | | | | | | | | | 57.0 | 59.1 | 43.2 | 54.6 |
| Fresno-First | 120.0 | 90.0 | 75.0 | 75.0 | 56.0 | 52.0 | 71.0 | 51.0 | 67.0 | 57.4 | 55.8 | 48.8 | 69.5 | | |
| Fresno-Garland | | | | | | | | | | | | | | 52.6 | 63.8 |
| Fresno-Winery | | 64.8 | 61.5 | 71.9 | 49.7 | 49.4 | 71.2 | 55.0 | 57.4 | 44.5 | 48.2 | 37.0 | 67.5 | 51.3 | 71.6 |
| Clovis | 59.2 | 72.5 | 71.5 | 53.2 | 48.1 | 52.4 | 63.0 | 51.3 | 60.9 | 49.0 | 49.0 | 44.3 | 68.5 | 48.0 | 56.2 |
| Tranquility | | | | | | | | | | | | 27.7 | 27.5 | 26.9 | 35.7 |
| Corcoran | 53.0* | 55.1 | 89.5 | 65.1 | 42.2 | 49.4 | 74.5 | 50.1 | 57.9 | 47.9 | 53.4 | 47.2 | 40.8* | 40.0* | 66.0 |
| Hanford | | | | | | | | | | | | | 64.6 | 48.3 | 67.6 |
| Visalia | 114.0 | 103.0 | 96.0 | 70.0 | 47.0 | 54.0 | 65.0 | 50.0 | 59.7 | 62.1 | 53.9 | 36.3 | 50.7 | 53.8 | 62.5 |
| Bakersfield-Golden | 95.3 | 93.9 | 95.9 | 80.4 | 51.9 | 53.9 | 74.9 | 64.4 | 67.7 | 60.8 | 68.6 | | | | |
| Bakersfield-California | 97.4 | 92.7 | 94.9 | 73.0 | 48.3 | 61.5 | 63.2 | 60.5 | 73.0 | 64.5 | 66.7 | 53.3 | 65.5 | 56.4 | 71.8 |
| Bakersfield-Planz | | 76.5 | 90.6 | 66.8 | 47.5 | 47.6 | 66.4 | 64.7 | 72.2 | 72.3 | 65.5 | 56.2 | 43.2 | 40.6 | 96.7 |

**Table A-4 24-hour Average PM2.5 Design Values (Three-Year Averages, µg/m$^3$), end year listed (2011-2013, 2013)**

| SJV Monitoring Site | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stockton | 64 | 54 | 50 | 42 | 40 | 41 | 45 | 51 | 50 | 44 | 38 | 36 | 45 |
| Manteca | | | | | | | | | | | | 38* | 37 |
| Modesto | 80 | 70 | 62 | 54 | 49 | 51 | 55 | 54 | 55 | 49 | 49 | 44 | 51 |
| Turlock | | | | | | | | | 60 | 55* | 51* | 49* | 53 |
| Merced-Coffee | | | | | | | | | | | 43** | 41 | 42 |
| Merced-M | 67 | 55 | 50 | 47 | 45 | 45 | 48 | 50 | 51 | 45 | 42 | 40 | 49 |
| Madera-City | | | | | | | | | | | | 53 | 52 |
| Fresno-First | 95 | 80 | 69 | 61 | 60 | 58 | 63 | 58 | 60 | 54 | 58 | | |
| Fresno-Garland | | | | | | | | | | | | | 58*** |
| Fresno-Winery | 63 | 66 | 61 | 57 | 57 | 59 | 61 | 52 | 50 | 43 | 53 | 53 | 63 |

| SJV Monitoring Site | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clovis | 68 | 66 | 58 | 51 | 55 | 56 | 58 | 54 | 53 | 47 | 54 | 54 | 58 |
| Tranquillity | | | | | | | | | | | 30** | 27 | 30 |
| Corcoran | 66 | 70 | 66 | 52 | 55 | 58 | 61 | 52 | 53 | 49 | 47* | 43 | 49 |
| Hanford | | | | | | | | | | | | 54* | 60 |
| Visalia | 104 | 90 | 71 | 57 | 55 | 56 | 58 | 57 | 59 | 51 | 47 | 47 | 56 |
| Bakersfield-Golden | 95 | 90 | 76 | 62 | 60 | 64 | 69 | 64 | 66 | | | | |
| Bakersfield-California | 95 | 87 | 72 | 61 | 58 | 62 | 66 | 66 | 68 | 62 | 62 | 58 | 65 |
| Bakersfield-Planz | 84 | 78 | 68 | 54 | 54 | 60 | 68 | 70 | 70 | 65 | 55 | 47 | 60 |

## Table A-5 Single Year Annual Mean PM2.5 Concentrations (μg/m$^3$)

| SJV Monitoring Site | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stockton | 19.7 | 15.5 | 13.9 | 16.7 | 13.6 | 13.2 | 12.5 | 13.1 | 12.9 | 14.4 | 11.3 | 10.6 | 11.3 | 12.4 | 17.7 |
| Manteca | | | | | | | | | | | | | 10.7 | 8.1 | 11.6 |
| Modesto | 24.9 | 18.7 | 15.6 | 18.7 | 14.5 | 13.6 | 13.9 | 14.8 | 15.0 | 16.0 | 13.0 | 12.1 | 14.7 | 11.9 | 14.3 |
| Turlock | | | | | | | | | | | 16.1 | 12.5* | 17.1 | 14.8 | 15.0 |
| Merced-Coffee | | | | | | | | | | | | 16.3 | 15.6 | 11.0 | 13.3 |
| Merced-M | 22.6 | 16.7 | 14.5* | 18.7 | 15.7 | 15.2 | 14.1 | 14.8 | 15.2 | 14.9* | 13.6 | 11.2 | 10.4 | 9.5 | 13.5 |
| Madera-City | | | | | | | | | | | | 21.1* | 20.4 | 16.0 | 17.8 |
| Fresno-First | 27.6 | 24.5 | 19.8 | 21.5 | 17.8 | 16.3 | 16.7 | 16.8 | 18.8 | 17.4 | 15.1 | 13.0 | 15.5 | | |
| Fresno-Garland | | | | | | | | | | | | | | 14.1 | 16.8 |
| Fresno-Winery | | 18.4 | 18.6 | 21.3 | 17.8 | 17.0 | 16.9 | 17.6 | 16.8 | 16.5 | 14.6 | 13.4 | 15.4 | 12.7* | 15.9* |
| Clovis | 19.8 | 16.3 | 18.0 | 16.2 | 18.5* | 16.4 | 16.3 | 16.4 | 16.4 | 16.2 | 18.3 | 14.7 | 17.9 | 15.4 | 15.9 |
| Tranquillity | | | | | | | | | | | | 7.0* | 8.2 | 7.0 | 8.3 |
| Corcoran | 14.3* | 16.4 | 19.2 | 21.5 | 16.2 | 17.4 | 17.5 | 16.9 | 18.4 | 15.8 | 17.7 | 17.9 | 12.8* | 16.5* | 15.6 |
| Hanford | | | | | | | | | | | | | 18.0 | 14.8 | 18.2 |
| Visalia | 27.6 | 23.9 | 22.5 | 23.2 | 18.2 | 17.0 | 18.8 | 18.8 | 20.4 | 19.8 | 16.0 | 13.6 | 16.1 | 14.8 | 18.9 |
| Bakersfield-Golden | 26.2 | 22.6 | 21.8 | 24.1 | 19.6 | 18.2 | 19.1 | 18.6 | 19.9 | 17.9 | 20.0 | | | | |
| Bakersfield-California | 23.8 | 22.5 | 21.2 | 22.7 | 17.1 | 18.9 | 18.0 | 18.7 | 22.0 | 21.9 | 19.0 | 14.2 | 16.2 | 13.0 | 20.0 |
| Bakersfield-Planz | | 20.3 | 20.8 | 23.5 | 17.8 | 17.4 | 19.8 | 19.3 | 21.8 | 23.5 | 22.5 | 17.6 | 14.5 | 14.7 | 22.8 |

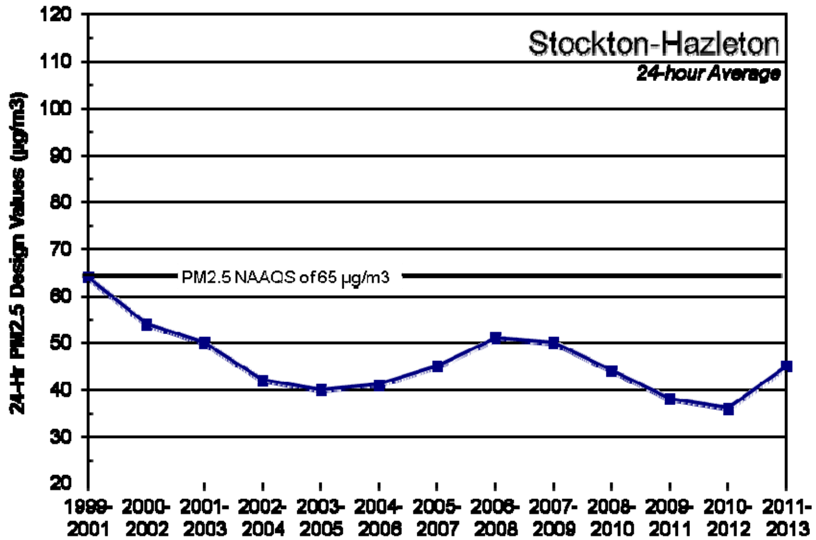
**Table A-6 Annual PM2.5 Design Values (Three-Year Averages, μg/m³), end year listed (2011-2013, 2013)**

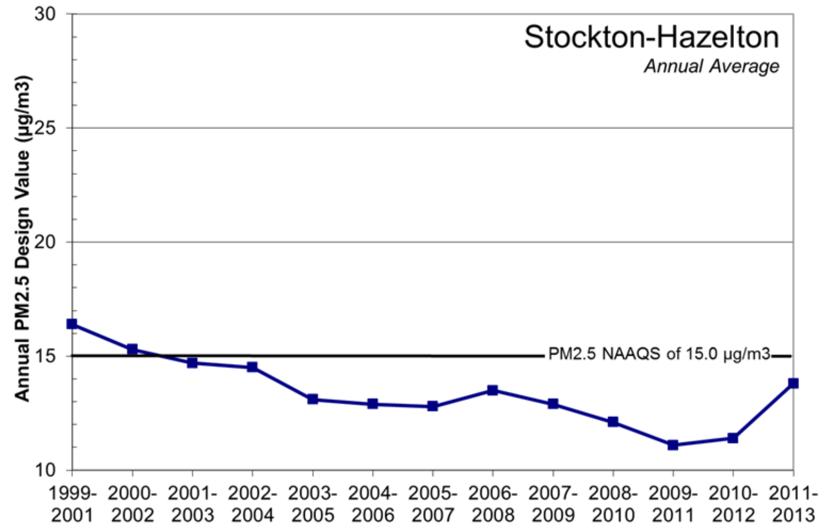
| SJV Monitoring Site | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stockton | 16.4 | 15.3 | 14.7 | 14.5 | 13.1 | 12.9 | 12.8 | 13.5 | 12.9 | 12.1 | 11.1 | 11.4 | 13.8 |
| Manteca | | | | | | | | | | | | 12.1* | 10.2 |
| Modesto | 19.7 | 17.7 | 16.2 | 15.6 | 14.0 | 14.1 | 14.6 | 15.3 | 14.7 | 13.7 | 13.3 | 12.9 | 13.6 |
| Turlock | | | | | | | | | | | 15.3* | 14.9* | 15.7 |
| Merced-Coffee | | | | | | | | | | | 18.2** | 14.3 | 13.3 |
| Merced-M | 17.9* | 16.6* | 16.3* | 16.5 | 15.0 | 14.7 | 14.7 | 15.0 | 14.6 | 13.2 | 11.7 | 10.4 | 11.1 |
| Madera-City | | | | | | | | | | | | 18.2** | 18.1 |
| Fresno-First | 24.0 | 21.9 | 19.7 | 18.6 | 16.9 | 16.6 | 17.4 | 17.7 | 17.1 | 15.2 | 14.5 | | |
| Fresno-Garland | | | | | | | | | | | | | 15.5*** |
| Fresno-Winery | 18.5 | 19.4 | 19.2 | 18.7 | 17.2 | 17.2 | 17.1 | 17.0 | 16.0 | 14.9 | 14.5 | 13.8* | 14.7* |
| Clovis | 18.0 | 16.8 | 17.6 | 17.0 | 17.1 | 16.4 | 16.4 | 16.3 | 17.0 | 16.4 | 16.8 | 16.0 | 16.4 |
| Tranquillity | | | | | | | | | | | 7.6** | 7.4 | 7.8 |
| Corcoran | | 19.0 | 19.0 | 18.4 | 17.0 | 17.2 | 17.6 | 17.0 | 17.3 | 17.1 | 16.2* | 15.8* | 15.0* |
| Hanford | | | | | | | | | | | | 15.8* | 17.0 |
| Visalia | 24.7 | 23.2 | 21.3 | 19.5 | 18.0 | 18.2 | 19.3 | 19.7 | 18.8 | 16.5 | 15.2 | 14.8 | 16.6 |
| Bakersfield-Golden | 23.6 | 22.8 | 21.8 | 20.6 | 19.0 | 18.6 | 19.2 | 18.8 | 19.3 | | | | |
| Bakersfield-California | 22.5 | 22.1 | 20.3 | 19.6 | 18.0 | 18.5 | 19.6 | 20.9 | 21.0 | 18.4 | 16.5 | 14.5 | 16.4 |
| Bakersfield-Planz | | 21.5 | 20.7 | 19.6 | 18.4 | 18.9 | 20.3 | 21.5 | 22.6 | 21.2 | 18.2 | 15.6 | 17.3 |

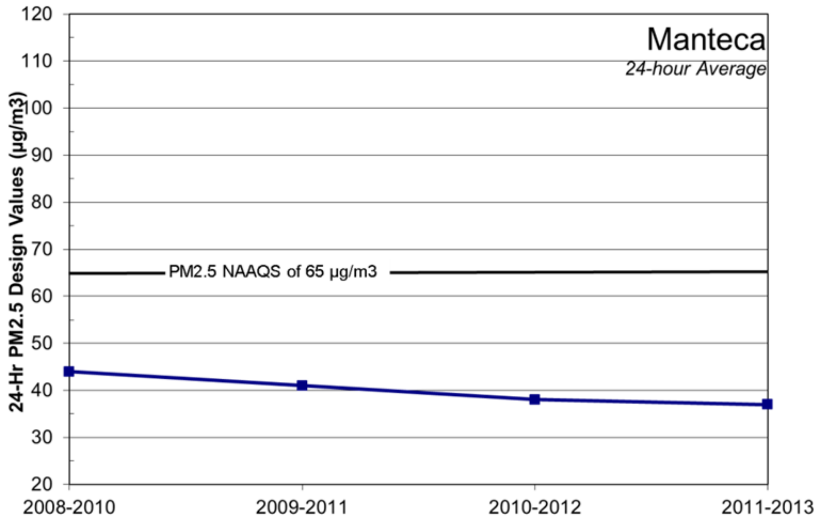
Notes for Tables A-3, A-4, A-5, and A-6

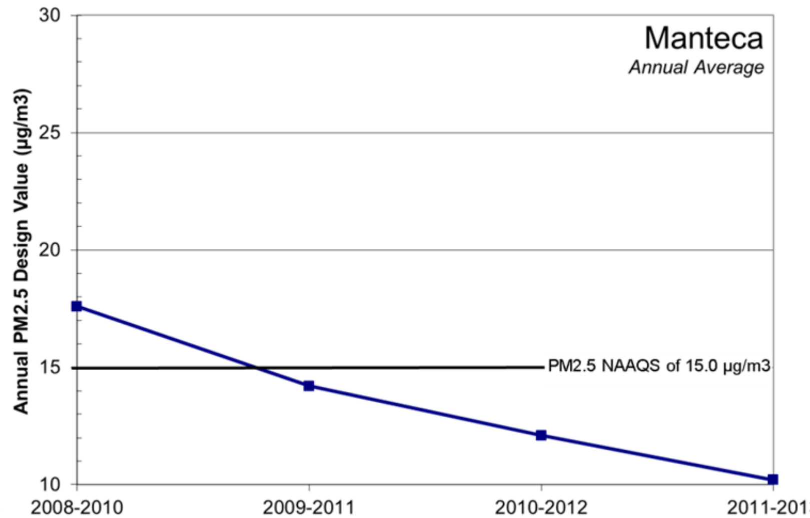
- Source: U.S. Environmental Protection Agency: Air Quality System (AQS): AMP 480 Report, available at http://www.epa.gov/ttn/airs/airsaqs/aqsweb/, January 6, 2015.
- Empty cell: No data or insufficient data
- Asterisk (*): Values do not meet completeness criteria
- Double asterisk (**): Value based on 2-year average of 2010-2011, 2009 had minimal sampling, Value based on 2-year average of 2011-2012, 2010 had minimal sampling
- Triple asterisk (***): Value based on 2-year average of 2012-2013

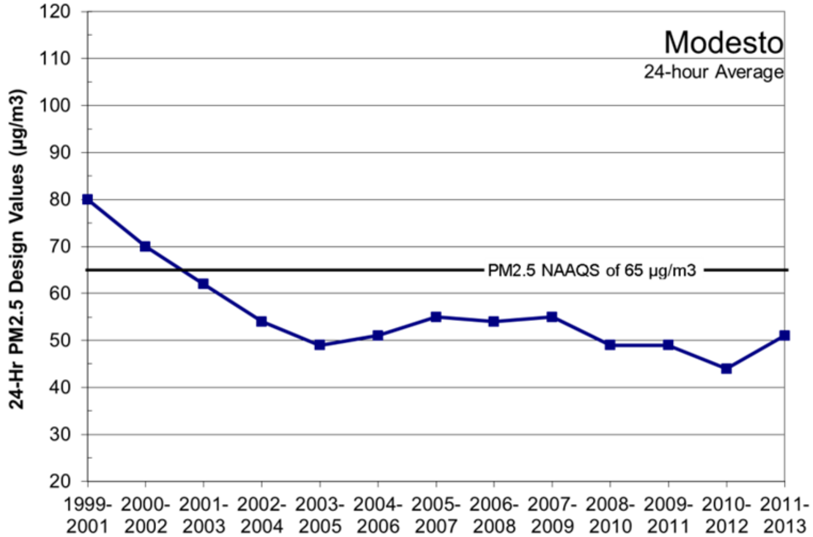
## Figures A-2.1 through A-2.32 24-hour and Annual Design Value Trends




Modesto
24-hour Average
24-Hr PM2.5 Design Values (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
80
70
60
50
40
30
20
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
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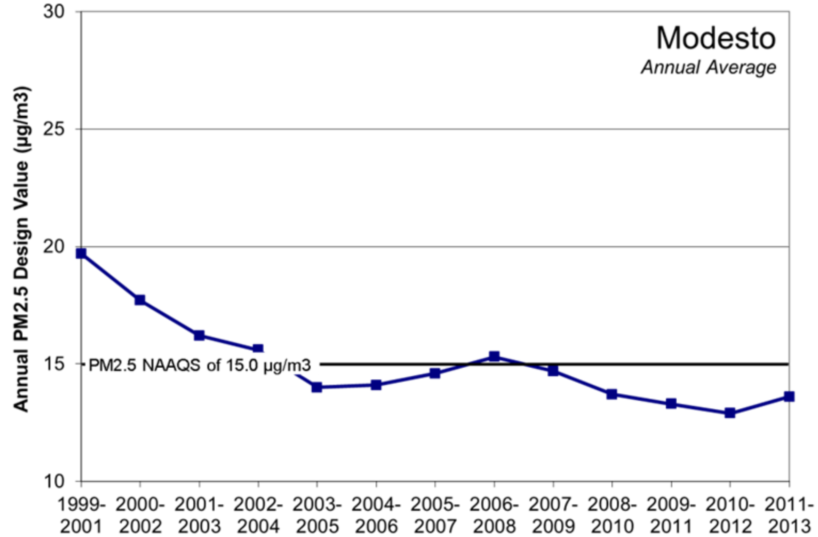
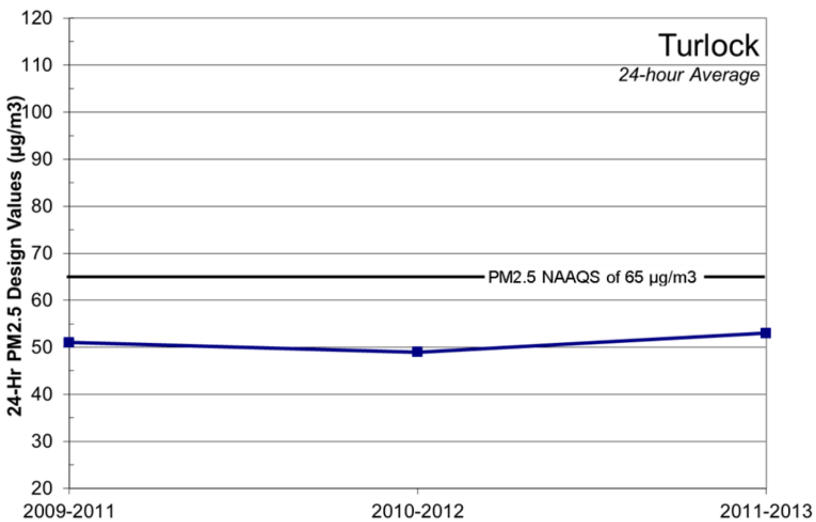
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Modesto
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
20
15
10
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Turlock
24-hour Average
24-Hr PM2.5 Design Values (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
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70
60
50
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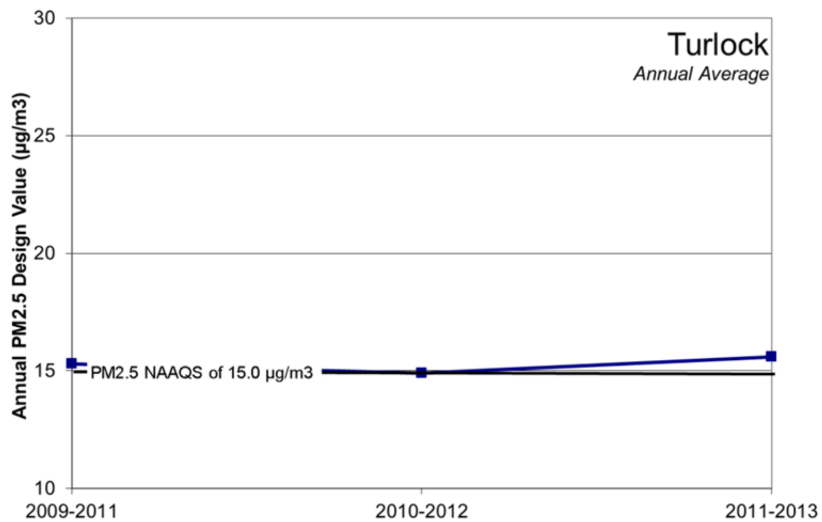
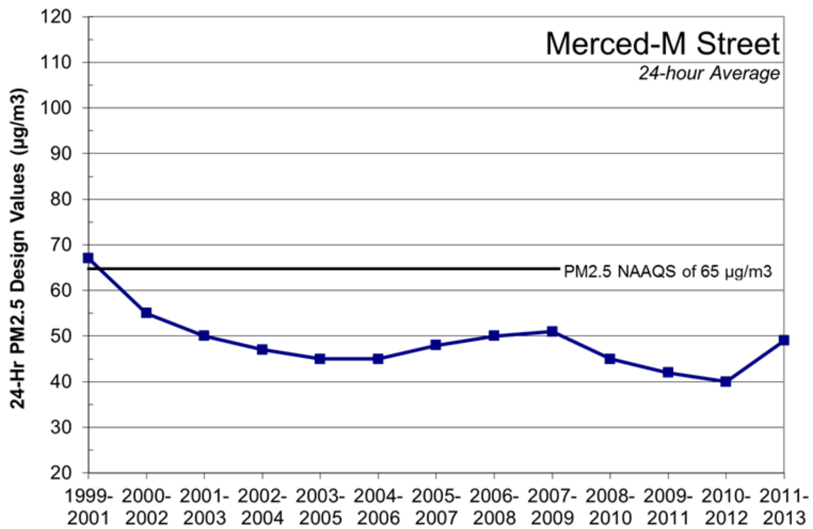
30
20
2009-2011
2010-2012
2011-2013


Turlock
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
20
15
10
2009-2011
2010-2012
2011-2013


Merced-M Street
24-hour Average
24-Hr PM2.5 Design Values (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
80
70
60
50
40
30
20
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
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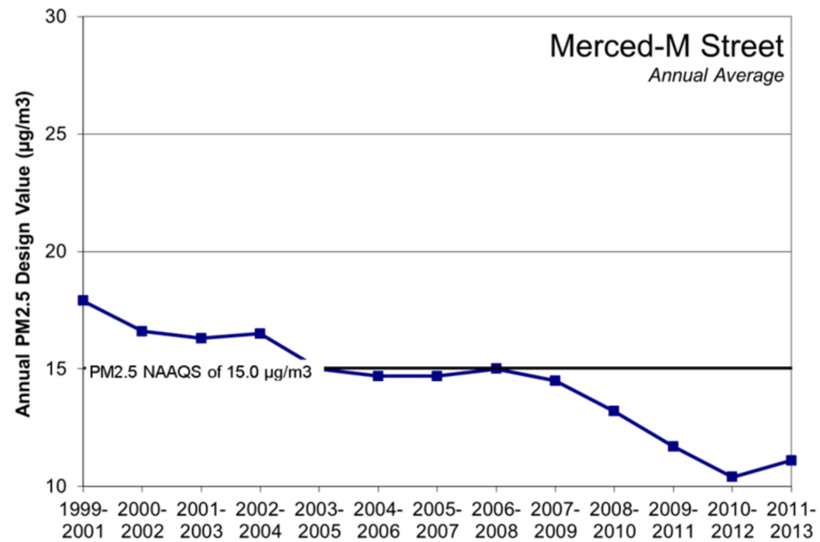
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Merced-M Street
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
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15
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1999-2001
2000-2002
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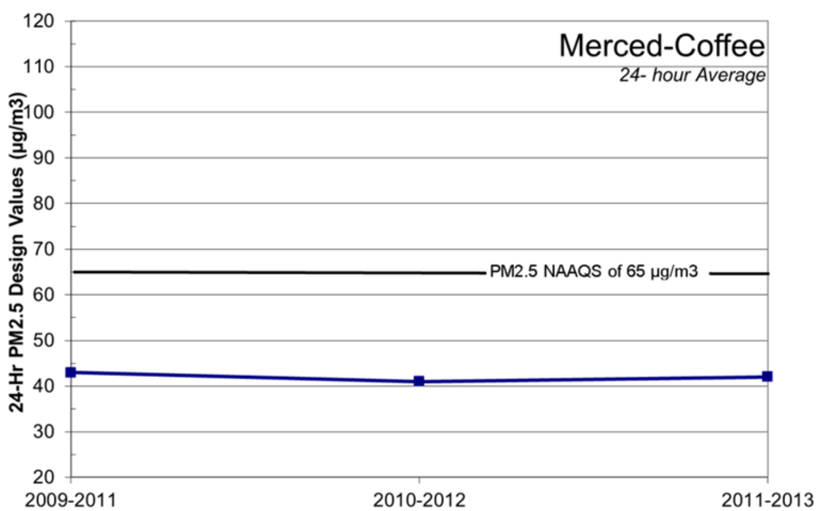
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Merced-Coffee
24- hour Average
24-Hr PM2.5 Design Values (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
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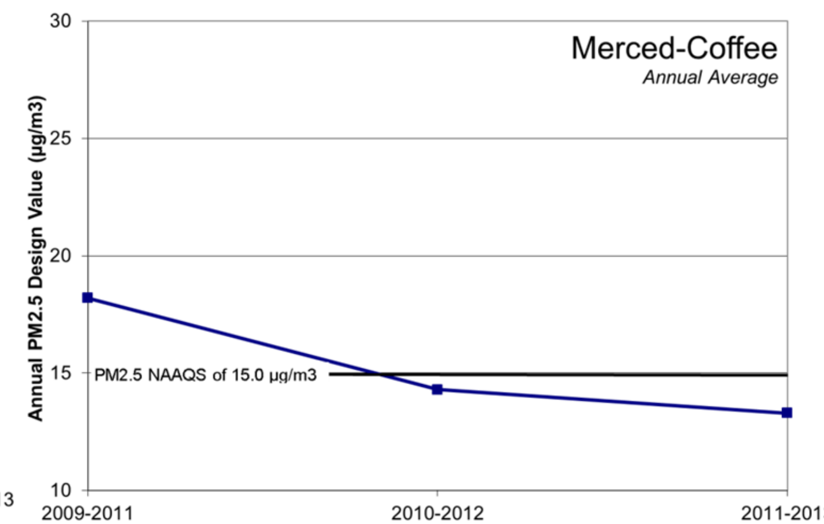
2009-2011
2010-2012
2011-2013


Merced-Coffee
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
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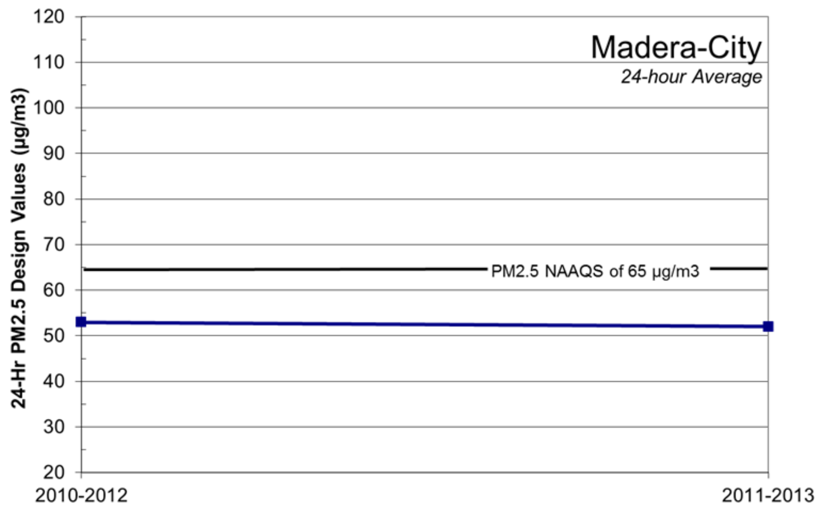
2009-2011
2010-2012
2011-2013


Madera-City
24-hour Average
24-Hr PM2.5 Design Values (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
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70
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50
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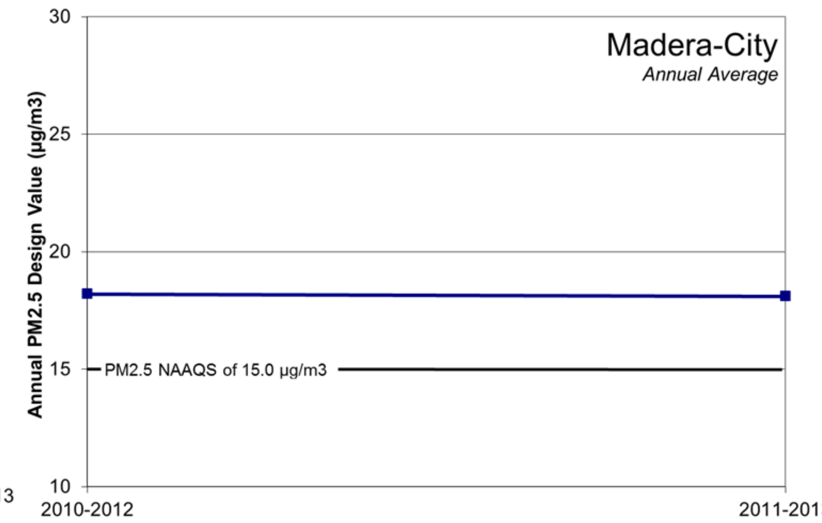
30
20
2010-2012
2011-2013


Madera-City
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
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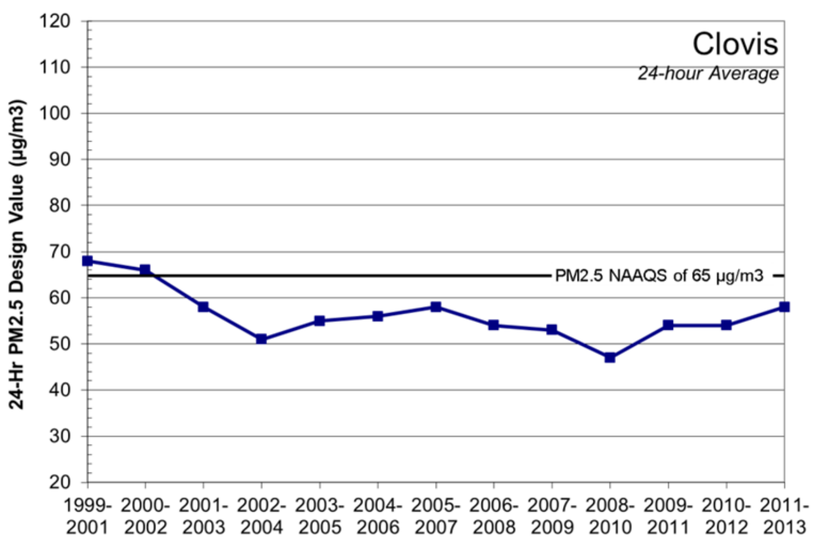
2010-2012
2011-2013


Clovis
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
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1999-2001
2000-2002
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2007-2009
2008-2010
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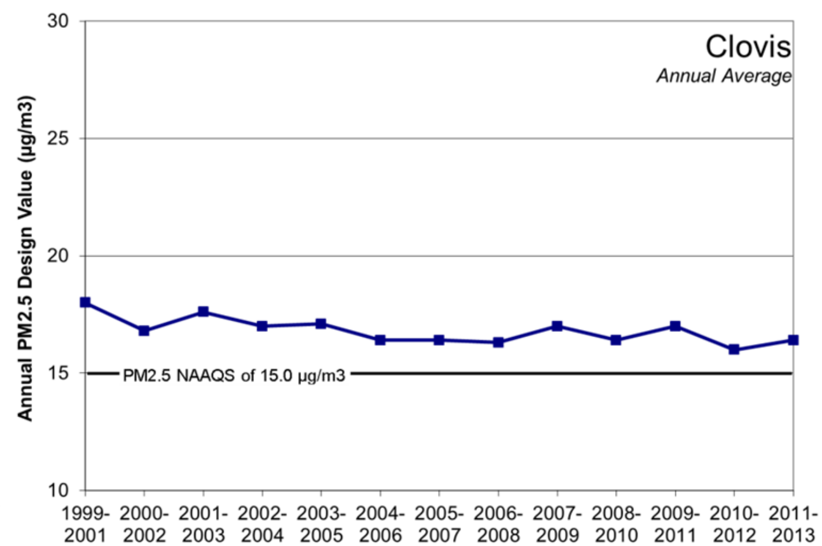
2010-2012
2011-2013


Clovis
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
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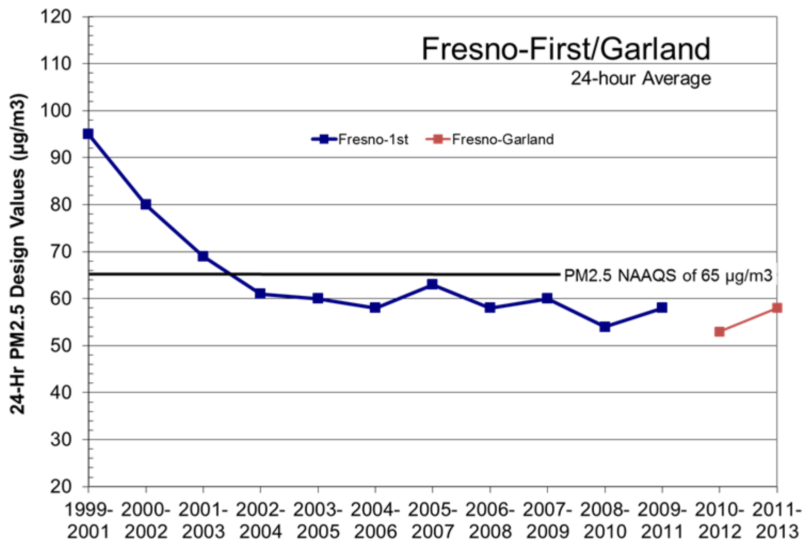
Fresno-First/Garland
24-hour Average
Fresno-1st
Fresno-Garland
PM2.5 NAAQS of 65 µg/m3
24-Hr PM2.5 Design Values (µg/m3)
120
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2000-2002
2001-2003
2002-2004
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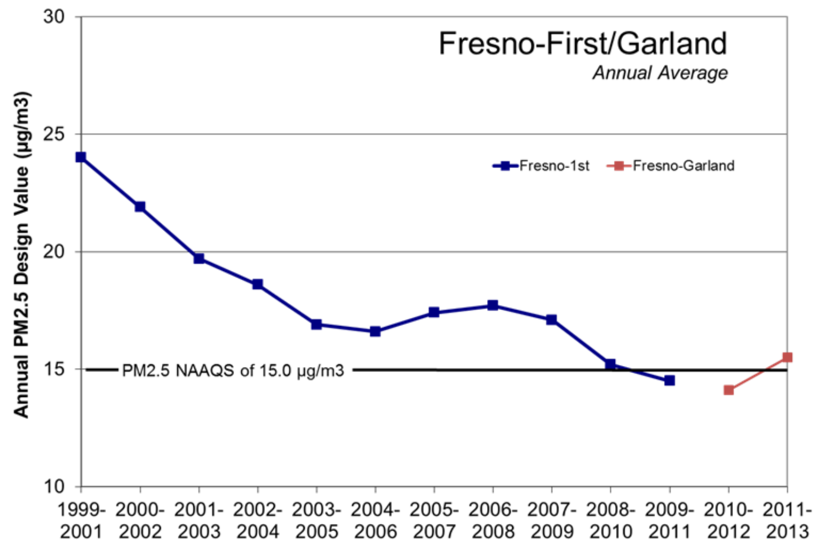
2011-2013


Fresno-First/Garland
Annual Average
Fresno-1st
Fresno-Garland
PM2.5 NAAQS of 15.0 µg/m3
Annual PM2.5 Design Value (µg/m3)
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1999-2001
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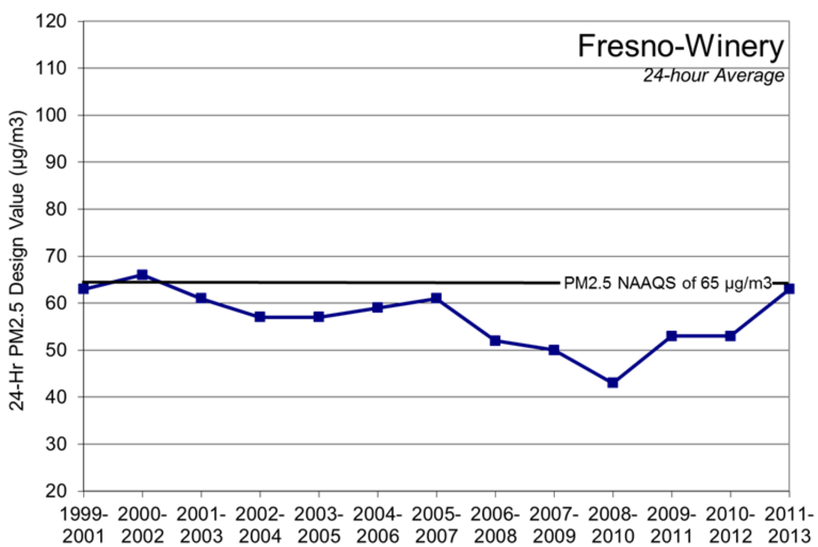
Fresno-Winery
24-hour Average
PM2.5 NAAQS of 65 µg/m3
24-Hr PM2.5 Design Value (µg/m3)
120
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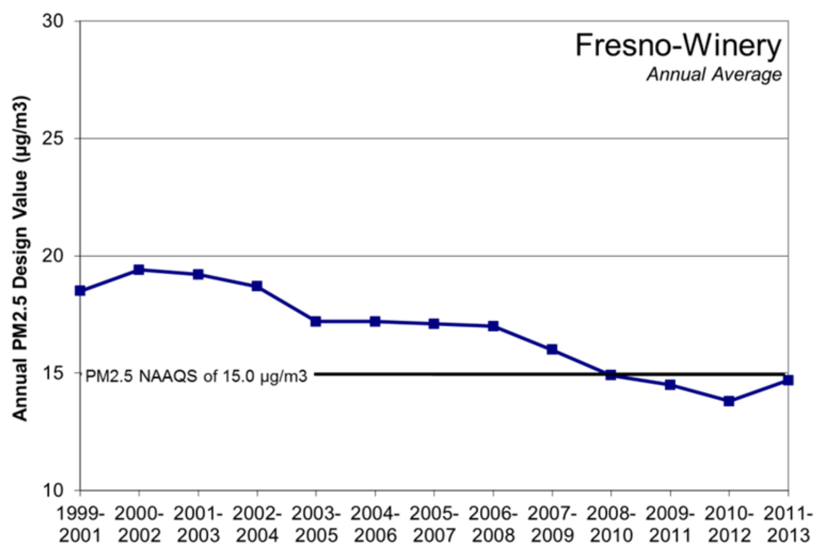
Fresno-Winery
Annual Average
PM2.5 NAAQS of 15.0 µg/m3
Annual PM2.5 Design Value (µg/m3)
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25
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15
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1999-2001
2000-2002
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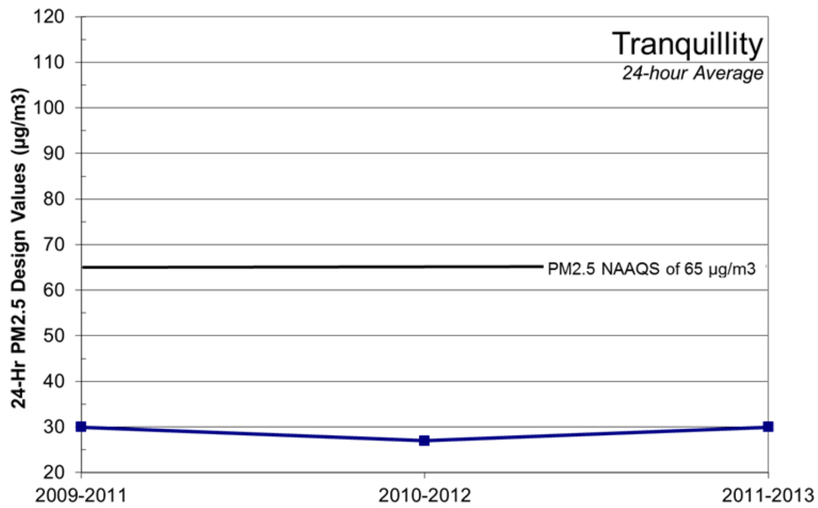
Tranquillity
24-hour Average
24-Hr PM2.5 Design Values (µg/m3)
120
110
100
90
80
70
60
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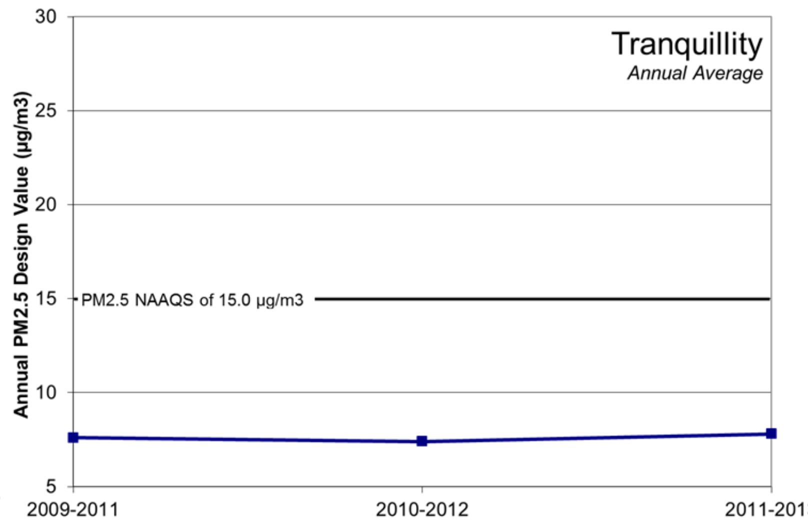
40
30
20
PM2.5 NAAQS of 65 µg/m3
2009-2011
2010-2012
2011-2013


Tranquillity
Annual Average
Annual PM2.5 Design Value (µg/m3)
30
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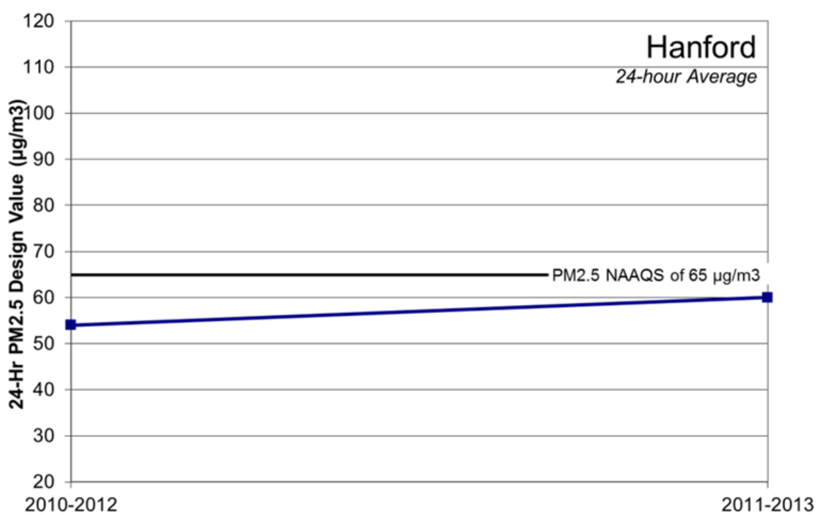
5
PM2.5 NAAQS of 15.0 µg/m3
2009-2011
2010-2012
2011-2013


Hanford
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
120
110
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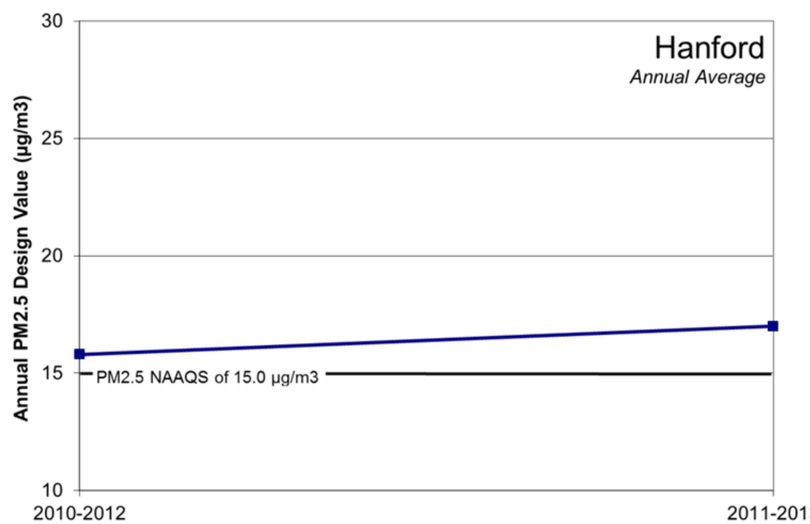
PM2.5 NAAQS of 65 µg/m3
2010-2012
2011-2013


Hanford
Annual Average
Annual PM2.5 Design Value (µg/m3)
30
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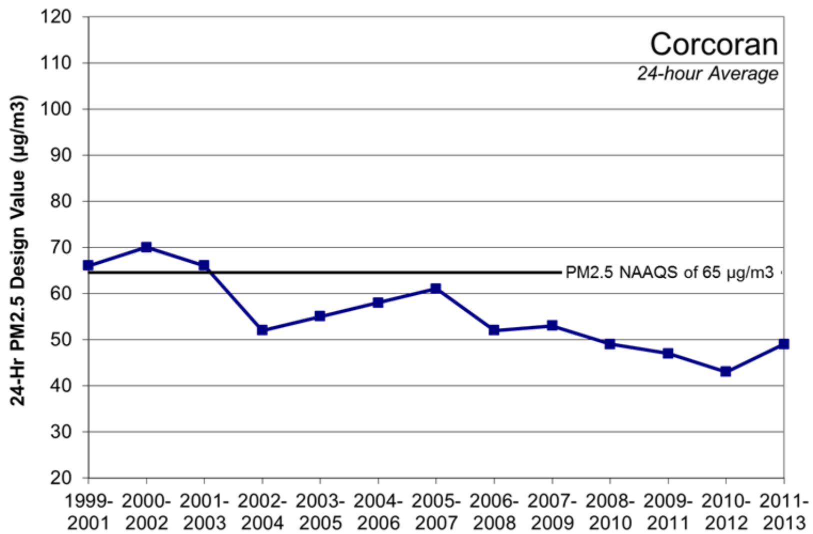
10
PM2.5 NAAQS of 15.0 µg/m3
2010-2012
2011-2013


Corcoran
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
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1999-2001
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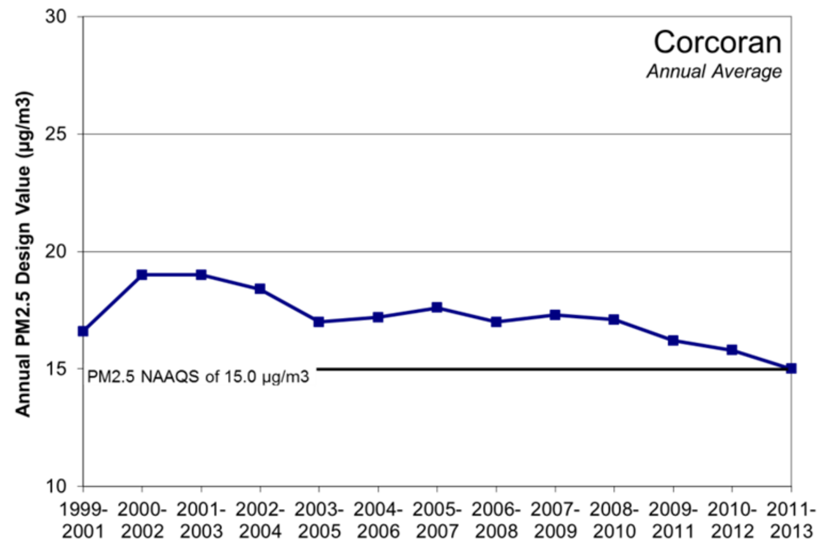
Corcoran
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
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1999-2001
2000-2002
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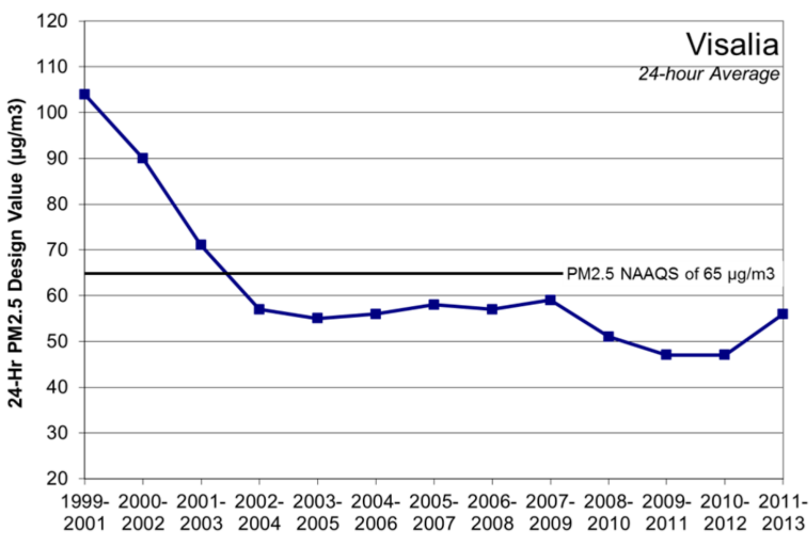
Visalia
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
80
70
60
50
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30
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1999-2001
2000-2002
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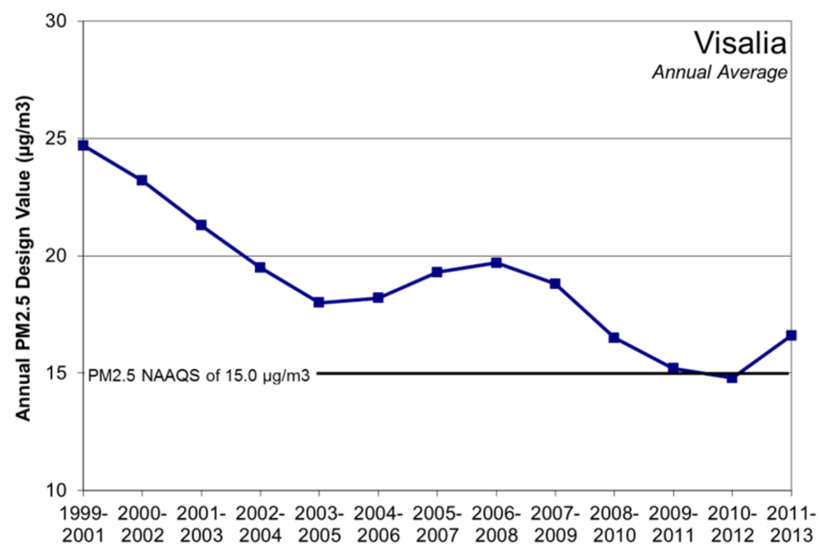
2009-2011
2010-2012
2011-2013


Visalia
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
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1999-2001
2000-2002
2001-2003
2002-2004
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2004-2006
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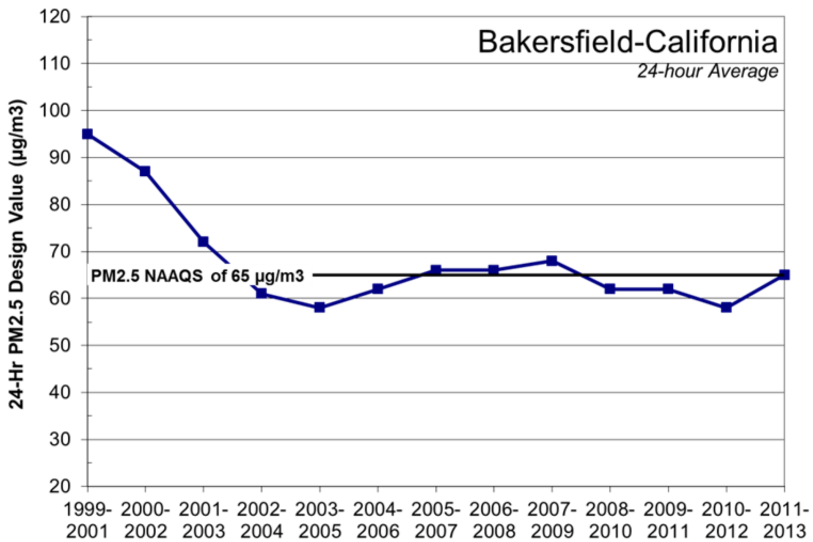
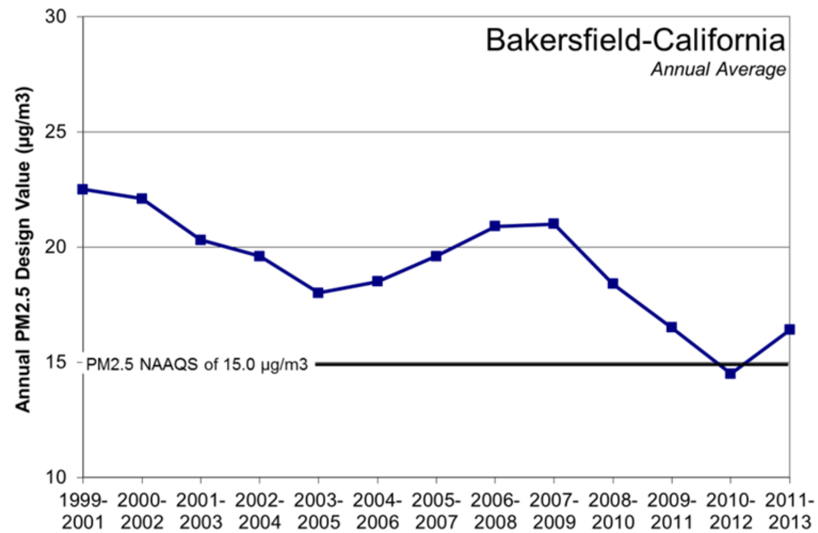
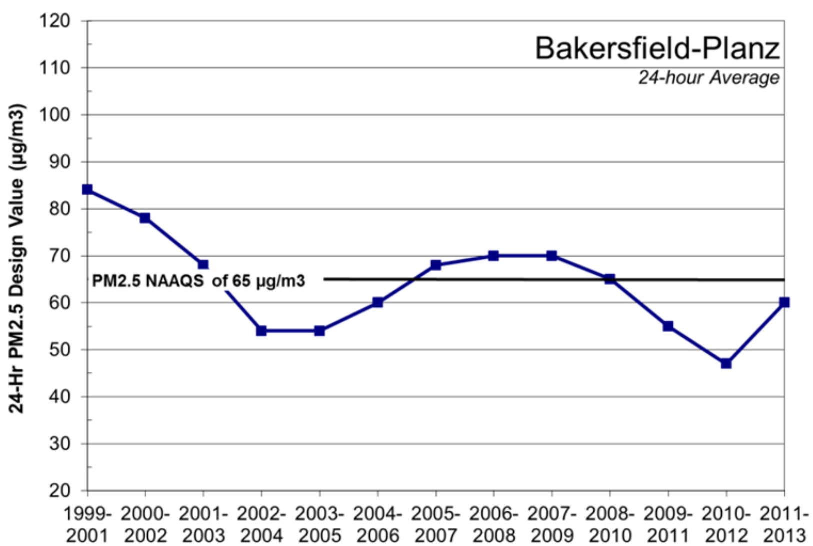
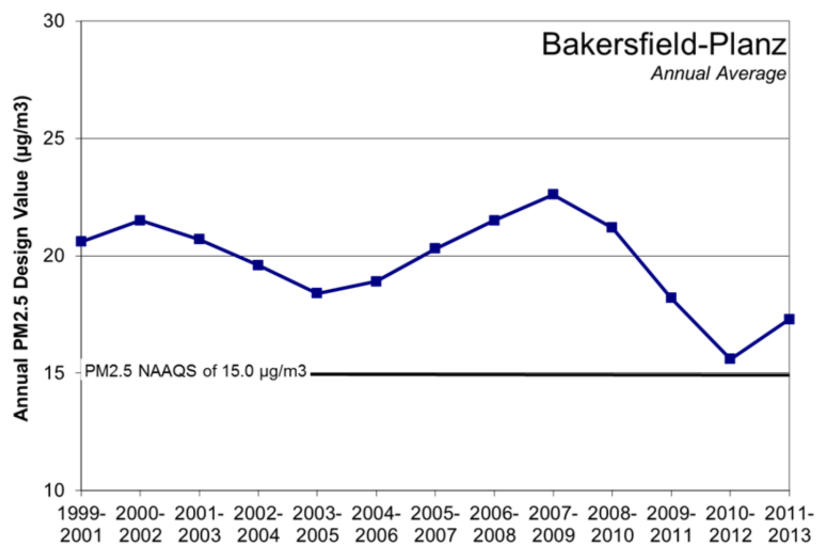
2008-2010
2009-2011
2010-2012
2011-2013


Bakersfield-California
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
80
70
60
50
40
30
20
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Bakersfield-California
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
20
15
10
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Bakersfield-Planz
24-hour Average
24-Hr PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 65 µg/m3
120
110
100
90
80
70
60
50
40
30
20
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013


Bakersfield-Planz
Annual Average
Annual PM2.5 Design Value (µg/m3)
PM2.5 NAAQS of 15.0 µg/m3
30
25
20
15
10
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013

## A.3 AMBIENT PM2.5 CONCENTRATION DATA TRENDS

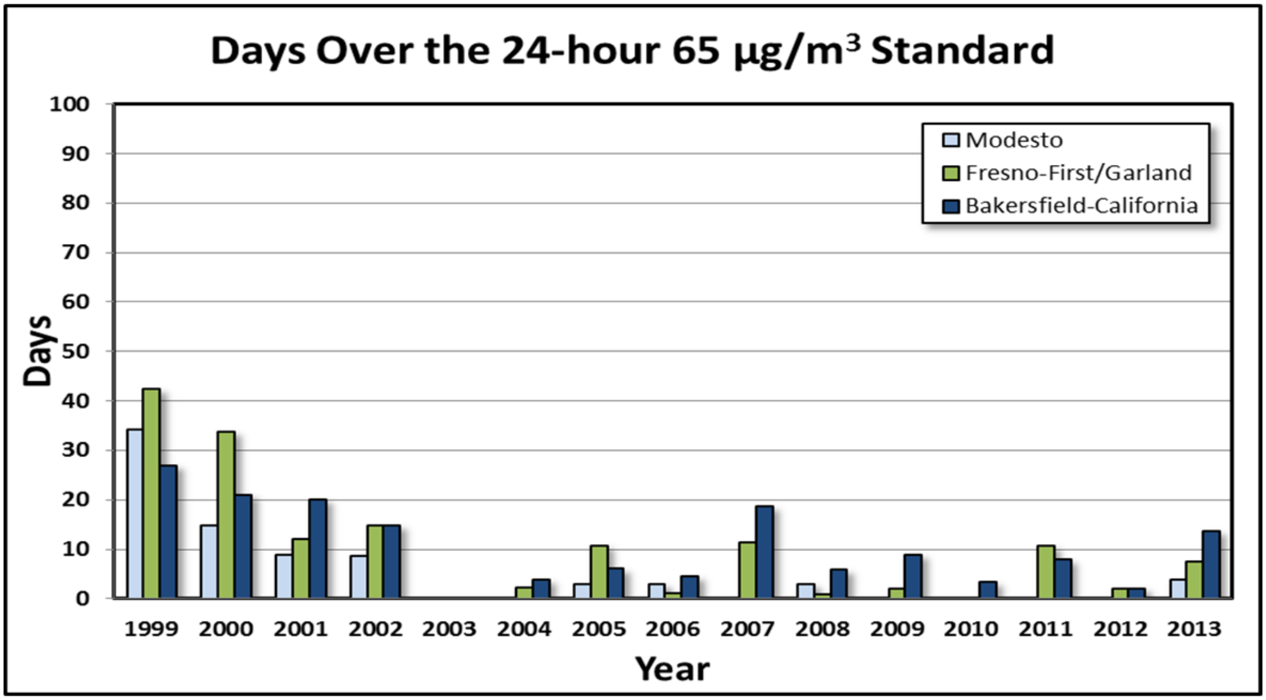
Design values summarize data from a monitoring site with just two concentration values representing a three-year time period: an annual average and a value representing 24-hour peaks. These parameters are required for attainment demonstrations, but design values alone do not reveal the hourly, daily, weekly, seasonal, and regional PM2.5 effects on public health, nor do they track air quality improvements within such parameters. The District uses data from air monitoring sites to analyze air quality trends to provide a deeper understanding of changes in ambient PM2.5 concentrations as they relate to the implementation of District programs and to inform the attainment planning process and Health Risk Reduction Strategy.

### A.3.1 Days over the 24-Hour PM2.5 Standard

The number of days over the PM2.5 Standard is another indicator of air quality progress. Focusing on historical air monitoring sites from the northern, central, and southern portions of the Valley, Figure A-3 shows the trend of the number of days above the 1997 standard at the Modesto, Fresno-First/Garland, and Bakersfield-California monitoring sites. These counts have been estimated and normalized to account for the varying sampling schedules of the Valley's 1-in-6-day, 1-in-3-day, and daily PM2.5 monitors.

Design value calculations for the 24-hour Standard use the $98^{th}$-percentile concentration value from each monitoring site (higher values in the $99^{th}$ and $100^{th}$ percentiles are not used to account for extreme outliers). Because of this, a region may experience a limited number of days over the standard, but still be considered in attainment.

**Figure A-3 Trend in Days over the 1997 24-Hour PM2.5 Standard**




Note: Years and sites with no data (colored bars) represent zero exceedances.

As shown in Figure A-3, the Valley has experienced a significant drop in the number of exceedances of the 65 µg/m³ standard since the turn of the last century (1999 and 2000). In 1999, approximately 104 exceedances of this standard occurred between the sites of Modesto, Fresno-First/Garland, and Bakersfield-California. Comparing this to the 25 exceedances that occurred in 2013, this represents a 76% decrease in the number of violations among these sites.

The District's emissions reduction strategy, the investment from the regulated industry in control technology, and the public's willingness to make a change for cleaner air have all played key roles in the reduction of concentrations over this time period. During the winter, with unfavorable stagnant meteorology as experienced during the 2011–2012 winter season, which has repeated itself each winter since and has created (as of 2014) the historic three year drought, has contributed greatly to the recent higher than expected PM2.5 concentrations and exceedances under identical regulatory controls. Similar poor dispersion conditions were experienced during the winter of 1999–2000; however, under those similar conditions, the number of exceedances in 2011 and onward has been markedly less than the number of exceedances in 1999, which strongly suggests a real reduction in emissions.

### A.3.2 Seasonal Trends - 1st and 4th Quarter Averages

Since the Valley's highest PM2.5 concentrations occur during the fall and winter months, in the 1st and 4th quarters (January through March and October through December, respectively), these months tend to have the highest average PM2.5 concentrations. Observing the trend in these quarterly averages can shed light on how the peak of the PM2.5 season is changing over time.

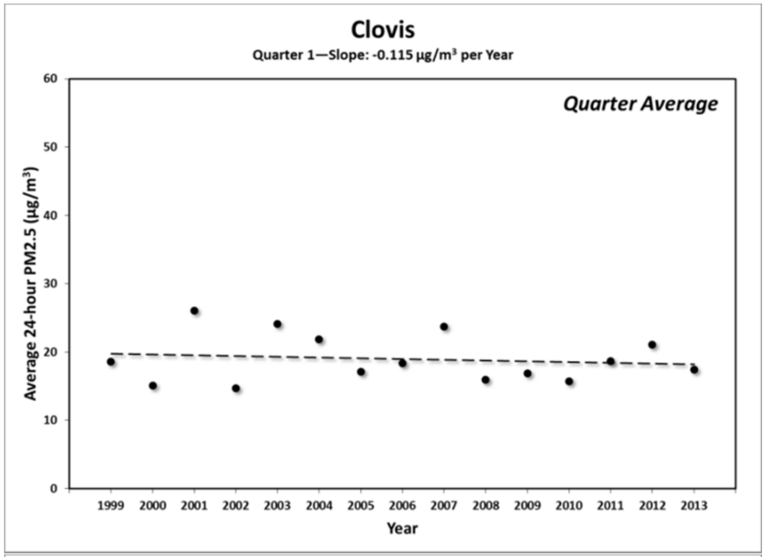
The data used in this analysis utilizes PM2.5 filter values from 1999 through 2013 focusing on the 1st and 4th quarters at six sites in the District that tend to have the highest concentrations; Clovis, Fresno-First/Garland, Corcoran, Visalia, Bakersfield-California, and Bakersfield-Planz. Note that the Fresno-First monitoring site was closed in early 2012 and its nearby replacement site of Fresno-Garland was opened soon after. To form a continuous data record, these two sites were combined to create a Fresno-First/Garland historical record.

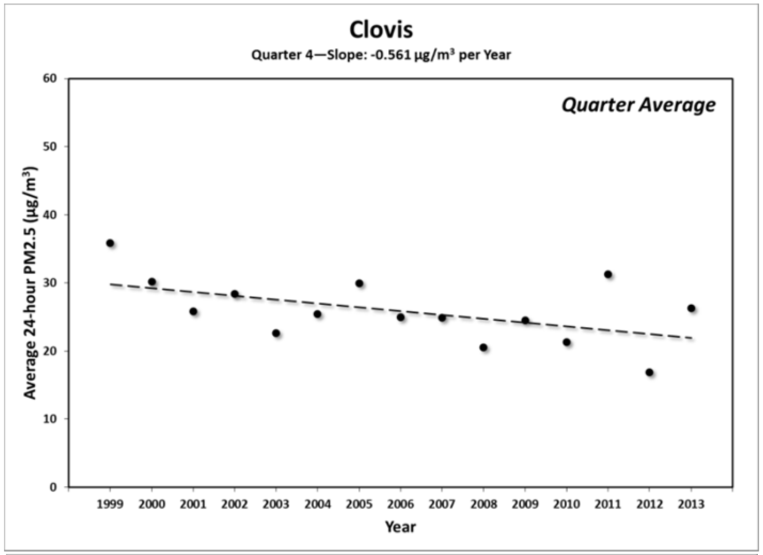
An analysis of the 24-hour PM2.5 historical filter data depicts a general trend of reductions in both the average over the quarter (*Quarter Average*), as well as the average over the quarter of the five highest (maximum) values (*Top 5 Average*). The *Top 5 Average* data demonstrates the episodic nature of PM2.5 pollution, the severity of peak PM2.5 episodes, and the public exposure to peak concentrations of PM2.5. The *Quarter Average* charts shown below (Figures A-4.1 through A-4.12) indicate that all sites are trending downward; averaging 0.8 µg/m³ less PM2.5 per year, collectively. In regards to the *Top 5 Average* (Figures A-5.1 through A-5.12) all but one site are trending downward. Clovis is the anomaly showing a slight upward trend. However, this may be due to random variation of the data resulting in the unusually high values in the first quarter of 2012 and the fourth quarter of 2011 and 2013 that pulls both quarter trend lines upward. Without those three data points the trend line would be flat, and not significantly increasing or decreasing. Despite Clovis, the overall trend for all of the *Top 5 Average* sites is averaging downward at 1.4 µg/m³ less PM2.5 per year. This demonstrates the reducing severity of the PM2.5 episodic peaks over time.

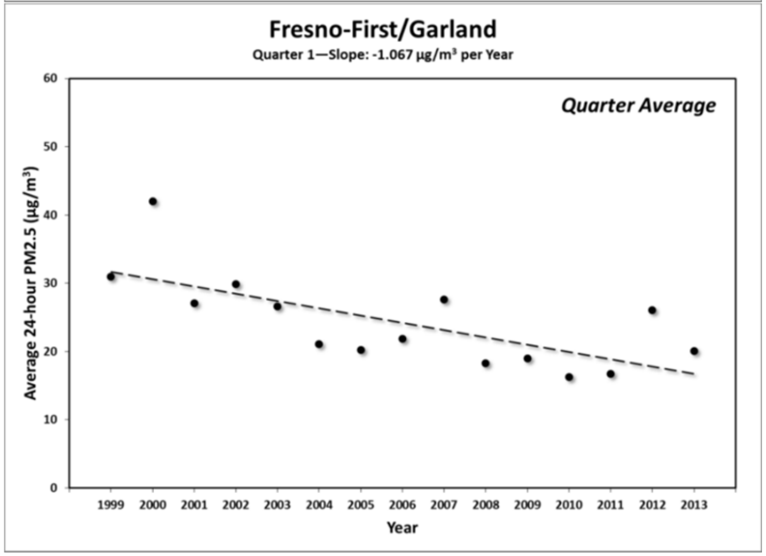
The *Quarter Average* with the greatest rate of reduction in PM2.5 is almost unanimously in the fourth quarter and less so in the first quarter. Conversely, the quarter with the greatest rate of reduction in PM2.5 for the *Top 5 Average* is almost unanimously in the first quarter and less so in the fourth quarter (except for Clovis).

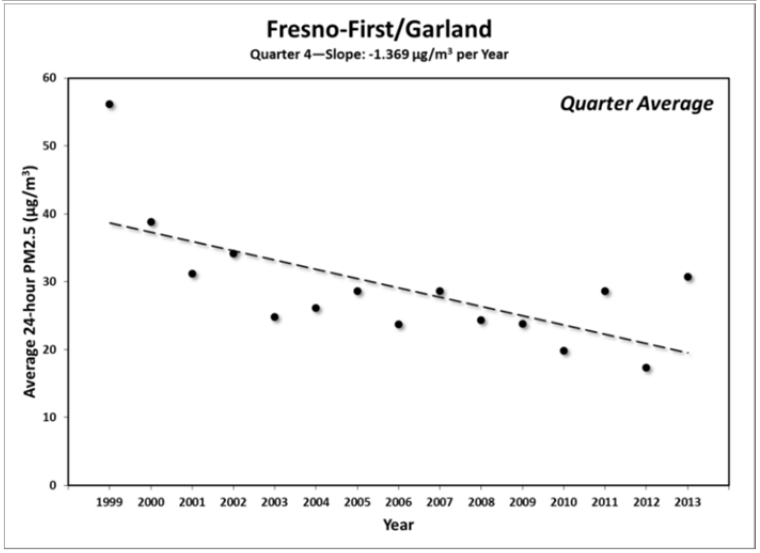
In conclusion, the overall quarterly downward trends of both the *Quarter Averages* and the *Top 5 Averages* are important indicators for attaining the District's Health-Risk Reduction Strategy and the annual average PM2.5 standard.

## Figures A-4.1 through A-4.12 Quarter Average Trends

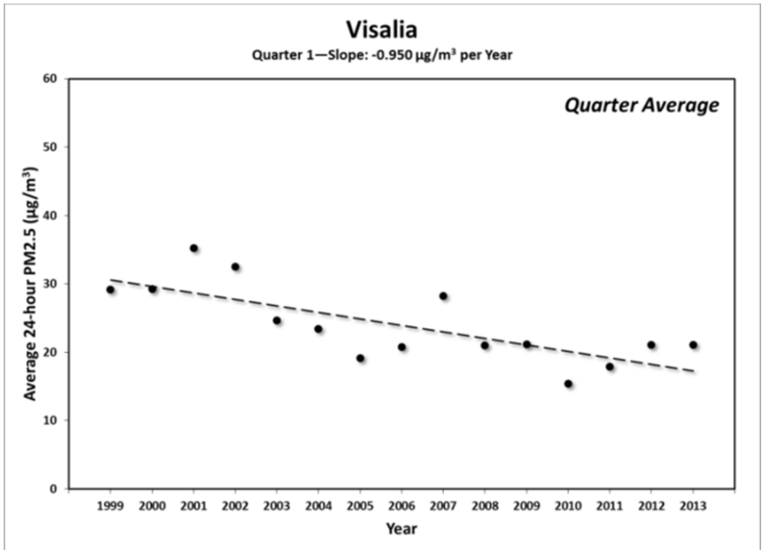


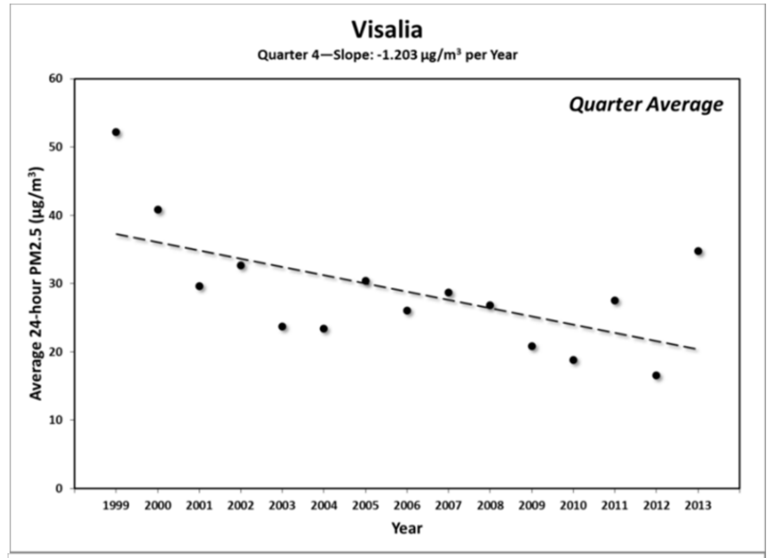



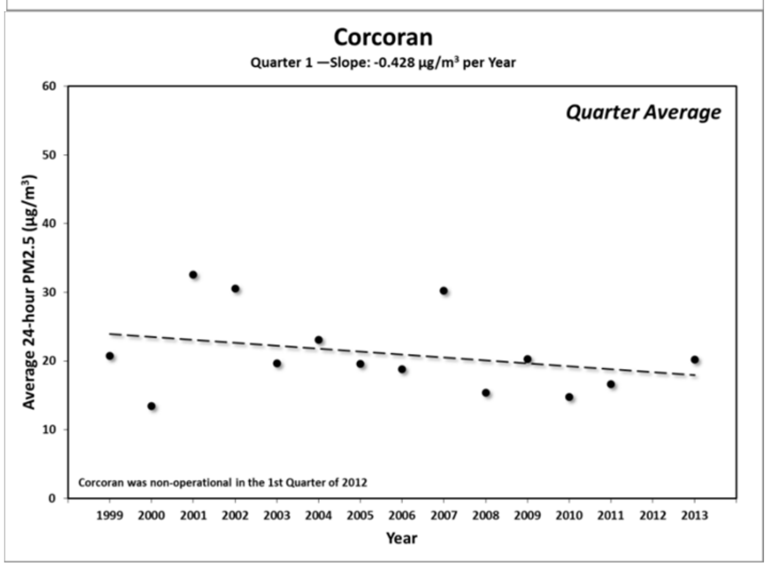



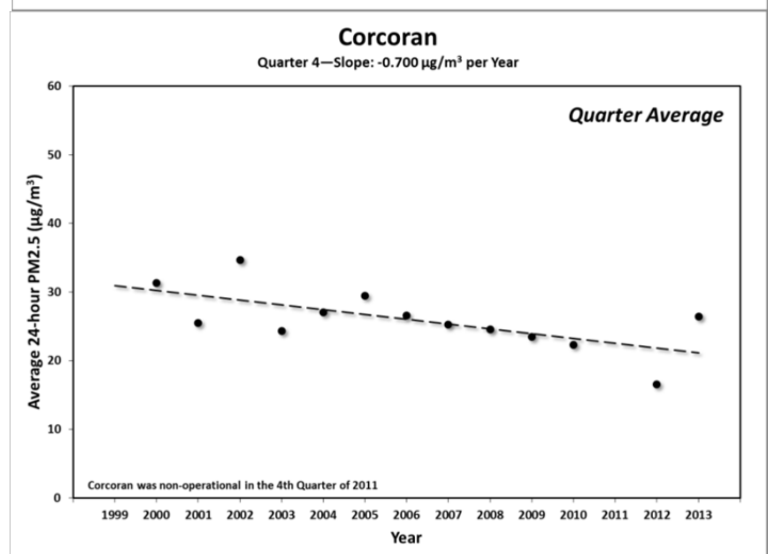



## Figures A-4.1 through A-4.12 Quarter Average Trends

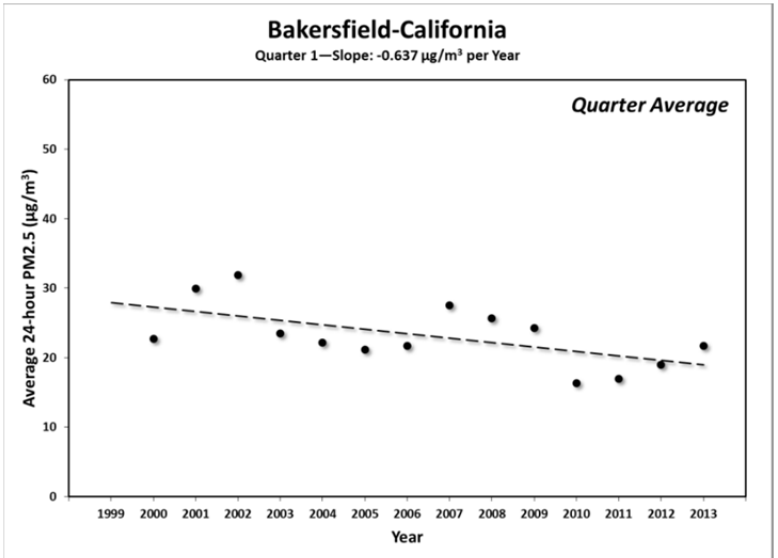


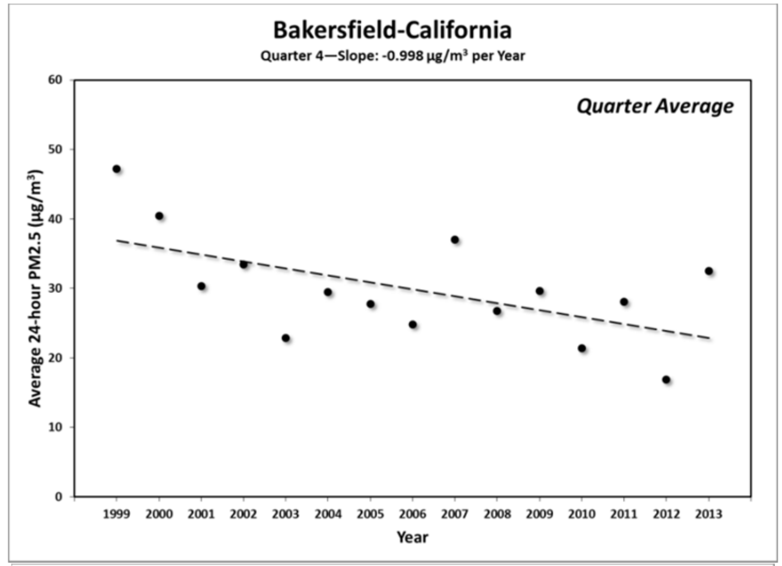



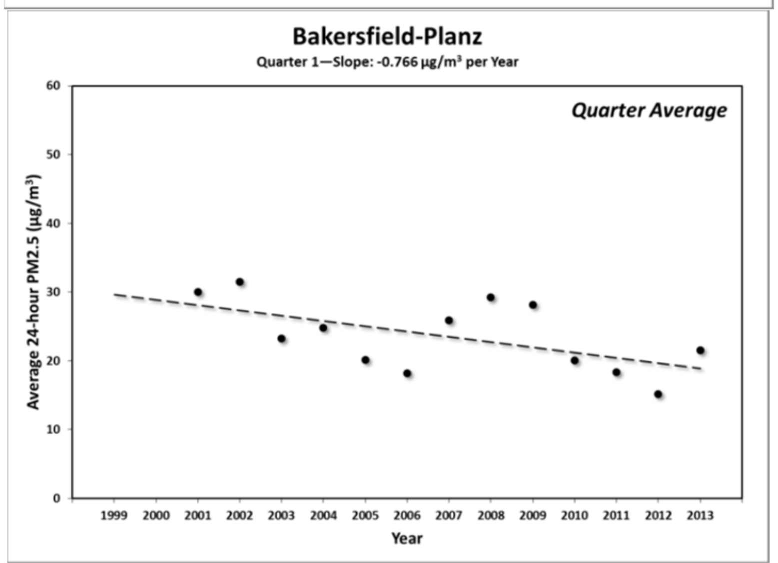



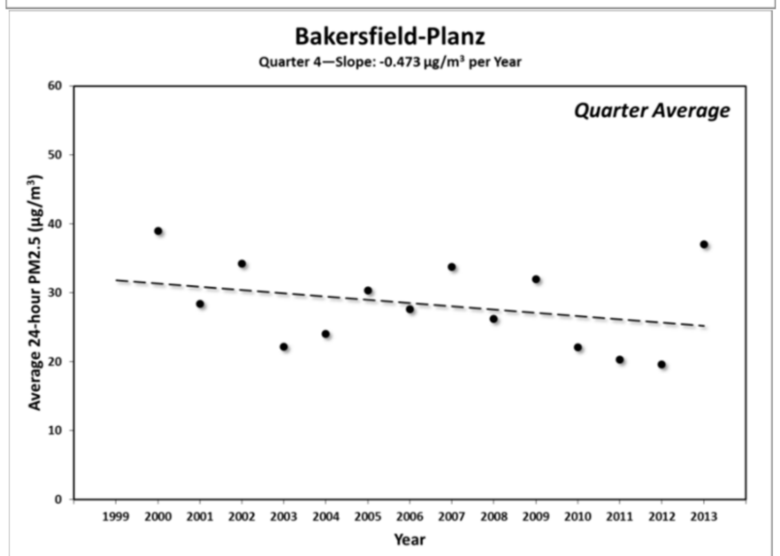



## Figures A-4.1 through A-4.12 Quarter Average Trends

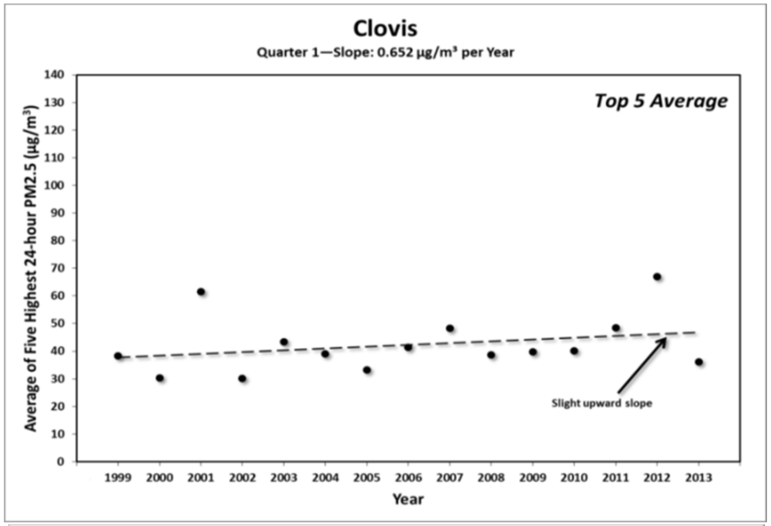


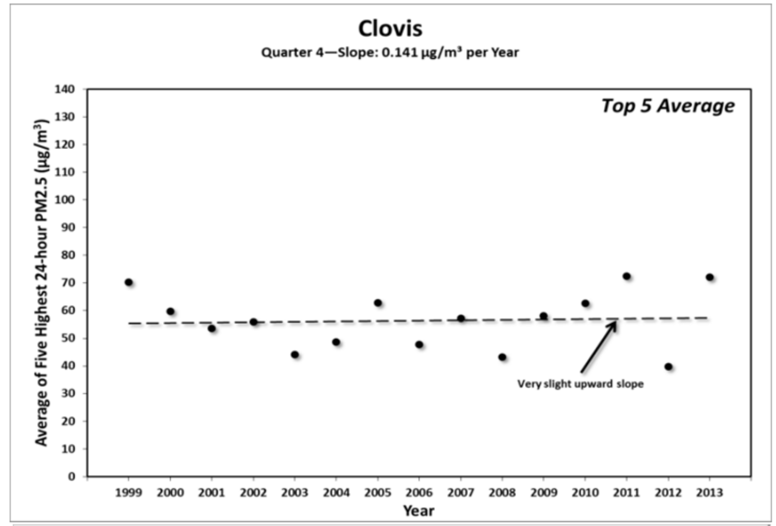



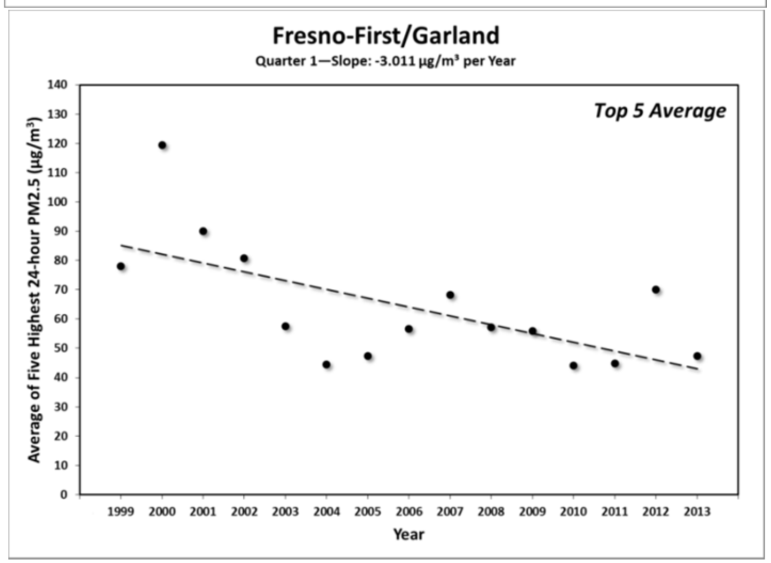



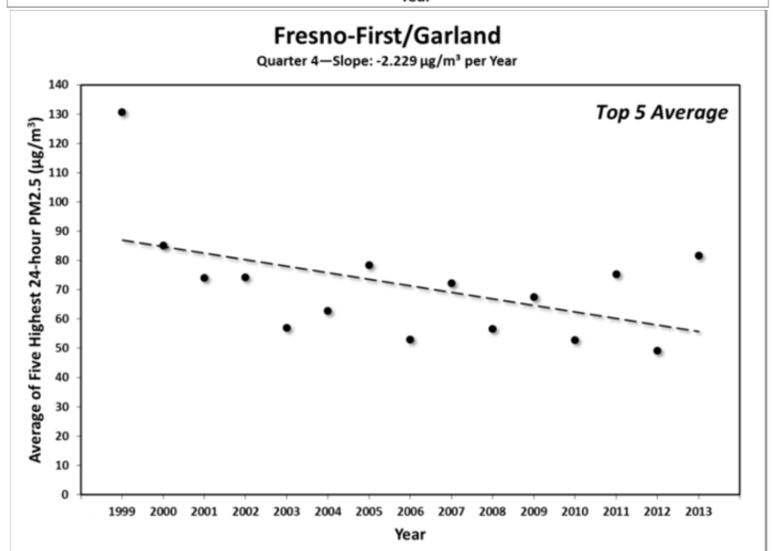



## Figures A-5.1 through A-5.12 Collection of *Top 5 Average* Trends

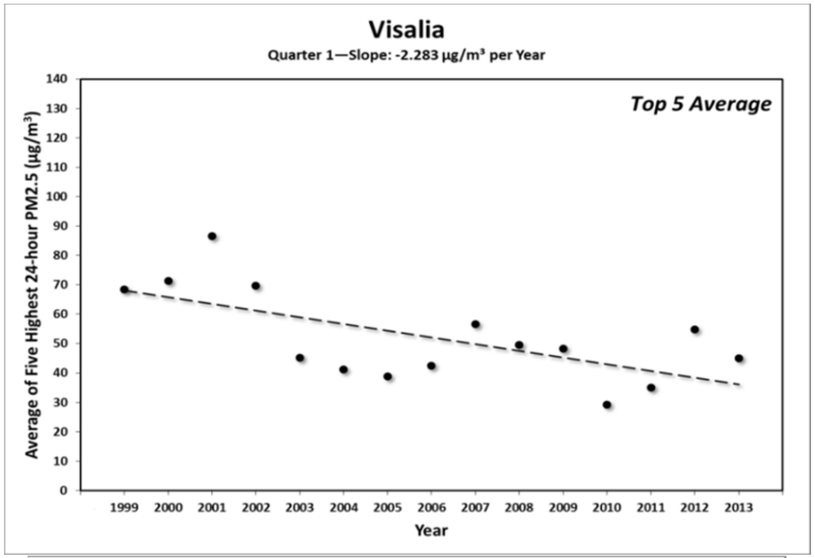


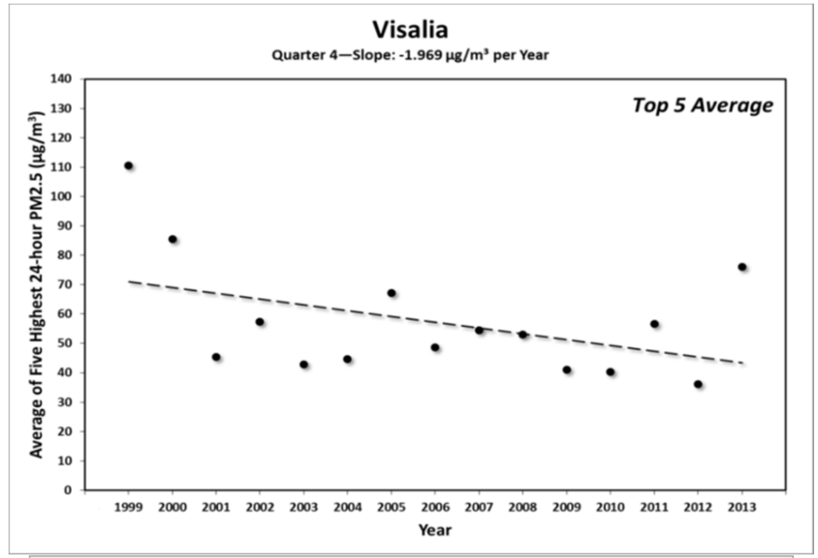



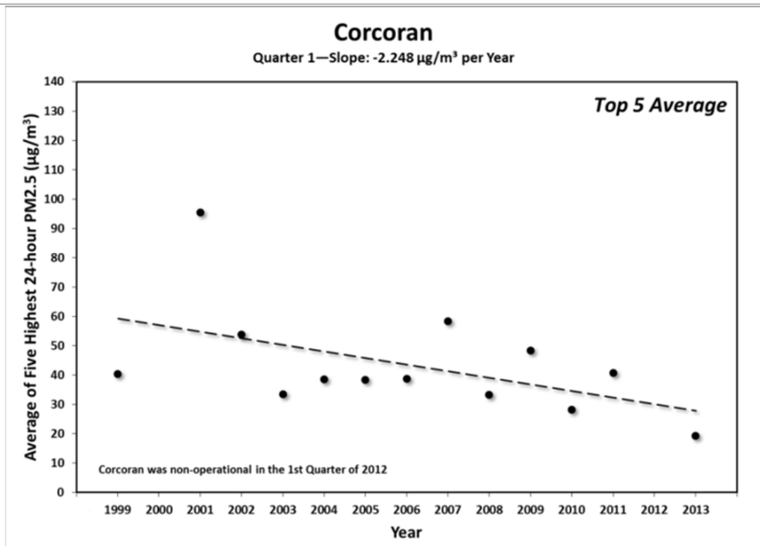



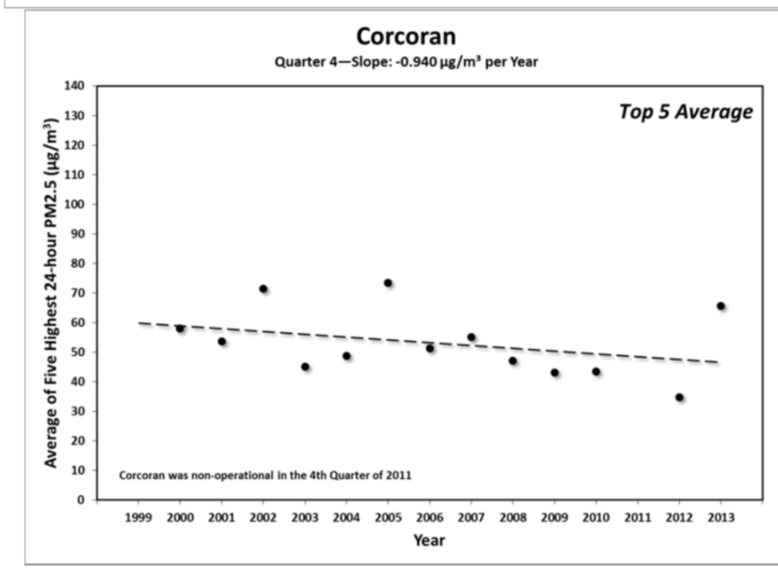



## Figures A-5.1 through A-5.12 Collection of *Top 5 Average* Trends

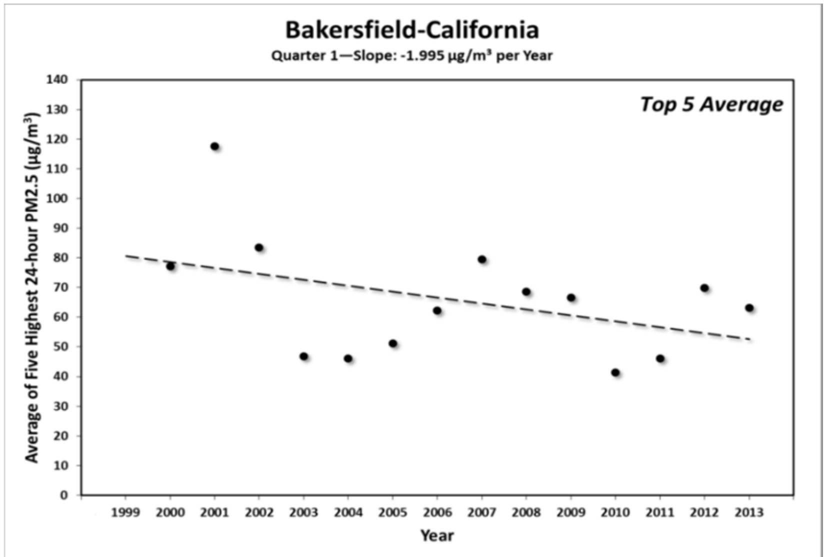


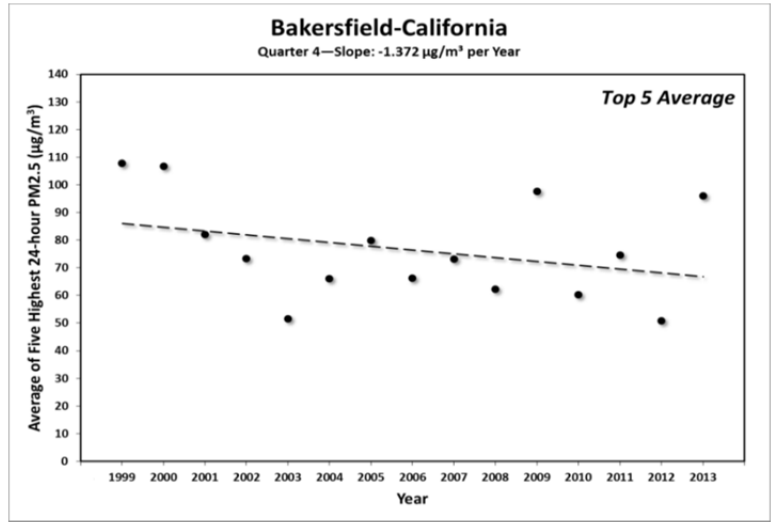



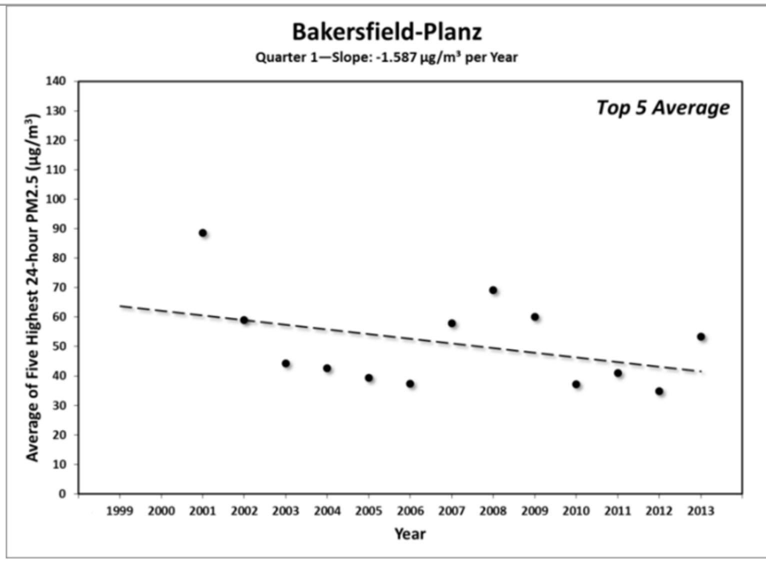



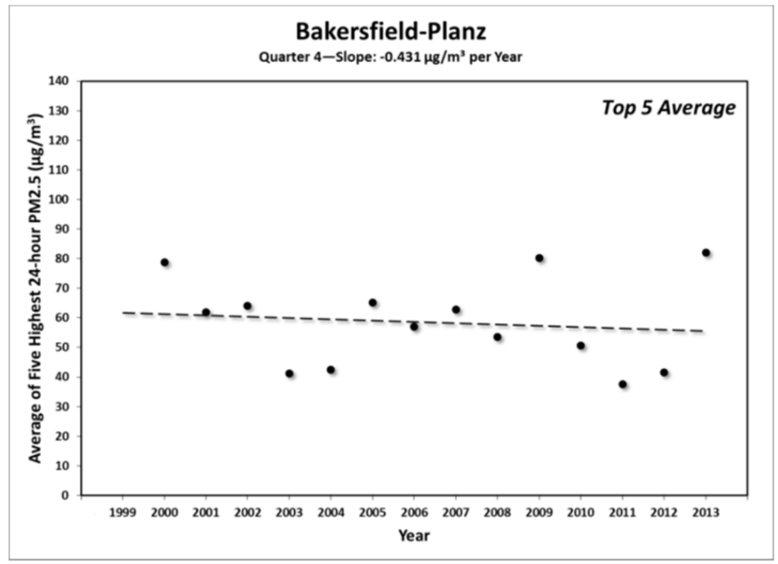



## Figures A-5.1 through A-5.12 Collection of *Top 5 Average* Trends



### A.3.3 Annual Trends

The District collects hourly PM2.5 concentration data using real-time monitors. The District uses this data every day to produce air quality forecasts, wood burning declarations, public health notifications, and Real-time Air Advisory Network (RAAN) notifications.

Based on historical hourly data, the District has compiled long-term diurnal profiles to evaluate how PM2.5 concentrations vary throughout the day at each of the Valley monitoring sites that measure PM2.5. An analysis of hourly measurements can show which portions of the day tend to have the highest and lowest concentrations. Understanding such profiles helps in the development of control strategies and programs that target activities during times of peak concentrations.

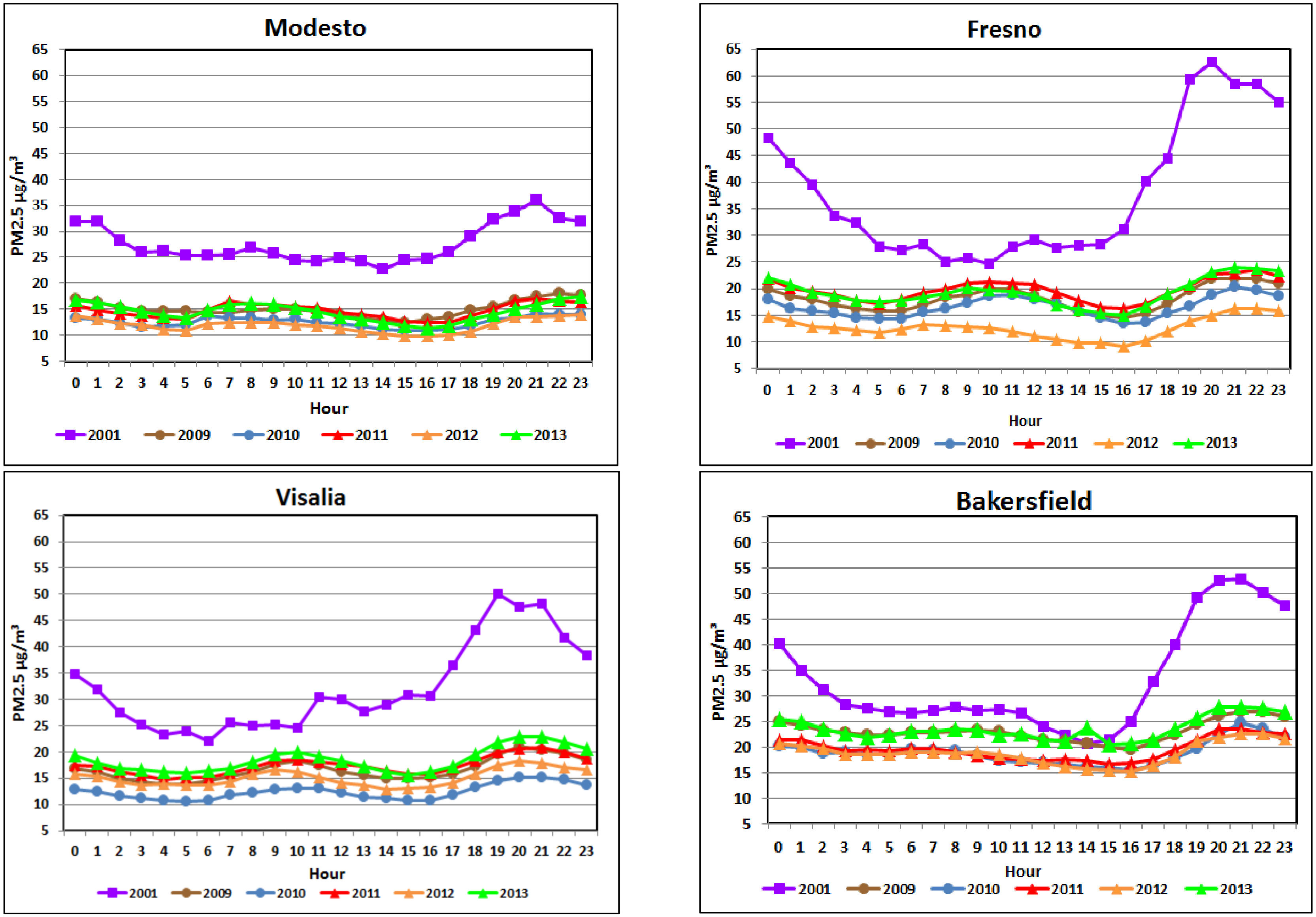
The long-term diurnal profiles can also indicate how the curve has changed from year to year. The District compares relative changes in hourly PM2.5 concentrations from year to year at each monitoring site to better understand the implications and effectiveness of PM2.5 control measures, especially Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters). Prior to 2003, Rule 4901 called for voluntary wood-burning curtailments. Such curtailments became mandatory beginning in the 2003–2004 winter season and have since been strengthened twice, once in 2008 and once again in 2014.

Prior to the 2008-2009 winter season, the Rule was amended to specify that wood-burning curtailments would be declared when a PM2.5 concentration of 30 $\mu g/m^3$ or higher was predicted for a county. Prior to the 2014-15 winter season, the threshold was lowered to 20 $\mu g/m^3$ or higher and contained a tiered system which effectively mitigates emissions from residential wood-burning by discouraging, limiting, or prohibiting wood burning in fireplaces and other non-EPA certified residential wood burning devices during the winter months.

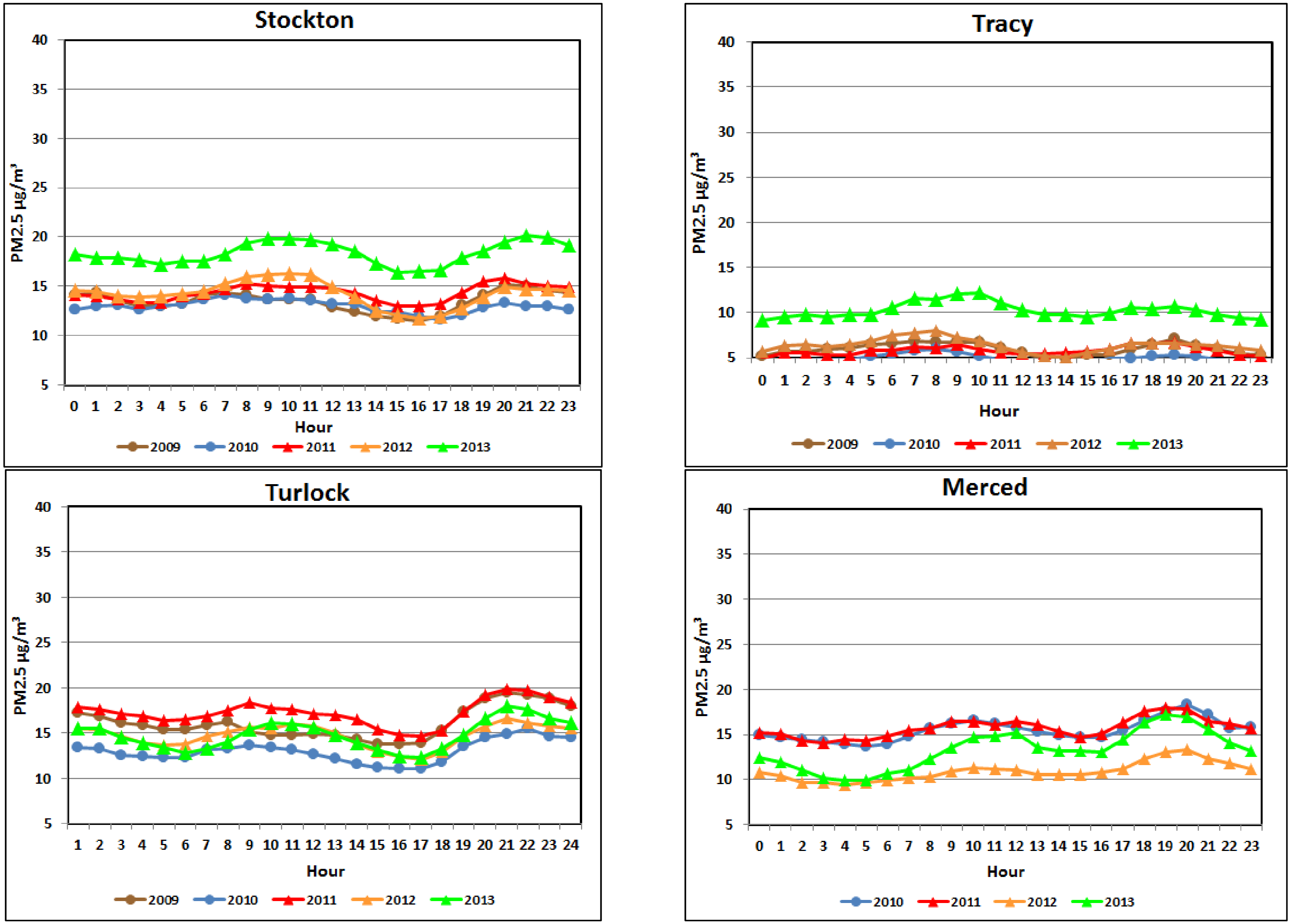
Figures A-6.1 through A-6.16 show a comparison of the yearly average diurnal profiles over time at select real-time monitoring sites within the District's monitoring network. As indicated in profiles A-8.1 through A-8.4, Modesto, Fresno[7], Visalia, and Bakersfield have a longer history of monitoring PM2.5 than the other sites and clearly illustrate that PM2.5 concentrations were much higher prior to the strengthening of Rule 4901.

[7] The Fresno-First Street monitor was relocated one block north to Garland Avenue in 2011 and is now the Fresno-Garland site. The two sites are considered to be the same site so data from the Fresno-First Street and Fresno-Garland sites were combined and used to create the Fresno chart.

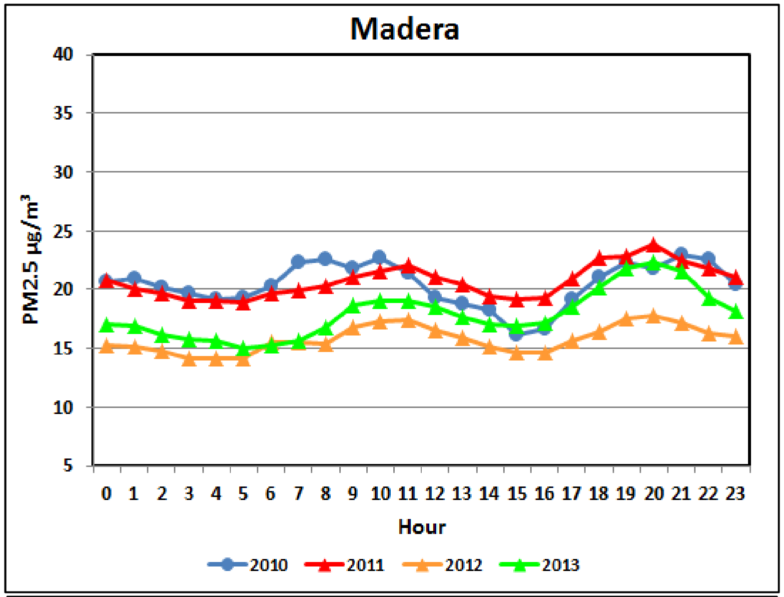
**Figures A-6.1 through A-6.16 PM2.5 Diurnal Profiles**

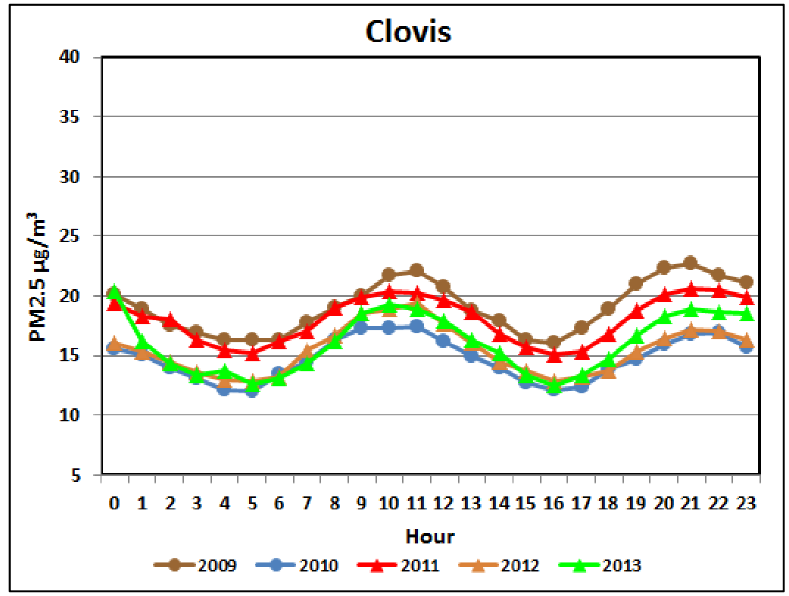


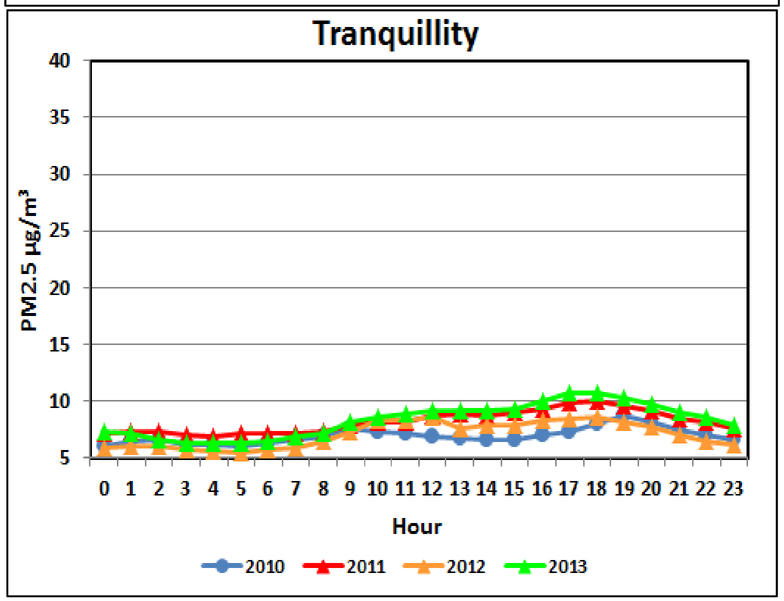
## Figures A-6.1 through A-6.16 PM2.5 Diurnal Profiles

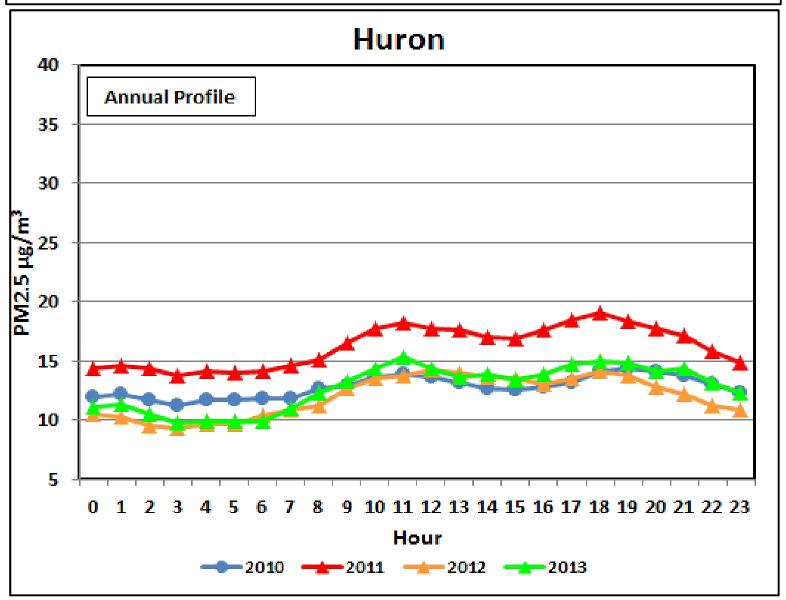


## Figures A-6.1 through A-6.16 PM2.5 Diurnal Profiles

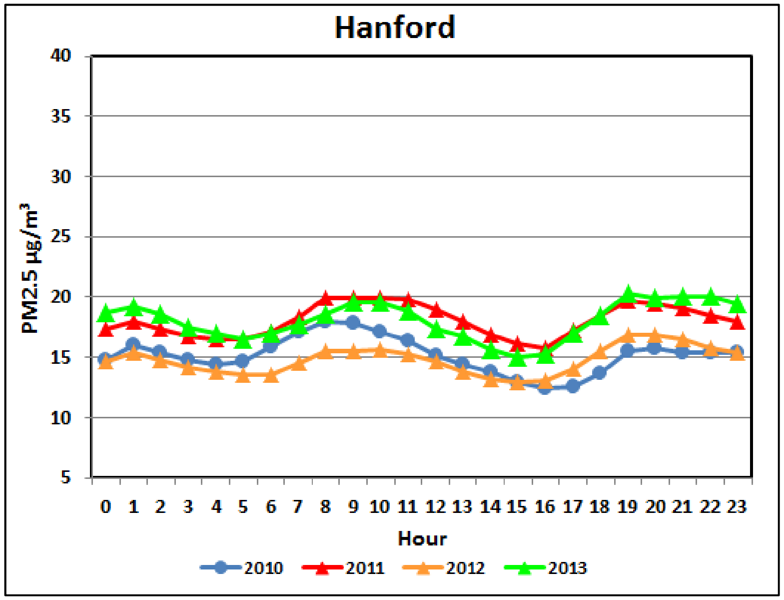


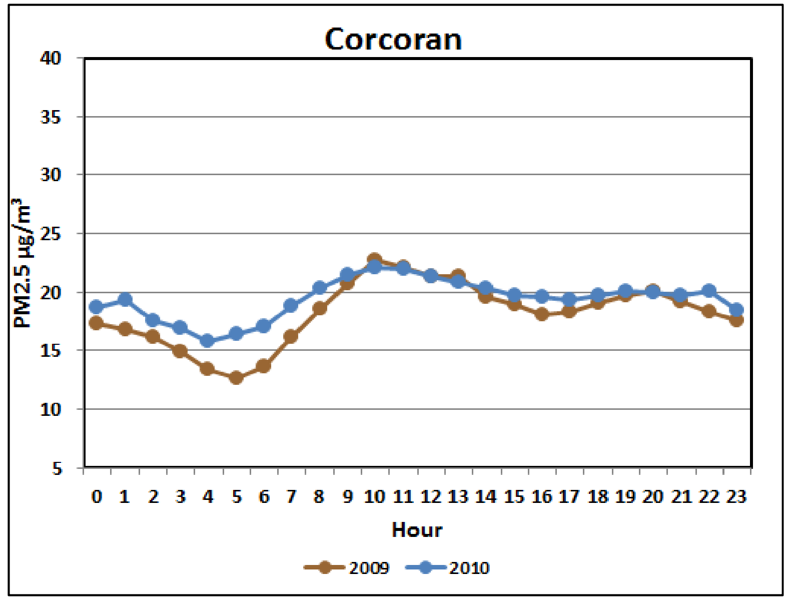



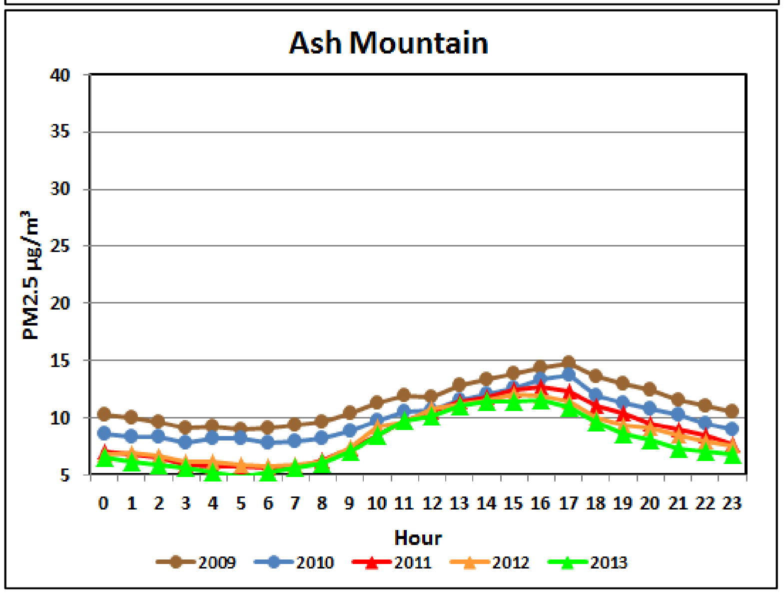



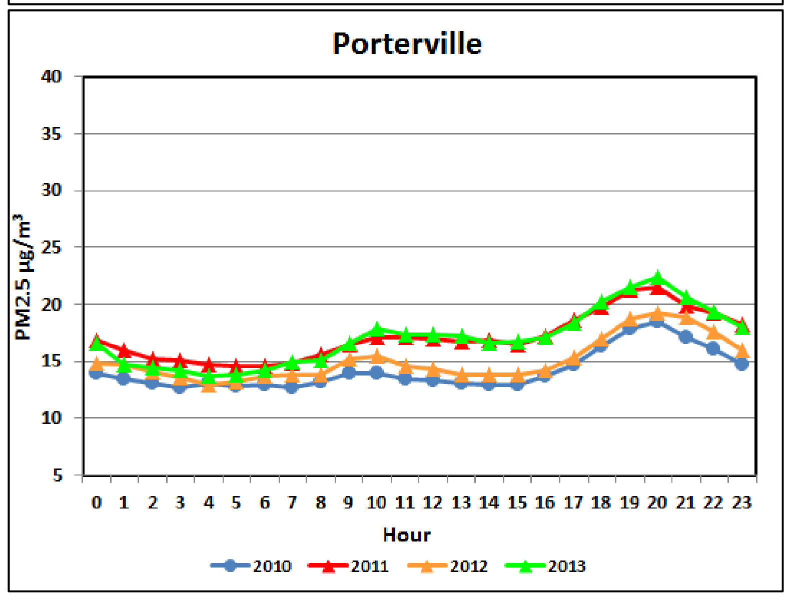



**Figures A-6.1 through A-6.16 PM2.5 Diurnal Profiles**




*Charts represent complete years of data within the past five years..

### A.3.4 PM2.5 Driven Air Quality Index Analysis

The EPA and the District use the Air Quality Index (AQI) to provide daily information about the Valley's air quality, educate the public about how they can protect their health, and to inform the public about how unhealthy air may affect them. AQI scales exist for all of the criteria pollutants regulated by the Clean Air Act, including PM2.5. The current[8] 24-hour average PM2.5 AQI scale is shown in Table A-7 below.

**Table A-7 PM2.5 AQI Scale**

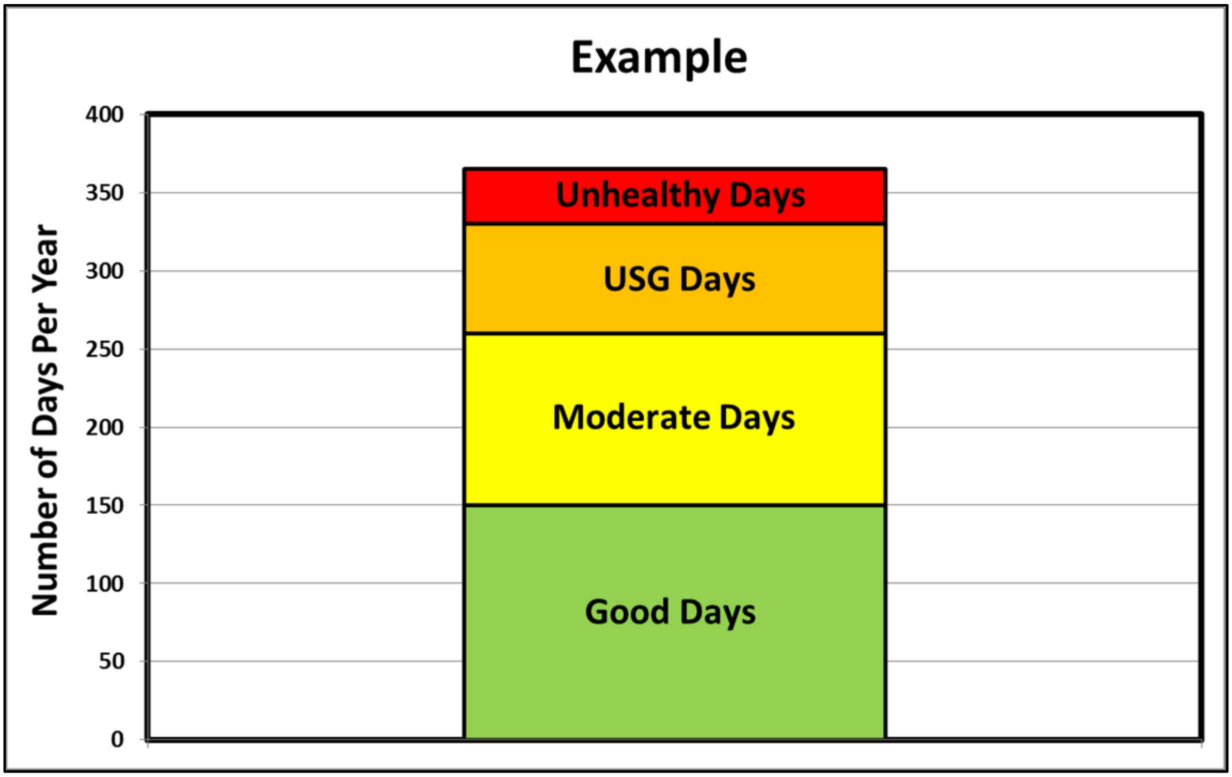
| AQI Category | Index Values | Concentration (µg/m$^3$, 24-hr average) |
|---|---|---|
| **Good** | 0-50 | 0 – 12.0 |
| **Moderate** | 51-100 | 12.1 – 35.4 |
| **Unhealthy for Sensitive Groups (USG)** | 101-150 | 35.5 - 55.4 |
| **Unhealthy** | 151-200 | 55.5 - 150.4 |
| **Very Unhealthy** | 201-300 | 150.5 - 250.4 |
| **Hazardous** | 301+ | 250.5+ |

The District analyzed the trends in the PM2.5 data from the sites with at least two years of daily AQI observations based on real-time data. For this analysis, the AQI trends are based upon PM2.5 concentrations only, and do not include ozone, PM10, or other pollutants. By excluding the other pollutants, the District is able to isolate the change in air quality trends related to PM2.5 only.

Figure A-7 is shown as a reference for interpreting Figures A-8.1 through A-8.11. The stacked bars represent the number of days within each year that fell within each of the AQI categories (totaling 365 days). Because of regular maintenance or repairs, monitors may be non-operational for a day or longer. For years with “missing” days, proportional adjustments were made to estimate the missing days so as to provide a full year’s data to display. Within each stacked bar, the categories are ordered as Good, Moderate, etc. from the bottom up.

[8] CFR Appendix G to Part 58, Uniform Air Quality Index (AQI) and Daily Reporting

**Figure A-7 Air Quality Index (AQI) Categories**




For the majority of the Valley sites, the observed AQI data for the 2008–2013 timeframe shows an improvement in PM2.5 air quality. This finding is significant and needs to be emphasized because this improvement is expressed despite the data being subject to the lowered AQI break points, as noted above in Table A-7. Over these five years, the frequency of Good AQI days increased, coupled with a decrease in the frequency of the Moderate and Unhealthy-for-Sensitive-Groups AQI days. For example, at the Fresno-First /Garland site, the number of Good days increased from 189 in 2008, to 207 in 2013. At the same time, the Moderate and USG days decreased from 126 to 103, and 41 to 31, respectively.

At the Bakersfield-California site, a similar pattern occurred with the frequency of Good AQI days increasing, and the frequency of the Moderate and USG AQI days decreasing. For example, the number of Good days increased from 117 in 2008 to 157 in 2013. At the same time, the Moderate and USG days decreased from 181 to 152, and 48 to 27, respectively.

These improvements over the 2008–2013 timeframe reflect the emissions reductions occurring over these five years. A key part of the emissions reductions during this period is the District's Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters), which was strengthened just before the 2008–2009 winter season, lowering the curtailment threshold from 65 $\mu g/m^3$ to 30 $\mu g/m^3$. The observed improvement in PM2.5 AQI values is partly attributable to the amended wood-burning rule.

Since 2011, the PM2.5 air quality declined at some sites for some years, as compared to previous years. Abnormally stagnant meteorology during the winter of 2011–2012, which has repeated itself each winter since, has created (as of 2014) the historic three year drought and contributed greatly to this PM2.5 deterioration.

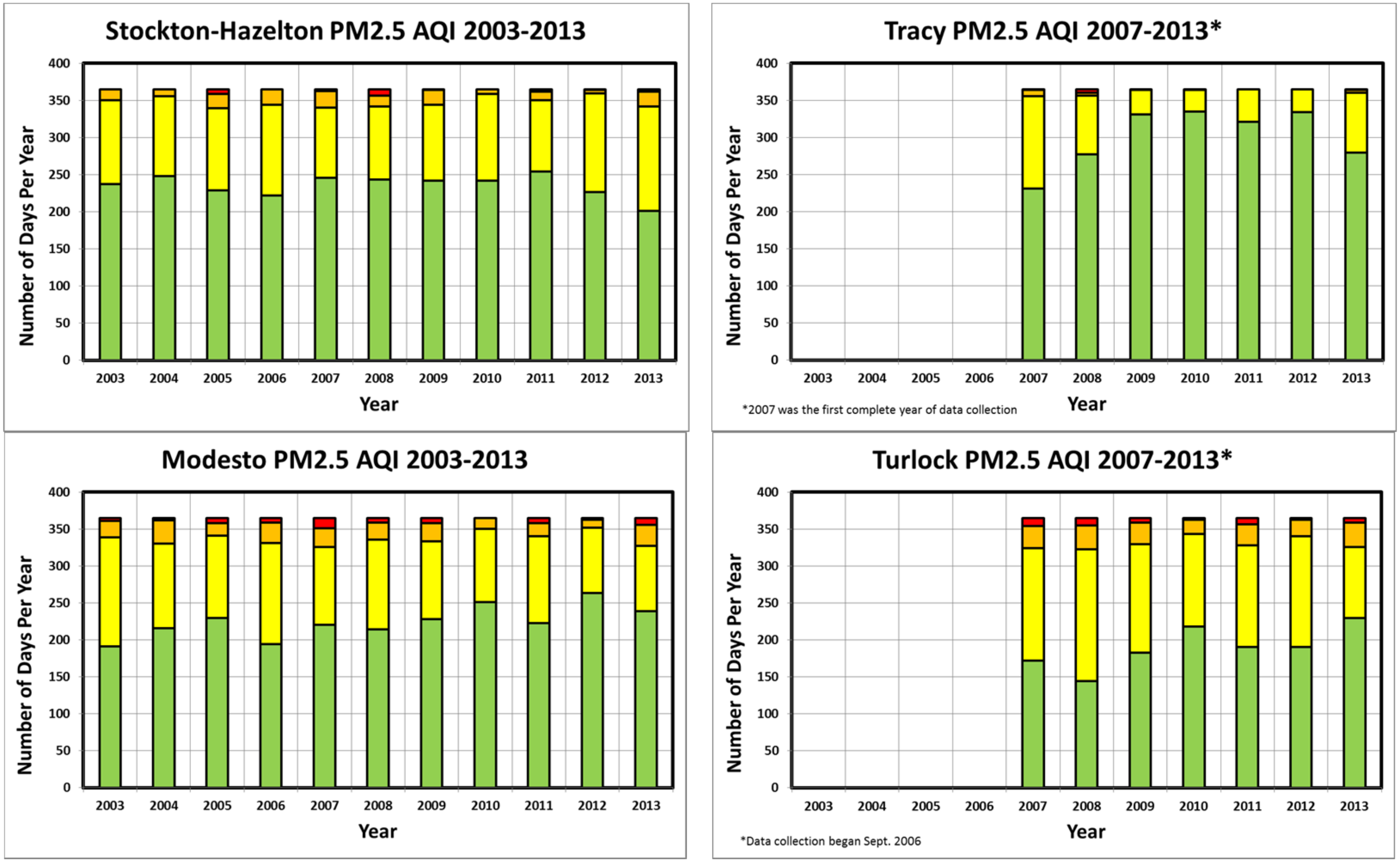
As noted above, over the past several winters, a persistent and strong high pressure ridge over the eastern Pacific Ocean and the western United States effectively blocked weather disturbances from entering California that would normally have removed and replenishment of the valley's air with clean air. The historic strength and longevity of this high pressure resulted in a lack of rainfall and stagnation conditions leading to a subsequent increase in the suspended particulate matter in the atmosphere. This caused of the exceptionally high PM2.5 concentrations found in the Valley and throughout the state of California. Despite these current conditions the general trend has been for improving air quality.

In Figure A-8.12, the data for each site was averaged for all years. In the graph the sites are arranged from north to south along the horizontal axis from left to right. This shows that the northern sites have more Good AQI days than the southern sites. The Stockton-Hazelton and Tracy sites (average between the two is approximately 72% Good AQI), and have about 25% more days in the Good AQI category than the Visalia and Bakersfield sites which average about 47% Good AQI.

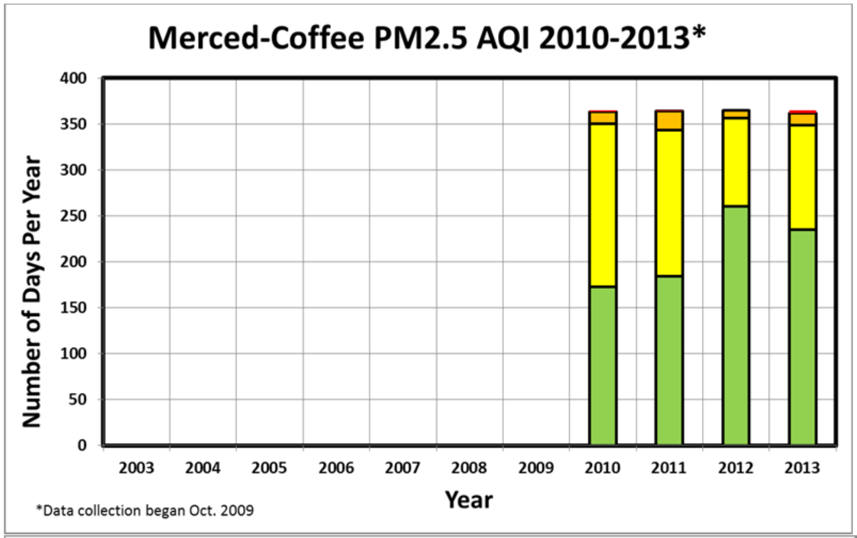
Figure A-8.13 presents the data by year averaging all the sites together for an overall regional view, illustrating that the percentage of Good AQI days is increasing for the District as a whole, while the percentage of Moderate AQI days is decreasing throughout the District. More specifically (and in terms of days instead of percent) for the 11 years between 2003 and 2013, the number of days in the Good AQI category increased by 58 days since 2003, while the number of days in the Moderate, USG, and Unhealthy AQI categories decreased by 46 days, 11, and 1 day, respectively. This finding is significant and needs to be emphasized because this improvement is expressed despite the population increase, the two year drought and winter atmospheric stagnation periods.

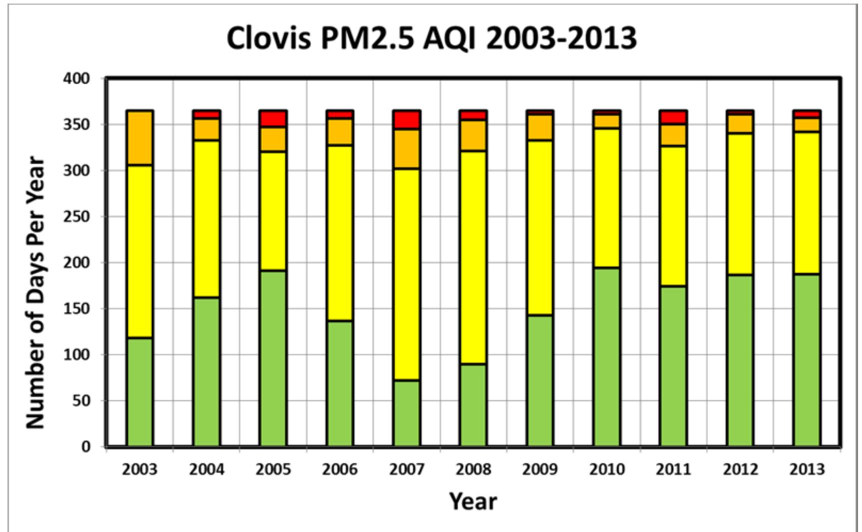
By observing all of the following figures, it is apparent that the dominant annual PM2.5 AQI categories are the Good and Moderate categories. The final figure (Figure A-8.14) is presented to summarize this observation. The data was averaged for all sites and all years (for all years that data that was available for each site). This analysis illustrates that for the Valley as a whole, and over the course of the eleven years, that 92% of all days (335 days) were within the Good and Moderate AQI categories. Breaking that down further shows that the Valley has averaged, 55% Good AQI days (199 days), 37% Moderate AQI days (136 days), 6% USG days (23 days), and 2% Unhealthy days (7 days).

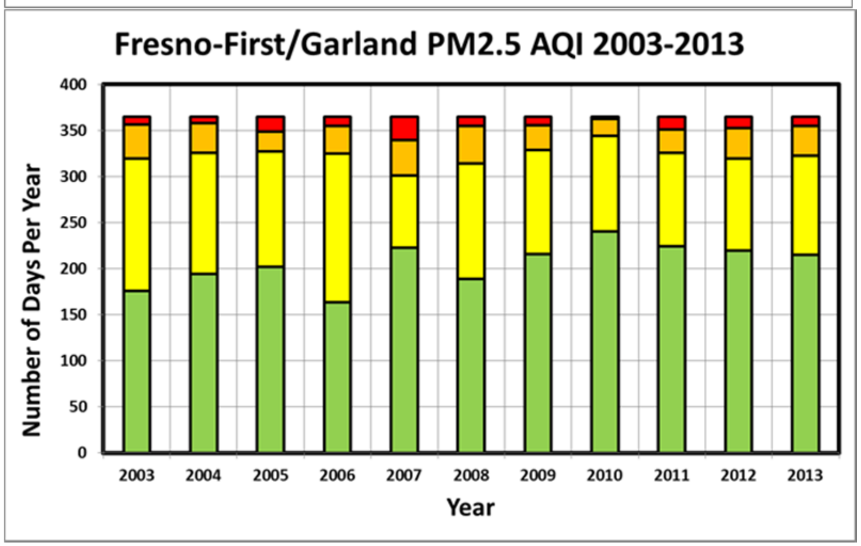
**Figures A-8.1 through A-8.4 Number of Days per AQI Category per Year: Stockton-Hazelton, Tracy, Modesto, and Turlock**

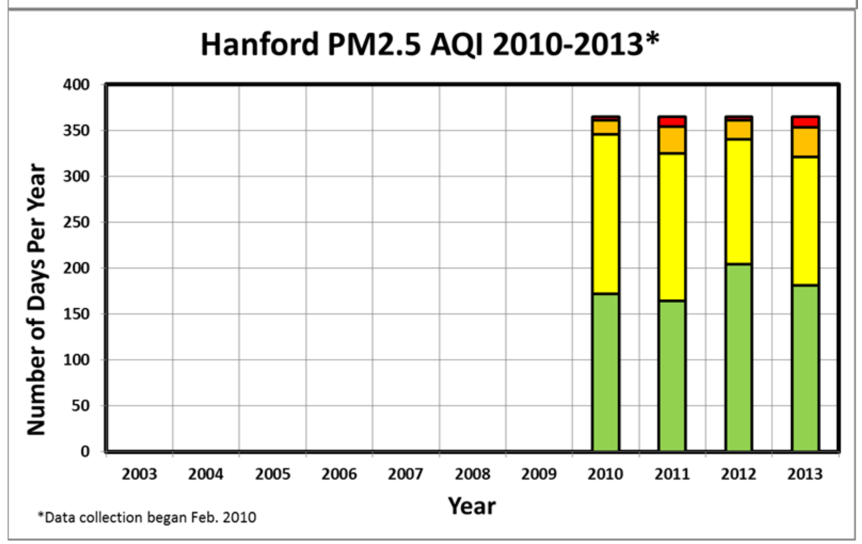


**Figures A-8.5 through A-8.8 Number of Days per AQI Category per Year; Merced, Clovis, Fresno-First/Garland, and Hanford**

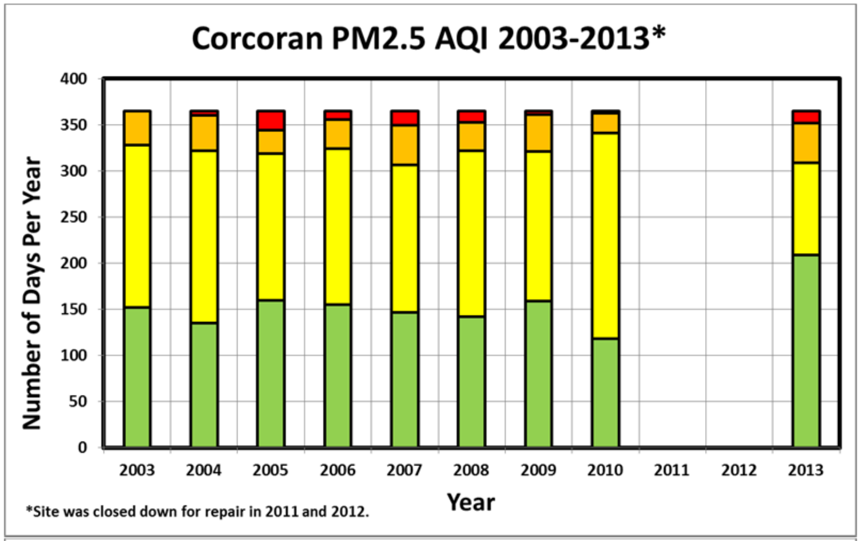


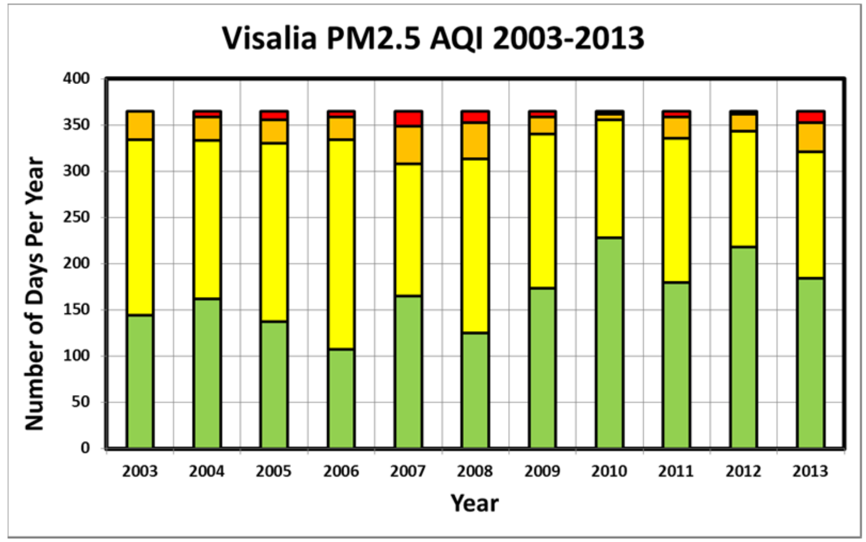



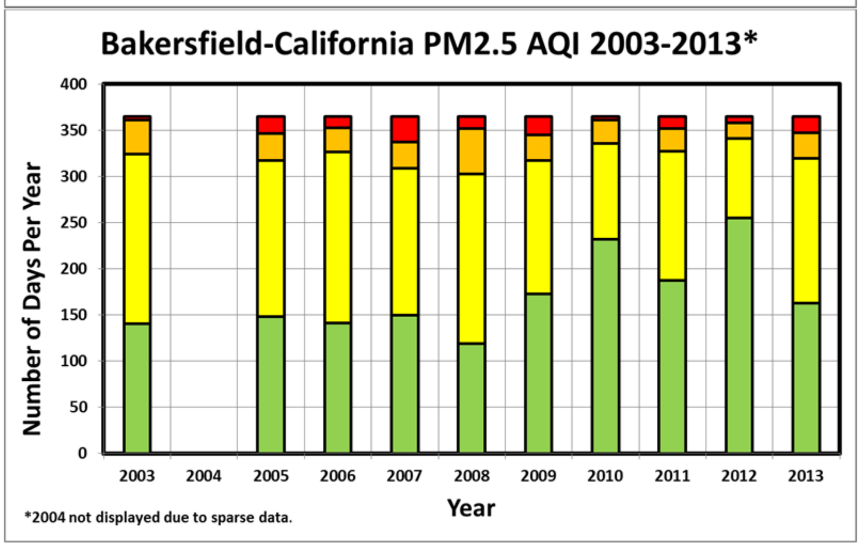



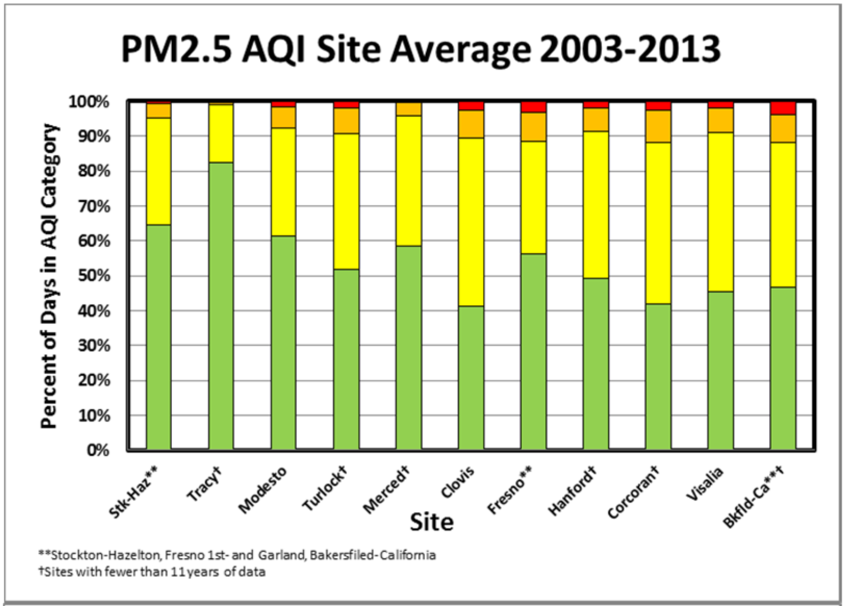
**Figures A-8.9 through A-8.11 Number of Days per AQI Category per Year: Corcoran, Visalia, and Bakersfield California**

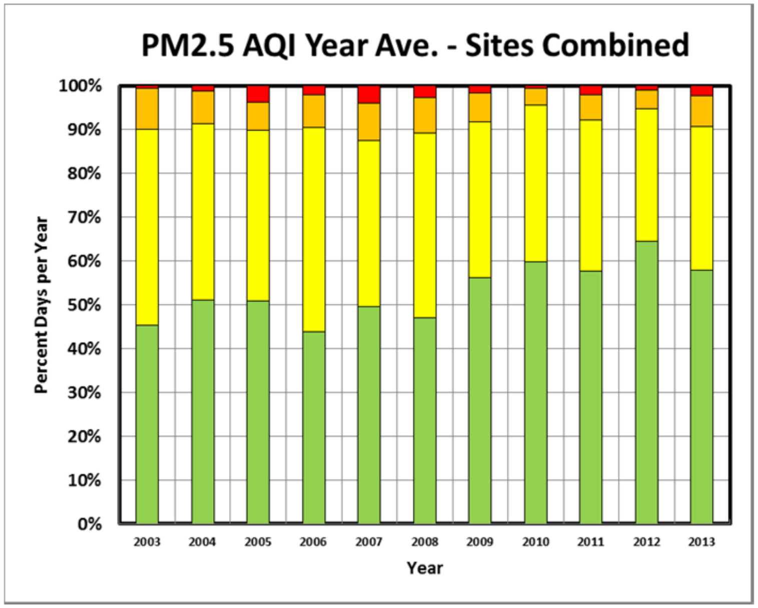


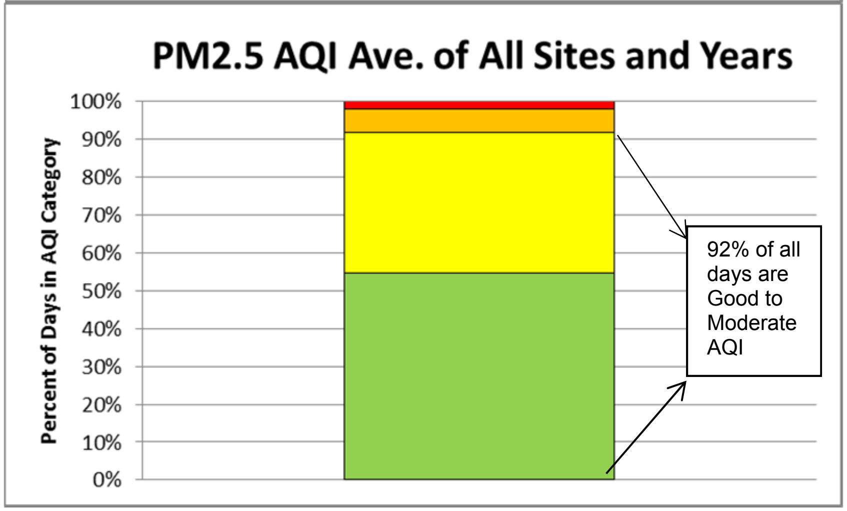



**Figures A-8.12 through A-8.14 PM2.5 AQI Site Average, PM2.5 AQI Year Average, and PM2.5 AQI Average for All Sites and all Years Combined**



### A.3.5 Trends in PM2.5 Species

The NAAQS for particulate matter is established on the basis of the amount of particulate matter, by mass (weight) that a filter sampler is able to collect per cubic meter of air. Most air monitoring devices for particulate matter report only the mass of the particulate matter filtered from the air; however, the mass alone does not tell what source the particulate matter may have come from, or provide direct evidence to determine whether the State Implementation Plan (SIP) measures are having the expected impact on particulate emissions.

Additional monitoring is conducted with special samplers that collect filters for additional analysis of contributing materials (species). The samples collected by speciation samplers are subjected to extensive physical and chemical laboratory analysis. The data produced from the analysis can be used to evaluate trends in the various materials (species) that contribute to particulate emissions and provide information to verify source contributions. The speciation data is also used to support some types of modeling methods to predict future air quality. The variation of materials that contribute to particulate matter shown by samples collected over several years can reveal long term trends. The trend information of the materials observed in the air can be compared to the expected changes predicted from emissions reductions and modeling.

#### *A.3.5.1 Valley Speciation Monitoring*

There are four speciation monitors collecting samples in the Valley these are located in Bakersfield, Fresno, Modesto and Visalia. The ARB provides the extensive and expensive laboratory analysis of the collected speciation filters and compiles the resulting data.

#### *A.3.5.2 Data provided by Speciation Analysis*

Analysis of the filter collected by a speciation sampler reports a variety of contributing materials. The largest mass contributions are the focus of SIP measures to reduce emissions. However, the contributing source of the material may not be clear because many different sources may emit the same common materials. The smaller speciation mass categories are important for use as “tracers” or fingerprints to help identify the relative contribution of sources.

The following tables (A-8 and A-9) provide a summary of the different contributing materials (species) that are identified by laboratory analysis of the speciation sampler filters.

**Table A-8 Largest Mass Contributions Reported in Speciation Analysis**

| Species Name | Description |
|---|---|
| PM2.5 Speciation Mass | Total mass of PM2.5 on the filter |
| OC CSN Unadjusted PM2.5 LC TOT *(there are a variety of different analysis methods reporting different fractions of this contribution)* | Organic Carbon *(VOC evaporation, incomplete combustion and biogenic)* |
| EC CSN PM2.5 LC TOT *(there are a variety of different analysis methods reporting different fractions of this contribution)* | Elemental Carbon *(combustion product)* |
| Nitrate (NO3-) | Key winter mass contribution to PM2.5 |
| Sulfate (SO42-) | Year-round minor contributor |
| Ammonium (NH4+) | Connects to both Nitrate and Sulfate |
| Soluble Potassium (K+) | Shows vegetative burning primarily, some industrial contribution |
| Soluble Sodium (NA+) | Various sources |
| Aluminum (Al) | Indicator for soil, but also engine wear |
| Calcium (Ca) | Indicator for soil, but also construction |
| Chlorine (Cl) | Various sources |
| Iron (Fe) | Break wear, engine wear, but also soil |
| Potassium (K) | Various industrial and agricultural sources |
| Silicon (Si) | Indicator for soil |
| Sodium (Na) | Various sources |
| Sulfur (S) | Indicator for some agricultural activities and some industrial combustion sources |
| Levoglucosan | Newer method to show burning, sugar released by wood combustion |

**Table A-9 Smaller and Trace Level Mass Contributions Reported in the Speciation Analysis**

| **Small or Moderate Contributing Sources** | |
|---|---|
| Barium (Ba) | |
| Copper (Cu) | |
| Tin (Sn) | |
| Titanium (Ti) | |
| Zinc (Zn) | |
| Galactosan *(sugar related to wood combustion)* | |
| Mannosan *(sugar related to wood combustion)* | |
| **Trace Contributions** | |
| Antimony (Sb) | Mercury (Hg) |
| Arsenic (As) | Molybdenum (Mo) |
| Bromine (Br) | Nickel (Ni) |
| Cadmium (Cd) | Niobium (Nb) |
| Cerium (Ce) | Phosphorus (P) |
| Cesium (Cs) | Rubidium (Rb) |
| Chromium (Cr) | Samarium (Sm) |
| Cobalt (Co) | Scandium (Sc) |
| Europium (Eu) | Selenium (Se) |
| Gallium (Ga) | Silver (Ag) |
| Gold (Au) | Strontium (Sr) |
| Hafnium (Hf) | Tantalum (Ta) |
| Indium (In) | Terbium (Tb) |
| Iridium (Ir) | Tungsten (W) |
| Lanthanum (La) | Vanadium (V) |
| Lead (Pb) | Yttrium (Y) |
| Manganese (Mn) | Zirconium (Zr) |

### *A.3.5.3 Trends and Findings Provided by Speciation Data*

Speciation samples collected from 2001 through 2013 have been evaluated to determine variation of species on each of the collected filters. The resulting data from filter analysis has been evaluated to detect trends in the reported species. There are limiting factors that affect the trend analysis including:

- Only the four speciation sampler locations in Bakersfield, Fresno, Modesto and Visalia can be evaluated directly from the speciation filter data. These sites are representative of the Valley but may not explain every variation in total particulate observed at other monitoring locations

- The Fresno speciation sampler was moved to a new, but nearby, location in 2012. Data appear to be consistent for both locations; therefore, the trend evaluation is interpreted as a continuous period of sampling
- Organic carbon and elemental carbon test methodology has changed during the sampling period. Older methodology was used through early 2009. Newer methods were introduced in mid-2007 providing two years of comparison data. The two methods do not provide comparable data for creation of a long term trend analysis for the entire 2001 through 2013 period. Newer methodology reports low concentrations with a narrow range of variability which is not ideal for trend evaluation.

Findings from analysis of the speciation data are discussed for the following topics:

- Trends (multiyear trends in total particulate and major contributing species, responsive species and times of year, nonresponsive species and times of year, interpretation)
- Drought impacts (soil as an indicator for drought impact, observed trends, implications for the SIP)
- SIP implications (District strategy effectiveness)

**Trends** (multiyear trends in total particulate and major contributing species, responsive species and times of year, nonresponsive species and times of year, interpretation)

- **Total particulate:** Both the average value recorded at the four sites and the peak value recorded at the four sites show clear trends of reduction. Figure A-9 and A-10 shown below illustrates the total particulate trend in average and maximum PM2.5 speciation mass. Each of the four sites shows very similar trends to the group analysis. This suggests that all of the Valley sites are expected to be experiencing similar trends, despite the lack of speciation filter data for confirmation at sites other than the four speciation sampler sites. The average of values for the entire year shows improvement from 24 $\mu g/m^3$ of air to 16 $\mu g/m^3$. Both the Average value and Maximum value analyses show improvement from March to October that is approaching the 15 $\mu g/m^3$ annual standard. However, while improving, the late fall and winter months from November through February are proving to be resistant to change, creating challenges in the Valley's journey to attainment of the federal PM2.5 standards.

**Figure A-9 Average PM2.5 Speciation Mass**

| Month Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 79 | 43 | 37 | 33 | 23 | 25 | 44 | 27 | 38 | 22 | 24 | 37 | 32 |
| Feb | 40 | 44 | 22 | 15 | 29 | 29 | 30 | 29 | 15 | 17 | 12 | 16 | 20 |
| Mar | 20 | 17 | 14 | 21 | 16 | 10 | 13 | 14 | 11 | 10 | 10 | 12 | 10 |
| Apr | 10 | 12 | 7 | 11 | 9 | 8 | 10 | 10 | 10 | 9 | 7 | 12 | 8 |
| May | 16 | 9 | 11 | 10 | 9 | 15 | 12 | 12 | 11 | 8 | 7 | 9 | 10 |
| Jun | 13 | 11 | 12 | 10 | 9 | 11 | 11 | 18 | 9 | 8 | 9 | 9 | 11 |
| Jul | 14 | 13 | 13 | 10 | 12 | 16 | 12 | 20 | 10 | 11 | 11 | 10 | 14 |
| Aug | 12 | 19 | 12 | 10 | 11 | 14 | 12 | 13 | 12 | 11 | 11 | 11 | 10 |
| Sep | 16 | 13 | 16 | 10 | 11 | 17 | 14 | 16 | 12 | 11 | 14 | 12 | 8 |
| Oct | 20 | 24 | 19 | 19 | 17 | 19 | 16 | 19 | 14 | 11 | 18 | 13 | 13 |
| Nov | 44 | 48 | 33 | 32 | 33 | 30 | 40 | 37 | 26 | 21 | 22 | 17 | 29 |
| Dec | 27 | 32 | 25 | 29 | 44 | 43 | 28 | 25 | 34 | 26 | 52 | 21 | 48 |
| **Average** | 24 | 23 | 18 | 19 | 19 | 20 | 20 | 20 | 17 | 14 | 16 | 15 | 16 |

**Figure A-10 Maximum PM2.5 Speciation Mass**

| Month Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 188 | 89 | 57 | 56 | 46 | 40 | 79 | 68 | 60 | 48 | 48 | 107 | 67 |
| Feb | 95 | 89 | 50 | 34 | 56 | 71 | 90 | 74 | 62 | 34 | 38 | 29 | 68 |
| Mar | 43 | 34 | 38 | 39 | 57 | 21 | 24 | 35 | 23 | 23 | 24 | 26 | 29 |
| Apr | 16 | 22 | 17 | 20 | 25 | 26 | 26 | 40 | 16 | 19 | 18 | 46 | 15 |
| May | 29 | 16 | 19 | 18 | 19 | 60 | 21 | 19 | 23 | 16 | 13 | 15 | 21 |
| Jun | 33 | 21 | 21 | 15 | 17 | 24 | 23 | 55 | 19 | 20 | 24 | 17 | 52 |
| Jul | 34 | 21 | 20 | 22 | 21 | 27 | 69 | 50 | 13 | 40 | 20 | 27 | 44 |
| Aug | 17 | 40 | 25 | 20 | 18 | 20 | 28 | 27 | 20 | 50 | 24 | 28 | 22 |
| Sep | 98 | 24 | 33 | 15 | 17 | 28 | 44 | 29 | 24 | 30 | 22 | 25 | 14 |
| Oct | 44 | 52 | 33 | 39 | 62 | 42 | 36 | 35 | 36 | 22 | 69 | 30 | 23 |
| Nov | 82 | 93 | 69 | 54 | 81 | 60 | 75 | 80 | 44 | 52 | 44 | 38 | 52 |
| Dec | 63 | 91 | 67 | 71 | 96 | 102 | 68 | 49 | 72 | 69 | 85 | 50 | 124 |
| **Maximum** | 188 | 93 | 69 | 71 | 96 | 102 | 90 | 80 | 72 | 69 | 85 | 107 | 124 |

The next step in analysis of the particulate trend is to evaluate which types of particulate matter are improving and which types are resistant to change. To perform trend analysis of the components included in particulate matter requires examining the major constituents (species) of particulate matter. Particulate matter can be divided into several major constituents: Nitrates, Sulfates, Organic Carbon, Elemental Carbon and Geologic material. Nitrates and Sulfates are formed in the atmosphere from gases (ammonia, NOx, SOx). Organic carbon is both directly emitted and formed in the atmosphere. Elemental carbon (from combustion) and geological material (soil related plus trace elements) are directly emitted and do not change once emitted.

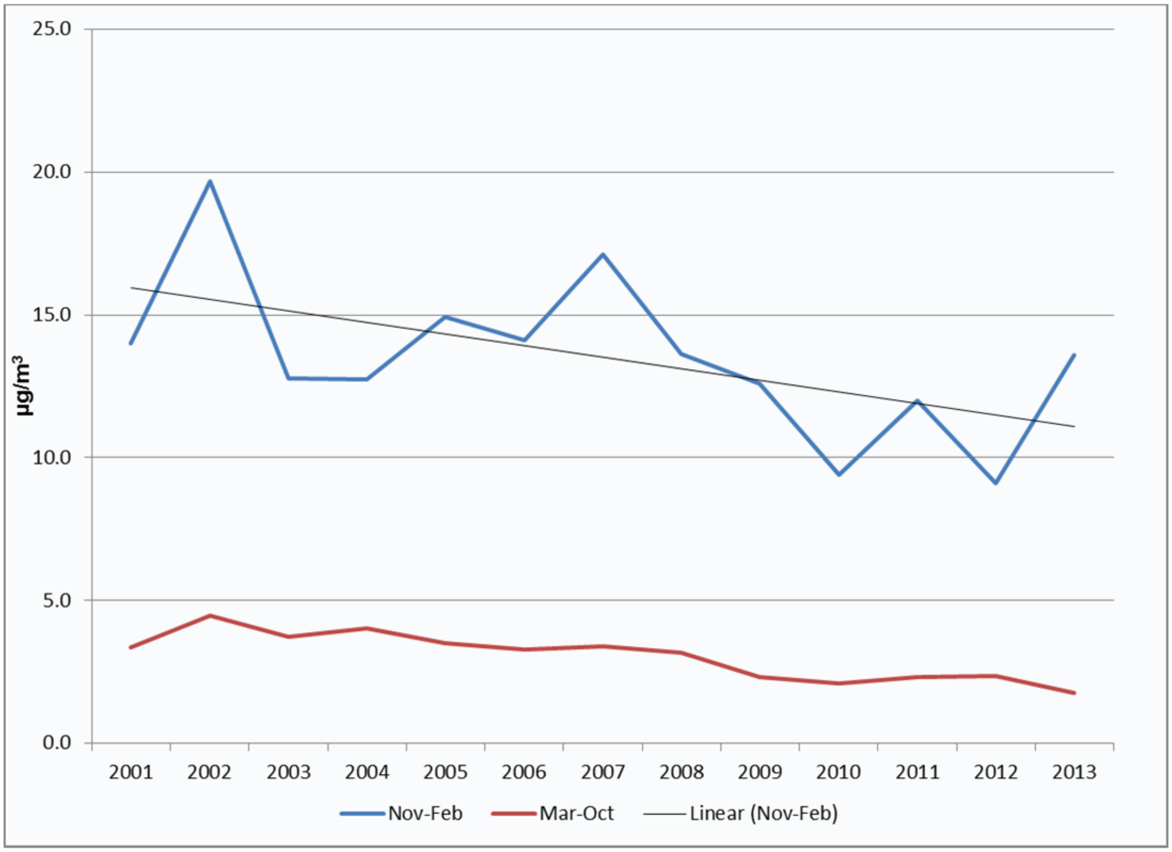
- **Nitrate:** Ammonium nitrate is the largest contributor to particulate matter on an annual basis. Ammonium nitrate is a material that forms in the atmosphere from materials that are considered to be gases (and would not collect on a filter sample) into a material that is considered to be particulate matter and does collect on filter samples. However, during the warmer times of year, while ammonium nitrate forms in the atmosphere it does not remain as particulate matter but evaporates and returns to the component gases. From March through October the amount of ammonium nitrate collected on filter samples is very low and is not the dominant source of particulate matter. The November through February levels of ammonium nitrate are a substantial portion of the total particulate mass. Ammonium nitrate is calculated from the speciation data by adding the reported amount of nitrate to a calculated portion of the ammonium (total reported ammonium minus the portion of ammonium that is involved in ammonium sulfate formation). Figure A-11 shown below illustrates the sum of ammonium (NH4+) and nitrate (NO3-) speciation mass.

**Figure A-11 Sum of Ammonium (NH4+) and Nitrate (NO3-) Speciation Mass**

| Month | Year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Jan | 15.7 | 18.5 | 17.8 | 15.4 | 9.4 | 9.8 | 19.5 | 11.5 | 17.2 | 8.8 | 10.6 | 16.1 | 11.4 |
| Feb | 10.0 | 22.9 | 9.7 | 6.4 | 14.4 | 14.1 | 15.1 | 14.5 | 6.3 | 7.8 | 4.2 | 5.7 | 7.7 |
| Mar | 8.2 | 8.5 | 6.9 | 11.1 | 7.5 | 3.9 | 6.0 | 6.5 | 4.1 | 3.7 | 3.7 | 4.2 | 3.7 |
| Apr | 3.1 | 4.4 | 2.8 | 3.3 | 3.2 | 3.3 | 3.9 | 2.5 | 2.1 | 3.1 | 1.9 | 3.0 | 1.7 |
| May | 1.8 | 2.5 | 2.7 | 2.0 | 2.2 | 3.1 | 2.0 | 2.1 | 2.0 | 1.8 | 1.3 | 1.6 | 1.2 |
| Jun | 1.7 | 2.2 | 2.2 | 1.7 | 1.5 | 1.5 | 1.6 | 2.0 | 1.6 | 0.8 | 1.5 | 1.2 | 1.1 |
| Jul | 1.9 | 2.1 | 2.0 | 1.7 | 1.7 | 1.6 | 1.7 | 2.0 | 1.1 | 1.2 | 1.3 | 1.3 | 1.3 |
| Aug | 1.6 | 3.2 | 2.6 | 2.2 | 1.9 | 2.6 | 1.6 | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 | 0.9 |
| Sep | 2.3 | 2.7 | 3.4 | 2.7 | 2.7 | 2.8 | 3.3 | 2.8 | 1.9 | 1.8 | 2.1 | 2.0 | 1.1 |
| Oct | 6.3 | 10.3 | 7.3 | 7.3 | 7.4 | 7.7 | 7.3 | 6.1 | 4.7 | 3.2 | 5.4 | 4.1 | 3.2 |
| Nov | 21.1 | 24.5 | 14.0 | 15.3 | 16.5 | 14.4 | 21.4 | 17.8 | 10.8 | 8.6 | 9.0 | 6.2 | 11.8 |
| Dec | 9.2 | 12.9 | 9.7 | 13.8 | 19.4 | 18.1 | 12.5 | 10.8 | 16.1 | 12.3 | 24.2 | 8.6 | 23.6 |

Evaluation of the trends of the average values observed for ammonium nitrate data do show reduction during the 2001 to 2013 period. Figure A-12 shown below illustrates the average value ammonium nitrate trend. Both the March to October low values and the November to February higher values show reduction when looking at the average values observed. This indicates that the reduction measures to reduce nitrogen oxide emissions are having an impact on the formation of ammonium nitrate.

**Figure A-12 Average Value Ammonium Nitrate Trend**



The maximum values of ammonium nitrate observed have not followed the trend projected by the average values. March through November maximum value data does show an improving trend; however January, February and December data does not show the same improvement, as shown in Figure A-13 below. The maximum monthly percentage of PM2.5 attributable to ammonium nitrate is shown in Figure A-14 below.

**Figure A-13 Sum of Ammonium (NH4+) and Nitrate (NO3-) Speciation Mass**

| Month | Year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Jan | 46.9 | 36.4 | 31.9 | 31.6 | 25.0 | 18.8 | 45.5 | 40.0 | 35.8 | 22.1 | 23.4 | 48.0 | 36.9 |
| Feb | 30.6 | 54.8 | 26.1 | 14.0 | 32.8 | 44.1 | 59.2 | 48.8 | 36.1 | 19.9 | 19.2 | 14.5 | 37.0 |
| Mar | 12.4 | 19.8 | 20.9 | 23.7 | 33.9 | 12.0 | 14.1 | 22.0 | 11.5 | 12.0 | 11.3 | 12.6 | 15.2 |
| Apr | 5.3 | 10.1 | 9.5 | 7.9 | 15.3 | 11.6 | 14.2 | 6.8 | 3.8 | 8.4 | 5.0 | 4.4 | 3.5 |
| May | 2.6 | 8.6 | 6.4 | 5.6 | 8.5 | 5.9 | 7.7 | 5.7 | 6.6 | 3.8 | 4.0 | 4.7 | 3.3 |
| Jun | 7.8 | 5.4 | 4.3 | 1.7 | 1.6 | 3.7 | 2.5 | 5.2 | 2.5 | 0.0 | 3.3 | 2.9 | 2.5 |
| Jul | 2.2 | 7.0 | 3.6 | 5.0 | 3.8 | 3.1 | 3.4 | 4.7 | 2.7 | 0.0 | 1.7 | 3.1 | 3.7 |
| Aug | 4.2 | 8.3 | 8.5 | 6.2 | 4.7 | 5.7 | 5.1 | 2.1 | 5.1 | 3.9 | 3.0 | 4.0 | 2.8 |
| Sep | 4.0 | 7.5 | 15.1 | 7.2 | 9.5 | 8.2 | 12.1 | 4.9 | 6.0 | 3.3 | 5.0 | 4.8 | 3.1 |
| Oct | 19.3 | 29.5 | 15.8 | 20.8 | 38.4 | 23.3 | 20.5 | 19.6 | 17.9 | 8.5 | 11.5 | 16.6 | 9.9 |
| Nov | 57.8 | 49.8 | 41.0 | 45.0 | 55.8 | 34.0 | 50.5 | 41.2 | 25.1 | 30.6 | 25.1 | 21.2 | 31.1 |
| Dec | 26.0 | 43.0 | 44.0 | 38.7 | 57.3 | 52.1 | 47.5 | 32.9 | 45.9 | 46.0 | 49.5 | 26.9 | 91.2 |

**Figure A-14 Maximum Monthly Percentage of PM2.5 Attributable to Ammonium Nitrate**

| Month | Year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Jan | 25% | 41% | 56% | 56% | 54% | 48% | 57% | 59% | 60% | 47% | 49% | 45% | 55% |
| Feb | 32% | 62% | 52% | 41% | 59% | 62% | 65% | 66% | 58% | 59% | 50% | 51% | 55% |
| Mar | 29% | 58% | 55% | 61% | 60% | 56% | 59% | 64% | 50% | 53% | 47% | 49% | 52% |
| Apr | 33% | 46% | 56% | 40% | 61% | 45% | 55% | 17% | 24% | 45% | 28% | 10% | 24% |
| May | 9% | 54% | 34% | 31% | 45% | 10% | 36% | 30% | 29% | 24% | 31% | 31% | 16% |
| Jun | 24% | 26% | 21% | 11% | 9% | 16% | 11% | 9% | 13% | 0% | 14% | 17% | 5% |
| Jul | 7% | 33% | 18% | 23% | 18% | 12% | 5% | 9% | 20% | 0% | 8% | 12% | 9% |
| Aug | 24% | 21% | 34% | 32% | 26% | 28% | 18% | 8% | 25% | 8% | 12% | 14% | 13% |
| Sep | 4% | 31% | 46% | 48% | 55% | 29% | 28% | 17% | 25% | 11% | 22% | 19% | 21% |
| Oct | 44% | 56% | 48% | 53% | 62% | 55% | 57% | 56% | 50% | 40% | 17% | 55% | 42% |
| Nov | 70% | 54% | 60% | 84% | 69% | 57% | 67% | 52% | 57% | 58% | 57% | 55% | 60% |
| Dec | 41% | 47% | 66% | 54% | 60% | 51% | 69% | 67% | 64% | 67% | 59% | 53% | 74% |

Because the peak values in January, February and December have not shown a proportional reduction to the average emissions reduction and reduction of average observed values, it is difficult to determine how much additional reductions will be required to sufficiently impact the peak values. An important finding for the SIP is that reductions achieved have not been sufficient to achieve the ambient air quality standard and a target for additional reductions to achieve that objective is difficult to forecast.

Another important finding for the SIP is that ammonium nitrate continues to be a dominant source of PM2.5, contributing more than half of the particulate observed during winter, and must remain a key component for reduction efforts through effective reduction of NOx emissions (see Chapter 2).

The reason that nitrate emission reductions have not achieved the improvement predicted by the model may be attributable to a variety of factors. Each of these factors may play a partial role. Data is not available at this time to provide a revision to the model to account for these factors. The potential factors include but may not be limited to:

- Aqueous atmospheric reactions not currently available for inclusion in the model – missing reactions may account for under-prediction of atmospheric formation of nitrates in winter
- Horizontal diffusion parameters appropriate for winter, with diffusion more limited than the current 4 kilometer grid representation of mixing used in the model – requires field investigation to provide parameters and model code enhancement to improve the simulation of observed horizontal diffusion
- Vertical diffusion parameters for winter inversions – requires field investigation to provide parameters and model code enhancement to improve the simulation of observed vertical diffusion
- Adjustment of atmospheric chemistry for impacts of drought (lower humidity results in higher photochemistry activity which provides radicals that promote particulate formation)

- **Sulfate:** Ammonium sulfate is a small contributor to particulate matter on an annual basis. Ammonium sulfate is a material that forms in the atmosphere from materials that are considered to be gases (and would not collect on a filter sample) into a material that is considered to be particulate matter and does collect on filter samples. Once formed, ammonium sulfate is relatively stable in the atmosphere and is removed by deposition to vegetation or soil or by dispersion by gradual horizontal dissipation or by being carried to other locations by action of wind.

  Evaluation of the trends of the average values observed for ammonium sulfate data do show reduction during the 2001 to 2013 period. Reductions are apparent for every month and do not show resistance to improvement in winter except in December. The cause of resistance to improvement in December may be due to reduced inversion heights and severe episodes of air stagnation. Improvement throughout the year indicates that the reduction measures to reduce sulfur oxide (SOx) emissions are having an impact on the formation of ammonium sulfate.

Ammonium Sulfate is calculated from the speciation data by adding the reported amount of sulfate to a calculated portion of the ammonium (total reported ammonium minus the portion of ammonium that is involved in ammonium nitrate formation). Figure A-15 shown below illustrates the sum of sulfate and nitrate in the speciation mass.

**Figure A-15 Sum of Sulfate ($(SO_4)^{2-}$) and Nitrate ($NO_3^-$) Speciation Mass**

| Month | Year 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 2.5 | 4.0 | 4.4 | 3.4 | 3.6 | 2.4 | 2.7 | 3.0 | 3.4 | 2.9 | 3.1 | 2.6 | 1.5 |
| Feb | 1.8 | 3.7 | 2.1 | 1.3 | 2.9 | 2.6 | 2.8 | 3.1 | 1.3 | 2.1 | 1.0 | 1.1 | 1.4 |
| Mar | 2.4 | 1.7 | 2.0 | 2.9 | 2.2 | 1.1 | 1.8 | 1.8 | 1.4 | 1.1 | 1.2 | 1.0 | 1.3 |
| Apr | 1.7 | 2.5 | 1.4 | 2.1 | 1.6 | 1.6 | 2.0 | 1.6 | 2.2 | 1.7 | 1.2 | 2.0 | 1.3 |
| May | 2.8 | 1.8 | 2.2 | 2.1 | 2.3 | 2.7 | 2.4 | 2.4 | 2.4 | 1.4 | 1.1 | 1.7 | 1.5 |
| Jun | 2.0 | 2.5 | 2.9 | 2.6 | 2.1 | 2.7 | 2.2 | 2.2 | 2.4 | 1.4 | 1.6 | 1.3 | 1.7 |
| Jul | 2.6 | 3.2 | 2.8 | 2.5 | 3.1 | 3.4 | 2.5 | 2.7 | 1.8 | 2.5 | 2.3 | 1.7 | 1.9 |
| Aug | 2.3 | 2.6 | 2.4 | 2.3 | 2.4 | 2.7 | 1.9 | 1.9 | 1.6 | 1.4 | 1.7 | 1.5 | 1.1 |
| Sep | 2.3 | 2.1 | 2.7 | 1.3 | 1.9 | 2.2 | 2.3 | 2.6 | 1.6 | 1.7 | 2.1 | 1.8 | 1.1 |
| Oct | 2.3 | 3.4 | 2.3 | 2.1 | 2.3 | 2.6 | 2.1 | 2.3 | 1.4 | 1.5 | 2.3 | 1.5 | 1.4 |
| Nov | 3.6 | 4.5 | 2.3 | 3.6 | 3.2 | 3.3 | 4.5 | 3.7 | 2.2 | 1.7 | 1.9 | 1.2 | 1.9 |
| Dec | 2.2 | 2.6 | 1.8 | 3.3 | 3.8 | 2.5 | 2.6 | 3.0 | 3.0 | 2.0 | 3.6 | 1.4 | 3.2 |

- **Elemental Carbon (EC) and Organic Carbon (OC)**: Elemental carbon from combustion is a small contributor to PM2.5. Organic carbon from incomplete combustion, evaporation and biogenic sources is a large contribution to observed levels of PM2.5, particularly during winter months. Elemental carbon reflects changes in industrial VOC emissions. Organic carbon reflects changes in evaporative VOC emissions and incomplete combustion processes such as charbroiling and residential wood combustion. Changes in the atmospheric levels of EC and OC are therefore important for evaluating the effectiveness of measure in the SIP.

  Laboratory filter sample speciation evaluation methods are used to determine how much of the observed carbon is elemental (does not contain oxygen) and how much is organic (contains oxygen). The combined processing to determine the EC and OC attributions requires discussion of both as a single topic. The laboratory methods for determining this apportionment have to use oxygen to break down compounds that contain carbon. The use of oxygen makes it difficult to determine an accurate measurement of elemental carbon if it is oxidized in the analysis process and made to appear to be organic carbon. The test methods have undergone several revisions to improve methodology.

The test method for organic carbon and elemental carbon changed during the sampling period. Older methodology was used through early 2009. Newer methods were introduced in mid-2007 providing two years of comparison data. The two methods do not provide comparable data for creation of a long term trend analysis for the entire 2001 through 2013 period. Newer methodology reports low concentrations with a narrow range of variability which is not ideal for trend evaluation.

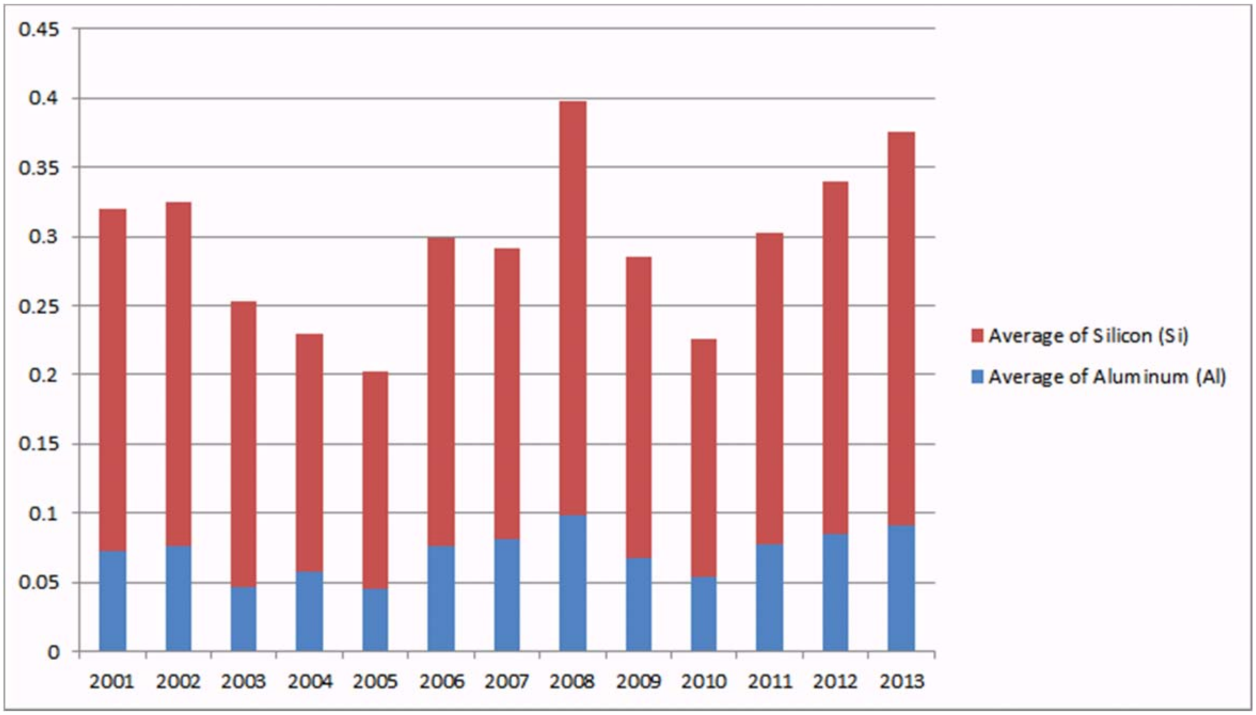
The limitations inherent in the test methodology have produced results that EPA does not consider reliable. EPA has recommended differencing methods for modeling and air monitoring speciation analysis where all easily quantifiable components are subtracted from the total PM 2.5 mass and the remainder is considered to be carbon. The recommended methodology of assigning carbon to all unknown material is not ideal for the 15 $\mu g/m^3$ annual standard due to the need for precision. Additionally this approach is not ideal for the 24-hour PM2.5 standard in areas like the Valley where windblown dust emissions have the potential to produce substantial levels of inert material, identifiable only from calculations for tracer compounds that must assume the molecular weight of the original material.

- **Geologic Material and Trace Elements**: Geologic material is related to windblown dust and trace elements contained in soil material, but geologic material also includes trace elements related to different sources such as fireworks, engine exhaust and tire and brake wear. The amount of geologic material in PM2.5 is generally the third largest source following nitrate and organic carbon. SIP measures to reduce geologic material have been effective but are beginning to show impact from the continuing drought.

## Drought Impacts

Drought related impacts can be assessed by examining the speciation data trends of materials commonly found in soil. Drought increases the amount of soil entrained from roads, agricultural activities, wind entrainment and other soil disturbances that emit particulate into the air. Some uncertainty exists in such a trend analysis because soil is not the only source of many of the compounds commonly found in soil. Soils contains, in decreasing order, silicon, aluminum, iron, magnesium, calcium, sodium, and potassium. The organic fraction of soil also includes phosphorus and sulfur. Additional common elements in soil include copper, zinc, manganese, cobalt, chlorine, boron and molybdenum. More than eighty elements occur in soils. Most of the other compounds not mentioned specifically occur in much smaller quantities. Figure A-16 shown below illustrates the increase soil elements that occur during a drought.

**Figure A-16 Increase of Soil Elements during a Drought**




Evaluation of major and trace components of PM2.5 reported in the speciation data were evaluated for indications of drought impact. Silicon and aluminum provided the strongest indication of the recent multiyear drought. Year by year increase is shown from 2010 through 2013. As silicon and aluminum are components of soil, and not the full mass of soil, the impact of drought on PM2.5 total mass is more than the mass of the two tracer compounds. The tracers conservatively show an up to 1 µg/m$^3$ increase in PM2.5 mass due to increased soil emissions due to the drought.

### *A.3.5.4 SIP Implications (District Strategy Effectiveness)*

Trend analysis of the total mass of PM2.5 shows improvement for the average of observed values. Peak values show improvement except for winter months from November through February. December and January show strong resistance to improvement of peak values.

- Ammonium nitrate (the largest contributor to winter PM2.5 mass) shows improvement in the average of monthly data but also shows resistance to improvement of peak values in winter months (December through February). Ammonium nitrate continues to be a dominant source of PM2.5, contributing more than half of the particulate observed during winter, and must remain a key component for reduction efforts.

- Organic Carbon (the second largest contributor to winter PM2.5 mass) shows less improvement than expected. This source category is difficult to assess due to limitations of the speciation analysis methods.

- Geologic material (the third largest contributor to winter PM2.5 mass) and trace compounds show improvement. However, geologic material is trending upward due to drought.

- Sulfate (a minor contributor) shows improvement.

- Elemental carbon (a minor contributor) shows improvement. This source category is difficult to assess due to limitations of the speciation analysis methods.

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# Appendix B

Emissions Inventory

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix B: Emissions Inventory

## B.1 EMISSIONS INVENTORY TABLES

### Table B-1 Directly Emitted PM2.5

| SUMMARY CATEGORY NAME | PM2.5 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **STATIONARY SOURCES** | | | | | | | | | | | | | | | | | | |
| FUEL COMBUSTION | | | | | | | | | | | | | | | | | | |
| ELECTRIC UTILITIES | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| COGENERATION | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.4 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.4 |
| 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MANUFACTURING AND INDUSTRIAL | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| FOOD AND AGRICULTURAL PROCESSING | 0.7 | 0.7 | 0.7 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 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 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| OTHER (FUEL COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL FUEL COMBUSTION** | **4.9** | **5.0** | **4.8** | **4.7** | **4.6** | **4.6** | **4.6** | **4.6** | **4.6** | **4.8** | **4.8** | **4.7** | **4.6** | **4.6** | **4.6** | **4.6** | **4.5** | **4.5** |
| 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 | 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| INCINERATORS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SOIL REMEDIATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL WASTE DISPOSAL** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.2** | **0.2** | **0.2** | **0.2** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.2** | **0.2** | **0.2** | **0.2** |
| 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| COATINGS AND RELATED PROCESS SOLVENTS | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| PRINTING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL CLEANING AND SURFACE COATINGS** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** |

| SUMMARY CATEGORY NAME | PM2.5 ANNUAL AVERAGE tons/day | | | | | | | | | PM2.5 WINTER AVERAGE tons/day | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| PETROLEUM PRODUCTION AND MARKETING | | | | | | | | | | | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM REFINING | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL PETROLEUM PRODUCTION AND MARKETING** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| INDUSTRIAL PROCESSES | | | | | | | | | | | | | | | | | | |
| CHEMICAL | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| FOOD AND AGRICULTURE | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| MINERAL PROCESSES | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 1.7 | 1.7 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 |
| METAL PROCESSES | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| WOOD AND PAPER | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| GLASS AND RELATED PRODUCTS | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| ELECTRONICS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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) | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| *** TOTAL INDUSTRIAL PROCESSES** | **3.3** | **3.4** | **3.4** | **3.5** | **3.6** | **3.7** | **3.7** | **3.8** | **3.9** | **3.2** | **3.3** | **3.3** | **3.4** | **3.5** | **3.5** | **3.6** | **3.7** | **3.7** |
| **** TOTAL STATIONARY SOURCES** | **8.8** | **8.9** | **8.8** | **8.8** | **8.8** | **8.9** | **9.0** | **9.0** | **9.0** | **8.5** | **8.6** | **8.6** | **8.5** | **8.6** | **8.7** | **8.8** | **8.8** | **8.8** |
| **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 | 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 | 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 | 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 | 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** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| MISCELLANEOUS PROCESSES | | | | | | | | | | | | | | | | | | |
| RESIDENTIAL FUEL COMBUSTION | 5.0 | 4.9 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 9.4 | 9.2 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| FARMING OPERATIONS | 13.9 | 13.9 | 13.8 | 13.8 | 13.8 | 13.8 | 13.8 | 13.7 | 13.7 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 9.0 | 9.0 | 9.0 |
| CONSTRUCTION AND DEMOLITION | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| PAVED ROAD DUST | 5.6 | 5.8 | 5.9 | 6.0 | 6.2 | 6.3 | 6.5 | 6.6 | 6.7 | 5.3 | 5.4 | 5.6 | 5.7 | 5.8 | 6.0 | 6.1 | 6.2 | 6.4 |
| UNPAVED ROAD DUST | 3.8 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 |
| FUGITIVE WINDBLOWN DUST | 7.6 | 7.5 | 7.5 | 7.5 | 7.4 | 7.4 | 7.4 | 7.3 | 7.3 | 4.8 | 4.8 | 4.7 | 4.7 | 4.7 | 4.7 | 4.6 | 4.6 | 4.6 |
| FIRES | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MANAGED BURNING AND DISPOSAL | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |

| SUMMARY CATEGORY NAME | PM2.5 ANNUAL AVERAGE tons/day | | | | | | | | | PM2.5 WINTER AVERAGE tons/day | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| COOKING | 3.6 | 3.6 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 3.6 | 3.6 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL MISCELLANEOUS PROCESSES** | **44.1** | **44.1** | **44.1** | **44.3** | **44.5** | **44.7** | **44.8** | **45.0** | **45.2** | **40.7** | **40.6** | **40.6** | **40.8** | **41.0** | **41.2** | **41.4** | **41.6** | **41.7** |
| **** TOTAL AREA-WIDE SOURCES** | **44.1** | **44.1** | **44.1** | **44.3** | **44.5** | **44.7** | **44.8** | **45.0** | **45.2** | **40.7** | **40.6** | **40.6** | **40.8** | **41.0** | **41.2** | **41.4** | **41.6** | **41.7** |
| **MOBILE SOURCES** | | | | | | | | | | | | | | | | | | |
| ON-ROAD MOTOR VEHICLES | | | | | | | | | | | | | | | | | | |
| LIGHT DUTY PASSENGER (LDA) | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 |
| LIGHT DUTY TRUCKS - 1 (LDT1) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| LIGHT DUTY TRUCKS - 2 (LDT2) | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| MEDIUM DUTY TRUCKS (MDV) | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 |
| LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY GAS TRUCKS (MHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY HEAVY DUTY GAS TRUCKS (HHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1) | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV) | 0.8 | 0.8 | 0.7 | 0.6 | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 | 0.8 | 0.8 | 0.7 | 0.6 | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 |
| HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV) | 4.0 | 3.2 | 1.7 | 1.3 | 1.2 | 0.9 | 0.8 | 0.8 | 0.7 | 4.0 | 3.2 | 1.7 | 1.3 | 1.2 | 0.9 | 0.8 | 0.8 | 0.7 |
| MOTORCYCLES (MCY) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| HEAVY DUTY GAS URBAN BUSES (UB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SCHOOL BUSES (SB) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER BUSES (OB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MOTOR HOMES (MH) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL ON-ROAD MOTOR VEHICLES** | **7.3** | **6.4** | **4.7** | **4.2** | **4.0** | **3.7** | **3.6** | **3.5** | **3.4** | **7.3** | **6.4** | **4.8** | **4.2** | **4.0** | **3.7** | **3.6** | **3.5** | **3.4** |
| OTHER MOBILE SOURCES | | | | | | | | | | | | | | | | | | |
| AIRCRAFT | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.7 | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.7 | 1.7 |
| TRAINS | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| SHIPS AND COMMERCIAL BOATS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RECREATIONAL BOATS | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| OFF-ROAD RECREATIONAL VEHICLES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OFF-ROAD EQUIPMENT | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.8 | 0.8 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.8 | 0.8 |

| SUMMARY CATEGORY NAME | PM2.5 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| FARM EQUIPMENT | 2.9 | 2.8 | 2.7 | 2.6 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 | 1.8 | 1.7 | 1.7 | 1.6 | 1.5 | 1.5 | 1.4 | 1.4 | 1.3 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL OTHER MOBILE SOURCES** | **5.9** | **5.7** | **5.6** | **5.5** | **5.3** | **5.2** | **5.0** | **5.3** | **5.1** | **4.6** | **4.5** | **4.4** | **4.3** | **4.2** | **4.1** | **4.0** | **4.3** | **4.2** |
| **** TOTAL MOBILE SOURCES** | **13.2** | **12.2** | **10.4** | **9.7** | **9.4** | **8.9** | **8.6** | **8.8** | **8.5** | **11.8** | **10.9** | **9.1** | **8.5** | **8.3** | **7.8** | **7.5** | **7.8** | **7.6** |
| | | | | | | | | | | | | | | | | | | |
| **GRAND TOTAL FOR SAN JOAQUIN VALLEY** | **66.0** | **65.2** | **63.3** | **62.8** | **62.6** | **62.5** | **62.4** | **62.9** | **62.8** | **61.0** | **60.2** | **58.3** | **57.9** | **57.8** | **57.7** | **57.7** | **58.2** | **58.1** |

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## Table B-2 NOx

| NOx | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **STATIONARY SOURCES** | | | | | | | | | | | | | | | | | | |
| FUEL COMBUSTION | | | | | | | | | | | | | | | | | | |
| ELECTRIC UTILITIES | 4.2 | 4.4 | 4.1 | 4.0 | 4.2 | 4.2 | 4.3 | 4.3 | 4.3 | 4.0 | 4.2 | 3.9 | 3.8 | 3.9 | 4.0 | 4.0 | 4.1 | 4.0 |
| COGENERATION | 1.6 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 | 1.9 | 2.0 | 2.0 | 1.4 | 1.5 | 1.5 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 | 1.9 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 2.7 | 2.6 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 | 2.1 | 2.0 | 2.7 | 2.6 | 2.5 | 2.3 | 2.3 | 2.2 | 2.1 | 2.1 | 2.0 |
| PETROLEUM REFINING (COMBUSTION) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MANUFACTURING AND INDUSTRIAL | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.2 | 5.2 | 5.2 | 5.3 | 5.4 | 5.4 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |
| FOOD AND AGRICULTURAL PROCESSING | 11.8 | 11.6 | 11.3 | 8.1 | 6.1 | 5.7 | 5.4 | 5.2 | 5.0 | 8.2 | 8.0 | 7.8 | 5.7 | 4.4 | 4.1 | 3.9 | 3.8 | 3.6 |
| SERVICE AND COMMERCIAL | 4.6 | 4.7 | 4.7 | 4.6 | 4.6 | 4.7 | 4.7 | 4.7 | 4.8 | 5.0 | 5.1 | 5.0 | 5.0 | 5.0 | 5.1 | 5.1 | 5.1 | 5.2 |
| OTHER (FUEL COMBUSTION) | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 |
| *** TOTAL FUEL COMBUSTION** | **31.1** | **31.0** | **30.3** | **26.8** | **24.9** | **24.6** | **24.4** | **24.2** | **23.8** | **27.4** | **27.5** | **26.8** | **24.4** | **23.2** | **23.0** | **22.9** | **22.8** | **22.5** |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LANDFILLS | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| INCINERATORS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SOIL REMEDIATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL WASTE DISPOSAL** | **0.2** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.2** | **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 | 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 | 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 | 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 | 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 | 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 | 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** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| PETROLEUM PRODUCTION AND MARKETING | | | | | | | | | | | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| PETROLEUM REFINING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM MARKETING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| SUMMARY CATEGORY NAME | NOx | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL PETROLEUM PRODUCTION AND MARKETING** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** |
| INDUSTRIAL PROCESSES | | | | | | | | | | | | | | | | | | |
| CHEMICAL | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 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 | 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 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GLASS AND RELATED PRODUCTS | 6.0 | 6.2 | 4.0 | 4.1 | 4.2 | 4.3 | 4.3 | 4.3 | 4.4 | 6.0 | 6.2 | 4.0 | 4.1 | 4.2 | 4.3 | 4.3 | 4.3 | 4.4 |
| ELECTRONICS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL INDUSTRIAL PROCESSES** | **6.5** | **6.7** | **4.5** | **4.6** | **4.7** | **4.8** | **4.9** | **4.9** | **5.0** | **6.5** | **6.7** | **4.5** | **4.6** | **4.7** | **4.8** | **4.8** | **4.9** | **4.9** |
| **** TOTAL STATIONARY SOURCES** | **38.3** | **38.4** | **35.4** | **32.1** | **30.3** | **30.1** | **29.9** | **29.8** | **29.4** | **34.6** | **34.8** | **31.9** | **29.7** | **28.6** | **28.5** | **28.4** | **28.3** | **28.1** |
| **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 | 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 | 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 | 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 | 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** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| MISCELLANEOUS PROCESSES | | | | | | | | | | | | | | | | | | |
| RESIDENTIAL FUEL COMBUSTION | 6.5 | 6.5 | 6.5 | 6.5 | 6.6 | 6.6 | 6.6 | 6.6 | 6.7 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 9.2 | 9.2 | 9.2 | 9.3 |
| FARMING OPERATIONS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 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 | 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 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MANAGED BURNING AND DISPOSAL | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| COOKING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL MISCELLANEOUS PROCESSES** | **8.2** | **8.2** | **8.2** | **8.2** | **8.2** | **8.3** | **8.3** | **8.3** | **8.4** | **11.7** | **11.7** | **11.7** | **11.7** | **11.7** | **11.7** | **11.8** | **11.8** | **11.8** |
| **** TOTAL AREA-WIDE SOURCES** | **8.2** | **8.2** | **8.2** | **8.2** | **8.2** | **8.3** | **8.3** | **8.3** | **8.4** | **11.7** | **11.7** | **11.7** | **11.7** | **11.7** | **11.7** | **11.8** | **11.8** | **11.8** |

| SUMMARY CATEGORY NAME | NOx | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **MOBILE SOURCES** | | | | | | | | | | | | | | | | | | |
| ON-ROAD MOTOR VEHICLES | | | | | | | | | | | | | | | | | | |
| LIGHT DUTY PASSENGER (LDA) | 10.5 | 9.6 | 8.5 | 7.6 | 6.8 | 6.1 | 5.4 | 4.9 | 4.5 | 11.5 | 10.5 | 9.5 | 8.5 | 7.6 | 6.7 | 6.0 | 5.4 | 5.0 |
| LIGHT DUTY TRUCKS - 1 (LDT1) | 3.2 | 2.8 | 2.4 | 2.1 | 1.8 | 1.5 | 1.3 | 1.1 | 1.0 | 3.5 | 3.1 | 2.7 | 2.3 | 2.0 | 1.7 | 1.4 | 1.2 | 1.1 |
| LIGHT DUTY TRUCKS - 2 (LDT2) | 7.7 | 7.0 | 6.2 | 5.5 | 4.9 | 4.2 | 3.7 | 3.3 | 2.9 | 8.5 | 7.7 | 6.9 | 6.2 | 5.4 | 4.7 | 4.1 | 3.6 | 3.2 |
| MEDIUM DUTY TRUCKS (MDV) | 10.8 | 10.1 | 9.1 | 8.3 | 7.5 | 6.7 | 6.0 | 5.3 | 4.6 | 11.8 | 11.0 | 10.2 | 9.3 | 8.3 | 7.5 | 6.7 | 5.9 | 5.2 |
| LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1) | 3.1 | 3.0 | 2.7 | 2.5 | 2.3 | 2.1 | 1.9 | 1.8 | 1.6 | 3.3 | 3.2 | 2.9 | 2.7 | 2.5 | 2.3 | 2.1 | 1.9 | 1.8 |
| LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2) | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| MEDIUM HEAVY DUTY GAS TRUCKS (MHDV) | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 | 0.4 | 0.4 | 0.3 | 0.3 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | 0.5 | 0.4 | 0.4 | 0.3 |
| HEAVY HEAVY DUTY GAS TRUCKS (HHDV) | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1) | 11.7 | 11.0 | 10.2 | 9.4 | 8.7 | 8.0 | 7.3 | 6.6 | 6.0 | 11.9 | 11.2 | 10.5 | 9.8 | 9.0 | 8.3 | 7.6 | 6.9 | 6.2 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2) | 3.0 | 2.8 | 2.5 | 2.3 | 2.1 | 1.9 | 1.7 | 1.5 | 1.3 | 3.1 | 2.8 | 2.6 | 2.4 | 2.1 | 1.9 | 1.7 | 1.5 | 1.3 |
| MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV) | 18.1 | 18.1 | 16.4 | 14.0 | 13.0 | 11.7 | 11.0 | 10.2 | 8.2 | 18.4 | 18.5 | 16.6 | 14.2 | 13.2 | 11.9 | 11.2 | 10.3 | 8.4 |
| HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV) | 120.5 | 109.8 | 89.4 | 81.8 | 76.6 | 69.9 | 65.7 | 64.1 | 61.3 | 122.4 | 111.8 | 90.7 | 83.0 | 77.6 | 70.8 | 66.5 | 64.9 | 62.1 |
| MOTORCYCLES (MCY) | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| HEAVY DUTY DIESEL URBAN BUSES (UB) | 3.7 | 3.4 | 3.0 | 2.8 | 2.5 | 2.3 | 2.1 | 1.8 | 1.6 | 3.8 | 3.5 | 3.1 | 2.8 | 2.6 | 2.3 | 2.1 | 1.9 | 1.7 |
| HEAVY DUTY GAS URBAN BUSES (UB) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| SCHOOL BUSES (SB) | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 0.9 | 0.9 | 0.8 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.0 | 0.9 | 0.9 | 0.8 |
| OTHER BUSES (OB) | 1.3 | 1.2 | 1.1 | 0.9 | 0.9 | 0.8 | 0.7 | 0.7 | 0.7 | 1.3 | 1.2 | 1.1 | 1.0 | 0.9 | 0.8 | 0.7 | 0.7 | 0.7 |
| MOTOR HOMES (MH) | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| *** TOTAL ON-ROAD MOTOR VEHICLES** | **198.0** | **183.3** | **156.1** | **141.5** | **130.9** | **118.9** | **110.2** | **104.4** | **96.8** | **204.1** | **188.9** | **161.0** | **145.9** | **134.8** | **122.4** | **113.4** | **107.3** | **99.4** |
| OTHER MOBILE SOURCES | | | | | | | | | | | | | | | | | | |
| AIRCRAFT | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.6 | 4.6 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 4.5 | 4.5 |
| TRAINS | 12.8 | 13.4 | 13.8 | 14.0 | 14.1 | 14.0 | 13.8 | 13.5 | 13.2 | 12.8 | 13.4 | 13.8 | 14.0 | 14.1 | 14.0 | 13.8 | 13.5 | 13.2 |
| SHIPS AND COMMERCIAL BOATS | 1.1 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 1.1 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 |
| RECREATIONAL BOATS | 1.6 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| OFF-ROAD RECREATIONAL VEHICLES | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |
| OFF-ROAD EQUIPMENT | 19.3 | 19.2 | 19.0 | 19.0 | 18.6 | 18.1 | 16.9 | 16.1 | 15.9 | 19.9 | 19.9 | 19.7 | 19.9 | 19.5 | 19.2 | 17.9 | 17.2 | 16.7 |
| FARM EQUIPMENT | 50.4 | 48.4 | 46.5 | 44.7 | 43.1 | 41.5 | 40.0 | 38.6 | 36.2 | 31.3 | 30.1 | 28.9 | 27.8 | 26.7 | 25.8 | 24.8 | 23.9 | 22.5 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| NOx | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| * TOTAL OTHER MOBILE SOURCES | 87.7 | 86.2 | 84.4 | 82.7 | 80.7 | 78.5 | 75.5 | 75.1 | 72.2 | 68.0 | 67.5 | 66.5 | 65.7 | 64.4 | 62.9 | 60.4 | 60.6 | 58.4 |
| ** TOTAL MOBILE SOURCES | 285.7 | 269.4 | 240.6 | 224.3 | 211.7 | 197.4 | 185.8 | 179.5 | 169.0 | 272.2 | 256.4 | 227.5 | 211.5 | 199.2 | 185.2 | 173.8 | 167.9 | 157.7 |
| | | | | | | | | | | | | | | | | | | |
| GRAND TOTAL FOR SAN JOAQUIN VALLEY | 332.2 | 316.1 | 284.2 | 264.6 | 250.2 | 235.7 | 223.9 | 217.6 | 206.9 | 318.5 | 302.8 | 271.0 | 252.9 | 239.4 | 225.5 | 213.9 | 208.0 | 197.7 |

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## Table B-3 SOx

| SUMMARY CATEGORY NAME | SOx ANNUAL AVERAGE tons/day | | | | | | | | | SOx WINTER AVERAGE tons/day | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **STATIONARY SOURCES** | | | | | | | | | | | | | | | | | | |
| FUEL COMBUSTION | | | | | | | | | | | | | | | | | | |
| ELECTRIC UTILITIES | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| COGENERATION | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 0.7 | 0.7 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.7 | 0.7 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| PETROLEUM REFINING (COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MANUFACTURING AND INDUSTRIAL | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| FOOD AND AGRICULTURAL PROCESSING | 0.3 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| SERVICE AND COMMERCIAL | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| OTHER (FUEL COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL FUEL COMBUSTION** | **3.0** | **3.0** | **2.4** | **2.3** | **2.4** | **2.4** | **2.4** | **2.4** | **2.4** | **2.9** | **2.9** | **2.3** | **2.3** | **2.3** | **2.4** | **2.4** | **2.4** | **2.4** |
| WASTE DISPOSAL | | | | | | | | | | | | | | | | | | |
| SEWAGE TREATMENT | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| LANDFILLS | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| INCINERATORS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SOIL REMEDIATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL WASTE DISPOSAL** | **0.1** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.1** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 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 | 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 | 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 | 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 | 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 | 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 | 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** | **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 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| PETROLEUM REFINING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM MARKETING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| SUMMARY CATEGORY NAME | SOx | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| *** TOTAL PETROLEUM PRODUCTION AND MARKETING** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| INDUSTRIAL PROCESSES | | | | | | | | | | | | | | | | | | |
| CHEMICAL | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 |
| FOOD AND AGRICULTURE | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MINERAL PROCESSES | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| METAL PROCESSES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GLASS AND RELATED PRODUCTS | 2.0 | 2.0 | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 2.0 | 2.0 | 2.0 | 2.0 | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 2.0 | 2.0 |
| ELECTRONICS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL INDUSTRIAL PROCESSES** | **3.6** | **3.6** | **3.5** | **3.6** | **3.6** | **3.7** | **3.7** | **3.8** | **3.8** | **3.3** | **3.4** | **3.2** | **3.3** | **3.3** | **3.4** | **3.4** | **3.5** | **3.5** |
| **** TOTAL STATIONARY SOURCES** | **6.9** | **7.0** | **6.2** | **6.3** | **6.3** | **6.4** | **6.5** | **6.5** | **6.6** | **6.6** | **6.7** | **5.9** | **6.0** | **6.0** | **6.1** | **6.2** | **6.2** | **6.3** |
| **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 | 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 | 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 | 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 | 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** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| MISCELLANEOUS PROCESSES | | | | | | | | | | | | | | | | | | |
| RESIDENTIAL FUEL COMBUSTION | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| FARMING OPERATIONS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 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 | 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 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MANAGED BURNING AND DISPOSAL | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| COOKING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL MISCELLANEOUS PROCESSES** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** |
| **** TOTAL AREA-WIDE SOURCES** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.3** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** |
| **MOBILE SOURCES** | | | | | | | | | | | | | | | | | | |
| ON-ROAD MOTOR VEHICLES | | | | | | | | | | | | | | | | | | |

| SOx | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| LIGHT DUTY PASSENGER (LDA) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| LIGHT DUTY TRUCKS - 1 (LDT1) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT DUTY TRUCKS - 2 (LDT2) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MEDIUM DUTY TRUCKS (MDV) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY GAS TRUCKS (MHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY HEAVY DUTY GAS TRUCKS (HHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MOTORCYCLES (MCY) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY DUTY DIESEL URBAN BUSES (UB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY DUTY GAS URBAN BUSES (UB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SCHOOL BUSES (SB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER BUSES (OB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MOTOR HOMES (MH) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL ON-ROAD MOTOR VEHICLES** | **0.6** | **0.7** | **0.7** | **0.7** | **0.7** | **0.7** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** |
| OTHER MOBILE SOURCES | | | | | | | | | | | | | | | | | | |
| AIRCRAFT | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| TRAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SHIPS AND COMMERCIAL BOATS | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| RECREATIONAL BOATS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OFF-ROAD RECREATIONAL VEHICLES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OFF-ROAD EQUIPMENT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FARM EQUIPMENT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL OTHER MOBILE SOURCES** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.3** | **0.3** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.3** | **0.3** |
| **** TOTAL MOBILE SOURCES** | **0.9** | **0.9** | **0.9** | **0.9** | **0.9** | **0.9** | **0.9** | **0.9** | **0.9** | **0.8** | **0.9** | **0.8** | **0.8** | **0.8** | **0.9** | **0.9** | **0.9** | **0.9** |
| | | | | | | | | | | | | | | | | | | |
| **GRAND TOTAL FOR SAN JOAQUIN VALLEY** | **8.1** | **8.2** | **7.4** | **7.5** | **7.6** | **7.6** | **7.7** | **7.8** | **7.8** | **7.9** | **8.0** | **7.3** | **7.3** | **7.4** | **7.5** | **7.6** | **7.6** | **7.7** |

## Table B-4 VOC

| SUMMARY CATEGORY NAME | VOC | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **STATIONARY SOURCES** | | | | | | | | | | | | | | | | | | |
| FUEL COMBUSTION | | | | | | | | | | | | | | | | | | |
| ELECTRIC UTILITIES | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| COGENERATION | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MANUFACTURING AND INDUSTRIAL | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| FOOD AND AGRICULTURAL PROCESSING | 1.0 | 1.0 | 1.0 | 0.9 | 0.7 | 0.7 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | 0.7 | 0.7 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| SERVICE AND COMMERCIAL | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 |
| OTHER (FUEL COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL FUEL COMBUSTION** | **3.8** | **3.8** | **3.7** | **3.6** | **3.4** | **3.3** | **3.3** | **3.3** | **3.2** | **3.6** | **3.6** | **3.5** | **3.4** | **3.3** | **3.2** | **3.2** | **3.2** | **3.2** |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LANDFILLS | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.8 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.8 |
| INCINERATORS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SOIL REMEDIATION | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| OTHER (WASTE DISPOSAL) | 21.4 | 21.6 | 22.0 | 22.4 | 22.9 | 22.5 | 23.4 | 23.9 | 24.3 | 21.4 | 21.6 | 22.0 | 22.4 | 22.9 | 22.5 | 23.4 | 23.9 | 24.3 |
| *** TOTAL WASTE DISPOSAL** | **23.0** | **23.2** | **23.7** | **24.1** | **24.6** | **24.4** | **25.3** | **25.8** | **26.3** | **23.0** | **23.2** | **23.7** | **24.1** | **24.6** | **24.3** | **25.3** | **25.8** | **26.3** |
| 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| DEGREASING | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| COATINGS AND RELATED PROCESS SOLVENTS | 7.8 | 8.1 | 8.3 | 8.4 | 8.6 | 8.8 | 9.0 | 9.1 | 9.2 | 7.8 | 8.1 | 8.2 | 8.4 | 8.6 | 8.7 | 9.0 | 9.1 | 9.2 |
| PRINTING | 4.8 | 4.9 | 5.0 | 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 5.6 | 4.8 | 4.9 | 5.0 | 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 5.6 |
| ADHESIVES AND SEALANTS | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| OTHER (CLEANING AND SURFACE COATINGS) | 6.2 | 6.3 | 6.5 | 6.7 | 6.8 | 6.9 | 7.1 | 7.2 | 7.3 | 6.2 | 6.3 | 6.5 | 6.6 | 6.8 | 6.9 | 7.1 | 7.2 | 7.3 |
| *** TOTAL CLEANING AND SURFACE COATINGS** | **21.0** | **21.5** | **22.0** | **22.4** | **22.8** | **23.2** | **23.7** | **24.1** | **24.4** | **21.0** | **21.5** | **22.0** | **22.4** | **22.8** | **23.2** | **23.6** | **24.0** | **24.4** |
| PETROLEUM PRODUCTION AND MARKETING | | | | | | | | | | | | | | | | | | |
| OIL AND GAS PRODUCTION | 25.9 | 25.4 | 24.8 | 24.3 | 23.7 | 23.2 | 22.7 | 22.2 | 21.7 | 25.9 | 25.4 | 24.8 | 24.3 | 23.7 | 23.2 | 22.7 | 22.2 | 21.7 |
| PETROLEUM REFINING | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| PETROLEUM MARKETING | 7.7 | 7.3 | 7.4 | 7.6 | 7.7 | 7.8 | 8.0 | 8.2 | 8.3 | 7.7 | 7.3 | 7.4 | 7.6 | 7.7 | 7.8 | 8.0 | 8.1 | 8.3 |

| VOC | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL PETROLEUM PRODUCTION AND MARKETING** | **34.4** | **33.5** | **33.0** | **32.6** | **32.3** | **31.9** | **31.5** | **31.2** | **30.8** | **34.4** | **33.5** | **33.0** | **32.6** | **32.2** | **31.9** | **31.5** | **31.1** | **30.8** |
| INDUSTRIAL PROCESSES | | | | | | | | | | | | | | | | | | |
| CHEMICAL | 4.8 | 4.9 | 4.9 | 5.0 | 5.1 | 5.1 | 5.2 | 5.3 | 5.4 | 4.8 | 4.9 | 4.9 | 5.0 | 5.0 | 5.1 | 5.2 | 5.3 | 5.4 |
| FOOD AND AGRICULTURE | 10.9 | 11.1 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.5 | 12.7 | 10.7 | 10.9 | 11.1 | 11.3 | 11.5 | 11.7 | 11.9 | 12.2 | 12.4 |
| MINERAL PROCESSES | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| METAL PROCESSES | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 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 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER (INDUSTRIAL PROCESSES) | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 1.0 |
| *** TOTAL INDUSTRIAL PROCESSES** | **17.0** | **17.3** | **17.6** | **17.9** | **18.2** | **18.5** | **18.8** | **19.2** | **19.5** | **16.7** | **17.0** | **17.3** | **17.6** | **17.9** | **18.2** | **18.5** | **18.9** | **19.2** |
| **** TOTAL STATIONARY SOURCES** | **99.2** | **99.3** | **100.0** | **100.6** | **101.2** | **101.2** | **102.6** | **103.5** | **104.2** | **98.7** | **98.7** | **99.4** | **100.1** | **100.8** | **100.8** | **102.1** | **103.0** | **103.8** |
| **AREA-WIDE SOURCES** | | | | | | | | | | | | | | | | | | |
| SOLVENT EVAPORATION | | | | | | | | | | | | | | | | | | |
| CONSUMER PRODUCTS | 22.2 | 21.3 | 21.6 | 21.9 | 22.3 | 22.8 | 23.3 | 23.7 | 24.2 | 22.2 | 21.3 | 21.6 | 21.9 | 22.3 | 22.8 | 23.3 | 23.7 | 24.2 |
| ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS | 9.0 | 9.0 | 9.2 | 9.3 | 9.5 | 9.7 | 9.9 | 10.1 | 10.3 | 7.7 | 7.8 | 7.9 | 8.1 | 8.2 | 8.4 | 8.6 | 8.7 | 8.9 |
| PESTICIDES/FERTILIZERS | 15.3 | 15.4 | 15.3 | 15.3 | 15.2 | 15.1 | 15.0 | 15.0 | 14.9 | 14.8 | 15.5 | 15.5 | 15.4 | 15.3 | 15.3 | 15.2 | 15.1 | 15.1 |
| ASPHALT PAVING / ROOFING | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| *** TOTAL SOLVENT EVAPORATION** | **47.4** | **46.6** | **46.9** | **47.3** | **47.9** | **48.6** | **49.1** | **49.7** | **50.3** | **45.6** | **45.4** | **45.8** | **46.2** | **46.7** | **47.4** | **47.9** | **48.5** | **49.0** |
| MISCELLANEOUS PROCESSES | | | | | | | | | | | | | | | | | | |
| RESIDENTIAL FUEL COMBUSTION | 5.6 | 5.4 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 10.6 | 10.4 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 |
| FARMING OPERATIONS | 96.0 | 97.0 | 98.1 | 99.2 | 100.2 | 101.3 | 102.4 | 103.5 | 104.5 | 95.9 | 97.0 | 98.1 | 99.1 | 100.2 | 101.3 | 102.3 | 103.4 | 104.5 |
| 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 | 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 | 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 | 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 | 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MANAGED BURNING AND DISPOSAL | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 3.7 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| COOKING | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL MISCELLANEOUS PROCESSES** | **104.8** | **105.7** | **106.6** | **107.7** | **108.8** | **109.9** | **111.0** | **112.1** | **113.2** | **110.9** | **111.7** | **112.5** | **113.6** | **114.7** | **115.8** | **116.8** | **117.9** | **119.0** |
| **** TOTAL AREA-WIDE SOURCES** | **152.1** | **152.2** | **153.6** | **155.1** | **156.7** | **158.5** | **160.1** | **161.8** | **163.4** | **156.5** | **157.1** | **158.3** | **159.8** | **161.4** | **163.1** | **164.7** | **166.4** | **168.0** |
| **MOBILE SOURCES** | | | | | | | | | | | | | | | | | | |

| VOC | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SUMMARY CATEGORY NAME** | **ANNUAL AVERAGE tons/day** | | | | | | | | | **WINTER AVERAGE tons/day** | | | | | | | | |
| | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| ON-ROAD MOTOR VEHICLES | | | | | | | | | | | | | | | | | | |
| LIGHT DUTY PASSENGER (LDA) | 14.7 | 13.7 | 12.1 | 10.7 | 9.4 | 8.3 | 7.4 | 6.7 | 6.2 | 14.8 | 13.6 | 12.0 | 10.5 | 9.3 | 8.2 | 7.3 | 6.6 | 6.1 |
| LIGHT DUTY TRUCKS - 1 (LDT1) | 5.4 | 5.0 | 4.5 | 3.9 | 3.4 | 2.9 | 2.6 | 2.3 | 2.0 | 5.7 | 5.3 | 4.7 | 4.1 | 3.6 | 3.1 | 2.7 | 2.4 | 2.1 |
| LIGHT DUTY TRUCKS - 2 (LDT2) | 7.7 | 7.4 | 6.7 | 6.1 | 5.5 | 4.9 | 4.5 | 4.1 | 3.8 | 8.1 | 7.7 | 7.0 | 6.3 | 5.7 | 5.1 | 4.6 | 4.2 | 3.9 |
| MEDIUM DUTY TRUCKS (MDV) | 7.8 | 7.9 | 7.6 | 7.2 | 6.8 | 6.4 | 6.1 | 5.7 | 5.3 | 8.3 | 8.3 | 7.9 | 7.5 | 7.1 | 6.7 | 6.3 | 5.9 | 5.5 |
| LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1) | 2.4 | 2.3 | 2.1 | 2.0 | 1.8 | 1.7 | 1.6 | 1.5 | 1.4 | 2.5 | 2.5 | 2.3 | 2.1 | 2.0 | 1.8 | 1.7 | 1.6 | 1.5 |
| LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2) | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 |
| MEDIUM HEAVY DUTY GAS TRUCKS (MHDV) | 0.8 | 0.6 | 0.5 | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| HEAVY HEAVY DUTY GAS TRUCKS (HHDV) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1) | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 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) | 1.5 | 1.5 | 1.3 | 1.0 | 0.9 | 0.7 | 0.7 | 0.6 | 0.4 | 1.5 | 1.5 | 1.3 | 1.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.4 |
| HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV) | 8.5 | 6.8 | 3.8 | 3.2 | 2.9 | 2.3 | 2.1 | 2.0 | 2.0 | 8.6 | 6.8 | 3.8 | 3.2 | 2.9 | 2.3 | 2.1 | 2.1 | 2.0 |
| MOTORCYCLES (MCY) | 3.4 | 3.3 | 3.2 | 3.1 | 3.1 | 3.0 | 3.0 | 2.9 | 2.9 | 3.5 | 3.4 | 3.3 | 3.1 | 3.1 | 3.0 | 3.0 | 2.9 | 2.9 |
| HEAVY DUTY DIESEL URBAN BUSES (UB) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| SCHOOL BUSES (SB) | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER BUSES (OB) | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MOTOR HOMES (MH) | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL ON-ROAD MOTOR VEHICLES** | **54.0** | **50.1** | **43.2** | **38.9** | **35.3** | **31.7** | **29.0** | **26.9** | **25.0** | **55.6** | **51.4** | **44.2** | **39.7** | **36.0** | **32.3** | **29.4** | **27.2** | **25.3** |
| OTHER MOBILE SOURCES | | | | | | | | | | | | | | | | | | |
| AIRCRAFT | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.9 | 3.9 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.9 | 3.9 |
| TRAINS | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 |
| 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 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| RECREATIONAL BOATS | 8.2 | 7.8 | 7.4 | 7.1 | 6.7 | 6.4 | 6.1 | 5.8 | 5.5 | 2.8 | 2.6 | 2.5 | 2.4 | 2.2 | 2.1 | 2.0 | 1.9 | 1.8 |
| OFF-ROAD RECREATIONAL VEHICLES | 2.7 | 2.6 | 2.5 | 2.4 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.3 | 2.2 | 2.2 |
| OFF-ROAD EQUIPMENT | 9.4 | 9.0 | 8.7 | 8.5 | 8.2 | 8.0 | 7.7 | 7.6 | 7.5 | 9.5 | 9.1 | 8.8 | 8.5 | 8.3 | 8.0 | 7.8 | 7.6 | 7.5 |
| FARM EQUIPMENT | 9.3 | 8.8 | 8.4 | 8.0 | 7.6 | 7.2 | 6.8 | 6.5 | 6.2 | 6.5 | 6.1 | 5.8 | 5.5 | 5.2 | 4.9 | 4.6 | 4.4 | 4.2 |
| FUEL STORAGE AND HANDLING | 1.8 | 1.7 | 1.7 | 1.6 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.7 | 1.6 | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.2 |
| *** TOTAL OTHER MOBILE SOURCES** | **35.3** | **33.8** | **32.5** | **31.3** | **30.2** | **29.1** | **28.1** | **28.1** | **27.3** | **26.8** | **25.7** | **24.7** | **23.9** | **23.1** | **22.4** | **21.7** | **22.0** | **21.4** |
| **** TOTAL MOBILE SOURCES** | **89.4** | **83.8** | **75.6** | **70.2** | **65.5** | **60.9** | **57.2** | **55.0** | **52.3** | **82.4** | **77.0** | **69.0** | **63.7** | **59.1** | **54.7** | **51.1** | **49.2** | **46.7** |

| VOC | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| | | | | | | | | | | | | | | | | | | |
| GRAND TOTAL FOR SAN JOAQUIN VALLEY | 340.7 | 335.4 | 329.2 | 325.8 | 323.4 | 320.6 | 319.8 | 320.3 | 320.0 | 337.5 | 332.9 | 326.7 | 323.6 | 321.3 | 318.6 | 318.0 | 318.6 | 318.5 |

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## Table B-5 Ammonia

| SUMMARY CATEGORY NAME | AMMONIA ANNUAL AVERAGE tons/day | | | | | | | | | AMMONIA WINTER AVERAGE tons/day | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| **STATIONARY SOURCES** | | | | | | | | | | | | | | | | | | |
| FUEL COMBUSTION | | | | | | | | | | | | | | | | | | |
| ELECTRIC UTILITIES | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.7 | 1.7 | 1.6 | 1.6 | 1.7 | 1.6 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| COGENERATION | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM REFINING (COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MANUFACTURING AND INDUSTRIAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FOOD AND AGRICULTURAL PROCESSING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SERVICE AND COMMERCIAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER (FUEL COMBUSTION) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL FUEL COMBUSTION** | **2.1** | **2.2** | **2.1** | **2.0** | **2.1** | **2.1** | **2.1** | **2.2** | **2.1** | **2.1** | **2.2** | **2.0** | **2.0** | **2.0** | **2.1** | **2.1** | **2.1** | **2.1** |
| WASTE DISPOSAL | | | | | | | | | | | | | | | | | | |
| SEWAGE TREATMENT | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| LANDFILLS | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 |
| INCINERATORS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SOIL REMEDIATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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) | 8.5 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.7 | 9.9 | 10.1 | 8.5 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.9 | 10.1 |
| *** TOTAL WASTE DISPOSAL** | **9.8** | **10.0** | **10.1** | **10.3** | **10.6** | **10.8** | **11.1** | **11.4** | **11.6** | **9.8** | **9.9** | **10.1** | **10.3** | **10.6** | **10.8** | **11.1** | **11.3** | **11.6** |
| 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 | 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 | 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 | 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 | 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 | 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 | 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** | **0.1** | **0.1** | **0.1** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.1** | **0.1** | **0.1** |
| PETROLEUM PRODUCTION AND MARKETING | | | | | | | | | | | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM REFINING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PETROLEUM MARKETING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| AMMONIA | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL PETROLEUM PRODUCTION AND MARKETING** | **0.1** | **0.1** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.1** | **0.1** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| INDUSTRIAL PROCESSES | | | | | | | | | | | | | | | | | | |
| CHEMICAL | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 |
| FOOD AND AGRICULTURE | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MINERAL PROCESSES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| METAL PROCESSES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GLASS AND RELATED PRODUCTS | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| ELECTRONICS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL INDUSTRIAL PROCESSES** | **1.5** | **1.5** | **1.6** | **1.6** | **1.6** | **1.6** | **1.7** | **1.7** | **1.7** | **1.5** | **1.5** | **1.6** | **1.6** | **1.6** | **1.6** | **1.7** | **1.7** | **1.7** |
| **** TOTAL STATIONARY SOURCES** | **13.6** | **13.8** | **13.9** | **14.1** | **14.4** | **14.7** | **15.0** | **15.3** | **15.5** | **13.5** | **13.7** | **13.8** | **14.0** | **14.3** | **14.7** | **15.0** | **15.3** | **15.5** |
| **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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PESTICIDES/FERTILIZERS | 118.2 | 117.6 | 116.9 | 116.3 | 115.7 | 115.0 | 114.4 | 113.8 | 113.1 | 98.4 | 97.9 | 97.3 | 96.8 | 96.2 | 95.6 | 95.1 | 94.5 | 94.0 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL SOLVENT EVAPORATION** | **118.2** | **117.6** | **116.9** | **116.3** | **115.7** | **115.0** | **114.4** | **113.8** | **113.1** | **98.4** | **97.9** | **97.3** | **96.8** | **96.2** | **95.6** | **95.1** | **94.5** | **94.0** |
| MISCELLANEOUS PROCESSES | | | | | | | | | | | | | | | | | | |
| RESIDENTIAL FUEL COMBUSTION | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| FARMING OPERATIONS | 186.4 | 190.2 | 194.1 | 198.0 | 201.9 | 205.8 | 209.7 | 213.6 | 217.5 | 186.3 | 190.1 | 194.0 | 197.9 | 201.8 | 205.7 | 209.6 | 213.5 | 217.4 |
| 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 | 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 | 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 | 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 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MANAGED BURNING AND DISPOSAL | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| COOKING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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) | 6.1 | 6.1 | 6.2 | 6.4 | 6.5 | 6.7 | 6.8 | 6.9 | 7.1 | 6.1 | 6.1 | 6.2 | 6.4 | 6.5 | 6.7 | 6.8 | 6.9 | 7.1 |
| *** TOTAL MISCELLANEOUS PROCESSES** | **193.0** | **197.0** | **201.0** | **205.0** | **209.0** | **213.0** | **217.1** | **221.1** | **225.1** | **193.4** | **197.3** | **201.3** | **205.3** | **209.3** | **213.4** | **217.4** | **221.4** | **225.5** |
| **** TOTAL AREA-WIDE SOURCES** | **311.2** | **314.5** | **317.9** | **321.3** | **324.7** | **328.1** | **331.4** | **334.9** | **338.2** | **291.8** | **295.2** | **298.6** | **302.1** | **305.5** | **309.0** | **312.5** | **316.0** | **319.4** |
| **MOBILE SOURCES** | | | | | | | | | | | | | | | | | | |

| AMMONIA | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUMMARY CATEGORY NAME | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| ON-ROAD MOTOR VEHICLES | | | | | | | | | | | | | | | | | | |
| LIGHT DUTY PASSENGER (LDA) | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 |
| LIGHT DUTY TRUCKS - 1 (LDT1) | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| LIGHT DUTY TRUCKS - 2 (LDT2) | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| MEDIUM DUTY TRUCKS (MDV) | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 |
| LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1) | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY GAS TRUCKS (MHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY HEAVY DUTY GAS TRUCKS (HHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV) | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| MOTORCYCLES (MCY) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY DUTY DIESEL URBAN BUSES (UB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HEAVY DUTY GAS URBAN BUSES (UB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SCHOOL BUSES (SB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OTHER BUSES (OB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MOTOR HOMES (MH) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL ON-ROAD MOTOR VEHICLES** | **4.7** | **4.5** | **4.4** | **4.3** | **4.3** | **4.2** | **4.2** | **4.2** | **4.2** | **4.7** | **4.5** | **4.4** | **4.3** | **4.3** | **4.2** | **4.2** | **4.2** | **4.2** |
| OTHER MOBILE SOURCES | | | | | | | | | | | | | | | | | | |
| AIRCRAFT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TRAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SHIPS AND COMMERCIAL BOATS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RECREATIONAL BOATS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OFF-ROAD RECREATIONAL VEHICLES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OFF-ROAD EQUIPMENT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FARM EQUIPMENT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *** TOTAL OTHER MOBILE SOURCES** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **** TOTAL MOBILE SOURCES** | **4.7** | **4.6** | **4.5** | **4.4** | **4.3** | **4.3** | **4.2** | **4.2** | **4.2** | **4.7** | **4.6** | **4.5** | **4.4** | **4.3** | **4.3** | **4.2** | **4.2** | **4.2** |

| SUMMARY CATEGORY NAME | AMMONIA | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ANNUAL AVERAGE tons/day | | | | | | | | | WINTER AVERAGE tons/day | | | | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| GRAND TOTAL FOR SAN JOAQUIN VALLEY | 329.5 | 332.9 | 336.2 | 339.7 | 343.3 | 347.0 | 350.7 | 354.4 | 358.0 | 310.0 | 313.5 | 316.9 | 320.4 | 324.1 | 327.9 | 331.6 | 335.4 | 339.1 |

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## B.2 EMISSIONS INVENTORY SUMMARY AND METHODOLOGY (PROVIDED BY CALIFORNIA AIR RESOURCES BOARD)

### B.2.1 Introduction

This document describes the emissions inventory included in this *2015 Plan for the 1997 PM2.5 Standard* (*2015 PM2.5 Plan*, or Plan). It also summarizes the revisions and improvements made to the inventory as part of this Plan.

The Air Resources Board (ARB) works with the local air districts to collect information and conduct research to improve emissions inventories. Over the last several years, ARB and the San Joaquin Valley Air Pollution Control District (District) have allocated substantial resources to the improvement of these estimates. The most recent efforts include updates to support the development of the 24-hour PM2.5 SIPs in 2012, and most recently updating of the inventories for areas designated nonattainment for the 0.075 ppm 8-hour ozone standard. The inventory in this Appendix incorporates all of these updates.

ARB and District staff have conducted a thorough review of the inventory to ensure that the emission estimates reflect accurate emission reports for point sources, and that estimates for mobile and area-wide sources are based on the most recent models and methodologies. Staff also reviewed the growth profiles for point and areawide source categories, and updated them as necessary to ensure that the emission projections are based on data that reflect historical trends, current conditions, and recent economic and demographic forecasts.

#### *B.2.1.1 Emissions Inventory Overview*

Emissions inventories are estimates of the amount and type of pollutants emitted into the atmosphere by industrial facilities, mobile sources, and areawide sources such as consumer products and paint. In simple terms, an emissions inventory is a systematic listing of the sources of air pollution along with the amount of pollution emitted from each source or category over a given time period. Emissions inventories are an estimate of the air pollution emissions that are actually released into the environment—they are not measurements of ambient concentrations.

Emissions inventories are fundamental components of an air quality plan, and serve critical functions such as:

1) the primary input to air quality modeling used in attainment demonstrations;
2) the emissions data used for developing control strategies; and
3) a means to track progress in meeting the emission reduction commitments.

The United States Environmental Protection Agency (U.S. EPA) establishes requirements pertaining to emissions information that must be included as part of the SIP submittal package. For the PM2.5 Plan, the regulations require that the emissions inventory contain emissions data for directly emitted PM2.5 and PM2.5 precursors: NOx, VOC, SOx, and ammonia.

The following are examples of pollution sources by key sectors:

- Industrial or stationary point sources—power plants and oil refineries;
- Areawide 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
- Nonanthropogenic (natural) sources—biogenic (or vegetation), geogenic (petroleum seeps), and wildfires.

#### *B.2.1.2 Agency Responsibilities*

ARB and District staff worked jointly to develop a comprehensive emissions inventory for the San Joaquin Valley PM2.5 Nonattainment Area. The District worked closely with operators of major stationary facilities in their jurisdiction to develop the point source emission estimates. ARB staff developed the emission inventory for mobile sources, both on-road and off-road. The District and ARB shared responsibility for developing estimates for the nonpoint (areawide) sources such as paved road dust and agricultural burning. 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 regional transportation agencies to assemble activity information necessary to develop the mobile and area-wide source emission estimates.

#### *B.2.1.3 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 emission levels against which progress in emission reductions will be measured. U.S. EPA regulations establish general guidelines for selecting an inventory base year. Based on those guidelines, ARB and the District selected 2012 as the base year for this Plan.

#### *B.2.1.4 Emission Forecasts*

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

Growth profiles for point and areawide sources are derived from surrogates such as economic activity, fuel usage, population, dwelling-units, etc., that best reflect the expected growth or decline rates for each specific source category. Growth forecasts were obtained primarily from government entities with expertise in developing forecasts for specific sectors, or in some cases, from econometric models. Control profiles, which account for emission reductions resulting from adopted rules and regulations, are derived from data provided by the regulatory agencies responsible for the affected emission categories.

Forecasts for mobile source emissions are generated by models that employ sophisticated 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.2.1.5 Annual and Seasonal Inventories

Annual and seasonal emissions inventories are often referred to as planning inventories. Annual emissions inventories represent the total emissions over an entire year (tons per year), or the daily emissions produced on an average day (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 areawide and mobile sources. Summer inventories include emissions from May through October, and winter inventories encompass November through April. The PM2.5 Plan addresses both the annual and 24-hour standards, and since 24-hour PM2.5 concentrations in the Valley are at their highest during the winter months, the Plan includes annual and winter emission inventories.

#### B.2.1.6 Geographical Scope

Emissions inventories are developed at various levels of geographical resolution encompassing district, air basin, and county. The inventories presented in this Plan include emissions for the seven full counties (Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare) and the portion of Kern County that comprise the San Joaquin Valley Air Basin.

#### B.2.1.7 Quality Assurance and Quality Control

ARB has established a quality assurance and quality control (QA/QC) process involving ARB and air district staff to ensure the integrity and accuracy of the emissions inventories used in the development of air quality plans. QA/QC occurs at the various stages of SIP emission inventory development. Base year emissions are assembled and maintained in the California Emission Inventory Development and Reporting System (CEIDARS). ARB inventory staff works with air districts, who are 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 emission estimates are developed by ARB staff as well as some air districts. The methodologies for estimating these are reviewed by ARB and district staff before their inclusion in the emission inventory. Additionally, CEIDARS is designed with automatic system checks to prevent errors such as double counting of emission sources. The system also makes various reports available to assist staff in their efforts to identify and reconcile anomalous emissions.

Future year emissions are estimated using the California Emission Projection Analysis Model (CEPAM). Growth and control factors are reviewed for each category and year along with the resulting emission 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-road and off-road emission models.

## B.2.2 Emissions Inventory Documentation

A summary of the information supporting the Plan emissions inventory is presented below.

### B.2.2.1 Stationary Source Emissions

The emissions inventory reflects actual emissions from stationary sources (industrial point sources) reported to the District by the facility operators for calendar year 2012. The growth surrogates used to forecast the emissions from these categories are presented in Table B-6 below.

**Table B-6 Growth Surrogates for Stationary Sources**

| Source Category | Subcategory | Growth Surrogate |
|---|---|---|
| Electric Utilities | Natural Gas | CEC Natural gas consumption data, 2010 |
| | Other Fuels | Annual Energy Outlook 2011(AEO 2011): Energy consumption forecasts |
| Cogeneration | Natural Gas | CEC Integrated Energy Policy Report (IEPR 2009) |
| | Other Fuels | AEO 2011 |
| Oil and Gas Production (Combustion) | All | Division of Oil, Gas and Geothermal Resources (DOGGR): statewide total oil production (2.2% annual decline) |
| Petroleum Refining | All | No growth – facilities operating at capacity |
| Manufacturing & Industrial | Natural Gas | IEPR 2009 |
| | Other Fuels | AEO 2011 |
| Food & Agricultural Processing | Ag Irrigation Pumps | Farmland acreage |
| | Other | IEPR 2009 & AEO 2011 |
| Service & Commercial | Natural Gas | IEPR 2009 |
| | Other Fuels | AEO 2011 |
| Other (Fuel Combustion) | I.C. Reciprocating Engines | Cal. Department of Finance (DOF) population projections |
| | Other | AEO 2011 |
| Sewage Treatment | All | Regional Economic Models, Inc. (REMI) industry-specific outputs |
| Landfills | Stationary Aggregated (SA) Sources | DOF population projections |
| | Point Sources | REMI industry-specific outputs |
| Incinerators | All | REMI industry-specific outputs |
| Soil Remediation | All | REMI industry-specific outputs |
| Other (Waste Disposal) | SA Sources | DOF Population projections |
| | Point Sources | REMI industry-specific outputs |
| Laundering | SA Sources | DOF Population projections |
| | Point Sources | REMI industry-specific outputs |
| Degreasing | Cold Cleaning, Petroleum Naphtha | No growth post 2008 due to sharp decline in petroleum naphta use |
| | Other | REMI industry-specific outputs |

| Source Category | Subcategory | Growth Surrogate |
|---|---|---|
| Coatings & Related Process Solvents | All | REMI industry-specific outputs |
| Printing | All | REMI industry-specific outputs |
| Adhesives & Sealants | All | REMI industry-specific outputs |
| Other (Cleaning & Surface Coatings) | All | REMI industry-specific outputs |
| Oil & Gas Production | All | DOGGR statewide total oil production (2.2% annual decline) |
| Petroleum Marketing | Gasoline Dispensing Facilities | Gasoline consumption projections (EMFAC2011) |
| | Natural Gas Transmission Losses | DOGGR and CEC natural gas consumption |
| | Point Sources | REMI industry-specific outputs |
| Other (Petroleum Production & Marketing) | All | REMI industry-specific outputs |
| Chemical | All | REMI chemical manufacturing output |
| Food & Agriculture | All | REMI food manufacturing output |
| Mineral Processes | Cement Concrete Manufacturing & Fabrication | REMI cement and concrete products manufacturing output |
| | Cement (Portland & Others) Manufacturing | AEO 2011 |
| | Other | REMI non-metallic mineral product manufacturing output |
| Metal Processes | All | REMI industry-specific outputs |
| Wood & Paper | All | REMI wood product and paper manufacturing output |
| Glass & Related Products | Flat Glass | Construction equipment curve, capped at pre-recession levels |
| | Container Glass | No growth |
| Other (Industrial Processes) | All | REMI manufacturing Output |

### B.2.2.2 Areawide Source Emissions

Areawide sources include categories associated with human activity where emissions take place over a wide geographic area. Consumer products and unpaved road dust are examples. Areawide sources also include smaller point sources or facilities, such as gasoline dispensing facilities and residential water heaters that are not inventoried individually, but are estimated as a group and reported as a single source category. The methodologies used to develop these estimates are described below.

*Architectural Coatings*

The architectural coatings category reflects emission estimates based on the comprehensive survey for the 2004 calendar year. The emission estimates include benefits of the 2003 and 2007 ARB Suggested Control Measures. These emissions are grown based on the growth in housing units. Additional information about ARB's

architectural coatings program is available at:
http://www.arb.ca.gov/coatings/arch/arch.htm

*Asphalt Paving/Roofing*

Asphalt paving and asphalt roofing emissions were estimated using methodologies developed by the District. VOC emissions are estimated based on tons of paving applied in 2008 or the amount of asphalt used for roofing in 2007, and a default emission factor for each type of asphalt operation. The growth profile for asphalt paving is based on construction employment from the REMI forecasting model. No growth is assumed for asphalt roofing, as the industry has been moving toward the use of more advanced alternative materials. The inventory reflects the emission reductions from District Rule 4641. The District methodologies are available at:
http://www.valleyair.org/Air_Quality_Plans/EmissionsMethods/MethodForms/Current/AsphaltPaving2008.pdf,
and
http://www.valleyair.org/Air_Quality_Plans/EmissionsMethods/MethodForms/Current/AsphaltRoofing2007.pdf

*Agricultural Land Preparation and Harvest Operations*

ARB staff developed methodologies for agricultural land preparation and harvest operations based on 2007 farmland acreage estimates from the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP). The growth profile for these categories is based on a linear regression analysis of the 2000-2009 FMMP data, which results in a slight decline of about 0.3 percent per year. The inventory also reflects the emission reductions from District Rule 4550. Additional information on these methodologies is available at:
http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm

*Commercial Cooking*

The commercial cooking inventory is based on emissions data reported by the District for 2008. The emissions estimates were developed from the number of restaurants, the number and types of cooking equipment, the food type, and emission factors from U.S. EPA's 2002 National Emissions Inventory. The growth profile reflects the latest population projections provided by the California Department of Finance (DOF). The inventory also reflects the emission reductions from District Rule 4692. Additional information on the District's methodology is available at:
http://www.arb.ca.gov/ei/areasrc/districtmeth/sjvalley/CommercialCooking2006.pdf

*Construction and Demolition*

Dust emissions from building and road construction operations are based on methodologies developed by ARB. Both methodologies employ disturbed acreage as the activity data and apply emission factors developed by Midwest Research Institute. The emission estimates were grown to 2012 based on REMI forecasting models for construction activity and employment. Road construction growth also includes estimates of annual road lane-miles constructed, based on forecasts by local metropolitan planning agencies. The inventory reflects the emission reductions from

District Regulation VIII. The methodologies are available at:
http://www.arb.ca.gov/ei/areasrc/arbmiscprocresconstdem.htm

*Consumer Products*

The consumer products category reflects the three most recent surveys conducted by ARB staff for the years 2003, 2006, and 2008. Together these surveys collected updated product information and ingredient information for approximately 350 product categories. Based on the survey data, ARB staff determined the total product sales and total VOC emissions for the various product categories. The growth trend for most consumer product subcategories is based on the latest DOF human population growth projections, except for aerosol coatings. Staff determined that a no-growth profile would be more appropriate for aerosol coatings based on survey data that show relatively flat sales of these products over the last decade. Additional information on ARB's consumer products surveys is available at:
http://www.arb.ca.gov/consprod/survey/survey.htm.

*Fires*

Emissions from structural and automobile fires were estimated using ARB's March 1999 methodology. Structural fire emissions estimates are based on rates of structural and content material loss per fire, average combustible content, and an emission factor per ton of material burned. Automobile fire emissions are based the number of vehicle fires per year and a composite emission factor from US EPA's AP-42 (April 1973). Structural fire emissions were grown based on the growth in occupied households, and automobile fire emissions were grown based on population projections from the California Department of Finance. ARB's methodology is available at:
http://www.arb.ca.gov/ei/areasrc/arbmiscprocfires.htm

*Fugitive Windblown Dust from Open Areas and Non-pasture Agriculture Lands*

Fugitive windblown dust emissions were estimated using ARB's 1997 methodology. The methodology is based on 1993 harvested crop acreage and a wind erosion equation that incorporates climate, soil, and vegetative cover attributes. Emissions were grown based on a growth profile derived from a linear regression of the FMMP farmland acreage estimates from 2000 to 2009. The inventory reflects the emission reductions from District Regulation VIII. ARB's methodology is available at:
http://www.arb.ca.gov/ei/areasrc/arbmiscprocfugwbdst.htm

*Livestock Husbandry*

The dairy, feedlot, and range cattle emission estimates reflect livestock population data from the U.S. Department of Agriculture's (USDA) 2012 Census of Agriculture, and emission factors for dairy support cattle provided by District staff. The emission estimates for other livestock categories are based on the USDA 2007 Census of Agriculture. Dairy emissions assume a 2.9 percent annual growth based on the historical trend. Other livestock categories reflect a no-growth assumption based on an earlier analysis that found no significant growth. The emissions reflect updated District control profiles to account for control requirements, including VOC controls from District

Rule 4570. Additional information on ARB's methodology is available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm

*Managed Burning & Disposal*

The managed burning and disposal category is based on emissions data reported by District staff for 2012. Emissions are calculated using crop specific emission factors and fuel loadings. The agricultural burning emissions were grown based on linear regression analyses of the 2000-2009 farmland acreage. Staff used a no-growth assumption for forest management emissions based on analyses of District reported data that don't show a discernible trend. No-growth was also used for weed abatement, as the emission levels for this category have been fairly stable since 2005. ARB's methodology for managed burning is available at: http://www.arb.ca.gov/ei/see/see.htm.

*Paved Road Dust*

The paved road dust emission estimates are based on an ARB methodology consistent with the current U.S. EPA AP-42 method (January 2011) for quantifying dust emissions. Revisions include California-specific reductions in silt loading values, updated vehicle miles traveled (VMT) data from EMFAC2011 for the year 2008, updated VMT distribution (travel fractions) for each road category for the year 2008, and incorporation of precipitation correction factors. Emissions were grown using VMT projections from EMFAC2011. The inventory also reflects the emission reductions from District Rules 803 and 805. Additional information on this methodology is available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocpaverddst.htm

*Pesticides*

The Department of Pesticide Regulation (DPR) develops month-specific emission estimates for agricultural and structural pesticides. Each calendar year, DPR updates the inventory based on the Pesticides Use Report, which provides updated information from 1990 to the most current data year available. The inventory includes estimates through the 2012 calendar year. Emission forecasts for years 2013 and beyond are based on the average of the most recent five years.

*Residential Wood Combustion*

The residential wood combustion methodology uses fuel consumption data from various surveys, including newer sales data for manufactured logs, and emission factors from U.S. EPA's National Emission Inventory. The fireplace wood consumption rate for 2008 and previous years is based on a 1997 firewood usage survey sponsored by the District. To reflect the episodic wood burning curtailment requirements in District Rule 4901 that became fully effective in 2009, the fireplace wood consumption rate for 2009 and subsequent years is based on the values suggested in a report by U.S. EPA staff and others entitled "A Recommended Procedure for Compiling Emission Inventory National, Regional and County Level Activity Data for the Residential Wood Combustion Source Category." Staff assumed no growth for this category because of limits in new construction and the stringency of the District's rule. Additional information on this methodology is available at:
http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfuelcom.htm

*Residential Natural Gas Combustion*

The inventory for residential natural gas combustion emissions is based on 2006 data provided by the District. Emissions are estimated based on the percentages of total natural gas consumed by various residential uses (space heating, water heating, cooking, other) obtained from the California Energy Commission (CEC), and U.S. EPA AP-42 emission factors. Emissions were grown from 2006 using CEC projections of natural gas consumption. The water heating inventory reflects the emission reductions from District Rule 4902. The District's methodology is available at: http://www.valleyair.org/Air_Quality_Plans/EmissionsMethods/MethodForms/Current/ResidentialNG2006.pdf

*Unpaved Road Dust – Farm Roads*

The methodology for unpaved farm road rust is based on 2005 harvested acreage data from National Agriculture Statistics Service (NASS), crop specific VMT factors, and an emission factor of 2.00 lbs PM10/VMT based on California test data. An updated particle-size profile (ARB PM profile #470) was used, which reduces the PM2.5 fraction by about 50 percent. Growth for this category is based on linear regression analyses of the 2000-2009 farmland acreage. In addition, the inventory reflects the emission reductions from District Rule 806. Additional information on this methodology is available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocunpaverddst.htm

*Unpaved Road Dust – Nonfarm Roads*

The unpaved nonfarm roads methodology reflects the same emission factor (2.00 lbs PM10/VMT) and revised particle size fraction (ARB PM profile #470) described above for farm roads, updated unpaved road mileage, data and the addition of a rainfall adjustment factor. Staff assumed no growth for this category based on the assumption that existing unpaved roads tend to get paved as vehicle traffic on them increases, which counteracts any additional emissions from new unpaved roads. The inventory reflects the emission reductions from District Rule 805. Additional information on this methodology is available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocunpaverddst.htm

*Ammonia Emissions from Publicly Owned Treatment Works (POTWs), Landfills, Composting, Fertilizer Application, Domestic Activity, and Native Soils*

ARB staff updated the ammonia emissions inventory methodology for publicly owned treatment works, landfills, composting, fertilizer application, domestic activity, and native soils based on activity data for the 2008 calendar year. Emissions for POTWs, landfills, composting, and domestic activity were grown by human population. The growth profile for fertilizer application is based on a linear regression analysis of the 2000-2009 FMMP data. The inventory assumes no growth for native soils.

Table B-7 below presents a summary of the growth surrogates used to grow the areawide source categories.

**Table B-7 Growth Surrogates for Areawide Sources**

| Source Category | Subcategory | Growth Surrogate |
|---|---|---|
| Consumer Products | Consumer Products | Population projections |
| | Aerosol Coatings | No growth |
| Architectural Coatings & Thinners | All | Household projections |
| Pesticides & Fertilizers | Agricultural Pesticides | Farmland acreage |
| | Structural Pesticides | Housing expenditures |
| Asphalt Paving & Roofing | Asphalt Paving | Construction employment |
| | Asphalt Roofing | No growth |
| Residential Fuel Combustion | Wood Stoves & Fireplaces | No growth |
| | Others | Natural gas consumption |
| Farming Operations | Tilling or Harvest Dust | Farmland acreage |
| | Dairy Livestock | 2.9% annual growth rate |
| | Other Livestock | No growth |
| Construction & Demolition | Building Construction Dust | Construction employment and output |
| | Road Construction Dust | TPA Road construction data |
| Paved Road Dust | All | Vehicle miles traveled (VMT) |
| Unpaved Road Dust | U.S. Forest & Park Roads | No growth |
| | Farm Roads | Farmland acreage |
| | City & County Roads | No growth |
| Fugitive Windblown Dust | Dust from Agricultural or Pasture Lands | Farmland acreage |
| | Dust from Unpaved Roads | No growth |
| Fires | Structural Fires | Household projections |
| | Automobile Fires | Population projections |
| Managed Burning & Disposal | Ag Burning - Prunings or Field Crops | Farm land acreage |
| | Forest Management | No Growth |
| | Weed Abatement | No Growth |
| Cooking | All | Population projections |

#### *B.2.2.3 Control Profiles*

The emissions inventory reflects emission reductions from point and areawide sources subject to District rules. The local rules reflected in the inventory are listed below.

**Table B-8 District Rules Included in the SIP inventory**

| Rule No. | Rule Title | Source Categories Impacted |
|---|---|---|
| 4103 | Open Burning | Agricultural burning |
| 4204 | Cotton Gins | Agricultural crop processing losses - Cotton ginning facilities |
| 4305 | Boilers, Process Heaters, and Steam Generators | Fuel combustion - Boilers, Process Heaters, and Steam Generators |
| 4306 | Boilers, Process Heaters, and Steam | Fuel combustion - Boilers, Process |

| Rule No. | Rule Title | Source Categories Impacted |
|---|---|---|
| | Generators | Heaters, and Steam Generators |
| 4307 | Boilers, Process Heaters, and Steam Generators | Fuel combustion - Boilers, Process Heaters, and Steam Generators |
| 4308 | Boilers, Process Heaters, and Steam Generators | Fuel combustion - Boilers, Process Heaters, and Steam Generators |
| 4309 | Dryers, Dehydrators, and Ovens | Laundering; manufacturing & industrial; service & commercial |
| 4320 | Boilers, Process Heaters, and Steam Generators - Advanced Options for Emission Reduction | Fuel combustion - Boilers, Process Heaters, and Steam Generators |
| 4352 | Solid Fuel Fired Boilers, Steam Generators and Process Heaters | Fuel combustion - Boilers, Process Heaters, and Steam Generators |
| 4354 | Glass Melting Furnaces | Glass and related processes |
| 4401 | Steam-Enhanced Crude Oil Production Well Vents | Oil and gas production |
| 4402 | Crude Oil Production Sumps | Oil and gas production |
| 4404 | Heavy Oil Test Station - Kern County | Oil and gas production |
| 4408 | Glycol Dehydration Systems | Oil and gas production |
| 4409 | Components at Gas/Oil Production Facilities | Oil and gas production |
| 4453 | Refinery Vacuum Producing Devices or Systems | Petroleum refining |
| 4455 | Components at Refineries & Chemical Plants | Petroleum refining |
| 4550 | Conservation Management Practices | Agricultural operations, dust, and managed burning |
| 4565 | Biosolids, Animal Manure, and Poultry Litter Operations | Composting operations |
| 4566 | Organic Material Composting Operations | Composting operations |
| 4570 | Confined Animal Facilities | Livestock operations |
| 4601 | Architectural Coatings | Architectural coatings |
| 4602 | Motor Vehicle and Mobile Equipment Coating Operations | Coating and related processes |
| 4603 | Surface Coating of Metal Parts and Products | Coating and related processes |
| 4604 | Can and Coil Coating Operations | Coating and related processes |
| 4605 | Aerospace Assembly and Component Coating Operations | Coating and related processes |
| 4606 | Wood Coating Operations | Coating and related processes |
| 4607 | Graphic Arts | Coating and related processes; printing |
| 4610 | Glass Coating Operations | Coating and related processes |
| 4612 | Automotive Coatings | Coating and related processes |
| 4621 | Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants | Petroleum marketing |
| 4622 | Gas Transfer into Vehicle Storage Tanks | Petroleum marketing |
| 4623 | Storage of Organic Liquids | Oil and gas production; petroleum refining; petroleum marketing |

| Rule No. | Rule Title | Source Categories Impacted |
|---|---|---|
| 4624 | Organic Liquid Loading | Petroleum marketing |
| 4625 | Wastewater Separators | Petroleum refining - Wastewater treatment |
| 4641 | Cutback, Slow Cure, and Emulsified Asphalt Paving and Maintenance Operations | Asphalt paving & roofing |
| 4642 | Solid Waste Disposal Sites | Landfills; waste disposal |
| 4651 | Volatile Organic Compound Emissions from Decontaminated Soil | Waste disposal - Soil remediation |
| 4653 | Adhesives and Sealants | Adhesives & sealants |
| 4661 | Organic Solvents | Coatings and related process solvents; cleaning and surface coatings |
| 4662 | Organic Solvent Degreasing Operations | Degreasing; thinning and cleanup solvent uses |
| 4663 | Organic Solvent Cleaning, Storage and Disposal | Degreasing; thinning and cleanup solvent uses; cleaning & surface coating |
| 4672 | Petroleum Solvent Dry Cleaners | Laundering |
| 4681 | Rubber Tire Manufacturing | Chemical - Rubber and rubber products manufacturing |
| 4682 | Polystyrene | Chemical - Plastic and plastic products manufacturing |
| 4684 | Polyester Resin Operations | Chemical - Plastic and plastic products manufacturing |
| 4691 | Vegetable Oil Processing Operations | Food and agriculture |
| 4692 | Commercial Charbroiling | Cooking |
| 4693 | Bakery Ovens | Food and agriculture |
| 4701 | Internal Combustion Engines (Phase 1) | Fuel combustion |
| 4702 | Internal Combustion Engines (Phase 2) | Fuel combustion |
| 4703 | Stationary Gas Turbines | Fuel combustion |
| 4901 | Wood Burning Fireplaces and Wood Burning Heaters | Residential wood combustion |
| 4902 | Residual Water Heaters | Residential fuel combustion - Water heating |
| REG VIII | Regulation VIII -- PM Control for Fugitive Dust | Construction and demolition; paved and unpaved road dust; fugitive windblown dust; mineral processes |

### *B.2.2.4 Mobile Sources*

ARB uses the EMFAC model to assess emissions from on-road vehicles. Off-road mobile source emissions are estimated using a new modular approach for different source categories. On-road and off-road models account for the effects of various adopted regulations, technology types, and seasonal conditions on emissions.

### *B.2.2.5 On-Road Mobile Sources*

Emissions from on-road mobile sources, which include passenger vehicles, buses, and trucks, were estimated using ARB's EMFAC2014 model. The on-road emissions were calculated by applying EMFAC2014 emission factors to the transportation activity data provided by the local Valley transportation agencies from their 2014 adopted Regional Transportation Plan.

EMFAC2014 includes data on California's car and truck fleets and travel activity. Light-duty motor vehicle fleet age, vehicle type, and vehicle population were updated based on 2012 California Department of Motor Vehicles data. The model also reflects the emissions benefits of ARB's recent rulemakings such as the Pavley Standards and Advanced Clean Cars Program, and includes the emissions benefits of ARB's Truck and Bus Rule and previously adopted rules for other on-road diesel fleets.

EMFAC2014 utilizes a socio-econometric regression modeling approach to forecast new vehicle sales and to estimate future fleet mix. Light-duty passenger vehicle population includes 2012 Department of Motor Vehicles (DMV) registration data along with updates to mileage accrual using Smog Check data. Updates to heavy-duty trucks include model year specific emission factors based on new test data, and population estimates using DMV data for in-state trucks and International Registration Plan (IRP) data for out-of-state trucks.

Additional information and documentation on the EMFAC2014 model is available at: http://www.arb.ca.gov/msei/categories.htm#emfac2014

### *B.2.2.6 Off-Road Mobile Sources*

Emissions from off-road sources were estimated using either a newer suite of category-specific models or, where a new model was not available, the OFFROAD2007 model. Many of the newer models were developed to support recent regulations, including in-use off-road equipment, ocean-going vessels and others. The sections below summarize the updates made to specific off-road categories.

*Oil and Gas Wells: Workover Rigs, Drill Rigs and Support Equipment Allocation*

The allocation of drill and work-over rigs and support equipment (such as pumps) for oil and gas wells was updated within the SJV Air Basin to reflect the physical location of wells instead of the registration location. This allocation was done at the county level, where the number of wells within a county in the SJV Air Basin was used to determine that county's share of emissions from specified equipment. The physical location and count of wells was updated using Division of Oil, Gas and Geothermal Resources (DOGGR) Well Finder data, from September, 2013, supplied to ARB by the District. (DOGGR data are available at: http://www.conservation.ca.gov/dog/Pages/Wellfinder.aspx)

*Ocean-Going Vessels (OGV)*

Staff updated the OGV activity growth rates and NOx emission calculations in September 2013. These updates reflect more recently available long-term economic forecasts and historical data from 2006 to 2012. ARB staff updated the long-term growth factors for container ships, auto ships, tankers, and cruise ships. Additional

information is available at:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Cargo Handling Equipment*

The emissions inventory for the Cargo Handling Equipment category has been updated to reflect new information on equipment population, activity, recessionary impacts on growth, and engine load. The new information includes regulatory reporting data which provide an accounting of all the cargo handling equipment in the State including their model year, horsepower and activity. Additional information is available at:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Pleasure Craft and Recreational Vehicles*

A new model was developed in 2011 to estimate emissions from pleasure craft and recreational vehicles. In both cases, population, activity, and emission factors were re-assessed using new surveys, registration information, and emissions testing. Additional information is available at:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*In-Use Off-Road Equipment*

ARB developed this model in 2010 to support the analysis for amendments to the In-Use Off-Road Diesel Fueled Fleets Regulation. Staff updated the underlying activity forecast to reflect more recent economic forecast data, which suggests a slower rate of recovery through 2024 than previously anticipated. Additional information is available at: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Locomotives*

In 2014, ARB developed a revised inventory for line-haul locomotive activity in California. The new model is based primarily on activity data reported to ARB by the major rail lines for calendar year 2011. To estimate emissions, ARB used duty cycle, fuel consumption and activity data reported by the rail lines. Activity is forecasted for individual train types and is consistent with ARB's ocean-going vessel and truck growth rates. Fuel efficiency improvements are projected to follow Federal Railroad Association projections and turnover assumptions are consistent with U.S. EPA projections. Additional information is available at:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Transport Refrigeration Units (TRU)*

This model reflects updates to activity, population, growth and turn-over data, and emission factors developed to support the 2011 amendments to the Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units. Additional information is available at:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Fuel Storage and Handling*

Emissions for fuel storage and handling were estimated using the OFFROAD2007 model. Additional information is available at: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

*Diesel Agricultural Equipment*

The inventory for agricultural diesel equipment (such as tractors, harvesters, combines, sprayers and others) was revised based on a 2008 survey of thousands of farmers, custom operators, and first processors. The survey data, along with information from the 2007 USDA Farm Census, was used to revise almost every aspect of the agricultural inventory, including population, activity, age distribution, fuel use, and allocation. This updated inventory replaces general information on farm equipment in the United States with one specific to California farms and practices. The updated inventory was compared against other available data sources such as Board of Equalization fuel reports, USDA tractor populations and age, and Eastern Research Group tractor ages and activity, to ensure the results were reasonable and compared well against outside data sources. Agricultural growth rates through 2050 were developed through a contract with URS Corp and UC Davis, in cooperation with the SJV agricultural community. Additional information is available at: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

### *B.2.2.7 Mobile Source Forecasting*

The table below summarizes the data and methods used to forecast future-year mobile source emissions by broad source category groupings.

**Table B-9 Growth Surrogates for Mobile Sources**

| Category | Growth Methodology |
|---|---|
| **On-Road Sources** | |
| All | Match Total VMT projections provided by Municipal Planning Organizations |
| **Off-Road Gasoline Fueled Equipment** | |
| Lawn & Garden | Household growth projection |
| Off-Road Equipment | Employment growth projection |
| Recreational Boats | Housing starts (short-term) and human population growth (long-term) |
| Recreational Vehicles | Housing starts (short-term) and human population growth (long-term) |
| **Off-Road Diesel-Fueled Equipment** | |
| Commercial Harbor Craft | Growth rates provided by District, except for tugs and fishing vessels. Fishing fleet growth rates were adjusted to reflect a decline in fish landings. Assumed no growth for tugboats. |
| Construction and Mining | California construction employment data from U.S. Bureau of Labor Statistics |
| Farm Equipment | 2011 study of forecasted growth by URS Corp, with SJV |

| Category | Growth Methodology |
|---|---|
| | Advisory Committee funding. |
| Industrial Equipment | California construction employment data from Bureau of Labor Statistics |
| Oil Drilling | California oil and gas extraction gross domestic product from the U.S. Bureau of Economic analysis, oil company diesel fuel use published by the U.S. Energy Information Administration, California rotary rig counts from Baker Hughes, and California oil and gas extraction employment from the U.S. Bureau of Labor Statistics |
| Ocean-Going Vessels | Projected commodity tonnage in the Freight Analysis Framework (FAF) Model developed by the Federal Highway Administration |
| Trains (line haul) | International/premium train growth tied to OGV forecast; Domestic train growth tied truck growth |
| Transport Refrigeration Units | Projection of historical Truck/Trailer TRU sales from ACT Research, adjusted for recession. |

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# Appendix C

BACM and MSM for Stationary and Area Sources

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix C: BACM and MSM for Stationary and Area Sources

## C.i Introduction

The San Joaquin Valley (Valley) faces significant challenges in meeting 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 wood burning, glass manufacturing, and agricultural burning, have set benchmarks for California and the nation.

Multiple regulatory control measures have been adopted under the District's air quality attainment plans that reduce particulate matter (PM) that is 2.5 microns or less in diameter (PM2.5), including but not limited to commitments made in the *2007 Ozone Plan, 2008 PM2.5 Plan, 2012 PM2.5 Plan,* and *2013 Plan for the Revoked 1-Hour Ozone Standard.* All of these commitments serve as control measures that will reduce emissions under the *2015 Plan for the 1997 PM2.5 Standard (2015 PM2.5 Plan)*. Under the U.S. Environmental Protection Agency (EPA) policy, there is a preference for reliance on control measures that have already been adopted. The *2015 PM2.5 Plan* 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.

Table C-1 below identifies the control measures that the District has already adopted and that are contributing to attainment of the 1997 PM2.5 standard. These adopted District rules are achieving new emissions reductions after 2012, the base year for this plan. Even pre-2012 emissions reductions are contributing, and will continue to contribute, to the Valley's progress toward clean air.

**Table C-1 District Regulations Contributing to Attainment of PM2.5 NAAQS**

| Rule # | Adopted District Rule | Last Adoption/ Amendment Date |
|---|---|---|
| **4307** | Boilers, Steam Generators, and Process Heaters—2.0 MMBtu/hr to 5.0 MMBtu/hr | 5/19/11 |
| **4308** | Boilers, Steam Generators, and Process Heaters—0.075 MMBtu/hr to less than 2.0 MMBtu/hr | 11/14/13 |
| **4311** | Flares | 6/18/09 |
| **4320** | Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr | 10/16/08 |
| **4354** | Glass Melting Furnaces | 5/19/11 |
| **4702** | Internal Combustion Engines | 8/18/11 |
| **4703** | Stationary Gas Turbines | 9/20/07 |
| **4901** | Wood Burning Fireplaces and Wood Burning Heaters | 9/18/14 |
| **4902** | Residential Water Heaters | 3/19/09 |
| **4905** | Natural Gas-Fired, Fan-Type Central Furnaces | 1/22/15 |
| **9310** | School Bus Fleets | 9/21/06 |
| **9410** | Employer-based Trip Reduction | 12/17/09 |

One of the requirements for a Serious nonattainment area plan under Subpart 4 is to demonstrate that the plan includes the best available control measures (BACM) that can be feasibly and cost effectively implemented. EPA defines BACM as being more stringent than reasonably available control measures (RACM), but less stringent than the lowest achievable emission rate (LAER), which does not take into consideration the cost effectiveness of implementing a particular control measure.[1]

As a Serious nonattainment area, the Valley would have until December 31, 2015 to attain the 1997 PM2.5 standard. As demonstrated in Chapter 2 and Appendix A, the Valley will not attain the 1997 PM2.5 standard by the attainment date and is therefore requesting an extension of the attainment date. Under Subpart 4, EPA may grant one extension of the attainment date of up to five years for a Serious nonattainment area provided the attainment plan for that area satisfies several federal requirements, including the most stringent measures (MSM) that are included in the implementation plan of any State or are achieved in practice in any State, and can feasibly be implemented in the area. EPA defines MSM as the, "maximum degree of emission reduction that has been required or achieved from a source or source category in other SIPs or in practice in other states and can be feasibly implemented in the area."[2] This appendix demonstrates that the control measures in this *2015 PM2.5 Plan* satisfy both BACM and MSM requirements.

The analysis in 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 capture relevant background information, examine potential emission reduction opportunities for technological and economic feasibility, and make recommendations for appropriate District actions moving forward. This appendix reflects the comprehensive evaluation performed by the District to examine the Valley's various emissions sources and identify any potential BACM or MSM for inclusion in this plan.

## C.ii BACM/MSM Evaluation Process

As discussed in detail in Chapter 5, the District must demonstrate that its rules meet both BACM and MSM requirements.

The Maricopa County PM10 nonattainment area is the only other area in the nation that has conducted a BACM and MSM analysis. Within the technical support document (TSD) for the Maricopa County Serious Area Nonattainment Plan,[3] EPA defined the process for determining BACM and MSM. EPA noted that MSM follows the same process for determining BACM, but with one additional step to compare the potential MSM against the measures already adopted in the area to determine if the existing

[1] EPA. 1994 Addendum to the General Preamble, p. 10.
[2] EPA. Technical Support Document for Maricopa County PM10 Nonattainment Area. 2001, p. 237.
[3] EPA. Technical Support Document (Notice of Proposed Rulemaking on the Serious Area PM-10 State Implementation Plan for the Maricopa County PM-10 Nonattainment Area Provisions for Attaining the 24-Hour Standard and Contingency Measures). (2001, September 14).

measures are most stringent. Because this is the only EPA guidance available for a Serious Nonattainment area under Subpart 4 (to evaluate BACM and MSM) at the time of the development of this *2015 PM2.5 Plan,* the District will follow this process as summarized below:

1. Develop a detailed emissions inventory of PM2.5 sources and source categories (Appendix B).

2. Model to evaluate the impact of various source categories on PM2.5 concentrations over the NAAQS to determine which sources are significant and which sources are de minimis (less than significant) for the purposes of adopting BACM and MSM[4] (Chapter 5).
    a. ARB relative response factor (RRF) results demonstrate that the significance levels for PM2.5, oxides of nitrogen (NOx), and oxides of sulfur (SOx) are as follows (*see Chapter 5 for the full calculations*):
        i. PM2.5: 1.4 tons per day (tpd) for combustion, 4.0 tpd for dust
        ii. NOx: 13.1 tpd
        iii. SOx: 1.0 tpd
    b. To determine if a particular source category is significant for the purposes of adopting BACM and MSM, the 2012 baseline emissions inventory for each source category was compared to the significance thresholds above.

3. Identify potential BACM and MSM in other implementation plans or used in practice in other states for each significant source category, and for each measure evaluate the technological and economic feasibility for the area, as necessary (Appendix C).

4. Compare potential BACM/MSM for each significant source category against the control measures, if any, already adopted for that source category (Appendix C).

5. Provide for the adoption of any BACM/MSM that is more stringent than existing similar local measures and provide for implementation as expeditiously as practicable or, in lieu of adoption, provide a reasoned justification for rejecting the potential MSM, i.e., why such measures cannot be feasibly implemented in the area (Appendix C).

Using the BACM/MSM process summarized above, emission control requirements for stationary and area source categories are evaluated to determine if they satisfy both BACM and MSM requirements or if there are any potential technologies or practices

[4] EPA stated in the Maricopa County TSD that more source categories should be subject to the MSM analysis than those subject to a BACM analysis by lowering the threshold for what is considered a de minimis source category. What constitutes a de minimis source category for BACM is dependent upon the specific facts of the nonattainment problem under consideration. EPA states that one means of determining an appropriate de minimis level is to determine if applying MSM to the proposed de minimis source categories would meaningfully expedite attainment. If it did, then the established de minimis level is too high, and if it did not, then the de minimis level is appropriate.

that could further reduce PM2.5 and precursor emissions and prove to be technologically and economically feasible for sources in the Valley.

## C.iii Appendix C Organization and Evaluation

Each control measure evaluation includes a discussion of the rule applicability and rule adoption/amendment history; an overview of the source category and affected sources; an emissions inventory table for the source category; a regulatory evaluation; a technological feasibility and cost effectiveness analysis of any other potential BACM/MSM; and a summary of the evaluation findings. The sections below elaborate in more detail with respect to the information included within each individual rule evaluation.

### *Discussion*

This section provides an overview of rule applicability, identifies what types of emissions the rule controls, provides the rule adoption/amendment history, and discusses additional pertinent details, as necessary. This section is not included for the source categories where there is no current District prohibitory rule.

### *Source Category*

This section discusses what types of units, industries, or operations are included in the respective source category.

### *Emissions Inventory*

Each emissions inventory table lists the annual average and wintertime average (November through April) PM2.5, NOx, and SOx emissions for the respective source category for the years 2012 through 2020. The data provided in this section is a compilation of the data sources identified in the emission inventory appendix. See Appendix B (Emission Inventory) for additional information.

This section also includes a significance discussion, which compares the emissions from the respective source category to the applicable significance/de minimis thresholds developed by ARB, as shown in Chapter 5 of the plan.

### *Regulatory Evaluation*

As part of the regulatory evaluation, District rules and source categories are compared to federal and state air quality regulations and standards, and the regulations and standards in other air districts. The following regulations and guidelines are referenced in the comparisons:

- **Federal Regulations –** Federal regulations include the following regulations and guidance documents:
    - Control Techniques Guidelines (CTG)[5]
    - Alternative Control Techniques (ACT)[6]

[5] EPA. Control Techniques Guidelines. Retrieved from http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html
[6] EPA. Alternative Control Techniques. Retrieved from http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html

- New Source Performance Standards (NSPS)[7]
- National Emission Standards for Hazardous Air Pollutants (NESHAP)[8]
- Maximum Achievable Control Technology (MACT)[9]

- **State Regulations –** Generally, state regulations are specific to mobile sources and consumer products. However, there are some California Health and Safety Code (CH&SC) requirements and ARB Airborne Toxic Control Measures (ATCM)[10] that apply to stationary and area sources. While most of the rules evaluated in this *2015 PM2.5 Plan* do not have a state regulation associated with their source category, any relevant state guidelines are evaluated within this section.

- **Other Air Districts' Rules –** As agreed to by EPA for the *2009 RACT SIP*, the rules were also compared to analogous regulations adopted by California's most progressive air districts. Control strategies and measures in other air districts and agencies include, but are not limited to the following air districts:

  - South Coast Air Quality Management District (SCAQMD)[11]
  - Bay Area Air Quality Management District (BAAQMD)[12]
  - Sacramento Metropolitan Air Quality Management District (SMAQMD)[13]
  - Ventura County Air Pollution Control District (VCAPCD)[14]

All potential BACM/MSM identified through this regulatory evaluation were then thoroughly evaluated using the following key factors, defined by EPA in the Maricopa County TSD, to determine if potential opportunities qualify as BACM/MSM for the Valley:

- **Technological feasibility**[15] – This analysis determines if the new control can be integrated with the existing controls without reducing or delaying the emission reductions from the existing control. If it cannot, then it would not be considered

[7] EPA. 40 CFR 60 – Standards of Performance for New Stationary Sources (NSPS). Retrieved from http://www.tceq.state.tx.us/permitting/air/rules/federal/60/60hmpg.html
[8] EPA. 40 CFR 61 – National Emission Standards for Hazardous Air Pollutants (NESHAPs). Retrieved from http://www.tceq.state.tx.us/permitting/air/rules/federal/61/61hmpg.html
[9] EPA. 40 CFR 63 – Maximum Achievable Control Technology (MACT). Retrieved from http://www.tceq.state.tx.us/permitting/air/rules/federal/63/63hmpg.html
[10] California Air Resources Board (ARB). Airborne Toxic Control Measures (ATCMs). Retrieved from http://www.arb.ca.gov/toxics/atcm/atcm.htm
[11] South Coast Air Quality Management District (SCAQMD). Rules and Regulations. Retrieved from http://www.aqmd.gov/home/regulations/rules/scaqmd-rule-book/table-of-contents
[12] Bay Area Air Quality Management District (BAAQMD). Rules and Regulations. Retrieved from http://www.baaqmd.gov/Divisions/Planning-and-Research/Rules-and-Regulations.aspx
[13] Sacramento Metropolitan Air Quality Management District (SMAQMD). Rules and Regulations. Retrieved from http://www.airquality.org/rules/
[14] Ventura County Air Pollution Control District (VCAPCD). Rules and Regulation. Retrieved from http://www.vcapcd.org/Rulebook/RuleIndex.htm
[15] EPA. (2001, June 22). *Technical Support Document for Maricopa County PM10 Nonattainment Area,* p. 34. Retrieved from http://www.epa.gov/region9/air/phoenixpm/pdf/tsd.pdf.

to be technologically feasible for the area unless the emission benefit of the new measure is substantially greater than the existing measure.

- **Economic feasibility**[16] – If the potential control is determined to be technologically feasible, it is then evaluated for economic feasibility. The District has evaluated the economic feasibility of various control measures by conducting cost effectiveness analyses within this appendix. 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. EPA cautions that the threshold for economic feasibility should be addressed on a case-by-case basis.

### *Additional Emission Reduction Opportunities*

The District reviewed the following areas to identify any additional potential BACM/MSM, exclusive of potential BACM/MSM evaluated in the Regulatory Evaluation section:

- Any emission reduction opportunities identified/considered in previously adopted District plans that were determined to be beyond reasonably available control technology (RACT) at that time.
- New emission reduction opportunities adopted in California SIPs, SIPs in other states, or achieved in practice in other areas.

All potential BACM/MSM identified were then thoroughly evaluated for technological and economic feasibility, as previously defined. The District reviewed staff reports and studies from other air districts, EPA technical guidance documents, and applicable study data from the scientific community to assist in evaluating the technological and economic feasibility of potential BACM/MSM.

### *Evaluation Findings*

This section provides a summary of the District's findings based on the control measure evaluation.

[16] EPA. (2001, June 22). *Technical Support Document for Maricopa County PM10 Nonattainment Area,* p. 34. Retrieved from http://www.epa.gov/region9/air/phoenixpm/pdf/tsd.pdf.

### C.iv Ammonia Regulations

Under Subpart 4 of the federal Clean Air Act (CAA), regions are required to address ammonia as a precursor in BACM/MSM analyses unless EPA determines that ammonia sources do not contribute significantly to PM concentrations. As demonstrated in Appendix A, ammonia emissions controls are not effective in significantly reducing ambient PM2.5 concentrations and do not contribute to the Valley's PM2.5 attainment. As such, the District is not required to evaluate its ammonia regulations as part of the BACM/MSM analysis for this *2015 PM2.5 Plan.*

Nevertheless, the District has implemented the most stringent controls feasible for local sources of ammonia and the Valley's ammonia emissions have been significantly reduced through stringent District regulations which include the following:

- Rule 4570 (Confined Animal Facilities)
- Rule 4566 (Organic Material Composting)
- Rule 4565 (Biosolids, Animal Manure, and Poultry Litter Operations)

Even though the District is not required to evaluate ammonia as part of this plan, Section C.41 (Ammonia Controls) includes a full analysis for the above sources and demonstrates that existing requirements meet or exceed BACM and MSM levels of control. Therefore, even if ammonia was a significant precursor to PM2.5 concentrations in the Valley (which they are not), there are no current opportunities for additional ammonia emission reductions.

## C.1 RULE 4103 OPEN BURNING

### Discussion

The provisions of Rule 4103 apply to open burning 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 Rule 4103 is to permit, regulate, and coordinate the use of open burning while minimizing smoke impacts on the public.

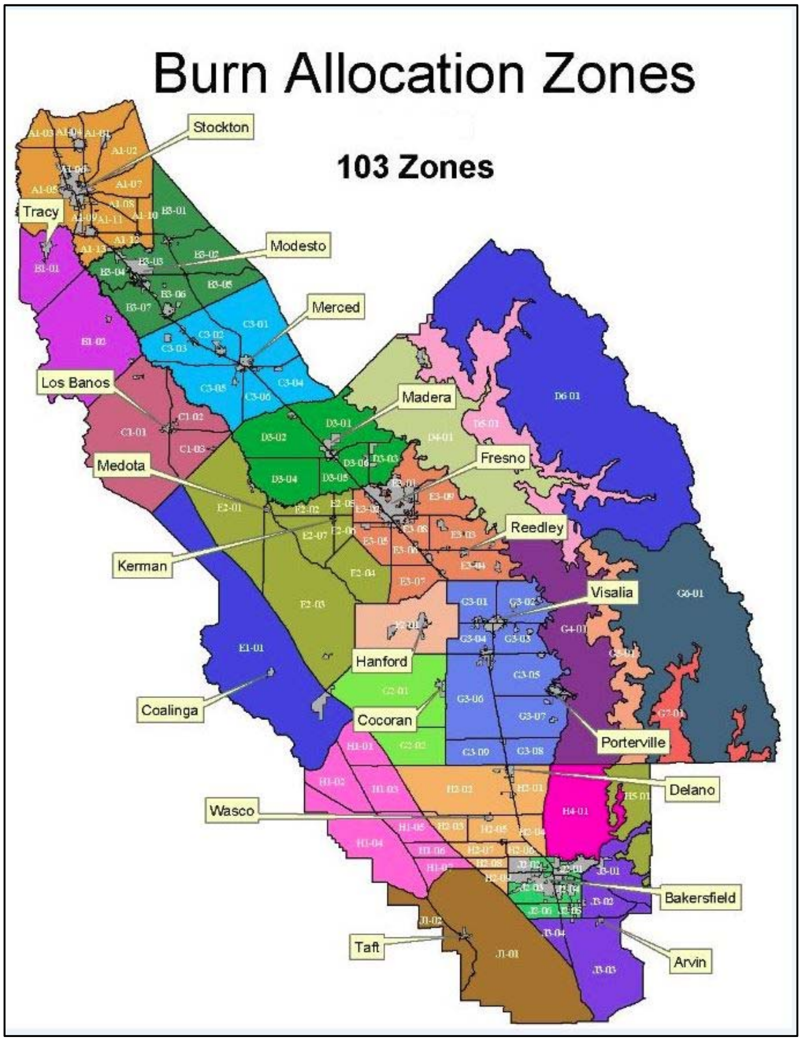
Rule 4103 was originally adopted on June 18, 1992 and it has been amended several times to incorporate state law requirements. In 2003, California Senate Bill (SB) 705 (CH&SC Section (§) 41855.5 and 41855.6) established a schedule for specific types of agricultural material to no longer be openly burned in the field, but provided for a postponement of the phase-out where justified by technical and economic impediments. The air quality impacts from open burning in the Valley are of significant concern for the District and Valley growers; as such, Valley growers have reduced open burning through the use of sustainable agricultural practices. Those practices have contributed to a significant reduction in PM emissions since 1992.

The historical cultural practice for disposing of agricultural materials, such as prunings and orchard removals, is to burn the materials. Burning agricultural materials provided an economically feasible method for the timely disposal of these materials, helped prevent the spread of plant diseases, and controlled weeds and pests. As part of implementing SB 705 and enhancing the effectiveness of the District's burn reduction efforts, 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. Rule 4103 and the District's SMS have reduced the total acreage of agricultural materials burned in the Valley to date by more than 80% since 2002.

**Smoke Management System**

The District uses the SMS to manage the Valley's remaining open burning of agricultural crops and materials. The District's air quality forecasters incorporate projected meteorological information and air quality statistical modeling to determine the amount and location of agricultural burning that can be allowed without resulting in ambient air pollutant concentrations that exceed federal health-based standards. Through the results of this daily analysis, the SMS allows the District to manage 103 burn zones in the Valley through allocating daily burning allowances in each zone based on local meteorology, the air quality conditions, the atmospheric holding capacity, the amount of burning already approved in a given area, and the potential impacts on downwind populations (see Figure C-1). This approach allows the District to better distribute air pollutant emissions from open burning temporally and spatially, providing flexibility of burn days for growers while minimizing the impact on the public.

**Figure C-1 Agricultural Burn Zones Defined in the District SMS**




Properly managed burning allocations under the existing District SMS ensures that air quality and health impacts of open burning of agricultural materials, prescribed burning, and hazard reduction burning are minimized to the fullest extent feasible. Under the SMS, emissions within a zone are limited to levels below the exceedance threshold of any applicable federal ambient air quality standard and burns are not allowed in zones on days when exceedances of the federal standards are projected to occur in that zone. Additionally, zones directly adjacent to an area where open burning is restricted are also allocated zero emissions in an effort to reduce pollutant transport into an area with already elevated pollutant concentrations.

During the wood-burning season from November through February, the District implements even tighter open burning restrictions based on the daily residential wood-burning declarations issued for the Check Before You Burn program. With the recent amendment of Rule 4901, residential wood-burning with unregistered devices is no longer allowed when an area's forecasted PM2.5 concentration is expected to be greater than or equal to 20 μg/m$^3$. This threshold is now lower compared to past years when it was set at 30 μg/m$^3$. To be consistent with the residential wood-burning declaration, an area's burn zones in SMS are allocated zero emissions when residential wood-burning is prohibited in that area. Following similar procedures discussed above, zones directly adjacent to an area where residential wood-burning is restricted are also allocated zero emissions. Under this policy, agricultural burning is placed under tighter control during the winter season and burning is only allowed when air quality is expected to be below 20 μg/m$^3$, when meteorological conditions are projected to be conducive for pollutant dispersion, which is well below the current federal 24-hour average PM2.5 standard of 35 μg/m$^3$.

Under the SMS, individuals who need to burn their agricultural waste first submit their permit request to the District, which includes information regarding the material that needs to be burned and the location of the burn project (see attachment for sample burn permit). If there are positive air quality and atmospheric dispersion conditions, the District allocates a certain amount of emissions to the applicable burn allocation zone. The SMS will then automatically call the specified contact's phone number to notify them that burn allocation is available in their zone for their project. Through the phone system, the individual can then either notify SMS that they will proceed with their burn or hold off until another time.

Through this process, SMS is able to automatically manage and notify a large number of stakeholders in the agricultural community on whether they can proceed with their burn project. If there are more requests for burning than there are emissions allocated in the system for a day, those individuals will be placed on a waiting list and given priority when another burn window opens.

As agricultural burning projects are occurring across the Valley, District air quality enforcement staff inspect the region to observe permitted agricultural burns to ensure their practices conform to District regulations. In addition, on days when agricultural burning is not permitted, enforcement staff inspect the region to ensure that un-permitted agricultural burning is not occurring and to issue notices of violation (NOVs), as needed.

The continued issuance of burn permits for certain crop categories is not expected to cause or substantially contribute to a violation of an applicable federal ambient air quality standard because the District follows its SMS procedures.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 2.27 | 2.27 | 2.26 | 2.26 | 2.25 | 2.25 | 2.24 | 2.24 | 2.23 |
| NOx | 1.61 | 1.60 | 1.60 | 1.59 | 1.59 | 1.59 | 1.58 | 1.58 | 1.57 |
| SOx | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 3.47 | 3.46 | 3.46 | 3.45 | 3.44 | 3.43 | 3.43 | 3.42 | 3.41 |
| NOx | 2.44 | 2.44 | 2.43 | 2.42 | 2.42 | 2.41 | 2.41 | 2.40 | 2.39 |
| SOx | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |

As previously stated, the emissions from this source category continue to decline and contribute 5.2% of average winter NOx and 5.6% of average winter PM2.5 emitted from stationary and area sources in the 2014 emission inventory. District regulatory efforts have fostered significant reductions in emissions from this source category.

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion emissions, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from open burning are lower than the NOx and SOx BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a NOx and SOx control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for Rule 4103.

## How does District Rule 4103 compare to federal and state rules and regulations?

### Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

### State Regulations
The following state regulation applies to sources covered under Rule 4103:

- CH&SC §41850-41866 (Agricultural Burning)

The District has continued to work closely with the stakeholders to identify economically feasible alternatives to open burning of various agricultural materials and to meet its legal obligation under the CH&SC. To fulfill the state law requirements, the District has implemented the requirements for most crop categories identified in CH&SC §41855.5. In addition to those requirements, the state law authorizes the District to postpone the burn prohibition dates for specific types of agricultural material if the District makes three specific determinations and the Air Resources Board (ARB) concurs. The determinations are: (1) there are no economically feasible alternatives to open burning for that type of material; (2) open burning for that type of material will not cause or substantially contribute to a violation of an air quality standard; and (3) there is no long-term federal or state funding commitment for the continued operation of biomass facilities in the Valley or the development of alternatives to burning.

The District amended Rule 4103 in April 2010 to incorporate CH&SC requirements and committed the District to review its determinations for any postponed crops and materials at least once every five years. In 2010, the District also evaluated each crop category identified in CH&SC §41855.5 to determine any technologically and economically feasible alternatives to open burning. After working extensively with stakeholders to understand viable alternatives to open burning and the associated costs, the District provided recommendations for allowing or prohibiting the open burning of agricultural material categories in the District's *2010 Final Staff Report and Recommendations on Agricultural Burning*. ARB concurred with the District's determinations and recommendations; however, ARB made a one-time request that the District re-visit the 2010 findings after two years to determine if additional reductions in open burning were feasible.

The District revisited its 2010 analysis in 2012 and submitted those findings to ARB. The 2012 Report showed that in the two years since the 2010 Report, there had been no significant changes in the economic feasibility of various alternatives to agricultural burning. The amount of agricultural materials accepted at biomass facilities continued to fluctuate based on market conditions and there were no long-term federal or state funding commitments for the operation of biomass facilities or development of alternatives to burning. EPA finalized approval for Rule 4103 on January 4, 2012 and deemed this rule as at least meeting RACT requirements.[17] The District most recently reevaluated the availability of alternatives to open burning in the *2014 Reasonably Available Control Technology Demonstration for the 8-Hour Ozone State Implementation Plan* (*2014 RACT SIP*). The District is committed to review its determinations for any postponed crops and materials by December of 2015.

### *Current Status of Biomass Facilities*

Biomass power plants in the Valley will generally accept agricultural, forestry, construction, and urban residues. The power plants burn the material in combustors to produce steam and the steam is then used to spin turbines to generate electricity.

Biomass power plants do not universally accept all agricultural material due to concerns that some materials may harm power plant machinery. Several issues have been noted concerning the types of material, such as citrus chips, that can be burned by the biomass power plants and the amount of agricultural materials that is accepted at the plants at any given time.

Using the orchard removal materials for fuel at the biomass power plant is currently the most viable and cost effective alternative to open burning for growers due to available

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[17] Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District, 75 Fed. Reg. 2, pp 214-217 (2012, January 4). (to be codified at 40 CFR Part 52)

tax credits for biomass facilities and required agricultural offsets for some biomass power plants. However, the ability to meet the needs of the agricultural industry in a timely and cost effective fashion is a critical factor in any action taken by the District to address the biomass industry's long-term viability as an alternative to open burning. Farmers need certainty and timely removal of material so that they do not miss planting seasons. In the past, lack of coordination and available storage for biomass fuels has led to uncertainty as to when material would be removed from the field. This has been a major concern of the agriculture industry. If the process is not optimized, it can quickly result in a system that does not meet agriculture's needs.

In addition, the reliance on biomass fuel as a primary alternative to open burning is somewhat uncertain since there are no long-term federal or state funding commitments for biomass facilities in the Valley. In fact, the biomass industry has indicated that given current energy policy in California there is concern that biomass power facilities are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking (base load vs. intermittent) and that the prices being offered for new contracts are too low to support their operations.

Two biomass power plants serving the Valley have shut down due to their inability to secure contracts with utilities at rates that are sufficient to sustain their operations. Greenleaf Power that operates the Tracy Biomass Plant, located in Tracy, reported that they shut down on October 31, 2014 and the Covanta facility located in Mendota was shut down in January 2015. Initially, another Covanta facility in Delano had indicated that they were likely to shut down, but is now reporting that they were able to secure a one-year extension on their current utility contract at the same rate that enables them to continue to operate.

Staff has convened a number of productive meetings with agricultural stakeholders and representatives of the biomass industry in order to more fully understand the issues faced by the industry and develop a common vision of the future of biomass power amongst the stakeholders in the Valley. The meetings have been helpful in forging a better working relationship between agriculture representatives and biomass power producers and developing consensus on short-term and long-term solutions.

The District and representatives from agriculture and biomass industries are working to develop and pursue specific actions with the legislative branch, utilities, Public Utility Commission, CalRecycle, and other government agencies to help level the playing field and allow the biomass industry to fairly compete.

In June 2014, the District's Governing Board adopted positions on two pieces of legislation that impact the biomass industry. The District adopted a position in support of AB 2363 (Dahle), which was sponsored by the biomass industry, and would make biomass plants more competitive by fully accounting for the costs associated with intermittent sources of renewable power (solar and wind) when comparing them to other sources of power. AB 2363 was signed by the Governor and will begin to help level the renewable energy playing field. The District also took a position in opposition to SB

1139 (Hueso) that would have given preferential treatment to new geothermal power plants by requiring that utilities purchase specified amounts of new geothermal power. Ultimately, AB 1139 was not passed by the legislature.

The District is also working with the stakeholders, including the Federal Department of Energy, California Energy Commission, and other partner agencies, to pursue clean alternatives to biomass power production for agricultural waste disposal.

### How does District Rule 4103 compare to rules in other air districts?

***BAAQMD***

- Regulation 5 (Open Burning)

The District evaluated the requirements contained within BAAQMD's Regulation 5 and found no requirements that were more stringent than those already in Rule 4103. BAAQMD Regulation 5 was amended on June 19, 2013 to add new fee requirements. The amendments did not implement any requirements more stringent than the current requirements in District Rule 4103.

***SMAQMD***

- Rule 407 (Open Burning)

The District evaluated the requirements contained within SMAQMD's Rule 407 and found no requirements that were more stringent than those already in Rule 4103.

***VCAPCD***

- Rule 56 (Open Burning)

The District evaluated the requirements contained within VCAPCD's Rule 56 and found no requirements that were more stringent than those already in Rule 4103.

***SCAQMD***

- Rule 444 (Open Burning)

The District evaluated the requirements contained within SCAQMD's Rule 444 and found no requirements that were more stringent than those already in Rule 4103. SCAQMD Rule 444 was amended on July 12, 2013 to include beach burning in the rule applicability. The amendments apply to sources that do not exist within District's boundaries. Rule 444 also restricts burning on residential wood combustion curtailment days. As discussed in detail above, this is a practice that has already been implemented within the District. District Rule 4103 is still as stringent as SCAQMD Rule 444.

## Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in another area or included in another state implementation plan. As demonstrated above, Rule 4103 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. Therefore, there are no recommendations for additional regulatory actions for Rule 4103.

The District carefully manages agricultural burning with its SMS with even tighter open burning restrictions based on the daily residential wood-burning declarations issued within the Check Before You Burn program. With the recent amendment of Rule 4901, residential wood-burning with unregistered devices is no longer allowed when an area's forecasted PM2.5 concentration is expected to be greater than or equal to 20 µg/$m^3$. This threshold is now lower compared to past years when it was set at 30 µg/$m^3$. Burning is only allowed when air quality is forecasted to be below 20 µg/$m^3$, which is well below the current federal 24-hour average PM2.5 standard of 35 µg/$m^3$. By restricting open burning to this level, impacts to ambient air quality are significantly minimized and are not expected to contribute to a violation of the federal PM2.5 standards. Furthermore, the District continues to consider the economic feasibility of burning alternatives on a case-by-case basis and in accordance with the five year evaluation period outlined in Rule 4103 with the next evaluation scheduled for 2015.

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. As the District continues to develop new attainment plans that address increasingly stringent federal air quality standards, the District will continue to evaluate potential opportunities to reduce emissions from open burning in the Valley.

## Figure C-2 Sample Agricultural Burn Permit (Front Page)

**San Joaquin Valley Air Pollution Control District**
1990 East Gettysburg Avenue, Fresno, CA 93726
Smoke Management Program (559) 227-7143 or 1 (800) 665-BURN (2876)
www.valleyair.org

PERMIT FOR AGRICULTURAL BURNING

SJVAPCD
DISTRICT_T SMS-TESTING
1990 EAST GETYSBURG
FRESNO, CA 93726

**Permit #:** **140111**
**Security Code:** 5252
**Expiration Date:** 3 February 2017

**Location and Crop List**

| Location Number | LocationDescription (Cross Streets) | Acres | County | Crop Code | Material allowed to be burned |
|---|---|---|---|---|---|
| 1 | 1990 EAST GETTYSBURG WEB TEST(A1-01) | 30 | FRESNO | 140 | * ALMOND PRUNING <20 |
| | | | | 151 | * ALMOND ATTRITION |

* Indicates a restriction exists for this crop. Refer to <u>Crop Restrictions</u> for details.

**<u>Crop Restrictions</u>**

140: ALMOND PRUNING <20 ACRES - Pruning do not include suckers, dead or broken branches and trees, or orchard removals. This crop code is limited to a total of 20 land acres across all agricultural operational sites per year.

151: ALMOND ATTRITION - Attrition materials include suckers and dead or broken branches and trees, but do not include annual prunings or orchard removals. When requesting to burn attrition materials using the automated system, report each ton of material as one acre.

**GENERAL BURN PERMIT CONDITIONS**

1. **Please read and follow all permit conditions.** All burning shall conform to general conditions 1-14, any site-specific conditions of this permit, and any applicable local and state regulations.

2. **Igniting an open burn without first receiving a burn authorization with a confirmation number is a violation subject to penalties.** Prior to ignition, you must contact the District to obtain burn authorization by calling **(559) 227-7143** or **1 (800) 665-BURN (2876)**, or accessing the District's web site via the Internet at **www.valleyair.org.** A confirmation number will be provided to you once the burn has been approved.

**Please refer to the backside of this permit for additional conditions.**

**(Back Page)**

## GENERAL BURN PERMIT CONDITIONS – Continued

3. **All ignition and burning shall comply with any special conditions given at the time of authorization.** Daily authorizations are required in cases where burning continues for more than one day. Materials and/or piles burning for more than one day may not be moved or actively tended to promote burning without a daily authorization.

4. **The permit holder is responsible for monitoring and managing the smoke created by the burn.** Burning shall cease immediately if the smoke impacts sensitive receptor areas. Active burns may be extinguished at the owner's expense if it becomes necessary for public health and safety or if the burn creates a nuisance as determined by the District or any public officer. Creating a nuisance will result in the issuance of a Notice of Violation to the permit holder.

5. **This permit is valid only for the materials listed on the permit.** The burning of any other types of materials, such as petroleum wastes; demolition or construction debris; garbage and residential rubbish; non-agricultural vegetation; tires; tar; wood waste; chemically treated, painted, or stained wood; or other combustible or flammable solid, liquid, or gaseous wastes is prohibited.

6. **Orchard or vineyard removals must be specifically listed on the permit and additional burn restrictions may apply.**

7. **Minimum material drying times are required.** In cold or wet seasons or for certain crop residue it will be necessary to extend these minimum drying times in order to facilitate burning with the least amount of smoke.

| | | |
|---|---|---|
| Spread rice straw 3 days | Prunings and small branches | 3 weeks |
| Rowed rice straw 10 days | Large branches and trees | 6 weeks |

8. **Materials shall be properly dried and loosely stacked to facilitate efficient combustion.** Piles shall be free of dirt, soil, and visible surface moisture in order to avoid smoldering or excessive smoke. Smoldering produces twice the smoke and is a rule violation.

9. **Burns are to be ignited by the use of approved ignition devices that will ignite the burn without the production of black smoke.** Approved ignition devices include: matches, paper, and flame producing devices (i.e. propane or gas burners). The spraying or dousing of materials with any accelerant such as gasoline or diesel fuel or using other types of flammable materials (e.g. motor oil or tires) to ignite an open burn is prohibited.

10. **Open burning is limited to materials produced in commercial agricultural operations.** Regardless of where they are produced, waste materials from landscaping, family orchards, or private garden crops cannot be burned. Such waste materials should be disposed of by other legal methods such as recycling, chipping, mulching, composting, or re-incorporation into the soil.

11. **Materials may not be transported from one location to another for burning.** Materials may only be burned at the location where they were produced.

12. **Paper pesticide, fertilizer, and seed sacks shall only be burned in the field where they are emptied.** The burning of plastic sacks or jugs, cardboard boxes, and packing materials is prohibited. These must be disposed of by recycling or proper waste disposal. Commercial applicators are not eligible to obtain agricultural burn permits for burning these and other materials under any circumstances.

13. **The burn area or materials shall not be left unattended until the burn is extinguished and dead out.** The law requires the application of common sense and reasoning by persons using fire so the fire does not escape control and do damage to others. Burning shall be attended by a sufficient number of able-bodied adults with adequate tools and equipment to control the fire at all times. The burn shall be confined by cleared firebreaks or barriers adequate to prevent it from escaping control.

14. **This permit may be revoked or suspended for violations of any burn permit condition, rule requirement, or if necessary for the protection of public health and safety.** Any person who violates any provision of the District's Rules and Regulations can be subject to significant penalties plus the costs associated with extinguishing the fire.

The issuance of this permit shall not be construed as imposing on the issuing agency, any official, or any employee thereof any responsibility whatsoever for damages incurred by the use of the permit.

Our air quality standards are health-based standards. Please keep in mind that they exist for everyone's benefit.

For burn authorization, please call **(559) 227-7143** or **1 (800) 665-BURN (2876)**, or access the District's web site via the Internet at **www.valleyair.org**.

Reference Authority: SJVAPCD Open Burning Rule 4103, Nuisance Rule 4102, the California Health and Safety Code § 41852 and § 41863 of California Code of Regulations Title 17.

## C.2 RULE 4104 REDUCTION OF ANIMAL MATTER

### Discussion

Rule 4104 is applicable to any source operation used for the reduction of animal matter. Adopted on May 21, 1992, primarily to control pathogens, this rule was amended for District rule number reorganization on December 17, 1992. Rule 4104 requires 100% VOC capture and a high level of destruction (1,200 degrees for 0.3 seconds). EPA finalized approval for Rule 4104 on March 9, 2010 and deemed this rule as being at least as stringent, if not more stringent than, RACT requirements.

### Source Category

The reduction of animal matter includes rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration processes. The emission control equipment for these processes generally includes a condenser for VOC control and a venturi scrubber or cyclone, followed by either a packed bed scrubber or a thermal oxidizer. Blood drying facilities have additional processes controlled by cyclones and a baghouse.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

These facilities generally use steam from a boiler (indirect-fired) or a rotary dryer (direct-fired) for their operations, which generates NOx emissions from these combustion units. Combustion units are regulated by other District rules; as such, those emissions are controlled by and accounted for as a part of other District rules.

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from this source category are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for the reduction of animal matter.

## How does District Rule 4104 compare with federal and state rules and regulations?

### Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

### State Regulations
There are no state regulations applicable to this source category.

## How does District Rule 4104 compare to rules in other air districts?

### *SCAQMD*
- Rule 472 (Reduction of Animal Matter)

The District evaluated the requirements contained within SCAQMD's Rule 472 and found no requirements that were more stringent than those already in Rule 4104.

### *BAAQMD*
- Regulation 12 Rule 2 (Rendering Plants)

The District evaluated the requirements contained within BAAQMD's Regulation 12 Rule 2 and found no requirements that were more stringent than those already in Rule 4104.

### *SMAQMD*
- Rule 410 (Reduction of Animal Matter)

The District evaluated the requirements contained within SMAQMD's Rule 410 and found no requirements that were more stringent than those already in Rule 4104.

### *VCAPCD*
- Rule 58 (Reduction of Animal Matter)

The District evaluated the requirements contained within VCAPCD's Rule 58 and found no requirements that were more stringent than those already in Rule 4104.

## Additional Emission Reduction Opportunities

### Packed Bed Scrubbers
The District evaluated the potential opportunity to reduce emissions if facilities were to replace their thermal oxidizers with packed bed scrubbers. In certain installations, packed bed scrubbers may be more efficient at removing PM from the exhaust and additionally do not generate NOx or SOx emissions. However, determining the scrubber medium may take some experimenting on the part of the facility to ensure it does not cause an increase in emissions or violate other District rules. It would also need to be replaced periodically, adding to the cost of upkeep. Thermal oxidizers do

not present similar issues. Also, facilities subject to Rule 4104 produce only a very small amount of directly emitted PM2.5 and are otherwise already required to have a high level of control for emissions. The current requirements are as stringent as possible for these types of facilities.

**Regenerative Thermal Oxidizers**
The District also evaluated the potential opportunity to reduce emissions from facilities by replacing thermal oxidizers with regenerative thermal oxidizers (RTOs) with heat recovery, which is a current practice at some facilities in the Valley. RTO devices use less supplementary fuel. While using less fuel may reduce NOx emissions, this is not necessarily the case. The PM control efficiency is nearly the same for both thermal oxidizers and RTOs, and the total NOx emissions from this category are relatively small given that there are only a few units subject to this rule that are not already subject to other combustion rules limiting NOx emissions. Any new units would be evaluated through the District’s Best Available Control Technology New Source Review requirements.

### Evaluation Findings
Even though the reduction of animal matter is not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4104 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

## C.3 RULE 4106 PRESCRIBED BURNING AND HAZARD REDUCTION BURNING

### Discussion

Adopted in June 2001 and approved by EPA as a SIP amendment in February 2002, [18] Rule 4106 is applicable to all prescribed burning and to hazard reduction burning in the wildland/urban interface within the Valley. Rule 4106 incorporated provisions made necessary by the March 23, 2000 amendment of Title 17 of the California Code of Regulations. Recognizing the importance of both prescribed burning and hazard reduction burning, the purpose of Rule 4106 is to permit, regulate, and coordinate the use of prescribed burning and hazard reduction burning while minimizing smoke impacts on the public. Through this rule, the District has expended considerable resources to ensure that the ignition of burn projects is only allowed when air quality and dispersion conditions are favorable, thus lessening the health impacts on Valley citizens and on air quality in the Valley.

### Source Category

This rule is applicable to range improvement burning, forest management burning, wildland vegetation management burning, and hazard reduction burning. Agricultural burning, which is subject to Rule 4103, is generally done by farmers to dispose of tree prunings, crop residue, and other agricultural materials; disease and pest control; and orchard removal. In contrast, prescribed burning generally includes forest waste, fire hazard reduction, rangeland management, wildlife habitat improvement, and ecosystem (forest health) burning.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.76 | 0.76 | 0.76 | 0.76 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| NOx | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| SOx | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.88 | 0.88 | 0.88 | 0.88 | 0.89 | 0.89 | 0.89 | 0.90 | 0.90 |
| NOx | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.11 | 0.11 |
| SOx | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from prescribed burning and hazard reduction burning are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does

[18] 67 Federal Register 39, pp. 8894-8897 (to be codified at 40 CFR Part 52). (2002, February 27). *Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District*. Retrieved from https://www.federalregister.gov/articles/2002/02/27/02-4526/revisions-to-the-california-state-implementation-plan-san-joaquin-valley-unified-air-pollution.

not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for prescribed burning and hazard reduction burning.

## How does District Rule 4106 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 4106 compare to rules in other air districts?

***SCAQMD***

- Rule 444 (Open Burning)

The District evaluated the requirements contained within SCAQMD's Rule 444 and found no requirements that were more stringent than those already in Rule 4106.

***BAAQMD***

- Regulation 5 (Open Burning)

The District evaluated the requirements contained within BAAQMD's Regulation 5 and found no requirements that were more stringent than those already in Rule 4106.

***SMAQMD***

- Rule 501 (Agricultural Burning)

The District evaluated the requirements contained within SMAQMD's Rule 501 and found no requirements that were more stringent than those already in Rule 4106.

***VCAPCD***

- Rule 56 (Open Burning)

The District evaluated the requirements contained within VCAPCD's Rule 56 and found no requirements that were more stringent than those already in Rule 4106.

***Placer County APCD (PCAPCD)***

- PCAPCD Rule 301 (Nonagricultural Burning Smoke Management)

The District evaluated the requirements contained within PCAPCD Rule 301 and found no requirements that were more stringent than those already in Rule 4106.

- PCAPCD Rule 303 (Prescribed Burning Smoke Management)

The District evaluated the requirements contained within PCAPCD Rule 303 and found no requirements that were more stringent than those already in Rule 4106.

## Additional Emission Reduction Opportunities

### Prescribed Burning Emission Reduction Opportunities

Land Management Agencies (LMAs) are the agencies that regularly conduct prescribed burning operations. Since the adoption of Rule 4106, the District has developed cooperative relationships with the LMAs. Through this cooperation, the District advises the LMAs on which days would be the most conducive for igniting a burn project, based on air quality and meteorological conditions. The District continues to work with LMAs to identify favorable burning conditions with the goal of completing a maximum number of prescribed burning projects while minimizing air quality impacts. This collaborative effort ensures that the ignition of burn projects occurs when air quality and dispersion conditions are favorable, thus lessening the impacts on air quality in the Valley. Potential opportunities to reduce emissions from prescribed burning include the mechanical removal of the materials, firebox air curtain burners, and management of wild fires.

#### *Mechanical Removal of Materials*

One potential option to reduce burning materials would be to physically remove material from a project site. As these locations are not near roadways, it is often not practical or possible to bring mechanical equipment to remote and dense forest lands to collect and remove the material. Additionally, mechanical removal is much more expensive for the LMAs, who are already subject to budgeting restrictions, to reduce the fuels in an area as compared to burning. Mechanical removal of materials from forest areas is not technologically or economically feasible.

#### *Firebox Air Curtain Burners*

Assuming that a LMA could mechanically remove all of the material from a project burn site and that the material was placed in piles and prepared for burning, an alternative to open burning would be to use a firebox air curtain burner. A firebox air curtain burner is a device that circulates large volumes of air over a burning fire in an open topped fire proof metal box. When compared to open burning, firebox air curtain burners have been shown to greatly reduce PM and carbon dioxide emissions; however, the potential NOx emissions compared to open burning have not been fully evaluated yet. Because the Valley is a NOx-limited area, more research on the technology is needed to verify that there would be potential NOx emission reductions by switching from open burning practices to the use of firebox air curtain burners.

#### *Wildfires*

Often, primarily during the warm summer months, wildfires are naturally ignited through lightning strikes from passing storms. These wildfires have the potential to produce significant emissions and heavily impact residents within the Valley. When these wildfires occur, the District works with the responsible LMA in managing the fire as the dispersion and air quality conditions fluctuate. This cooperation allows the LMA to be more aggressive with the fire when meteorological conditions are favorable and more defensive when the conditions are poor. The District will continue to use the tools available to guide the activities of LMAs when wildfires occur, and is continuously seeking opportunities to work with LMAs to improve the management of these fires in order to reduce emissions and impacts to Valley residents.

**Hazard Reduction Burning Emission Reduction Opportunities**

Hazard reduction burning is used exclusively by landowners in the wildland/urban interface within the foothill and mountain regions in the State Responsibility Areas, which comprise about 20% of the total land area in the Valley. Section 4291 of the California Public Resources Code (CPRC) states that structures must maintain a defensible perimeter of 100 feet in all directions; this defensible perimeter is commonly created through the clearing of vegetation. Although Section 4291 does not require it, most of this vegetation is burned because it is less expensive, faster, and more convenient than other options. Potential opportunities evaluated below include the reorganization of hazard reduction zones and alternatives to burning the vegetation.

***Reorganization of Hazard Reduction Zones***

Under Rule 4106, hazard reduction burning is only allowed when the District forecasts favorable air quality and dispersion conditions. Currently this forecast is 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. Managing the allowance of hazard reduction burning under this type of scheme also has the potential to limit smoke impacts on residents. Establishing this type of management system would not cause an increase in costs for landowners, making this a cost effective opportunity. However, emissions reduced, if any, would be minimal, since the burning would still occur, just on different days when conditions are favorable.

***Alternatives to Burning***

As an alternative to the open burning of the vegetation, the District could encourage alternative methods like chipping or burn boxes through grant programs targeted at communities that regularly conduct hazard reduction burning.

1. ***Chipping***

   One potential alternative to the open burning of material is to use a chipper to break down the material into small pieces suitable for landscaping, dust control cover, or biomass burning. Evaluation of this alternative option revealed that chippers are not a viable alternative. The requirement by the CPRC to maintain a defensible perimeter of 100 feet is enforced annually; therefore, the organic materials to be cleared and disposed of consist of leaves, pine needles, weeds, and some small brush, all of which are not acceptable materials for wood chippers.

### 2. *Firebox Air Curtain Burners*

Another potential opportunity examined is the feasibility of usage of a firebox air curtain burner, which was described earlier. Again, this is not a feasible option for the Valley because the potential NOx emission reductions have not been verified.

### 3. *Biomass Removal Program*

A potential opportunity to reduce emissions from hazard reduction burning would be by removing the biomass from the area and sending it for combustion at a biomass plant, similar to a pilot program implemented by the PCAPCD in 2007. The pilot program in Placer County was evaluated below to determine feasibility for implementation in the Valley.

#### *PCAPCD Program*

PCAPCD implemented a “Biomass Box” program beginning in the spring of 2007 to collect and utilize biomass that would traditionally be collected and burned as a part of hazard reduction efforts, for use as fuel for producing energy. The program, funded with a grant from PCAPCD, collected the biomass by distributing 20 to 40 foot industrial containers throughout participating communities in the county. When full, the containers were transported to another location where the materials were grinded into useable fuel that biomass energy companies could accept. The chipped biomass was then loaded onto larger trucks and hauled to one of two biomass facilities.

**Figure C-3 Image of a Typical 40' Biomass Box Used in Placer County in 2007**


The final report by PCAPCD that evaluated this pilot program documented that from an emissions reductions standpoint the project was a success, with net air pollution reductions at 88.6%, including 24.7 tons of particulates and 4.0 tons of NOx reduced at a cost of $80,000. Based on the perceived success of this study, the District evaluated this pilot program for potential emissions reductions and feasibility of implementation in the Valley.

Hazard reduction in Placer County is overseen by the Placer County Biomass Program with help from local fire departments and land managers. The Placer County Biomass Program and PCAPCD confirmed that the community biomass bins are no longer prominently used. The program was initially designed to change the culture of hazard reduction burning by providing an alternative to burning. However, the bin program proved to have many complications that rendered it an ineffective program. One issue was that residents were disposing of items other than biomass into the bins. This caused problems for the chippers and produced less than ideal fuel for biomass plants. Additionally, PCAPCD determined that the transport of biomass bins any further than 30 miles round trip was cost prohibitive.[19]

A few biomass bins were still in use as of 2013, but only in communities that explicitly requested them following the 2007 pilot project. PCAPCD determined that there are more cost effective options for removing residential biomass then using community biomass bins, such as using mobile chippers to provide residents with a low cost “curb side” chipping service. The chipped biomass is blown back onto the property for use as mulch or as a dust suppressant. The program is supported in part by grants from Placer County Resource Conservation District, Placer County Sheriff’s Department, PCAPCD, and Calfire. As stated above, chipping is not a feasible option to implement in the Valley.

### Evaluation Findings

Even though prescribed burning and hazard reduction burning are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4106 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from prescribed burning and hazard reduction burning in the Valley.

[19] Storey, B., Biomass Program Manager, Placer County Executive Office, Personal Communication.

## C.4 RULE 4203 PARTICULATE MATTER EMISSIONS FROM THE INCINERATION OF COMBUSTIBLE REFUSE

### Discussion

Rule 4203 is applicable to any person, operation, facility, incinerator, or equipment used to dispose or process combustion refuse. The rule limits the concentration of particulate matter emissions based on process weight rates, and prohibits the discharge of visible emissions. Rule 4203 was adopted on May 21, 1992 and subsequently amended for District rule number reorganization on December 17, 1992.

### Source Category

There are currently 3 facilities in the Valley subject to Rule 4203. Units subject to this rule already meet BACT level requirements, which require the mitigation of air pollution to the maximum degree achievable using control technologies like baghouses and lime scrubbers.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion. As identified in the above table, emissions from the incineration of combustible refuse are lower than the BACM/MSM PM2.5 significance threshold. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for the incineration of combustible refuse.

### How does District Rule 4203 compare with federal and state rules and regulations?

#### Federal Regulations

There are no specific federal guidelines for particulate matter concentration in terms of EPA CTG, ACT, NSPS, NESHAP, or MACT requirements. EPA BACT standards require the use of a fabric filter or baghouse. District BACT standards are as stringent and require existing facilities to use a natural gas supplemental fuel with a baghouse.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 4203 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 473 (Disposal of Solid and Liquid Wastes)

The District evaluated the requirements contained within SCAQMD's Rule 473 and found no requirements that were more stringent than those already in Rule 4203.

***SMAQMD***
- Rule 407 (Open Burn)

The District evaluated the requirements contained within SMAQMD's Rule 407 and found no requirements that were more stringent than those already in Rule 4203.

***VCAPCD***
- Rule 57 (Incinerators)

The District evaluated the requirements contained within VCAPCD's Rule 57 and found no requirements that were more stringent than those already in Rule 4203.

## Evaluation Findings
Even though particulate matter emissions from the incineration of combustible refuse are not a significant source of PM2.5 in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4203 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from the incineration of combustible refuse in the Valley.

## C.5 RULE 4204 COTTON GINS

### Discussion

Adopted on February 17, 2005, Rule 4204 is intended to reduce particulate emissions from cotton ginning facilities operating within the Valley. The implementation of this rule has achieved 0.79 tpd of PM10 reductions from this source category. EPA finalized approval of Rule 4204 on November 9, 2006 and deemed this rule as meeting established RACT standards.

The *2003 PM10 Plan* identified cotton gins as a significant source of PM10 emissions in the Valley. The federal CAA requires air districts designated as Serious nonattainment for PM10 to implement BACM, including BACT, on significant stationary and area sources of PM10 and PM10 precursors. Although many gins in the Valley were already retrofitted with 1D3D high-efficiency cyclones, considered BACT, the District developed Rule 4204 to assure that all cotton gins met BACT requirements at the earliest practicable date.

### Source Category

There are two types of cotton gins: saw and roller. A saw gin is commonly used for short fiber cotton where the cotton is pulled across knifed edges to remove seeds and trash. A roller gin is instead used for long fiber cotton and the cylinders or rollers carry the cotton across screens or perforated metal where the trash is removed. Throughput for saw gins can be higher than that of a roller gin, but a roller gin produces a higher quality end-product.

Modern ginning uses pneumatic conveyance, in the form of fans blowing air, which moves the cotton gin material. Particulate matter emissions are the unwanted by-products of this otherwise very efficient means of transferring massive quantities of cotton gin material from one process to the next process, such as from unloading to drying and cleaning. PM emissions from cotton ginning facilities occur mostly during a three-month period from October to December, the time of year during which the Valley's ambient PM concentrations are highest.

Cotton ginning, the process of separating the lint from the seed, has evolved from a labor-intensive process capable of producing small quantities of cotton to a highly efficient industry producing millions of bales. With this increase in production came the problem of how to handle the debris made up of plant and soil material that comes from machine harvesting the cotton. Since cotton gins use large quantities of air for conveying, the use of cyclones for air pollution abatement was a logical choice.

Cotton gins are regulated through a combination of permit conditions and other prohibitory rules aside from Rule 4204. Permit conditions cite Rules 1070, 2201, 4101, 4102, 4201, and 4202 as the regulatory basis for cotton gins:

- **Rule 1070** requires the keeping of daily records, which are available for District inspection upon request.
- **Rule 2201** covers the following areas:

a. Type of cyclones or other control devices for specific exhaust points.
b. Allowable PM10 emission rate for the cotton gins as an integrated system and allowable PM10 emission rate for specific exhaust points.
c. Bale throughput in bales/day or bales/season.

- **Rule 4101** prohibits the discharge into the atmosphere of air contaminants for a period or periods aggregating more than three minutes in any one hour, which is as dark as or darker than Ringelmann 1 or 20% opacity.
- **Rule 4102** prohibits the release of air contaminants that causes a public nuisance.
- **Rule 4201** limits particulate matter emissions concentration to 0.1 grains/dscf or less.
- **Rule 4202** limits particulate matter emissions by establishing allowable emission rates based on process weights.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | ***Annual Average - Tons per day*** | | | | | | | | |
| **PM2.5** | 0.22 | 0.22 | 0.23 | 0.22 | 0.22 | 0.23 | 0.23 | 0.24 | 0.24 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | ***Winter Average - Tons per day*** | | | | | | | | |
| **PM2.5** | 0.34 | 0.35 | 0.35 | 0.35 | 0.35 | 0.36 | 0.36 | 0.37 | 0.37 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from cotton gins are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for cotton gins.

## How does District Rule 4204 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

### State Regulations

There are no state regulations applicable to this source category.

## How does District Rule 4204 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, or VCAPCD.

### *Other Analogous Rules*

- New Mexico Administrative Code 20.2.66.1 (Cotton Gins)

The District evaluated the requirements contained within New Mexico Administrative Code 20.2.66.1 and found no requirements that were more stringent than those already in Rule 4204.

- Louisiana Department of Environmental Quality, Title 33 (Environmental Regulatory Code), Part III (Air)

The District evaluated the requirements contained within Louisiana Department of Environmental Quality, Title 33 and found no requirements that were more stringent than those already in Rule 4204.

- North Carolina Administrative Code Title 15A, Subchapter 2D, Section .0542 (Control of Particulate Emissions from Cotton Ginning Operations)

The District evaluated the requirements contained within North Carolina Administrative Code Title 15A, Subchapter 2D, Section .0542 and found no requirements that were more stringent than those already in Rule 4204.

- South Carolina Air Pollution Control Regulations and Standards, Regulation 61-62.5, Standard No. 4, Section V (Cotton Gins)

The District evaluated the requirements contained within South Carolina Regulation 61-62.5, Standard No. 4, Section V and found no requirements that were more stringent than those already in Rule 4204.

- Oklahoma Department of Environmental Quality, Air Pollution Control, 252:100-23 (Cotton Gins)

The District evaluated the requirements contained within South Carolina Regulation 61-62.5, Standard No. 4, Section V and found no requirements that were more stringent than those already in Rule 4204.

- Texas Commission on Environmental Quality, Air Quality Standard Permit for Cotton Gin Facilities and Cotton Burr Tub Grinders

The District evaluated the requirements contained within the above rules and found no requirements that were more stringent than those already in Rule 4204.

## Additional Emission Reduction Opportunities

### Research and PM2.5 Fraction

Research was completed in 2013 by the United States Department of Agriculture Agricultural Research Service (USDA-ARS), in partnership with cotton associations, EPA, ARB, and the District to measure actual PM10 and PM2.5 emissions from stack sources and fugitive emissions in and around several ginning facilities. This research provided emission factors for comparison to previous estimations that are included in emission inventories and provided data for both types of cotton gins currently in use in California. This project was designed to measure emissions from facilities with current emissions control technologies in place and to improve emissions estimations by measurement with the highest quality methods and instruments. The project was not designed to evaluate new technologies or measures to further reduce emissions. Results for the seven gins that were sampled for the project indicate the estimated ratio of PM2.5 to PM10 is approximately 16%.[20] This fraction of PM2.5 to PM10 is lower than indicated in the emissions inventory currently being used. Future research will include particle size analysis of EPA Method 17 samples, and modeling to compare model output and ambient sampling data and develop suggested modeling corrections.

### 1D3D Cyclones with Expansion Chamber

Currently, all cotton gins in the Valley are required to operate using a 1D3D cyclone. About two thirds of the 1D3D cyclones used in the Valley have an expanded chamber outlet. Research has shown that an expansion chamber allows for more flow since it is not as narrow. In initial tests, a larger D/3 size expanded chamber exit produced PM10 emissions that were about 8% lower than those resulting from use of the standard, small-diameter (D/4) exit.[21] However, there is no completed research indicating the fraction of PM2.5 emitted or the effectiveness of reducing PM2.5 by installing an expanded chamber. Since 1D3D cyclones are already required by the current rule, and there is no definitive data to verify the effectiveness in reducing PM2.5 emissions with an expansion chamber, this is not a feasible opportunity to reduce emissions.

### Loadout

Rule 4204 currently requires wind screens for loadout. Two potential opportunities to reduce emissions through control options to capture PM10 emissions from the truck loading operation were identified as follows: 1) venting the loadout area to pre-cleaning cyclones and a baghouse; and 2) venting the receiving pit to a 1D-3D cyclone. While it is technologically feasible to enclose the loadout area and receiving pits and vent to the respective control devices, the District's BACT Guideline 5.1.8 has found those options to not be cost effective. This analysis was calculated according to PM10 emission factors and again, the PM2.5 fraction is unknown at this time.

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[20] United States Department of Agriculture, Agricultural Research Service. (2013). *Characterization of Cotton Gin Particulate Matter Emissions.* Obtained from http://buser.okstate.edu/air-quality/cotton-gin/national-study/.
[21] Baker R.V. and Hughs S.E. (1998). *Influence of Air Inlet and Outlet Design and Trash Exit Size on 1D3D Cyclone Performance*. Transactions of the ASAE, vol. 42(1): 17-21.

### Mechanical Conveyance

Mechanical conveyance for the main trash handling system could be a potential opportunity to reduce emissions, but it has only been demonstrated as feasible for newly constructed or rebuilt cotton gins. Mechanical conveyance almost entirely eliminates emissions from cotton gin trash handling exhaust streams, which were previously moved pneumatically. The cotton gin trash handling systems only comprise a fraction of the emissions that are released from the full cotton ginning process. Newer or rebuilt cotton gins are able to accommodate a mechanical conveyance system since they are able to design the cotton gin around the equipment and space needed. Operators that have installed a mechanical conveyance system for their cotton gin have had to build a lower floor, below the main level containing the major cotton gin equipment, to house the mechanical conveyors. Therefore, as confirmed by industry representatives and equipment manufacturers, it is not technologically feasible to retrofit existing cotton gins with mechanical conveyance systems to replace existing trash handling equipment. Additionally, any new facilities would trigger New Source Review requirements and would be required to implement BACT level controls.

### Plenum Chambers

Plenum chambers are in use at a number of cotton gins in the Valley. Plenum chambers are placed upstream of selected cyclones to remove large trash. Studies have been inconclusive in demonstrating an increase in PM control efficiency with the utilization of a plenum chamber. Most cotton ginning facilities that have installed plenum chambers are using those devices to reduce wear and tear on the cyclones, thus prolonging the life of the cyclones, and not for increased PM controls.

## Evaluation Findings

Even though cotton gins are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4204 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from cotton gins in the Valley.

## C.6 RULE 4301 FUEL BURNING EQUIPMENT

### Discussion
Rule 4301 was last amended in 1992 and applies to all types of fuel burning equipment, except air pollution control equipment. The purpose of this rule is to limit emissions of air contaminants from fuel burning equipment by specifying maximum emission rates for SOx, NOx, and PM (identified in the rule as combustion contaminant emissions). 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.

### Source Category
Rule 4301 has a very broad applicability, as it applies to all types of fuel burning equipment. Since its early adoption in 1992, it has largely been superseded by several District rules with more stringent NOx requirements for specific types of fuel burning equipment. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4352, and 4703 for more specific information about the individual fuel burning equipment source categories.

### Emissions Inventory
There is no emissions inventory specific to Rule 4301; see Rules 4306, 4307, 4308, 4309, 4352, and 4703 for the individual emissions inventories.

### How does District Rule 4301 compare with federal and state rules and regulations?
Facilities subject to Rule 4301 are subject to various state rules and federal requirements, such as CTG, ACT, NSPS, NESHAP, and MACT. However, as previously mentioned, several District rules have superseded Rule 4301 with more stringent requirements. Comparisons of those District rules to the applicable federal and state rules are discussed within those control measure evaluations.

### How does District Rule 4301 compare to rules in other air districts?
There are no analogous rules in BAAQMD, SMAQMD, and VCAPCD.

***SCAQMD***

- Rule 474 (Fuel Burning Equipment—Oxides of Nitrogen)

The District evaluated the requirements contained within SCAQMD's Rule 474 and found no requirements that were more stringent than those already in Rule 4301.

### Evaluation Findings
District Rule 4301 alone cannot be considered to fulfill BACM/MSM requirements for this source category. The NOx requirements of this rule have been superseded by the requirements of other District rules that satisfy BACM/MSM for fuel burning equipment since all units subject to Rule 4301 are subject to a more specific NOx rule discussed elsewhere in this appendix. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4352, and 4703.

## C.7 RULE 4306 AND RULE 4320 ADVANCED EMISSION REDUCTION OPTIONS FOR BOILERS, STEAM GENERATORS, AND PROCESS HEATERS GREATER THAN 5.0 MMBTU/HR

### Discussion

Rules 4306 and 4320 apply to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input greater than 5 million British thermal units per hour (MMBtu/hr). The purpose of these rules is to limit NOx and carbon monoxide (CO) emissions from boilers, steam generators, and process heaters of this size range.

Rule 4320 is the third generation rule for this source category. The first District rule for this source category, Rule 4305 (Boilers, Steam Generators, and Process Heaters), was adopted on December 16, 1993. Rule 4305 was superseded by Rule 4306 (Boilers, Steam Generators, and Process Heaters – Phase 3) on September 18, 2003 to implement a NOx control measure from the District's ozone and PM10 attainment plans, lowering the NOx emissions limits in Rule 4305. Since adoption, Rule 4306 has been amended twice.

The amendment of Rule 4306 in October 2008 was initially proposed to lower the NOx emission limit from 9 ppmv to 6 ppmv for units greater than 20 MMBtu/hr. It was determined that the proposed NOx limits could be accomplished by using selective catalytic reduction (SCR) or a combination of SCR and ultra-low NOx burners (ULNBs), thus making the lower limits technologically feasible. However, through the public workshop process and additional research it was also determined that most of the units subject to Rule 4306 have undergone several generations of NOx controls, and consequently, certain applications of SCR may not be cost effective and/or technological infeasible because of physical limitations. Therefore, the lower NOx limits were included in new Rule 4320 and an option was provided in the rule that allows for the payment of an annual emissions fee based on total actual emissions, rather than installation of additional NOx controls. These fees are used by the District to achieve cost effective NOx reductions through District incentive programs, the District's Technology Advancement Program, and other routes. The previous versions of Rule 4305 and 4306 combined with the implementation of Rule 4320 achieve approximately 96% control of NOx emissions from 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 4306 and Rule 4320.

### Source Category

Facilities with units subject to this rule represent a wide range of industries, including but not limited to electrical utilities, cogeneration, oil and gas production, petroleum refining, manufacturing and industrial processes, food and agricultural processing, and service and commercial facilities.

To recognize the operational and technical differences between different types of equipment subject to Rules 4306 and 4320, the different equipment types were separated into several major categories, with different requirements, including the following:

- Units with a total rated heat input greater than 5.0 MMBtu/hr to 20.0 MMBtu/hr
- Units with a total rated heat input greater than 20.0 MMBtu/hr
- Oilfield steam generators of all ratings and fuel types
- Refinery units of all ratings and fuel types
- Low-use units limited by a Permit to Operate to an annual heat input greater than 1.8 billion Btu/year but less than or equal to 30 billion Btu/year
- Units at a wastewater treatment facility using less than 50% PUC quality fuel
- Small specialty units operated by a small producer

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 1.27 | 1.25 | 1.23 | 1.21 | 1.19 | 1.17 | 1.14 | 1.13 | 1.10 |
| NOx | 1.93 | 1.83 | 1.72 | 1.61 | 1.56 | 1.51 | 1.46 | 1.41 | 1.36 |
| SOx | 0.60 | 0.59 | 0.24 | 0.24 | 0.23 | 0.23 | 0.23 | 0.22 | 0.22 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 1.25 | 1.24 | 1.21 | 1.19 | 1.17 | 1.15 | 1.13 | 1.11 | 1.09 |
| NOx | 1.88 | 1.78 | 1.68 | 1.57 | 1.51 | 1.47 | 1.42 | 1.38 | 1.32 |
| SOx | 0.58 | 0.57 | 0.24 | 0.23 | 0.23 | 0.23 | 0.22 | 0.21 | 0.21 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion emissions, 13.1 tons per day (tpd) for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from boilers, steam generators, and process heaters greater than 5.0 MMBtu/hr are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for this source category.

## How does District Rule 4306/4320 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTG requirements for this source category.

### *ACT*

- EPA-453/R-93-034 (Alternative Control Techniques Document – NOx emissions from Process Heaters)

The District evaluated the requirements contained within the ACT for NOx Emissions from Process Heaters and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- EPA-453/R-93-022 (Alternative Control Techniques Document – NOx Emissions from Industrial/Commercial/Institutional Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- EPA-453/R-93-023 (Alternative Control Techniques Document – NOx Emissions from Utility Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rules 4306 and 4320.

***NSPS***

- 40 CFR 60 Subpart D (Standards of Performance for Fossil-Fuel Fired Steam Generators for Which Construction Is Commenced After August 17, 1971)

The District evaluated the requirements contained within 40 CFR 60 Subpart D and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- 40 CFR 60 Subpart Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units)

The District evaluated the requirements contained within 40 CFR 60 Subpart Db and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- 40 CFR 60 Subpart Dc (Standards of Performance for Small Industrial- Commercial-Institutional Steam Generating Units)

The District evaluated the requirements contained within 40 CFR 60 Subpart Dc and found no requirements that were more stringent than those already in Rules 4306 and 4320.

***NESHAP/ MACT***

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin

emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches for compliance with the PM limit. The PM limit in District Rule 4320 is more stringent for liquid fuels because it only allows liquid fuels to be burned during PUC quality natural gas curtailment periods. It is equivalent to DDDDD for all gasses burned except for gasses exceeding 40 μg/$m^3$ of mercury.

The District evaluated the requirements contained within the above NESHAP and found no requirements that were more stringent than those already in Rules 4306 and 4320.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 4306/4320 compare to rules in other air districts?

***SCAQMD***

- Rule 1146 (Emissions of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

SCAQMD Rule 1146 was amended on November 1, 2013 to include rule language clarifications and revisions to address SIP creditability issues. None of the amendments affected emissions reductions.

The District evaluated the requirements contained within SCAQMD's Rule 1146 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

***BAAQMD***

- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- Regulation 9 Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 10 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

***SMAQMD***

- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

### *VCAPCD*

- Rule 74.15 (Boilers, Steam Generators and Process Heaters)

The District evaluated the requirements contained within VCAPCD's Rule 74.15 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

## Additional Emission Reduction Opportunities

Over the years, the District has adopted numerous generations of rules and rule amendments for boilers greater than 5 MMBtu/hr that have significantly reduced NOx and PM emissions from this source category. The emissions inventory for NOx from these boilers has dropped from 40.2 tpd in 1993 to 1.61 tpd in 2015. As part of these regulatory efforts, hundreds of boilers in the Valley have been equipped with the best available NOx and PM control technologies. Given the significant effort already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

### *Low Temperature Oxidation*

The District researched emerging technologies that may have the potential to reduce emissions. A Low Temperature Oxidation (LTO) System was installed at a dairy in the SCAQMD and was able to reach NOx limits between 1.0- 3.2 ppmv for loads 4.1-13 MMBtu/hr. The LTO system utilizes ozone to oxidize and control various pollutants, including NOx. According to the SCAQMD BACT database information, capital and installation costs ranged from $360,000 - $400,000 for the LTO system when it was installed in 1997.[22] Installation within the South Coast region was heavily subsidized with government funding and the installation costs appear cost prohibitive for an installation that is not subsidized. In addition, the LTO system is classified as "Other Technologies" in the SCAQMD BACT guidelines, which means that the technology has not met the achieved in practice (AIP) criteria of six months of continuous operation at a minimum of 50% operating capacity and does not qualify as the lowest achievable emission rate (LAER). Since the technology has not been achieved in practice and cost prohibitive without significant subsidies, this is not a feasible opportunity at this time.

### *EMx*

The District researched the potential for emissions reductions through EMx, the second generation of the SCONOx technology that is a post-combustion control that reduces NOx, SOx, CO, and volatile organic compound (VOC) emissions. This technology has not been AIP in the District and there is no available data that indicates that SCONOx or EMx has been installed on boilers even though the manufacturer's website states that the technology is transferrable to industrial boilers. Based on research of the best available controls from EPA and other air districts, the SCONOx and EMx systems have only been utilized by power plants for control of turbine emissions. In fact, cost effectiveness analyses conducted by the District for the installation of SCONOx/EMx

[22] South Coast Air Quality Management District. (2012). *SCAQMD Best Available Control Technology (BACT) Database*.

units on large power plant turbine installations within the Valley have been found to not be cost effective. Given the high cost effectiveness demonstrated for turbines and lack of demonstrated practice with boilers, this technology is not feasible or cost effective for reducing emissions from this category.

### PM2.5 Limits for Alternative Fuels

The majority of boilers (>5 MMBtu/hr) in the Valley combust Public Utilities Commission (PUC) quality natural gas, which contains a very low sulfur content and inherently has low emissions. Few boilers in the Valley use alternative fuels for their combustion processes. Alternative fuels include digester gas, produced gas, and liquid fuel. Units fired on digester gas or produced gas are already required to use inlet gas scrubbers to meet District rule requirements. Current rule language requires that liquid fuel shall be used only during a PUC-quality natural gas curtailment period provided it contains no more than 15 ppm sulfur. While the use of liquid fuel is strictly limited, the feasibility of reducing PM emissions through adding PM2.5 limits for units using liquid fuel was explored as part of the District's comprehensive control measure evaluation.

There are 83 units that are permitted to utilize liquid fuel in the Valley (>5 MMBtu/hr) during a natural gas curtailment with an average combined emissions inventory of approximately 0.034 tons per year of total PM. The low emissions inventory is attributed to the fact that these units either utilize liquid fuel as a backup if there is a natural gas curtailment. The following three technologies were researched as potential opportunities to reduce PM emissions: baghouses, electrostatic precipitators (ESPs), and wet scrubbers. Baghouses control total PM and PM2.5 emissions by 90-99%; ESPs control total PM and PM2.5 emissions by 90-99%; and wet scrubbers control large particulates (>PM5) by 99% and PM2.5 emissions by approximately 50%.[23] Currently, there are a few crude oil-fired or field gas-fired steam generators operating in crude oil production facilities that are required by their permits to operate SOx scrubbers and ESPs. However, baghouses are typically not used with liquid-fired boilers due to the potential clogging of the baghouse[24] and are therefore not a recommended technology due to infeasibility and safety issues.

[23] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[24] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

### *PM Potential Emissions Reductions for an ESP and Scrubber*

For the purposes of these calculations, the following assumptions were made:

1. For simplicity, the analysis will evaluate the cost effectiveness of these technologies for total PM reductions from liquid fuel fired units.
2. The PM control efficiency of an ESP is 99%.
3. The PM control efficiency of a scrubber is 99%.

Potential Emissions Reductions $_{(ESP)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reduction $_{(ESP)}$ = 0.034 tons/year X 0.99
Potential Emissions Reduction $_{(ESP)}$ = 0.0337 tons/ year (tpy)

Potential Emissions Reductions $_{(scrubber)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reduction $_{(scrubber)}$ = 0.034 tons/year X 0.99
Potential Emissions Reduction $_{(scrubber)}$ = 0.0337 tons/ year (tpy)

### *Annualized Cost of an ESP and Wet Scrubber*

The capital cost for the installation of an ESP for a 1-5 MMBtu/hr boiler ranges from \$90,000 - \$100,000 and the annual maintenance cost is \$1,000-\$2,000.[25] For the wet scrubber system, EPA estimated the annualized cost at \$5,300-\$102,000 per $sm^3$/sec at an average air flow rate of 0.7-47 $sm^3$/sec.[26] The District used the following assumptions in the cost effectiveness calculations:

1. The capital cost of an ESP for a 5 MMBtu/hr boiler is assumed to be \$100,000.
2. The annual maintenance cost of an ESP for a 5 MMBtu/hr boiler is assumed to be \$2,000.
3. The annualized cost of a wet scrubber system is assumed to be the median of the range above (\$53,650 per $sm^3$/sec).
4. The average air flow rate for a wet scrubber system is assumed to be the median of the range above (23.85 $sm^3$/sec).
5. The total capital and maintenance cost of an ESP will be calculated by multiplying the cost of 1 unit by the total number of units.
6. The total annualized cost of a wet scrubber will be calculated by multiplying the annualized cost of 1 unit by the total number of units.
7. Lifetime of the ESP is 10 years at 10% interest. To account for this, the annualized capital cost will be calculated by multiplying the total capital cost by the capital recovery factor of 0.1627 and adding the annual maintenance costs.

Annual Cost$_{(ESP)}$ = (Total Capital Cost) x (0.1627) + (Annual Maintenance Cost x 83)
Annual Cost$_{(ESP)}$ = (\$100,000 x 83) x (0.1627) + (\$2,000 x 83)
Annual Cost$_{(ESP)}$ = \$1,516,410/year

[25] Catherine Roberts. (March 2009) *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Environmental Protection Agency Office of Air Quality Planning and Standards and Northeast States for Coordinated Air Use Management.
[26] EPA. (2002). *Air Pollution Control Technology Fact Sheet: Spray-Chamber/Spray-Tower Wet Scrubber.* Retrieved from http://www.epa.gov/ttncatc1/dir1/fsprytwr.pdf.

Annual $Cost_{(scrubber)}$ = (Annualized Cost of 1 unit) x (Number of Units) x (Avg. Flow Rate)
Annual $Cost_{(scrubber)}$ = (\$53,650/ $sm^3$/sec) x (83) x (23.85 $sm^3$/sec)
Annual $Cost_{(scrubber)}$ = \$106,202,858/ year

***Cost Effectiveness of an ESP and Wet Scrubber***

Cost Effectiveness = Annual Cost / Annual Emissions Reductions

Cost $Effectiveness_{(ESP)}$ = (\$1,516,410/year) / (0. 0337 tons/ year)
Cost $Effectiveness_{(ESP)}$= \$44,997,329/ton of PM

Cost $Effectiveness_{(scrubber)}$= (\$106,202,858/year) / (0. 0337 tons/ year)
Cost $Effectiveness_{(scrubber)}$ = \$3,151,420,104/ton of PM

As illustrated above, neither PM control technology is a cost effective option for this source category. The cost of the ESP technology does not include costs of retrofitting equipment and/or the facility or compliance monitoring costs, which would drive the cost effectiveness up even more.

### Evaluation Findings

Even though boilers, steam generators, and process heaters greater than 5.0 MMBtu/hr are not a significant source of NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4306 and 4320 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

## C.8 RULE 4307 BOILERS, STEAM GENERATORS AND PROCESS HEATERS– 2.0 MMBTU/HR TO 5.0 MMBTU/HR

### Discussion

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.

Rule 4307 was adopted on December 15, 2005 to establish emissions limits and control requirements for these units which were previously exempt because of their smaller size. Since its adoption, the rule has been amended three times. The October 2008 amendments strengthened the rule by removing some exemptions, imposing NOx limits of 9 or 12 ppmv for new and replacement units, and adding a menu-approach for particulate matter control that also encompasses SOx controls. The rule was amended again in 2011 to specifically incorporate tree nut pasteurizers as a separate type of unit. EPA published a direct final approval of the 2011 amendments to Rule 4307 on February 12, 2015 and deemed this rule as being at least as stringent as established RACT requirements. NOx emissions have been controlled by over 84% for units in this source category.

### Source Category

Based on District permits information, there are currently 540 permitted and Permit-Exempt Equipment Registration (PEER) units subject to Rule 4307 requirements. Facilities with units subject to this rule represent a wide range of industries, including but not limited to, medical facilities, educational institutions, office buildings, prisons, military facilities, hotels, and industrial facilities.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.32 | 0.32 | 0.31 | 0.30 | 0.30 | 0.29 | 0.29 | 0.28 | 0.28 |
| **NOx** | 0.49 | 0.46 | 0.43 | 0.41 | 0.39 | 0.38 | 0.37 | 0.36 | 0.34 |
| **SOx** | 0.15 | 0.15 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.32 | 0.31 | 0.31 | 0.30 | 0.30 | 0.29 | 0.28 | 0.28 | 0.27 |
| **NOx** | 0.47 | 0.45 | 0.42 | 0.40 | 0.38 | 0.37 | 0.36 | 0.35 | 0.33 |
| **SOx** | 0.15 | 0.14 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from boilers, steam generators, and process heaters 2.0 to 5.0 MMBtu/hr are lower than the BACM/MSM significance thresholds. Therefore, the

Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for this source category.

## How does District Rule 4307 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG or NSPS requirements for this source category.

***ACT***

- EPA–453/R-93-034 (Alternative Control Techniques Document–NOx Emissions from Process Heaters)

The District evaluated the requirements contained within the ACT for NOx Emissions from Process Heaters and found no requirements that were more stringent than those already in Rule 4307.

- EPA–453/R-94-022 (Alternative Control Techniques Document–NOx Emissions from Industrial/Commercial/Institutional Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rule 4307.

- EPA–453/R-94-023 (Alternative Control Techniques Document–NOx Emissions from Utility Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rule 4307.

***NESHAP/ MACT***

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches for compliance with the PM limit. The PM limits in 40 CFR 63 Subpart DDDDD would not apply to Rule 4307 sources. Subpart DDDDD contains alternative requirements for units less than 10 MMBtu/hr and requires tuning every 2-5 years.

The District evaluated the requirements contained within 40 CFR 63 Subpart DDDDD and found no requirements that were more stringent than those already in Rule 4307.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 4307 compare to rules in other air districts?

***SCAQMD***
- Rule 1146.1 (Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within SCAQMD's Rule 1146.1 and found no requirements that were more stringent than those already in Rule 4307.

***BAAQMD***
- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4307.

- Regulation 9 Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 10 and found no requirements that were more stringent than those already in Rule 4307.

***SMAQMD***
- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4307.

***VCAPCD***
- Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within VCAPCD's Rule 74.15.1 and found no requirements that were more stringent than those already in Rule 4307.

## Additional Emission Reduction Opportunities
The District has adopted numerous rule amendments over the years for boilers that have significantly reduced emissions from units subject to Rule 4307. Most units subject to Rule 4307 are fired on Public Utilities Commission (PUC) quality natural gas, and are inherently low-emitters of SOx and PM2.5 emissions. The NOx limits implemented through Rule 4307 and its amendments will reduce emissions from over 1,000 small (2-5 MMBtu/hr) boilers in the Valley when fully implemented, including from units that were previously exempt. As a result of these regulatory efforts, the emissions inventory for NOx from these boilers has dropped from 3.81 tpd in 2005 to 0.41 tpd in

2015. Additional emissions reductions are forthcoming with existing Rule 4307 as additional compliance dates are approaching in 2016. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

**EMx as Potential Control**

The District researched post-combustion controls such as EMx, the second generation of the SCONOx technology that reduces NOx, SOx, CO, and volatile organic compound (VOC) emissions. This technology has not been achieved in practice (AIP) in the District and there is no available data that indicates that SCONOx or EMx has been installed on boilers, particularly in this size range, even though the manufacturer's website states that the technology is transferrable to industrial boilers. Based on research of the best available controls from EPA and other air districts, the SCONOx and EMx systems have only been utilized by power plants for the control of turbine emissions. In fact, cost effectiveness analyses conducted by the District for the installation of SCONOx/EMx units on large power plant turbine installations within the Valley have shown that this technology is not cost effective. Given the high cost effectiveness demonstrated for turbines and lack of demonstrated practice with boilers, this technology is not feasible or cost effective for reducing emissions from this category.

**PM2.5 Limits for Alternative Fuels**

The majority of boilers (2-5 MMBtu/hr) in the Valley combust PUC-quality natural gas; PUC natural gas contains a very low sulfur content and inherently has low emissions. Few boilers in the Valley use alternative fuels for their combustion processes. Alternative fuels include digester gas, produced gas, and liquid fuel. Units fired on digester gas or produced gas are already required to use inlet gas scrubbers to meet District rule requirements. Current rule language requires that on and after July 1, 2015 liquid fuel shall be used only during a PUC quality natural gas curtailment period provided it contains no more than 15 ppm sulfur. While the currently limited use of liquid fuel will become even more strictly limited by July 2015, the feasibility of reducing PM emissions through adding PM2.5 limits for units using liquid fuel was explored as part of the District's comprehensive control measure evaluation.

There are 24 liquid fuel fired units in the Valley (2-5 MMBtu/hr) with an average combined emissions inventory of approximately 0.00077 tons per year of total PM. The low emissions inventory is attributed to the fact that these units either utilize liquid fuel as a backup if there is a natural gas curtailment or are minimally operated units. The following three technologies were evaluated as potential control options for reducing PM emissions: baghouses, electrostatic precipitators (ESPs), and wet scrubbers. Baghouses control total PM and PM2.5 emissions by 90-99%; ESPs control total PM and PM2.5 emissions by 90-99%; and wet scrubbers control large particulates (>PM5) by 99% and PM2.5 emissions by approximately 50%.[27] However, baghouses are

[27] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from

typically not used with liquid-fired boilers due to the potential clogging of the baghouse and are therefore not a recommended technology due to infeasibility and safety issues.[28]

## PM Potential Emissions Reductions for an ESP and Scrubber

For the purposes of these calculations, the following assumptions were made:

1. For simplicity, the analysis will evaluate the cost effectiveness of these technologies for total PM reductions from liquid fuel fired units.
2. The PM control efficiency of an ESP is 99%.
3. The PM control efficiency of a scrubber is 99%.

Potential Emissions Reductions $_{(ESP)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(ESP)}$ = 0.00077 tons/year X 0.99
**Potential Emissions Reductions $_{(ESP)}$ = 0.00076 tons/ year (tpy)**

Potential Emissions Reductions $_{(scrubber)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(scrubber)}$ = 0. 00077 tons/year X 0.99
**Potential Emissions Reductions $_{(scrubber)}$ = 0.00076 tons/ year (tpy)**

## Annualized Cost of an ESP and Wet Scrubber

The capital cost for the installation of an ESP for a 1-5 MMBtu/hr boiler ranges from \$90,000 - \$100,000 and the annual maintenance cost is \$1,000-\$2,000.[29] For the wet scrubber system, EPA estimated the annualized cost at \$5,300-\$102,000 per $sm^3$/sec at an average air flow rate of 0.7- 47 $sm^3$/sec.[30] The following assumptions were made for this cost effectiveness analysis:

1. The capital cost of an ESP is assumed to be the median of the range above (\$95,000).
2. The annual maintenance cost of an ESP is assumed to be the median of the range above (\$1,500).

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http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[28] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[29] Catherine Roberts. (March 2009) *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Environmental Protection Agency Office of Air Quality Planning and Standards and Northeast States for Coordinated Air Use Management.

[30] EPA. (2002). *Air Pollution Control Technology Fact Sheet: Spray-Chamber/Spray-Tower Wet Scrubber.* Retrieved from http://www.epa.gov/ttncatc1/dir1/fsprytwr.pdf.

3. The annualized cost of a wet scrubber system is assumed to be the median of the range above ($53,650 per $sm^3$/sec).
4. The average air flow rate for a wet scrubber system is assumed to be the median of the range above (23.85 $sm^3$/sec).
5. The total capital and maintenance cost of an ESP will be calculated by multiplying the cost of 1 unit by the total number of units.
6. The total annualized cost of a wet scrubber will be calculated by multiplying the annualized cost of 1 unit by the total number of units.
7. Lifetime of the ESP is 10 years at 10% interest. To account for this, the annualized capital cost will be calculated by multiplying the total capital cost by the capital recovery factor of 0.1627 and adding the annual maintenance costs.

Annual Cost $_{(ESP)}$ = (Total Capital Cost) x (0.1627) + (Annual Maintenance Cost)
Annual Cost $_{(ESP)}$ = ($95,000 x 24) x (0.1627) + ($1,500 x 24)
**Annual Cost $_{(ESP)}$ = $406,956/year**

Annual Cost $_{(scrubber)}$ = (Annualized Cost of 1 unit) x (Number of Units) x (Average Flow Rate)
Annual Cost $_{(scrubber)}$ = ($53,650/ $sm^3$/sec) x (24) x (23.85 $sm^3$/sec)
**Annual Cost $_{(scrubber)}$ = $30,709,260/ year**

**<u>Cost Effectiveness of an ESP and Wet Scrubber</u>**

Cost Effectiveness = Annual Cost / Annual Emissions Reductions

Cost Effectiveness $_{(ESP)}$ = ($406,956/year) / (0.00076 tons/ year)
**Cost Effectiveness $_{(ESP)}$ = $535,468,421/ton of PM**

Cost Effectiveness $_{(scrubber)}$ = ($30,709,260/year) / (0.00076 tons/ year)
**Cost Effectiveness $_{(scrubber)}$ = $40,406,921,053/ton of PM**

As illustrated above, neither PM control technology is a cost effective option for this source category. The cost of the ESP technology does not include costs of retrofitting equipment and/or the facility or compliance monitoring costs, which would drive the cost effectiveness up even more.

### Evaluation Findings

Even though boilers, steam generators, and process heaters 2.0 to 5.0 MMBtu/hr are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4307 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

## C.9 RULE 4308 BOILERS, STEAM GENERATORS AND PROCESS HEATERS– 0.075 MMBTU/HR TO LESS THAN 2.0 MMBTU/HR

### Discussion

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 and carbon monoxide (CO) emissions from units within this source category. As a point of sale rule, Rule 4308 achieves emissions reductions as units subject to the rule are replaced over time. This rule has resulted in more than 93% control of emissions from this source category.

Rule 4308 was adopted on October 20, 2005 to establish NOx emissions limits for these units which were previously exempt from District regulations because of their small size. The rule was amended in December 2009 to lower the NOx emissions limits to 20 ppmv for units fired on natural gas, with the exception of instantaneous water heaters and pool heaters greater than or equal to 0.075 MMBtu/hr but less than or equal to 0.4 MMBtu/hr. In 2013, the District determined that a 20 ppmv limit was now technologically feasible and cost effective for instantaneous water heaters 0.075 MMBtu/hr to 0.4 MMBtu/hr; as such, that emission limit was lowered during the November 2013 amendment of Rule 4308. EPA published a direct final approval the 2013 amendments to Rule 4308 on February 12, 2015.

### Source Category

Units subject to Rule 4308 are used in settings including, but not limited to, apartment buildings, large homes, small businesses, commercial buildings, manufacturing facilities, government facilities, restaurants, hotels, hospitals, educational institutions, and religious organizations. Affected persons include water heater manufacturers, plumbing wholesalers, supply stores, plumbers, contractors, and end-users. This point-of-sale approach allows the District to achieve NOx emission reductions without forcing immediate replacement of existing units to comply with rule requirements and thus placing an undo financial burden on the consumer.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.61 | 0.60 | 0.59 | 0.58 | 0.57 | 0.56 | 0.55 | 0.54 | 0.53 |
| NOx | 0.92 | 0.87 | 0.82 | 0.77 | 0.74 | 0.72 | 0.70 | 0.67 | 0.65 |
| SOx | 0.28 | 0.28 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.59 | 0.58 | 0.57 | 0.56 | 0.55 | 0.54 | 0.53 | 0.52 | 0.51 |
| NOx | 0.89 | 0.84 | 0.79 | 0.74 | 0.72 | 0.69 | 0.67 | 0.65 | 0.63 |
| SOx | 0.28 | 0.27 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from these units are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for boilers, steam generators, and process heaters 0.075 to 2.0 MMBtu/hr.

## How does District Rule 4308 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTG, NSPS, NESHAP, or MACT requirements for boilers, steam generators, and process heaters of this size.

#### *ACT*

- EPA – 453/R-93-034 (Alternative Control Techniques Document—NOx Emissions from Process Heaters)

The District evaluated the requirements contained within the ACT for NOx Emissions from Process Heaters and found no requirements that were more stringent than those already in Rule 4308.

- EPA – 453/R-94-022 (Alternative Control Techniques Document—NOx Emissions from Industrial/Commercial/ Institutional Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rule 4308.

- EPA – 453/R-94-023 (Alternative Control Techniques Document—NOx Emissions from Utility Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rule 4308.

### State Regulations

There are no state regulations that apply to this source category.

## How does District Rule 4308 compare to rules in other air districts?

#### *SCAQMD*

- Rule 1146.2 (Emissions of Oxides of Nitrogen From Large Water Heaters and Small Boilers and Process Heaters)

The District evaluated the requirements contained within SCAQMD's Rule 1146.2 and found no requirements that were more stringent than those already in Rule 4308.

***BAAQMD***

- Regulation 9 Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 6 and found no requirements that were more stringent than those already in Rule 4308.

- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4308.

***SMAQMD***

- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4308.

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 Btu Per Hour)

The District evaluated the requirements contained within SMAQMD's Rule 414 and found no requirements that were more stringent than those already in Rule 4308.

***VCAPCD***

- Rule 74.11.1 (Large Water Heaters and Small Boilers)

VCAPCD Rule 74.11.1 was amended on September 11, 2012 to implement a 20 ppmv NOx emission limit for all natural gas fired units with a rated heat input of 0.075-1.0 MMBtu/hr, with the exception of pool heaters. All District units 0.075-1.0 MMBtu/hr (with the exception of pool heaters 0.075-0.4 MMBtu/hr) are currently subject to a 20 ppmv NOx emission limit. As such, there are no requirements in VCAPCD Rule 74.11.1 that are more stringent than those already in Rule 4308.

- Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)

VCAPCD Rule 74.15.1 was also amended on September 11, 2012. The amendments incorporated a 20 ppmv NOx emission limit for natural gas fired units 1-2 MMBtu/hr and other administrative recordkeeping requirements. Rule 4308 contains a 20 ppmv NOx emission limit for all natural gas fired units 1-2 MMBtu/hr so the amendments did not implement any requirements more stringent than the requirements in District Rule 4308. Therefore, there are no requirements in VCAPCD Rule 74.15.1 that are more stringent than those already in Rule 4308.

### *Placer County APCD (PCAPCD)*

- Rule 247 (Natural Gas-Fired Water Heaters, Small Boilers and Process Heaters)

PCAPCD Rule 247 was amended on February 13, 2014; however, the amendments incorporated the same emission limits contained within District Rule 4308. Therefore, there are no requirements in PCAPCD Rule 247 that are more stringent than those already in Rule 4308.

## Additional Emission Reduction Opportunities

### Mobile Home Exemption

The District evaluated the possibility of removing the exemption for water heaters used in mobile homes because multiple air districts do not exempt these sources in their analogous rules. However, because those air districts have different rule structures with regards to the size of devices regulated, District Rule 4308 requirements are as stringent as the other districts' rules.

For example, SCAQMD Rule 1146.2 does not regulate mobile home water heaters, per the definition for type 1 units, because they are subject to Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters). SCAQMD Rule 1121 regulates units less than 0.075 MMBtu/hr, which is out of the size range of District Rule 4308. Similarly, in SMAQMD Rule 414, mobile home units are regulated in the size range of units less than 0.075 MMBtu/hr. District Rule 4902 (Residential Water Heaters) applies to units less than 0.075 MMBtu/hr and currently regulates mobile home water heaters with the same emission limit contained in SCAQMD and SMAQMD rules. BAAQMD Rule Regulation 9 Rule 6 regulates all units less than 2 MMBtu/hr, essentially combining the requirements of District Rules 4308 and 4902.

In addition, after researching the size of mobile home water heaters, it was found that mobile home water heaters are not available in the 0.075-2.0 MMBtu/hr size range. Four mobile home retailers and three mobile home manufacturers were contacted to inquire about the size of mobile home water heaters. All seven contacts stated that the average size of a mobile home water heater is 30-40 gallons, whereas a 0.075 MMBtu/hr water heater is approximately 80 gallons. One manufacturer and one retailer stated that 50 gallon mobile home water heaters are available but rarely used. If the exemption for mobile home water heaters in Rule 4308 were to be removed, it would not result in any additional emissions reductions since units do not exist in this size range.

### Recreational Vehicle Exemption

The District evaluated the potential opportunity to remove the exemption for recreational vehicles (RVs). Stakeholder input indicates that there are very few units in RVs that fall under the size category subject to this rule. Most units in RVs are 12 gallons, which is significantly smaller than the 80 gallon size of a typical 0.075 MMBtu/hr unit.[31] Also, RV units are typically not used on a frequent basis and thus are small contributors to the NOx emissions of this source category. Other air districts, such as SCAQMD and BAAQMD, include this exemption in their rules. Removing this exemption would result in little to no emissions reductions because of the lack of units within this size range and the intermittent use of units in RVs.

### Evaluation Findings

Even though boilers, steam generators, and process heaters 0.075 to 2.0 MMBtu/hr are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4308 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

[31] SJVAPCD. (2009). *Final Staff Report for Amendments to Rule 4308 (Boilers, Steam Generators, and Process Heaters—0.075 MMBtu/hr to less than 2.0 MMBtu/hr)*.

## C.10 RULE 4309 DRYERS, DEHYDRATORS, AND OVENS

### Discussion

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 million British thermal units per hour (5.0 MMBtu/hr) or greater. The purpose of this rule is to limit NOx and carbon monoxide (CO) emissions from these units, which result from the combustion of fuel in the burners. The rule enforces NOx emission limits between 3.5-12 ppmv for four categories of equipment, achieving approximately 34% control of total NOx emissions.

Rule 4309 was adopted on December 15, 2005 and has not been amended. EPA finalized approval of Rule 4309 on May 30, 2007 and deemed this rule as being at least as stringent as established RACT requirements.

### Source Category

Dryers, dehydrators, and ovens are utilized in a broad range of industries. Analyses performed for the rule adoption separated the unit types into four broad industry groups: dehydrators; asphalt/concrete; milk, cheese, and other dairy processing; and other. Dryers, dehydrators, and ovens currently operate either seasonally or year-round depending on the industry and the unit's purpose within the process. There are 126 units subject to this rule, ranging in size from 5.0 MMBtu/hr to 200 MMBtu/hr.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.85 | 0.88 | 0.90 | 0.92 | 0.95 | 0.98 | 1.00 | 1.02 | 1.04 |
| NOx | 0.20 | 0.20 | 0.21 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 |
| SOx | 0.47 | 0.48 | 0.49 | 0.50 | 0.52 | 0.53 | 0.55 | 0.56 | 0.57 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.80 | 0.82 | 0.85 | 0.87 | 0.89 | 0.92 | 0.95 | 0.96 | 0.98 |
| NOx | 0.18 | 0.18 | 0.19 | 0.19 | 0.20 | 0.20 | 0.21 | 0.21 | 0.22 |
| SOx | 0.38 | 0.39 | 0.40 | 0.41 | 0.42 | 0.43 | 0.44 | 0.45 | 0.46 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from dryers, dehydrators, and ovens are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for dryers, dehydrators, and ovens.

### How does District Rule 4309 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, NSPS, NESHAP, or MACT requirements for this source category.

***Alternative Control Techniques (ACT)***

- EPA – 453/R-94-004 (Alternative Control Techniques Document–NOx Emissions from Cement Manufacturing)

The District evaluated the requirements contained within the ACT for NOx Emissions from Cement Manufacturing and found no requirements that were more stringent than those already in Rule 4309.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 4309 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***

- SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources)

The District evaluated the requirements contained within SCAQMD's Rule 1147 and found no requirements that were more stringent than those already in Rule 4309.

### Additional Emission Reduction Opportunities

The adoption of Rule 4309 has considerably reduced NOx and PM emissions from this source category. The emissions inventory for NOx from dryers, dehydrators, and ovens has dropped from 1.93 tpd in 2005 to 0.20 tpd in 2012. Although this source category had a relatively small emissions inventory prior to the adoption of Rule 4309, stakeholders have installed control equipment and modified their operations considerably to reduce emissions to ultra-low levels. Given the significant effort already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

**Asphalt Plants**
PUC-quality natural gas fuel is part of the BACT requirements for asphalt plants for the District, BAAQMD, and SCAQMD. There are currently nine asphalt plants in the Valley that do not utilize PUC-quality natural gas because some facilities are physically too far removed from natural gas lines to use natural gas. Six of these asphalt plants use LPG fuel or propane to comply with the same gaseous fuel fired limit as PUC-quality natural gas-fired facilities. The other three facilities utilize diesel gas; however, none of the facilities operate full time and their combined NOx emissions are less than 7 tons per

year. Therefore, requiring natural gas for all asphalt facilities is not a feasible opportunity that would generate significant emission reduction benefits.

The District evaluated the potential opportunity to lower the NOx emissions limits for asphalt plants from the current limits of 4.3 ppmv (gaseous fuel) and 12 ppmv (liquid fuel) to make them closer or equivalent to the BAAQMD BACT limit of 3.9 ppmv @ 19% O2. To meet this limit, operators would need to install low-NOx burners or modify existing burners to comply with lower limits; however, all of the asphalt plants have already installed new low-NOx burners or modified their units to meet the 4.3 ppmv @ 19% O2 and 12 ppmv @ 19% O2 emissions limits in Rule 4309.

Based on District permit records, a good portion of the asphalt units fired on gaseous fuel would be in compliance with a 3.9 ppmv @ 19% O2 NOx limit. However, reducing the limit to 3.9 ppmv @ 19% O2 would reduce the margin of compliance the facility has, and would make it more difficult for the facility to show continued compliance. In addition, reducing the limit from 4.3 ppmv to 3.9 ppmv would be an administrative change in nature, since it would not require any additional control equipment or changes in operating techniques or practices to comply, and it would not generate additional emissions reductions from these units.

A higher NOx limit is required for the liquid fuel fired facilities due to the characteristics of liquid fuels. In BAAQMD's BACT guideline for hot mix asphalt facilities, there is a clause that states, *"For remote locations where natural gas is not available, liquefied petroleum gas may be permitted up to 38 ppmvd NOx @ 15% O2 and fuel oil < 0.05 wt. % sulfur may be permitted up to 55 ppmvd NOx @ 15% O2."* This equates to 12.24 ppmv @ 19% O2 for liquefied petroleum gas and 17.73 ppmv @ 19% O2 for fuel oil. The District's Permits department enforces a limit of 4.3 ppmv @ 19% O2 for liquefied petroleum gas and 12 ppmv for other liquid fuels. Therefore, the District's requirements are more stringent than both limits in the BAAQMD BACT guideline.

**Dehydrators**

Rule 4309 requires dehydrators be fired on PUC-quality natural gas. The District evaluated the potential opportunity to further reduce emissions by requiring the use of low-NOx burners; however, this option is infeasible due to the potential negative effects on product quality. Additionally, enforcing the emissions limits is potentially infeasible because monitoring and source testing of dehydrators is difficult to perform, if not impossible.

**Dryers**

The District considered the potential opportunity to add a requirement for the use of dust collection devices, such as baghouses. Through the District's New Source Review Rule (Rule 2201), dust collection devices are already in place in the permit requirements for units that create PM emissions from handling the products they are drying. These facilities install baghouses or cyclones because they do not want to blow their product out of their stack. While baghouses can foster PM2.5 reductions, cyclones are generally not as effective in removing fine particulate matter.[32]

The District researched the potential installation of baghouses on dryers. However, it is technologically infeasible to install a baghouse for some of the dryers subject to Rule 4309. The purpose of a dryer is to remove moisture from a product, which means that the exhaust from dryers have a high humidity. Baghouses can have problems with high humidity exhaust streams because the bags become caked. The air stream would have to be dried somehow before entering the baghouse. As a result, this is not a feasible opportunity at this time.

The District also evaluated the possibility of removing the exemption for column dryers and dryers with no stack and one or more sides open to the atmosphere. However, compliance with the proposed limits would be difficult to determine reliably given the design of these units. Column dryers have large fans to move the warm air through the material and air escapes through screens that cover the side of the dryer. Similarly, dryers with no stack and at least one side open deal with air escape, which makes monitoring and testing emissions difficult, if not impossible. Since source testing of these types of dryers is difficult due to the fact that there is not a stack where all emissions are exhausted, this is not a technologically feasible opportunity at this time.

### Evaluation Findings

Even though dryers, dehydrators, and ovens are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4309 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from dryers, dehydrators, and ovens in the Valley.

[32] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVIXQ&bvm=bv.86956481,d.cWc.

## C.11 RULE 4311 FLARES

The purpose of Rule 4311 is to limit volatile organic compounds (VOC), NOx, and SOx emissions from any operation involving the use of flares, with the exception of a limited list of sources identified in the rule. Any unreasonable restrictions on flaring could potentially result in catastrophic consequences which may lead to explosions resulting in loss of property, injury, and potentially loss of human life.

Flaring is a high temperature oxidation process used to burn combustible components, primarily hydrocarbons, of waste gases from industrial operations, primarily for the purpose of controlling emissions and as a safety device. The majority of waste gases flared are natural gas, propane, ethylene, propylene, butadiene and butane. During combustion, gaseous hydrocarbons react with atmospheric oxygen to form carbon dioxide ($CO_2$) and water. In some waste gases, carbon monoxide (CO) is the major combustible component. In addition to serving as safety devices, the combustion of industrial gas streams in flares is also recognized as a means of reducing greenhouse gases (GHG), in line with California's AB32 GHG reduction goals and emerging federal GHG reduction goals.

Combustion efficiency depends on flame temperature, residence time in the combustion zone, vent gas flammability, auto ignition temperature, heating value, and turbulent mixing. When operated at an optimal combination of these factors, flares have a destruction efficiency of 98 percent or greater. Complete combustion converts all VOCs to $CO_2$ and water; however incomplete combustion generates air pollutants such as NOx, sulfur dioxide, carbon monoxide, and particulate matter. Additionally, there is a possibility of release of hydrocarbons if they have not been completely combusted. To prevent the creation of smoke or soot, which is influenced by fuel characteristics and the amount and distribution of oxygen in the combustion zone, most industrial flares are steam-assisted or air-assisted. In some cases, another fuel must be added to flare gas to achieve the minimum heating value of 200-250 Btu/$ft^3$ required for complete combustion.

There are two general types of flares: open and enclosed flares. Flares are further categorized by the height of the flare tip, and by the method of enhancing combustion by mixing at the flare tip (i.e., steam-assisted, air-assisted, pressure assisted, or non-assisted).

### Flaring in the San Joaquin Valley

Flares serve two basic functions: as a safety device during unforeseeable and unpreventable emergency situations/standby situations and less commonly as a primary emissions control device for VOC emissions. As safety devices, flares are necessary to prevent catastrophic consequences such as the release of toxic gases and explosions, which could result in loss of property, injury, and loss of human life. In the Valley, the vast majority of flares are employed as emergency/standby control devices, which is in direct contrast with other regions, such as North Dakota, where flares are used for primary disposal of waste gas from oil and natural gas production. Also, while regions like North Dakota utilize flares to combust associated gas during the initial extraction phase of the production process (i.e., directly from the well), Valley flares are typically used further down the process chain, primarily as a safety device associated with gas collection systems, resulting in far lower quantities of flared gas.

Valley operators have generally evaluated all feasible and cost effective options for handling and disposing of the associated/waste gases generated by their facilities and installing a flare as the primary method of disposal would be the last resort. In addition to Rule 4311 requirements to evaluate and implement all feasible measures to reduce flaring activities, other associated rules also implement stringent capture and control of these gases. Therefore, most facilities have made significant investments to capture and utilize these process gases in a variety of methods and this ability has allowed facilities to maximize income generation. Some capture and treat these gases and sell them to natural gas/utility providers (generates monetary income), while others utilize these gases on-site to fuel equipment that generates electricity and/or provides process heating (saves fuel costs). In fact, most Valley facilities regard flaring events as a significant monetary cost, through directly lost profit or increased fuel costs.

In the District's evaluation of Valley flaring activity,[33] nearly all of the flaring events were either one-time events due to new control equipment installation or maintenance of existing equipment, and therefore not repeated, or in response to emergency situations or process upsets. For example, one Valley facility (light oil production facility) experienced abnormally high flaring because the sales transmission pipeline was offline for repairs, an event beyond their control. Another facility (wastewater treatment plant) normally uses the fuel onsite to produce electricity and process heating, but could not do so because additional air pollution control devices were being installed.

Flares in the Valley subject to the requirements in Rule 4311 are employed by a diverse group of industries for a wide variety of applications, as illustrated by the below list. In contrast, other air districts' flare rules generally limit the applicability of their rules to petroleum production facilities or refineries.

- Gas plants
- Heavy oil production/ thermally enhanced oil recovery
- Light oil production
- Refinery operations
- Wastewater treatment plants
- Cheese production
- Wine
- Dairy operations
- Flat glass production
- Correctional facility

[33] SJVAPCD. (2014). *Rule 4311 (Flares) Further Study*. Retrieved February 3, 2015 from: http://valleyair.org/Air_Quality_Plans/docs/R4311.pdf.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.17 | 0.17 |
| NOx | 0.56 | 0.56 | 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.54 | 0.54 |
| SOx | 0.33 | 0.33 | 0.33 | 0.33 | 0.32 | 0.32 | 0.33 | 0.32 | 0.32 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.17 | 0.17 |
| NOx | 0.56 | 0.56 | 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.54 | 0.54 |
| SOx | 0.33 | 0.33 | 0.33 | 0.33 | 0.32 | 0.32 | 0.33 | 0.32 | 0.32 |

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from flares are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for Rule 4311.

## Valley Flaring Activity Compared to Other Regions

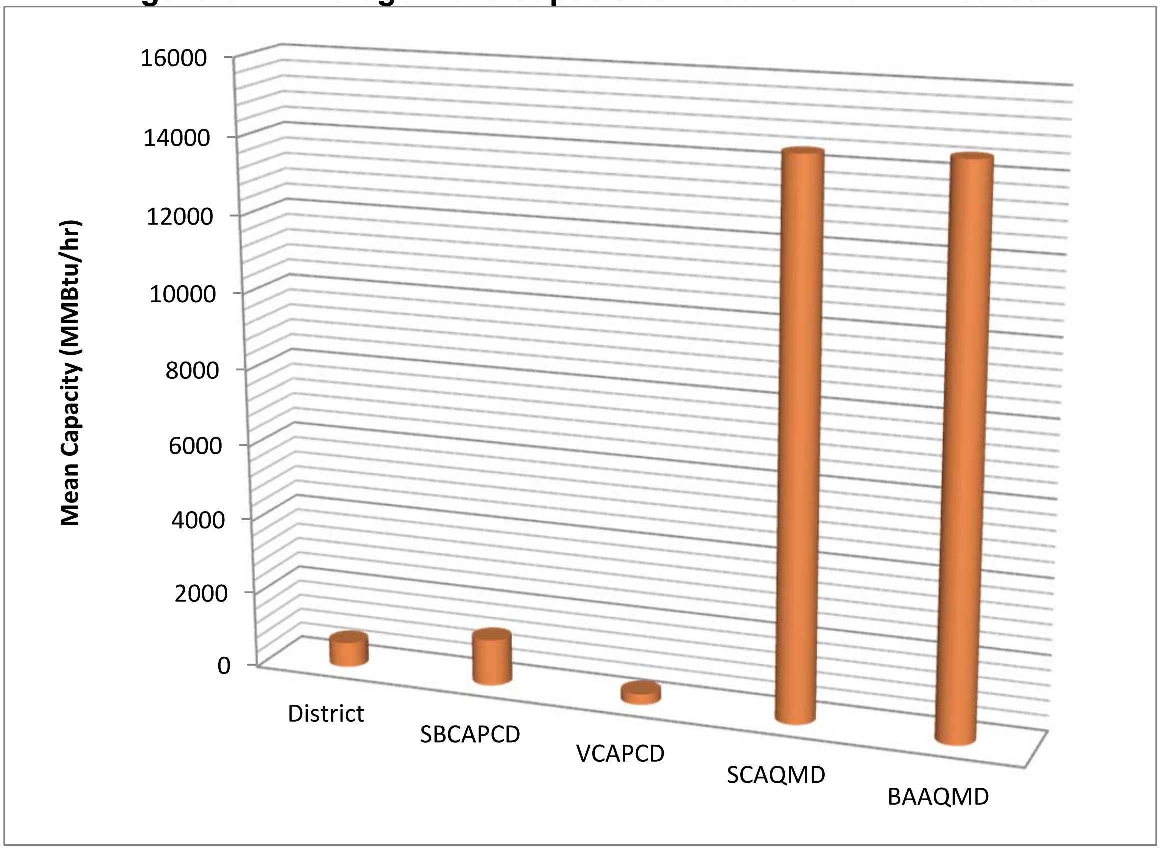
Flares in the Valley and other air districts are primarily engineered for emergency operation during process upsets and emergency situations. Given this use, any unreasonable restrictions on flaring could potentially result in catastrophic consequences which may lead to explosions resulting in loss of property, injury and potentially loss of human life. While flares can be used during maintenance, new equipment installations, and startup/shut-down, the main concern is safety. In this regard, Valley flares are similar to those in other districts, the difference being that facilities in SCAQMD, BAAQMD, and SBCAPCD are much larger. The facilities in those districts are mostly operated at massive oil and gas refineries, with significantly higher throughputs than those in the Valley. Temperatures and pressures are higher, cracking occurs regularly, and the flares must be engineered to control emergencies and process upsets on a larger scale. Flare gas is typically sent to a flare header, where it is distributed to multiple large flares. The flares at these facilities are much larger in physical size, as well as capacity, as shown in the table below.

**Table C-2 Comparison of Flaring Capacity for Flares in California Air Districts**

| Air District | Total Flares | Median (MMBtu/hr) | Mean (MMBtu/hr) | Largest (MMBtu/hr) |
|---|---|---|---|---|
| SJVAPCD | 235 | 33 | 663 | 40,000 |
| SCAQMD | 29 | 10,234 | 14,328 | 72,751 |
| BAAQMD | 23 | 108 | 14,442 | 246,612 |
| VCAPCD | 55 | 34 | 284 | 7,100 |
| SBCAPCD | 75 | 17 | 1,242 | 18,200 |

Flaring capacities of the flares in the SCAQMD, BAAQMD, and SBCAPCD are all significantly higher than the flaring capacities of flares in the Valley, while those in VCAPCD are similar size to Valley flares. Flares in BAAQMD have a wide range of capacities, while those in SCAQMD are all greater than 1,000 MMBtu/hr. The figure below shows the average capacity of flares in the District, SCAQMD, BAAQMD, VCAPCD, and SBCAPCD.

**Figure C-4 Average Flare Capacities in California Air Districts**




With roughly ten times the number of flares, the Valley has total NOx emissions from flares that are less than BAAQMD and less than half of SCAQMD, as illustrated in the emission inventory tables below. The flaring data in the tables below is compiled from all flaring activities in each air district's jurisdiction and is provided in the ARB-maintained 2012 CEPAM: NORCAL 2012 PM2.5 SIP Baseline Emission Projection Tool.

**Table C-3 NOx Emissions Inventories for Flares in California Air Districts (tpd)**

| Air District | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| SJVAPCD | 0.57 | 0.57 | 0.57 | 0.56 | 0.56 | 0.55 | 0.55 | 0.55 |
| SCAQMD | 1.19 | 1.20 | 1.20 | 1.21 | 1.22 | 1.22 | 1.23 | 1.23 |
| BAAQMD | 0.64 | 0.64 | 0.64 | 0.64 | 0.64 | 0.64 | 0.64 | 0.65 |
| VCAPCD | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.13 | 0.13 | 0.13 |
| SBCAPCD | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |

**Table C-4 VOC Emissions Inventories for Flares in California Air Districts (tpd)**

| Air District | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| SJVAPCD | 0.27 | 0.27 | 0.27 | 0.26 | 0.26 | 0.26 | 0.26 | 0.25 |
| SCAQMD | 0.40 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| BAAQMD | 1.32 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 |
| VCAPCD | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| SBCAPCD | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |

**Table C-5 SOx Emissions Inventories for Flares in California Air Districts (tpd)**

| Air District | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| SJVAPCD | 0.34 | 0.34 | 0.34 | 0.34 | 0.33 | 0.33 | 0.33 | 0.33 |
| SCAQMD | 3.27 | 3.27 | 3.27 | 3.27 | 3.28 | 3.28 | 3.28 | 3.28 |
| BAAQMD | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 |
| VCAPCD | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| SBCAPCD | 0.18 | 0.17 | 0.17 | 0.17 | 0.16 | 0.16 | 0.16 | 0.15 |

In summary:

- Emissions in SCAQMD, BAAQMD, and SBCAPCD are much higher per flare than in the Valley;
- Valley facilities flare a far lower volume;
- Each facility contributes only a small fraction of emissions;
- Emissions are effectively controlled at these facilities; and
- Flaring is necessary for safety.

To supplement the discussion found later in this chapter comparing North Dakota Century Code 38-08-06.4 to District Rule 4311, the District examined flaring in North Dakota. Research indicates that North Dakota has become the second largest producer of oil in the United States, behind Texas. The recent boom in oil production has led to far greater production, without the infrastructure and regulation to support emissions control. Oil production facilities in North Dakota have focused on expanding oil production by opening new wells, and as a consequence have not invested in the installation of onsite cogeneration equipment or sales transmission pipelines. The result has been the flaring off of approximately 29% of all natural gas produced in North Dakota[34], compared to approximately 3.8% in the Valley (as shown in the table below).

## Rule 4311 Regulatory Background

Rule 4311 was adopted in June 2002 to establish flaring requirements and reduce emissions from flares. Amendments were adopted on June 15, 2006 and June 18, 2009. The September 2009 amendment incorporated requirements for flare minimization plans and increased the stringency of existing requirements for sulfur emissions. 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.[35] On January 10, 2012 EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* and deemed this rule as still being at least as stringent as established RACT requirements.[36]

**Rule 4311 Components**

Rule 4311 applies to all operations involving the use of flares. Exemptions include flares operated in municipal solid waste landfills subject to the requirements of Rule 4642, flares subject to the requirements of 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Waste Landfills) or Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills), and except for recordkeeping requirements, any stationary source that does not have the potential to emit at least ten tons per year of VOC and NOx (non-major sources).

Of the 235 flares operating in the Valley, 126 are exempt from Rule 4311 requirements other than basic recordkeeping due to one of the following reasons:

- The flare is not part of a major source - 60 flares
- The flare is subject to other rules regulating landfills – 27 flares
- The flare is not stationary (i.e. transportable units) – 39 flares

Of the flares exempt from Rule 4311 requirements (other than record keeping), over 90% flaring activity is associated with landfills that utilize flares as part of their federally mandated gas collection systems. These flares are already required to meet strict local and federal requirements through 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Solid Waste Landfills), or Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills) and District Rule 4642 (Solid Waste Disposal Sites). Rule 4642 applies to any solid waste disposal sites which have a gas collection system and/or control device in operation or undergoing maintenance or repair. Major requirements include:

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[34] Scientific American. (2013, September 12). *North Dakota flared off $1 billion worth of natural gas last year*. Retrieved February 14, 2015 from http://blogs.scientificamerican.com/plugged-in/2013/09/12/north-dakota-flared-off-1-billion-worth-of-natural-gas-last-year/.

[35] EPA. (2011, November 3). 76 FR 68106. Retrieved April 4, 2014 from http://www.gpo.gov/fdsys/pkg/FR-2011-11-03/pdf/2011-28391.pdf

[36] EPA. (2012, January 10). 77 FR 1417. Retrieved April 4, 2014 from http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf

- For gas collection system: operate so that TOC concentrations do not exceed 1000 ppmv at any point on the surface of the solid waste disposal site or along the gas transfer path of the gas collection system; install sampling ports on each well head; operate in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system; control by a control device that meet the control device requirements.
- For a control device: achieve a VOC destruction efficiency of at least 98% by weight, or reduce the VOC concentration to 20 ppmv or less; for those that have an Authority to Construct (ATC) permit issued prior to July 20, 1995, achieve a destruction efficiency of at least 90% by weight or reduce the VOC concentration to 20 ppmv; operate enclosed flares in accordance with 40 CFR 60.756(b) and 40 CFR 60.18 and open flares in accordance with 40 CFR 60.756(c) and 40 CFR 60.18.
- During maintenance, notify the APCO 24 hours in advance, minimize the emissions during shutdown, and prevent shut down for more than 144 cumulative hours in any calendar year.
- Other requirements not applicable to flares.

In addition to Rule 4311 requirements, any new flares are subject to New Source Review (NSR) requirements (District Rule 2201) including Best Available Control Technology (BACT) requirements, meaning they may be required to implement even more stringent controls regardless of whether they are subject to Rule 4311. All sources must obtain an ATC permit before they are operated.

Rule 4311 includes the following major requirements (described in more detail in the following sections):

- Operation requirements that ensure the flare is achieving maximum destruction efficiency
- Operation of measurement and monitoring devices to ensure all requirements are being met
- VOC and NOx emission limits for ground-level enclosed flares
- Flare minimization plans
- Petroleum refinery SO2 performance targets
- Extensive recordkeeping requirements including annual monitoring reports and reportable flaring event reports

**Operation Requirements**

General requirements for flare operation include:

- Maintain a flame at all times when combustible gases are vented through the flare
- Equip the outlet with an automatic ignition system, or operate with a pilot flame present at all times when combustible gases are vented through the flare, except during purge periods for automatic-ignition equipment flares
- Except for flares equipped with a flow-sensing ignition system, install and operate a heat sensing device such as a thermocouple, ultraviolet beam sensor, infrared

sensor, or an alternative equivalent device, capable of continuously detecting at least one pilot flame or the flare

- Use purge gas for purging flares that use flow-sensing automatic ignition systems and that do not use a continuous flame pilot
- For open flares (air-assisted, steam-assisted, or non-assisted) in which the flare gas pressure is less than 5 psig, operate the flare pursuant to 40 CFR 60.18

**Emission Limits**

Emission reductions are obtained directly by requiring ground-level enclosed flares to meet the following emission standards for VOC and NOx:

**Table C-6 Rule 4311 Emission Limits for Ground-level Enclosed Flares**

| Type of Flare and Heat Release Rate in MMBtu/hr | VOC (lb/MMBtu) | NOx (lb/MMBtu) |
|---|---|---|
| Without Steam-assist | | |
| <10 MMBtu | 0.0051 | 0.0952 |
| 10-100 MMBtu | 0.0027 | 0.1330 |
| >100 MMBtu | 0.0013 | 0.5240 |
| With Steam-assist | | |
| All | 0.14 as TOG | 0.068 |

**Flare Minimization Plans**

Rule 4311 requires a Flare Minimization Plan (FMP) to be submitted to and approved by the District for any petroleum refinery with a flare or any flare with a flaring capacity greater than or equal to 5.0 MMBtu/hr. The rule prohibits facilities subject to FMP requirements from flaring unless it is consistent with a District-approved FMP and all commitments in that FMP have been met. FMPs must include all necessary information to satisfy the underlying regulatory requirements, and must be submitted to the District for approval. In addition to their initial submittal, FMPs must be modified prior to making any modifications to related equipment or processes, and at least every five years. FMPs are required to include the following:

- Description and technical specifications for each flare and associated knock-out pots, surge drums, water seals, and flare gas recovery systems
- Process flow diagrams of upstream equipment and process units venting to each flare (with identification of type and location of control equipment)
- Description of equipment, processes, or procedures the operator plans to install or implement to eliminate or minimize flaring, and planned date of installation or implementation
- Evaluation of prevention measures to reduce flaring that has occurred or may be expected to occur during planned major maintenance activities, including startup and shutdown

- Evaluation of preventative measures to reduce flaring that may be expected to occur due to issues of gas quantity and quality. This includes an audit of vent gas recovery capacity of each flare system, storage capacity for excess vent gas, and scrubbing capacity available for vent gas for use as a fuel; and shall determine the feasibility of reducing flaring through the recovery, treatment, and use of the gas
- Evaluation of preventative measures to reduce flaring caused by the recurrent failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Evaluation shall determine adequacy of existing maintenance schedules and protocols for such equipment. A failure is recurrent if it occurs more than twice during any five year period as a result of the same cause.

Of the 109 facilities subject to Rule 4311 requirements, 14 do not have a flaring capacity of at least 5.0 MMBtu/hr and are not operated at a petroleum refinery and are therefore not subject to FMP requirements. The remaining 95 are subject to FMP requirements. FMP submittals by facility type are summarized in the below table.

**Table C-7 Submitted FMPs Summarized by Industry**

| Industry Summary | Qty |
|---|---|
| **Cheese production** | 1 |
| **Wine** | 2 |
| **Correctional Facility** | 1 |
| **Oil and natural gas production, processing, and transmission** | 76 |
| **Petroleum refinery** | 7 |
| **Dairy** | 1 |
| **Flat glass** | 1 |
| **Wastewater** | 6 |
| **Total** | 95 |

Actions identified in the FMPs are typically dependent on the facility and operation type, as well as the quality of gas being flared. Similarly, the feasibility of potential control options is highly dependent on the same factors. The following table is a sample of measures committed to in FMPs submitted to the District:

**Table C-8 Sample FMP Measures by Facility Type**

| Facility Category | Actions Identified in FMP to Minimize Flaring* |
|---|---|
| **Oil and Gas Production and Transmission** | Include permit limit on gas flared daily and annually<br><br>Streamline startup, shutdown, and maintenance procedures to minimize equipment downtime, thereby minimizing flaring<br><br>Hydrogen sulfide scrubbing of flare gases to condition for sale<br><br>Inject flare gas in DOGGR-approved wells<br><br>Use other combustion devices (and offset the need for other natural gas fuel sources) such as glycol re-boiler/thermal oxidizer |
| **Wastewater Treatment/ Reclamation** | Install new equipment to combust digester gas in internal combustion engines, fuel cells, and process heaters<br><br>Install equipment to allow digester gas storage and conditioning for greater use in turbines (additional storage is minimal and only capable of handling excess gas during minor process upsets) |
| **Wine Production** | Burn flare gas in steam generation boilers; coordinate plant operations that generate the flare gas with production operations requiring steam |
| **Cheese Production** | Modify boiler to combust a natural gas/digester gas blend |
| **Flat Glass Manufacturing** | Reduce idle time during calibration and purge test to reduce necessary flaring |
| **Dairy Farming** | Install additional gensets (electricity generation equipment located near the end user) to combust more produced biogas |

Many of the above measures are not feasible for all facilities. For oil and gas production, the flare gas produced is often in excess of what could be used onsite to power equipment. For these facilities, flares are generally used only under abnormal conditions, as the flare gas is usually high enough quality to sell for use at other facilities.

For facilities other than oil and gas production, the gas produced is usually a much lower heating value and requires conditioning if combusted for electrical generation or process heating. Expensive modifications or new equipment is often required to allow said combustion activities and the flare gas is sometimes of too low quality or quantity to make these installations cost effective. Additionally, emissions from other combustion devices would likely be higher because flares are inherently low emitting and serve as combustion control devices.

Of the 95 flares required to submit FMPs, 92 are standby flares or emergency flares that are only utilized when needed such as during maintenance or to dispose of excess flare gas or during emergencies. Only the remaining 3 flares in the Valley are permitted to be used as primary disposal devices. Two of the three flares are used at an oil and natural gas production facility as strictly an emissions control device for vapors displaced from trucks only during load-out operations pursuant to requirements in District Rule 2201 (New and Modified Stationary Source Review Rule). The third flare is used at a cheese making facility as an emissions control device for gases generated at the wastewater anaerobic digester at the facility. As a component of their submitted FMP, this cheese making facility has committed to modify an on-site boiler to combust a natural gas/digester gas as a means of reducing current flaring activity.

**Petroleum Refinery SO2 Performance Targets**
Operators of petroleum refineries are required to minimize SO2 emissions to less than 1.5 tons per million barrels of crude processing capacity. Starting January 1, 2017, operators of petroleum refineries will be required to lower this target to 0.5 tons SO2 per million barrels of crude processing capacity.

**Annual Monitoring Reports**
Rule 4311 also requires the operator of any petroleum refinery flare or any flare with a flaring capacity equal to or greater than 50 MMBtu/hr to submit an Annual Monitoring Report (AMR) to the District no later than July 31$^{st}$ of each calendar year, containing the following information:

- Total volumetric flow of vent gas
- Hydrogen sulfide content, methane content, and hydrocarbon content of vent gas
- If vent gas composition is monitored by a continuous analyzer: average total hydrocarbon content by volume, average methane content by volume, and depending upon the analytical method used, total reduced sulfur content by volume or hydrogen sulfide content by volume of vent gas flared for each hour of the month
- If the flow monitor measures molecular weight, the average molecular weight for each hour of each month
- For any pilot and purge gas used, the type of gas used, the volumetric flow for each day and for each month, and the means used to determine flow
- Flare monitoring system downtime periods, including dates and times
- For each day and each month provide calculated sulfur dioxide emissions
- A flow verification report for each flare

Of the facilities subject to FMP requirements, 40 are not required to submit annual monitoring reports. Some of these facilities are too small or do not utilize their flares, but the majority have accepted specific limiting conditions on their permits to operate that limit the amount of flaring the facility can conduct to less than the threshold for reportable flaring events. The remaining 55 facilities are therefore subject to AMR requirements. Of these 55 flares, only one is used as a primary disposal device, one is dormant, and eleven are designated for emergency use only. The remaining flares are standby flares.

Information from the AMRs has allowed the District to evaluate the total amount of vent gases combusted and their compositions and increased understanding of flaring activities in the Valley. This information in turn allows the District to calculate the amounts of emissions from reported flaring and compare those values to verify the accuracy of the emissions inventory for flares.

**Reportable Flaring Events**

Rule 4311 requires annual reports to be submitted each year summarizing all reportable flaring events. A flaring event is considered a reportable flaring event if more than 500,000 standard cubic feet (scf) of vent gas is flared per calendar day, or where sulfur oxide emissions are greater than 500 pounds per calendar day. Assuming an estimated heating value for flare gas of 1,000 Btu/scf, a flare must have a capacity greater than or equal to 20.8 MMBtu/hr to achieve a reportable flaring event, although most flares commonly operate at a small fraction of maximum capacity. Additionally, some low quality waste gases can have heating values of 200-300 Btu/scf, which would lower the minimum capacity for reportable flaring events. Reportable flaring event requirements are applicable to the operator of a flare subject to FMP requirements with the exception of flares that the operator can verify are not capable of producing reportable flaring events.

The reports are required to include at least the following:

- The results of an investigation to determine the primary cause and contributing factors of the flaring event
- Any prevention measures considered or implemented to prevent recurrence together with a justification for rejecting any measures that were considered but not implemented
- If appropriate, an explanation of why the flaring was an emergency and necessary to prevent accident, hazard or release of vent gas to the atmosphere, or where, due to a regulatory mandate to vent a flare, it cannot be recovered, treated, and used as a fuel at the facility
- The date, time, and duration of the flaring event

The majority of reportable flaring events are planned—thereby allowing for greater preparation and control—for repair, maintenance, or new equipment installations, including new air pollution control devices. Most of the events are one-time events. Of the gas flared, less than 20% is salable quality, lending support to the fact that facilities sell flare gas when feasible.

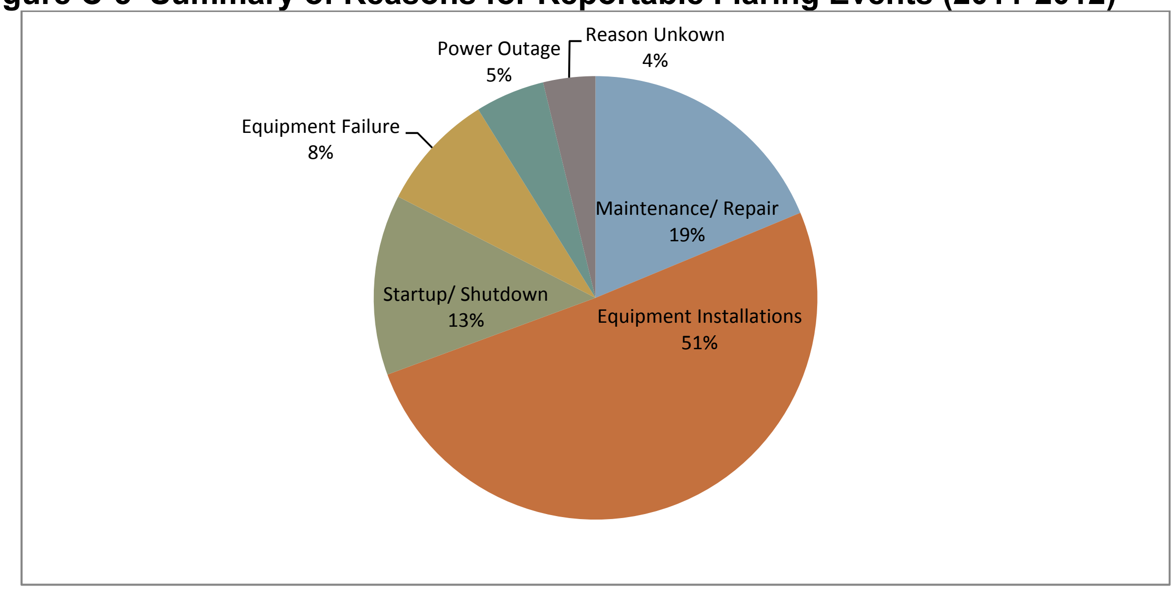
Of the 109 flares subject to Rule 4311, 21 flares generated 395 reportable flaring events during the 2011-2012 period. This period is a conservative reflection of potential reporting flaring event activity in the Valley given the unusually high number of events reported by a single facility (described in more detail below). The table below summarizes these events by facility type.

**Table C-9 Summary of Total Reportable Flaring Events from 2011-2012 Period**

| Industry Summary | Qty of Flares | Reportable Flare Events – Total (MMscf) |
|---|---|---|
| **Crude Oil and natural gas production** | 3 | 27.8 |
| **Gas plant** | 2 | 12.0 |
| **Light oil production** | 3 | 7.7 |
| **Natural gas processing and production** | 5 | 42.8 |
| **Oil and natural gas production** | 4 | 52.5 |
| **Petroleum and NG production** | 1 | 20.9 |
| **Petroleum refining** | 2 | 59.4 |
| **Wastewater reclamation facility** | 1 | 124.2 |
| **Total** | 21 | 347.4 |

The following graph illustrates the fact that the majority of flaring events are for equipment installations, maintenance, and repair.

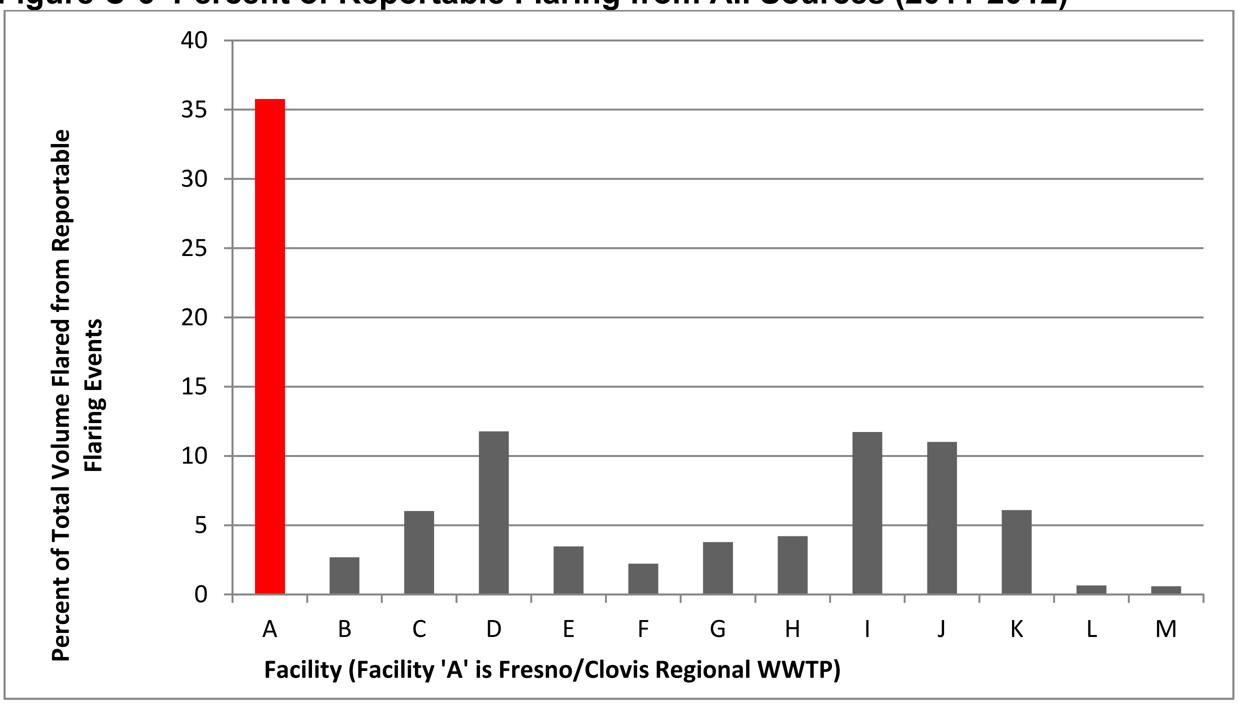
**Figure C-5 Summary of Reasons for Reportable Flaring Events (2011-2012)**




During this period, the largest percent of all gas flared during reportable flaring events was by a single wastewater treatment plant. According to the District-approved FMP for this facility, digester gas is utilized to create electricity and provide heat for the digesters (and offset the combustion of pipeline natural gas). The WWTP uses two 3.4 MW turbine engines and one 16.7 MMBtu/hr process boiler that are almost completely fueled by digester gas. Because there is no significant gas storage capacity, any excess digester gas or gas produced during interruptions to the turbines or boiler must be flared to avoid direct emissions to the atmosphere or potential gas build-up leading to explosions at the plant. To fulfill commitments in the FMP, the facility installed a small digester gas storage tank, installed additional digester gas conditioning, and increased the allowable digester gas fuel for the turbines from 50% to 100%. The storage tank is capable of holding gas for small periods, such as during switchover between turbines, and the gas conditioning allows the use of selective catalytic reduction (SCR) on the turbines. The addition of this equipment has resulted in a 71% reduction in the volume of gas flared by the WWTP; however, during the 2011-2012 reporting period the facility experienced abnormally high flaring activity. During this period, the turbines were out of service to allow installation of SCR control devices for reducing over 90% of NOx emissions from the turbines pursuant to District Rule 4703 (Stationary Gas Turbines) and permitted emission limits. As a result, a large portion of the digester gas was flared. Out of the 395 total reportable flaring events in the Valley during the 2011-2012 reporting period, 164 occurred at the WWTP. Those events accounted for 36% of the total volume of gas flared during reportable events, more than three times the next highest volume at any facility. By contrast, the 2012-2013 reporting period showed only 46 reportable flaring events at this facility, all of which were for regular activities except one due to failure of a turbine. Because the majority of flaring events during the 2011-2012 reporting period were due to installations and are therefore one-time events, they are not part of normal facility operations.

The following graph illustrates the percentages of gas flared from all sources during reportable flaring events for the 2011-2012 period.

**Figure C-6 Percent of Reportable Flaring from All Sources (2011-2012)**




## Comparison of Rule 4311 to State, Federal, and Local Regulations

**Comparison of Rule 4311 to Federal Regulations**
There are no EPA CTG or ACT requirements for this source category.

The following federal regulations apply to Rule 4311 sources:

- NESHAP/MACT:
  - 40 CFR 63 Subpart SS (National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process)
- NSPS:
  - 40 CFR 60.18 (General Control Device and Work Practice Requirements)
  - 40 CFR 65.147 (Flares)
  - 40 CFR 60 Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution)
  - 40 CFR 60 Subpart Ja (Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007)

Rule 4311 is as stringent as or more stringent than the above NSPS and NESHAP requirements. The most recently amended NSPS (40 CFR 60 Subpart OOOO and 40 CFR 60 Subpart Ja) are discussed below.

40 CFR 60 Subpart OOOO is a new NSPS requirement that was finalized by EPA on August 16, 2012. This NSPS may indirectly affect some Valley 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.

Affected facilities under this subpart that may use flares as an approved control device include centrifugal compressors, storage vessels, and onshore natural gas processing plants. If the facility chooses to meet the control requirements, then the flare must be designed and operated in accordance with §60.18(b) and must conduct the compliance determination using Method 22 at 40 CFR part 60, appendix A-7, to determine visible emissions. §60.18(b) was last amended on December 22, 2008, which is before the last amendment for District Rule 4311 (June 18, 2009). The requirements of the 2008 amendments were closely evaluated during the District's 2009 Rule amendment. EPA deemed Rule 4311 as being at least as stringent as established RACT requirements on January 10, 2012.[37] Since Subpart OOOO has no new requirements for flares after the 2012 EPA RACT approval, Rule 4311 continues to be at least as stringent as these requirements.

40 CFR 60 Subpart Ja was amended by EPA on September 12, 2012. Amendments clarified existing requirements and applicability, including what constitutes a flare modification, clarification of secondary flares, and clarification of the records that must be maintained by the operator. EPA also added new requirements to Subpart Ja as part of these amendments, including flare related unit and process descriptions, assessments, and evaluations; analyses of causes and corrective actions for reportable flaring events; and sulfur limits for petroleum refineries.

[37] EPA. (2012, January 10). 77 FR 1417. Retrieved 2/11/15 from http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf.

Subpart Ja did not implement more stringent requirements than District Rule 4311. Subpart Ja has one new exemption for continuous monitoring, which allows for fewer requirements than previously required in the NSPS, and therefore, is not more stringent than current rule language. While there may be some minor differences in terminology or requirements making direct comparisons not possible, the same level of controls and emission reductions are achieved through District regulations as through this NSPS. Additionally, the District's Permit Services Department continuously evaluates NSPS on a case-by-case basis to ensure the relevant flares comply with all federal requirements as they are promulgated. Rule 4311 is as stringent as, if not more stringent than, this NSPS.

As demonstrated by the discussion above, Rule 4311 is as stringent as or more stringent than the applicable federal regulations.

**Comparison to State Regulations**
There are no state rules or regulations that apply to this source category.

**Comparison to Regulations in other Air Districts**
As previously stated, EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in other air districts in California (76 FR 68106); however, in keeping with the methodology of this plan, the District conducted a thorough examination of rules in other air districts, including the following:

- SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)
- BAAQMD:
    - o Regulation 12 Rule 11 (Flare Monitoring at Petroleum Refineries)
    - o Regulation 12 Rule 12 (Flares at Petroleum Refineries)
- SMAQMD and VCAPCD do not have an analogous rule for this source category.

The District also conducted an exhaustive search for rules in all other air districts, including those outside of California, to identify any that might contain more stringent requirements. While Rule 4311 is as stringent as or more stringent than any rules in the nation, the District prepared comparisons to Santa Barbara County Air Pollution Control District (SBCAPCD) Rule 359 and North Dakota Century Code 38-08-06.4. The North Dakota rule is not included in the comparison table below because it does not contain most of the core requirements of California air district flare regulations. The following table compares major elements of Rule 4311 with those in other California air districts.

**Table C-10 Summary of Rule Requirement Comparisons**

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| **DATES OF ADOPTION/ AMENDMENT** | | | | | |
| Adopted Jun 20, 2002; Amended Jun 15, 2006; Jun 18, 2009 | Adopted Feb 13, 1998; Amended Nov 4, 2005 | Adopted Jun 4, 2003 | Adopted Jul 20, 2005 | Adopted Jul, 1968; Revised Oct 1968; Jun 1969; May | Adopted Jun 28, 1994 |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| | | | | 1972; Jul 1983; Jun 1994 | |
| **APPLICABILITY** | | | | | |
| All flares | Flares used at:<br>• Petroleum (petro.) refineries<br>• Sulfur recovery plants<br>• Hydrogen production plants | Flares used at petro. refineries | Flares used at petro. refineries | Any person who discharges sulfur compounds from any source | Flares and thermal oxidizers used at:<br>• Oil and gas production<br>• Petro. refinery<br>• Natural gas services and transportation<br>• Wholesale trade in petro./petro. products |
| **EXEMPTIONS** | | | | | |
| • Municipal solid waste landfill flares subject to Rule 4642<br>• Flares subject to 40 CFR 60 WWW or Cc<br>• Stationary sources w/ potential to emit <10 tons VOC and <10 tons NOx per year<br><br>(Not exempt from recordkeeping) | Exempt from sampling and analyses for higher heating values and sulfur concentration for flare event that:<br>• Results from catastrophic event<br>• Is safety hazard to sampling personnel;<br><br>Sulfur dioxide ($SO_2$) emissions (emissions) from flaring events caused by:<br>• External power curtailment beyond operator's control<br>• Natural disasters<br>• Acts of war or terrorism<br><br>(Not exempt from flare monitoring system requirements) | Flares and thermal oxidizers used for:<br>• Emissions from organic liquid storage vessels (subj. to R. 8-5)<br>• Emissions from loading racks (subj. to R. 8-6, 8-33, or 8-39)<br>• Emissions from marine vessel loading terminals (subj. to R. 8-44)<br><br>Thermal oxidizers used for:<br>• Emissions from wastewater treatment systems (subj. to R. 8-8)<br>• Emissions from pump seals (subj. to R. 8-18) (except when emissions from pump | Same as Rule 11 (except last exemption on list) | Sulfur emission limit and avg. concentration limit don't apply to:<br><br>Unplanned flaring for emergency or safety if:<br>• Not result of intentional or negligent act, omission, improper maintenance or setting of shut-in sensors<br>• Results from operational problems (emergency blowdowns, process upsets, power outages, equipment breakdown)<br>• Records of event kept<br>• corrective measures immediately taken<br>• Event lasts <24 hr.<br>• Notify <4 hr. after | Burning of sulfur, hydrogen sulfide, acid sludge, or other sulfur compounds in manufacturing of sulfur or sulfur compounds<br><br>For oil and gas sources that recover sulfur as by-product of gas treating/sweetening, manufacturing exemption applies only to those specific processes<br><br>(Except technology-based std.) Burning gas w/ net heating value <300 Btu/scf if fuel used to incinerate gas has sulfur compounds:<br>• <15 grain/100 ft3 in Southern Zone<br>• <50 grain/100 ft3 in Northern Zone<br><br>Flare and thermal oxidizer units rated ≤1.7 MMBtu/hr., unless total cumulative rating of all such units at a source is ≥5 MMBtu/hr. (Not exempt from sulfur |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| | | are routed to flare header)<br><br>Monitoring and reporting total hydrocarbon (HC) or methane composition doesn't apply to flare that burns flexicoker gas if weekly sampling shows methane/non-methane content of vent gas flared is <2%/<1% by volume | | detection and submit report if event >1 hr.<br><br>Planned flaring if:<br>• Notice submitted >72 hr. in advance, justifying work (reasons and steps to minimize sulfur emissions)<br>• Notice can be submitted <72 hr. if hazardous situation, economic harm, or excess emissions<br>• Submit planned flaring mgmt. plan<br>• Records kept 2 yrs.<br>• District notified when work complete<br>• Sulfur emissions are minimized<br>• Excess emissions fee paid to District each year ($5.00/lb. SO2 emitted) | content std., technology std., monitoring, recordkeeping, and recording.)<br><br>Flares and thermal oxidizers exempt from FMP:<br>• Rated at <15 MMBtu/hr, unless cumulative rating >50 MMBtu/hr.<br>• Operations of only planned, continuous flaring due to non-availability of a produced gas pipeline outlet |
| **FLARE MINIMIZATION PLAN (FMP) REQUIREMENTS** | | | | | |
| FMP requirements don't apply if flaring caused by emergency and necessary to prevent accident, hazard or release of vent gas directly to the | Owner/operator of petro. refinery exceeding performance targets submit FMP:<br>• <90 days from end of year w/ emissions | None | FMP required for flares subject to rule and 3-month status reports required until FMP completed:<br>• Technical | Each operator submits a planned flaring management plan:<br>• Measures to decrease FG volume and reduce sulfur | Sources subject to rule and flares and thermal oxidizers rated at ≥15 MMBtu/hr submit FMP:<br>• Planned flaring: targeted max monthly FG volume |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| atmosphere<br><br>FMP required for petro. refinery flare or any flare w/ capacity ≥5.0 MMBtu/hr.:<br>• Technical specs for each flare, knock-out pots, surge drum, water seal, and flare gas (FG) recovery system<br>• Process flow diagrams of upstream equipment and process units venting to each flare<br>• Equipment, processes, or procedures planned to install or implement to minimize flaring and planned date<br>• Evaluations of preventative measures to reduce flaring expected due to planned major maintenance activities, gas quantity and quality issues, and recurrent failure of equipment or processes<br>• Submit updated FMP every 5 years and for new or modified equipment prior to installing | exceeding target<br>• Plan is pursuant to Rule 221 and fees pursuant to Rule 306<br>• List all actions to be taken to meet targets:<br>o Technical specs for flares, knock-out pots, surge drums, water seals and FG recovery systems<br>o Process flow diagrams of upstream equipment and process units venting to flares<br>o Policies, procedures, and equipment improvements to minimize flaring and flare emissions<br>o FG recovery equipment and treatment systems to be installed<br>• FMPs available for 60-day public review prior to approval<br>• 45 days allowed to correct deficiencies<br>• Facility in violation if FMP denied<br>• Revised FMP submitted 90 days after end of year if performance | | information for each flare<br>• Upstream equipment and processes (Same as SJVAPCD and SCAQMD)<br>• Equipment, processes, and procedures implemented in last 5 years to reduce flaring and those planned to be installed or implemented<br>• Prevention measures, including schedule for implementation for flaring:<br>o That has or will occur during planned major maintenance<br>o Expected to occur due to issues of gas quantity and quality (include audits of capacities), or caused by recurrent failure of equipment or processes | emissions<br>• Description of planned operational or maintenance procedures that may cause flaring<br>• Description of each flare system including design features<br>• Description of any sulfur reduction system<br>• Measures to be implemented to reduce the number of planned flaring events | o <5% avg. monthly gas handled/ produced/ treated at source based on 3 years<br>o Higher limit may be granted by APCO if demonstrated to be infeasible<br>• Submit emissions mitigation plan if:<br>o Volume limit >10% of avg. monthly gas<br>o Sulfur content of flared gas >239 ppmv/ >796 ppmv in Southern/ Northern Zone<br>• The emissions mitigation plan must achieve 50% reduction of greater of actual or proposed avg. monthly FG volume limit<br>• Owner/operator reimburses for review and approval of plans<br><br>FMP includes:<br>• Measures to decrease volume of FG and planned flaring events<br>• Measures to prevent emergency flaring and unplanned flaring<br>• Flare system<br>• FG monitoring system<br>• Design and operation features of pilot and purge gas system<br>• Design features of flare to handle nominal and peak gas flows and range of compositions |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| | targets exceeded | | | | • Plans to reduce planned flaring emissions<br>• Schedules to reduce planned shutdowns<br>• Proposed study of different settings to minimize emissions<br>• Summary of scheduled/typical planned flaring<br>• Review FMP every 5 years |
| **ANNUAL MONITORING REPORTS** | | | | | |
| For refinery flare or flare w/ flaring capacity $\geq$50 MMBtu/hr: Operator submit annual report $\leq$30 days after end of each 12 month period including:<br>• Total volumetric flow of vent gas (scf) for each day<br>• Contents of vent gas composition:<br>o Hydrogen sulfide<br>o Methane<br>o HC<br>• If vent gas composition monitored by continuous analyzer or analyzers: the following for each hour of the month:<br>o Avg. total HC content by volume<br>o Avg. methane content by volume<br>o Total reduced sulfur content by volume or hydrogen sulfide content by volume<br>• Avg. molecular | Submit quarterly report $\leq$30 days after end of each quarter including:<br>• Information required to be monitored:<br>o Table of nine operating parameters, based on flare type (clean service, emergency service, general service)<br>o Alternative flare vent gas sampling information necessary to calculate flare emissions<br>o Flare monitoring system data<br>o Images of visible emissions<br>o Presence of pilot flame<br>o Pilot gas and purge gas flow to each flare<br>• Total daily and quarterly emissions of criteria | Monthly report:<br>• Total volumetric flow each day and month<br>• If gas composition monitored w/ sampling, content by volume for each sample of total HC, methane, and $H_2S$<br>• If composition monitored w/ continuous analyzer, avg. content by volume of: total HC; methane; total reduced sulfur; $H_2S$<br>• Avg. molecular weight for each hour of the month (if measured)<br>• For pilot & purge gas<br>o Type of gas<br>o Volumetric flow for each day and month<br>o Means used to | None | None | Submitted annually, by March 1 of the following calendar year, including:<br>• Monthly volumes of gas flared per planned continuous and planned intermittent flaring categories<br>• Summary of total gas volume released during emergencies and weighted-average H2S content for the entire volume<br>• Monthly reporting on any exceedance of the allowable monthly volume of gases planned for flaring |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| weight for each hour of each month (if measured)<br>• For pilot and purge gas:<br>o Type of gas used<br>o Volumetric flow for each day and each month<br>o Means used to determine flow<br>• Flare monitoring system downtime<br>• $SO_2$ emissions for each day and each month<br>• Flow verification report for each flare | pollutants from each flare and each flare event along with information used to calculate emissions<br>• Description of cause and category of each flare event<br>• Records of annual acoustical or temperature leak survey<br>• Flare monitoring system downtime periods<br>• Copy of written notices for all reportable air releases related to any flare event | determine flow<br>• For any 24-hr period when 1 million scf flared, description:<br>o Cause<br>o Time and duration<br>o Source<br>o Measures to reduce or eliminate flaring<br>• Monitoring system downtime periods<br>• Images recorded for the month<br>• Methane, non-methane, and $SO_2$ emissions for each day and for the month<br><br>Semi-annual flow verification report, comparing flow measured by monitoring system and flow verification for same period of time | | | |
| **REPORTABLE FLARING EVENT REPORTS** | | | | | |
| • Definition:<br>o Flaring event where >500,000 scf gas flared/day or<br>o SO2 emissions >500 lb/day<br>o Ends when water seal integrity demonstrated or | Requirements:<br>• Notify by telephone <u><</u>1 hr. of unplanned flare event w/ emissions >100 lb. VOC, >500 lb. SO2, or >500,000 scf gas<br>• Submit Specific Cause Analysis | For any 24-hour period during which >1 million scf of vent gas was flared:<br>• Cause<br>• Time of occurrence and duration<br>• Source or equipment of origin | Notify if volume flared >500,000 scf per day:<br>• Results of cause investigation<br>• Measures to prevent recurrence<br>• Justification for rejecting measures<br>• Explanation | For unplanned flaring >1 hr. in duration:<br>• Notify <4hr. after detection<br>• Submit report:<br>o Date, time, duration, volume of gas flared<br>o Reasons for flaring | Exceedance not a violation if emergency:<br>• Inform <4 hr. after start of next business day<br>• Document event occurrence and causes<br>• Submit <7days after end of event:<br>o Description of event and |

| District Rule 4311 (Flares) | SCAQMD Rule 1118 (Control of Emissions from Refinery Flares) | BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries) | BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries) | VCAPCD Rule 54 (Sulfur Compounds) | SBCAPCD Rule 359 (Flares and Thermal Oxidizers) |
|---|---|---|---|---|---|
| o For flares w/o water seal, ends when flow <0.12 ft/s<br>• Submit annual report summarizing all reportable flaring events:<br>o Results of cause investigation<br>o Mitigation/ corrective actions to prevent recurrence<br>o Justification for rejecting measures<br>o Explanation of why emergency and cannot be recovered<br>o Date, time, duration | w/in 30 days – cause, duration, mitigation/ corrective actions | • Measures taken to reduce or eliminate flaring | why consistent with FMP<br>• Explanation of why emergency and cannot be recovered<br>• Volume flared<br>• Methane, non-methane, HC, and $SO_2$ emissions | o Settings pressure relief valves and max/min allowed safety settings<br>o Corrective measures and actions to prevent recurrence<br>o Sulfur emissions<br>o Equipment or controls that failed<br><br>For planned flaring:<br>• Notice submitted >72 hr. prior:<br>o Work that requires<br>o Date and time<br>o Expected gas volume and sulfur emissions<br>o Steps or equipment to minimize sulfur emissions | mitigating and corrective actions implemented<br>o Demonstration reasonable steps taken to minimize excess emissions<br>o Demonstration that emergency not caused by improperly designed equipment; lack of preventative maintenance; careless or improper operation; operator error; willful misconduct<br>o Document that source was properly operated at time event occurred |

As demonstrated above, Rule 4311 is as stringent as or more stringent than analogous rules in other California air districts.

## SBCAPCD Rule 359 (Flares and Thermal Oxidizers)[38]

SBCAPCD Rule 359 was adopted on June 28, 1994. Provisions of this rule apply to the use of flares and thermal oxidizers at oil and gas production sources, petroleum refinery and related sources, and natural gas services. Rule 359 sets specific requirements for the sulfur content in gaseous fuels, technology based standards, flare minimization plans, emergency events, and emission and operational limits.

[38] Santa Barbara County Air Pollution Control District. (1994, June 28). *Rule 359 Flares and Thermal Oxidizers. Retrieved February 13, 2015 from* http://www.ourair.org/wp-content/uploads/rule359.pdf.

Section D.3 of Rule 359 requires a FMP be submitted by any source subject to this rule that operates a flare rated at 15 MMBtu/hour or greater. For planned flaring, the FMP for all sources subject to this rule shall list a targeted maximum monthly flared gas volume, which shall not exceed 5% of the average monthly gas handled/produced/treated at the source unless the operator demonstrates such a maximum volume to be infeasible based on safety, engineering or cost constraints and proposes a different percentage. Any flaring that causes an exceedance of the emission limits or standards of Rule 359 is also not considered to be in violation if the operator demonstrates that the exceedance resulted from an emergency event.

Unlike District Rule 4311, SBCAPCD Rule 359 does not apply to the burning of sulfur compounds in the manufacturing of sulfur compounds. Additionally, under SBCAPCD Rule 359, flares for which flaring operations solely consist of planned, continuous flaring due to the non-availability of a produced gas pipeline are exempt from FMP requirements.

Although FMPs in SBCAPCD Rule 359 are required to list a targeted maximum monthly flared gas volume of five percent (5%) of the average monthly gas handled/produced/treated, the operator can obtain approval of a higher percentage by demonstrating that the maximum flare volume limit is infeasible based on safety, engineering, or cost constraints, which leaves the rule open to allow a higher amount of flaring. The District evaluated the percentage of gas flared in the Valley and found that the average percentage of gas flared between 2009 and 2013 was well below SBCAPCD's 5% theoretical level at 3.8% as shown in the table below.

**Table C-11 Percent of Gas Flared at Valley Facilities**

| Year Of Data | Gas Produced (MCF) | 5% Flared (if meeting SBCAPCD target) (Mscf) | Actual Flared (Mscf) | Percent of gas flared |
|---|---|---|---|---|
| 2009 | 223,220,118 | 11,161,006 | 7,134,977 | 3.2 |
| 2010 | 241,676,822 | 12,083,841 | 7,884,879 | 3.3 |
| 2011 | 240,000,594 | 12,000,030 | 8,324,237 | 3.5 |
| 2012 | 216,232,509 | 10,811,625 | 10,147,080 | 4.7 |
| 2013 | 238,058,188 | 11,902,909 | 10,581,415 | 4.4 |
| | | | **Total Average Percent of Gas Flared in Valley** | **3.8%** |

In addition, unlike SBCAPCD rule 359, Rule 4311 does not allow an exceedance of any emissions limits or the requirement to minimize flaring activity, regardless of the cause. Allowing such a measure in the Valley would result in a serious relaxation of rule requirements and a potential increase in emissions. Under the District's rule, any exceedance or excess flaring not allowed under Rule 4311, regardless of the cause, would result in a violation and be subject to enforcement action. Flares subject to SBCAPCD Rule 359 whose flaring operations solely consist of planned, continuous flaring due to the non-availability of a produced gas pipeline outlet are also exempt from

FMP requirements while such flares subject to Rule 4311 are not exempt from FMP requirements and are still required to identify and implement actions that reduce flaring.

Based on the discussion above, District Rule 4311 is clearly more stringent than SBCAPCD Rule 359 for the following reasons:

- Rule 4311 applies to a broader range of sources than SBCAPCD Rule 359
- SBCAPCD Rule 359 includes a performance standard for the volume of gas flared (5%), but also includes APCO discretion for allowing unlimited flaring activity
- SBCAPCD Rule 359 contains several exemptions not allowed in Rule 4311, including the allowance for exceedance of emission limits
- EPA analysis resulted in the 2012 determination that Rule 4311 is as stringent as requirements in SBCAPCD Rule 359 in terms of core RACT requirements
- Overall, Rule 4311 results in significantly less flared gas relative to flaring capacity in the District as compared the allowable levels of flaring under SBCAPCD

**State of North Dakota**

- **Century Code 38-08-06.4**[39]
- **Industrial Commission Order**[40]

North Dakota Century Code 38-08-06.4 applies to flaring of gas produced with crude oil from an oil well. The North Dakota rule allows for the uncontrolled flaring of all gases during the first year after opening a new crude oil production well, after which flaring of the entire volume of gas must cease and the well must be:

- Capped;
- Connected to a gas gathering line;
- Equipped with an electrical generator that consumes at least seventy-five percent (75%) of the gas from the well;
- Equipped with a system that intakes at least seventy-five percent (75%) of the gas and natural gas liquids volume from the well for beneficial consumption by means of compression to liquid for use as fuel, transport to a processing facility, production of petrochemicals or fertilizer, conversion to liquid fuels, separating and collecting over fifty percent (50%) of the propane and heavier hydrocarbons; ***or***
- Equipped with other value-added processes as approved by the industrial commission, which reduce the volume or intensity of the flare by more than sixty percent (60%).

[39] North Dakota Legislative Branch. (2013, August). *Century Code 38-08-06.4 Flaring of Gas Restricted – Imposition of Tax – Payment of Royalties – Industrial Commission Authority. Retrieved February 13, 2015 from* http://www.legis.nd.gov/cencode/t38c08.pdf?20150213153521.
[40] North Dakota Industrial Commission. (2014, July 1). *Order of the Commission*. Obtained February 3, 2015 from https://www.dmr.nd.gov/oilgas/or24665.pdf.

Because of excessive flaring in North Dakota, the North Dakota Industrial Commission acted on a motion of the commission to consider amending the current oil production rule to reduce the amount of flared gas by issuing an order in July 2014 to increase gas capture from oil wells. The order requires 74% of gas capture (instead of flaring) by October 2014, 77% by January 2015, 85% by 2016, and 90% by 2020. If such gas capture percentage is not attained at a maximum efficient oil production rate, the well may still continue to produce 200 barrels of oil per day if at least 60% of the monthly volume of associated gas produced from the well is captured. If the 60% gas capture target is not met, the well may continue to produce 100 barrels of oil per day. This Order of the Commission is not an actual rule amendment and, because it did not pass through the entire public process, could be defeated in court or simply expire January 2016.[41]

Many of the sources subject to Rule 4311 design and operate their equipment and processes in a manner that inherently results in minimal flaring activity. Flare gas is typically flared further along in the process, rather than directly from production wells, resulting in less flaring activity. In contrast, sources in North Dakota flare large portions of the gas generated at oil production wells. This is a rudimentary oil production method that is often seen in regions with little to no history of emission regulations. Flaring in North Dakota has increased more than 50% in the past two years to levels previously unknown in the United States and comparable to those of Russia and Nigeria.[42] According to North Dakota's Department of Mineral Resources, 29 percent (29%) of the natural gas now extracted in North Dakota is flared off, which accounts for almost 28% of all flaring in the United States and one percent (1%) of all flaring worldwide.[43] In April, 2014 alone, North Dakota wells burned off 10.3 billion scf of natural gas, worth almost $50 million on the spot market. The annual value of flared gas is reportedly worth as much as $1 billion.[44] This excessive flaring is due in part to the addition of 1,100 to 2,700 wells per year, with tens of thousands of wells still lacking access to a gas transmission pipeline.[45,46]

Even with the recent order from the North Dakota Industrial Commission to increase gas capture to 74% by October 2014, 77% by January 2015, 85% by 2016, and 90% by 2020, the District already requires a minimum of 95% gas capture and achieves over 96%. In addition, because the North Dakota rule contains no requirements to control

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[41] The Bismarck Tribune. (2015, January 19). *Helm says tax revenue at risk if flaring, oil conditioning orders voided*. Retrieved February 13, 2015 from http://bismarcktribune.com/news/state-and-regional/helms-says-tax-revenue-at-risk-if-flaring-oil-conditioning/article_e615f72d-d2ff-50a6-a151-4875945792c5.html

[42] King & Spalding. (2014, June). *Dispute Resolution, Oil & Gas Litigation*. Retrieved February 13, 2015 from http://www.kslaw.com/library/newsletters/EnergyNewsletter/2014/June/article2.html.

[43] North Dakota Pipeline Authority. *Natural Gas Facts*. Retrieved February 13, 2015 from http://northdakotapipelines.com/natgasfacts/.

[44] General Electric. (2014, September 10). *Taming North Dakota's Gas Flares*. Retrieved February 13, 2015 from http://www.gereports.com/post/97136504480/taming-north-dakotas-gas-flares.

[45] Oil & Gas Monitor. (2014, August 11). *Can a Flaring Problem Become Natural Gas Industry Advantage in North Dakota?* Retrieved February 13, 2015 from http://www.oilgasmonitor.com/can-flaring-problem-become-natural-gas-industry-advantage-north-dakota/7617/.

[46] North Dakota Department of Mineral Resources. Retrieved February 13, 2015 from http://www.ndoil.org/image/cache/NDPCAnnual092111_2.pdf.

the fraction of gas not addressed by one of the required options, a producer would be able to vent up to 40% of produced gas directly to the atmosphere and still have the ability to flare the full captured amount. For the first year of operation, operators of new oil production wells are permitted to flare 100% of produced gas. Additionally, the optional equipment used to control the captured gas, such as uncontrolled internal combustion engines, could easily increase emissions because flaring in itself is a highly effective control technology. Finally, a producer may obtain an exemption by demonstrating to the industrial commission that connection of the well to a natural gas gathering line is economically infeasible or that a market for the gas is not available and equipping the well with an electrical generator to produce electricity from gas or employing a collection system is economically infeasible. North Dakota regulators granted ninety-five percent (95%) of extension requests over the last two years.[47]

In the Valley, operators do not have the flexibility to capture only 60% of associated gas or to obtain extensions or exemptions from rule requirements as allowed in the North Dakota rule. New steam enhanced wells (the vast majority of wells in the District are heavy oil steam enhanced wells) require an ATC permit before they are operated. As part of receiving an ATC, these wells are subject to the District's New Source Review rule (District Rule 2201), which requires the installation of Best Available Control Technology (BACT) consisting of a system that collects and controls well vapors and must comply with a multitude of additional requirements (i.e, offsets, public noticing, health risk assessment, etc.).

The District has two rules specific to the operation of crude oil wells. Rule 4401 (Steam-Enhanced Crude Oil Production Wells) and Rule 4409 (Components at Light Crude Oil Production Facilities, Natural gas Production Facilities, and Natural Gas Processing Plants). These rules contain control requirements including a minimum 95% capture and control, periodic leak detection, and repair requirements for steam enhanced wells and light oil wells. These rules also require the development of an Operator Management Plan (OMP) that describes how a facility will comply. The OMP must be updated annually to reflect any changes to the OMP, including changes to address newly installed wells. These prohibitory rules are applicable to both existing and new wells.

Regions such as North Dakota have only recently begun controlling emissions from flares and, as such, must make significant progress before matching the District in capture and control technology and stringency of regulations. After extensive analysis of the North Dakota rule requirements and comparison to those in the District, it is clear that Rule 4311 is significantly more stringent than North Dakota Century Code 38-08-06.4 for at least the following reasons:

- Rule 4311 applies to a broader range of sources than the North Dakota rule

[47] Scientific American. (2013, September 12). *North Dakota flared off $1 billion worth of natural gas last year*. Retrieved February 14, 2015 from http://blogs.scientificamerican.com/plugged-in/2013/09/12/north-dakota-flared-off-1-billion-worth-of-natural-gas-last-year/.

- Rule 4311 requires 95% capture and treatment of produced gas, whereas the North Dakota rule only requires 60% capture and allows one year of unlimited flaring
- The North Dakota rule does not contain any requirements that address the remaining 40% of produced gas
- 95% of facilities that requested extensions to the requirements of the North Dakota rule were approved

### Evaluation Findings

Even though flares are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4311 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category.

As described in the section detailing FMP requirements, operators of flares in the Valley are already implementing all feasible measures to reduce flaring activity. Even for those devices that have been committed to in FMPs, alternative methods of disposal do not necessarily decrease emissions, and could even increase emissions compared to the baseline from flares; however, combusting gas onsite or transmitting it for use at other sources could prevent the additional combustion of other fuel, thereby reducing overall emissions in the Valley, if not actually reducing emissions from the combustion of the flare gas.

In other air districts, the addition of transmission pipelines is the only major viable possible measure to reduce emissions. In the Valley, most producers of associated gas have access to transmission pipelines and are already selling as much gas as possible. The addition of pipelines would most likely not be performed by the facilities operating flares, but would instead be installed by utility companies such as PG&E. Requiring oil and gas producers that do not have access to transmission pipelines to construct them would be cost prohibitive and is beyond the scope of what is required by any other air district.

Although Rule 4311 already meets BACM and MSM requirements, the District is committing to further evaluate Rule 4311 beginning in 2015. See Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities) for more information.

## C.12 RULE 4313 LIME KILNS

### Discussion
Rule 4313 was adopted in 2003 to limit NOx emissions from the operation of lime kilns. Lime kilns can be used in a variety of manufacturing and processing operations, including food and agriculture. EPA finalized approval of the 2003 adoption of Rule 4313 on September 4, 2003 and deemed this rule as being at least as stringent as established RACT requirements.

### Source Category
There are currently no lime kilns operating in the Valley. At the time of rule adoption, there were a total of three lime kilns in the Valley, used at two sugar processing plants; however, these plants have been non-operational since 2008. 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).

### Emissions Inventory
There is no emissions inventory associated with lime kilns because there are no lime kilns operating in the Valley; no lime kilns are in the preliminary permitting process to become operational in the Valley, nor are any lime kilns expected to be operated in the Valley in the future.

### How does District Rule 4313 compare with federal and state rules and regulations?

#### Federal Regulations
There are no EPA CTG or ACT requirements for this source category.

***NSPS***
- 40 CFR 60 Subpart HH (Standards of Performance for Lime Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 60 Subpart HH and found no requirements that were more stringent than those already in Rule 4313.

***NESHAP/ MACT***
- 40 CFR 63 Subpart AAAAA (National Emission Standards for Hazardous Air Pollutants for Lime Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 63 Subpart AAAAA and found no requirements that were more stringent than those already in Rule 4313.

#### State Regulations
There are no state regulations applicable to this source category.

### How does District Rule 4313 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, and VCAPCD.

### Evaluation Findings

There are no lime kilns operating in the Valley and thus no emissions or emission reduction opportunities for this source category. As previously mentioned, any lime kilns beginning operation in the future would be required to meet District BACT requirements. As such, Rule 4313 meets or exceeds both BACM and MSM requirements for this source category.

## C.13 RULE 4352 SOLID FUEL FIRED BOILERS, STEAM GENERATORS, AND PROCESS HEATERS

### Discussion

The purpose of Rule 4352 is to limit NOx and carbon monoxide (CO) emissions from any boiler, steam generator or process heater fired on solid fuel. Prior to September 14, 1994 solid fuel fired units were exempt from the requirements of District Rule 4305. The adoption of Rule 4352 established NOx limits of 200 parts per million volume (ppmv) for municipal solid waste facilities (MSW), 0.35 pounds per million British thermal units per hour (lb/MMBtu) for biomass facilities, and 0.20 lb/MMBtu for all other solid fuel fired units. Since its adoption, the rule has been amended three times. The December 2011 amendments strengthened the rule by lowering NOx emissions limits for all three source categories. However, no emissions reductions were quantified because the rule amendments were meant to satisfy EPA RACT requirements and all units were determined to be operating at the new emission limits. EPA finalized approval of Rule 4352 on November 6, 2012 and deemed this rule as being at least as stringent as established RACT requirements.

While previous rule-amending projects for Rule 4352 have not quantified specific emissions reductions, the use of biomass facilities in the Valley has fostered emissions reductions. As an energy source, biomass can either be used directly or converted into other energy products such as biofuel. Biomass facilities in the Valley reduce the amount of pollutants created by open burning practices and the landfilling of potential biofuels such as agricultural materials, and urban and forest wood waste products by utilizing these materials. The District has reduced the total acreage of agricultural materials burned in the Valley to date by more than 80%.

### Source Category

Boilers, steam generators, and process heaters are used in a broad range of industrial, commercial, and institutional settings. Units subject to this rule fire on a variety of solid fuels: coal, petroleum coke, biomass, tire-derived fuel, and MSW. Although the output from units subject to the rule could be utilized in many settings, all of the operators within the Valley use the units' output to generate electricity. There are 17 units subject to this rule located at 15 facilities.

The two primary methods of controlling NOx emissions from boilers, steam generators, and process heaters are either to change the combustion parameters to reduce NOx formation (i.e., combustion modification) or to treat the NOx formed in the process before the NOx is emitted into the atmosphere (i.e., post-combustion control or flue gas treatment).

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.62 | 0.65 | 0.67 | 0.72 | 0.76 | 0.79 | 0.82 | 0.84 | 0.87 |
| NOx | 2.69 | 2.77 | 2.85 | 2.99 | 3.14 | 3.21 | 3.30 | 3.36 | 3.47 |
| SOx | 0.56 | 0.57 | 0.59 | 0.61 | 0.64 | 0.66 | 0.68 | 0.69 | 0.71 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.61 | 0.64 | 0.66 | 0.71 | 0.75 | 0.77 | 0.81 | 0.83 | 0.86 |
| NOx | 2.40 | 2.49 | 2.56 | 2.71 | 2.85 | 2.91 | 3.01 | 3.07 | 3.18 |
| SOx | 0.54 | 0.56 | 0.57 | 0.59 | 0.62 | 0.64 | 0.66 | 0.68 | 0.69 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from solid fuel fired boilers, steam generators, and process heaters are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for solid fuel fired boilers, steam generators, and process heaters.

## How does District Rule 4352 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTG requirements for this source category.

### *ACT*

- EPA–453/R-94-022 (Alternative Control Techniques Document– NOx Emissions from Industrial/Commercial/ Institutional Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rule 4352.

- EPA – 453/R-94-023 (Alternative Control Techniques Document– NOx Emissions from Utility Boilers)

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rule 4352.

### *NSPS*

- 40 CFR 60 Subpart Cb (Emission Guidelines and Compliance Times for Municipal Waste Combustors that are Constructed on or before December 19, 1995)

The District evaluated the requirements contained within 40 CFR 60 Subpart Cb and found no requirements that were more stringent than those already in Rule 4352.

- 40 CFR 60 Subpart D (Standards of Performance for Fossil-Fuel-Fired Steam Generators for which Construction is Commenced after August 17, 1971)

The District evaluated the requirements contained within 40 CFR 60 Subpart D and found no requirements that were more stringent than those already in Rule 4352.

- 40 CFR 60 Subpart Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units)

The District evaluated the requirements contained within the 40 CFR 60 Subpart Db and found no requirements that were more stringent than those already in Rule 4352.

***NESHAP/ MACT***

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches. The District evaluated the requirements contained within this NESHAP and found no requirements that were more stringent than those already in Rule 4352.

**State Regulations**

There are no state regulations applicable to this source category.

### How does District Rule 4352 compare to rules in other air districts?

There are no analogous rules for this source category in VCAPCD.

***SCAQMD***

- Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within SCAQMD's Rule 1146 and found no requirements that were more stringent than those already in Rule 4352.

***BAAQMD***

- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4352.

- Regulation 9 Rule 11 (Nitrogen Oxides and Carbon Monoxide from Electric Power Generating Steam Boilers)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 11 and found no requirements that were more stringent than those already in Rule 4352.

***SMAQMD***

- Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4352.

## Additional Emission Reduction Opportunities

**Biomass Facilities**

The presence of biomass facilities in the Valley, from either new facilities or other solid fuel fired boilers that have converted to biomass, continues to significantly reduce NOx and PM emissions from open burning practices. However, the biomass industry has indicated that given current energy policy in California there is concern that biomass power facilities are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking (base load vs. intermittent) and that the prices being offered for new contracts are too low to support their operations.

The District has learned that two biomass power plants have shut down due to their inability to secure contracts with utilities at rates that are sufficient to sustain their operations. Greenleaf Power that operates the Tracy Biomass Plant, located in Tracy, reported that they shut down on October 31, 2014 and the Covanta facility located in Mendota was shut down in January 2015. Initially, another Covanta facility in Delano had indicated that they were likely to shut down but is now reporting that they were able to secure a one-year extension on their current utility contract at the same rate that enables them to continue to operate. With additional biomass facilities on the brink of closure, it has become even more infeasible to require citrus orchard removals to be sent for use in biomass.

The District has convened a number of productive meetings with agricultural stakeholders and representatives of the biomass industry in order to more fully understand the issues faced by the industry and develop a common vision of the future of biomass power amongst the stakeholders in the Valley. The meetings have been helpful in forging a better working relationship between agriculture representatives and biomass power producers and developing consensus on long-term solutions. The group has also discussed potential short term solutions.

In June 2014, the District's Governing Board adopted positions on two pieces of legislation that impact the biomass industry. The District adopted a position in support of AB 2363 (Dahle), which was sponsored by the biomass industry, and would make biomass plants more competitive by fully accounting for the costs associated with intermittent sources of renewable power (solar and wind) when comparing them to other sources of power. AB 2363 was signed by the Governor and will begin to help level the renewable energy playing field. The District also took a position in opposition to SB 1139 (Hueso) that would have given preferential treatment to new geothermal power plants by requiring that utilities purchase specified amounts of new geothermal power. Ultimately, AB 1139 was not passed by the legislature.

### *Long-Term Solutions for Biomass*

There is consensus that biomass power producers currently are not on a level playing field in competing with other renewable sources of power for utility contracts. They are also not receiving any preferential treatment for the societal benefits for providing a cleaner alternative to the open burning of agricultural waste and assisting with meeting landfill diversion goals.

Contracts between power producers and utilities are confidential, but the current market rate that the biomass plants can garner is approximately 6 cents/KWH. This is the rate that the utilities obtain through contracts with solar power providers. This low cost is made possible largely due to government subsidies provided for solar power production. Biomass power producers have indicated that it takes approximately 9-10 cents/KWH for the plants to cover their operating costs.

The District and representatives from agriculture and biomass industries are working to develop and pursue specific actions with the legislative branch, utilities, Public Utility Commission, CalRecycle, and other government agencies to help level the playing field and allow the biomass industry to fairly compete.

The District will also work with the stakeholders including the Federal Department of Energy, California Energy Commission, and other partner agencies to pursue clean alternatives to biomass power production for agricultural waste disposal.

### 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. In the analyses below, the District evaluated the cost effectiveness of requiring SCR for all three categories of solid fuel fired boilers: MSW, biomass, and other fuels.

### *Cost Effectiveness of SCR for MSW Units*

Currently, facilities are generally equipped with Selective Non-Catalytic Reduction (SNCR) and utilize this technology to meet emission limits ranging between 165 ppmv to 210 ppmv. Although it appears that facilities can achieve a lower NOx limit beyond the current rule requirements, an additional NOx control technology such as Selective Catalytic Reduction (SCR) would be needed. In fact, the installations that are achieving lower NOx emissions were installed as new installations equipped with the SCR technology. The District could not find an example of an SCR installation as a retrofit on an existing MSW facility.

Though a retrofit installation has not been demonstrated in practice, the District conducted a cost effectiveness analysis to determine if installing SCR as a retrofit would be reasonable. The District used the following methodology and assumptions for this cost effectiveness analysis:

**Assumptions**

- Baseline emission factor is 0.286 lb-NOx/MMBtu (equivalent to 165 ppmv @ 12% CO2)
- SCR provides control to 50 ppmv at 7% O2 (47 ppmv @ 12% CO2)
- Capital cost annualized at 10% interest for 10 years

Cost data was obtained from a preconstruction approval by the Florida Department of Environmental Protection (FDEP) issued on December 23, 2010. The approval was issued for an MSW-fired combustor equipped with SCR for NOx control. The control equipment costs from the FDEP application include uncontrolled NOx emissions of 250 ppmv and controlled NOx emissions of 50 ppmv which represents an 80% reduction in NOx from the SCR. However, 80% reduction from 165 ppmv @ 12% CO2 would yield controlled emissions of 33 ppmv, which is well below BACT. Therefore, controlled emissions are evaluated at the BACT limit of 47 ppmv @ 12% CO2.

The SCR installation is sized for a unit rated at approximately 460 MMBtu/hr used to produce superheated steam for an electrical generator. The District reviewed the expected exhaust parameters and found them comparable to the parameters for solid fuel-fired boilers in the Valley. Therefore, it is believed that this cost estimate provides a valid basis for estimating costs for installing SCR on boilers in the Valley.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 350 MMBtu/hr unit operating at full fire at 100% capacity factor year round for the MSW facility. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

**Table C-12 Emissions from a MSW Unit**

| Fuel | Rating (MMBtu/hr) | Time (hr/yr) | EF (lb/MMBtu) | Emissions (lb/yr) | Emissions (tons/yr) |
|---|---|---|---|---|---|
| MSW (baseline) | 350 | 8,760 | 0.286 | 876,000 | 438 |
| MSW (controlled) | 350 | 8,760 | 0.081 | 248,346 | 124 |

The capital and operational costs are sized to the facility size using the six-tenths rule, where:

- CA is a known cost of equipment of size A
- CB is the estimated cost of equipment of size B

- SB is the size of equipment B
- SA is the size of equipment A

$$C_B = C_A \times (S_B \div S_A)^{0.6}$$

It is standard District policy for Best Available Control Technology (BACT) analyses to use a 10 year life and 10% interest rate unless information indicates otherwise; therefore the capital recovery factor (CRF) of 0.1627 will be used to annualize the capital costs.

It is noted that the FDEP cost analysis is for a new unit with an adequately-sized induced draft (ID) fan. However, for a new unit the ductwork can be laid out in a way that minimizes pressure losses, allowing for a smaller ID fan than may be required for a retrofit. Affected sources have provided some estimates for additional electrical costs associated with the larger ID fan required for a retrofit, so these have been incorporated into the analysis. In addition, the FDEP analysis is for a new unit so it does not include the loss of revenue from taking a unit off-line to retrofit the new technology. For each unit it is estimated that the retrofit would require at least six months of downtime at $118/MW-hr; this will be added to the capital cost. Finally, the FDEP analysis specifically ignored sales tax on capital equipment on the grounds it is exempt from sales tax in Florida. This would not be the case in California, so 8% sales tax has been included.

The cost effectiveness analysis for installing SCR on a MSW unit is as follows:

**Table C-13 Cost Effectiveness for Installing SCR on a MSW Unit**

| Description of Cost | Cost Factor | Cost | Source |
|---|---|---|---|
| **Direct Capital Costs (DC):** | | | |
| Purchase Equipment Costs (PE): | | | |
| (A) Basic Equipment: | | | |
| 1) SCR System (Quote from Babcock Power) | | 6,790,099 | FDEP[48] |
| 2) Additional Ductwork (220 ft) | $1,800/ft | 336,110 | FDEP |
| 3) Increased ID fan size | | 7,384 | FDEP |
| Subtotal of Basic Equipment | A | 7,133,593 | FDEP |
| (B) Instrumentation and controls: (1% of A) | 0.01 A | 71,336 | FDEP |
| (C) Freight: (5% of A) | 0.05 A | 356,680 | FDEP |
| (D) Taxes | 0.08 (A+B+C) | 604,929 | OAQPS |
| PE Total: | | 8,166,538 | |
| **Direct Installation Costs (DI): Assume Modular SCR w/ simple installation** | | | |
| Foundation and Supports: | 0.16 PE | 1,306,646 | FDEP |
| Handling and Erection: | 0.40 PE | 3,266,615 | FDEP |
| Electrical: (quote from CH2M Hill) | 0.10 PE | 816,654 | Industry |
| Piping: (quote from CH2M Hill) | 0.20 PE | 1,633,308 | Industry |
| Insulation: | 0.01 PE | 81,665 | OAQPS |
| Painting: | 0.01 PE | 81,665 | OAQPS |

[48] All costs from FDEP size-adjusted using six-tenths rule from 460 MMBtu/hr to 350 MMBtu/hr.

| Description of Cost | Cost Factor | Cost | Source |
|---|---|---|---|
| Costs for Expansion of APC Building for SCR Components (quote Malcolm Pirnie) | | 366,665 | FDEP |
| DI Total: | | 7,553,218 | |
| Retrofit (Deconstruct existing building/structures, estimated equal to DI total) | | 7,553,218 | District |
| Natural gas pipeline (replace fuel oil #2) | | 3,000,000 | Industry |
| Site Preparation and Buildings | | | |
| DC Total = PE + DI + retrofit + pipeline: | | 26,272,974 | |
| **Indirect Costs (IC):** | | | |
| Engineering: | 0.10 PE | 816,654 | OAQPS |
| Construction and Field Expenses: | 0.05 PE | 408,327 | OAQPS |
| Contractor Fees: | 0.10 PE | 816,654 | OAQPS |
| Contingencies: | 0.15 PE | 1,224,981 | FDEP |
| Start-up: | 0.02 PE | 163,331 | OAQPS |
| Performance Testing: | 0.01 PE | 81,665 | OAQPS |
| Retrofit Downtime (6 months minimum, electricity sales and tipping fees) | | 11,000,000 | Industry |
| IC Total: | | 14,511,612 | |
| Total Capital Investments (TCI = DC + IC): | | 40,794,586 | |
| **Direct Annual Costs (DAC): Assume SCR requires 0.5 hrs/shift** | | | |
| Operating Costs (O): (≈ 1,095 shifts/year @ 3 shifts/day) | | | |
| Operator: 1.0 hr/shift | \$50/hr | 54,750 | FDEP |
| Supervisor: | 15% operator | 8,213 | OAQPS |
| Maintenance Costs (M): | | | |
| Labor: 1.0 hr/shift | \$50/hr | 54,750 | FDEP |
| Material: | 100% labor | 54,750 | FDEP |
| Utility Costs (U): | | | |
| Performance loss: | \$0.08848/kW-hr | 386,495 | FDEP |
| Electricity Cost: (additional 818 kW[49]) | \$0.08848/kWhr | 634,019 | Industry |
| Catalyst Replace: | | 123,071 | FDEP |
| Total DAC: | | 1,316,048 | |
| **Indirect Annual Costs (IAC):** | | | |
| Overhead: | 60% O & M | 87,828 | OAQPS |
| Insurance: | 0.01 TCI | 407,946 | OAQPS |
| Property Tax: | 0.01 TCI | 407,946 | OAQPS |
| Administrative: | 0.02 TCI | 815,892 | OAQPS |
| Annualized Total Capital Investment: interest rate (%) 10 | | | |
| Period (years): 10 | 0.1627 TCI | 6,637,279 | District Policy |
| Total IAC: | | 9,672,939 | |
| **Total Annual Cost (DAC + IAC):** | | **9,672,939** | |

[49] Resized from industry estimate of 2 trains, 628 kW/train, for a 715 MMBtu/hr facility, resized to 350 MMBtu/hr

**Table C-14 Summary of Cost Effectiveness for Installing SCR on a MSW Unit**

| Fuel Type | Baseline Emissions (tons/yr) | Controlled Emissions (tons/yr) | Emissions Reduced (tons/yr) | Adjusted Annualized Cost ($/yr) | Cost Effectiveness ($/ton) |
|---|---|---|---|---|---|
| MSW | 438 | 124 | 314 | 9,672,939 | $30,806/ton |

The cost effectiveness for installing SCR on a MSW fired boiler is $30,806 per ton of NOx reduced. It is important to note that this calculation is based off of a new installation of SCR, not a retrofit as would be required by Valley facilities. While some retrofit expenses have been included, operators would potentially incur additional costs when retrofitting to incorporate SCR including expenses for additional ductwork, installation of a new natural gas pipeline to replace the existing fuel oil supply, and labor; therefore, District staff assumes the cost effectiveness is even higher than presented in this analysis.

***Cost Effectiveness of SCR for Biomass Units***

Currently, facilities are generally equipped with SNCR and although it appears that facilities could possibly achieve a lower NOx limit beyond the revised proposed rule amendments, additional NOx control technology such as SCR would be needed. In fact, the installations that are achieving lower NOx emissions are typically installed as new installations equipped with the SCR technology, with one exception. One facility in the Valley has installed SCR on a smaller existing boiler under an experimental research exemption approved in February 2008. In March 2009, the District approved the facility’s application to replace the existing SNCR (which had become inoperable) with the SCR installed under the experimental research exemption. This modification did not result in any reduction in permitted emissions as the SCR-equipped boiler is only required to comply with the same emission limit the SNCR-equipped boiler was. This modification was incorporated into the Title V permit in September 2010. While this example may indicate that SCR is technologically feasible as a retrofit for smaller sized biomass-fired boilers, there are many other considerations unique to each facility that may inhibit the retrofit of a SCR system. Based on the following analysis, SCR is not cost effective at this time. It is important to note that this cost effectiveness analysis does not take into consideration the current economic struggles of the biomass industry, as previously described.

The District used the following methodology and assumptions for this cost effectiveness analysis:

**Assumptions**

- Baseline emission factor is 0.11 lb-NOx/MMBtu for Biomass(equivalent to 85ppmv @ 3% O2)
- SCR provides 80% control efficiency (from the provided cost estimates)
- Capital cost annualized at 10% interest for 10 years

Cost data was obtained from a preconstruction approval by the FDEP issued on December 23, 2010 as described above in the MSW section.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 700 MMBtu/hr unit is operating at full fire at 100% capacity factor year round is representative for the Valley biomass facilities. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

**Table C-15 Emissions Calculations for a Biomass Unit**

| Fuel Type | Rating (MMBtu/hr) | Time (hr/yr) | EF (lb/MMBtu) | Emissions (tons/yr) | Control Efficiency | Emissions Reduced (tons/yr) |
|---|---|---|---|---|---|---|
| Biomass | 700 | 8,760 | 0.11 | 337.26 | 80% | 269.8 |

The capital and operational costs are sized to the facility size using the six-tenths rule, as described in the MSW section above.

$$C_B = C_A \text{ x } (S_B \div S_A)^{0.6}$$

Therefore;

$$C_B = \$9{,}672{,}939/\text{year x } (700 \text{ MMBtu/hr} \div 350 \text{ MMBtu/hr})^{0.6}$$
$$= \$14{,}661{,}434/\text{year}$$

It is standard District policy to use a 10 year life and 10% interest rate; therefore the capital recovery factor (CRF) of 0.1627 will be used to annualize the capital costs.

**Table C-16 Cost Effectiveness for Installing SCR on a Biomass Unit**

| Fuel Type | Adjusted Annualized Cost ($/yr) | Emissions Reduced (tons/yr) | Cost Effectiveness ($/ton) |
|---|---|---|---|
| Biomass | 14,661,434 | 269.8 | $54,342/ton |

It is estimated based on the above data and assumptions that requiring the installation of SCR would provide a cost effectiveness of $54,342/ton for a biomass-fired boiler. The cost effectiveness was evaluated without taking into account additional potential costs involved in a retrofit of the facility. It should also be noted that the District's cost effective analysis is very conservative since the installation of the SCR technology with an 80% control efficiency assumes a NOx emission level of approximately 17 ppmv @ 3% O2. This level is lower than established BACT levels and well beyond RACT thresholds. Therefore, even with these conservative assumptions, the installation of SCR is not cost effective for these types of installations.

Furthermore, the emission factors used above are short-term emission limits on a block 24-hour average basis and in all probability will not be representative of actual annual emission rates. Indeed, the post-SCR emission factors for biomass is 0.022 lb/MMBtu, which is well below the short-term emission limits for recently issued biomass-fired boiler ATCs. If, as appears possible, the post-SCR emission rates are higher than assumed above, then the quantity of emission reductions will be lower and the cost of emission reductions greater. Finally, it is vital to remember that the 700 MMBtu/hr boiler assumed for biomass boilers above is an idealized hypothetical chosen to maximize the economies of scale in using the six-tenths rule to scale the cost estimate. For any actual plant within the population of solid fuel-fired boilers in the Valley, the boiler rating will be lower (as small as 171.2 MMBtu/hr) and the cost of emission reductions will be correspondingly higher.

***Cost Effectiveness of SCR for Units Using Other Fuels***
Currently, facilities are equipped with SNCR and although facilities may be able to achieve a lower NOx limit beyond the revised proposed rule amendments, additional NOx control technologies such as SCR would be needed. District staff conducted a cost effectiveness analysis to determine if installing SCR as a retrofit would be reasonable.

District staff used the following methodology and assumptions for this cost effectiveness analysis:

**Assumptions**

- Baseline emission factor is 0.10 lb-NOx/MMBtu (equivalent to 73 ppmv @ 3% O2)
- SCR provides 80% control efficiency (from the provided cost estimates)
- Capital cost annualized at 10% interest for 10 years

Cost data to install the SCR technology was obtained from a preconstruction approval the FDEP issued on December 23, 2010 as described above in the MSW section.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 700 MMBtu/hr unit operating at full fire at 100% capacity factor year round is representative for boilers firing on “other” fuels. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

**Table C-17 Emissions Calculations for Other Units**

| Fuel Type | Rating (MMBtu/hr) | Time (hr/yr) | EF (lb/MMBtu) | Emissions (tons/yr) | Control Efficiency | Emissions Reduced (tons/yr) |
|---|---|---|---|---|---|---|
| Other | 700 | 8,760 | 0.10 | 306.6 | 80% | 245.3 |

The capital and operational costs are sized to the facility size using the six-tenths rule, as described in the MSW section above.

$$C_B = C_A \times (S_B \div S_A)^{0.6}$$

Therefore;

$$C_B = \$9{,}672{,}939/\text{year} \times (700\ \text{MMBtu/hr} \div 350\ \text{MMBtu/hr})^{0.6}$$
$$= \$14{,}661{,}434/\text{year}$$

It is standard District policy to use a 10 year life and 10% interest rate; therefore the capital recovery factor (CRF) of 0.163 will be used to annualize the capital costs.

**Table C-18 Cost Effectiveness for Installing SCR Other Unit**

| Fuel Type | Adjusted Annualized Cost ($/yr) | Emissions Reduced (tons/yr) | Cost Effectiveness ($/ton) |
|---|---|---|---|
| Other | 14,661,434 | 245.3 | $59,769/ton |

It is estimated based on the above data and assumptions that requiring the installation of SCR would result in a cost effectiveness of $59,769/ton for an Other Fuel-fired boiler. The cost effectiveness was evaluated without taking into account additional potential costs involved in a retrofit of the facility. The District has determined that is not economically feasibility to require SCR based on this cost effectiveness analysis and did not further evaluate additional costs associated with a retrofit. It should also be noted that the District's cost effective analysis is very conservative since the installation of the SCR technology with an 80% control efficiency assumes a NOx emission level of approximately 15 ppmv @ 3% O2. This level is lower than established BACT levels and well beyond RACT thresholds. Therefore, even with these conservative assumptions, the installation of SCR is not cost effective.

Furthermore, the emission factors used above are short-term emission limits on a block 24-hour average basis and in all probability will not be representative of actual annual emission rates. Indeed, the post-SCR emission factors for "other" fuels is 0.020 lb/MMBtu, which is well below the short-term emission limits for recently issued ATCs. If, as appears possible, the post-SCR emission rates are higher than assumed above, then the quantity of emission reductions will be lower and the cost of emission reductions greater. Finally, it is vital to remember that the 700 MMBtu/hr boiler assumed for "other" fuels above is an idealized hypothetical chosen to maximize the economies of scale in using the six-tenths rule to scale the cost estimate. For any actual plant within the pollution of solid fuel-fired boilers in SJVAPCD, the boiler rating will be lower (as small as 171.2 MMBtu/hr) and the cost of emission reductions will be correspondingly higher. Based off of this information, it would not be cost effective to require Valley facilities to retrofit with additional NOx reduction technology beyond what is currently being used.

**Controls for Direct PM2.5 Emissions**

The District researched the potential opportunity of specifying required controls for direct PM2.5 emissions. Three technologies were recognized as being able to potentially reduce direct PM2.5 emissions: electrostatic precipitators (ESPs), baghouses, and cyclones.

An ESP is a particulate collection device that removes particles from a flowing gas using the force of an electrostatic charge with a 90- 99.9% control efficiency of PM2.5 for solid fuel fired boilers within the 100-500 MMBtu/hr size range of District units.[50] A baghouse, on the other hand, is a technology in which particulates are removed from a stream of exhaust gases as the stream passes through a large cloth bag. Baghouses have a PM2.5 removal effectiveness of 90-99.9% for solid fuel fired boilers in the size range of District units.[51] Coal and coke-fired units generally use baghouses, but biomass boilers usually use ESPs because of the health and safety risk of the burning embers causing a fire in the baghouse. However, when cyclones are combined with the use of a baghouse, the burning embers are extinguished and allow for the use of a baghouse in a biomass facility[52]. This also reduces acid gases and some PM2.5 compared to the use of a baghouse alone.

All of the facilities subject to Rule 4352 have installed either a baghouse or ESP particulate matter removal system due to permitting requirements. Since the control efficiency ranges for both technologies are equivalent, there are currently no other PM controls more effective than current practices.

**Controls for SOx Emissions**

Potential opportunities to reduce SOx emissions from this source category were also researched. Most facilities subject to Rule 4352 currently inject limestone into the combustion chamber to react with fuel sulfur and produce various sulfate compounds, which can then be removed by the ESP or baghouse. This control technology typically achieves around 50% control of SOx emissions[53]; however, the emissions reduced are less for a low sulfuric fuel due to the lower concentration of sulfur dioxide (SO2) initially in the combustion products.

Scrubbers are an add-on control technology that can achieve 70-95% control of SOx emissions for solid fuel fired boilers[54]. The only MSW facility in the Valley currently utilizes a semi-dry scrubber system to control SOx emissions. Therefore, the District calculated the average cost effectiveness of a scrubber system for biomass and coal/coke facilities.

The District conducted a SOx BACT evaluation for a local power generation facility that was installing a biomass boiler and determined the capital costs for a wet scrubber

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[50] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.

[51] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.

[52] Roberts, C. (2009). *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Northeast States for Coordinated Air Use Management and the EPA Office of Air Quality Planning and Standards.

[53] Alberta Research Council Inc. (2001). *Technical Advice on Air Pollution Control Technologies for Coal-fired Power Plants*.

[54] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.

system are approximately $5.8 million. The annualized capital equipment cost is calculated by multiplying the installed equipment cost by the capital recovery factor of 0.1627.

**Annual Capital Costs ($AC_{capital}$)**

$AC_{capital}$= $5,800,000 X 0.1627
**$AC_{capital}$= $943,660/year**

In addition, this system has additional costs for the sodium hydroxide reagent used in the scrubber which are estimated to be an additional $642,000 per year. Thus, the total annual cost would be:

**Total Annual Costs ($AC_{total}$)**

$AC_{total}$ = Capital Costs + Reagent Costs = ($943,660/year) + ($642,000/year)
**$AC_{total}$ = $1,585,660/year**

Cost effectiveness is calculated by dividing the annual cost by the annual emissions reductions from District standard emissions. One cost effectiveness analysis was conducted for the biomass and coal/coke fired units in the Valley because the four coal/coke fired units are fired on biomass part of the time.

The average SOx emissions limit of these units, based on District Permits SOx emissions limits, is 0.044 lb/MMBtu and the average heat input is 341 MMBtu/hr. An emissions factor of 0.27 lb/MMbtu at 24 hours per year is assumed to reflect the time needed for the startup and shutdown period, when the exhaust temperature is not high enough for controls to be fully effective. Therefore, those numbers were utilized to calculate annual standard emissions as follows:

**Annual Standard Emissions ($AE_{standard}$)**

$AE_{standard}$ = [(0.044 lb/MMBtu) x (341 MMBtu/hour) x (8,760 hour/year)] + [(0.27 lb/MMBtu) x (24 hour/year) x (341 MMBtu/hr)]
**$AE_{standard}$ = 133,644.7 lb/year**

Potential emissions, using the technologically feasible emission limit of 0.012 lb/MMBtu that is achieved by the use of a wet scrubber system, can be calculated as follows:

**Annual Emissions with Wet Scrubber System ($AE_{scrubber}$)**

$AE_{scrubber}$ = [(0.012 lb/MMBtu) x (341 MMBtu/hour) x (8,760 hour/year)] + [(0.27 lb/MMBtu) x (24 hour/year) x (341 MMBtu/hour)]
**$AE_{scrubber}$ = 38,055.6 lb/year**

Therefore, the cost effectiveness would be:

**Cost Effectiveness (CE)**

CE= ($1,585,660/year) ÷ [(133,644.7 lb/year – 38,055.6 lb/year) x (1 ton/2,000 lb)]
**CE = $33,177/ton**

It is important to note that the cost effectiveness analysis above does not reflect the costs of additional electricity consumption, additional labor costs, additional solid waste disposal, and other operational changes or additions that would be required to comply with the lower limit. The option of scrubbers is not a cost effective option, and therefore, is not feasible.

There are no additional technologies available to reduce SOx emissions from solid fuel fired units.

**Start-up Periods**

The possibility of reducing the allowed start-up period of solid fuel fired boilers was considered, since facilities are exempt from emissions limits during this period. Facilities subject to Rule 4352 are currently subject to a start-up limit of 96 hours. Operators currently limit their start-up and shut-down times as much as possible since down time results in reduced productivity and profits. However, facilities periodically perform “cold repairs” on their solid fuel fired boilers for maintenance or trouble-shooting purposes. This requires operators to completely shut down the boilers, which in turn requires a longer start-up period to return to correct operating temperature. When the solid fuel fired boilers are starting up, the units are not operating with a full load which reduces emissions. Therefore, this is not a technologically feasible option for solid fuel fired facilities given the needs of current work practices.

### Evaluation Findings

Even though solid fuel fired boilers, steam generators, and process heaters are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4352 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from solid fuel fired boilers, steam generators, and process heaters in the Valley.

## C.14 RULE 4354 GLASS MELTING FURNACES

### Discussion
The provisions of Rule 4354 are applicable to glass melting furnaces in the Valley. The purpose of this rule is to limit NOx, SOx, volatile organic compounds (VOC), carbon monoxide (CO), and PM emissions from glass melting furnaces.

Rule 4354 was adopted on September 14, 1994 and has been subsequently amended six times. Rule 4354 was amended September 16, 2010 to strengthen the NOx emission limits in the rule; EPA finalized approval for these amendments on August 29, 2011. Rule 4354 was subsequently amended again in May 19, 2011 to implement updated start-up requirements; EPA finalized approval of the 2011 amendments to Rule 4354 on January 31, 2013 and deemed this rule as being as stringent as, if not more stringent than, established RACT requirements. As a result of this stringent prohibitory rule and continuing efforts on behalf of this industry to reduce emissions, the Valley is home to glass-making facilities with glass melting furnaces that utilize the most advanced low-NOx firing technology.

### Source Category
Industrial glass making is a continuous process with raw materials supplied to the furnace at the front end, and product taken off the line at the back end of the process. The raw materials for making glass are silica sand and soda ash. Melting these basic materials and forming them into the desired product geometry creates the final glass product. The different end products vary widely in raw material additives, processing equipment and conditions, and product quality requirements. The emission limits of Rule 4354 depend on the type of glass produced, furnace firing technology and the emission-averaging period.

Rule 4354 is among the most stringent rules in the nation for glass melting furnaces. The NOx emission limits contained within Rule 4354 require the installation of the best available NOx technology (i.e. oxy-fuel firing or SCR systems).

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.33 | 0.34 | 0.35 | 0.36 | 0.38 | 0.39 | 0.39 | 0.40 | 0.40 |
| NOx | 6.04 | 6.21 | 3.99 | 4.08 | 4.17 | 4.27 | 4.31 | 4.35 | 4.38 |
| SOx | 1.96 | 2.00 | 1.83 | 1.87 | 1.90 | 1.93 | 1.95 | 1.96 | 1.98 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.33 | 0.34 | 0.35 | 0.36 | 0.38 | 0.39 | 0.39 | 0.40 | 0.40 |
| NOx | 6.04 | 6.21 | 3.98 | 4.08 | 4.17 | 4.27 | 4.31 | 4.34 | 4.38 |
| SOx | 1.96 | 2.00 | 1.83 | 1.87 | 1.90 | 1.93 | 1.95 | 1.96 | 1.98 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, PM2.5 and NOx emissions from glass melting furnaces are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements for PM2.5 and NOx; however, the District has still conducted a full control measure evaluation for glass melting furnaces.

### How does District Rule 4354 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG requirements for this source category.

***ACT***

- EPA-435/R-94-037 (Alternative Control Techniques Document—NOx Emissions from Glass Manufacturing)

The District evaluated the requirements contained within the above ACT and found no requirements that were more stringent than those already in Rule 4354.

***NSPS***

- 40 CFR 60 Subpart CC (Standards of Performance for Glass Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 60 Subpart CC and found no requirements that were more stringent than those already in Rule 4354.

- 40 CFR 60 Subpart PPP (Standards of Performance for Wool Fiberglass Insulation Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 60 Subpart PPP and found no requirements that were more stringent than those already in Rule 4354.

***NESHAP/ MACT***

- 40 CFR 61 Subpart N (National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants)

40 CFR 61 Subpart N was last amended February 27, 2014; however, this NESHAP only regulates inorganic arsenic emissions and therefore does not apply to this control measure evaluation.

- 40 CFR 63 Subpart NNN (National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 63 Subpart NNN and found no requirements that were more stringent than those already in Rule 4354.

- 40 CFR 63 Subpart SSSSSS (National Emission Standards for Hazardous Air Pollutants for Glass Manufacturing Area Sources)

The District evaluated the requirements contained within 40 CFR 63 Subpart SSSSSS and found no requirements that were more stringent than those already in Rule 4354.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 4354 compare to rules in other air districts?
There are no analogous rules for this source category in VCAPCD and SMAQMD.

***SCAQMD***
- Rule 1117 (Emissions of Oxides of Nitrogen from Glass Melting Furnaces)

The District evaluated the requirements contained within SCAQMD's Rule 1117 and found no requirements that were more stringent than those already in Rule 4354.

***BAAQMD***
- BAAQMD Regulation 9 Rule 12 (Nitrogen Oxide Emissions from Glass Melting Furnaces)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 12 and found no requirements that were more stringent than those already in Rule 4354.

### Additional Emission Reduction Opportunities

**SOx Limits for Container Plants**
The District evaluated the possibility of lowering the existing SOx limits for container plants from the current limits of 0.9 and 1.1 lbs of SOx per ton of glass, depending on cullet content, to the District BACT limit of 0.8 lbs/ton. The analysis below indicates that it is not technologically feasible to lower the SOx limits.

The glass container industry is mandated by the State of California to use a minimum quantity of recycled glass (cullet) as part of the production process. The quantity of clear glass cullet available to glass manufacturers is very limited; therefore, cullet with a large portion of colored glass is included in each batch. The continued use of mixed color cullet is critically important to meeting California's recycling goals. Due to the variable quality of mixed color cullet, SOx emissions produced by the melting of recycled cullet are also variable.

Container glass manufacturers control multiple furnaces as a single unit, meaning that the exhaust from multiple furnaces are ducted together and the total emissions are averaged over the total amount of glass pulled from all furnaces. Because emissions are averaged across furnaces, EPA requires that there be a 10% air quality benefit, meaning that the overall limit for multiple furnaces be 10% less than the limit for a single furnace. This imposes the lowest SOx emission limit on container glass furnaces, but allows operators to install one control device per facility rather than one add-on control device per furnace. SOx emissions limits for container glass were adopted at 1.1 pounds per ton of glass produced if the operator uses at least 25% by weight of mixed color cullet and a limit of 0.9 pounds per ton of glass produced for all other container glass manufacturing. If the District were to lower the limits in the rule to 0.8 lbs/ton, then the 10% required air quality benefit for multiple furnaces extend beyond BACT, which is not feasible. The 0.8 lbs/ton BACT limit is equivalent to the 0.9 lbs/ton limit with the additional EPA required 10% air quality benefit.

### Evaluation Findings

Even though glass melting furnaces are not a significant source of PM2.5 or NOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4354 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from glass melting furnaces in the Valley.

## C.15 RULE 4550 CONSERVATION MANAGEMENT PRACTICES

### Discussion

Rule 4550 is the District's Conservation Management Practices (CMP) rule. Rule 4550 was the first rule of its kind in the nation to reduce fugitive particulate emissions from agricultural operations through the reduction of passes of agricultural equipment and implementation of other conservation practices. Rule 4550 is unique because it is based upon a menu approach of control techniques to accommodate the variability of agricultural industries. The selected CMPs are listed on application forms that are submitted to the District for approval as a CMP Plan. Agricultural operations are required to maintain detailed records verifying use of the approved Conservation Management Practices. Approved CMP plans are enforced through onsite inspections and operators are required to submit applications and modify their plans when changing their conservation management practices. Through this rule, PM10 emissions have been reduced by 35.3 tons per day[55], which is approximately a 24% reduction for this source category.

The District worked extensively with stakeholders, growers, and the Agricultural Technical Committee for the San Joaquin Valley-wide Air Pollution Study Agency (AgTech) for two years prior to developing the Conservation Management Practices (CMP) Rule. Rule 4550 was adopted on August 19, 2004 to help bring the Valley into attainment of federal PM10 standards. Rule 4550 has served as a model for other regions seeking to reduce fugitive particulate emissions from agricultural sources.

Upon adoption of Rule 4550, the District embarked on an ambitious implementation strategy, working extensively with agricultural stakeholders to ensure that affected sources were assisted as much as possible in complying with the requirements, and consequently ensuring that the CMP Program was successful. To this end, the District created special CMP application forms, which were designed to allow growers to select approved practices from simplified checklists. A special web page was created that contains answers to frequently asked questions, application forms, and other forms of assistance for agricultural operations. The District hired additional staff, including additional Small Business Assistance (SBA) staff, and took part in over 40 workshops throughout the Valley to assist sources in completing and submitting the required CMP application forms. The workshops were coordinated with agricultural stakeholders, and tremendous outreach was performed to ensure that as many affected sources as possible would attend and receive assistance at the workshops. As a result of these efforts, the District's CMP Program realized the following notable achievements:

- Approximately 4,000 workshop participants, with many of the participants submitting CMP Plan applications during the workshops.
- The District received and processed over 6,000 CMP Plan applications during 2005.

[55] SJVAPCD. *Conservation Management Practices Program Report for 2005.* (2006, January 19). Retrieved from http://www.valleyair.org/farmpermits/updates/cmp_program_report_for_2005.pdf

- The practices used by valley agricultural sources encompass 3.2 million acres of farmland, and over 30,000 miles of unpaved roads.
- The PM10 reductions are quantifiable and enforceable through approved CMP plans and inspections.
- The collaborative effort responsible for the CMP program received US EPA Region IX's "2005 Environmental Award for Outstanding Achievement."

The District also conducted an additional 60 workshops throughout the Valley over the last 10 years for the purpose of assisting sources comply with the CMP and other ag-related rules.

EPA finalized approval of Rule 4550 on February 14, 2006 and determined that the rule met BACM requirements.[56] Subsequent to EPA's approval of Rule 4550, two separate lawsuits were filed challenging EPA's approval of the rule as satisfying BACM. The Ninth District Court of Appeals, in both cases, agreed with EPA's approval and reaffirmed EPA's finding that Rule 4550 meets BACM requirements.[57,58]

### Source Category

This rule is applicable to on-field farming and agricultural operation sites located within the Valley. Rule 4550 limits fugitive dust emissions from farming operations by requiring CMP plans for farms with 100 acres or more, dairies with 500 or more mature cows, cattle feedlots with 190 or more cows, turkey ranches with 55,000 or more turkeys, chicken ranches with 125,000 or more chickens, and chicken egg ranches with 82,000 or more laying hens.

Rule 4550 specifies that agricultural operations must select at least one CMP from each of the identified applicable CMP categories. Animal feeding operation (AFO) sources subject to Rule 4550 that also grow field crops must select CMPs for their field crops, as well as their AFO. There are five CMP categories for the cropland source category, four CMP categories for the dairy source category, four CMP categories for the feedlot source category, and five CMP categories for the poultry source category. The selected CMPs must be noted on the applications provided and then submitted to the District for approval. Completed applications constitute a CMP Plan once approved by the District.

Emissions from agricultural operations vary by many factors, some beyond the control of the agricultural operations. PM10 emissions are generated during land preparation activities, harvest activities, and post-harvest activities. Emissions are caused by the mechanical disturbance of the soil by implements and the tractors pulling them,

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[56] 71 Federal Register 30, 7683-7688. (2006, February 14). *Revisions to the California State Implementation Plan; San Joaquin Valley Unified Air Pollution Control District*. Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2006-02-14/pdf/06-1311.pdf

[57] U.S. Court of Appeals for the Ninth Circuit. *Latino Issues Forum v. EPA.* Retrieved from http://njlaw.rutgers.edu/collections/resource.org/fed_reporter/NEWcircs/cir9/0671907_cir9.html

[58] SJVAPCD. *Court rules in favor of Air District ag rule. Second decision this week affirms PM progress.* Retrieved from https://www.valleyair.org/recent_news/Media_releases/2009/PR%20Court%20decision%20favors%20District%20ag%20rule.pdf

resulting in the entrainment of soil or plant materials into the air. Wind blowing across exposed agricultural land also causes the entrainment of PM10 into the air. In addition, PM10 emissions can also become entrained from vehicular travel over unpaved roads and unpaved parking/equipment areas. Conservation management practices fall into several broad categories and are intended to reduce emissions as follows:

- The reduction of soil or manure disturbance;
- Soil protection from wind erosion;
- Equipment modifications to physically produce less PM10; and
- Application of water or dust suppressants on unpaved roads and other travel areas to reduce emissions entrained by moving vehicles and equipment.

### Emissions Inventory

There are no NOx or SOx emissions attributable to the sources subject to CMP requirements. The following emissions inventory table represents PM2.5 emissions only.

| Source | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **Tilling Dust** | 5.17 | 5.14 | 5.12 | 5.09 | 5.07 | 5.04 | 5.02 | 5.00 | 4.97 |
| **Harvest Operations – Dust** | 7.28 | 7.25 | 7.23 | 7.20 | 7.18 | 7.15 | 7.12 | 7.10 | 7.07 |
| **Dust from Agricultural Lands (non-pasture)** | 6.15 | 6.12 | 6.08 | 6.05 | 6.02 | 5.99 | 5.96 | 5.93 | 5.90 |
| **Dust from Pasture Lands** | 1.09 | 1.09 | 1.08 | 1.08 | 1.08 | 1.07 | 1.07 | 1.06 | 1.06 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **Tilling Dust** | 7.37 | 7.33 | 7.29 | 7.25 | 7.21 | 7.18 | 7.14 | 7.10 | 7.06 |
| **Harvest Operations – Dust** | 0.31 | 0.31 | 0.30 | 0.30 | 0.30 | 0.29 | 0.29 | 0.29 | 0.29 |
| **Dust from Agricultural Lands (non-pasture)** | 4.36 | 4.33 | 4.30 | 4.28 | 4.25 | 4.23 | 4.20 | 4.17 | 4.15 |
| **Dust from Pasture Lands** | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.22 | 0.22 | 0.22 |

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 4.0 tons per day (tpd) for PM2.5 dust emissions. As identified in the above table, annual average emissions from pasture lands are lower than the BACM/MSM significance threshold. Therefore, the Clean Air Act does not require a control measure evaluation for that source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for CMPs for all emission categories.

### Contribution of PM2.5 to PM10 Emissions from Agricultural Operations

While Rule 4550 has been successful in reducing both PM10 and PM2.5 emissions, recent studies have indicated that the PM2.5 fraction of emissions makes up a small portion of the total particulate emissions from agricultural operations. Additionally, particulate emissions from agricultural operations are geologic in nature. These geologic particulate emissions make up a relatively small portion of the overall PM2.5

concentrations during the winter season and have relatively low toxicity relative to the organic carbon fraction of PM2.5 and to re-suspended road dust.[59]

Accordingly, particulate emissions from agricultural sources do not play a significant role with regard to attainment of the PM2.5 standards addressed by this plan, and Rule 4550 is primarily a PM10 reduction strategy. For example, 2004-2006 speciation analyses of PM2.5 from the Speciated Trends Network in Fresno and Bakersfield found that the annual average geologic fraction was 4% and 6%, respectively.[60] Given that PM2.5 emissions from agricultural field operations are generally subject to deposition near their source, the predominant source of this geologic PM2.5 would be urban re-suspended road dust with relatively little contribution from agricultural activities.

PM2.5 emissions from agricultural field operations have been generally over-estimated in absolute terms due to species differences between the fine and coarse fractions of geologic emissions. Using Valley ambient measurements of trace elements, the PM2.5/PM10 ratios for the predominant trace elements found in fugitive dust have been estimated.[61] The average ratio for aluminum and silicon was 0.05 and ranged between 0.10 to 0.16 for calcium, titanium, and iron. Based on the relative abundances of these elements in fugitive dust, the overall PM2.5/PM10 ratio was estimated to be 0.06 (6%). This ratio estimate is substantially lower that the ratio of 0.20 reported previously for agricultural crops nationwide by MRI in 1996 based on limited supporting data and broad assumptions.[62] Further review of Valley research on PM2.5/PM10 ratios shows a consistent mid-point estimate of 0.10.[63] To summarize, PM2.5 comprises a small fraction of total PM10 emissions from field operations, approximately 10% in the Valley.

Historically, both grid models and PM2.5 monitors used in field studies have significantly over-estimated overall PM2.5 emissions from agricultural field operations as well as their contribution to ambient PM2.5 concentrations. In respect to grid modeling biases, there is an expert consensus regarding the sources of grid model overestimation: (1) faulty emission factor algorithms, (2) imprecise or difficult to obtain activity data to apply these algorithms (including inability to account for the effect of actual meteorological conditions on emissions), (3) the multiplier used to infer PM2.5 from PM10 emissions, and (4) modeling transport over-estimation (especially in the treatment of particles near their point of emissions).[64]

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[59] Rogge, W. F., Hildemann, L. M., Mazurek, M. A., Cass, G. R. and Simoneit, B. R. T. *Sources of Fine Organic Aerosol—3. Road Dust, Tire Debris, and Organometallic Brake Lining Dust—Roads as Sources and Sinks*. Environmental Science & Technology 27(9), 1892-1904. 1993.
[60] SJVAPCD. (2012). *2012 PM2.5 Plan*. Retrieved from http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/04%20Chapter%204%20Sci%20Foundation%20and%20Modeling.pdf
[61] Countess, R. *Reconciling Fugitive Dust Emission Inventories with Ambient Measurements.* 12th Annual EPA EI Mtg, San Diego, CA. April 29-May 1, 2003.
[62] Cowherd, C., and W. Kuykendal. (1996, June). *Paper No. WP96.04, Proceedings of the Annual Meeting of the Air and Waste Management Association*
[63] Pace, T.G, EPA. (2005, April). *Examination of the Multiplier Used to Estimate PM2.5 Fugitive Dust Emissions from PM10.* Retrieved from http://www.epa.gov/ttn/chief/conference/ei14/session5/pace.pdf.
[64] Pace, T.G, EPA. (2005). *Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses*.

In respect to over-estimation of PM2.5 transport, much of the ground level fugitive dust from soil disturbance is likely to be removed close to the source.[65,66,67] This is due to the low release height and turbulence which keeps particles temporarily close to the surface where they are subject to removal by impaction on nearby surfaces, including vegetation and structures. Equally significant in respect to over-estimation of PM10 and PM2.5, grid models ignore all removal processes in the grid cell where the emissions originate. Given that 4 kilometers is a typical grid dimension, a considerable fraction of PM2.5 emitted under normal field operations could and often would be deposited within that cell.

**Wind-blown Dust in the Valley**

The Valley experiences wind-blown dust events from time to time typically during the spring and fall seasons when weather disturbances are most common. These events are less likely to occur during the long stagnation periods of the summer and winter. When soil conditions are dry, strong wind events often entrain coarse particulate matter into the atmosphere, carrying the pollution long distances across the Valley. This phenomenon has the potential to create higher concentrations of PM10 in its path of impact.

Although these events primarily cause higher PM10 concentrations, there are rare instances where PM2.5 concentrations become elevated. In addition to the rarity of elevated PM2.5 concentrations, the PM2.5 values recorded during the strong stagnation periods of the winter season are usually much higher than those recorded during wind events. Because of this, the Valley's PM2.5 design values are driven primarily by high winter-time concentrations, mostly due to organic carbon and the secondary formation of ammonium nitrate. Comparatively, the geologic component of the Valley's peak PM2.5 concentrations is only a fraction of the mass formed through secondary processes and other sources. As a result, the wind events experienced in the Valley are not a significant contributor to the PM2.5 attainment challenges for the region, and placing further controls on this source would not make a substantial difference in the District's PM2.5 design values.

## Continuous Evaluation of Potential CMPs

The District evaluates the effectiveness of CMPs on a regular basis, as illustrated on the District's web page under *Requirements for Agricultural Operations*.[68] Rule 4550 was adopted in August 2004, and during that same year the *Ag CMP Handbook*, the *Poultry CMP Handbook*, and a list of conservation management practices were posted to the same District site. In 2006, the District prepared and published a CMP Program Report

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[65] Watson, J. G., J. Chow and contributors (2000, May). *Reconciling Urban Fugitive Dust Emissions Inventory and Ambient Source Contribution Estimates*. Desert Research Institute Report 6110.4F. Prepared for U.S. EPA. Retreieved from http://www.epa.gov/ttn/chief/efdocs/fugitivedust.pdf

[66] Slinn, W. "Predictions for Particle Depositions to Vegetative Canopies", Atmospheric Environment, 16: 1785-1794, 1982.

[67] Etyemezian, V. et al., Desert Research Institute (2003, January) *Field Testing and Evaluation of Dust Deposition and Removal Mechanisms – Final Report*. Retrieved from http://www.westar.org/Docs/Dust/Transportable_Dust_Final_Report_DRI_WESTAR.pdf

[68] SJVAPCD. *Requirements for Agricultural Operations.* http://www.valleyair.org/farmpermits/

for 2005,[69] in which the District provided an explanation of the key components of the CMP program and a detailed summary of the process of identifying and quantifying the emission reductions achieved through December 31, 2005.

The District also posted a guidance document entitled, *San Joaquin Valley Air Pollution Control District Approval of New Conservation Management Practices (CMPs),*[70] to the District web page in 2010. This document outlines procedures for the approval of new CMPs proposed by owners/operators to be used for compliance with the requirements of Rule 4550 conservation management practices. In addition, District Rule 4550 is brought up for discussion frequently in the AgTech Committee, which consists of various regulatory agencies, agricultural industry representatives, and university professors. The AgTech Committee has evaluated proposed CMPs for inclusion as part of the approved CMP list, including the promotion of conservation tillage at Valley farms, misting to reduce PM10 generated by disking, and almond harvesting techniques to reduce emissions.

- **Conservation Tillage/Combined Operations**
  Conservation tillage includes types of tillage that reduce loss of soil and water in comparison to conventional tillage. Benefits include the reduction of passes and soil disturbance and soil improvements because it retains plant residue and increases organic matter. Examples of conservation tillage include converting to no or low till operations, implementing reduced till activities, adding soil/water amendments to improve resources, and reducing tillage needs.

  In the spring of 2008, EPA and USDA Agricultural Research Service (ARS) in collaboration with the District, NRCS, and other agencies/stakeholders performed a study of conservation tillage/combined operations and demonstrated significant PM emission reductions from this practice. EPA completed the final report in June 2013. This report, including the merits of conservation tillage/combined operations were discussed in great detail in the AgTech meetings and amongst industry stakeholders. It was determined that the conservation tillage/combined operations management practice is already included in nine out of the eleven crop categories with the other two crop categories consisting of a “non-tillage/chemical tillage” option. Non-tillage requires no disturbance of soil and can achieve even more reductions than conservation tillage. In addition, Rule 4550 already allows the option to select an “other” mitigation measure, which needs to be approved on a case by case basis. Since “conservation tillage” is already an approved conservation management practice, if an operator chose this for the “other” mitigation measure it would likely be approved.

[69] SJVAPCD. (2006, January 19). *Conservation Management Practices Program Report for 2005.* Retrieved 2/2/2015 from http://www.valleyair.org/farmpermits/updates/cmp_program_report_for_2005.pdf.
[70] SJVAPCD. (2010, December 14). *San Joaquin Valley Air Pollution Control District Approval of New Conservation Management Practices (CMPs)*. Retrieved 2/2/2015 from http://www.valleyair.org/policies_per/Policies/SSP_3010.pdf.

- **<u>CSUF Foundation Report: MISTING: A Conservation Management Practice for Reducing PM10 Generated by Disking</u>**
  A study was performed between March 2008 and September 2011 to test if the addition of a Misting System Duct Control Unit manufactured by Diamond E. Manufacturing would reduce emissions from disking. The final report was published in December 2011. In January 2013, Diamond E. Manufacturing requested that the Diamond E. Manufacturing Dust Control Unit be added to the official CMP list. A District review of the report indicated that it did not provide sufficient information to demonstrate the minimum 10% reduction in PM10 emissions and therefore, was not added to the official CMP list. If sufficient information demonstrating that the dust control unit achieves the minimum PM10 reductions is provided in the future, this measure would be allowed to be selected under the existing CMP category: Cropland – Land Preparation/Cultivation, Equipment changes/Technological Improvements.

- **<u>Harvesting Equipment to Reduce PM Emissions from Almond Harvest Operations</u>**
  A study was performed in 2010 and 2011 by Texas A&M to evaluate a variety of improved almond harvesters and their ability to reduce PM emissions. A final report was published in January 2013, demonstrating that the newer harvesters achieved significant PM emissions compared to their predecessors. This specific measure was not added to the list of conservation practices because it was determined that using newer almond harvesters to reduce PM emissions would be allowed under the existing CMP Category: Cropland-Harvest, Equipment Changes/Technological Improvements.

### How does District Rule 4550 compare with federal and state rules and regulations?

Federal requirements such as NSPS, NESHAP, MACT, CTGs, and ACTs and state regulations are not applicable to this source category.

### How does District Rule 4550 compare to rules in other air districts and states?

The requirements and applicability of Rule 4550 were compared to analogous rules in other air districts and states to determine the stringency of Rule 4550 compared to those other rules. BAAQMD and VCAPCD do not have rules that are analogous to Rule 4550.

***SMAQMD***

- Rule 215 (Agricultural Permit Requirements and New Agricultural Permit Review): District Rule 4550 is at least as stringent as if not more stringent than the analogous rule in SMAQMD.

***SCAQMD***

- SCAQMD has adopted agricultural best management practices (BMP) programs, which were approved by EPA as Best Available Control Measures (BACMs); however, the District's CMP rule exceeds these standards.

### *Imperial County Air Pollution Control District (ICAPCD)*

- Rule 806 (Conservation Management Practices)

Imperial County APCD (Imperial) first adopted their Regulation VIII rules in 2005 to implement requirements designed to reduce the amount of PM10 entrained in the ambient air as a result of emissions generated from anthropogenic fugitive dust sources. Rule 806 (Conservation Management Practices) is a part of this set of rules. EPA did not approve the Regulation VIII rules as amendments to the state implementation plan (SIP) in July 2010. After a public process and mediation between Imperial and EPA, on October 16, 2012, a revised rule was adopted with rule requirements effective on and after January 1, 2013.

Imperial Rule 806 requires one conservation practice from each of three categories (land preparation and cultivation, harvesting, and cropland-other), but the rule also specifies that if the owner or operator of an Agricultural operation site chooses to implement conservation tillage as a conservation practice, then that owner/operator does not need to select any additional conservation practices.

As stated earlier, the District's CMP rule includes conservation tillage as a conservation management practice for nine out of the eleven crop categories, listed as an option under Land Preparation/Cultivation and/or under the Harvest section. The option to select conservation tillage is also available to all crops by program design because each of the three sections includes an "Other (approved on a case-by-case basis)," thus allowing conservation tillage to be chosen as a conservation practice by any owner/operator. District Rule 4550 is more stringent than Imperial Rule 806 where a Valley operator selects "conservation tillage" in one category, but still has to select two additional measures, resulting in even more emission reductions. Therefore, requirements in Rule 4550 are equivalent, if not more stringent than Imperial Rule 806.

### *Arizona Department of Environmental Quality*

- The Arizona Department of Environmental Quality adopted agricultural BMP programs.

The Arizona Agricultural Best Management Practices Committee was established in 1998 by Arizona Revised Statutes (A.R.S) §49-457 to research and adopt BMPs for agricultural operations that generate dust. The BMPs are designed to reduce emissions of PM10 in the Maricopa County Serious PM10 nonattainment area. In 2006, the Committee reconvened the Technical Workgroup to review the current use of BMPs in Maricopa County.

The Arizona rule is not applicable to dairies, cattle feedlots, turkey ranches, chicken ranches, or chicken egg ranches. District Rule 4550 is more stringent than the Arizona rule for these categories. With regards to measures specific to agricultural crops, the measures offered as conservation practices in Arizona are similar to the conservation practices offered within District Rule 4550 and would likely yield similar amounts of emission reductions.

### Evaluation Findings

EPA's approval of Rule 4550 as BACM and the District's review of similar rules in other regions demonstrate that the District has adopted the most stringent rule of its kind. Rule 4550 is more stringent than the Imperial rule and the Arizona rule, as both rules are not applicable to dairies, cattle feedlots, turkey ranches, broiler ranches, or layer hen ranches. With regards to measures specific to agricultural crops, the measures allowed as conservation practices in Imperial County and Arizona are similar to the conservation practices allowed under Rule 4550 and yield similar amounts of emission reductions.

Given the relatively low contribution that emissions from this category make to the Valley's PM2.5 concentrations and current stringent requirements under Rule 4550, the District has not identified any additional rule amendment opportunities for further emission reductions from source categories subject to CMP requirements to include in this plan. As demonstrated above, Rule 4550 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category.

Although Rule 4550 already meets BACM and MSM requirements, the District is committing to further evaluate Rule 4550 for additional opportunities. See Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities) for more information.

## C.16 RULE 4692 COMMERCIAL CHARBROILING

### Discussion

Rule 4692 applies to chain-driven charbroilers used to cook meat. The purpose of the rule is to limit volatile organic compound (VOC) and PM10 emissions from commercial charbroiling. The rule also specifies administrative, recordkeeping requirements, and test methods.

The original rule, adopted in March 2002, reduced PM2.5 emissions from chain-driven charbroilers by 84%. The September 2009 rule amendment expanded rule applicability to more chain-driven charbroilers, reducing 25% of the remaining PM2.5 chain-driven charbroiler emissions. EPA finalized approval for Rule 4692 on November 3, 2011. The District evaluated Rule 4692 in its *2009 Reasonably Available Control Technology Demonstration for Ozone State Implementation Plans (2009 RACT SIP)*; however, EPA noted in its Technical Support Document (TSD) for the approval of Rule 4692 that the rule is not subject to RACT because it is not subject to CTG requirements and it does not regulate major sources.

### Source Category

There are two types of commercial charbroilers: chain-driven and under-fired. A chain-driven charbroiler is a semi-enclosed broiler that moves food mechanically through the device on a grated grill to cook the food for a specific amount of time. An under-fired charbroiler has a metal "grid," a heavy-duty grill like that of a home barbecue, with gas burners, electric heating elements, or wood under the grid to cook the food. The smoke and vapors generated by cooking on either type of charbroiler contain water, VOCs, and PM. Larger particles and grease are typically captured by the grease filter of the ventilation hood over the charbroiler. The remaining VOCs and PM2.5 are exhausted outside the restaurant, unless a secondary control is installed.

Currently, District Rule 4692 reduces emissions by requiring catalytic oxidizers for chain-driven charbroilers that meet rule applicability thresholds. Charbroiler exhaust is directed through the catalytic oxidizer with little loss of temperature. As high-temperature exhaust goes through the heated catalyst, PM and VOC are oxidized to carbon dioxide and water vapor. This chemical reaction releases energy that heats the catalyst and is transferred to a heat recovery system, so no additional fuel is needed for the unit. Controlling emissions from under-fired charbroilers has proven to be far more challenging. To date, no cost effective technologies have been demonstrated.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 2.84 | 2.87 | 2.92 | 2.97 | 3.04 | 3.11 | 3.18 | 3.24 | 3.31 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 2.84 | 2.87 | 2.92 | 2.97 | 3.04 | 3.11 | 3.18 | 3.24 | 3.31 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## How does Rule 4692 compare with federal and state rules and regulations?

### Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

### State Regulations
There are no state regulations applicable to this source category.

## How does Rule 4692 compare to rules in other air districts?
There are no analogous rules for this source category in SMAQMD.

### *SCAQMD*
- Rule 1138 (Control of Emissions from Restaurant Operations)

The District evaluated the requirements contained within SCAQMD's Rule 1138 and found no requirements that were more stringent than those already in Rule 4692.

### *BAAQMD*
- Regulation 6 Rule 2 (Commercial Cooking Equipment)

BAAQMD Regulation 6 Rule 2 regulates both chain-driven and under-fired units. Newly installed under-fired units with more than 10 square feet of cooking area are required to limit emissions to 1 lb of PM10 per 1,000 lbs of cooked beef. Effective January 2013, the same emissions requirements also apply to pre-existing units. However, as the BAAQMD rule is implemented, a significant portion of under-fired charbroilers are below the applicability thresholds for grill size or amount of food cooked, and are thus exempt from rule requirements. In addition, BAAQMD has been unable to enforce this rule because no control technologies have been certified.

The applicability thresholds for grill size in District Rule 4692 are lower than those in BAAQMD Regulation 6 Rule 2. Therefore, because BAAQMD Regulation 6 Rule 2 is not currently being enforced for under-fired charbroilers, District Rule 4692 is effectively more stringent. Additionally, the District committed in the *2012 PM2.5 Plan* to amend

Rule 4692 in 2016 to expand applicability to include under-fired charbroilers. During the rule development process for this amendment, the District will examine all potential opportunities for further emission reductions.

***VCAPCD***

- Rule 74.25 (Restaurant Cooking Operations)

The District evaluated the requirements contained within VCAPCD's Rule 74.25 and found no requirements that were more stringent than those already in Rule 4692.

## Additional Emission Reduction Opportunities

**Chain-Driven Charbroilers**

Rule 4692 requires emission controls for chain-driven charbroilers that cook 400 pounds of meat or more per week. In 2009, the amended rule was estimated to apply to about 280 of the 427 chain-driven identified charbroilers of the Valley. This rule thus applies to about 65% of the units and a much greater percentage of the total emissions from chain-driven charbroilers since they are higher use. The applicability threshold for chain-driven charbroilers under Rule 4692 could be lowered to make smaller facilities subject to the rule. However, these currently-exempt chain-driven units are a very small portion of the total inventory for this category. Emissions reductions would be minimal and costly through this approach. Furthermore, the District's applicability threshold is already lower than that of other air districts.

**Under-Fired Charbroilers**

Rule 4692 does not currently require emissions controls for under-fired charbroilers. Catalytic oxidizers are not effective for reducing emissions from under-fired charbroilers because the exhaust from these devices loses too much heat as it is directed to the control device, and the reactions at the catalyst cannot take place under this lower temperature. The following control strategies are more effective for under-fired charbroilers:

- **High efficiency particulate-arresting (HEPA) filtration systems:** This system adds a HEPA filter to the appliance's existing grease filters to effectively eliminate particulates down to about 0.3 microns in diameter. System maintenance is relatively easy to perform, but filters need to be regularly changed (perhaps weekly, depending on the amount of food cooked).

- **Electrostatic precipitators (ESPs):** Exhaust particles become electrically charged as they pass through an electrically charged screen. These ionized particles are then collected by one of two oppositely-charged plates. ESP systems need filtration prior to the ESP itself to remove grease and larger particles from kitchen exhaust. These devices are cleaned daily with a clean-in-place system, and more thorough cleaning is required once or twice a year. Routine maintenance often requires hiring an outside company, since the ESP plates can weigh as much as 75 pounds.

- **Wet scrubbers:** A fine stream of water and detergent "washes" the particulates from the kitchen exhaust. The particulate/water/detergent mix is then filtered; the filtered water/detergent mix is recycled through to clean more exhaust, and the particulate-laden wash water is discharged to the sewer system. In addition to the cost of the system itself, associated water/sewer usage costs and detergent costs can be high, although recent improvements in design are improving system efficiencies.

These controls for under-fired charbroilers were unproven and extremely costly during the District's 2009 amendment of Rule 4692. The costs of these under-fired charbroiler controls, as analyzed in 2009, ranged from $37,500 to $104,000, with a cost effectiveness of up to $58,200 per ton of PM2.5 reduced. However, the control technology for under-fired units has continued to develop over the past few years, in part through the District, SCAQMD, and EPA technology demonstration efforts. Since under-fired charbroilers are a larger part of the total commercial charbroiling inventory, and since these units are currently unregulated in the Valley, there is potential to achieve emissions reductions from under-fired charbroilers.

In parallel with this plan, SCAQMD has also included a draft commitment in Chapter 4 of their *Draft 2012 AQMP* to achieve a 1 tpd PM2.5 reduction from under-fired charbroilers, though the details of their approach are yet to be determined.[71] SCAQMD would submit their approach into the SIP once technically feasible and cost effective options are confirmed.

The District created and implemented a pilot program in 2009, the Charbroiler Incentive Program (ChIP), to provide grant funding to cover a significant portion of the cost of installing particulate control devices on under-fired charbroilers. However, there was no stakeholder interest in this program and no projects were funded under ChIP. The District released a Request for Qualifications (RFQ) for its Restaurant Charbroiler Technology Partnership (RCTP) in 2014 and received several applications that were approved to move forward with the contracting process. Multiple projects are still in the contracting phase and the District expects to begin demonstration of some of the above described control technologies by mid-2015.

The District has also been tracking and involved with technology demonstration projects for under-fired charbroilers at other agencies, including testing of control technologies for under-fired charbroilers at University of California at Riverside's Center for Environmental Research and Technology (CE-CERT). This program began in early 2012 and several tests were completed in early 2014. Additional tests are ongoing.

According to estimates submitted by manufacturers for RCTP, the initial capital costs of feasible control technologies will range from $40,000 to over $100,000, and monthly operation and maintenance costs will range from a few thousand dollars to tens of thousands of dollars. As such, it is yet to be seen whether any cost effective and

[71] SCAQMD. (2012). *Draft 2012 AQMP*. Retrieved from http://aqmd.gov/aqmp/2012aqmp/draft/Chapters/Ch4.pdf

technologically feasible control technologies will be identified and demonstrated in the next few years. However, as part of the 2016 rule amendment process, the District will examine all potential opportunities for further emissions reductions.

### Evaluation Findings

The District has evaluated all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4692 currently has in place the most stringent measures feasible to implement in the Valley at this time and therefore meets or exceeds both BACM and MSM requirements for this source category.

Rule 4692 achieves significant emissions reductions from chain-driven charbroilers; however, the rule does not require emissions controls for under-fired charbroilers. Analyses indicate that extending the applicability of the rule to include under-fired units could further reduce PM2.5 emissions by as much as 20% (0.4 tpd PM2.5) from the baseline inventory for under-fired charbroilers upon implementation in 2017, thus providing significant health benefits Valley-wide per the District's Health Risk Reduction Strategy. Research and demonstration projects are underway to evaluate emission control technologies for under-fired charbroilers in support of this measure. As included in the *2012 PM2.5 Plan*, the District will amend Rule 4692 in 2016 to add requirements for under-fired charbroilers, with an anticipated compliance date of 2017. The District will also consider development of a new incentive program to assist in the deployment of new technologies upon their development and commercial availability.

## C.17 RULE 4702 INTERNAL COMBUSTION ENGINES

### Discussion

Rule 4702 applies to any internal combustion (IC) engine rated at 25 brake horsepower (bhp) or greater. The purpose of this rule is to limit NOx, carbon monoxide (CO), volatile organic compounds (VOC), and SOx emissions from units subject to this rule.

The District's original IC engine rule, Rule 4701 (Internal Combustion Engines – Phase 1), was adopted on May 21, 1992, superseded by Rule 4702, adopted on August 21, 2003, and subsequently amended five times. The rule originally established NOx limits between 25-50 ppmv achieving 90-96% control for non-agricultural operations rich-burn engines and 65-75 ppmv achieving 85-90% control for non-agricultural operations lean-burn engines. In its continuous effort to improve air quality in the Valley, the District has adopted numerous amendments to Rule 4702 that have resulted in significant reductions of NOx and PM emissions.

Substantial emission reductions from agricultural IC engines have also been achieved through a combination of regulatory efforts and incentive actions. Rule 4702 has effectively reduced emissions from agricultural engines by 84% since the 2005 amendments to the rule, with substantial investments being made by the affected sources to comply with the rule. The rule was further strengthened in August 2011 when rule amendments implemented more stringent NOx limits as low as 11 ppmv for non-agricultural operations spark-ignited engines. Additional emission reductions are forthcoming under Rule 4702 as compliance dates for emission control requirements continue to approach over the coming years.

### Source Category

An internal combustion engine is any engine that operates by burning its fuel inside the engine. Engines generate power by the combustion of an air/fuel mixture. The main types of engines are spark-ignited engines and compression-ignited (or diesel) engines. In the case of spark-ignited engines, a spark plug ignites the air/fuel mixture. Spark-ignited engines come in several designs such as: two-stroke and four-stroke, rich-burn and lean-burn, turbocharged and naturally aspirated. Spark-ignited engines may use one or more fuels, such as natural gas, propane, butane, liquefied petroleum gas, oil field gas, digester gas, landfill gas, methanol, ethanol, and gasoline.

Compression-ignited engines rely on heating of the inducted air during the compression stroke to ignite the injected diesel fuel. In addition to being classified into compression-ignited and spark-ignited, IC engines can be further divided into two-stroke and four-stroke engines. Most diesel engines are four-stroke, while larger diesel engines often are two-stroke. Natural gas fired spark-ignited engines are usually four-stroke, but some operators prefer two-stroke engines for their applications.

Engines are used by a variety of private businesses and public agencies throughout the Valley for a number of purposes, primarily for powering pumps, compressors, or electrical generators. Examples of businesses and industries that use engines include schools and universities, agriculture, oil and gas production and pipelines, petroleum refining, manufacturing facilities, food processing, electrical power generation, landfill and waste water treatment facilities, and water districts. Many engines are limited or low use in nature, such as emergency standby engines that provide backup power when electric service is interrupted.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.49 | 0.49 | 0.48 | 0.40 | 0.31 | 0.30 | 0.29 | 0.28 | 0.27 |
| NOx | 13.06 | 12.85 | 12.50 | 9.21 | 7.22 | 6.82 | 6.57 | 6.37 | 6.09 |
| SOx | 0.12 | 0.12 | 0.12 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.36 | 0.36 | 0.35 | 0.30 | 0.24 | 0.23 | 0.23 | 0.22 | 0.21 |
| NOx | 9.44 | 9.29 | 9.03 | 6.82 | 5.51 | 5.24 | 5.07 | 4.93 | 4.72 |
| SOx | 0.10 | 0.10 | 0.09 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from IC engines are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for IC engines.

## How does District Rule 4702 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA Control Technique Guidelines (CTG) requirements for this source category. Rule 4702 is at least as stringent as the following applicable federal regulations:

#### *ACT*

- EPA – 453/R-93-032 (Alternative Control Techniques Document – NOx Emissions from Stationary Reciprocating Internal Combustion Engines)

The District evaluated the requirements contained within the EPA – 453/R-93-032 ACT document and found no requirements that were more stringent than those already in Rule 4702.

#### *NSPS*

- 40 CFR 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines)

The District evaluated the requirements contained within 40 CFR 60 Subpart IIII and found no requirements that were more stringent than those already in Rule 4702.

- 40 CFR 60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines)

The District evaluated the requirements contained within 40 CFR 60 Subpart JJJJ and found no requirements that were more stringent than those already in Rule 4702.

***NESHAP/ MACT***
- 40 CFR 63 Subpart ZZZZ (NESHAP for Stationary Reciprocating Internal Combustion Engines)

The District evaluated the requirements contained within 40 CFR 63 Subpart ZZZZ NESHAP and found no requirements that were more stringent than those already in Rule 4702.

**State Regulations**
The following state regulations apply to sources covered under Rule 4702:

- 17 CCR 93114 (ATCM to Reduce Particulate Emissions from Diesel-Fueled Engines—Standards for Nonvehicular Diesel Fuel)
- 17 CCR 93115 (ATCM for Stationary Compression Ignition Engines)

The District implements the requirements of 17 CCR 93114 and 17 CCR 93115 through Rule 4702 and the District's new source review permitting program (Rule 2201).

### How does District Rule 4702 compare to rules in other air districts?

***BAAQMD***
- Regulation 9 Rule 8 (Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 8 and found no requirements that were more stringent than those already in Rule 4702.

***SMAQMD***
- Rule 412 (Stationary Internal Combustion Engines Located at Major Stationary Sources of NOx)

The District evaluated the requirements contained within SMAQMD's Rule 412 and found no requirements that were more stringent than those already in Rule 4702.

***VCAPCD***
- Rule 74.9 (Stationary Internal Combustion Engines)

The District evaluated the requirements contained within VCAPCD's Rule 74.9 and found no requirements that were more stringent than those already in Rule 4702.

***SCAQMD***

- Rule 1110.2 (Emissions from Gaseous- and Liquid-Fueled Engines)
- Rules 2000 – 2020 (RECLAIM program)

South Coast Air Quality Management District (SCAQMD) regulates the emissions from IC engines through a combination of control measures. SCAQMD 1110.2 is directly applicable to IC engines and includes emissions limitations for various applications. SCAQMD's RECLAIM program (Rules 2000 – 2020) allows most operators to purchase credits in lieu of instituting engine emissions controls otherwise required under SCAQMD 1110.2. Given these overlapping sets of requirements, Rule 4702 must be compared in context of both regulations. Additionally, many of the engine applications found in the San Joaquin Valley vary substantially from engine applications in SCAQMD; for example, engines used for agricultural irrigation pumping that exist in the Valley and are no longer found in SCAQMD. While not directly comparable, the following tables compare the emission limits between SCAQMD Rule 1110.2 and District Rule 4702.

**Table C-19 Comparison of District and SCAQMD NOx Emission Limits for Non-Agricultural Operations (Non-AO) Spark-Ignited Waste Gas Engines Rated at >50 bhp (corrected to 15% oxygen on a dry basis)**

| Engine Type | District NOx Limit (ppmv) | SCAQMD NOx Limit (ppmv) |
|---|---|---|
| Waste Gas Fueled (Rich-Burn) | 50 | <u>*Until 01-01-16*</u><br>bhp ≥ 500: 36 x ECF[72]<br>bhp < 500: 45 x ECF[1]<br><br><u>*On and after 01-01-16*</u><br>11 ppmv |
| Waste Gas Fueled (Lean-Burn) | 65 ppmv or 90% reduction | <u>*Until 01-01-16*</u><br>bhp ≥ 500: 36 x ECF[1]<br>bhp <500: 45 x ECF[1]<br><br><u>*On and after 01-01-16*</u><br>11 ppmv |

[72] The efficiency correction factor (ECF) is 1.0 unless: 1) The engine operator has measured the engine's net specific energy consumption, in compliance with ASME Performance Test Code PTC 17 -1973, at the average load of the engine; and 2) the ECF-corrected emission limit is made a condition of the engine's permit to operate. The ECF is never less than 1.0 so in some cases the SCAQMD limits could potentially be less stringent than the District's NOx limits.

**Table C-20 Comparison of District and SCAQMD NOx Emission Limits for Non-AO Spark-Ignited Engines Rated >50 bhp (corrected to 15% oxygen on a dry basis)**

| Engine Type | District NOx Limit (ppmv) | SCAQMD NOx Limit (ppmv) |
|---|---|---|
| **1. Rich-Burn** | | |
| Rich-Burn Engine (except for below special applications) | 11 | 11 |
| Cyclic Loaded, Field Gas Fueled | 50 | 11 |
| Limited Use | 25 | 11[73] |
| **2. Lean-Burn Engines** | | |
| Lean-Burn Engine (except for below special applications) | 11 | 11 |
| Two-Stroke, Gaseous Fueled, >50 bhp and < 100 bhp | 75 | 11 |
| Limited Use | 65 | 11[2] |
| Lean-Burn Engine used for gas compression | 65 ppmv or 93% reduction | 11 |

**Table C-21 Comparison of District and SCAQMD NOx Emission Limits for Agricultural Operations (AO) Spark-Ignited Engines Rated >50 bhp (corrected to 15% oxygen on a dry basis)**

| Engine Type | District NOx Limit | SCAQMD NOx Limit |
|---|---|---|
| 1. Rich-Burn | 90 ppmv or 80% reduction | 11 |
| 2. Lean-Burn | 150 ppmv or 70% reduction | 11 |
| 3. Certified and installed on or before June 16, 2005 | Meet a Certified Spark-Ignited Engine Standard of HC + NOx < 0.6 g/bhp-hr | 11 |

Medium and large operators in the South Coast Air Basin are most likely part of the South Coast RECLAIM program and are subsequently not required to meet the engine emission limitations included in Rule 1110.2. All facilities that emit over a certain threshold are required to participate in the RECLAIM program. As part of the RECLAIM program certain companies receive emission allocations every year and each allocation is good for 12 months. The portion of the allocation not needed to offset the operator's own emissions can be sold to other companies. If the operator does not receive an emission allocation, they must buy emission credits from operators with unused emission allocations. In this way, the RECLAIM program is similar to a cap-and-trade program. The District does not have a RECLAIM-type program for this source category and all operators are required to meet the stringent emission limitations included in Rule 4702.

[73] SCAQMD exempt units that operate less than 500 hours from this limit; District defines "limited use" units as those operating less than 4,000 hours and only exempts engines operating less than 200 hours.

Although the SCAQMD emission level of 11 ppm has not yet been proven as technologically feasible in agricultural settings and it is unclear what percentage of facilities are complying with the current SCAQMD NOx limits for non-ag categories, the District evaluated the cost-effectiveness and feasibility of implementing an 11 ppmv NOx emission limit for the following categories of IC engines:

- Non-Agricultural Operations (Non-AO) Waste Gas Engines
- Non-AO Spark-Ignited Engines
    - Cyclic Loaded, Field Gas Fueled
    - Limited Use Engines
        - Lean-Burn Engines
        - Rich-Burn Engines
    - Two-Stroke, Gaseous Fueled Engines 50-100 bhp
    - Lean-Burn Engines Used for Gas Compression
- Agricultural Operations (AO) Spark-Ignited Engines

The District also evaluated the cost-effectiveness and feasibility of implementing intermediate NOx emission limits for AO spark-ignited engines that more closely match the current NOx emission limits for non-AO limited use rich-burn and lean-burn engines. The following analyses were conducted:

- 25 ppmv NOx emission limit for AO Rich-Burn Spark-Ignited Engines
- 65 ppmv NOx emission limit for AO Lean-Burn Spark-Ignited Engines

To determine potential emissions reductions, the District used the following equations:

NOx = (BHP x HR x EF x LF) / (CF)

***Where:***

| | | |
|---|---|---|
| NOx | = | Current annual NOx emissions or potential annual NOx emissions in ton/year |
| BHP | = | engine power |
| HR | = | annual hours of operation |
| EF | = | NOx emission factor |
| LF | = | engine load factor |
| CF | = | conversion factor from grams to pounds |

The estimated annual NOx emissions reduction was calculated using the following equation:

Potential Emissions Reduction = current annual NOx emissions – potential NOx annual NOx emissions

**NOx Emission Limitation for Non-Agricultural Operations (Non-AO) Waste Gas Engines:**

The District analyzed the technological feasibility of lowering the NOx emission limit for waste gas engines and determined that due to the variability of waste gas, additional levels of NOx control on existing waste gas engines can pose significant technical and feasibility challenges. Waste gas includes landfill gas, which is generated at landfills, and digester gas, which is generated from anaerobic digestion. Both landfill and digester gas result from the decomposition of organic matter by microorganisms in the absence of oxygen. Unlike pipeline natural gas, the composition of waste gas is not consistent or guaranteed. The heating value and composition of the gas (e.g. methane and oxygen contents) will vary with the type of materials that enter the landfill or digester and can also fluctuate seasonally or even daily. Both landfill and digester gases contain impurities, such as siloxanes, sulfur compounds, and halides. Landfill gas also contains entrained particulate matter, and both landfill and digester gas may contain particulate that results from combustion of the impurities in the gas. The contaminants in waste gas can coat and/or poison catalysts, rendering them ineffective. Because of its variable composition and contaminants, untreated waste gas is not interchangeable with pipeline-quality natural gas and extensive and costly cleanup would be necessary to allow the use of catalytic emission controls needed to achieve 11 ppmv. This is not a practical option for most existing waste gas-fired engines, which were not designed to include the required gas systems and catalytic controls.

In addition to the District's efforts to identify additional potential technology options for this category, SCAQMD has also been evaluating this issue. In February 2008, SCAQMD amended Rule 1110.2 to include an 11 ppmv limit for waste gas engines rated at >50 bhp. The original compliance date for this emissions limit was July 1, 2012, with the assumption that SCAQMD would complete a Technology Assessment to verify the feasibility of available control technologies for waste gas engines. However, SCAQMD had to amend Rule 1110.2 in September 2012 to extend the compliance deadline for waste gas engines from 2012 to 2016 in order to allow for more time to complete their Final Technology Assessment, which is currently still incomplete and has yet to identify feasible technology options. Additionally, these sources may also be in a position to avoid installing additional NOx control technologies through their participation in SCAQMD's RECLAIM program.

District Rule 4702 contains the most stringent limits feasible for existing waste gas-fueled engines based on the use of combustion processes that minimize emissions without the use of post-combustion catalytic controls. Therefore, Rule 4702 meets or exceeds BACM and MSM for non-AO waste gas fueled spark-ignited engines. Additionally, the District continues to investigate potential NOx and SOx control technologies for waste gas engines through its Technology Advancement Program, with projects currently approved for funding that will continue to demonstrate new technologies in this sector.

## NOx Emission Limitation for Non-AO Spark-Ignited Engines:

### *Cyclic Loaded, Field Gas Fueled*

Cyclic-loaded, field gas fueled engines can achieve some level of control, but not the stringent level of control that can be imposed on engines that operate in a narrow and more stable range of loads. The exhaust gas temperature of cyclic loaded engines varies as a function of the engine load; however, catalyst chemistry is dependent on a minimum temperature to be effective in reducing emissions. When the cyclic load engine is operating in a particular engine load range, the exhaust gas temperature can reach the catalyst's effective range and allow for emissions to be well-controlled; however, as the engine cycles out of this load range, the exhaust gas temperature becomes too low for effective emissions control. Since the exhaust temperature fluctuates frequently for this category of units, it is technologically infeasible to require a lower NOx limit for cyclic loaded field-gas fueled engines. The current emission limit for this category of engines meets or exceeds BACM and MSM for these sources.

### *Limited Use Engines*

During the 2011 amendments to Rule 4702, the District created this category of engines based on the high costs and cost effectiveness associated with the installation of additional controls for these engines (> 4,000 hours of operation). As discussed in the staff report, the NOx emission reductions foregone from not lowering the existing NOx limits to 11 ppmv for limited use engines was insignificant (about 0.004 tons per day in 2011).[74]

However, since the evaluation was conducted in 2011, the District re-evaluated the cost effectiveness of lowering the NOx emission limits to 11 ppmv for limited use non-AO rich-burn and lean-burn engines. The costs in the analyses below were gathered from information in the District's Permits database, IC engine manufacturers, and operators.

### ***Limited Use Lean-Burn Engines***

When evaluating the ability to lower NOx emissions to 11 ppmv, an operator can either retrofit the existing lean-burn IC engine with a selective catalytic reduction (SCR) system or install a new lean-burn engine with an SCR system. In many cases, retrofitting an existing IC engine is technologically infeasible or may require substantial additional unanticipated costs (such as the incompatibility of an older engine with less sophisticated operating controls with additional control technology, additional labor/maintenance costs, etc.). However, for the purpose of evaluating all potential controls, the District has included both options in the below analysis.

[74] SJVAPCD. (2011, August 18). *Adopt Revised Proposed Amendments to Rule 4702 (Internal Combustion Engines).* Retrieved from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2011/August/Agenda_Item_10_Aug_18_2011.pdf

## Table C-22 Annual Costs for Retrofitting an Existing Limited Use Lean-Burn Engine and Installing a New Limited Use Lean-Burn Engine with SCR

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 1100 brake horsepower (bhp) | n/a |
| Annual Operation | 2500 hours (hr) | n/a |
| | | |
| ***Capital Costs*** | | |
| New Engine Cost (without SCR) | Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax | $110,656 |
| **Annualized Engine Capital Costs (10 years, 10%)** | 0.163 x New Engine Cost | **$18,037** |
| | | |
| ***SCR Equipment Costs*** | | |
| SCR System | $73,000 per engine | $73,000 |
| 550 gallon double wall plastic urea tank and accessories | $5,270 per tank | $5,270 |
| 3 hp rotary screw air compressor with dryer and receiver tank | $5,875 per compressor package | $5,875 |
| Total SCR Equipment Costs | Equipment costs x 20% profit/mark-up | $100,974 |
| ***SCR Installation Costs*** | | |
| Start-up and Commissioning Rate | $1,500/day; assume 1 day for each system | $1,500 |
| Electrical upgrade to power compressor | n/a | $0 |
| Total SCR Installation Costs | | $1,500 |
| Total SCR Capital Costs | SCR Equipment Costs + SCR Installation Costs | $102,474 |
| **Annualized SCR Capital Costs (10 years, 10%)** | 0.163 x Total SCR Capital Costs | **$16,703** |
| | | |
| ***Annual Operating and Maintenance Costs*** | | |
| Annual Reagent (urea) Cost | $3 per gallon; 1 gallon/hr<br>Cost = $3 x 2500 hr | $7,500 |
| Annual Increase in Fuel Cost (due to drop in fuel efficiency with SCR) | Fuel usage = 9,322.5 standard cubic feet per hour (scf/hr)<br>Fuel cost (per 1,000 scf) = $7.36<br>Fuel cost (per hour) = (9,322.5 x $7.36) / 1000<br>Fuel cost (per year) = hourly cost x 2500 hr<br>2.5% drop in fuel efficiency<br>Added Fuel Cost = Annual fuel cost x 2.5% | $4,288 |
| Annual Electricity Cost (for compressor) | 3 hp compressor = 2.24 kW power rating<br>Electricity rate for industrial operations = $0.132/kW-hr<br>Hourly electricity cost = 2.24 kW x $0.132/kW-hr<br>Daily meter charge = $49.281<br>Annual electricity cost = hourly cost x 2500 hr<br>Annual meter charge = daily meter charge x 365 days<br>Total utility cost = Annual electricity cost + Annual meter charge | $18,728 |

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Annual Catalyst Cost | Life of catalyst = 5 years<br>Cost per catalyst = $5,000<br>Catalyst costs for 10 years = $5,000 x 2<br>Annualized cost = $10,000 x 0.163 | $1,630 |
| Annual Maintenance Cost | Maintenance = $0.02 per bhp per hour of operation<br>Annual cost = $0.02 x 1,100 bhp x 2500 hr | $55,000 |
| **Annual Operating & Maintenance (O&M) Costs** | Annual O&M = Annual Reagent Cost+ Annual Increase in Fuel Cost + Annual Electricity Cost + Annual Catalyst Cost + Annual Maintenance Cost | **$87,147** |
| | | |
| **Annual Cost for Retrofit of LB Engine with SCR** | Annualized SCR Capital Cost + Annual O&M Cost | **$103,850** |
| **Annual Cost for New LB Engine with SCR** | Annualized Engine Capital Cost + Annualized SCR Capital Cost + Annual O&M Cost | **$121,887** |

The emissions reductions are calculated below:

BHP = 1,100 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 0.78 g-NOx/bhp-hr (equivalent to 65 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
LF = 0.8
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (1,100 bhp x 2500 hr/yr x 0.78 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 3,783 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (1,100 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 640 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (3,783-640 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 1.57 tons/year**

**Cost Effectiveness**

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current limited use lean-burn spark-ignited engines is as follows:

- Retrofitted limited use lean-burn engine with SCR: $66,086/ton of NOx reduced
- New limited use lean-burn engine with SCR: $77,564/ton of NOx reduced

As demonstrated in the analysis and summary above, it is not cost effective to require the retrofit or replacement of limited use lean-burn engines to achieve 11 ppmv.

***Limited Use Rich-Burn Engines***

When evaluating the ability to lower NOx emissions to 11 ppmv, an operator will generally retrofit the existing rich-burn IC engine with a nonselective catalytic reduction (NSCR) system. In many cases, retrofitting an existing IC engine is technologically infeasible or may require substantial additional unanticipated costs (such as the incompatibility of an older engine with less sophisticated operating controls with additional control technology, additional labor/maintenance costs, etc.). However, for the purpose of evaluating potential controls in this category, the District has included the less costly, potentially feasible scenario of retrofitting an existing rich-burn engine with NSCR in the below analysis.

**Table C-23 Annual Costs for Retrofitting an Existing Limited Use Rich-Burn Engine**

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 500 bhp | n/a |
| Annual Operation | 2500 hours (hr) | n/a |
| | | |
| ***Capital Costs*** | | |
| New Catalyst System | Includes: catalyst, air-to fuel ratio controller, ignition system, and installation | \$75,000 |
| **Annualized Catalyst Capital Cost (10 years, 10%)** | 0.163 x New Catalyst System | **\$12,225** |
| | | |
| **Annual Cost for Retrofit of RB Engine with New Catalyst** | Annualized Catalyst Capital Cost | **\$12,225** |

The emissions reductions are calculated below:

BHP = 500 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 0.30 g-NOx/bhp-hr (equivalent to 25 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
LF = 0.8
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (500 bhp x 2500 hr/yr x 0.30 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 661 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (500 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)

= 291 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (661 - 291 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 0.19 tons/year**

**Cost Effectiveness**
The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current limited use rich-burn spark-ignited engines is as follows:

- Retrofitted limited use rich-burn non-AO engine with new catalyst: $66,015/ton of NOx reduced

As demonstrated in the analysis and summary above, it is not cost effective to require the retrofit or replacement of limited use rich-burn engines to achieve 11 ppmv, even without including additional substantial costs, such as annual operating and maintenance costs.

***Two-Stroke, Gaseous Fueled Engines 50-100 bhp***
There is no control technology compatible with two-stroke, gaseous fueled engines, including SCR, which will allow these units to achieve a NOx emission limit below 75 ppmv. An 11 ppmv NOx emission limit is not technologically feasible for these engines; the current limit implements BACM and MSM for two-stroke, gaseous fueled engines less than 100 bhp.

***Lean-Burn Engines Used in Gas Compression***
Similar to the “Limited Use” engine category, during the 2011 amendments to Rule 4702, the District created this category of engines based on the technological infeasibility to control these types of engines. Lean-burn engines used in gas compression in the Valley are used in natural gas distribution and storage service, and these engines frequently experience changing load conditions. As noted in EPA’s Stationary IC Engine Technical Support Document[75], SCR use is problematic for these engines due to the fluctuations over a broad range of conditions. For this reason, EPA states that there is an insufficient basis to conclude that SCR is an appropriate technology for large lean-burn engines used for gas compression. The current emission limit is achievable through low-NOx combustion technology, which includes changes to the engine’s timing, enhanced control of the air-fuel ratio, and other changes that lower NOx emissions. Due to the technological complexities associated with lean-burn engines used in gas compression, the current emissions limit implements BACM and MSM for these units.

[75] EPA. (2003, October). *Stationary Reciprocating Internal Combustion Engines Technical Support Document for NOx SIP Call*.

## NOx Emission Limitation for AO Spark-Ignited Engines:

Potential methods for reducing NOx emissions from Agriculture Operation (AO) spark-ignited engines include retrofitting them with emission control technologies or replacing them. As the below analysis demonstrates, given the high costs and limited seasonal nature of operation of AO spark-ignited engines, requiring additional controls beyond the existing stringent requirements is not cost-effective and often technologically infeasible. Despite the technological feasibility issues associated with retrofitting or replacing existing AO spark-ignited engines, the District evaluated the cost effectiveness and feasibility of achieving an 11 ppmv NOx emission limit for the following scenarios:

- Installing a new IC lean-burn engine with SCR as a replacement for an existing unit
- Retrofitting an existing lean-burn IC engine with SCR
- Installing a new rich-burn engine with a three-way catalyst system as a replacement for an existing unit

The District also evaluated the cost effectiveness and feasibility of achieving intermediate NOx emission limits of 25 ppmv for AO rich-burn spark-ignited engines and a 65 ppmv for lean-burn spark-ignited engines, similar to the corresponding limited use engine limits for non-AO engines. The scenarios evaluated include:

- Installing a new IC lean-burn engine as a replacement for an existing unit to meet 65 ppmv
- Installing a new rich-burn engine with a three-way catalyst system as a replacement for an existing unit to meet 25 ppmv

The costs in the analyses below were gathered from information in the District's Permits database, IC engine manufacturers, and agricultural industry representatives.

### *AO Lean-Burn Engines (11 ppmv)*

When evaluating the ability to lower NOx emissions to 11 ppmv, an agricultural operator can either retrofit the existing lean-burn IC engine with a selective catalytic reduction (SCR) system or install a new lean-burn engine with an SCR system.

**Table C-24 Annual Costs for Retrofitting an Existing AO Lean-Burn Engine with SCR and Installing a New AO Lean-Burn Engine with SCR**

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 241 brake horsepower (bhp) | n/a |
| Annual Operation | 2500 hours (hr) | n/a |
| | | |
| ***Capital Costs (Engine)*** | | |
| New Engine Cost (without SCR) | Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax | $109,480 |
| **Annualized Engine Capital Costs (10 years, 10%)** | 0.163 x New Engine Cost | **$17,845** |
| | | |
| ***SCR Equipment Costs*** | | |
| SCR System | $73,000 per engine | $73,000 |
| 550 gallon double wall plastic urea tank and accessories | $5,270 per tank | $5,270 |
| 3 hp rotary screw air compressor with dryer and receiver tank | $5,875 per compressor package | $5,875 |
| Total SCR Equipment Costs | Equipment costs x 20% profit/mark-up | $100,974 |
| ***SCR Installation Costs*** | | |
| Start-up and Commissioning Rate | $1,500/day; assume 1 day for each system | $1,500 |
| Electrical upgrade to power compressor | $43.22/foot; avg. 1,020 feet to extend electrical line | $44,084 |
| Total SCR Installation Costs | | $45,584 |
| Total SCR Capital Costs | SCR Equipment Costs + SCR Installation Costs | $146,558 |
| **Annualized SCR Capital Costs (10 years, 10%)** | 0.163 x Total SCR Capital Costs | **$23,889** |
| | | |
| ***Annual Operating and Maintenance Costs (SCR)*** | | |
| Annual Reagent (urea) Cost | $3 per gallon; 1 gallon/hr<br>Cost = $3 x 2500 hr | $7,500 |
| Annual Increase in Fuel Cost (due to drop in fuel efficiency with SCR) | Fuel usage = 1750.7 standard cubic feet per hour (scf/hr)<br>Fuel cost (per 1,000 scf) = $7.36<br>Fuel cost (per hour) = (1,750.7 x $7.36) / 1000<br>Fuel cost (per year) = hourly cost x 2500 hr<br>2.5% drop in fuel efficiency<br>Added Fuel Cost = Annual fuel cost x 2.5% | $805 |
| Annual Electricity Cost (for compressor) | 3 hp compressor = 2.24 kW power rating<br>Electricity rate for AO = $0.136/kW-hr<br>Hourly electricity cost = 2.24 kW x $0.136/kW-hr<br>Annual electricity cost = hourly cost x 2500 hr | $761 |
| Annual Catalyst Cost | Life of catalyst = 5 years<br>Cost per catalyst = $5,000<br>Catalyst costs for 10 years = $5,000 x 2<br>Annualized cost = $10,000 x 0.163 | $1,630 |
| Annual Maintenance Cost | Maintenance = $0.02 per bhp per hour of operation<br>Annual cost = $0.02 x 241 bhp x 2500 hr | $12,050 |

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| **Annual Operating & Maintenance (O&M) Costs** | Annual O&M = Annual Reagent Cost+ Annual Increased Fuel Cost + Annual Electricity Cost + Annual Catalyst Cost + Annual Maintenance Cost | **$22,746** |
| | | |
| **Annual Cost for Retrofit of LB Engine with SCR** | Annualized SCR Capital Cost + Annual O&M Cost | **$46,635** |
| **Annual Cost for New LB Engine with SCR** | Annualized Engine Capital Cost + Annualized SCR Capital Cost + Annual O&M Cost | **$64,480** |

*The values within this table are rounded.

The emissions reductions are calculated below:

BHP = 241 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 2.092 g-NOx/bhp-hr (equivalent to 150 ppmv)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmv)
LF = 0.65
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 2.092 g-NOx/bhp-hr x 0.65) / (453.6 g/lb)
= 1,806 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.65) / 453.6
= 114 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1806-114 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 0.85 tons/year**

**Cost Effectiveness (AO Lean-Burn, 11 ppmv)**

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current AO lean-burn spark-ignited engines is as follows:

- Retrofitted lean-burn engine with SCR: $55,118/ton of NOx reduced
- New lean-burn engine with SCR: $76,209/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness values above demonstrate that it is not cost effective to retrofit or replace existing AO lean-burn engines with new more controlled engines.

***AO Lean-Burn Engines (65 ppmv)***

When evaluating the ability to lower NOx emissions to 65 ppmv, an agricultural operator would have to replace the existing lean-burn IC engine with a new lean-burn engine certified to meet 65 ppmv.

**Table C-25 Annual Costs for Installing a New AO Lean-Burn Engine**

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 241 brake horsepower (bhp) | n/a |
| Annual Operation | 2500 hours (hr) | n/a |
| | | |
| ***Capital Costs (Engine)*** | | |
| New Engine Cost (without SCR) | Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax | $109,480 |
| **Annualized Engine Capital Costs (10 years, 10%)** | 0.163 x New Engine Cost | **$17,845** |
| | | |
| ***Annual Operating and Maintenance Costs*** | | |
| **Annual Maintenance Cost** | Maintenance = $0.01 per bhp per hour of operation<br>Annual cost = $0.01 x 241 bhp x 2500 hr | **$6,025** |
| | | |
| **Annual Cost for New LB Engine** | Annualized Engine Capital Cost + Annual O&M Cost | **$23,870** |

*The values within this table are rounded.

The emissions reductions are calculated below:

BHP = 241 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 2.092 g-NOx/bhp-hr (equivalent to 150 ppmv)
EF2 = 0.78 g-NOx/bhp-hr (equivalent to 65 ppmv)
LF = 0.65
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 2.092 g-NOx/bhp-hr x 0.65) / (453.6 g/lb)
= 1,806 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 0.78 g-NOx/bhp-hr x 0.65) / 453.6
= 673 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1806-673 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 0.57 tons/year**

**Cost Effectiveness (AO Lean-Burn, 65 ppmv)**

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO lean-burn spark-ignited engines is as follows:

- New lean-burn engine: $42,146/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness value above demonstrates that it is not cost effective to replace existing AO lean-burn engines with newer less polluting engines.

***AO Rich-Burn Engines (11 ppmv)***

When evaluating the ability to lower NOx emissions to 11 ppmv, an agricultural operator can install a new rich-burn engine with 3-way catalyst.

**Table C-26 Annual Cost for Installing a New AO Rich-Burn Engine with a 3-way Catalyst**

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 256 bhp | n/a |
| Annual Operation | 2500 hr | n/a |
| | | |
| ***Total Capital Costs*** | | |
| New Engine Cost | Includes: engine with 3-way catalyst, freight, installation, and tax | $95,000 |
| **Annualized Engine Capital Costs (10 years, 10%)** | 0.163 x New Engine Cost | **$15,485** |
| | | |
| ***Annual Operating and Maintenance Costs (SCR)*** | | |
| Annual Added Fuel Cost (due to drop in fuel efficiency with catalyst) | Fuel usage = 1,859.7 scf/hr<br>Fuel cost (per 1,000 scf) = $7.36<br>Fuel cost (per hour) = (1,859.7 x $7.36) / 1000<br>Fuel cost (per year) = hourly cost x 2500 hr<br>Assume 2.5% drop in fuel efficiency<br>Added Fuel cost = Annual fuel cost x 2.5% | $855 |
| Annual Catalyst Cost | Life of catalyst = 5 years<br>Cost per catalyst = $5,000<br>Catalyst costs for 10 years = $5,000 x 2<br>Annualized Catalyst Cost = $10,000 x 0.163 | $1,630 |
| Annual Maintenance Cost | Maintenance = $0.02 per bhp per hour of operation<br>Annual Maintenance Cost = $0.02 x 256 bhp x 2500 hr | $12,800 |
| **Annual Operating & Maintenance (O&M) Costs** | Annual O&M = Annual Added Fuel Cost + Annual Catalyst Cost + Annual Maintenance Cost | **$15,285** |
| | | |
| **Annual Cost for New RB Engine with 3-way** | Annualized Engine Capital Cost + Annual O&M Cost | **$30,770** |

*The values within the above table are rounded.

The emissions reductions are calculated below:

| | | |
|---|---|---|
| BHP | = | 256 bhp |
| HR | = | 2,500 hours/year |
| EF1 | = | 1.255 g-NOx/bhp-hr (equivalent to 90 ppmv) |
| EF2 | = | 0.132 g-NOx/bhp-hr (equivalent to 11 ppmv) |
| LF | = | 0.65 |
| CF | = | 453.6 grams/pound |

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 1.255 g-NOx/bhp-hr x 0.65) / 453.6
= 1,151 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.65) / 453.6
= 121 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1,151-121 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 0.52 tons/year**

**Cost Effectiveness (AO Rich-Burn, 11 ppmv)**

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO rich-burn engines is as follows:

- New rich-burn engine with a 3-way catalyst to meet 11 ppmv: $59,754/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness value above demonstrates that it is not cost effective to replace existing AO spark-ignited engines with new controlled engines.

***AO Rich-Burn Engines (25 ppmv)***

In order to meet a 25 ppmv, an agricultural operator would have to install a new rich-burn engine with a slightly less expensive catalyst compared to the catalyst needed to meet 11 ppmv.

**Table C-27 Annual Cost for Installing a New AO Rich-Burn Engine with a 3-way Catalyst**

| Item | Assumptions/Methodology | Cost |
|---|---|---|
| Average Engine Power Rating | 256 bhp | n/a |
| Annual Operation | 2500 hr | n/a |
| | | |
| ***Total Capital Costs*** | | |
| New Engine Cost | Includes: engine with 3-way catalyst, freight, installation, and tax | $95,000 |
| **Annualized Engine Capital Costs (10 years, 10%)** | 0.163 x New Engine Cost | **$15,485** |
| | | |
| ***Annual Operating and Maintenance Costs (SCR)*** | | |
| Annual Added Fuel Cost (due to drop in fuel efficiency with catalyst) | Fuel usage = 1,859.7 scf/hr<br>Fuel cost (per 1,000 scf) = $7.36<br>Fuel cost (per hour) = (1,859.7 x $7.36) / 1000<br>Fuel cost (per year) = hourly cost x 2500 hr<br>Assume 2.5% drop in fuel efficiency<br>Added Fuel cost = Annual fuel cost x 2.5% | $855 |
| Annual Catalyst Cost | Life of catalyst = 5 years<br>Cost per catalyst = $4,000<br>Catalyst costs for 10 years = $4,000 x 2<br>Annualized Catalyst Cost = $8,000 x 0.163 | $1,304 |
| Annual Maintenance Cost | Maintenance = $0.02 per bhp per hour of operation<br>Annual Maintenance Cost = $0.02 x 256 bhp x 2500 hr | $12,800 |
| **Annual Operating & Maintenance (O&M) Costs** | Annual O&M = Annual Added Fuel Cost + Annual Catalyst Cost + Annual Maintenance Cost | **$14,959** |
| | | |
| **Annual Cost for New RB Engine with 3-way** | Annualized Engine Capital Cost + Annual O&M Cost | **$30,444** |

*The values within the above table are rounded.

The emissions reductions are calculated below:

BHP = 256 bhp
HR = 2,500 hours/year
EF1 = 1.255 g-NOx/bhp-hr (equivalent to 90 ppmv)
EF2 = 0.30 g-NOx/bhp-hr (equivalent to 25 ppmv)
LF = 0.65
CF = 453.6 grams/pound

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 1.255 g-NOx/bhp-hr x 0.65) / 453.6
= 1,151 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 0.30 g-NOx/bhp-hr x 0.65) / 453.6

= 275 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1,151-275 lb) x (1 ton / 2,000 lb)
**Potential Emissions Reduction = 0.44 tons/year**

**Cost Effectiveness (AO Rich-Burn, 25 ppmv)**
The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO rich-burn engines is as follows:

- New rich-burn engine with a 3-way catalyst to meet 25 ppmv: $69,521/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness values above demonstrate that it is not cost effective to replace existing AO spark-ignited engines with new controlled engines.

***Other Feasibility Considerations AO Spark-Ignited Engines***
In addition to the high cost-effectiveness and potential infeasibility associated with retrofitting or replacing existing AO spark-ignited engines currently regulated under Rule 4702, requiring additional costly controls on AO engines is economically challenging and potentially infeasible. Unlike most other industries, AOs cannot pass increased production costs on to consumers, thereby forcing AOs to absorb the compliance costs associated with costly additional retrofits and replacements. Over the past decade, AOs have invested significant capital to retrofit and replace thousands of irrigation pump and other engines reducing emissions by over 80% in this category, and continue to do so as emission limitations and associated compliance deadlines materialize under Rule 4702.

Additionally, AO spark-ignited engines are generally located in rural, hard to access areas with minimal oversight due to limited resources and staffing. With seasonal labor and minimal year-round staffing, it is difficult for AOs to provide the frequent and complex maintenance required for retrofitted or new engines equipped with advanced emission controls. The oil production industry is the only other major industry in the Valley that has IC engines located in remote locations; however, with the highly technical nature of oil production and refining as compared to agricultural production and additional economic resources, it is feasible for the oil and gas production industry to hire qualified staff dedicated to maintaining and operating IC engines and other equipment on-site.

## Additional Emission Reduction Opportunities

**SOx and PM limitations**

Rule 4702 contains stringent requirements requiring the combustion of Public Utilities Commission (PUC) quality natural gas, or other equivalent ultra-low sulfur fuels, and diesel engines subject to Rule 4702 are required to be EPA Tier 3 or Tier 4 certified, depending on the size of the engine and the annual operating hours. EPA Tier 3 and 4 certifications require the units to meet low PM limits and Tier 4 engines are required to meet even lower PM emissions through the use of particulate filters. Given the low PM2.5 and SOx emissions from IC engines and existing rule requirements, the District determined that no further requirements were needed to address PM2.5 and SOx emissions.

**Emission limitation exemptions for emergency standby engines and low-use engines**

The existing requirements are consistent with Air Resources Board (ARB) RACT/BARCT Determination for Spark-Ignited Engines and ARB Airborne Toxics Control Measures (ATCM). Since these units are used only for emergencies or in very limited capacities, emissions from these units are relatively minor, and requiring additional emissions controls would likely not be cost effective.

## Non-Regulatory Actions

The District implements a stationary agricultural irrigation pump engine program as a component of the *Heavy-Duty Engine Program*. This program provides incentives for both the conversion of Tier 1 and Tier 2 engines to lower NOx and PM-emitting Tier 4 engines and for the electrification of diesel engines, as the District highly prioritizes electrification efforts to achieve zero and near-zero emissions from engines. The District's legislative platform[76] includes support for incentive funding through the Carl Moyer Program. Continued support of this funding stream will continue to provide incentives for accelerated reductions from IC engines.

Meeting air quality standards requires transformative measures and technologies to achieve near zero emissions. In order to further develop technology to close the gap in required emissions reductions, the District operates a Technology Advancement Program (TAP). Along with its own resources, the District seeks state and federal assistance through its legislative platform to advance technologies to reduce emissions in the Valley. District TAP projects seek innovations in several areas of technology including IC engines. While no technologies to reduce emissions from IC engines have been achieved in practice yet, these projects may provide the basis for future feasible, SIP-creditable emission reductions.

[76] SJVAPCD. (January 2015). *Legislative Platform 2015.* http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2015/January/final/10.pdf

### Evaluation Findings

Even though IC engines are not a significant source of PM2.5 or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4702 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce NOx emissions from IC engines in the Valley.

## C.18 RULE 4703 STATIONARY GAS TURBINES

### Discussion

The provisions of this rule are 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 million British Thermal Units per hour (MMBtu/hr), and that are used for the generation of electrical power. The purpose of this rule is to limit NOx emissions from these stationary gas turbines.

Rule 4703 was adopted on August 18, 1994. Since its adoption, the rule has been amended six times. The latest rule amendment in September 2007 strengthened the rule by establishing more stringent NOx limits for existing stationary gas turbines. EPA finalized approval for Rule 4703 on October 21, 2009 and deemed this rule as being at least as stringent as established RACT requirements. NOx emissions have been controlled by over 86% for this source category.

### Source Category

The requirements of Rule 4703 affect owners and operators of stationary gas turbine systems used to pump, compress, generate electricity, or perform other tasks. The four major industry groups are oil and gas production, utilities, manufacturing, and government.

In complying with the rule, all affected entities are required to control NOx and CO emissions by installing approved emissions control devices. Early in the rule development process, the District identified five different emissions control technologies that could be used to achieve proposed limits for stationary gas turbines. Of the five options, four mainly control NOx emissions, while the other one controls CO emissions. The four NOx control technologies are:

- Dilutant (water or steam) injection systems,
- Dry, low-NOx,
- Selective catalytic reduction, and
- SCONOx

Costs associated with different compliance options vary a great deal depending on technologies and available products. Depending on the size of the existing turbine systems, engine model and make, type of existing emissions control equipment, and many other factors, owners and operators of stationary gas turbine systems face different compliance costs. The impacts of Rule 4703 have been concentrated in the oil and gas production sector and utilities sector of the Valley, as they own and operate the vast majority of stationary gas turbines subject to the rule.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 1.22 | 1.28 | 1.14 | 1.09 | 1.11 | 1.14 | 1.14 | 1.14 | 1.10 |
| **NOx** | 3.09 | 3.23 | 2.89 | 2.77 | 2.83 | 2.89 | 2.90 | 2.92 | 2.81 |
| **SOx** | 0.22 | 0.23 | 0.20 | 0.19 | 0.19 | 0.20 | 0.20 | 0.20 | 0.19 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 1.21 | 1.27 | 1.13 | 1.08 | 1.10 | 1.13 | 1.13 | 1.14 | 1.09 |
| **NOx** | 3.00 | 3.14 | 2.82 | 2.70 | 2.76 | 2.82 | 2.83 | 2.84 | 2.74 |
| **SOx** | 0.21 | 0.23 | 0.20 | 0.19 | 0.19 | 0.20 | 0.20 | 0.20 | 0.19 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from stationary gas turbines are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for stationary gas turbines.

## How does District Rule 4703 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTG requirements for this source category.

***ACT***

- EPA–435/R-93-007 (Alternative Control Techniques Document—NOx Emissions from Stationary Gas Turbines)

The District evaluated the requirements contained within the ACT for NOx Emissions from Stationary Gas Turbines and found no requirements that were more stringent than those already in Rule 4703.

***NSPS***

- 40 CFR 60 Subpart GG (Standards of Performance for Stationary Gas Turbines)

The District evaluated the requirements contained within 40 CFR 60 Subpart GG and found no requirements that were more stringent than those already in Rule 4703.

- 40 CFR 60 Subpart KKKK (Standards of Performance for Stationary Combustion Turbines)

The District evaluated the requirements contained within above NSPS and found no requirements that were more stringent than those already in Rule 4703.

***NESHAP/ MACT***

- 40 CFR 63 Subpart YYYY (NESHAP for Stationary Combustion Turbines)

The District evaluated the requirements contained within 40 CFR 63 Subpart YYYY and found no requirements that were more stringent than those already in Rule 4703.

**State Regulations**

There are no state regulations applicable to this source category.

## How does District Rule 4703 compare to rules in other air districts?

***SCAQMD***

- Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines)

The District evaluated the requirements contained within SCAQMD's Rule 1134 and found no requirements that were more stringent than those already in Rule 4703.

***BAAQMD***

- Regulation 9 Rule 9 (Nitrogen Oxides from Stationary Gas Turbines)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 9 and found no requirements that were more stringent than those already in Rule 4703.

***SMAQMD***

- Rule 413 (Stationary Gas Turbines)

The District evaluated the requirements contained within SMAQMD's Rule 413 and found no requirements that were more stringent than those already in Rule 4703.

***VCAPCD***

- Rule 74.23 (Stationary Gas Turbines)

The District evaluated the requirements contained within VCAPCD's Rule 74.23 and found no requirements that were more stringent than those already in Rule 4703.

## Additional Emission Reduction Opportunities

The District has adopted numerous rule amendments to the turbine rule that have successfully and significantly reduced emissions from this source category. The emissions inventory for NOx from turbines has been reduced from 31.9 tpd in 1994 to 2.77 tpd in 2015. Significant emission reductions have been achieved through the implementation of the most stringent regulations in the nation for this source category and significant investments by stakeholders to implement effective and innovative emission control technologies. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining feasible opportunities for obtaining additional emissions reductions.

## BACT Comparisons

Comparisons of this rule with the District, BAAQMD, and SCAQMD BACT requirements showed that some BACT emissions limits are more stringent than Rule 4703 limits. For units greater than 3 MW, some of the District's NOx limits ranged from 3-5 ppmv, whereas the BACT limits ranged from 2-3 ppmv. For units less than 3 MW, the District's NOx limit was 9 ppmv, whereas the BACT limit was 5 ppmv. The BACT guidelines list SCR and SCONOx as the emissions control technologies used to achieve emission limits in the range of 2-5 ppmv. Although lower emission limits are potentially achievable for this source category, BACT requirements are imposed on new or modified turbine installations where ultra-low NOx controls can be installed and the equipment and the facility can be designed to function with this new technology. Rule 4703 is a prohibitory rule that has undergone several generations of NOx limits for existing units in the Valley; facilities comply with these limits by retrofitting their existing equipment. Requiring the installation of entirely new turbine systems is extremely expensive and not cost effective, and therefore not required of facilities.

### *Selective Catalytic Reduction*

Many of the larger units (> 3MW) have already employed SCR to achieve the 5 ppmv limits in place. Therefore, the District evaluated the potential opportunity to employ SCR for units less than 3 MW.

A SCR system reduces NOx emissions by converting the emissions to water and elemental nitrogen. Ammonia is generally injected into the exhaust stream and reacts with the nitrogen. Due to the high cost of SCR systems, they are typically used for controlling emissions from larger units, greater than 3 MW that generally create more emissions. The cost effectiveness of an SCR system for a 1 MW unit was calculated based on the cost effectiveness methodologies in the 2007 Staff Report for Rule 4703 and some of the newer methodologies used to calculate the cost effectiveness of SCR in the August 2011 Staff Report for Rule 4702. The tables below present the total annual costs for a new SCR system and a retrofit system.

**Table C-28 SCR Annual Costs for a New Installation on a 1 MW Turbine**

| Item | | Source | Cost |
|---|---|---|---|
| Turbine Rating | 1 MW | | |
| SCR Cost/KW | $125/KW | Mid-point between high and low estimate from R4703 analysis | |
| Operating Hours | 7884 hrs/year | | |
| ***Direct Capital Costs*** | | | |
| Total Purchased Equip Cost | $125/KW x 1000 KW | | $125,000 |
| Freight | 5% Purchased Equip. Cost (PEC) | Rule 4702 | $6,250 |
| Sales Tax | 8.25% PEC | Rule 4702 | $10,313 |
| Direct Installation Costs | 25% PEC | Rule 4702 | $31,250 |
| Total Direct Capital Costs | | | **$172,813** |
| ***Indirect Capital Costs*** | | | |
| Facilities | 5% PEC | Rule 4702 | $6,250 |
| Engineering | 10% PEC | Rule 4702 | $12,500 |
| Process Contingency | 5% PEC | Rule 4702 | $6,250 |
| Total Indirect Capital Costs | | | **$25,000** |
| Project Contingency | 20% PEC | Rule 4702 | $25,000 |
| Total Capital Costs (TCC) | Direct Capital + Indirect Capital + Project Contingency | Rule 4702 | $222,813 |
| **Annualized Capital Costs (10 years @ 10%)** | 0.1627*TCC | Rule 4702 | **$36,252** |
| ***Direct Annual Costs*** | | | |
| *Operating Costs* | | | |
| Operator | 0.5 hr/shift, $25/hr | OAQPS | $13,688 |
| Supervisor | 15% of operator | OAQPS | $2,053 |
| *Maintenance Costs* | | | |
| Labor | 0.5 hr/shift, $25/hr | OAQPS | $13,688 |
| Material | 100% of labor cost | OAQPS | $13,688 |
| *Utility Costs* | | | |
| Electricity Costs | | Variable | $5,747 |
| Cat. Replacement | | MHIA | $5,621 |
| Cat. Disposal | | OAQPS | $211 |
| Ammonia | | Variable | $1,008 |
| NH3 Inject Skid | | MHIA | $2,916 |
| **Total Direct Annual Costs** | | | **$58,620** |
| ***Indirect Annual Costs*** | | | |
| Overhead | 60% of Operating and Maintenance | OAQPS | $25,870 |
| Administrative | 0.02 x PEC | OAQPS | $2,500 |
| Insurance | 0.01 x PEC | OAQPS | $1,250 |
| Property Tax | 0.01 x PEC | OAQPS | $1,250 |
| Capital Recovery | 0.13 x PEC (10% int. rate, 15 yr period) | OAQPS | $16,250 |
| **Total Indirect Annual Costs** | | | $47,120 |
| | | | |
| **Total Annual Costs** | Annualized capital + Direct Annual + Indirect Annual | | **$141,992** |

**Table C-29 SCR Annual Costs for a Retrofit on a 1 MW Turbine**

| Item | | Source | Cost |
|---|---|---|---|
| Turbine Rating | 1 MW | | |
| SCR Cost/KW | $325/KW | Middle point between high and low estimate from R4703 analysis | |
| Operating Hours | 7884 hrs/year | | |
| ***Direct Capital Costs*** | | | |
| Total Purchased Equip Cost | $325/KW x 1000 KW | | $325,000 |
| Freight | 5% Purchased Equip. Cost (PEC) | Rule 4702 | $16,250 |
| Sales Tax | 8.25% PEC | Rule 4702 | $26,813 |
| Direct Installation Costs | 25% PEC | Rule 4702 | $81,250 |
| Total Direct Capital Costs | | | **$449,313** |
| ***Indirect Capital Costs*** | | | |
| Facilities | 5% PEC | Rule 4702 | $16,250 |
| Engineering | 10% PEC | Rule 4702 | $32,500 |
| Process Contingency | 5% PEC | Rule 4702 | $16,250 |
| Total Indirect Capital Costs | | | **$65,000** |
| Project Contingency | 20% PEC | Rule 4702 | $65,000 |
| Total Capital Costs (TCC) | Direct Capital + Indirect Capital + Project Contingency | Rule 4702 | $579,313 |
| **Annualized Capital Costs (10 years @ 10%)** | 0.1627*TCC | Rule 4702 | **$94,254** |
| ***Direct Annual Costs*** | | | |
| *Operating Costs* | | | |
| Operator | 0.5 hr/shift, $25/hr | OAQPS | $13,688 |
| Supervisor | 15% of operator | OAQPS | $2,053 |
| *Maintenance Costs* | | | |
| Labor | 0.5 hr/shift, $25/hr | OAQPS | $13,688 |
| Material | 100% of labor cost | OAQPS | $13,688 |
| *Utility Costs* | | | |
| Electricity Costs | | Variable | $5,747 |
| Cat. Replacement | | MHIA | $5,621 |
| Cat. Disposal | | OAQPS | $211 |
| Ammonia | | Variable | $1,008 |
| NH3 Inject Skid | | MHIA | $2,916 |
| **Total Direct Annual Costs** | | | **$58,620** |
| ***Indirect Annual Costs*** | | | |
| Overhead | 60% of Operating and Maintenance | OAQPS | $25,870 |
| Administrative | 0.02 x PEC | OAQPS | $6,500 |
| Insurance | 0.01 x PEC | OAQPS | $3,250 |
| Property Tax | 0.01 x PEC | OAQPS | $3,250 |
| Capital Recovery | 0.13 x PEC (10% int. rate, 15 yr period) | OAQPS | $42,250 |
| **Total Indirect Annual Costs** | | | $81,120 |
| | | | |
| **Total Annual Costs** | Annualized capital + Direct Annual + Indirect Annual | | **$233,994** |

**Potential Emissions Reduction Methodology**

The estimated current annual NOx emissions and the estimated potential annual NOx emissions were calculated using the following equation:

NOx = LF x MMBtu/hr x HR x EF/ 2,000 lb/ton

Where:

| | | |
|---|---|---|
| NOx | = | Current annual NOx emissions or potential annual NOx emissions (tpy) |
| LF | = | turbine load factor |
| MMBtu/HR | = | heat input rating |
| HR | = | annual hours of operation |
| EF | = | NOx emission factor in pounds per MMBtu |

Where:

| | | |
|---|---|---|
| EF | = | NOx emission factor in ppmv x 0.00366 |
| ppmv | = | NOx emissions in parts per million corrected to 15% oxygen |
| 0.00366 | = | Conversion factor used: 0.00366 lb/MMBtu per ppmv NOx |

The estimated annual NOx emissions reduction was calculated using the following equation:

NOx Emissions Reduction = Current NOx emissions - Potential NOx emissions

**<u>Potential Emissions Reduction Calculation</u>**

The emissions reduction calculations below utilized the following information:

Loading factor = 0.75
Heat input rating for a 1 MW unit = 15 MMBtu/hr
Annual Hours of Operation = 7884 hours
Current Emission Factor in Rule 4703 = 9 ppmv
Potential Emissions Factor through the use of SCR = 5 ppmv

| | | |
|---|---|---|
| Current NOx | = | LF x MMBtu/hr x HR x EF / 2,000 lb/ton |
| | = | 0.75 x 15 x 7884 x (9 x 0.00366) / 2000 |
| | = | 1.46 tons/year |

| | | |
|---|---|---|
| Potential NOx | = | LF x MMBtu/hr x HR x EF / 2,000 lb/ton |
| | = | 0.75 x 15 x 7884 x (5 x 0.00366) / 2000 |
| | = | 0.81 tons/year |

| | | |
|---|---|---|
| Emissions Reductions | = | Current NOx emissions - Potential NOx emissions |
| | = | 0.65 tons/year |

**Table C-30 SCR Cost Effectiveness**

| Type of Installation | MW | MMBtu/hr | Current NOx Emission Factor (EF), ppmv | Potential NOx EF, ppmv | NOx Reduction (Tons/Year) | Total Annual Cost ($) | Cost Effectiveness ($/ton) |
|---|---|---|---|---|---|---|---|
| New | 1 | 15 | 9 | 5 | 0.65 | $141,992 | $218,449 |
| Retrofit | 1 | 15 | 9 | 5 | 0.65 | $233,994 | $359,991 |

As demonstrated above, SCR is not a cost effective option as a retrofit or replacement for units less than 3 MW.

**EMx**

Certain BACT limits for simple cycle plants were achieved through the use of SCONOx. This multifaceted technology reduces NOx, SOx, carbon monoxide (CO), and volatile organic compound (VOC) emissions and is stated as achieving NOx levels less than 1.5 ppmv by its manufacturer. One issue with the use of SCONOx is that it requires steam to operate and simple cycle plants do not generate steam. Therefore, a simple cycle facility would have to add a boiler to their facility to generate steam for the SCONOx system, making the addition of this technology more costly. The District is not aware of any SCONOx applications on simple cycle plants.[77] While SCONOx is better suited for combined cycle turbines, this technology has not been achieved in practice (AIP) yet in the District.

BAAQMD evaluated SCONOx, now known as the EMx system, for turbines in a recent Final Determination of Compliance (FDOC) for the Oakley Generating Station. The FDOC states that EMx could potentially be an improvement over SCR as an add-on control device for achieving NOx reductions – assuming it can achieve the same level of NOx control – because it does not use ammonia. Ammonia has the potential, under certain atmospheric conditions, to react with nitric acid in the atmosphere to form ammonium nitrate, which can be a form of PM2.5. However, based on the implementation of EMx at a facility in Shasta County, BAAQMD voiced some concerns for its use.

EMx has never been used on a large utility-scale turbine and so there is no data on which to make a direct evaluation of how well the technology would work on larger turbines. EMx has been used on a smaller aeroderivitive turbine at the Redding Power Plant Unit No. 5, a 45-MW combined-cycle facility in Shasta County, CA. The Shasta County Air Quality Management District evaluated EMx at the Redding facility under a demonstration NOx limit of 2.0 ppm, which SCR can consistently achieve. After three years of operation, the Shasta County AQMD evaluated whether the facility was meeting this demonstration limit with EMx, and concluded that "*Redding Power is not*

[77] Brian K. Lusher, Bay Area Air Quality Management District. (June 2010). *Final Determination of Compliance: Marsh Landing Generating Station.*

*able to reliably and continuously operate while maintaining the NOx demonstration limit of 2.0 ppmvd @ 15% O2.*"[78]

The FDOC states that although the EMx manufacturer maintains that such problems have been overcome, concerns remain about how consistently the technology would be able to perform. Communications between BAAQMD and Shasta County Air District confirmed that the earlier conclusions about the achievability of a lower limit remain valid.[79] In addition, monthly reports of Continuous Emissions Monitoring System (CEMS) data submitted by Redding Power Plant to Shasta County Air District during 2007 and 2008 indicated that emissions have often been substantially higher.[80] Furthermore, the data from Redding is from a smaller aeroderivitive turbine, and there is no guarantee that if it were scaled up for uses on utility-size turbines that it would even be able to achieve the performance required from larger turbines. For these reasons, BAAQMD concluded that EMx is not as developed as SCR and cannot achieve the same level of emissions performance that SCR is capable of.

SCAQMD is funding a research project that will study and demonstrate the feasibility of control technologies to reduce PM2.5 and ultrafine particulate emissions from natural gas-fired turbine power plants. EMx is one of the two technologies that were selected for demonstration. The findings of this report could potentially be beneficial for evaluating the feasibility of EMx applications for turbines in the future.

**SOx**

The District considered implementing sulfur dioxide (SO2) limits at least as stringent as the requirements in 40 CFR 60 Subpart KKKK (Standards of Performance for Stationary Combustion Turbines). Fuel treatment sulfur removal systems were recognized as being able to reduce SOx emissions from turbines, other than those fired on Public Utilities Commission (PUC) quality natural gas. One Valley facility installed SCR onto their digester gas-fired turbine to meet the Rule 4703 limit. To do this, they installed a fuel pretreatment system that removes H2S and siloxanes, as they can damage the SCR catalyst if not removed. Other landfill and digester-gas turbines outside the District are also using these systems.

There are only seven units at six facilities in the Valley that utilize a fuel other than natural gas. Four units are fired on diesel gas, while the other three units utilize digester gas. However, the facilities with diesel-fired units utilize natural gas the majority of the time and utilize diesel fuel only during emergencies. Due to California Diesel Fuel requirements, the diesel facilities in the Valley are limited to a sulfur content of 0.0016 lb-SO2/MMBtu. PUC-quality natural gas typically has a sulfur content of 0.00285 lb-SO2/MMBtu and digester turbines are limited to 0.016 lb-SO2/MMBtu per

[78] Letter from R. Bell, Air Quality District Manager, Shasta County Air Quality Management District, to R. Bennett, Safety & Environmental Coordinator, Redding Electric Utility, June 23, 2005.
[79] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*
[80] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

District permits' requirements. By comparison, the Subpart KKKK limit is much higher at 0.060 lb-SO2/MMBtu and all of the units in the Valley are achieving much lower SO2 limits. Adding a SO2 limit similar to Subpart KKKK to the rule will not foster additional emissions reductions for Valley facilities.

**PM2.5**

PM2.5 reduction technologies for turbines were also researched. Post-combustion controls, including baghouses, electrostatic precipitators, and scrubbers were examined since these technologies can be used to remove PM2.5 emissions from exhaust gas streams.

As previously mentioned, every unit in the Valley subject to Rule 4703 operates on strictly natural gas, with the exception of seven facilities that operated on an alternate fuel part-time or during emergencies. Based on District Permits records and information in the BAAQMD FDOC for the Oakley Generating Station, electrostatic precipitators, baghouses, and scrubbers have not been achieved-in-practice for natural gas-fired turbines. These devices are normally used on solid fuel fired sources or others with high PM emissions, and are not used in natural gas-fired applications, which have inherently low PM emissions. The District is not aware of any gas turbine that has ever been required to use add-on controls such as these. BAAQMD reviewed the EPA BACT/LAER Clearinghouse and confirmed that EPA has no record of any post-combustion particulate controls that have been required for natural gas-fired gas turbines.[81]

Furthermore, these devices would not be technologically feasible to implement for certain facilities. As noted in the BAAQMD FDOC, if add-on control equipment were installed, it would create significant backpressure that would significantly reduce the efficiency of a power plant and would cause more emissions per unit power produced. Moreover, these devices are designed to be applied to emissions streams with far higher particulate emissions, and they would have very little effect on the low-PM emissions streams from natural gas-fired facilities in further reducing PM emissions.[82] It takes an emissions stream with a much higher grain loading for these types of abatement devices to operate efficiently. This low level of abatement efficiency (if any) also means that these types of control devices would not be cost effective, even if they could feasibly be applied to this type of source. For these reasons, post-combustion particulate control equipment is not technologically feasible for units subject to Rule 4703.

As previously mentioned, SCAQMD is funding a research project that will study and demonstrate the feasibility of control technologies to reduce PM2.5 and ultrafine particulate emissions from natural gas-fired turbine power plants. Sulfur removal and the EMx multi-pollutant control system are the two technologies which were selected for

[81] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

[82] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

demonstration. The findings of this report could potentially be beneficial for evaluating the cost effectiveness and feasibility of applying these emerging technologies to turbines in the future.

## Evaluation Findings

Even though stationary gas turbines are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4703 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from stationary gas turbines in the Valley.

## C.19 RULE 4802 SULFURIC ACID MIST

### Discussion
The purpose of Rule 4802 is to limit sulfuric acid emissions from any sulfuric acid production unit that was constructed or modified before August 17, 1971. The rule was adopted on May 21, 1992 to limit sulfuric acid mist to 0.30 pounds per short ton of acid produced and only applies to one facility in the Valley. EPA approved Rule 4802 into the SIP on June 8, 1999.

### Source Category
A sulfuric acid production unit is any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide, organic sulfides, or acid sludge. It does not include acid plants used as sulfur dioxide (SO2) control systems, chamber process plants, acid concentrators, or petroleum storage and transfer facilities.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.75 | 0.76 | 0.77 | 0.78 | 0.79 | 0.80 | 0.81 | 0.83 | 0.85 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.75 | 0.76 | 0.77 | 0.78 | 0.79 | 0.80 | 0.81 | 0.83 | 0.85 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from sulfuric acid mist are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for sulfuric acid mist.

### How does District Rule 4802 compare with federal and state rules and regulations?

#### Federal Regulations
There are no EPA CTG, ACT, NESHAP, or MACT requirements for this source category.

***NSPS***

- 40 CFR 60 Subpart Cd (Emissions Guidelines and Compliance Times for Sulfuric Acid Production Units)

The District evaluated the requirements contained within 40 CFR 60 Subpart Cd and found no requirements that were more stringent than those already in Rule 4802.

- 40 CFR 60 Subpart H (Standards of Performance for Sulfuric Acid Plants)—last amended on February 27, 2014, but the revisions only included corrections for source testing procedures.

The District evaluated the requirements contained within 40 CFR 60 Subpart H and found no requirements that were more stringent than those already in Rule 4802.

**State Regulations**

There are no state regulations applicable to this source category.

### How does District Rule 4802 compare to rules in other air districts?

There are no analogous rules for this source category in SMAQMD or VCAPCD.

***SCAQMD***

- Rule 469 (Sulfuric Acid Units)

The District evaluated the requirements contained within SCAQMD Rule 469 and found no requirements that were more stringent than those already in Rule 4802.

***BAAQMD***

- Regulation 9, Rule 1 (Sulfur Dioxide)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 1 and found no requirements that were more stringent than those already in Rule 4802.

- Regulation 12, Rule 6 (Acid Mist from Sulfuric Acid Plants)

The District evaluated the requirements contained within BAAQMD Regulation 12 Rule 6 and found no requirements that were more stringent than those already in Rule 4802.

### Additional Emission Reduction Opportunities

Only one facility in the Valley—a sulfuric acid plant—is subject to Rule 4802 (Sulfuric Acid Mist). This facility was in operation before 1971 and is limited by this rule to 0.30 pounds of acid mist per ton of acid produced. The facility uses a mist eliminator to remove fine particles from the acid gas stream, which has been determined to meet BACT requirements. By definition of Rule 4802, no new facility within the Valley will be subject to this rule. Instead, all new facilities would be subject to Rule 2201 (New and Modified Stationary Source Review Rule) and would be required to implement BACT level controls.

The District evaluated the potential opportunity to reduce emissions from this source category by lowering the limit for sulfur emissions from 0.30 pounds per ton produced to 0.1 pound per ton produced, consistent with EPA's BACT determination. Source tests conducted in 2010 and 2011 at the single facility permitted under Rule 4802, showed an actual sulfuric acid mist emission rate of 0.09 pound per ton using existing technology. Hence, the facility is meeting the current national BACT standard with the most advanced technology currently available and enforced through existing permit requirements, despite the fact that their current permit and Rule 4802 do not set that requirement. Therefore, the District has determined that there are no potential opportunities to further reduce emissions from this source category.

### Evaluation Findings

Even though sulfuric acid mist is not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4802 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from sulfuric acid mist in the Valley.

## C.20 RULE 4901 WOOD BURNING FIREPLACES AND WOOD BURNING HEATERS

### Discussion

Rule 4901 limits emissions from wood burning fireplaces, wood burning heaters, and outdoor wood burning devices through wood burning curtailments in areas with natural gas service. Rule 4901 also restricts the sale and transfers of non-compliant wood burning devices, and limits the installation of wood burning devices in new residential developments.

Through the Check Before You Burn program, which is based on Rule 4901, the District has declared and enforced episodic wood burning curtailments, also called “No Burn” days, since 2003. Check Before You Burn and District Rule 4901 reduce harmful species of PM2.5 when and where those reductions are most needed: in impacted urbanized areas when the local weather is forecast to hamper PM dispersion.

Rule 4901 was first adopted in 1993 and has been subsequently amended three times. The 1993 adoption of Rule 4901 established a public education program on techniques to reduce wood burning emissions. It also enforced EPA Phase II requirements for new wood burning heaters, prohibited the sale of used wood burning heaters, established a list of prohibited fuel types, and required the District to request voluntary curtailment of wood burning on days when the ambient air quality was unhealthy.

The 2003 rule amendments added episodic wood burning curtailments when air quality was forecast to be at 150 or higher on the air quality index (AQI), which is equivalent to a PM2.5 concentration of 65 $\mu g/m^3$, and added restrictions on the installation of wood burning devices in new residential developments, based on housing density. The 2008 rule amendments lowered the mandatory curtailment level to a PM2.5 concentration of 30 $\mu g/m^3$, and added a contingency measure to lower the wood burning curtailment level to 20 $\mu g/m^3$ in the event that EPA finds that the Valley does not attain the 1997 PM2.5 air quality standard in 2014.

The 2014 amendments to Rule 4901 lowered the No Burn threshold for high polluting wood burning heaters and fireplaces from 30 $\mu g/m^3$ to 20 $\mu g/m^3$. The amendments doubled the number of No Burn days for high polluting units that are the source of over 95% of the wintertime residential wood smoke emissions. By contrast, under the newly amended rule, clean certified units are subject to a minimal number of No Burn days ranging from zero to six days depending on the location in the Valley during the winter season because the No Burn thresholds for these units were raised to 65 $\mu g/m^3$.

## Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 4.48 | 4.38 | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 |
| NOx | 0.50 | 0.49 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| SOx | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 8.73 | 8.54 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 |
| NOx | 0.98 | 0.96 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| SOx | 0.16 | 0.16 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from wood burning fireplaces and wood burning heaters are lower than the BACM/MSM significance thresholds for NOx and SOx. Therefore, the Clean Air Act does not require a NOx and SOx control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for wood burning fireplaces and wood burning heaters.

## How does District Rule 4901 compare with federal and state rules and regulations?

### Federal Regulations

There are no EPA CTGs, ACTs, NESHAPs, or MACT guidelines for this source category.

### *NSPS*

- 40 CFR Part 60 Subpart AAA (Standards of Performance for New Residential Wood Heaters)

On February 3, 2014, EPA published proposed amendments to 40 CFR Part 60 Subpart AAA.[83] The proposed rule was finalized by EPA on February 3, 2015. District Rule 4901 points to the NSPS for emission limits and is therefore as stringent as the newly promulgated NSPS.

### *1988 NSPS*

Under the 1988 NSPS, only those wood or pellet-burning units meeting the following criteria require certification and all other units are not required to obtain certification and are therefore considered exempt:

[83] 40 CFR Part 60 Subpart AAA, *Standards of Performance for New Residential Wood Heaters* (FR 79 6330–6416)

1. Units that have an air-to-fuel ratio averaging less than 35-to-1;
2. Units with a usable firebox volume less than 20 cubic feet;
3. Units with a minimum burn rate less than 5 kilograms per hour (11 pounds per hour); and
4. Units that weigh 1,760 pounds or less.

For wood heaters meeting these requirements, the current certification emissions limits are 4.1 grams per hour (g/hr) of PM for units equipped with a catalytic combustor and 7.5 g/hr for units without a catalytic combustor. Units certified to these emission limits are said to be *Phase-II Certified* and will maintain that certification until the certification expires, which is up to 5 years from the issuance date.

Under the current NSPS, pellet stoves are not explicitly exempt from required certification; however, most models currently sold fall outside the regulation because they operate on an air-to-fuel ratio greater than 35-to-1. Single burn rate wood heaters are also not explicitly exempt from the current NSPS, but are not regulated by it because they operate below the burn rate criteria of 5 kilograms per hour.

***2015 NSPS***

The 2015 NSPS significantly lowers the certification emission limits for wood-burning heaters that are currently required to be certified and sets certification limits for a broader range of wood-burning heaters by removing the existing certification criteria (1 through 4 above). New standards will apply not only to adjustable burn rate wood heaters (the focus of the original regulation), but also to single burn rate wood heaters/stoves, pellet heaters/stoves, and any other affected appliance as defined in revised Subpart AAA as a “room heater.”

Although they do not require EPA certification under the 1988 NSPS, 96% of pellet heaters meet the proposed Step 1 PM emissions limit of 4.5 grams per hour. Single burn rate wood heaters are incapable of operating at the lowest burn rates, and it is the lower burn rates that result in the highest level of PM emissions; therefore, most single burn rate wood heaters will also meet the proposed Step 1 PM emissions limit. Manufacturers of such units will not initially be required to modify their design if they already meet the emissions standard and will automatically be deemed as certified to meet the Step 1 emission limits.

EPA promulgated a two-step compliance approach that applies to all new adjustable burn rate wood heaters, single burn rate wood heaters and pellet heaters/stoves. Under this approach, Step 1 emission limits for these sources will apply to each source manufactured on or after the effective date of the final rule or sold at retail on or after December 31, 2015. Step 2 emission limits for these sources will apply to each heater manufactured or sold at retail on or after the date five years after the effective date of the final rule. EPA is allowing an alternative compliance option for manufacturers who choose to certify using cord wood (rather than crib wood) to meet the Step 2 limits.

**Table C-31 Subpart AAA PM Emissions Limits**

| 2-Step, 5-Year Phase-In | | |
|---|---|---|
| **Step** | **PM limit** | **Compliance deadline** |
| **1** | 4.5 g/hr | Upon the effective date of the final rule |
| **2** | 2.0 g/hr | 5 years after effective date of final rule |
| | 2.5 g/hr (Cord wood alternative compliance option) | |

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 4901 compare to rules in other air districts?

There are no analogous rules for this source category in VCAPCD.

***SCAQMD***
- Rule 445 (Wood Burning Devices)

Rule 445 was last amended on May 3, 2013 to lower the curtailment threshold from 35 to 30 µg/m3. District Rule 4901 is more stringent than Rule 445, as the District lowered the No Burn threshold for high polluting wood burning heaters and fireplaces from the 30 µg/$m^3$ to 20 µg/$m^3$ in 2014. The District evaluated the requirements contained within SCAQMD Rule 445 and found no requirements that were more stringent than those already in Rule 4901.

***BAAQMD***
- Regulation 6 Rule 3 (Wood-Burning Devices)

The District evaluated the requirements contained within BAAQMD Regulation 6 Rule 3 and found no requirements that were more stringent than those already in Rule 4901.

***SMAQMD***
- Rule 417 (Wood Burning Appliances)

The District evaluated the requirements contained within SMAQMD Rule 417 and found no requirements that were more stringent than those already in Rule 4901.

- Rule 421 (Mandatory Episodic Curtailment of Wood and other Solid Fuel Burning)

The District evaluated the requirements contained within SMAQMD Rule 421 and found no requirements that were more stringent than those already in Rule 4901.

***Other Analogous Rules***
- Washington State's Department of Ecology Regulation Chapter 173-433 WAC (Solid Fuel Burning Devices)

The District evaluated the requirements contained within the above regulation and found no requirements that were more stringent than those already in Rule 4901.

- Colorado Air Quality Control Commissions Regulation No. 4

The District evaluated the requirements contained within Colorado's rule and found no requirements that were more stringent than those already in Rule 4901.

- Spokane Regional Clean Air Agency Regulation I Article VIII

The District evaluated the requirements contained within the Spokane rule and found no requirements that were more stringent than those already in Rule 4901.

- Oregon Department of Environmental Quality Division 262 (Heat Smart Program for Residential Woodstoves and Other Solid Fuel Heating Devices)

The District evaluated the requirements contained within Oregon's rule and found no requirements that were more stringent than those already in Rule 4901.

- Yolo-Solano AQMD Rule 2.40 (Wood Burning Appliances)

The District evaluated the requirements contained within Rule 2.40 and found no requirements that were more stringent than those already in Rule 4901.

## Additional Emission Reduction Opportunities

**2014 Amendments to the District's Residential Wood Burning Program**
The District takes a multidimensional and proactive approach to reducing emissions in the Valley. This philosophy is especially true for reducing emissions from residential wood burning with a combination of regulatory controls through Rule 4901, public outreach and education, and the District's Burn Cleaner Wood Stove Change-out Program (Burn Cleaner Program). The District's approach to reducing emissions from residential wood burning empowers Valley residents to play a major role in reducing emissions at almost no cost, and, in many cases, with savings in heating-related energy costs. Valley residents are encouraged to transition from older more polluting wood burning heaters and wood burning fireplaces (also commonly called open hearth fireplaces) to cleaner alternatives, by decreasing the number of allowable burn days for high polluting wood burning heaters and fireplaces while at the same time increasing the number of burn days allowed for registered clean wood burning heaters through a tiered episodic wood burning curtailment program. Emissions reduced through the 2014 amendments to the program are significantly greater than those achieved by reducing the curtailment threshold alone.

***Curtailment Level***
A potential opportunity for further emissions reductions was to lower the curtailment level, which would reduce emissions by increasing the number of "No Burn" days. Lowering the curtailment level below the 30 $\mu g/m^3$ level has reduced the build-up of emissions during the long stagnation periods experienced in the Valley during the 2014-15 winter season, and helped avoid exceedances of the PM2.5 standard.

During the September 2014 rule amendment project, the District estimated the average number of additional No Burn days likely to occur in future years as a result of lowering the curtailment level from the previous threshold level of 30 µg/m³ to the threshold level of 20 µg/m³. The average increase in No Burn days in future years in each county was calculated by averaging the historical data from the past five wood burning seasons of the number of days P M2.5 concentrations were forecasted to be equal to or exceed 30 µg/m³ versus 20 µg/m³. This analysis is summarized in the table below. The estimated average increase in No Burn days in future years was determined to be 34 days per county (an average of the last column in the table below) per wood burning season. However, the estimation of 34 additional No Burn days per wood burning season in the future will vary. No Burn days are called based on the air quality forecast for each day and are dependent on several variables. As a result of this analysis, the District amended Rule 4901 to lower the curtailment threshold to 20 µg/m³ in September 2014.

**Table C-32 Average Number of Days Forecast Above Curtailment Thresholds***

| County | Previous Threshold (≥30 µg/m³) | 2014 Adopted Threshold (≥20 µg/m³) | Additional No Burn days |
|---|---|---|---|
| San Joaquin | 24 | 53 | 29 |
| Stanislaus | 36 | 72 | 36 |
| Merced | 19 | 55 | 36 |
| Madera | 29 | 67 | 38 |
| Fresno | 49 | 85 | 36 |
| Kings | 39 | 70 | 31 |
| Tulare | 36 | 69 | 33 |
| Kern | 44 | 79 | 35 |

*Based on Forecast values from the 2009-10, 2010-11, 2011-12, 2012-13, 2013-14 wood-burning seasons

Although a No Burn day can potentially increase a resident's natural gas costs from using a central heating system in lieu of a wood burning heater, this potential cost is offset by the central heating system since a central heating system more efficiently heats the whole home, resulting in less money being spent on firewood based on the increase in No Burn days. Compared to other District rules, curtailing residential wood burning under Rule 4901 is the most cost effective rule for reducing directly emitted PM2.5 emissions.

### *Wood Burning Season*

During the 2014 amendment, the District evaluated the potential opportunity for further reducing emissions from the residential wood burning source category by extending the wood burning curtailment season. The current wood-burning season runs from the beginning of November until the end of February. Expanding the wood-burning season to include October and/or March could have potentially increased the number of No Burn days in each wood-burning season.

Measured Valley concentrations of levoglucosan, a primary indicator for wood burning, are not nearly as high in October or March as found to be during the current wood burning season of November through February. Additionally, a six-year average was calculated for the number of No Burn days in each county from 2008 through 2013 for the months of October and March as illustrated in the following table. The resulting estimated number of increased No Burn days based on historical data is in the range of less than one day up to six days. Extending the wood burning season would not significantly benefit air quality in the Valley due to the combination of less extensive burning activity and the minute number of additional No Burn days.

**Table C-33 Days with PM2.5 ≥ 30μg/m$^3$**

| County | Month | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Average |
|---|---|---|---|---|---|---|---|---|
| Fresno | March | 3 | 0 | 0 | 0 | 0 | 0 | 0.5 |
| Kern | March | 2 | 0 | 0 | 1 | 0 | 2 | 0.8 |
| Kings | March | 1 | 0 | 1 | 0 | 0 | 4 | 1 |
| Madera | March | NA | NA | NA | 0 | 0 | 0 | 0 |
| Merced | March | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| San Joaquin | March | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stanislaus | March | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tulare | March | 2 | 0 | 0 | 0 | 0 | 3 | 0.8 |
| | | | | | | | | |
| Fresno | October | 6 | 2 | 2 | 7 | 1 | 1 | 3.2 |
| Kern | October | 6 | 6 | 3 | 3 | 2 | NA | 4 |
| Kings | October | 10 | 9 | 7 | 10 | 2 | 1 | 6.5 |
| Madera | October | NA | NA | NA | 3 | 0 | 0 | 1 |
| Merced | October | 3 | 0 | 2 | 0 | 0 | 0 | 0.8 |
| San Joaquin | October | 2 | 0 | 0 | 0 | 0 | 0 | 0.3 |
| Stanislaus | October | 5 | 1 | 2 | 5 | 0 | 0 | 2.2 |
| Tulare | October | 4 | 5 | 1 | 6 | 0 | 3 | 3.2 |

### *New Residential Developments*

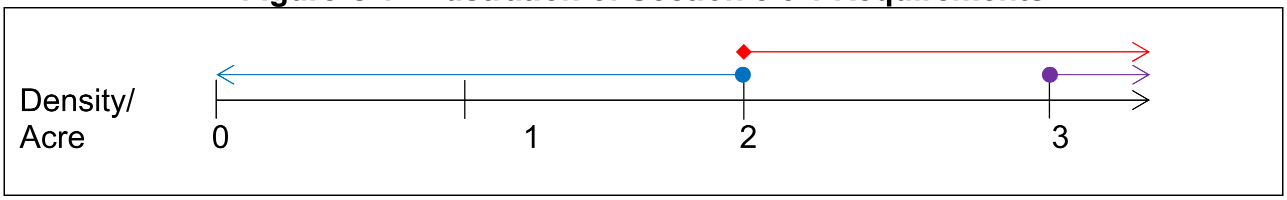
The District also considered further limiting the installation of wood burning fireplaces and heaters in new residential developments by strengthening Section 5.3 of Rule 4901, which sets limits for the quantity of wood burning fireplaces or wood burning heaters that can be installed in new residential developments. South Coast Rule 445 prohibits the installation of wood burning devices in any development that has natural gas service. However, since most of the Valley's new developments are already subject to restrictions based on their housing densities, the emissions reduction potential is minimal.

As a part of the 2014 amendments to Rule 4901, the District amended Section 5.3. Previous rule language was not completely clear as to the number of heaters allowed to be installed if that number falls between two whole numbers. The rule language was strengthened by clarifying the number of heaters allowed for installation in a given area, in addition to the language being clarified with regards to the applicability of the density requirements by the removal of the term "new" from rule language.

**<u>Section 5.3.1 (Effective until December 31, 2014)</u>**
Previous language provided for:

- 5.3.1.1: >2 dwellings/acre: no wood burning fireplaces
- 5.3.1.2: ≥3 dwellings/acre: max of two certified units
- 5.3.1.3: ≤2 dwellings/acre: max of one wood burning fireplace or wood burning heater per dwelling

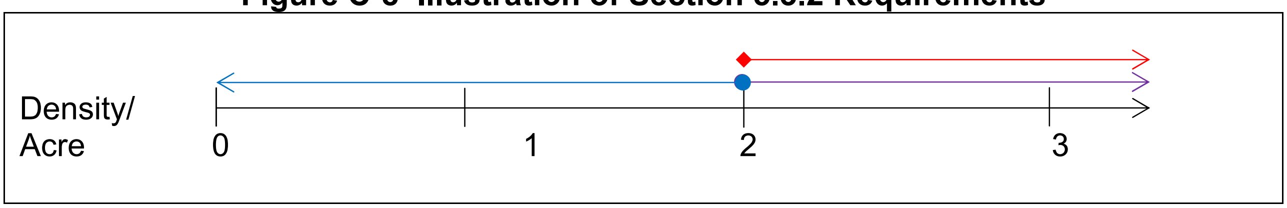
**Figure C-7 Illustration of Section 5.3.1 Requirements**




**<u>Section 5.3.2 (Effective on and after January 1, 2015)</u>**
Amended language provides for:

- 5.3.2.1: >2 dwellings/acre: no wood burning fireplaces
- 5.3.2.2: >2 dwellings/acre: max of two certified units
- 5.3.2.3: ≤2 dwellings/acre: max of one wood burning fireplace or certified wood burning heater per dwelling

**Figure C-8 Illustration of Section 5.3.2 Requirements**




Section 5.3.2.1 prohibits the installation of a wood burning fireplace in a residential development with a density greater than two dwelling units per acre. While this could be misinterpreted as being less stringent than a similar requirement in SCAQMD Rule 445, in reality it is more stringent because Rule 4901 does not afford the same flexibilities as the SCAQMD rule does. While SCAQMD Rule 445 has language prohibiting the installation of a permanently installed wood burning device into any new development, this requirement is not applicable to new developments where there is no existing infrastructure for natural gas service within 150 feet of the property line or those 3,000 or more feet above mean sea level. District Rule 4901 is more stringent in that for the extremely limited cases where wood burning devices are allowed to be installed, the number of units allowed is limited to no more than two per acre. Additionally, Rule 4901 does not exempt any homes from any aspect of rule requirements based on elevation.

***Encouraging the Transition to Clean Burning Heaters through Non-Regulatory Measures***
Upgrading a home's wood burning device reduces air pollutant emissions on days when wood burning is allowed. By operating more efficiently, these devices can also lower

the overall home heating cost. District Rule 4901 neither prohibits nor requires wood burning device upgrades. However, the District encourages such upgrades through its public outreach and through its Burn Cleaner Program, which provides funding to Valley residents to upgrade their current wood-burning devices and open fireplaces to natural gas or propane gas devices, to certified wood stoves or inserts, or to pellet devices. The District's webpage[84] has more information on program eligibility and qualified devices.

There are several types of wood burning devices and device inserts available. Wood stoves, especially newer models, are generally safe and efficient devices for home heating. There are two types of wood stoves: catalytic and non-catalytic. EPA's Phase II certified wood stoves produce only 2 to 7 grams of smoke per hour, compared to 15 to 30 grams of smoke per hour from older, uncertified devices, and in future years the EPA certified devices will emit even less.

Pellet stoves are similar in appearance to wood stoves, but burn compressed pellets made of ground, dried wood and other biomass wastes. Pellet stoves are generally more expensive than wood stoves and require electricity for operation; however, they are typically more efficient than wood stoves due to the better fuel-to-air ratio in the combustion chamber.

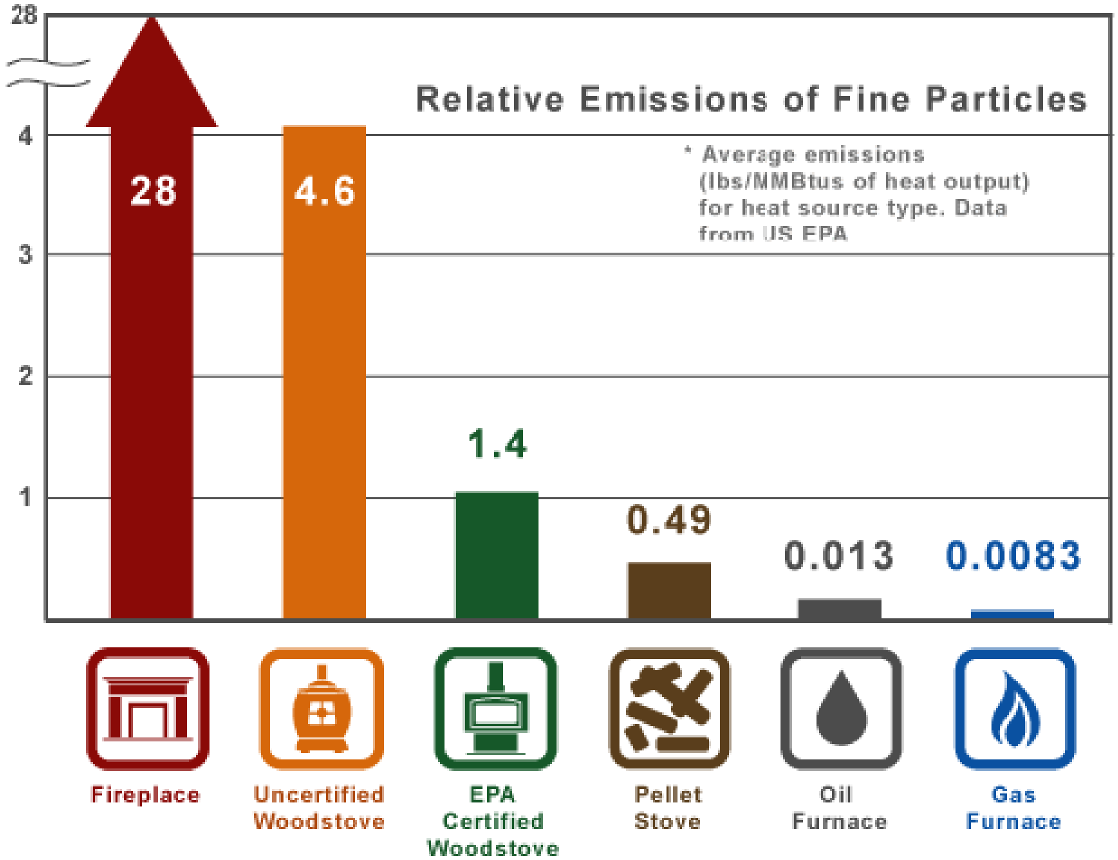
Wood burning fireplaces include traditional masonry fireplaces built into brick or stone, constructed in the home, and "low mass" fireplaces that are pre-fabricated prior to installation. Most fireplaces are not used as a primary source of heat, but serve as a secondary heating source or for ambiance. Fireplaces generate much more emissions than wood stoves or pellet stoves, but fireplace inserts are available to reduce emissions. EPA does not certify fireplaces or fireplace inserts, but does have a voluntary program for devices that meet qualifications to be considered cleaner burning than typical fireplaces and fireplace inserts. While these devices reduce emissions relative to uncontrolled fireplaces, their emissions are still relatively higher than certified wood stoves and pellet stoves.

Gas stoves and gas fireplaces burn natural gas or propane, emit very little air pollution, and require little maintenance. Gas devices are not subject to the requirements of Rule 4901, so they can be used on "No Burn" days. For more information about the various types of wood burning devices available, see EPA's Burn Wise program webpages[85].

The following figure illustrates the average PM2.5 emissions based on various heat sources.

[84] www.valleyair.org/Grant_Programs/GrantPrograms.htm#WoodStoveChangeOut
[85] www.epa.gov/burnwise

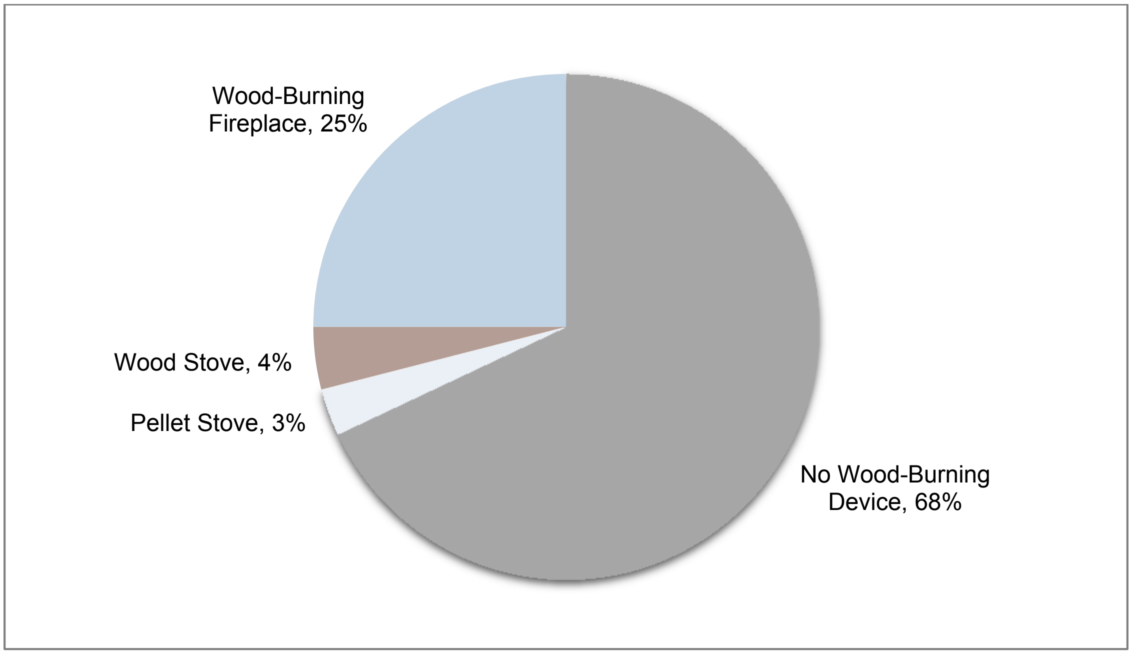
**Figure C-9 Average PM2.5 Emissions Based on Wood Burning Heater Type**[86]




A third party survey of Valley residents (see Appendix E) revealed that the majority of Valley residents do not have wood burning heaters or wood burning fireplaces. However, of those that do have wood burning heaters and wood burning fireplaces, the majority have wood burning fireplaces, refer to Figure C-10 (Proportion of Residents with a Wood-Burning Fireplace, Wood Stove or Pellet Stove) for a graphical representation of the proportion of Valley residents with wood burning heaters, pellet-fueled wood burning heaters, and wood burning fireplaces.

[86]EPA. (2012, November 14). *Consumers – Energy Efficiency and Wood-Burning Stoves and Fireplaces*. Retrieved from http://www.epa.gov/burnwise/energyefficiency.html.

**Figure C-10 Proportion of Residents with a Wood-Burning Fireplace, Wood Stove or Pellet Stove**




EPA reports that 75% of wood stoves (also called wood burning heaters) in the United States are non EPA-certified stoves. EPA certified wood burning heaters produce 70% less particle pollution then their older dirtier counterparts.

Survey results indicate the most effective ways to encourage transition to clean burning heaters is to allow more wood burning days for less polluting wood burning heaters and update the District's Burn Cleaner Program to increase incentive amounts. By encouraging Valley residents to transition to clean wood burning heaters, emissions will not only be reduced on No Burn days but also on days when burning is allowed. This health and air quality benefit will occur because cleaner alternatives such as EPA Phase II Certified wood burning heaters and pellet-fueled wood burning heaters, and gaseous-fueled heaters will be in use instead of the older more polluting wood burning heaters and wood burning fireplaces.

Many Valley residents have upgraded their homes with these newer devices, including through programs such as the *District's Burn Cleaner Program* and federal tax incentives. Given their much lower relative emissions, allowed use of these devices during a lower curtailment level still achieves the goal of significantly reducing the overall emissions that ultimately lead to violations of the standard. Enforcing this added flexibility is difficult given the challenge in distinguishing wood smoke emissions from various wood burning devices, and the District explored various options during the rule development process for ensuring that this issue is addressed. Along with this allowance, the District will continue to provide incentives to encourage the replacement of existing older devices with newer clean devices.

**Burn Cleaner Incentive Program**

The District's Burn Cleaner Wood Stove Change-out Program (Burn Cleaner Program) plays a key role in the success of the transition from older more polluting wood burning heaters and fireplaces to cleaner wood burning heaters. Since 2006, the Burn Cleaner Program has been helping residents overcome some of the financial obstacles in purchasing cleaner alternatives. There are currently more than 30 hearth retailers in the Valley that have partnered with the District to successfully implement the Burn Cleaner Program.

The Burn Cleaner Program offers multiple levels of incentive funding, increased as of the 2014-2015 wood burning season:

- Up to $1,000 to replace a qualifying unit with a certified wood insert/freestanding stove, certified pellet insert/freestanding stove, or natural gas insert/freestanding stove
- Up to $2,500 of any eligible device if the applicant is eligible for Low-Income
- Up to $500 as an additional incentive towards gas devices (for both standard and low-income)

The District continuously reevaluates the Burn Cleaner Program and implements enhancements to the program. In addition to increased incentive amounts, the District has also recently implemented the following enhancements:

- Reducing a substantial portion of the upfront, out-of-pocket cost of a new qualifying unit for low-income qualified applicants. The District has partnered with contracted hearth retailers to allow low-income qualified applicants to make the purchase at a reduced price by deducting the incentive amount from the invoice at the point of purchase. Allowing the incentive funding to be directly applied when purchase is made makes it more feasible for additional low-income applicants to take advantage of the program.
- Refining the low-income eligibility form to streamline the determination process and identifying the hearth retailers that provide the reduced upfront cost option.
- Program documents are now available in Spanish to further extend the outreach efforts to the local community.
- Updates to program documents to make them more user-friendly and to improve the process during the application, installation, and claim for payment request phases.
- The document submittal process has been updated to allow applications and claim for payment requests to now be emailed to the District for faster processing. Also, supplemental forms have been developed further streamline the review process and help keep the retailers and applicants informed on the status of projects.

The upgrades to processing, applications, and incentive amounts, combined with effective and proactive public outreach and education campaign and the assistance of District retail partners, the initial funding for the Burn Cleaner Program was quickly exhausted. At the November 13, 2014 Governing Board meeting, the District Governing Board approved an additional $2 million in funding to meet the increased demand for this highly successful program. Immediately after the November Board meeting, District staff worked expeditiously to ensure that the additional funding was allocated quickly and efficiently to the residents in the Valley. Given this program's critical role in supporting the District's efforts to reduce the impact of residential wood burning and continued high demand in the program the District went back to the Governing Board at the December 18, 2014 public hearing to request additional funding and other amendments to the program, and an additional $3.6 million in funding was allocated along with programmatic changes proposed by staff including lowering the voucher incentive amount for non-low income applicants from the then $1,500 to $1,000, limiting the number of vouchers per household, and directing funding based upon demand for any surplus remaining in each county.

**Collaboration with participating hearth retailers**
The District has renewed its contracts with the hearth retailers and hosted informational meetings to discuss program changes in order to ensure a smooth roll out of the enhancements. As part of the District's initiative to increase the effectiveness of the program, District staff has worked closely with the participating hearth retailers on outreach efforts and provided them with promotional tools, such as flyers and quick screens with information about the Burn Cleaner Program.

**Public Outreach and Education**
The District has an extremely successful outreach and education program with regards to residential wood burning and educating Valley residents about air quality, the effects of air pollution on the population's health, and on options they can take to reduce emissions. In the 2013-14 wood-burning season the District took part in 51 media interviews about extreme weather and wood burning.

The District's informational *Check Before You Burn* program minimizes elevated PM2.5 concentrations throughout the winter. The PM2.5 air quality improvements that the Valley has experienced since the adoption of Rule 4901 have been assisted by strong multimedia outreach by the District and a resultant increase in public awareness and participation in winter District programs.

During the wood-burning season of 2013-14, the District Outreach staff received hundreds of public calls and emails specific to residential wood burning. An interesting new trend has surfaced regarding public opinion, an increased number of the phone calls were in support of an outright ban on residential wood burning year-round (with the exception of residents for whom wood burning is the sole source of heat). This is attributed to heightened awareness among the general population of the deleterious effects of wood burning on public health.

Since the inception of *Check Before You Burn*, the District's complementary tools, such as the Real-time Air Advisory Network (RAAN) and the "Valley Air" smart phone app, have continued to gain in popularity. Annual public call and website "hit" statistics, plus growth in the District's Facebook page activity, also illustrate continued growth in wood-burning awareness. Survey results also showed an increased public awareness with eight out of ten respondents being aware of the District's *Check Before You Burn* program, 78% of whom confirmed reduced wood-burning activities as a direct result of the program.

The District also incorporates wood-burning messaging into other public outreach products, including Healthy Air Living Schools materials, "Blue Sky, Brown Sky … It's Up to You!" elementary curriculum and other materials.

***Multimedia Advertising Campaign***

The District's seasonal public outreach advertising campaign is retooled each year to include timely and relevant messaging. In the past few seasons, this messaging has been delivered by the District's Governing Board members, with billboards in English and Spanish strategically placed throughout the Valley, radio and TV spots, and value-added messaging delivered through media throughout the Valley.

***Expanding New Media Outreach***

The most significant evolution of *Check Before You Burn* messaging has occurred with the expanded and accelerated use of new media: Facebook and Twitter posts. Facebook "likes" have nearly doubled from the 2012-13 season, to more than 1,100 at the end of the 2013-14 season. This has proven to be a valuable way to deliver immediate messaging regarding wood-burning statuses, in addition to providing a platform for direct, two-way interaction with the public.

***Strengthening Media Partnerships***

The District maintains partnerships with television, newspaper, radio, outdoor and print, as well as more non-traditional media, such as on-screen messaging in local movie theaters, internet advertising and video loops in medical offices. During seasonal *Check Before You Burn* campaigns, the District runs media on 11 broadcast television stations in the Fresno and Bakersfield markets, including four Spanish stations, as well as 10 cable networks in four cable markets including zoned cable in Stockton, Modesto, Turlock and Manteca. In the Sacramento market, which includes the District's northern counties, the wood-burning message runs on two English language broadcast television stations and one Spanish language broadcast television station.

The District also typically runs messaging on 42 radio stations and 18 newspapers (six of them Spanish) throughout the eight-county area. *Check Before You Burn* outdoor messaging appears on more than 100 outdoor billboards (including large-format vinyl billboards) and smaller "one-sheets" in Environmental Justice communities throughout the Valley. With these purchases come added value in the form of bonus spots, news sponsorships, and extra billboards and overages in outdoor messaging. Outdoor messaging is strategically placed in high-traffic areas as well as neighborhood and rural communities to ensure a wide reach in those areas where residential wood burning might be common.

The District's print campaign includes major papers such as the *Bakersfield Californian*, *Fresno* and *Modesto Bees* and *Stockton Record*, but also rural newspapers such as the

*Arvin Tiller*, *Manteca Bulletin* and *Shafter Press*. The District also appears in each issue of the Bakersfield Business Journal, which offers the opportunity to promote seasonal campaigns. Media buys allow leveraging buying power that typically returns an additional $100,000+ in media placement. The related Cinemedia campaign is also regularly featured on 100 movie screens from Stockton to Bakersfield, with more than 25,000 spots that reach more than 475,000 people.

### Evaluation Findings

Even though wood burning fireplaces and wood burning heaters are not a significant source of NOx or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4901 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from wood burning fireplaces and wood burning heaters in the Valley.

## C.21 RULE 4902 RESIDENTIAL WATER HEATERS

### Discussion

Rule 4902 is a point-of-sale rule, adopted on July 17, 1993, to limit NOx emissions from natural gas-fired residential water heaters with heat input rates less than or equal to 75,000 Btu/hr. The original rule enforced a NOx emissions limit of 40 nanograms of NOx per Joule of heat output (ng/J). Since its adoption, the rule has been amended once. The March 2009 amendments strengthened the rule by enforcing a limit of 10 ng/J for new or replacement water heaters and a limit of 14 ng/J for instantaneous water heaters. NOx emissions have been controlled by approximately 88% for this source category. EPA finalized approval for Rule 4902 on May 5, 2010.

### Source Category

As a point-of-sale rule, Rule 4902 affects water heater manufacturers, plumbing wholesalers, retail home supply stores, plumbers and contractors, and homeowners.

This source category encompasses several types of water heaters, including conventional storage water heaters, demand water heaters, heat pump water heaters, solar water heaters, and tankless coil and indirect water heaters. Water heater options also vary by fuel type which includes electricity, fuel oil, geothermal energy, natural gas, propane, and solar energy.

Conventional storage water heaters are the most common. They have an insulated tank sized from 20 to 80 gallons and natural gas fired units have a gas burner under the tank regulated by a thermostat. Demand water heaters, also known as instantaneous water heaters, heat water as it is required and do not use a storage tank. As soon as there is a demand for hot water, a gas burner heats cold water as it travels through a pipe in the unit. Natural gas fired units provide hot water at a rate upwards of 5 gallons per minute.

A tankless coil water heater heats water flowing through a heat exchanger installed in a furnace or boiler. Similar to the tankless coil water heater an indirect water heater uses a furnace or boiler. Fluid heated by the furnace or boiler is circulated through a heat exchanger in a storage tank.

Manufacturers have focused on combustion modification to meet the lower $NO_x$ limit as required in other California air districts. Combustion modification systems are designed to reduce thermal $NO_x$ formation by changing the flame characteristics to reduce peak flame temperature. Combustion modification for residential water heaters is achieved by different burner designs such as low NOx and ultra-low NOx burners. Some of the design principles used in low NOx and ultra-low NOx burners include staged air burners, staged fuel burners, pre-mix burners, internal recirculation, and radiant burners.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.21 | 0.21 | 0.21 | 0.22 | 0.22 | 0.22 | 0.22 | 0.23 | 0.23 |
| NOx | 2.21 | 2.19 | 2.17 | 2.16 | 2.14 | 2.12 | 2.11 | 2.09 | 2.08 |
| SOx | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.28 | 0.28 | 0.29 | 0.29 | 0.29 | 0.30 | 0.30 | 0.31 | 0.28 |
| NOx | 2.91 | 2.89 | 2.87 | 2.84 | 2.82 | 2.80 | 2.78 | 2.77 | 2.91 |
| SOx | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from residential water heaters are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for residential water heaters.

### How does District Rule 4902 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 4902 compare to rules in other air districts?

***SCAQMD***

- Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters)

The District evaluated the requirements contained within SCAQMD Rule 1121 and found no requirements that were more stringent than those already in Rule 4902.

***BAAQMD***

- Regulation 9 Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 6 and found no requirements that were more stringent than those already in Rule 4902.

***SMAQMD***

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU Per Hour)

The District evaluated the requirements contained within SMAQMD Rule 414 and found no requirements that were more stringent than those already in Rule 4902.

***VCAPCD***

- Rule 74.11 (Natural Gas-Fired Water Heaters)

The District evaluated the requirements contained within VCAPCD Rule 74.11 and found no requirements that were more stringent than those already in Rule 4902.

### Additional Emission Reduction Opportunities

Units subject to Rule 4902 are fired on PUC quality natural gas, and are inherently low-emitters of SOx and PM2.5 emissions. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

**Electric Water Heaters**

The District evaluated the potential opportunity to replace natural gas and propane water heaters with electric units. A comparison of three water heaters that utilize the different fuel types with an emissions reductions and cost effectiveness analysis for these units is summarized below.

**Table C-34 Emissions Reductions and Cost Effectiveness of Water Heaters by Fuel Type**

| Fuel Type | Low NOx Natural Gas | Propane | Electricity |
|---|---|---|---|
| Capacity[1] | 50 gallons | 50 gallons | 50 gallons |
| Shipping Weight[1] | 180 lbs | 151 lbs | 109 lbs |
| Energy Factor[1] | 0.62 | 0.59 | 0.91 |
| Purchase Price[1] | $902.00 | $899.00 | $473.25 |
| Estimated Life Expectancy[2] | 13 years | 13 years | 13 years |
| Lifetime Energy Use[2] | 3,133 therms | 2,867 gallons of LP | 62,439 kWh |
| Lifetime Energy Costs[3] | $3,568 | $7,176 | $9,834 |
| Lifetime NOx Emissions[4] | 30.60 lbs | 48.09 lbs | 0.00 lbs |
| Annual NOx Emissions | 2.35 lbs | 3.70 lbs | 0.00 lbs |
| **Comparing Natural Gas and Propane to Electricity** | | | N/A |
| Annualized capital cost[5] | $76.99 | $76.99 | |

| Fuel Type | Low NOx Natural Gas | Propane | Electricity |
|---|---|---|---|
| Annual Operating Cost Savings Compared to Electric | $482.00 | $204.46 | |
| Cost per pound NOx | $237.87 | $76.07 | |
| **Cost per ton NOx** | **$475,736** | **$152,135** | |

[1] Unit specifications and prices acquired from Grainger Industrial Supply as of August 7, 2012
[2] Data from US Department of Energy – Energy Cost Calculator for Electric and Gas Water Heaters http://www1.eere.energy.gov/femp/technologies/eep_waterheaters_calc.html
[3] Cost data based on the average cost of units of energy in 2010 according to the US Energy Information Administration. http://www.eia.gov/
[4] Emissions factors derived from Appendix EA-1 of US Department of Energy's Energy Assessment for Proposed Energy Conservation Standards for Residential Clothes Washers
[5] The annualized capital equipment cost is calculated by multiplying the installed equipment cost by the capital recovery factor of 0.1627.

The operating cost for electric water heaters is higher than for propane and natural gas units, due to the higher cost of electricity compared to propane and natural gas. However, the initial purchase price is lower for electric units. Converting to an electric water heater also may require modifications to the residence and have associated costs.

### Evaluation Findings

Although residential water heaters are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4902 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from residential water heaters in the Valley.

## C.22 RULE 4905 NATURAL GAS-FIRED, FAN-TYPE CENTRAL FURNACES

### Discussion

Rule 4905 is a point-of-sale rule that applies to any person who sells, offers for sale, installs or solicits the installation of natural-gas-fired, fan-type central furnaces, for use within the Valley with a rated heat input capacity of less than 175,000 Btu/hour, and for combination heating and cooling units with a rated cooling capacity of less than 65,000 Btu/hour.

The rule was adopted on October 20, 2005 to establish NOx limits for residential central furnaces supplied, sold, or installed in the Valley. The rule set a NOx emission limit of 0.093 pounds per million Btu of heat output (lb/MMBtu). EPA finalized approval for Rule 4905 on May 30, 2007. Rule 4905 was amended on January 22, 2015 to:

- Lower the NOx emission limit for residential units from 40 ng/J (0.093 lb/MMBtu) to 14 ng/J
- Expand the rule applicability to include non-residential units with a NOx emission limit of 14 ng/J and units installed in manufactured homes with a NOx limit of 40 ng/J, to be lowered to 14 ng/J in 2018
- Additional labeling requirements

The January 2015 amendments exceeded SCAQMD Rule 1111 requirements and made Rule 4905 the most stringent rule in the nation for this source category.

### Source Category

Affected parties include furnace manufacturers, residential heating wholesalers, supply stores, contractors and end-users. The point-of-sale approach has allowed the District to achieve NOx reductions without placing an undue financial burden on the residents, operators and businesses that sell these units in the Valley.

Applicable units are used in approximately 71% of Valley residences and are not labeled for retail as “residential” or “commercial” furnaces. Units used in commercial buildings, which are subject to the requirements of Rule 4905 as of the January 2015 amendments, are essentially the same as residential units with the exception of possible differences in usage patterns and indoor/outdoor location. Research for the analyses in the January 2015 amendments estimated 1,252,190 residential and commercial units will be operating in the Valley in 2017. Replacement will occur gradually as these units reach the end of the 20-year useful life.

The most common residential and commercial heat sources are boilers and furnaces; other heating options include heat pumps, active solar heating, electric heating, wood or pellet stoves, portable and direct vent wall heaters, and fireplaces.[87] Heat distribution systems are either central heating, where heat is generated in a central location and

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[87] Department of Energy. (2013, December 16). *Energy Saver 101: Everything You Need to Know About Home Heating*. Retrieved 12/17/13 from http://energy.gov/articles/energy-saver-101-infographic-home-heating.

distributed throughout the building, or point-of-use or space heating, meaning supplemental heat is provided to a specific room. Types of central heating systems include forced air, steam radiant, radiant, hot water baseboards, and electric baseboards. Types of space heaters include wood or pellet stoves, portable and direct vent wall heaters, and fireplaces. Fuel types include natural gas, propane, heating oil, electricity, and solid fuels such as wood or pellets.

All heating systems have three basic components: a heat source, a heat distribution system, and a control system. The control system is usually a programmable thermostat. The heat source, which generally determines the type of distribution system used, is selected based on many factors. The most important factor is geographical location, which determines the climate and types of available fuel. Most commercial and residential buildings in the Valley have access to natural gas, which is typically the cheapest and most convenient fuel source in areas where it is available.

Rule 4905 applies to furnaces fueled by natural gas that use forced air distribution, the most common type of heating system for residential and commercial buildings. Central furnaces are controlled by a thermostat, which sends signals to turn the device on or off when the building temperature does not match a chosen set point. A valve then opens to send natural gas to the burners, which combust the gas directly into the heat exchangers. A blower pulls air from outside the building through a filter, across the heat exchanger, and through a series of ducts and vents to different areas of the building. Exhaust from the combustion exits the building through a separate duct. Condensing units use an additional heat exchanger to extract the latent heat in the flue (exhaust) gas by cooling the combustion gasses to near ambient temperature and thereby increase the heating efficiency by up to 10%. The water vapor in the flue gas is condensed, collected, and drained.

Units installed in manufactured homes utilize the same types of materials and operating principles as commercial and residential units; however, significant differences exist. Furnaces installed in manufactured homes use sealed combustion, meaning all of the combustion air is taken from outside the building. These units also pre-heat the air, typically to 50-60°F, using a concentric vent where the combustion air is drawn in through the outer ring, while exhaust gases are vented through the inside core of the vent pipe. The air is pre-heated because the cold outside air does not mix well with the fuel, while pre-heated air blends well and allows for quieter ignition and combustion. Furnaces installed in manufactured homes also have to comply with strict space restrictions.[88]

[88] U.S. Department of Energy. (2014, July 7). *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnace Fans.* Retrieved 9/23/14 from https://www.federalregister.gov/articles/2014/07/03/2014-15387/energy-conservation-program-for-consumer-products-energy-conservation-standards-for-residential.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.20 | 0.20 | 0.20 | 0.21 | 0.21 | 0.21 | 0.21 | 0.22 | 0.22 |
| **NOx** | 2.46 | 2.49 | 2.52 | 2.55 | 2.58 | 2.61 | 2.64 | 2.68 | 2.72 |
| **SOx** | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.27 | 0.27 | 0.27 | 0.27 | 0.28 | 0.28 | 0.28 | 0.29 | 0.27 |
| **NOx** | 3.28 | 3.31 | 3.35 | 3.39 | 3.43 | 3.47 | 3.51 | 3.56 | 3.28 |
| **SOx** | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from natural gas-fired, fan-type central furnaces are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for natural gas-fired, fan-type central furnaces.

### How does District Rule 4905 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 4905 compare to rules in other air districts?

***SCAQMD***

- Rule 1111 (Reduction of NOx Emissions from Natural Gas-Fired, Fan-Type Central Furnaces)

The District evaluated the requirements contained within SCAQMD Rule 1111 and found no requirements that were more stringent than those already in Rule 4905.

***BAAQMD***

- Regulation 9 Rule 4 (Nitrogen Oxides from Fan Type Residential Central Furnaces)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 4 and found no requirements that were more stringent than those already in Rule 4905.

***SMAQMD***

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU Per Hour)

The District evaluated the requirements contained within SMAQMD Rule 414 and found no requirements that were more stringent than those already in Rule 4905.

***VCAPCD***

- Rule 74.22 (Natural Gas-Fired, Fan-Type Central Furnaces)

The District evaluated the requirements contained within VCAPCD Rule 74.22 and found no requirements that were more stringent than those already in Rule 4905.

### Evaluation Findings

Even though natural gas-fired, fan-type central furnaces are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4905 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from natural gas-fired, fan-type central furnaces in the Valley.

## C.23 RULE 8011 GENERAL REQUIREMENTS

### Discussion

The provisions of Rule 8011 are applicable to specified outdoor fugitive dust sources. The definitions, exemptions, requirements, administrative requirements, recordkeeping requirements, and test methods set forth in this rule are applicable to all rules under District Regulation VIII (Fugitive PM10 Prohibitions). The Regulation VIII series was adopted in November 2001, and subsequently amended in 2004. The rules were developed pursuant to EPA guidelines for serious PM10 nonattainment areas. In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas.

### Emissions Inventory

There is no specific emissions inventory associated with Rule 8011.

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| NOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| SOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| NOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| SOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

### How does District Rule 8011 compare with federal and state rules and regulations?

**Federal Regulations**

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT guidelines for this source category. The following federal regulations apply to sources covered under Rule 8011:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8011.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures (BACM))

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8011.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 8011 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD.

***SCAQMD***

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8011.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD 1157 and found no requirements that were more stringent than those already in Rule 8011.

***SMAQMD***

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8011.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8011.

***Clark County Department of Air Quality (CCDAQ)***

- Section 41 (Fugitive Dust)

The District evaluated the requirements contained within CCDAQ Section 41 and found no requirements that were more stringent than those already in Rule 8011.

## Additional Emission Reduction Opportunities

This rule is administrative in nature, and is intended to be a supplementary rule to the other District Regulation VIII rules. Opportunities for emission reductions would be found with each of the other Regulation VIII rules and would not be identified as a possibility for this rule. As such, there are no emission reduction opportunities for Rule 8011.

## Evaluation Findings

The District has evaluated all potential requirements achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8011 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from outdoor fugitive dust sources in the Valley.

## C.24 RULE 8021 CONSTRUCTION, DEMOLITION, EXCAVATION, EXTRACTION, AND OTHER EARTHMOVING ACTIVITIES

### Discussion

Rule 8021 applies to construction or demolition related disturbances of soil, including land clearing, grubbing, scraping, excavation, extraction, land leveling, grading, cut and fill operations, travel on the site, travel access roads to and from the site, and demolition activities. The rule also applies to construction of new landfill disposal sites or modifications to existing landfill disposal sites prior to commencement of landfilling activities.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8021 was amended to add dust suppression requirements, and to require submittal of Dust Control Plans on residential construction sites 10.0 acres or more in size and on non-residential construction sites 5.0 acres or more in size.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 1.46 | 1.47 | 1.48 | 1.48 | 1.49 | 1.50 | 1.51 | 1.52 | 1.53 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 1.34 | 1.34 | 1.35 | 1.36 | 1.37 | 1.38 | 1.39 | 1.39 | 1.40 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from construction, demolition, excavation, extraction, and other earthmoving activities are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for construction, demolition, excavation, extraction, and other earthmoving activities.

While District Regulation VIII was critical in the District's attainment of the PM10 standards, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8021 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for earthmoving activities. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

### How does District Rule 8021 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8021:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8021.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8021.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 8021 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8021.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8021.

***SMAQMD***
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8021.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8021.

***Clark County Department of Air Quality (CCDAQ)***

- Section 94 (Permitting and Dust Control for Construction Activities)

The District evaluated the requirements contained within CCDAQ Section 94 and found no requirements that were more stringent than those already in Rule 8021.

### Additional Emission Reduction Opportunities

District analysis identified one potential opportunity for this source category; to require signs to be posted at certain size work sites, asking the public to contact the District if the work site is producing significant dust emissions. While this potential opportunity would increase the awareness of the workers and the public, there is no conclusion that it would result in reduced emissions. If emissions are reduced, it is not likely to result in quantifiable emission reductions.

### Evaluation Findings

Even though construction, demolition, excavation, extraction, and other earthmoving activities are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8021 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from construction, demolition, excavation, extraction, and other earthmoving activities in the Valley.

## C.25 RULE 8031 BULK MATERIALS

### Source Category

Rule 8031 applies to the outside storage and handling of any unpackaged material, which emits or has the potential to emit dust when stored or handled. Rule 8031 requires bulk handling and storage facilities to restrict dust from material transfer, and reduce emissions from transport material and storage piles that emit dust. Facilities subject to Rule 8031 are required use control measures to ensure that visible dust emissions are limited to 20% opacity or less. These control measures can include application of water or other dust stabilizers, covering of bulk materials, construction of wind barriers, covering of haul trucks, and other measures.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8031 was amended to require construction and maintenance of wind barriers when handling bulk materials.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from bulk materials are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for bulk materials.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standards, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8031 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for bulk materials. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has a relatively low toxicity.

## How does District Rule 8031 compare with federal and state rules and regulations?

### Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8031:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8031.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8031.

### State Regulations
There are no state regulations applicable to this source category.

## How does District Rule 8031 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8031.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8031.

***SMAQMD***
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8031.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8031.

***Clark County Department of Air Quality (CCDAQ)***

- Section 41 (Fugitive Dust)

The District evaluated the requirements contained within CCDAQ Section 41 and found no requirements that were more stringent than those already in Rule 8031.

### Additional Emission Reduction Opportunities

Rule 8031 currently employs the best dust mitigation techniques; there are no additional potential opportunities for further emissions reductions from this source category. Rule 8031's requirement of limiting opacity to 20% is as or more stringent than any other district's rule and compliance with the standard requires significant mitigation efforts from sites that store bulk materials.

### Evaluation Findings

Even though storage and handling of bulk materials are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8031 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from bulk materials handling in the Valley.

## C.26 RULE 8041 CARRYOUT AND TRACKOUT

### Source Category

Rule 8041 applies to the prevention and cleanup of mud and dirt whenever it is deposited (carryout and trackout) onto public paved roads from activities subject to the requirements of Rules 8021, 8031, 8061, and 8071. The rule contains requirements for: removing carryout and trackout at the end of each workday; thresholds for any site with 150 daily vehicle trips; addressing carryout and trackout in Dust Control Plans; removing carryout and trackout in urban areas; paved interior roads; and prevention of carryout and trackout.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8041 was amended to require a threshold for vehicles with three or more axles to takes actions for carryout/trackout. Amendments included a threshold for projects located in rural areas, a provision requiring actions within half an hour if specified measures are insufficient to prevent carryout/trackout, and specifications for dust collectors, gravel pads, and paved surfaces.

### Emissions Inventory

The emissions from this source category are included in Rule 8061 (Paved and Unpaved Roads).

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| NOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| SOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| NOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| SOx | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

While District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8041 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for carryout and trackout. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

## How does District Rule 8041 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8041:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8041:

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8041.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 8041 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8041.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8041.

***SMAQMD***
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8041.

***VCAPCD***
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8041.

***Clark County Department of Air Quality (CCDAQ)***

- Section 94 (Permitting and Dust Control for Construction Activities)

The District evaluated the requirements contained within CCDAQ Section 94 and found no requirements that were more stringent than those already in Rule 8041.

### Additional Emission Reduction Opportunities

Two potential opportunities to reduce emissions were identified, evaluated, and determined to not be feasible.

The first potential emission reduction opportunity would be to reduce the threshold for daily trips per worksite that requires a carryout and trackout prevention system (currently 150 trips). Reducing this threshold would require smaller worksites to install costly trackout prevention equipment like wheel washers, metal grates, and gravel pads. At these smaller worksites the emission reductions that would be achieved would be minimal and not cost effective because of the small size of the sites.

The second potential opportunity would be to shorten the distance from the nearest unpaved exit point of a site at which trackout must be immediately cleaned (currently 50 feet). Lowering this threshold would significantly increase the use of street sweepers and their associated emissions, which are more toxic to human health (see Chapter 3). Therefore, this opportunity has been determined to not be feasible.

### Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8041 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from carryout and trackout of mud and dirt onto public paved roads in the Valley.

## C.27 RULE 8051 OPEN AREAS

### Source Category

Rule 8051 applies to any open area 0.5 acres or more within urban areas, or 3.0 acres or more within rural areas that contains at least 1,000 square feet of disturbed surface area. The rule has requirements for limiting visible dust emissions (VDE) to 20% opacity, to comply with the conditions of a stabilized surface, and to install barriers to prevent unauthorized vehicles from accessing the stabilized areas.

In 2004, the District adopted amendments to Regulation VIII that upgraded existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8051 was amended to add applicability thresholds for rural and urban areas.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | ***Annual Average - Tons per day*** | | | | | | | | |
| **PM2.5** | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | ***Winter Average - Tons per day*** | | | | | | | | |
| **PM2.5** | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 |
| **NOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from open areas are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for open areas.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8051 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for open areas. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

## How does District Rule 8051 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8051:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8051.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8051.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 8051 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD.

***SCAQMD***

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8051.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8051.

***SMAQMD***

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8051.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8051.

***Clark County Department of Air Quality* (*CCDAQ)***

- Section 90 (Fugitive Dust from Open Areas and Vacant Lots)

The District evaluated the requirements contained within CCDAQ Section 90 and found no requirements that were more stringent than those already in Rule 8051.

### Additional Emission Reduction Opportunities

The District's analysis did not identify any potential opportunities to further reduce emissions from this source category beyond those emissions that are already being reduced by rule requirements. As a part of due diligence efforts in seeking addition emission reduction opportunities, the following two potential opportunities have been identified to improve rule clarity. Language could be added to the rule to clarify that it applies to off-road recreational vehicle use areas. Also, the rule provides an exemption for weed abatement activity utilizing mowing and/or cutting. Adding language to specify that weed abatement by tilling is not exempt would also add clarity to the rule. While these opportunities could clarify rule language, neither would likely generate emissions reductions from this source category.

### Evaluation Findings

Even though open areas are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8051 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from open areas in the Valley.

## C.28 RULE 8061 PAVED AND UNPAVED ROADS

### Source Category

Rule 8061 establishes standards for the construction of new and modified paved roads in accordance with published guidelines by the American Association of State Highway and Transportation Officials for road construction and applies to any paved, unpaved, or modified public or private road, street highway, freeway, alley way, access drive, access easement, or driveway. The rule also allows alternative means of achieving the same level of dust reduction. Rule 8061 also establishes thresholds that when exceeded require that roads are treated to reduce visible dust emissions.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8061 was amended to replace the existing 75 maximum daily vehicle trip threshold with a 26 annual average daily vehicle trips (AADT) threshold on unpaved roads, and require all new unpaved roads within urban areas be paved.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 7.59 | 7.71 | 7.83 | 7.98 | 8.13 | 8.28 | 8.41 | 8.55 | 8.69 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 6.63 | 6.75 | 6.87 | 7.00 | 7.14 | 7.28 | 7.41 | 7.55 | 7.67 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

While District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8061 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for paved and unpaved roads. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

### How does District Rule 8061 compare with federal and state rules and regulations?

#### Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8061:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8061.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8061.

**State Regulations**
There are no state regulations applicable to this source category.

**How does District Rule 8061 compare to rules in other air districts?**
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8061.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8061.

***SMAQMD***
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8061.

***VCAPCD***
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8061.

***Clark County Department of Air Quality (CCDAQ)***

- Section 91 (Fugitive Dust from Unpaved Roads, Unpaved Alleys, and Unpaved Easement Roads)

The District evaluated the requirements contained within CCDAQ Section 91 and found no requirements that were more stringent than those already in Rule 8061.

- Section 93 (Fugitive Dust from Paved Roads and Street Sweeping Equipment)

The District evaluated the requirements contained within CCDAQ Section 93 and found no requirements that were more stringent than those already in Rule 8061.

**Additional Emission Reduction Opportunities**

The following potential opportunity to reduce emissions from paved and unpaved roads was determined to be infeasible. Section 5.2.1 of the rule requires dust control measures for any unpaved road segments with 26 or more annual average daily trips. A potential opportunity to reduce emissions would be to lower this threshold. This would require more owners/operators to implement at least one control measure to reduce fugitive emissions.

Analysis of the emission inventory indicates that the majority of the particulate emissions attributable to unpaved roads are generated from unpaved roads already subject to the mitigation requirements of Rule 8061. Therefore, the remaining portion of emissions associated with unpaved roads (less than 26 AADT) does not provide an opportunity for additional emissions reductions.

Additionally, emissions from unpaved roads are lowest in the winter months, when the District's PM2.5 24-hour exceedances occur. District staff believes the winter average PM2.5 emission inventory is overestimated for the following reasons:

- ARB methodology assumes that rainfall of at least 0.01 inch on any day mitigates unpaved road dust for 24 hours
- 71% of the days with precipitation occur during the winter months.
- Many US Forest and Park Roads are inaccessible during winter months due to increased amounts of rain and snow, yet emissions from these roads make up a larger percentage of the total unpaved road emissions in winter (42.8%) than in the annual average (40.7%)

For these reasons, lowering the trip threshold is not a viable emission reduction opportunity.

**Evaluation Findings**

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8061 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from paved and unpaved roads in the Valley.

## C.29 RULE 8071 UNPAVED VEHICLE/EQUIPMENT TRAFFIC AREAS

### Source Category

Rule 8071 is applicable to unpaved vehicle/equipment areas, parking, fueling and service areas, and shipping, receiving, and transfer areas. The rule contains requirements for when vehicle traffic reaches or exceeds specified thresholds, limitations on visible dust emissions (VDE), compliance requirements with the conditions of a stabilized surface, and lists control techniques, which could be implemented to limit VDE and to comply with the conditions of a stabilized surface.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8071 was amended to remove the 1.0 acre or larger threshold; change the vehicle threshold from 75 vehicle daily trips to 50 annual average daily trips; add a single day peak threshold of 150 VDT or require control for sources that exceed the 150 VDT threshold limit on at least 30 days per year; and add a requirement whenever 25 or more three-axle vehicle trips will occur on an unpaved vehicle/equipment traffic area.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from unpaved vehicle/equipment traffic areas are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for unpaved vehicle/equipment traffic areas.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8071 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5

emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for unpaved vehicle/equipment traffic areas. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

## How does District Rule 8071 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8071:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8071.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8071.

**State Regulations**
There are no state regulations applicable to this source category.

## How does District Rule 8071 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

***SCAQMD***
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8071.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8071.

***SMAQMD***
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8071.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8071.

***Clark County Department of Air Quality (CCDAQ)***

- Section 92 (Fugitive Dust from Unpaved Parking Lots and Storage Areas)

The District evaluated the requirements contained within CCDAQ Section 92 and found no requirements that were more stringent than those already in Rule 8071.

### Additional Emission Reduction Opportunities

Section 5.2.1 of current rule language requires dust control measures for any unpaved traffic area with 50 or more annual average daily trips. Analysis of lowering this threshold to determine if it is a feasible option to reduce emissions determined that this is not a cost effective opportunity. Lowering the trip threshold of Rule 8071 would result in direct PM emission reductions, but would also result in the requirement that owners and/or operators implement a dust control measure. The most common control measures are watering and covering with gravel. Local cost estimates indicate that installing a 2 inch gravel base with another 2 inches of top gravel would cost approximately $1.90 per square foot, or around $83,000 per acre. Based on the small size of the emissions from this source category, and the estimated mitigation costs, requiring control measures for areas with such minimal activity is not a cost effective option.

### Evaluation Findings

Even though unpaved vehicle/equipment traffic areas are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8071 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from unpaved vehicle/equipment traffic areas in the Valley.

## C.30 RULE 8081 AGRICULTURAL SOURCES

### Source Category

Rule 8081 applies to "off-field" agricultural sources including, but not limited to, unpaved roads, unpaved vehicle/equipment traffic areas, and bulk materials. The rule contains requirements to limit visible dust emissions (VDE) and/or to comply with the conditions of a stabilized surface, and lists control techniques which could be implemented to limit VDE and to comply with the conditions of a stabilized surface.

In 2004, the District adopted amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. The amendments added an exemption to the rule for vehicle/equipment traffic areas if they are less than one acre in size and more than one mile from an urban area; expanded rule applicability by updating the vehicle threshold from 75 vehicle daily trips to 50 annual average vehicle trips; and added a requirement specific to whenever 26 or more three-axle vehicle trips will occur on an unpaved vehicle/equipment traffic area.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 1.21 | 1.21 | 1.20 | 1.20 | 1.19 | 1.19 | 1.18 | 1.18 | 1.17 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Winter Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.75 | 0.75 | 0.75 | 0.74 | 0.74 | 0.74 | 0.73 | 0.73 | 0.73 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from agricultural sources are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for agricultural sources.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8081 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for agricultural sources. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

### How does District Rule 8081 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8081:

- Rule 57 FR 13498 (General Preamble for Title I of CAA)

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Rule 8081.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Rule 8081.

**State Regulations**
There are no state regulations applicable to this source category.

### How does District Rule 8081 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD.

***SCAQMD***

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8081.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8081.

***SMAQMD***

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8081.

***VCAPCD***

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8081.

***Clark County Department of Air Quality (CCDAQ)***

- Section 91 (Fugitive Dust from Unpaved Roads, Unpaved Alleys, and Unpaved Easement Roads)

The District evaluated the requirements contained within CCDAQ Section 91 and found no requirements that were more stringent than those already in Rule 8081.

### Additional Emission Reduction Opportunities

The District's analysis did not identify any potential opportunities to further reduce emissions from this source category. However, a potential opportunity to improve enforceability of this for this source category has been identified. Section 5.4 of the rule references California Vehicle Code section 23112-23113 for prevention of carryout and trackout. This section could be removed and replaced with specific language from the vehicle code, however, as previously stated, this amendment would not result in emissions reductions.

### Evaluation Findings

Even though off-field agricultural sources are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8081 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from off-field agricultural sources in the Valley.

## C.31 SC 001 LAWN AND GARDEN EQUIPMENT

### Source Category

This source category includes the commercial and residential lawn and garden sectors. The commercial sector includes larger businesses that employ licensed contractors, public agencies and organizations that maintain their own properties or provide landscape services, and small businesses serving residential properties. The residential sector of lawn and garden equipment includes equipment purchased by the public for personal use. A survey conducted in 2003 by the California Air Resources Board (ARB) estimated that there are approximately 13 million pieces of lawn and garden equipment statewide: 12% in the commercial sector and 88% in the residential sector. Although there are more pieces of equipment used by the residential sector, the survey showed that the commercial sector accounts for 68% of annual use of all lawn care equipment.

Lawn and garden equipment includes the following: chainsaws, chippers, commercial turf equipment, front mowers, lawn and garden tractors, lawn mowers, leaf blowers and vacuums, rear-engine riding mowers, shredders, snow blowers, tillers, trimmers, edgers, brush cutters, wood splitters, and other lawn and garden equipment.

Handheld lawn and garden tools (such as leaf blowers) typically use two-stroke engines, while larger machines (such as lawn and garden tractors) use four-stroke engines. Lawn mowers are available with either type of engine. Two-stroke engines rely on oil mixed with the gasoline to lubricate the engine components. Much of this oil is not completely combusted by the engine thus creating high exhaust emissions. The major pollutants from a two-stroke engine, for example, are oil-based particulates, PM2.5, NOx, and a mixture of hydrocarbons, which combine with other gases in the atmosphere to form ozone, carbon monoxide, and other toxic air contaminants. Overall, four-stroke engines emit significantly lower emissions than their two-stroke counterparts, with significantly lower levels of hydrocarbons and particulate matter. Lawn care equipment, particularly leaf blowers, can also cause a significant amount of fugitive dust depending on the work practices employed such as blowing on bare dirt or very dusty paved surfaces. These types of activities would increase fugitive emissions including PM, toxic air contaminants (TAC) and ultrafine particles (UFP) resulting in a negative health impact on those in proximity to the activity.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **PM2.5** | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| **NOx** | 0.58 | 0.57 | 0.57 | 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.53 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | |
| **PM2.5** | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| **NOx** | 0.54 | 0.53 | 0.53 | 0.52 | 0.51 | 0.50 | 0.50 | 0.49 | 0.49 |
| **SOx** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from lawn care equipment are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for lawn care equipment.

### How would District SC 001 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under SC 001:

- EPA Rule 40 CFR Part 90 (Small Non-Road Spark-Ignition Engine Rule)

The EPA regulation required exhaust emission standards by 2011 and 2012, depending on the class of the engine.

**State Regulations**
The following state regulations apply to sources covered under SC 001:
(Small Off-Road Engines)

- 13 CCR 2403 (Exhaust Emission Standards)
- 13 CCR 2404 (Emission Control Labels)
- 13 CCR 2405 (New Engine Compliance)

### How would District SC 001 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***

- Rule 1623 (Credits for Clean Lawn and Garden Equipment)

The District evaluated the requirements contained within SCAQMD's Rule 1623 and found it was not approved by EPA and is not currently being implemented.

**Additional Emission Reduction Opportunities**

ARB and EPA have regulatory authority over engine standards. ARB and EPA rules rely on natural turnover and do not push zero emissions technology; therefore, there are still opportunities to reduce emissions by closing the emissions gap and accelerating the use of zero emissions technology. While the District cannot establish new engine standards, it could regulate the use of lawn and garden equipment. Given the Valley's air quality challenges and the potential benefits, the District may explore in-use regulatory options as a long-term strategy. The District's analysis of potential opportunities to reduce emissions includes evaluations of emerging technologies and potential control strategies such as an in-use rule, best management practices, episodic controls, and zoning.

**Emerging Technologies**

There have been recent improvements in the availability and applications of zero emissions lawn care technology. Manufacturers are producing more electric lawn care equipment options and are developing ways to allow for this equipment to be used in the commercial sector, such as carrying additional battery packs. Examples of more recent advances in new electric options include the following:

- Lawn mowers
    - Riding mowers
    - Robotic mowers
    - Self-propelled walk behind mowers
    - Cordless electric lawn mowers
- Battery powered leaf blowers
- Electric sweepers and backpack vacuums
- Battery powered chainsaws
- Electric line trimmers/edgers
- Electric hedge trimmers
- Stronger batteries and battery chargers

Though zero-emitting or battery operated lawn equipment has significantly improved in recent years, the viability of cordless electric technology has not been proven in the commercial sector. This is largely due to the need for a longer battery life and durability to allow for more frequent and prolonged equipment use. On March 21, 2012, the District hosted a conference on lawn care, landscaping, and air quality. The conference highlighted challenges operators face when using lower emitting equipment and commercial viability. Local operators expressed concerns about the cost and reliability of cordless electric equipment, and how this equipment might affect productivity and competition with other operators.

In 2013, the District completed the *Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program*. The program was funded with State Air Quality Improvement Program and District program funds and provided eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals who conduct business within the boundaries of the San Joaquin Valley. The final report was submitted to ARB in 2013 with plans to allocate future incentive funds for cordless zero-emission lawn and garden equipment.

**Potential Strategies to Reduce Emissions**
In evaluating potential control strategies, the District's analysis identified a number of potential regulatory and outreach opportunities. However, there are no recommended regulatory actions at this time due to the need to revise the emissions inventory. The District will continue evaluating which of the following regulatory approaches are feasible from a regulatory standpoint as well as from a public health standpoint.

***In-Use Rule***
One potential control strategy would be to require the use of the cleanest available equipment by prohibiting the use of gas combustion equipment. This could be achieved through a point-of-sale rule implementing a tiered approach or by phasing in restrictions as lower or zero-emissions technology becomes more available in the future. This type of control measure could potentially eliminate the portion of emissions resulting from the combustion of fuel. There might also be a need to bifurcate this type of regulation due to the varying availability of low or zero-emitting equipment in the residential sector versus commercial sector.

***Best Management Practices***
Another potential control strategy would be to require operators to implement Best Management Practices (BMPs) using a menu approach for the use of lawn and garden equipment in the commercial sector. Some examples of potential BMPs include:

- Restrictions near schools and other heavily populated areas
- Courtesy practices (e.g. don't point at people or open windows, don't blow material onto public roads, sidewalks, or neighboring properties)
- Particulate prevention practices (e.g. no leaf blower use on bare dirt surfaces or very dusty paved surfaces, etc.)

This BMP option would focus on providing education on safety and more efficient use of equipment. Enforcing this type of rule could be challenging due to the large number of operators, variation in size of businesses, and the widespread distribution of operator activities. Operators could be required to complete a certification course so that they can be educated on proper work practices. The District could also require operators to show a certificate of completion to purchase gas equipment after a certain date, to ensure contractors operating gas equipment are using the most effective work practices to protect public health and decrease emissions.

### *Episodic Control*

Episodic control provides another potential control strategy where use of gas equipment could be limited or prohibited during high-pollution days. There has also been precedence set throughout California with numerous cities and counties adopting ordinances banning or prohibiting the use of leaf blowers on specified days, times, distances from residential areas, or noise levels. The District could create a model ordinance for cities and counties to adopt throughout the Valley to limit or prohibit the use of gas equipment and/or leaf blowers. One example was found where the City of Menlo Park prohibited the use of gas equipment on Spare the Air days in the BAAQMD. This could be an option for future regulatory control in the Valley to reduce emissions, especially on high pollution days.

**Table C-35 City Bans of Leaf Blowers**

| Cities | Ban Type |
|---|---|
| Dana Point<br>San Diego | Decibel and hours of operations restrictions |
| Foster City<br>Los Angeles<br>Palo Alto | Restrictions on distance from residential unit and hours allowed to operate |
| Sacramento<br>Sunnyvale | Restrictions on decibels, hours of operations, and distance from residential areas |
| Berkeley<br>Beverly Hills<br>Claremont<br>Lawndale<br>Los Altos<br>Santa Barbara | Bans gas blowers |
| Burlingame | Restrict commercial use to one day per week dependent on determined city districts; Residential areas restricted by days and hours of operation |
| Menlo Park | Prohibited on Sundays, observed federal holidays, and on "Spare the Air" days as declared by the BAAQMD |
| Laguna Beach<br>Santa Monica | Bans all blowers |

### *Zoning*

Another potential opportunity to reduce emissions could be through the promotion of “zones,” where gas equipment would be prohibited or limited in designated zones, such as those close to schools, parks, etc. This approach, known as “greenzoning,” is currently being pioneered in Los Angeles County. Greenzoning could potentially be included as a part of the Healthy Air Living outreach program to individual businesses, schools, cities, and counties. A related option could be limiting gas powered equipment use in certain zones to designated days of the week, similar to days allowed to water residential yards. This approach was recently adopted by the city of Burlingame for leaf blower use only. Cleaner electric equipment would have an advantage by still being able to be operated on the days or areas that gas powered equipment is limited. This strategy would also be a win-win by reducing noise nuisances in neighborhoods and near schools. The District could provide model ordinances to cities and counties to adopt to assist them in implementing this type of measure.

### *Non-Regulatory Actions*

There are no recommendations for new incentive or technology advancement programs at this time. The recommendation is to continue to run the *Clean Green Yard Machine Residential Lawn Mower Incentive Program,* as well as evaluate the commercial lawn care equipment technologies capable of reducing emissions in the Valley that were demonstrated as a part of the *Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program*. The District, along with the technology demonstrators, submitted their Cordless Zero-Emission Commercial Lawn and Garden Equipment evaluation to ARB in June 2013.

## Evaluation Findings

Even though lawn and garden equipment are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. The District cannot establish new engine standards; therefore, it is recommended the District continue current incentive programs in order to close the emissions gap and accelerate the use of zero emissions technology, ultimately exceeding both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from lawn and garden equipment in the Valley.

## C.32 SC 002 ENERGY EFFICIENCY

### Source Category

This category does not include specific emissions inventory sources in the Valley, but rather the opportunity to reduce emissions from all Valley sectors through the promotion of energy efficiency and conservation measures. Generally, emissions reductions could be obtained from reductions in electrical power generation or fuel through the implementation of such measures. Potential areas of focus include residential and commercial buildings, manufacturing and industrial facilities, agricultural operations, and oil/gas production and processing facilities.

### Additional Emission Reduction Opportunities

Energy use is not a regulated activity; however, emissions from the generation of electricity are regulated at power plants. Overall, electricity generation in California is relatively clean when compared to emission factors (criteria pollutants and greenhouse gases (GHG)) from other states. California has been on the forefront of developing renewable energy sources, and has implemented regulations to ensure cleaner non-renewable energy. Whereas coal-fired electricity generation provides a significant percentage of electricity in other parts of the country, especially the eastern states, California relies more heavily on natural gas-fired power plants, which have lower emission rates for criteria pollutants and GHGs.

California imports 30% of its electricity from surrounding states (2010 data from California Energy Commission (CEC)). The state's four major utility companies use this electricity, as well as resources from around the state to supply continuous, reliable electricity to its customers. The inter-related nature of California's electricity transmission leads to a complex relationship between local energy efficiency programs and emissions reductions. Energy dispatch for needed demand is time and market dependent; the closest plant does not necessarily supply energy to the closest demand. In some cases, peak energy demand is met for areas outside the Valley, including Los Angeles and San Diego, with marginal (peaker) power plants within the Valley. Likewise, Valley demand may be met with electricity from marginal power plants outside the Valley. To complicate matters, which marginal plant is used can depend on the time of day, the minute-by-minute energy market, or other highly variable factors.

In 2010, the CEC commissioned an evaluation of energy usage and potential reductions from energy efficiency and renewable energy measures. Using sophisticated dispatch modeling, Synapse Energy Economics Inc. (Synapse) was able to estimate NOx emissions reductions for renewable energy and energy efficiency projects within California and within each of the four major utility companies.[89] In preliminary model runs, Synapse showed that approximately 45 pounds of NOx could be reduced for each gigawatt of displaced base load electricity. Likewise, 76 pounds of NOx could be

[89] Synapse Energy Economics, Inc. for CEC Public Interest Energy Research (PIER) Program. CEC-500-2011-XXX. (2011, May). *Emission Reductions from Renewable Energy and Energy Efficiency in California Air Quality Management Districts: Final Project Report* (Draft).

reduced for each gigawatt of displaced peak load electricity displaced by targeted energy efficiency efforts during peak demand hours.

In 2012, EPA released a roadmap manual[90] to assist state, tribal, and local air agencies with quantifying and including emissions reductions from energy efficiency and renewable energy in State Implementation Plans (SIPs). The document focuses on emission benefits from energy policies and programs in the electric power sector. The complex nature of electricity transmission and dispatch, combined with import and export of electricity into and out of the District and California, will require sophisticated energy modeling to pinpoint emissions reductions attributable to potential energy efficiency and renewable energy control measures.

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.[91] This policy document identifies the District's commitment to fostering energy efficiency and clean energy alternatives as opportunities for emissions reductions. The District has initiated several projects that exemplify this policy guidance.

### *Non-Regulatory Actions*

The District currently has incentive and technology advancement programs aimed at reduced energy use in the Valley. To date, the projects include the following:

- The administration of approximately $4 million in federal and state Energy Efficiency and Conservation Block Grant funds made available to 37 small jurisdictions in the Valley. The majority of the funding was used to retrofit municipal facilities with lighting and other cost effective energy efficiency retrofits, resulting in about 1.8 MkWh of electricity savings per year.
- The funding of an innovative pilot program to assess the potential to operate more efficiently, thus saving money and using less energy.
- The funding of an outreach program showing governmental and service organizations the benefits of "going green." This program started in Stockton through the Stockton Chamber of Commerce, and with the District's help has expanded to the central and southern San Joaquin Valley.
- The allocation of $4 million for the District's Technology Advancement Program. Two of the three focus areas for FY 2014–2015 are renewable energy and waste solutions, which take into account energy efficiency.

While there are no recommendations for new incentive programs at this time, the District will continue supporting existing incentive and technology advancement programs.

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[90] EPA. (2012) *Incorporating Energy Efficiency/Renewable Energy in State and Tribal Implementation Plans*. Retrieved July 10, 2012 from http://www.epa.gov/airquality/eere/.

[91] SJVAPCD. (2010). *Approval of the District's Regional Energy Efficiency Strategy*. Memorandum to the SJVAPCD Governing Board. Public Hearing, January 21, 2010. Retrieved from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2010/January/Agenda_Item_7_Jan_21_2010.pdf.

### Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. The District cannot regulate energy use; therefore, it is recommended the District continue current incentives and technology advancement programs in order to close the emissions gap and accelerate the use of energy efficient technologies. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities for improving energy efficiency to reduce emissions in the Valley.

## C.33 SC 003 FIREWORKS

### Source Category
This category consists of fireworks sold and/or used in the Valley. This includes consumer fireworks for home displays, as well as professional products for use by licensed operators in public displays.

### Emissions Inventory
The emissions inventory for this category has not been quantified.

### How would District SC 003 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

**State Regulations**
The following state regulations apply to sources covered under SC 003:

- California Health and Safety Code, Section 12500 – 12759 (Law)
- Title 19, California Code of Regulations, Chapter 6 (Regulation)

### How would District SC 003 compare to rules in other air districts?
There are no references to the use of fireworks or pyrotechnics for entertainment purposes in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***
- Rule 219 (Equipment not Requiring a Written Permit Pursuant to Regulation II)

Rule 219 exempts pyrotechnic equipment, special effects, or fireworks paraphernalia equipment used for entertainment purposes from permit requirements.

- Rule 444 (Open Burning)

Fireworks and fireworks displays and pyrotechnics used for creation of special effects at theme parks are excluded from the open burning requirements of Rule 444.

- Rule 401 (Visible Emissions)
- Rule 402 (Nuisance)

Rules 401 and 402 do not explicitly exempt fireworks displays.

### Additional Emission Reduction Opportunities
Fireworks usage in the Valley is limited to occasional displays at a small number of entertainment venues (minor league sporting events, for example) and Independence Day (July $4^{th}$). On July $4^{th}$, with widespread consumer fireworks use, the Valley's air

monitors typically show peak PM2.5 concentrations for several hours on the evening of July 4th and into July 5th. These hourly PM2.5 concentrations are much higher than normal PM2.5 concentrations during the summer, although 24-hour average PM2.5 concentrations on July 4th and 5th do not always go above the level of EPA's standard. In addition, exceedances of the air quality standard due to fireworks qualify as an exceptional event under federal regulations and, with proper documentation and EPA concurrence, do not count against an area's attainment status.[92] However, the clear relationship between fireworks activity and ambient PM2.5 levels; the location of emissions in populated areas; and the fact that the PM2.5 species associated with fireworks are health-impacting metals and carbons all demonstrate the value of reducing emissions from fireworks as part of the District's Health-Risk Reduction Strategy. Fireworks emissions are reduced by limiting the use of fireworks. For several years, the District has utilized public education to inform residents of the risks associated with firework emissions, and the dangers to sensitive populations. Enhancements to future outreach efforts may include partnering with other state and local agencies' outreach efforts.

Despite the strong public affinity for July 4th fireworks, many parts of the country are moving away from pyrotechnic fireworks displays and towards laser light-based shows – particularly in regions with severe drought conditions and extreme fire danger. According to the International Laser Display Association, laser-light-based shows are gaining popularity steadily as more and more communities are moving in this direction. Several companies in California and throughout the country are engaged in the business of incorporating laser-light based shows into 4th of July celebrations.

Some fireworks are lower-emitting than others. Disneyland Theme Park started using a patented air launch pyrotechnics system in 2004 to reduce noise and pollution. Use of such a system appears to be limited, and is likely most effective in situations where fireworks displays are frequent enough to justify the cost and permanent installation.

**Non-Regulatory Action**

In 2012, the District launched an incentive program for municipal laser-light shows to replace fireworks displays. Due to timing, the District was unable to fund shows that year, and has yet to reevaluate the program for implementation in future years.

On August 16, 2012, the District's Governing Board voted to adopt a position in opposition of California Senate Bill (SB) 1468 (Calderon), which would have allowed for the sale of safe and sane fireworks during the period of December 6th to January 2nd for two years, as a pilot for considering whether such an expanded use of fireworks should continue. This legislation would have thus expanded the use of fireworks to winter months when the Valley experiences stagnant conditions that trap particulates for extended periods of time. Given the potential for extreme adverse impact to public health, the District opposed SB 1468. Ultimately, the bill was not enacted, likely for

[92] 40 CFR 50.14 (b)(2), (2011). *Treatment of Air Quality Monitoring Data Influenced by Exceptional Events*.

financial reasons associated with the data collection and analysis associated with the bill.

### Evaluation Findings

The District has evaluated all potential emission reduction opportunities for fireworks achieved in practice in other areas or included in other SIPs. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from fireworks in the Valley.

## C.34 SC 004 SAND AND GRAVEL OPERATIONS

### Source Category
Particulate matter emissions from sand and gravel operations occur as excavated aggregate material is conveyed, screened, crushed, and stored.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | |
| PM2.5 | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from sand and gravel operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for sand and gravel operations.

### How would District SC 004 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NESHAP, and MACT requirements for this source category.

***NSPS***
- 40 CFR Part 60, Section 111 of the Clean Air Act (40 FR 58416)

**State Regulations**
There are no state regulations applicable to this source category.

### How would District SC 004 compare to rules in other air districts?
There are no analogous rules for this source category in in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***
- Rule 1157 (PM10 Emission Reductions from Aggregate and Related Operations)
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SCAQMD's Rules 1157 and 403 and found no requirements that were more stringent than those already in District Rules 8011, 2201, and 4101.

### Additional Emission Reduction Opportunities

Generally, sand and aggregate materials are wet or moist when handled and emissions are often negligible. For processes where water is not an appropriate method for minimizing emissions, baghouse and filter technology and achieved-in-practice controls are generally sufficient to limit visible dust emissions to less than 20 percent opacity, as required by District Rule 8011 (General Requirements for Regulation VIII) and District Rule 4101 (Visible Emissions).

While other districts have specific rules for aggregate and related operations (SCAQMD Rule 1157), the ultimate limits for dust emissions is the same as opacity and visible emissions standards used for District operations. SCAQMD provides guidance for specific activities (e.g. loading, conveying, crushing, screening, and storage), but the emissions limits are the same as the District's limits. The District reviews any new or modified stationary source under Rule 2201 (New and Modified Stationary Source Review), which in most cases will trigger BACT requirements, thus requiring operators to apply the best controls to reduce emissions during operational activities including crushing, screening, and conveying.

### Evaluation Findings

Even though sand and gravel operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rules 2201, 8011 and 4101 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from sand and gravel operations in the Valley.

## C.35 SC 005 ASPHALT/CONCRETE OPERATIONS

### Source Category

This source category includes emissions from asphalt and concrete production operations. Cement concrete production includes cement manufacturing and concrete production. There are only a few cement plants in California, but none within the Valley. However, many operations contribute to potential emissions associated with concrete production, which include the blending of cement powder, water, sand, and coarse aggregate. Similarly, there are operations producing asphalt concrete, which is primarily used for paving parking lots and on-road surfaces and is commonly made by hot-mixing asphalt with size-graded aggregate in drums or batches. If a cement production plant were to be built within the Valley, it would be reviewed and evaluated under District Rule 2201 (New and Modified Stationary Source Review) and would trigger BACT requirements for equipment and processes associated with the production of cement.

### Emissions Inventory

| Source | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| **Mineral Processes – PM2.5** | 0.82 | 0.84 | 0.86 | 0.89 | 0.92 | 0.94 | 0.97 | 0.99 | 1.01 |
| **Mineral Processes – NOx** | 0.20 | 0.20 | 0.21 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 |
| **Mineral Processes – SOx** | 0.36 | 0.37 | 0.38 | 0.40 | 0.41 | 0.42 | 0.43 | 0.44 | 0.45 |
| **Mineral Processes – VOC** | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | 0.26 | 0.26 | 0.27 |
| **Asphalt Mixing and Application – VOC only** | 0.76 | 0.76 | 0.76 | 0.76 | 0.77 | 0.77 | 0.77 | 0.77 | 0.78 |
| | *Winter Average - Tons per day* | | | | | | | | |
| **Mineral Processes – PM2.5** | 0.79 | 0.81 | 0.84 | 0.86 | 0.89 | 0.91 | 0.94 | 0.96 | 0.98 |
| **Mineral Processes – NOx** | 0.18 | 0.18 | 0.19 | 0.19 | 0.20 | 0.20 | 0.21 | 0.21 | 0.22 |
| **Mineral Processes – SOx** | 0.35 | 0.36 | 0.37 | 0.38 | 0.39 | 0.40 | 0.42 | 0.42 | 0.43 |
| **Mineral Processes – VOC** | 0.20 | 0.20 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | 0.24 |
| **Asphalt Mixing and Application – VOC only** | 0.76 | 0.76 | 0.76 | 0.76 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |

The emissions inventory table above illustrates that the PM2.5, NOx, and SOx emissions from asphalt/concrete operations occur during the mineral processes for asphalt/concrete production. Asphalt mixing and application processes only generate VOC emissions, which occur via off-gassing. There would be NOx emissions from the combustion equipment used for asphalt mixing and application; however, those emissions are accounted for in District Rule 4309 (Dryers, Dehydrators, and Ovens) and off-road equipment.

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from asphalt/concrete operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for asphalt/concrete operations.

## How would SC 005 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, or MACT requirements for this source category.

***NSPS***
- 40 CFR 60 Subpart OOO (Standards of Performance for Nonmetallic Mineral Processing Plants)
- 40 CFR 60 Subpart I (Standards of Performance for Hot Mix Asphalt Facilities)
- 40 CFR 60 Subpart UU (Standards of Performance for Asphalt Processing and Asphalt Roofing Manufacturing)

The District evaluated the requirements contained within the above NSPSs and found no requirements that were more stringent than those already in Rules 4101 (Visible Emissions), 2201 (New and Modified Stationary Source Review), and 4309 (Dryers, Dehydrators, and Ovens).

***NESHAP***
- 40 CFR 63 Subpart LLLLL (Asphalt Processing and Asphalt Roofing Manufacturing for Major Sources)
- 40 CFR 63 Subpart AAAAAAA (Asphalt Processing and Asphalt Roofing Manufacturing for Area Sources)

The District evaluated the requirements contained within the above NESHAPs and found no requirements that were more stringent than those already in Rule 4101 (Visible Emissions), Rule 2201 (New and Modified Stationary Source Review), and Rule 4309 (Dryers, Dehydrators, and Ovens).

**State Regulations**
There are no state regulations applicable to this source category.

## How would SC 005 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD, SMAQMD, and VCAPCD.

***SCAQMD***
- Rule 1157 (PM10 Emission Reductions from Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in District Rule 4101 (Visible Emissions), Rule 2201 (New and Modified Stationary Source Review), and Rule 4309 (Dryers, Dehydrators, and Ovens).

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SCAQMD Rule 403 and found no requirements that were more stringent than those already in District Rules 4101 (Visible Emissions), 2201 (New and Modified Stationary Source Review), and 4309 (Dryers, Dehydrators, and Ovens).

### Additional Emission Reduction Opportunities

Liquid asphalt is unworkable at ambient temperatures, so most asphalt mixtures are manufactured, spread, and compacted at temperatures higher than 300°F (>150°C) to temporarily reduce the viscosity, thereby making the mixture workable. Working at these high temperatures produces greenhouse gases and other criteria and hazardous air pollutant emissions, in addition to creating an undesirable working environment. These emissions are minimized by achieved-in-practice controls meeting the opacity requirements of District Rule 4101 (Visible Emissions) and Rule 2201 (New and Modified Stationary Source Review). Additionally, new technologies allowing for warm-mix asphalt techniques provide better emissions control at lower temperatures.

#### *Achieved-in-Practice Controls for Concrete and Asphalt Processes*

For concrete production operations, achieved-in-practice controls include baghouses for screens, crushers, and concrete weight batchers; bin vent filters for concrete and fly ash silos; and water spray for other emissions points. For asphalt operations, achieved-in-practice controls include oil mist collectors and "blue smoke" control with electrostatic precipitators or filter packs. Dryers used for drying aggregate in the asphalt production process are regulated under District Rule 4309 (Dryers, Dehydrators, and Ovens), which limits NOx and CO to 4.3 and 42 ppmv, respectively, for gaseous-fuel fired units.

#### *Warm-mix Asphalt (WMA)*

Asphaltic concrete, or pavement, is used worldwide for road construction. An asphaltic concrete mix consists of aggregate and liquid asphalt. Liquid asphalt, also termed asphalt cement, is a natural hydrocarbon substance primarily derived from the heaviest part of petroleum crude oil. The aggregate, which is basically rocks of different size, angularity, and hardness, is bound with the liquid asphalt to make the strongest and most durable pavement combination for expected road conditions.

The performance of liquid asphalt depends on the chemistry of the crude oil source and how it was refined. The physical properties of the liquid asphalt can also be adjusted with various additives, such as polymers or hydrated lime. The performance of the aggregate depends on the physical chemistry of the rock as well as its shape and size. The performance of the final asphalt mixture depends on the quality and proportions of the components and the quality of the construction. Asphalt pavements are typically 95% by weight aggregate and 5% asphalt binder.[93]

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[93] MyAsphaltPavingProject.Com. (2011). "What are the Specifications?" Retrieved from http://www.myasphaltpavingproject.com/whatisasphalt/what-are-the-specifications/.

The high viscosity[94] inherent to liquid asphalt makes it suitable for paving projects, but requires added heat during mixing and application. Liquid asphalt is unworkable at ambient temperatures, so most asphalt mixtures are manufactured, spread, and compacted at temperatures higher than 300°F (>150°C) to temporarily reduce the viscosity, thereby making the mixture workable. Working at these high temperatures produces greenhouse gases and other criteria and hazardous air pollutant emissions, in addition to creating an undesirable working environment.[95]

Heating and mixing takes place at a batch or drum plant where dry, and sometimes heated, aggregate is mixed with heated liquid asphalt. Once mixed, the asphalt is loaded into trucks and transported to a job site where a paver lays the asphalt mix. The laid asphalt mix is then compacted with rollers to reduce air voids.

European and American companies have developed several techniques, collectively known as warm-mix asphalt (WMA), to increase the workability of asphalt by lowering the viscosity at temperatures as much as 100°F below that of hot-mix asphalt (HMA). WMA was introduced in Europe in 1997 and in the United States (U.S.) in 2002. Techniques for WMA include the use of mechanical methods, specifically foaming and water injection, and the use of organic or chemical additives. Mechanical methods may require some plant modifications, but the use of additives can, in most cases, be accommodated using existing plant and production technology. In all cases however, WMA technologies may require more finesse in controlling moisture in the aggregate and in the overall system operation, such as tuning of the burner to run efficiently at lower temperatures. Improper burner adjustment can cause the burner to not add enough air to burn all the fuel and may cause mix contamination.

Mechanical methods for WMA have been shown to reduce the production temperature by 25-90°F. These methods include, but are not limited to, adding water-containing products, water-based foaming processes, and using hot coarse aggregate mixed with wet sand. Chemical additives for WMA have been shown to reduce the production temperature by 59-86°F. The additives include, but are not limited to, organic wax, chemical packages, cationic surfactants, surface-active agents, processing aids, and polymers. Additive dosages range from 0.2% to 3% by mass or weight.[96]

WMA has shown potential for reducing emissions associated with the production of asphalt for paving projects when compared to HMA. Lower temperatures required for production, storage, transport, and application translates to lower fuel consumption, which in turn reduces the criteria air pollutant emissions associated with combustion. In a 2013 California Department of Transportation (Caltrans) report[97], WMA was

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[94] Viscosity is a material's resistance to gradual deformation when stress is applied.
[95] Rubio et al. (2013). "Comparative Analysis of Emissions from the Manufacture and Use of Hot and Half-Warm Mix Asphalt." *Journal of Cleaner Production, 41*, 1-6.
[96] Rubio et. al. (2012). "Warm-mix Asphalt: An Overview". *Journal of Cleaner Production, 24*, 76-84.
[97] Caltrans. (2013, April). *Caltrans Activities to Address Climate Change: Reducing Greenhouse Gas Emissions and Adapting to Impacts. Retrieved from:* http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf

recognized as potentially yielding 25–35% fuel savings and thus contributing to a significant level of emissions reductions from manufacturing, mixing, and laying the asphalt.

Asphaltic concrete production plants are regulated by District Rule 2201 (New and Modified Stationary Source Review Rule), Rule 4301 (Fuel Burning Equipment), Rule 4309 (Dryers, Dehydrators, and Ovens), and Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations), which have all been approved by EPA to meet or exceed RACT requirements.

### Benefits of WMA

The use of WMA was initially promoted as a means of reducing emissions from road projects, especially in nonattainment areas[98]. However, after extensive research and numerous case studies, the potential benefits of WMA have expanded beyond reduced emissions. Benefits include, but are not limited to the following:

- **Improved performance**: WMA improves workability and ease of compaction, which is critical to long-term performance of the mixture. [99]
- **Energy Savings**: By lowering the production, storage, transport, and application temperatures, manufacturers require less energy to heat aggregate and liquid asphalt. Energy savings could potentially offset the added cost of additives or needed modifications to plants, especially where energy costs are high. Reduced plant temperatures may also cause less wear on plant equipment, thus reducing plant maintenance costs. [100]
- **Increased Capacity for Reclaimed Asphalt Pavement**: WMA allows for higher percentages of reclaimed asphalt pavement (RAP) to be used in the mixture with no effect on ultimate pavement performance. The use of RAP is less expensive than producing an asphalt mixture from raw materials, and additional savings can be generated from avoiding landfill disposal or recycling fees.
- **Potential Cost Savings**: Fuel savings, increase in reclaimed asphalt pavement content, and reductions in fuel and labor during the process of installing WMA translate to reduced costs for WMA projects. One cost assessment indicated $3,000-$6,000 in savings per lane mile.[101] Life cycle assessments have shown reduced agency costs, user costs, and environmental costs.

[98] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.
[99] MyAsphaltPavingProject.Com. (2011). "What are the Specifications?" Retrieved from http://www.myasphaltpavingproject.com/whatisasphalt/what-are-the-specifications/.
[100] Caltrans. (2013, April). *Caltrans Activities to Address Climate Change: Reducing Greenhouse Gas Emissions and Adapting to Impacts. Retrieved from:* http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf
[101] Leng & Al-Qadi. Illinois Center for Transportation, University of Illinois at Urbana-Champaign, Champaign, Illinois. (2011). "Comparative Life Cycle Assessment between Warm SMA and Conventional SMA."

- **Extended paving season**: A smaller difference between the asphalt temperature and ambient temperature reduces the rate of cooling, which means paving can take place during colder weather.
- **Longer transport time**: Lower temperatures required for storage allow the asphalt to be transported to more remote locations and introduces more flexibility in transportation schedules.
- **Shorter cooling time**: The lower temperature allows cooling to take place in a shorter time, increasing the project completion rate and opening roads to traffic more quickly.
- **Safer working conditions**: VOC and other hazardous emissions are significantly reduced with WMA, as is a potential burn hazard.

### Potential Emissions Reductions from WMA

As previously mentioned, WMA production has the potential to reduce combustion emissions by reducing the amount of energy (fuel) needed to heat aggregate and liquid asphalt. While fuel savings have been reported to be from 20% to over 50% for some WMA technologies, U.S. studies have reported burner fuel savings of zero to 30%, with 15% to 25% being typical.[102] These fuel savings translate into reductions in criteria pollutants, such as NOx.

European studies have documented the reduction of NOx emissions associated with the use of WMA. The table below summarizes the range of NOx emission reductions expected from the use of WMA; however, actual emissions reductions for U.S. production of WMA will vary depending on the fuel used for combustion, control technology, and local regulations.

**Table C-36 NOx Emission Reductions for Warm-mix Asphalt**

| | Vaitkus et al.[103,104] | Larsen, O.R.[105] | D'Angelo et al.[106] | Evotherm[107] |
|---|---|---|---|---|
| **$NO_x$ Reduction** | 60–70% | 62% | 60–70% | 58% |

The emissions inventory for asphaltic concrete production in the Valley includes emissions from asphalt plants, dryers, storage piles, and vehicle traffic. As evidenced by the emissions inventory table for this source category, the NOx emissions from this source category are extremely small. In addition, only 88% of these NOx emissions are

[102] California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.
[103] Vaitkus, A., Cygas, A., Laurinavicius, A. Perveneckas, Z. (2009a). Analysis and Evaluation of possibilities for the use of Warm Mix Asphalt in Lithuania. The Baltic Journal of Road and Bridge Engineering, 4(2), 80–86.
[104] Vaitkus, A., Vorobjovas, V. Ziliut, L. (2009b). The Research on the Use of Warm Mix Asphalt for Asphalt Pavement Structures. Road Department, Vilnius Gediminas Technical University, Vilnius, Lithuania.
[105] Larson, O.R. (2001). Warm Asphalt Mix with Foam—WAM™FOAM. International Road Federation, 2001 Partie B: Themes Techniques, S.00469. Kolo Veidekke, Norway.
[106] Vaitkus et al., 2009a,b.
[107] Evotherm® (2010, March). Stack Emissions & Jobsite Fumes Reductions using Evotherm® Warm Mix Asphalt. Available at: http://www.meadwestvaco.com/mwv/groups/content/documents/document/mwv017395.pdf

from production processes, as about 12% of these emissions account for associated vehicle traffic.[108]

### Feasibility of WMA

As more tests and case studies are run in the U.S., WMA is proving to perform as effective as or better than HMA. Caltrans and the University of California Pavement Research Center have been evaluating WMA technology and its performance by testing rutting and cracking performance, moisture sensitivity, durability, aging, emissions, and stability of multiple types of WMA production.[109] WMA has so far been shown to have equal or better overall performance compared to HMA, less smoke and odor, and increased workability.[110]

The use of WMA in the U.S. has been growing steadily since the first test section was completed in 2004. Caltrans use of WMA has grown from laying about 67,000 tons of WMA between 2006 and 2009, to just over 2 million tons by 2012.[111] To further encourage the use of WMA, in June 2012 Caltrans issued a directive that provided guidance for implementing a contractor-requested option to use an approved WMA technology to encourage the use of WMA by contractors.[112] On a national scale, there are estimates that while 19.2 million tons of WMA had been placed by 2009 that value has increased to an estimated 500 million tons per year in 2013.[113] WMA is even being used in situations where safety is looked at closely, such as airport runways for Boston Logan and Chicago O'Hare airports.

WMA is on the uptake and will become more widely used over time. The U.S. Department of Transportation Federal Highway Administration (FHWA) has chosen WMA for rapid deployment under its *Every Day Counts* (EDC) initiative. In 2013, 30% of paving in the U.S. was WMA, and FHWA has a goal that by 2015, half of all the asphalt used in the U.S. will be WMA.[114] As a result of these efforts, the use of WMA is continuing to grow in the Valley with the current backing from state and national transportation agencies.

Despite the technological feasibility of using WMA as a substitute for HMA, the cost of converting equipment to produce WMA remains a potential barrier to adoption. Certain facilities would incur more costs than others to employ this technology. More research into the capital costs of converting production equipment is needed to determine

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[108] EPA, 2000,Table 1; excludes mobile source emissions; average for batch and drum plants

[109] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.

[110] Rubio, M.C., Martínez, G., Baena, L. & Moreno, F. (2012). Warm Mix Asphalt: An Overview. Journal of Cleaner Production, 24, 76–84. doi:10.1016/j.jclepro.2011.11.053

[111] St. Martin, 2013.

[112] California Department of Transportation (Caltrans). (2012, June 7). Contractor Option for Use of Warm Mix Asphalt Technologies in Hot Mix Asphalt. Available at: http://www.dot.ca.gov/hq/construc/CPDirectives/CPD12-2.pdf

[113] St. Martin, 2013.

[114] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). Warm Mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California. Available at: http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf

whether WMA is cost effective for asphalt production facilities in the Valley. In addition, some applications may not be suitable for WMA. Just as with HMA use and application, WMA use is not a one-size-fits-all product. Continued studies and field tests are showing which product, mix, and application are best for specific uses and conditions.

While the benefits of WMA are far-reaching, more research into the capital costs associated with converting production equipment to handle WMA and other feasibility issues is still needed to fully determine whether WMA would be feasible and cost effective to require for all Valley asphalt production facilities. Therefore, as discussed in Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities), the District is committing to further evaluate warm mix asphalt for additional opportunities.

### Cutback Asphalt

District Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations) contains an exemption for the use of cutback (medium cure) asphalt where the National Weather Service official forecast of the high temperature for the 24-hour period following application is below 50°F. The use of cutback asphalt results in VOC emissions, which do not contribute significantly to the formation of PM2.5. As such, this is not a potential emission reduction opportunity for this *2015 PM2.5 Plan*. Although the use of cutback asphalt has declined in recent years, Rule 4641 maintains the exemption based on the following:

- The exemption for cutback asphalt during colder ambient temperatures, which occurs during winter (non-ozone) season, is analogous to EPA's Blue Book on Cutback and Emulsified Asphalt recommended seasonal exemptions (i.e. outside of the ozone season).
- During colder ambient temperatures, VOCs do not evaporate rapidly, especially from medium cure asphalt that is limited by Rule 4641 to no more than 5% organic compounds that evaporate at 500°F.
- Road construction and road repairs using asphalt are very minimal during the colder winter months, except for emergency road repairs. In addition, during winter months, the Valley experiences the majority of rainfall, including long periods of fog. In these conditions, asphalt will not properly cure or harden due to the increased moisture on the surfaces or areas where asphalt is applied and therefore, this type of activity is minimal.

### Evaluation Findings

Although asphalt/concrete operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District evaluated the feasibility of all potential emissions reductions measures for this source category. As demonstrated in the above control measure evaluation, existing District regulations for this source category (Rules 4309 and 4641) currently implement BACM and MSM for these sources.

In addition, as discussed above, WMA is potentially a viable alternative to HMA and the benefits obtained by switching from HMA to WMA have contributed to the fast growing use of WMA throughout California and the Valley. FHWA's goal of achieving 50% of

WMA paving by 2015 has further accelerated the widespread adoption of this technology throughout the country and will likely further increase the use of WMA in the Valley in future years.

Although current District rules already meet BACM and MSM requirements for this source category, as previously mentioned, the District is committing to further evaluate warm mix asphalt for additional opportunities. See Chapter 8 for more information.

## C.36 SC 006 ALMOND HULLING/SHELLING OPERATIONS

### Source Category

This control measure source category would apply to almond hulling and shelling operations. Almonds are harvested from orchards and transported to almond processing facilities, where the almonds are hulled and shelled leaving the nut, or meat. Orchard debris, soil, and pebbles represent 10-25% of the field weight of material brought to the almond processing facility. Clean almond meats are obtained as about 20% of the field weight. Processes for removing the debris and almond hulls and shells are potential sources of air emissions. The Valley harvests 86% of the almonds produced in California. Production has roughly doubled in the last decade, with the 2010/2011 crop year reaching 1.4 billion pounds.[115]

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.38 | 0.39 | 0.40 | 0.40 | 0.41 | 0.42 | 0.42 | 0.43 | 0.44 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | |
| PM2.5 | 0.24 | 0.24 | 0.24 | 0.25 | 0.25 | 0.26 | 0.26 | 0.27 | 0.27 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from almond hulling/shelling operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for almond hulling/shelling operations.

### How would District SC 006 compare with federal and state rules and regulations?

#### Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, and MACT for this source category.

#### State Regulations

There are no state regulations applicable to this source category.

[115] The Tioga Group. (2012). *SJV Nut Industry Profile Preliminary Draft.* Retrieved from http://www.sjvcogs.org/pdfs/2012/Nut%20Industry%20030612.pdf.

## How would SC 006 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, VCAPCD, or SMAQMD.

## Additional Emission Reduction Opportunities

Evaluation of emission reduction opportunities for almond hulling and shelling operations included a review of ongoing research efforts, and the technologicial feasibility and cost effectiveness of polytetrafloroethylene (PTFE) bags.

### Ongoing Research Efforts

Research is currently being conducted by Texas A&M University in partnership with almond harvesting equipment manufacturers, almond farmers, United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), and the District to compare "low dust" almond harvesters and an exhaust abatement devices to conventional harvesters in the harvesting of almonds at a Valley farm. No differences were detected in the particle size distribution (PSD) characteristics of PM emitted from each harvester, with the exception of the exhaust abatement device, where large particles were efficiently captured by the cyclone. Emissions of total suspended particulates (TSP) and PM10 trended lower for all new harvesters and were significantly lower for most harvesters. There were significant reductions of PM2.5 ranging from 61-69% observed from the harvesters and a 95% reduction in PM2.5 from the Clean Air Concept cyclone. The results of these tests imply that new harvest technologies are able to reduce PM emissions without affecting product quality.

### Polytetrafloroethylene Bags

District BACT guidelines for almond hullers and shellers require the use of a baghouse, which controls PM by moving the contaminated flow of air through bag type filters. The technology has been achieved in practice in the District. Standard polyester bags are the most commonly used type of bag for baghouses in the almond hulling/shelling industry. A layer of dust (dust cake) collects on the upstream side of these bags and filtering efficiency increases as the layer grows; however, they are not designed to provide high PM2.5 control. On the other hand, membrane type bags treated with polytetrafloroethlyene (PTFE) contain extremely small pores and filtering occurs on the bag surface instead of in a dust cake. These types of filters are capable of controlling 99.9%[116] of PM2.5 emissions, whereas baghouses with polyester bags control PM2.5 emissions by 95-99%.[117]

The costs of using baghouses with PTFE bags rather than standard polyester bags were calculated. The pressure drop across polyester and PTFE bags is about the same so there should not be a significant increase in electrical costs by using one bag over another. Additionally, existing baghouses would not require modifications to accommodate PTFE bags so the increased cost lies solely in the cost of the bags. A

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[116] EPA, Control Technology Center, Verified Technologies. (2012) *Baghouse: PTFE Filters*. Retrieved February 19, 2015 from http://www.baghouse.com/products/dust-collector-filters/baghouse-filter/ptfe-filters/.

[117] Roberts, C. (2009). *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Northeast States for Coordinated Air Use Management and the EPA Office of Air Quality Planning and Standards.

PTFE bag typically costs $23, whereas a polyester bag costs $12. The lifetime of both bags is approximately 2 years. The following cost differential was calculated, with knowledge that some facilities in the Valley have up to 2-3 baghouses, each with 500 bags. District permits also require facilities to have replacement bags accounting for 10% of the total number of bags; therefore 550 bags will be used for the following calculations.

**Additional Costs for Using PTFE Bags**

550 bags x ($23/ PTFE bag - $12/ polyester bag) / 2 years = **$3,025/ year** (per baghouse)

3 baghouses x $3,025/ year = **$9,075/ year** (for 3 baghouses)

**Potential PM2.5 Emission Reductions from Using PTFE Bags**

The control efficiency for PM2.5 for polyester bags is assumed to be equivalent to the control efficiency for PM10.
(99.9% control efficiency from PTFE bags – 99% control efficiency of polyester bags) = 0.9% additional control efficiency

2015 emission inventory is 0.40 tons/day
(0.40 tons/day PM2.5) x (0.9% additional control from using PTFE bags)
= **0.0036 tons/day reduced**

(0.0036 tons/day reduced from using PTFE bags) x (365 days/year)
=**1.314 tons/year reduced**

**Potential Cost Effectiveness of Using PTFE Bags**

101 baghouses in the Valley

(101 baghouses) x (PTFE bag costs $3,025/ year) = **$305,525/year**

($305,525/year) / (1.314 tons/year reduced) = **$232,515.22/ton**

The cost effectiveness of replacing polyester bags was also calculated at the lower end of the emission control efficiency scale (95%) with the PTFE bags to determine what a more conservative cost effectiveness analysis would reveal; the cost effectiveness from 95% polyester bags to 99.9% PTFE bags is $42,706.88/ton PM2.5 reduced.

Although the initial annual capital cost may seem relatively low; in terms of cost effectiveness, PTFE bags are not a cost effective alternative to standard bags. The additional control efficiency gains are in the fractions of tons of incremental emissions reductions. Additionally, as mentioned above, the emission inventory used in these calculations (0.40 tons/day PM2.5) includes the emissions of both almond hulling and pistachio hulling, meaning the actual inventory is smaller, and making the actual cost effectiveness even higher than calculated.

The cyclone is another technology in common use at Valley facilities for PM control in almond hulling/shelling; however, like baghouses with polyester bags, the technology primarily provides PM10 control. Additionally, cyclones typically achieve 80-85% control efficiency. Approximately 37 facilities in the Valley use cyclones to control PM emissions. Therefore, if these facilities were required to replace cyclones with baghouses, the cost effectiveness would be as follows:

**Potential PM2.5 Emission Reductions for Replacing Cyclones with Baghouses with PTFE Bags**

The PM2.5 control efficiency for cyclones is assumed to be equivalent to the control efficiency for PM10
(99.9% control efficiency of baghouse – 85% control efficiency of cyclone)
= 14.9% additional control efficiency

2015 emission inventory is 0.40 tons/day
(0.40 tons/day PM2.5) x (14.9% control with use of baghouse)
= **0.0596 tons/day reduced**

(0.0596 tons/day reduced) x (365 days/year)
= **21.754 tons/year reduced**

**Potential Cost Effectiveness for Replacing Cyclones with Baghouses with PTFE Bags**

37 facilities to install baghouses at a minimum of $150,000 each

With a 10 year amortization factor and 10% interest, the annualized cost for a $150,000 baghouse would be:

(0.1627 CRF) x ($150,000) = **$24,405/year**

(37 facilities) x (capital cost of baghouse $24,405/year) = **$902,985/year**

($902,985/year) / (21.754 tons/year reduced) = **$41,508.92/ton**

Replacing the existing cyclones with baghouses with PTFE bags would cost $41,508.92/ton, which does not include additional costs of installation, electrical system upgrades, ductwork, demolition or disposal of the cyclone. Therefore, replacing cyclones with baghouses is not a cost effective control option. As previously stated, the emissions inventory used in these calculations (0.40 tons/day PM2.5) includes the emissions of both almond hulling and pistachio hulling, meaning the actual inventory is smaller, and making the actual cost effectiveness even higher than stated.

### Evaluation Findings

Even though almond hulling/shelling operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, current control techniques have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from almond hulling/shelling operations in the Valley.

## C.37 SC 007 PISTACHIO HULLING/SHELLING OPERATIONS

### Source Category

This control measure source category would apply to pistachio hulling and shelling operations within the Valley. Pistachio hulling operations are permitted under the same permit with the pistachio receiving and pre-cleaning portions of the operation. These operations use 1D-3D cyclones to control PM emissions from the pre-cleaning portion of the process, which is the Best Available Control Technology (BACT) standard. Typically pistachio processing equipment, located after the pre-cleaning section and prior to the pistachio dryers, is of a wet-process design; PM emissions from this portion of the operation are assumed to be negligible. California produces 98.5% of U.S. pistachios and production has expanded greatly in the last decade. Pistachio acreage doubled between 1997 and 2010, and production looks like it will continue to increase in the near future.[118] In the interest of identifying every possible strategy to reduce PM2.5 emissions, pistachio hulling and shelling operations were evaluated for potential opportunities to reduce emissions; see the discussion below.

### Emissions Inventory

The emissions inventory for this category is included as a part of the emissions inventory for the control measure source category for almond hulling. Refer to the emission inventory table presented in SC 006 for this combined inventory.

### How would District SC 007 compare with federal and state rules and regulations?

**Federal Regulations**

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

**State Regulations**

There are no state regulations applicable to this source category.

### How would SC 007 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, or VCAPCD.

### Additional Emission Reduction Opportunities

Pistachio shelling operations are served by a baghouse, which is the industry standard for shelling operations. While there is no specific BACT guideline for shelling operations, baghouses are typically attributed to a PM2.5 control efficiency of 95-99%. As discussed above in SC 006 (Almond Hulling/Shelling Operations), polytetrafloroethylene (PTFE) bags have the potential to provide additional PM2.5 control when used in baghouses but are not cost effective due to the already high

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[118] The Tioga Group. (2012). *SJV Nut Industry Profile Preliminary Draft.* Retrieved from http://www.sjvcogs.org/pdfs/2012/Nut%20Industry%20030612.pdf.

control efficiency of existing practices. Refer to SC 006 (Almond Hulling/Shelling Operations) for the cost effectiveness analysis.

Unlike almonds which are shaken on the ground and vacuumed off the soil during harvesting, pistachios are caught with a canvas catcher before they hit the ground, which allows for a very small amount of dust and debris in addition to the pistachios. Much of the PM emissions associated with the processing of pistachios occur during the pre-cleaning stage, which is controlled by cyclones. The hulling stage is a wet process as the nuts are floated on water; PM emissions from this portion of the operation are assumed to be negligible. At this time, the District's analysis indicates that there are no feasible opportunities for additional emission reduction regulatory strategies for this source category.

### Evaluation Findings

Even though pistachio shelling operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. While there is no specific rule or guideline for pistachio shelling, the industry-standard baghouse operation described above meets or exceeds both BACM and MSM requirements. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from pistachio shelling operations in the Valley.

## C.38 SC 008 AGRICULTURAL MATERIAL SCREENING/SHAKING OPERATIONS

### Source Category
This control measure source category would be applicable to the handling and processing of agricultural materials in biomass, composting, and other agricultural material handling facilities.

### Emissions Inventory
The emissions inventory for this category is accounted for in other control measure source categories. Refer to Appendix B for the emissions inventory.

### How would District SC 008 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, and MACT requirements for this source category.

**State Regulations**
There are no state regulations applicable to this source category.

### How would District SC 008 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***
- Rule 1131.1 (Chipping and Grinding Activities)

The District evaluated the requirements contained within SCAQMD 1131.1 and found no requirements that were more stringent than those already in New Source Review Rule 2201.

### Additional Emission Reduction Opportunities
District analysis of potential emission reduction opportunities includes an evaluation of the efficacy of wet suppression systems and enclosing conveyors and transfer points.

***Wet Suppression System***
A wet suppression system can achieve between 40-65% control of PM2.5.[119] In a wet suppression system, water is generally applied to all emissions units, transfer points, and raw material stockpiles to ensure that adequate moisture is provided to the operation to successfully reduce PM emissions. No emissions would be reduced by requiring a wet suppression system because this control is currently in use at all identified facilities in the Valley and would be required at any new facility triggering BACT under the New Source Review Rule 2201.

[119] Environmental Protection Agency [EPA]. (1995). *Compilation of Air Pollutant Emission Factors, Table B.2-3.*

### *Enclosed Conveyors and Transfer Points*

Enclosing conveyors and transfer points to limit the emissions of PM is a practice used in addition to water spray at seven facilities in the Valley. This control option would potentially reduce emissions at the drop or transfer points on the conveyors. However, in addition to the control efficiency of enclosed conveyors being unknown, conveyors are already operated so that they move very slowly to avoid entraining dust and limit visible emissions. Therefore, the potential to reduce emissions is minimal and reduced emissions would not be quantifiable.

## Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, current business practices have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from agricultural material screening/shaking operations in the Valley.

## C.39 SC 009 TUB GRINDING

### Source Category
This control measure source category would apply to operations using a tub grinder for agricultural material processing. Tub grinders are used to grind organic materials such as wood and agricultural materials for biomass fuel processing facilities, composting facilities, landscape material manufacturing (e.g. wood bark, mulch, etc.), or agricultural waste grinding (e.g. orchard removal, land clearing, etc.). These units are typically powered by diesel-fired internal combustion engines (ranging from 100 horse power (hp) to 1,600 hp) and mounted on wheels to be transportable, which allows the units to be towed to the jobsite where the piles of material are to be ground. In addition, these units may also be self-propelled and track-mounted; in this case the diesel engine powering the equipment is also used for motive power and is exempt from District permits since it is considered to be mobile equipment. The diesel engines powering the transportable units are subject to District Rule 4702 (Internal Combustion Engines) and Best Available Control Technology (BACT) Guideline 3.2.11. This control measure source category discussion addresses the particulate matter (PM) emissions from the loading, grinding, and conveying of the process materials.

### Emissions Inventory
Emissions generated by the engines of the tub grinders are accounted for as a part of the inventory for District Rule 4702 (Internal Combustion Engines). The fugitive particulate emissions from these units are accounted for as a part of the stationary and area source emissions inventory. See Appendix B.

### How would District SC 009 compare with federal and state rules and regulations?

**Federal Regulations**
There are no EPA CTG, ACT, NSPS, NESHAP, and MACT requirements for this source category.

**State Regulations**
There are no state regulations applicable to this source category.

### How would SC 009 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

***SCAQMD***
- Rule 1131.1 (Chipping and Grinding Activities)

The District evaluated the requirements contained within SCAQMD Rule 1131.1 and found no requirements that were more stringent than those already in District Rules 2201 (New Source Review) and 4101 (Visible Emissions) and BACT guideline 6.4.2.

## Additional Emission Reduction Opportunities

Currently, fugitive particulate emissions from transportable and self-propelled tub grinders are controlled with a water sprinkler system during loading, grinding, and unloading of the process materials to prevent visible emissions in excess of 5% opacity per Rule 2201 (New Source Review) and BACT guideline 6.4.2. Water sprinkler systems achieve between 40-65% control of PM2.5.[120] It is standard practice to use water spray on this type of equipment to meet the visible emission requirements of Rule 4101 (Visible Emissions); therefore, requiring water control for tub grinding operations would not result in additional emission reductions from this source category. A potential control option considered would be to require a baghouse to be installed onto the trailer of the equipment to capture fugitive PM emissions. Due to the large size of the additional equipment required to be installed onto the trailer and the limited space available, a baghouse is not technologically feasible for a transportable unit.
No technologically feasible or alternative basic equipment were identified in the District's BACT guidelines.

## Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rules 2201, 4101, and District BACT guideline 6.4.2 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from tub grinding in the Valley.

[120] Environmental Protection Agency [EPA]. (1995). *Compilation of Air Pollutant Emission Factors, Table B.2-3.*

## C.40 SC 010 ABRASIVE BLASTING

### Source Category

Abrasive blasting involves the cleaning or preparing of a surface by forcibly propelling a stream of abrasive material against such surface. Abrasive blasting can occur in a confined or an unconfined area, depending on the type of surface or application. Abrasive materials commonly used are walnut shells, various mineral or metal products, garnet, sand or aggregate, slag, steel grit abrasive, or steel shot.

### Emissions Inventory

| Pollutant | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | *Annual Average - Tons per day* | | | | | | | | |
| PM2.5 | 0.33 | 0.34 | 0.35 | 0.36 | 0.37 | 0.38 | 0.40 | 0.40 | 0.41 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | |
| PM2.5 | 0.33 | 0.34 | 0.35 | 0.36 | 0.37 | 0.38 | 0.39 | 0.40 | 0.41 |
| NOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SOx | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from abrasive blasting are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for abrasive blasting.

### How would District SC 010 compare with federal and state rules and regulations?

**Federal Regulations**

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

***NESHAP/ MACT***

- 40 CFR 63, Subpart XXXXXX (National Emission Standards for Hazardous Air Pollutants Area Source Standards for Nine Metal Fabrication and Finishing Source Categories)

The District evaluated the requirements contained within 40 CFR 63, Subpart XXXXXX and found no requirements that were more stringent than those already in District Rule 4102 (Nuisance) and 17 CCR 6 92200 (Opacity) through 92500 (Performance Standards).

**State Regulations**
The following state regulations apply to sources covered under SC 010:

- 17 CCR 6, Sections 92000-92530 (Abrasive Blasting).

### How would District SC 010 compare to rules in other air districts?

No rule from another air district has requirements beyond what is already required in state standards. BAAQMD Regulation 12, Rule 4 (Sandblasting), SCAQMD Rule 1140 (Abrasive Blasting), and VCAPCD Rule 74.1 (Abrasive Blasting) regulate abrasive blasting operations and activities, but all simply conform to the state standards.

### Additional Emission Reduction Opportunities

Achieved-in-practice BACT controls for sandblasting include baghouses, filters, or cartridge dust collectors. With such technologies, 99% control efficiency can be achieved. As emissions sources, sandblasting operations within the District are subject to District Rule 4102 (Nuisance) and the standards of 17 California Code of Regulations (CCR) Section 92200 (opacity) and 17 CCR Section 92500 (performance standards such as CARB-certified abrasives).

Opportunities for further emissions reductions are limited because of the CH&SC stipulation that air districts cannot impose stricter rules on sandblasting operations. The District's analysis has determined that there are no feasible opportunities for additional emissions reductions for this source category.

### Evaluation Findings

Even though abrasive blasting operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, the California Code of Regulations and District Rule 4102 currently provide the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from abrasive blasting operations in the Valley.

## C.41 AMMONIA CONTROLS

Under Subpart 4 of the CAA, regions are required to address ammonia as a precursor in BACM/MSM analyses and other areas of the plan unless EPA determines that ammonia sources do not contribute significantly to PM concentrations. To improve public health while also ensuring effective use of resources, additional ammonia controls should only be required when there is clear scientific evidence that reasonable measures to reduce ammonia emissions would be effective in significantly reducing ambient PM2.5 concentrations.

Extensive scientific research and technical analyses (see Appendix A) demonstrate that ammonia reductions do not contribute to the Valley's PM2.5 attainment; as such, ammonia does not need to be addressed in this BACM/MSM analysis for the 1997 PM2.5 standard. Even though ammonia is an insignificant PM2.5 precursor in the Valley, the following analysis shows that the Valley's ammonia emissions have been significantly reduced through stringent regulations, that additional ammonia control measures are infeasible, and that Valley sources currently implement BACM and MSM.

As demonstrated in Appendix B of this *2015 PM2.5 Plan*, the three main sources of ammonia emissions in the Valley from stationary and area sources that account for 95% of the Valley's ammonia emissions are as follows (based on 2015 estimates):

- Farming Operations with 198.0 tons per day (tpd),
- Solvent evaporation from Agricultural Fertilizers at 116.3 tpd, and
- Composting Solid Waste Operations at 9.0 tpd.

The following discussion evaluates:
- Confined Animal Facilities (District Rule 4570)
- Agricultural Fertilizers
- Organic Material Composting (District Rule 4566)
- Biosolids, Animal Manure, and Poultry Litter Operations (District Rule 4565)
- Major Sources of Ammonia

**Confined Animal Facilities (District Rule 4570)**

### I. District Rule Description

District Rule 4570, was originally adopted on June 15, 2006 and was most recently amended on October 21, 2010. The purpose of this rule is to limit emissions of volatile organic compounds (VOC) from Confined Animal Facilities (CAF). District Rule 4570 applies to facilities where animals are corralled, penned, or otherwise caused to remain in restricted areas and primarily fed by a means other than grazing for at least 45 days in any twelve-month period. In addition to limiting VOC emissions, District Rule 4570 also includes measures that limit ammonia (NH3) emissions from these operations; the required measures have reduced ammonia emissions by over 100 tpd[121] (this reduction is reflected in the emissions inventory data above). The analysis below focuses on how District Rule 4570 limits NH3 emissions in comparison to other rules and regulations.

## A. Types of Confined Animal Facilities

Confined Animal Facilities are used for the raising of animals including, but not limited to, cattle, calves, chickens, ducks, goats, horses, sheep, swine, rabbits, and turkeys, which are corralled, penned, or otherwise caused to remain in restricted areas for commercial agricultural purposes and fed by a means other than grazing. (CH&SC §39011.5 (a)(1)). The major categories of Confined Animal Facilities are listed below.

- Dairy Operations - Dairy operations are those operations producing milk or animals for facilities that produce milk.
- Poultry Operations - Poultry facilities operate either as layer ranches for egg production or as broiler ranches where birds are grown for the fresh meat market.
- Beef Cattle Feeding Operations – Beef cattle facilities are facilities that raise beef cattle (heifers and steers) for their meat.
- Swine Operations – These operations raise pigs for their meat. The production cycle for hogs has three (3) phases: farrowing (giving birth), nursing, and finishing.

## B. Rule 4570 Applicability Thresholds

The thresholds for a facility to be classified as a large CAF in the Valley and the thresholds for a facility to be subject to District Rule 4570 are shown in the following table. The large CAF thresholds are based on the definition of a large CAF adopted by ARB as required by California Senate Bill (SB) 700. District Rule 4570 applies to confined animal facilities that have the capacity to house a number of animals equal to or exceeding the Rule 4570 regulatory thresholds, which are lower than the large CAF thresholds for certain facilities.

[121] Appendix F of the Staff Report for the June 2009 re-adoption of Rule 4570, starting on the 329th page of the pdf available here http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2009/June/Agenda%20Item_10_June_18_2009.pdf

| Rule 4570 Thresholds for Regulation | | |
|---|---|---|
| Livestock Category | SJVAPCD Large CAF Thresholds | Rule 4570 Regulatory Thresholds |
| Dairy | 1,000 milking cows | 500 milking cows |
| Beef Feedlots | 3,500 beef cattle | 3,500 beef cattle |
| Other Cattle Facility | 7,500 calves, heifers, or other cattle | 7,500 calves, heifers, or other cattle |
| Poultry Facilities | | |
| Chicken | 650,000 head | 400,000 head |
| Duck | 650,000 head | 400,000 head |
| Turkey | 100,000 head | 100,000 head |
| Swine Facility | 3,000 head | 3,000 head |
| Horses Facility | 3,000 head | 3,000 head |
| Sheep and Goat Facilities | 15,000 head of sheep, goats, or any combination of the two | 15,000 head of sheep, goats, or any combination of the two |
| Any livestock facility not listed above | 30,000 head | 30,000 head |

## C. Emission Control Requirements of District Rule 4570

District Rule 4570 requires multiple mitigation measures from the following CAF categories: Dairy, Beef Feedlots, Other Cattle Facilities, Swine Facilities, Poultry facilities, and various other smaller operations. Each of these facilities consists of multiple sources of emissions within the facility. Since these facilities generally cover a large area and have different processes, a single mitigation measure or technology is generally not sufficient to control overall emissions from the facility. Mitigation measures required by Rule 4570 have been tailored for each source of emissions, thereby ensuring that the overall emissions from a facility are reduced. The current methodology in Rule 4570 allows for the greatest overall control from the entire facility.

District Rule 4570 recognized the following five emission sources for all of the CAFs: Feed, Housing, Solid Waste, Liquid Waste, and Land Application of Manure. Rule 4570 requires each CAF to implement a certain number of mitigation measures for each of these sources. District Rule 4570 also distinguishes between the different types of housing configurations (freestall vs open corrals) for cattle and, as such, requires specific mitigation measures for each type of housing. By requiring mitigation measure(s) for each source of emissions at a facility, District Rule 4570 ensures that reductions are achieved throughout the facility.

The following describes some of the mitigation measures and the ways in which these measures reduce ammonia emissions:

- Nutritional management: Ammonia emissions result from the decomposition of undigested nitrogen compounds in animal waste. Proper nutritional management, with diets formulated to feed proper amounts of protein, improves nitrogen utilization by the animal, reducing production of ammonia from animal waste.

- Increased cleaning and removal of manure and litter from animal housing areas: Because animal waste is the primary source of ammonia emissions, increased removal of waste from animal housing areas will reduce emissions by reducing the exposed area. Proper management of the waste will stabilize the nitrogen compounds in the waste, which will reduce the rate that these compounds are converted to ammonia that can be lost to the atmosphere. In addition, ammonia is highly soluble in water; therefore, when a flush system is used, ammonia emissions will be reduced because much of the ammonia will dissolve in the water rather than volatilize to the air.
- Incorporation of manure into fields: Incorporation of manure in fields reduces volatilization of gaseous pollutants by minimizing the amount of time that the manure is exposed to the atmosphere. Once the waste has been incorporated into the soil, VOCs and ammonia are absorbed onto soil particles, providing the opportunity for these soil microbes to oxidize these compounds into carbon dioxide, water, and nitrates.

One area to which some of these rules may apply is silage and silage-based total mixed ration (TMR) used as feed for cattle. Research has demonstrated that silage and TMR are one of the largest sources of VOC emissions at cattle facilities but are not significant sources of NH3 emissions, which primarily results from the animal waste at CAFs; therefore, the measures that specifically apply to management of silage and TMR will not be discussed in detail in this analysis.

## II. How does District Rule 4570 compare with federal rules and regulations?

### *A. EPA-Control Technique Guidelines (CTG)*

There is no EPA CTG guidance document for confined animal facilities.

### *B. EPA - Alternative Control Technology (ACT)*

There is no EPA ACT guidance document for confined animal facilities.

### *C. Standards of Performance for New Stationary Sources (NSPS)*

There is no NSPS guidance document for guidance document for confined animal facilities.

### *D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)*

There is no NESHAP guidance document for confined animal facilities.

## III. How does District Rule 4570 compare to rules in other air districts?

As the largest agricultural area in California, the District took the lead in devising a list of mitigation measures for the various emission sources during the initial development of

District Rule 4570. This list of mitigation measures was essentially utilized, almost identically, by all air districts in their rules. However, during the last amendments to District Rule 4570, all of the mitigation measures were reevaluated in light of the latest available science. In comparison to the previous version of the rule, the current rule lowered threshold limits to bring in additional CAFs, requires additional mitigation measures, clarified previous mitigation measures, and added additional monitoring, testing, and recordkeeping to improve enforceability.

The following California air district rules were compared to District Rule 4570:

- SCAQMD Rule 223, adopted June 2, 2006
- SCAQMD Rule 1127, adopted August 6, 2004
- BAAQMD Regulation 2 Rule 10, adopted July 19, 2006
- VCAPCD Rule 23 (Exemptions), amended April 8, 2008
- SMAQMD Rule 496, adopted August, 24, 2006
- Imperial County APCD (ICAPCD) Rule 217 and Policy Number 38, adopted October 10, 2006
- Butte County AQMD (BCAQMD) Rule 450, adopted December 21, 2006

Idaho Administrative Procedure Act (IDAPA) 58.01.01 Sections 760-764 was also compared with District Rule 4570 and the analysis is shown below.

It is important to note that only District Rule 4570, SMAQMD Rule 496, and SCAQMD Rule 1127 are prohibitory rules. For this reason, these rules include detailed recordkeeping as well as monitoring and testing requirements. Generally, the level of detail in a prohibitory rule is absent from permits rules because the purpose of a permit rule is different from the purpose of a prohibitory rule.

## A. SCAQMD Rule 223

<u>Applicability/Exemption/Large CAF Definition</u>

SCAQMD Rule 223 was adopted on June 2, 2006 and has not been amended.

SCAQMD Rule 223 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas SCAQMD Rule 223 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for Dairy CAFs

*Feed Mitigation Measures*

District Rule 4570 has seven mitigation measures for feed and two mitigation measures for silage. Operators must implement four mandatory feed mitigation measures and chose another one from a list of three, for a total of five mitigation measures required for feed. In the SCAQMD rule, there are nine feed mitigation measures, from which the operator must implement five. Both rules require selection of five mitigation measures for feed, excluding silage, but four of the five feed mitigation measures are mandatory in District Rule 4570. Therefore, overall District Rule 4570 is more stringent.

*Milk Parlor Mitigation Measures*

The milk parlor mitigation measures for SCAQMD includes one Class One and one Class Two mitigation measure. District Rule 4570 contains the same mitigation measures included in the SCAQMD rule as Class One and has removed the Class Two mitigation measures due to infeasibility; see the Staff Report for the October 21, 2010 amendments to Rule 4570 for more detail. Therefore, both rules will be considered identical in this category.

*Freestall Mitigation Measures*

District Rule 4570 has five mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 223 has eight Class One mitigations measures, from which facilities are required to implement at least two. District Rule 4570 requires one additional mitigation measure; therefore, District Rule 4570 is more stringent.

SCAQMD Rule 223 has three Class One mitigation measures that require increased frequency in comparison to the corresponding District Rule 4570 measures: (*inspect water pipes and troughs and repair leaks; remove animal waste that is not dry from individual cow freestall beds; and rake, harrow, scrape, or grade bedding in freestalls*). The South Coast rule requires pipes and troughs to be inspected daily, and manure from freestall beds to be removed daily, whereas District Rule 4570 does not require inspection of pipes and troughs in freestall barns. In the Valley, the majority of freestall barns use flush systems for manure management and may also use misters or water sprays to keep animals cool; therefore, inspection of the pipes and troughs in the freestall barns was determined to be irrelevant since this is already a wet system. SCAQMD Rule 223 requires freestall beds to be raked/harrowed/graded at least twice every seven days, whereas District Rule 4570 requires this measure to be carried out once every 7 days for large dairies and once every 14 days for medium dairies.

Although, SCAQMD Rule 223 has a higher frequency for these measures, the emissions generated from these sources are not significant, including the reductions achieved from the overall dairy. In addition, the CAF stakeholders have questioned the cost effectiveness of a daily frequency.

*Corral Mitigation Measures*

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 223 has 14 Class One mitigation measures and two Class Two mitigation measures, from which facilities are required to choose at least six. District Rule 4570 requires one additional mitigation measure; therefore, District Rule 4570 is more stringent.

SCAQMD Rule 223 has one Class One mitigation measure (*inspect water pipes and troughs and repair leaks*) that require increased frequency in comparison to the corresponding District Rule 4570 measure. SCAQMD Rule 223 requires this measure to be carried out daily, whereas District Rule 4570 requires it to be carried out only once every seven days. Although, SCAQMD Rule 223 has a higher frequency for this measure, the difference in the emissions reductions from the two frequencies is not expected to be significant.

*Solid Waste and Separated Solids Mitigation Measures*

District Rule 4570 contains only two mitigation measures, from which operators are required to choose at least one. SCAQMD Rule 223 has three Class One mitigation measures and three Class Two mitigation measures, from which facilities are required to choose at least two.

Available studies have indicated that NH3 emissions from stored solid waste and separated solids pile to be a very small fraction of total NH3 emissions at dairies. Since the NH3 emissions from solid manure account for a very small fraction of emissions from the overall dairy, there would not be a significant increase in NH3 emission reductions if more measures are required from this category.

*Liquid Waste Mitigation Measures*

District Rule 4570 has four mitigation measures, from which operators are required to choose at least one. SCAQMD Rule 223 has five Class One mitigation measures and five Class Two mitigation measures, from which operators are required to choose at least one. Since only one measure is required by both rules, the rules are similar in stringency.

*Manure Land Application Mitigation Measures*

District Rule 4570 has two mitigation measures required out of six optional measures. SCAQMD Rule 223 has four mitigation measures, from which facilities are required to choose at least two. All the mitigation measures are similar in stringency.

Requirements for Poultry CAFs

There is a large degree of variability in the manure management practices, housing techniques, and potential feeding practices for the different type of poultry operations in the Valley. Due to these differences, District Rule 4570 separates poultry CAFs into the following categories: 1) layers and 2) broilers, ducks, and turkeys.

Although on the surface the poultry requirements results in fewer mitigation measures compared to the other rules, the segregating of the types of poultry has allowed the mitigation measures to be tailored specifically to the type of poultry operation. In addition, all measures for poultry in District Rule 4570 are now mandated rather than left as options. Due to this reconfiguration and taking into consideration the latest science, the District Rule 4570 requirements for poultry are more stringent than SCAQMD Rule 223.

Requirements for Other CAF Categories

In addition to dairy and poultry CAF mitigation measures discussed above, District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle, and swine CAFs. SCAQMD Rule 223 does not address mitigation measures for these additional CAF categories. For these types of large CAFs, District Rule 4570 is more stringent.

Requirements – Suspension and Substitution of Mitigation Measures

Both rules allow the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. In addition, both rules allow for substitution of one mitigation measure with an equivalent or more stringent one with the submission of the appropriate information. Therefore, the suspension and substitution requirements of both rules are equally stringent.

Conclusion – Comparison with South Coast AQMD Rule 223

Based on the analysis of the CAF categories in District Rule 4570 and SCAQMD Rule 223, it is clear that District Rule 4570 is more stringent than SCAQMD Rule 223. There are differences in the frequency with which some mitigation measures are to be implemented. However, as stated earlier, many of these sources are a small portion of a dairy’s overall emissions. The amended version of District Rule requires facilities to choose more mitigation measures and makes several mitigation measures mandatory.

District Rule 4570 also provides mitigation for more CAF categories (beef feedlots, other cattle, and swine) that are not addressed by SCAQMD Rule 223, and also has much more detailed recordkeeping requirements to demonstrate implementation of selected mitigation measures. In addition, SCAQMD recently identified District Rule 4570 as the most stringent rule for this source category in their ozone Reasonably Available Control Technology (RACT) Demonstration.[122]

## B. SCAQMD Rule 1127

Applicability/Exemption/Large CAF Definition

SCAQMD Rule 1127 was adopted on August 4, 2004 and has not been amended.

SCAQMD Rule 1127 applies to dairies with 50 or more cows, heifers, and/or calves. The rule applies to dairy farms and related operations such as heifer and calf farms and the manure produced on them. By comparison, District Rule 4570 applies to dairy CAFs with at least 500 milking cows, but applies to more than just manure-handling operations. Although the SCAQMD Rule has a lower applicability threshold, the overall control effectiveness of Rule 1127 when compared to District Rule 4570, is far less stringent.

Requirements for Dairy CAFs

*Milking Parlor and Freestall Mitigation Measures*

For the milking parlor, the District rule has one mandatory mitigation measure. District Rule 4570 has five mitigation measures for freestalls, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three to implement. SCAQMD Rule 1127 does not address these operations. Therefore, overall District Rule 4570 is more stringent than SCAQMD Rule 1127.

*Corral Mitigation Measures*

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 1127 has eight mitigation measures, from which facilities are required to choose at least six. The mitigation measures required by SCAQMD Rule 1127 specify the removal of manure from the corrals, the minimization of water in the corrals, and the cleaning schedule and cleaning strategy for the corrals. While the mitigation measures in the two rules are not

[122] South Coast Air Quality Management District (June 6, 2014). Reasonably Available Control Technology Demonstration. http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2014/2014-jun6-031.pdf?sfvrsn=2

phrased the same way, they cover similar requirements. District Rule 4570 requires one additional measure; therefore, Rule 4570 is more stringent.

*Solid Waste, Separated Solids, and Liquid Waste, and Manure Land Application Mitigation Measures*

District Rule 4570 has two mitigation measures for solid waste/separated solids, from which operators are required to choose at least one. For liquid waste, District Rule 4570 has four mitigation measures for liquid waste, from which operators are required to choose at least one. District Rule 4570 has two mitigation measures for land application of manure required out of six optional measures. SCAQMD Rule 1127 states that manure removed must be either treated at an approved manure processing operation, or applied on agricultural land with local approval. SCAQMD Rule 1127 does not specify different mitigation measures for solid waste, separated solids, or liquid waste. District Rule 4570 has specific mitigation measures for each of these operations; therefore, it is able to better target the reduction of emissions from these the different operations. District Rule 4570 is therefore as stringent as or more stringent than SCAQMD Rule 1127.

Requirements for Other CAFs

District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. SCAQMD Rule 1127 does not address mitigation measures for these additional CAF categories. Therefore, District Rule 4570 is more stringent for this category.

Requirements – Suspension and Substitution of Mitigation Measures

SCAQMD Rule 1127 provides one exemption per year from one of the corral clearings required every 90 days if the moisture content in the corrals is greater than 50%. The operator is required to notify SCAQMD 30 days before the required cleaning, and test moisture content weekly. If moisture content is still above 50% when the cleaning is due, the operator may claim the exemption.

In comparison, District Rule 4570 allows an operator to temporarily suspend any mitigation measure as long as the suspension is recommended by a licensed veterinarian of animal nutritionist on the basis of animal health. The operator must notify the District within 48 hours prior to the suspension. If the suspension is expected to last longer than 30 days, then the operator must submit a new mitigation plan that identifies a new mitigation measure to be implemented in place of the suspended one.

District Rule 4570's exemption under this category is much more stringent because it is only a temporary suspension that cannot exceed 30 days, whereas SCAQMD Rule 1127's exemption may be permanent, without any requirement to substitute another measure.

Therefore, in this category of mitigation measure suspensions/substitutions, District Rule 4570 is more stringent than SCAQMD Rule 1127.

Testing, Monitoring, Recordkeeping Requirements

Both SCAQMD Rule 1127 and District Rule 4570 require monitoring, record keeping and source testing as appropriate and sufficient to provide evidence of each mitigation measure being implemented.

In addition to recordkeeping, Rule 1127 requires an annual report of manure being shipped out from the dairy. No annual reporting is required by Rule 4570. Rule 1127 requires records be retained for 3 years for minor sources and 5 years for major sources, whereas Rule 4570 requires records be retained for five years for all sources.

Overall, the monitoring, testing and recordkeeping requirements are similar for both rules.

Conclusion – Comparison with SCAQMD Rule 1127

For dairy CAFs, District Rule 4570 is more stringent than SCAQMD Rule 1127. District Rule 4570 requires emission reductions from additional emission categories - milk parlors, freestall barns, and liquid manure - that are not addressed by SCAQMD Rule 1127 as well as requiring emission reductions from CAFs from other animal species. As mentioned above, the current version of District Rule 4570 requires facilities to choose more mitigation measures and makes several mitigation measures mandatory. District Rule 4570 also provides specific mitigation measures for beef cattle feedlots, other cattle, poultry, and swine CAFs, while SCAQMD Rule 1127 does not. District Rule 4570 is therefore more stringent than SCAQMD Rule 1127.

## C. BAAQMD Regulation 2 Rule 10 (Rule 2-10)

BAAQMD Rule 2-10 is a permit rule. As such, it has fewer specifics about large CAFs than District Rule 4570, which is a prohibitory rule.

Applicability/Exemption/Large CAF Definition

BAAQMD Rule 2-10 was adopted on July 19, 2006 and has not been amended.

BAAQMD Rule 2-10 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas BAAQMD Rule 2-10 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for CAFs

The BAAQMD permit conditions must implement control measures that represent Reasonably Available Control Technology (RACT) to reduce emissions of VOC, NOx and PM from the facility. BAAQMD Rule 2-10 requires RACT mitigation measures rather than the more stringent BARCT controls required by District Rule 4570 as specifically noted in the BAAQMD staff report for their rule. District staff previously contacted BAAQMD staff and verified that there is no list of RACT mitigation measures in place should a large CAF apply for a permit. In this respect, District Rule 4570 is more stringent than BAAQMD Rule 2-10.

Testing, Monitoring, Recordkeeping Requirements

District Rule 4570 requires records to be maintained and retained for at least five years, whereas BAAQMD Rule 2-10 requires records to be retained for three years. District Rule 4570 therefore has a more stringent record retention requirement.

District Rule 4570 requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. Facilities subject to the mitigation measure requirements must maintain sufficient records to demonstrate implementation of each mitigation measure selected. Facilities must also maintain animal population records. BAAQMD Rule 2-10 requires the maintenance of animal population records but does not require specific records needed to demonstrate implementation of each mitigation measure selected. District Rule 4570 is therefore more stringent in the type of records that must be maintained.

Conclusion – Comparison with Bay Area AQMD Regulation 2 Rule 10

District Rule 4570 requires facilities to choose specific mitigation measures and makes several mitigation measures mandatory. In addition, District Rule 4570 has lower applicability thresholds for dairies, chickens, and ducks. Based on this information and the discussion above, District Rule 4570 is far more stringent than BAAQMD Rule 2-10.

## D. VCAPCD Rule 23 – Exemptions from Permit

In response to California Senate Bill (SB) 700, VCAPCD revised its “Exemptions from Permit” rule to remove an exemption for agricultural operations, including CAFs. VCAPCD does not have a specific rule for CAFs. In its staff report for the rule revision, VCAPCD staff noted that no facilities in their jurisdiction would meet the “large CAF” definition and there was no expectation that a large CAF would move into the area in the foreseeable future; therefore, no separate CAF rule was necessary.

Applicability/Exemption/Large CAF Definition

VCAPCD Rule 23 adopted ARB’s definition of large CAFs. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas VCAPCD Rule 23 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for CAFs

There are no facilities that would trigger the large CAF threshold within Ventura County, as stated in the VCAPCD staff report for amending Rule 23. The VCAPCD New Source Review Rule does not list mitigation measures for large CAFs. Instead, BACT would be triggered by a new CAF that met the “large CAF” definition or BACT would be triggered if an existing CAF expanded operations enough to meet the “large CAF” definition. At that point, VCAPCD staff would determine BACT for the CAF.

Conclusion – VCAPCD Rule 23

VCAPCD does not have a specific rule for CAFs; therefore, District Rule 4570 is more stringent.

## E. SMAQMD Rule 496

Like District Rule 4570, SMAQMD Rule 496 is a prohibitory rule, meaning that there are detailed requirements for operators.

Applicability/Exemption/Large CAF Definition

SMAQMD Rule 496 was adopted on August 24, 2006 and has not been amended.

SMAQMD Rule 496 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas SMAQMD Rule 496 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies - 1,000 milk cows to 500 milk cows
- Broilers/ducks and Layers – 650,000 – 400,000

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for Dairy CAFs

*Feed Mitigation Measures*

District Rule 4570 has seven mitigation measures for feed and two mitigation measures for silage. Operators must implement four mandatory feed mitigation measures and chose another one from a list of three, for a total of five mitigation measures required for feed.

SMAQMD Rule 496 has seven Class One mitigation measures for feed and two Class One mitigation measures for silage. Operators must implement four feed mitigation measures and one silage mitigation measure.

District Rule 4570 requires a total of five feed mitigation measures, excluding silage, which is greater than the four feed mitigation measures required by SMAQMD Rule 496. In addition, four of the five feed mitigation measures are mandatory in District Rule 4570. Therefore, District Rule 4570 is more stringent.

*Milk Parlor Mitigation Measures*

District Rule 4570 has one required milk parlor mitigation measure. SMAQMD Rule 496 also only requires one mitigation measure for milk parlors. Since both rules only require the use of one mitigation measure, both rules will be considered identical for this category.

*Freestall Mitigation Measures*

District Rule 4570 has five freestall mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SMAQMD Rule 496 has eight Class One mitigations measures and one Class Two mitigation measure from which facilities are required to implement at least two.

Rule 4570 is more stringent since it requires more mitigation measures.

*Corral Mitigation Measures*

District Rule 4570 has nine corral mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SMAQMD Rule 496 has 15 Class One mitigation measures, which are all optional, and three Class Two mitigation measures, from which facilities are required to choose at least six. District Rule 4570 requires one additional mitigation measure; therefore in this respect District Rule 4570 is more stringent.

SMAQMD Rule 496 has one Class One mitigation measure (*inspect water pipes and troughs and repair leaks*) that requires increased frequency in comparison to the corresponding District Rule 4570 measure. SMAQMD Rule 496 requires this measure to be carried out daily, whereas District Rule 4570 requires it to be carried out only once every seven days. Although, SMAQMD Rule 496 has a higher frequency for this measure, the difference in the emissions reductions from the two frequencies is not expected to be significant. Overall, District Rule 4570 is more stringent.

*Solid Waste and Separated Solids Mitigation Measures*

District Rule 4570 contains only two mitigation measures, from which operators are required to choose at least one. SMAQMD Rule 496 has five Class One mitigation measures and three Class Two mitigation measures, from which facilities are required to choose at least two.

Available studies have indicated that NH3 emissions from stored solid waste and separated solids pile to be a very small fraction of total NH3 emissions at dairies. Since the NH3 emissions from solid manure account for a very small fraction of emissions from the overall dairy, there would not be a significant increase in NH3 emission reductions if more measures are required from this category.

*Liquid Waste Mitigation Measures*

District Rule 4570 has four mitigation measures mitigation measures, from which operators are required to choose at least one. SMAQMD Rule 496 has four Class One mitigation measures and four Class Two mitigation measures, from which facilities are required to choose at least one. Since only one measure is required, both rules are equivalent in this respect.

*Manure Land Application Mitigation Measures*

District Rule 4570 has two mitigation measures required out of six measures. SMAQMD Rule 496 has six Class One mitigation measures, from which facilities are required to choose at least two. Since two mitigation measures are required, both rules are equivalent in this respect.

Requirements for Poultry Large CAFs

There is a large degree of variability in the manure management practices, housing techniques, and potential feeding practices for the different type of poultry operations in the Valley. Due to these differences, District Rule 4570 separates poultry CAFs into the following categories: 1) layers and 2) broilers, ducks, and turkeys.

Although on the surface the poultry requirements results in fewer mitigation measures compared to the other rules, the segregating of the types of poultry has allowed the mitigation measures to be tailored specifically to the type of poultry operation. In addition, all measures for poultry in District Rule 4570 are now mandated rather than left as options. Due to this reconfiguration and taking into consideration the latest science, District Rule 4570 requirements for poultry are more stringent than SMAQMD Rule 496.

Other CAFs

In addition to dairy and poultry CAF mitigation measures discussed above, District Rule 4570 provides specific mitigation measure option tables for beef cattle feedlots, other cattle facilities, and swine facilities. SMAQMD Rule 496 does not address mitigation measures for these additional CAF categories. For these types of large CAFs, District Rule 4570 is more stringent.

Requirements – Suspension and Substitution of Mitigation Measures

Both rules allow for substitution of one mitigation measure with an equivalent or more stringent measure with the submission of the appropriate application. District Rule 4570 also allows the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. SMAQMD Rule 496 does not have a specific provision for temporary suspension of mitigation measures. As discussed above, District Rule 4570 is as stringent as SMAQMD Rule 496.

Testing, Monitoring, Recordkeeping Requirements

The testing, monitoring, and recordkeeping provisions of District Rule 4570 and SMAQMD Rule 496 are nearly identical and are of equal stringency.

Conclusion – Comparison with Sac Metro AQMD Rule 496

For dairy CAFs, District Rule 4570 is more stringent than SMAQMD Rule 496. District Rule 4570 requires emission reductions from four additional emission categories - milk parlors, feed, freestall barns, and liquid manure - that are not addressed by SMAQMD Rule 496 as well as having specific requirements for other types of CAFs. District Rule 4570 also requires facilities to choose more mitigation measures and mandates several mitigation measures. In addition, Rule 4570 applies to dairies with greater than 500 milk cows and 400,000 layers and broilers while SMAQMD Rule 496 applies to dairies with 1,000 milk cows or more and broiler and layer operations with more than 650,000 birds. As shown in the discussion above, District Rule 4570 is more stringent than SMAQMD Rule 496.

## F. ICAPCD Rule 217 – Large Confined Animal Facilities Permits Required and ICAPCD Policy Number 38 – Recommended Mitigation Measures for Large Confined Animal Facilities

ICAPCD Rule 217 is a permits rule. ICAPCD Rule 217 requires that owners or operators of large CAFs submit an emissions mitigation plan that demonstrates that the facility will use RACT to reduce emissions of pollutants that contribute to the non-attainment of any ambient air quality standard and are within the ICAPCD's regulatory authority.

ICAPCD Rule 217 requires operators of large CAFs to implement the control measures identified in their emissions mitigation plan, which may be selected from the ICAPCD Policy Number 38, Recommended Mitigation Measures for Large Confined Animal Facilities. ICAPCD Policy Number 38 specifies the number of mitigation measures the operator should implement for each operation within the CAF. The following discussion compares the recommended mitigation measures in ICAPCD Policy Number 38 to the measures in District Rule 4570. However, since the mitigation measures in ICAPCD Policy Number 38 are only recommended by ICAPCD Rule 217 rather than being explicitly required, it is clear that District Rule 4570 is more stringent.

Applicability/Exemption/Large CAF Definition

ICAPCD Rule 217 was adopted on October 10, 2006 and has since not been amended.

ICAPCD adopted ARB's definition of large CAF. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas ICAPCD Rule 217 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

ICAPCD Policy Number 38 only lists mitigation measures for dairy operations and beef feedlot operations while District Rule 4570 covers additional CAFs (swine, chicken layer, chicken broiler, duck and turkey, and other CAFs). Therefore, more CAFs are subject to the requirements of District Rule 4570 than ICAPCD Rule 217 and Policy Number 38.

Therefore, Rule 4570 is more stringent regarding applicability.

<u>Requirements for Dairy CAFs</u>

*Milk Parlor Mitigation Measures*

ICAPCD Policy Number 38 has only one mitigation measure for the milk parlor. The District rule also only has one mitigation measure. Since the mitigation measure is identical, both rules are identical under this section.

*Freestall Mitigation Measures*

District Rule 4570 has five freestall mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has eight mitigation measures, from which operators are required to choose at least two. Since District Rule 4570, requires three mitigation measures and mandates two out of the three, District Rule 4570 is more stringent than ICAPCD Policy Number 38.

*Corral Mitigation Measures*

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has eight mitigation measures, from which facilities are required to choose at least four.

For three of the mitigation measures, the compliance times differ between the District rule and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows longer time periods between repeated performance of the measures than District Rule 4570. For these three mitigation measures, District Rule 4570 is more stringent because District Rule 4570 requires repeated performance of the otherwise identical mitigation measures in shorter time periods.

For two of the mitigation measures, the maximum depth of manure differs significantly between the District Rule 4570 and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows manure depths that are deeper than allowed by District Rule 4570. For these two mitigation measures, District Rule 4570 rule is more stringent because the District Rule 4570 requires shallower manure depths for otherwise identical mitigation measures.

Therefore, District Rule 4570 is far more stringent than the ICAPCD Policy Number 38.

*Solid Waste and Separated Solids Mitigation Measures*

District Rule 4570 has two solid waste and separated solids mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures from which facilities are required to choose at least one. Therefore, both rules are identical in this category.

There are a few differences in ICAPCD Policy Number 38 mitigation measures when compared to District Rule 4570. ICAPCD Policy Number 38 policy requires that manure piles are covered year round whereas District Rule 4570 requires that the piles be covered from October through May – the months in the Valley in which rainfall is most likely. However, because of the greater depth of manure allowed in corrals and increased duration (up to two years) for removal of manure from the corrals allowed by ICAPCD Policy Number 38, CAFs in the ICAPCD are able to allow manure to accumulate in the corrals until it can be hauled offsite. Few, if any, CAFs in the ICAPCD are expected to actually store manure onsite outside of corrals, so it is likely that no facilities in ICAPCD are actually choosing and implementing this measure. Separated solids piles are not specifically addressed in ICAPCD Policy Number 38. Overall District Rule 4570 is as stringent as ICAPCD Policy Number 38.

*Liquid Waste Mitigation Measures*

District Rule 4570 has four liquid waste mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 contains an option to manage the facility so that lagoons only contain waste from milking parlor and storm water as a mitigation measure. District Rule 4570 does not contain this option. This difference, although worth noting, is not expected to influence the overall effectiveness of District Rule 4570; District Rule 4570 is as stringent as ICAPCD Policy Number 38.

*Manure Land Application Mitigation Measures*

District Rule 4570 has two mitigation measures that are mandatory if applicable. ICAPCD policy has a menu of five mitigation measures from which operators are required to choose two. Since two measures are required by both ICAPCD Policy Number 38 and District Rule 4570, they will be considered identical under this category.

Requirements for Beef Feedlot CAFs

*Animal Housing Mitigation Measures*

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has nine mitigation measures, from which facilities are required to choose at least four. Since operators in Imperial County are required to implement fewer mitigation measures, District Rule 4570 is more stringent.

For three of the mitigation measures, the compliance times differ between the District rule and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows longer time periods between repeated performances of the measures than District Rule 4570. For these three mitigation measures, the District rule is more stringent because the District Rule 4570 requires repeated performance of the otherwise identical mitigation measures in shorter time periods.

For two of the mitigation measures, the maximum depth of manure differs significantly between the District Rule 4570 and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows manure depths that are deeper than allowed by District Rule 4570. For these two mitigation measures, District Rule 4570 rule is more stringent because the District Rule 4570 requires shallower manure depths for otherwise identical mitigation measures.

*Solid Waste and Separated Solids Mitigation Measures*

District Rule 4570 has two solid waste and separated solids mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures from which facilities are required to choose at least one. Therefore, both rules are identical in this category.

ICAPCD Policy Number 38 policy requires that manure piles are covered year round whereas District Rule 4570 requires that the piles be covered from October through May – the months in the Valley in which rainfall is most likely. However, because of the greater depth of manure allowed in corrals and increased duration (up to two years) for removal of manure from the corrals allowed by ICAPCD Policy Number 38, CAFs in the ICAPCD are able to allow manure to accumulate in the corrals until it can be hauled offsite. Few, if any, CAFs in the ICAPCD are expected to actually store manure onsite outside of corrals, so it is likely than no facilities in ICAPCD are actually choosing and implementing this measure. Overall District Rule 4570 is as stringent as ICAPCD Policy Number 38.

*Liquid Manure Handling*

ICAPCD Policy Number 38 does not address liquid manure handling for beef feedlot operations. This is likely because beef feedlot facilities in ICAPCD do not generally use liquid manure management systems. District Rule 4570 requires one measure to be selected out of a menu of options, if applicable. Therefore, Rule 4570 is more stringent in this category.

*Manure Land Application Mitigation Measures*

District Rule 4570 has two mitigation measures that are mandatory if applicable. ICAPCD Policy Number 38 has a menu of five mitigation measures from which operators are required to choose two. Since two measures are required by both ICAPCD Policy Number 38 and District Rule 4570, they will be considered identical under this category.

Requirements for Other CAFs

In the same manner as for dairy and beef feedlot operations, District Rule 4570 specifies mitigation methods for confined animal facilities other than dairies and beef feedlots. ICAPCD Policy Number 38 only has mitigation measures for dairy and beef feedlot operations. In comparing the two documents, District Rule 4570 is therefore more comprehensive and stringent.

Requirements – Suspension and Substitution of Mitigation Measures

District Rule 4570 and ICAPCD Policy Number 38 allow for substitution of one mitigation measure with an equivalent or more stringent one with the submission of the appropriate application. District Rule 4570 also allows the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. ICAPCD Policy Number 38 allows for temporary suspension of mitigation measures under circumstances similar to District Rule 4570. Based on the discussion, Rule 4570 is as stringent as ICAPCD Policy Number 38.

Testing, Monitoring, Recordkeeping Requirements

District Rule 4570 requires records to be maintained and retained for at least five years, whereas ICAPCD Rule 217 requires records to be retained for two years. District Rule 4570 therefore has a more stringent record retention requirement.

District Rule 4570 requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. Facilities subject to the mitigation measure requirements must maintain sufficient records to demonstrate implementation of each mitigation measure selected. Facilities must also maintain animal population records. ICAPCD Rule 217 requires the maintenance of animal population records but does not require specific records needed to demonstrate implementation of each mitigation measure selected. District Rule 4570 is therefore more stringent in the type of records required to be maintained.

Conclusion- Comparison with ICAPCD Rule 217 and ICAPCD Policy Number 38

ICAPCD Rule 217 requires operators of large CAFs to implement the control measures identified in their emissions mitigation plan, which may be selected from the ICAPCD Policy Number 38, Recommended Mitigation Measures for Large Confined Animal Facilities; however, compliance with ICAPCD Policy Number 38 is not explicitly required by the rule. District Rule 4570 contains several mandatory mitigation measures, unlike the optional nature of the mitigation measures in ICAPCD Rule 217. District Rule 4570 also has a lower applicability threshold for dairies (500 milk cows). In addition, ICAPCD Policy Number 38 only lists mitigation measures for dairy operations and beef feedlot operations while District Rule 4570 covers additional CAFs (swine, chicken layer, chicken broiler, duck and turkey, and other CAFs). As shown the discussion above, District Rule 4570 is far more stringent than ICAPCD Rule 217 and ICAPCD Policy Number 38.

## G. BCAQMD Rule 450 – Large Confined Animal Facilities

BCAQMD Rule 450 is a permits rule. It outlines, in general terms, the requirements for a complete permit application and how the staff would evaluate and approve/disapprove the permit application.

Applicability/Exemption/Large CAF Definition

BCAQMD Rule 450 was adopted on December 21, 2006 and has since not been amended.

BCAQMD adopted ARB's definition of large CAF. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas BCAQMD Rule 450 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

CAF Requirements

BCAQMD Rule 450 requires large CAFs to obtain a permit and to submit and implement a mitigation plan; however, the rule does not list mitigation measures or specify the number of mitigation measures required. District Rule 4570 has a menu of specific mitigation measures and stipulates the number of mitigation measures an operator is required to implement. In this regard, District Rule 4570 is more stringent than BCAQMD Rule 450.

Testing, Records, and Reporting Requirements

BCAQMD Rule 450 requires that all CAFs record the daily number of animals on-site. These records are to be kept on-site for two years and presented if requested. District Rule 4570 requires testing and records be kept to demonstrate compliance with the operator's selected mitigation measures. The records are to be kept for five years and presented upon the request of EPA or the District. Because District Rule 4570 covers testing, as well as having a longer record retention time, it is more stringent than BCAQMD Rule 450.

Conclusion – Comparison with Butte County AQMD Rule 450

District Rule 4570 contains specifies the actual mitigation measures that facilities are required to implement. In addition, District Rule 4570 has lower applicability thresholds for dairies, chicken facilities, and duck facilities. As shown in the discussion above, District Rule 4570 is more stringent than BCAQMD Rule 450.

## H. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms

Applicability/Exemption

IDAPA 58.01.01 Sections 760-763 was adopted on March 30, 2007 and IDAPA 58.01.01 Subsection 764.02: Table – Ammonia Control Practices for Idaho Dairies was last amended on May 8, 2009.

Pursuant to IDAPA 58.01.01 Section 761, Sections 760-764 apply to dairies of the following sizes. The thresholds are based on estimating the number of cattle required to produce 100 tons of ammonia emissions annually. Different thresholds are given for drylot dairies, dairies with scraped freestalls, and dairies with flushed freestalls. The thresholds are given on the basis of Animal Units (AU) (1,000 lbs of live weight) and on a mature cow equivalent basis (1,400 lbs of live weight).

**SUMMARY: Animal Unit (AU) or mature cow threshold to produce 100 tons NH3/year**

| Animal Unit (AU) Basis | Drylot | Free Stall/Scrape | Free Stall/Flush |
|---|---|---|---|
| | AU (100 t NH3) Threshold | | |
| No land app | 7,089 | 3,893 | |
| 27% volatilization[1] | 6,842 | 3,827 | 2,293 |
| 80% volatilization[2] | 6,397 | 3,700 | |
| | Total Cows (100 t NH3) Threshold | | |
| **Cow Basis (1,400 lb)** | **Drylot** | **Free Stall/Scrape** | **Free Stall/Flush** |
| No land app | 5,063 | 2,781 | |
| 27% volatilization[1] | 4,887 | 2,733 | 1,638 |
| 80% volatilization[2] | 4,589 | 2,643 | |
| No land app | 5,063 | 2,781 | |

1 Assumes expected level of N->NH3 volatilization for drop-hose or ground level liquid manure application.
2 Assumes expected level of N->NH3 volatilization for center pivot or other conventional sprinkler irrigation liquid manure application

The smallest dairy to which IDAPA 58.01.01 Sections 760-764 applies would have the equivalent of at least 1,638 mature cows in flushed freestalls and a larger number of animals in scraped freestalls or corrals. In comparison, District Rule 4570 applies to dairy CAFs with at least 500 milking cows (at least 700 AU or 500 mature cows). In addition, District Rule 4570 applies to other types of confined animal facilities, including beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. Therefore, District Rule 4570 is more stringent regarding applicability.

<u>Requirements for Dairies</u>

Each dairy farm subject to IDAPA 58.01.01 Sections 760 - 764 must employ Best Management Practices (BMPs) for the control of ammonia. The BMPs are applied to the following systems at a dairy: Waste Storage and Treatment Systems, General Practices, Freestall Barns, Open Lots and Corrals, Animal Nutrition, Composting Practices, and Land Application. A total of twenty-seven (27) points must be achieved for the BMPs employed. The table located in Subsection 764.02 lists the approved BMPs and their associated point values. During development of the regulation, a point system with a maximum of 20 points was assigned to each practice. A practice receiving 20 points equates to a system or practice that is considered to result in major reduction in ammonia emissions for that specific process. However, according to the supporting documentation, this point system is "arbitrary".[123] Therefore, there is no direct correlation from the points required and the amount of emission reductions achieved. In fact, due to the flexibility allowed in this rule, even if all points have been met by the rule and depending on which mitigation measures are selected, the overall ammonia emission reductions may not be substantial. The Idaho Department of Environmental Quality (IDEQ) may also determine a practice not listed in the table constitutes a BMP and assign a point value. Points may also be obtained through third party export with sufficient documentation.

The paper Commentary *Ammonia-Based Air Quality Permits for Idaho Dairies*[124] indicated that, "Solid separation of manure, corral harrowing, low-pressure irrigation, composting, and rapid manure removal from outdoor lots were found to be the most common BMPs."

Solids Separation

In the Idaho regulation, solids separation refers to "gravity or mechanical separation system to remove manure solids from liquid waste stream." This practice has been implemented by almost all dairies in the Valley subject to District Rule 4570 to comply with the liquid manure mitigation measure requirements of District Rule 4570.

Corral Harrowing/Cleaning

In the Idaho regulation corral harrowing refers to harrowing to distribute deposited manure, reshaping corral surface, and/or removing manure from corral surface and rapid manure removal from outdoor lots refers to the removal of winter time manure and corral bedding from an open lot surface in spring or as quickly as practicable. District Rule 4570 has much more stringent requirements for corral cleaning and maintenance at dairies. For corrals, District Rule 4570 requires dairies to implement the following measures: a) Cleaning manure from corrals at least four times per year with at least 60 days between cleaning, or b) Cleaning corrals at least once between April and July and at least once between September and December; a) Scraping, vacuuming, or flushing concrete lanes in corrals at least once every day for mature cows and every seven days for support stock, or b) Cleaning concrete lanes such that the depth of manure does not exceed twelve inches at any point or time; inspection of water pipes and troughs and repairing leaks at least once every seven days; and a) Sloping the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less and Sloping the surface of the corrals at least 1.5%

[123] Idaho Department of Environmental Quality (2006). Scientific Basis for the Control of Ammonia from Dairy Farms Best Management Practices 7/18/2006 by Ron E. Sheffield, Waste Management Engineer, University of Idaho and Bruce Louks, Air Quality Division, Idaho Department of Environmental Quality. http://www.deq.idaho.gov/media/635665-58_0101_0502_scientific_basis_final.pdf

[124] Sheffield, R. E. and Louks, B. (2008). COMMENTARY: Ammonia-Based Air Quality Permits for Idaho Dairies. Environmental Practice, 10, pp 13-19. doi:10.1017/S1466046608080046. http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=1888928

where the available space for each animal is more than 400 square feet per animal, b) Maintaining corrals to ensure proper drainage preventing water from standing more than forty-eight (48) hours, or c) Harrowing, raking, or scraping corrals sufficiently to maintain a dry surface. In addition, District Rule 4570 requires dairies to choose an additional corral mitigation measure, requiring corrals to be managed such that the manure depth in the corral does not exceed twelve inches at any time or point, except for in-corral mounding. Therefore, the corral cleaning and maintenance requirements of District Rule 4570 are far more stringent than IDAPA 58.01.01 Sections 760 – 764.

Previous emission studies conducted in the Valley have demonstrated that the corrals and pens are the sources with the greatest potential for NH3 emissions in Valley dairies[125] and, therefore, the much more stringent corral cleaning and maintenance measures required by District Rule 4570 have the potential for far greater NH3 reductions.

Liquid Manure Application
In the Idaho regulation, Low Energy/Pressure Application Systems refers to use of center pivot and liner-move irrigation strategy that applies liquids at low pressures using drop nozzles. The guidance for the regulation states that larger droplets result in lower emissions but may cause infiltration problems on some soils. The use of center pivot and liner-move irrigation to apply liquid manure is very uncommon in the Valley and may be prohibited in the use permits for many dairies. In the Valley it is much more common to apply liquid manure to cropland through flood or furrow irrigation after it has been diluted with fresh irrigation water as generally required by either the Water Quality Board or the local County and as a means to avoid damage to growing crops. Because of the reduced surface area, flood and furrow irrigation have even lower emissions than low pressure sprinkler irrigation systems. Dilution of the liquid manure with fresh irrigation water further reduces NH3 emissions and is also listed as a BMP in the Idaho regulation. Therefore, the liquid manure practices utilized in the Valley are more stringent than the Idaho regulation.

Composting
In the Idaho regulation "composting" refers to stacking and drying of separated manure solids or corral manure. Almost all dairies in the Valley utilize this practice to prepare solid manure and/or separated solids for bedding and/or for use on cropland. In addition, District Rule 4570 requires that dairies implement one of the following measures for solid manure or separated solids: 1) within 72 hours of removal from housing, either: a) Remove dry manure from the facility, or b) Cover dry manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering,

[125] See: Schmidt, C. and Card, T. (2006) Dairy Air Emissions Report: Summary of Dairy Emission Estimation Procedures (May 2006). Final Report to California Air Resource Board (ARB).
http://www.arb.ca.gov/ag/caf/SchmidtDairyEmissions2005.pdf
http://www.arb.ca.gov/ag/caf/SchmidtDairyTestData2005.pdf

not to exceed 24 hours per event; or 2) Within seventy-two hours of removal from the drying process, either: a) Remove separated solids from the facility, or b) Cover separated solids outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event. Therefore, the general management practices conducted on dairies in the Valley and the requirements of District Rule 4570 are far more stringent than the Idaho regulation.

For dairy corrals, which are the largest source of NH3 emissions at dairies in the Valley, District Rule 4570 requires more stringent mitigation measures and a greater number of these measures. District Rule 4570 is also more specific in regards to mitigation measures required from other processes at dairies and the number of mitigation measures that must be implemented for each process; as a result, District Rule 4570 is able to better target the reduction of emissions from these different operations. Therefore, District Rule 4570 is more stringent than IDAPA 58.01.01 Sections 760- 764.

Requirements for Other Confined Animal Facilities

As stated above, District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. IDAPA 58.01.01 Sections 760-764 does not address mitigation measures for these additional categories. Therefore, District Rule 4570 is more stringent for this category.

Requirements – Suspension and Substitution of Mitigation Measures

IDAPA 58.01.01 Subsection 762.03 provides that if a dairy farm not subject to Sections 760-764 becomes subject to these regulations as a result of an emergency (for example if a dairy farmer takes additional cows due to unforeseen circumstances), the dairy farm must notify the IDEQ in writing within 14 days explaining the emergency circumstances. The dairy farm would be exempt from these requirements for up to one year as long as the consequences of the emergency continue. In the event of unforeseen equipment upsets and breakdowns, so long as corrective action is taken within a reasonable time, the event does not reduce the BMP point value.

In comparison, District Rule 4570 allows an operator to temporarily suspend any mitigation measure as long as the suspension is recommended by a licensed veterinarian or animal nutritionist on the basis of animal health. The operator must notify the District within 48 hours prior to the suspension. If the suspension is expected to last longer than 30 days, then the operator must submit a new mitigation plan that identifies a new mitigation measure to be implemented in place of the suspended one.

District Rule 4570's exemption under this category is much more stringent because it is a temporary suspension that cannot exceed 30 days, whereas the

IDAPA 58.01.01 Sections 760-764 exemption may last much longer, without any requirement to substitute another measure.

Therefore, in this category of mitigation measure suspensions/substitutions, District Rule 4570 is more stringent than IDAPA 58.01.01 Sections 760-764.

Testing, Monitoring, Recordkeeping Requirements

Compliance with the requirements of IDAPA 58.01.01 Sections 760-764 is primarily determined by inspections by the Idaho State Department of Agriculture. The Idaho regulations do not specify what records must be kept or have any requirement that the records be maintained for a certain period of time.

District Rule 4570 includes specific requirements for monitoring, source testing as appropriate and recordkeeping to ensure mitigation measure are being implemented. Facilities must also maintain animal population records. District Rule 4570 also requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. District Rule 4570 requires records be retained for five years for all sources. District Rule 4570 is therefore more stringent in this area.

Conclusion – Comparison with IDAPA 58.01.01 Sections 760-764

For dairy facilities, District Rule 4570 is far more stringent than IDAPA 58.01.01 Sections 760-764. Unlike IDAPA 58.01.01 Sections 760-764, District Rule 4570 requires specific practices for the various operations at dairies. District Rule 4570 also provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities, while IDAPA 58.01.01 Sections 760-764 does not. The measures required by the Idaho regulation are also based on an arbitrary point system and as such do not guarantee a specific degree of control. District Rule 4570 is, therefore, more stringent than IDAPA 58.01.01 Sections 760-764.

## IV. Evaluation of Additional Control Measures

Recent studies have cited the episodic application of sodium bisulfate (SBS) onto manure at dairies as a potential control strategy to reduce ammonia emissions. SCAQMD included a potential control measure within their 2012 Air Quality Management Plan (AQMP) to evaluate the use of SBS at dairies to determine the technical and economic feasibility of its application in reducing ammonia emissions as well as potential impacts to groundwater. The District did not find any agency requiring the use of SBS. The District has evaluated SBS as a potential control measure and determined that for a variety of reasons that this control strategy is infeasible and ineffective for reducing PM2.5 concentrations in the Valley.

SBS is an acid salt that has been used to reduce pH and bacterial levels in the bedding for dairy cattle. Application of SBS on fresh manure or corral surfaces has the potential to reduce ammonia emissions by reducing the pH of the manure or corral surface. With a lower pH, a greater fraction of the ammonia is converted to non-volatile ammonium (NH4+). The ammonium combines with sulfate to form ammonium sulfate, which is retained in the manure or on the surface of the corral.

There are a number of potential issues that need to be considered related to the application of SBS at dairies including, but not limited to, the health and safety of dairy workers and dairy cattle, impacts on water quality, and overall cost and effectiveness. The SCAQMD 2012 AQMP states: that potential use of SBS would be specific to dairies in the SCAQMD and may be unique to localized operations, that “the requirements may not be applicable to dairies elsewhere where a site-specific assessment would need to be made relative to those particular conditions”, and that it is likely that each air district would need to conduct an assessment as to the feasibility of SBS application in their jurisdiction.

The SCAQMD AQMP focuses on episodic controls to reduce ammonia emissions during periods of high PM2.5 concentrations. PM concentrations in the Valley are highest during the winter season (November – February). Unlike the SCAQMD where the majority of dairies are open corral facilities, most dairies in the Valley utilize a freestall design and generally restrict the cows’ access to corrals during the winter months since the corrals are wet and muddy. As a result, there would be very little to no fresh manure excreted in corrals during the winter period. In addition, once wet conditions set in, it is not feasible to utilize tractors in the corrals to apply SBS since the tractors tend to get stuck in mud. Application by hand at large dairies would be very labor intensive, time consuming, be extremely costly, and would potentially pose health and safety risks to the workers.

Although SBS is generally considered to be safe in small quantities, excessive loading of salts is a major water quality concern in the central and southern regions of the Valley where many dairies are located. In addition, applying SBS to corrals, which for many dairies can be greater than several acres in size, is not practical or feasible. Applying SBS to large areas also requires significant amounts of SBS to be applied, which as discussed below can be quite cost-prohibitive. The application of SBS will also be short lived and conflict with requirements from Rule 4550 which requires dairies to scrape their corrals on a frequent basis at least once every two weeks, making the application of SBS ineffective and even more costly due to the constant need to reapply.

A dairy would also need to work with the Regional Water Quality Control Board to determine if the application of SBS is allowed and if a dairy’s nutrient management plan would need to be revised since the water quality surrounding dairies is a major concern and any additional impacts would need to be thoroughly reviewed. This may require hauling manure significant distances to areas that would not be adversely affected by the increased salinity, which would result in increased emissions and costs related to hauling.

There are significant costs associated with the application of SBS. Iowa State University Extension estimates the costs of SBS to be $660/ton. District estimates show that 1,304 lb-1,955 lb/cow-yr of SBS would be needed for application to one entire corral area, costing $430-$645/cow-yr. Using the District's corral ammonia emission factor for milk cows and assuming a conservatively high estimate of 50% reduction in overall ammonia emissions, the cost of the ammonia reductions would be at least $41,067/ton to $61,601/ton or higher depending on corral size. Information from Iowa State shows reduced costs of $129-$193/cow-yr for only treating heavy use areas, such as feed bunks and water troughs. It is not clear how much manure is excreted in heavy use areas, but even if the resulting cost per ton of reduction was cut in half, the costs would still be significant.

Also, because flush dairies are common in the Valley (both freestall and open corral), the heavy use areas will generally be paved, and frequent flushing of the freestall or corral lanes (as required by Rule 4570) already significantly reduces ammonia emissions; therefore, application of SBS to only these areas would not provide significant additional reductions in ammonia emissions. By design, SBS will be flushed to a lagoon or pond where the high buffering capacity would render it ineffective and possibly increase H2S emissions.

Overall, given the insignificant PM2.5 reduction achieved per ton of ammonia reduction (as demonstrated in this plan), the cost effectiveness associated with implementing SBS translates to a much higher relative cost effectiveness when compared to other, more effective strategies, such as NOx reductions.

## V. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4570 meets BACM and MSM requirements for ammonia emissions from CAFs. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures. In fact, the SCAQMD recently identified District Rule 4570 as the most stringent rule for this source category.[126]

## Agricultural Fertilizers

Farms have continued to improve methods of fertilizer application over the years to maximize nitrogen use efficiency and minimize environmental impacts. Best

[126] South Coast Air Quality Management District (June 6, 2014). Reasonably Available Control Technology Demonstration. http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2014/2014-jun6-031.pdf?sfvrsn=2

management practices are being implemented to minimize nitrate leaching in irrigated crop production. Researchers at UC Cooperative Extension have been studying the nitrogen use efficiency for various crop types and have begun identifying the point at which the application of additional nitrogen no longer significantly increases crop quality and yields. This will allow growers to apply fertilizer with more precision to reduce the amount of nitrogen left in the soil.

Agricultural operations in California are regulated by the State Water Resources Control Board, which is charged by the state Legislature in enforcing state and federal water quality protection laws. The State Water Resources Control Board consists of Regional Water Quality Control Boards (Regional Boards) that develop objectives and plans to protect the beneficial uses of water, recognizing local differences in climate, topography, geology and hydrology. All dairy farms in California's Central Valley are regulated by the Central Valley Regional Water Quality Control Board ("Regional Board"). The vast majority of dairies—about 1,200 dairies—are regulated under a Regional Board General Order[127] and the remainder are regulated via individual orders that ensure compliance with the same requirements. These requirements include:

- A Nutrient Management Plan (NMP), prepared by a certified professional crop advisor or equivalent, designed to control nutrient losses for protection of surface water and groundwater;
- A Waste Management Plan (WMP), prepared by a licensed engineer;
- Environmental sampling and monitoring of soil, manure, water and plant tissue for compliance;
- Routine site inspections, recordkeeping, and reporting; and
- Additional groundwater monitoring to assess ongoing water quality protection

A major purpose of these regulations is to ensure responsible storage and use of manure as an important crop fertilizer and soil builder, thus preventing unnecessary runoff or leaching of nitrogen compounds to the environment, where they can impact water quality. The NMP is designed to assure that the amount of nitrogen excreted by milking cows and support stock is in reasonable balance with the needs of crops grown at the dairy farm. Manure nitrogen in excess of crop needs should be exported off the farm to where it can be used by other farmers. Nitrogen used on the farm is required to be stored safely until it is used (the major purpose of the WMP) and then only applied to agricultural fields when needed for crop growth and in the amounts needed. Over-application or mistimed application of nitrogen fertilizers can result in unnecessary losses of nitrogen to the environment, both as seepage below the root zone (in the form of nitrate or other nitrogen compounds)[128] or as air emissions of ammonia gas, ammonium, and oxides of nitrogen.

The University of California suggested in 2005 that "…optimal N loading rates of 1.4 to 1.65 times the crop N harvest removal are practical and, based on field observations,

[127] http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0122.pdf

[128] See "Managing Dairy Manure in the Central Valley of California," published by the University of California Committee of Experts on Dairy Manure Management, 2005. http://groundwater.ucdavis.edu/files/136450.pdf

achievable if the production field is properly managed."[129] The UC assessment was the ultimate basis for performance standards set by the Regional Board in the General Order, which was adopted in 2007 and revised and reissued in 2013. Research suggests that to achieve the more stringent targets in the General Order, many dairies had to greatly increase the precision of their manure and fertilizer applications, while also reducing the overall amount of nitrogen applied to their crops compared to plant uptake.[130] On a group of Valley dairy farms, it was estimated that prior to adoption of the General Order in 2007, losses of nitrogen to groundwater alone ranged from 370 to 570 pounds per acre compared to 500 pounds of uptake by crops.[131] Similar or larger amounts of nitrogen are expected to volatilize to the atmosphere as ammonia and other compounds following excretion of manure from animals, during storage of manure in ponds or corrals, and in the process of applying manure to soil as a crop nutrient.[132] Thus, as a result of full implementation of the General Order, losses of nitrates to groundwater on dairies may be reduced by up to 85 percent compared to pre-General Order conditions, though this number will be smaller for dairies where manure was managed more precisely prior to the General Order's adoption.

Increasing crop nutrient uptake is also expected to reduce air emissions by providing for application of less excess fertilizer to crops, and therefore, less opportunity for volatilization in the fields. Some research already conducted found lower emissions with moderate nitrogen applications and suggested, "…synchronizing N applications with crop N demand. Once the N requirement for each crop stage is known, the N applications can be adjusted accordingly. This strategy should lead to improved N use efficiency and likely lower N2O emissions."[133]

Other nitrogen compounds such as ammonia can also volatilize to air during application to fields. The University of California Committee of Experts on Dairy Manure Management has suggested that during application of manure water to crops, significant ammonia emissions can occur when manure water is not properly diluted (to below 100 ppm NH3/N) or applied during early growth of the crop. However, "in systems with frequent, but well diluted manure water applications, ammonia losses from the ground surface will commonly be minimal during the irrigation (10% or less)."[134]

Although additional research will be helpful in quantifying the environmental benefits of improved waste management and nutrient applications, the weight of evidence suggests that managing nutrient applications to fields as prescribed in the General Order, especially compared to pre-General Order management on some dairy farms, has significantly reduced losses of nitrogen compounds to the environment, including

[129] Ibid., p. 47
[130] "Cow Numbers and Water Quality – is there a magic limit?" (Harter, Menke 2005), http://groundwater.ucdavis.edu/files/136451.pdf
[131] Ibid., Harter.
[132] Ibid., "Managing Dairy Manure in the Central Valley of California."
[133] "Assessment of Nitrous Oxide Emissions in California's Dairy Systems, DRAFT FINAL REPORT, California Air Resources Board, Contract No. 09-325, William R. Horwath, Martin Burger, Stuart Pettygrove, http://www.arb.ca.gov/research/rsc/10-18-13/item6dfr09-325.pdf
[134] Ibid., "Managing Dairy Manure in the Central Valley of California," p. 41.

leaching of nitrogen compounds to groundwater and air emissions such as ammonia and nitrous oxide.

**Organic Material Composting (District Rule 4566)**

## I. District Rule Description:

District Rule 4566 (Organic Material Composting) is the most stringent rule in the nation for controlling emissions from composting operations; additional controls are infeasible. Additionally, as discussed in Appendix E of this *2015 PM2.5 Plan,* one of the technology focus areas for the District's Technology Advancement Program is for waste solutions that 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. The District has taken every regulatory action feasible to reduce emissions from this source and continues to seek additional methods to reduce emissions through innovative strategies such as the support of research and technology demonstrations with potential to reduce emissions further.

District Rule 4566, was adopted on August 18, 2011, to limit VOC emissions from composting facilities whose feedstock consists of greenwaste and/or foodwaste. District Rule 4566 applies to operations that stockpile and compost greenwaste and foodwaste. In addition to limiting VOC emissions, District Rule 4566 also limits NH3 emissions from these operations. The analysis below focuses on how District Rule 4566 limits NH3 emissions in comparison to other rules and regulations.

## II. How does District Rule 4566 compare with federal rules and regulations?

*A. EPA-Control Technique Guidelines (CTG)*

There is no EPA CTG guidance document for greenwaste or foodwaste composting operations.

*B. EPA - Alternative Control Technology (ACT)*

There is no EPA ACT guidance document for greenwaste or foodwaste composting operations.

*C. Standards of Performance for New Stationary Sources (NSPS)*

There is no NSPS guidance document for greenwaste or foodwaste composting operations.

*D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)*

There is no NESHAP or MACT guidance document for greenwaste or foodwaste composting operations.

## III. How does District Rule 4566 compare to rules in other air districts?

District staff compared District Rule 4566 with the rules for greenwaste and foodwaste composting operations from other California air districts. The results of the analysis are discussed below. District staff only located one other air district rule that applied to similar sources: SCAQMD Rule 1133.3. No other air district rules that applied to greenwaste or similar sources were found.

### A. SCAQMD Rule 1133.3 - Emission Reductions from Greenwaste Composting Operations (Adopted July 8, 2011)

The purpose of SCAQMD Rule 1133.3 is to reduce emissions of VOCs and NH3 from greenwaste and foodwaste composting operations. The table below compares the significant similarities and differences between SJVAPCD Rule 4566 and SCAQMD Rule 1133.3. For purposes of this analysis, the ammonia control efficiencies achieved by the requirements of SJVAPCD Rule 4566 are assumed to be the same as the VOC control efficiencies since the same control measures will reduce both VOC and NH3 from these operations. It is worth noting that greenwaste/foodwaste composting produces about 16% of the ammonia emissions on a per ton basis compared to co-composting.[135]

[135] SCAQMD Rule 1133.3, baseline $NH_3$ emissions from greenwaste/foodwaste composting = 0.46 lb-NH3/ton-throughput. SCAQMD Rule 1133.2, baseline $NH_3$ emissions from co-composting = 2.93 lb-NH3/ton-throughput.

| Rule Section | SCAQMD Rule 1133.3 | District Rule 4566 | Explanation of Differences |
|---|---|---|---|
| Applicability | New and existing greenwaste and foodwaste composting operations. | New and existing organic material composting and stockpiling facilities. (Organic material is defined as green material, food material, or mixtures of the two, with <100 ton/yr biosolids or manure.) | SCAQMD Rule 1133.3 limits foodwaste stockpiling time (48 hr), whereas District Rule 4566 limits organic material stockpiling time (3 or 10 days, depending on throughput). |
| Exemptions | Applicability/exemptions based on facility type, not throughput. | Applicability/exemptions based on facility type, not throughput. | The same types of facilities are exempt in both rules: facilities subject to a co-composting rule (SCAQMD Rule 1133.2 or District Rule 4565), nursery, household, recreational, and community composting facilities. District Rule 4566 also exempts agricultural facilities which are subject to District Rules 4204, 4550, or 4570. |
| Composting Control Requirements | • ≤5,000 ton/yr foodwaste or ≤20% manure (watering and finished compost cover or ≥20% control for $NH_3$)<br>• >5,000 ton/yr foodwaste, (emission control device with ≥80% control for $NH_3$) | • <200,000 ton/yr organic material (watering system or ≥19% control for $NH_3$)<br>• ≥200,000 and <750,000 ton/yr organic material (watering system and finished compost cover or ≥60% control for $NH_3$)<br>• ≥750,000 ton/yr organic material (emission control device with ≥80% control for $NH_3$) | The throughput/control levels in Rule 4566 are based on cost effectiveness and socioeconomic studies conducted by the District as part its Final Staff Report for the Revised Proposed New Rule 4566 (Appendices C and D, August 18, 2011). Rule 4566 requires the same management practices and control requirements as Rule 1133.3; however, the throughput levels at which the stricter control requirements in Rule 4566 become triggered are much higher than in Rule 1133.3. Thus, on paper, Rule 1133.3 appears to be more stringent than Rule 4566. However, SCAQMD does not have any greenwaste composting facilities (that are not under an experimental research permit) subject to the 80% control requirements of Rule 1133.3. |

As shown in the table above, based on discussions with SCAQMD permitting and rule development staff, <u>SCAQMD does not have any greenwaste composting production facilities subject to the 80% ammonia reduction requirement of Rule 1133.3</u>. SCAQMD has recently issued Authority to Construct permits for two experimental research greenwaste composting facilities located in Fontana and Riverside operated by Burrtec. The permits authorize Burrtec to perform greenwaste composting for one year (with the possibility of an extension) in order to evaluate the feasibility of three different compost emissions control technologies and conduct emissions testing for each technology. If at the end of the permitted experimental research period, Burrtec wanted to convert one or both facilities into a regular greenwaste composting production facility, they would need to obtain new ATC permits. The Burrtec facilities then are not representative of a commercial production greenwaste composting facility.

Because SCAQMD has no existing production greenwaste composting facilities that are subject to the 80% ammonia control requirement of Rule 1133.3, and the new facilities are permitted under experimental research exemptions, then Rule 1133.3 cannot be used to establish BACM or MSM as 80% for that category/throughput level of greenwaste composting.

**B. No rules that apply to organic materials composting operations were located for the air districts listed below:**

- Amador County Air Pollution Control District (ACAPCD)
- Bay Area Air Quality Management District (BAAQMD)
- Eastern Kern County Air Pollution Control District (EKAPCD)
- El Dorado County Air Quality Management District
- Imperial County Air Pollution Control District (ICAPCD)
- Mojave Desert Air Quality Management District (MDAQMD)
- North Coast Unified Air Quality Management District (NCAQMD)
- Placer County Air Pollution Control District (PCAPCD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- San Diego County Air Pollution Control District (SDCAPCD)
- Ventura County Air Pollution Control District (VCAPCD)
- Yolo-Solano Air Quality Management District (YSAQMD)

**C. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms**

The purpose of IDAPA 58.01.01 Sections 760-764 is to set forth requirements for the control of ammonia through best management practices for certain size dairy farms licensed by the Idaho State Department of Agriculture to sell milk for human consumption.

This regulation only applies to large dairies and does not apply to other agricultural facilities or facilities in which the primary activity is the production of compost. Therefore, it was determined that this regulation is not relevant to the current analysis since it does not specifically limit emissions from composting facilities.

## IV. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4566 meets BACM and MSM requirements for ammonia emissions from greenwaste and foodwaste composting operations. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures.

**Biosolids, Animal Manure, and Poultry Litter Operations (District Rule 4565)**

## I. District Rule Description:

District Rule 4565, was adopted on March 15, 2007, to limit VOC emissions from facilities whose throughput consists entirely or in part of biosolids, animal manure, or poultry litter. District Rule 4565 applies to operations that landfill, land apply, compost, or co-compost these materials. In addition to limiting VOC emissions, District Rule 4565 also limits NH3 emissions from these operations. The analysis below focuses on how District Rule 4565 limits NH3 emissions in comparison to other rules and regulations.

## II. How does District Rule 4565 compare with federal rules and regulations?

*A. EPA-Control Technique Guidelines (CTG)*

There is no EPA CTG guidance document for biosolids, animal manure, and/or poultry litter operations.

*B. EPA - Alternative Control Technology (ACT)*

There is no EPA ACT guidance document for biosolids, animal manure, and/or poultry litter operations.

*C. Standards of Performance for New Stationary Sources (NSPS)*

There is no NSPS guidance document for biosolids, animal manure, and/or poultry litter operations.

*D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)*

There is no NESHAP or MACT guidance document for biosolids, animal manure, and/or poultry litter operations.

## III. How does District Rule 4565 compare to rules in other air districts?

District staff compared District Rule 4565 with the rules for biosolids, animal manure, and poultry litter operations from other California air districts. The results of the analysis are discussed below. District staff only located one other air district rule that applied to similar sources, which was SCAQMD Rule 1133.2. No other air district rules that applied to similar sources were found.

## A. SCAQMD Rule 1133.2 - Emission Reductions from Co-Composting Operations (Adopted January 10, 2003)

SCAQMD adopted SCAQMD Rule 1133.2. This rule applies to new and existing co-composting operations in the SCAQMD.
Staff notes that there are some differences between District Rule 4565 and SCAQMD Rule 1133.2. This does not mean that one rule is more stringent than the other; rather the differences are due to the following factors:

1. Technology has changed significantly since SCAQMD Rule 1133.2 was adopted on January 10, 2003;
2. Additional research projects regarding mitigation measures have been completed since SCAQMD Rule 1133.2 was adopted; and
3. The socioeconomic climate of the SCAQMD is significantly different from that of the District.

The table below summarizes the significant differences between SCAQMD Rule 1133.2 and SJVAPCD Rule 4565. Below are the important differences between the two rules. For purposes of this analysis, the NH3 control efficiency for the requirements of District Rule 4565 are assumed to be the same as the VOC control efficiency for these requirements since the same measures will generally reduce both VOC and NH3 from these operations.

| Category | SCAQMD Rule 1133.2 | SJVUAPCD Rule 4565 | Reason |
|---|---|---|---|
| Facilities Other Than Co-Composting (Landfilling, Land Applying) | Rule does not apply to these operations | Management practice requirements | Knowledge of control options has increased since Rule 1133.2 adoption and staff believes that cost effective methods of controlling VOC and NH3 emissions from these facilities exist. |
| Co-Composting Threshold for Applicability | Facilities with at least 1,000 tpy throughput | Facilities that handle 100 tpy or more of biosolids, animal manure, or poultry litter | Staff believes that there are reasonable options that are not exceedingly costly for facilities with throughputs of ≥100 tpy that would not impose an undue burden on operators. |
| Composting Control Requirements | In-vessel composting with 70% control efficiency for VOC and NH3 for existing facilities and 80% control efficiency for VOC and NH3 for new facilities | Control efficiency of 10%-80% for VOC (and NH3) depending on type of operation and facility throughput | Management practices (mitigation measures) are effective, reasonable, and have been achieved in practice for smaller facilities.<br><br>In-vessel composting is not cost-effective for smaller or medium facilities and there are no known, unsubsidized facilities in the SCAQMD that would comply with such rule requirements. |

It should also be noted that in practice, the facilities that are actually subject to SCAQMD Rule 1133.2 will have much larger throughputs than 1,000 ton per year throughput threshold given in the rule. SCAQMD Rule 1133.2 includes the following exemptions for existing co-composting operations with a design capacity of less than 35,000 tons of throughput per year containing no more than 20 percent biosolids by volume and new and existing municipal facilities using aeration and processing less than 5,000 tons of biosolids or manure per year. In addition many operations in the SCAQMD have found it to be economical to transport these materials to other jurisdictions for processing. An example of this is the Synagro South Kern Compost Manufacturing Facility, which is a newer facility located in the Valley and processes biosolids transported from SCAQMD.

Because some mitigation measures are only cost-effective for larger facilities, District staff developed the concept of Class One and Class Two mitigation measures. Class One mitigation measures are cost effective options for all facilities, regardless of size. These measures are management practices found to be best practices for all composting operations.

Class Two mitigation measures are the technology options and achieve reductions greater than Class One mitigation measures; however, they were determined to not be cost effective for facilities with throughputs of less than 100,000 wet tons per year.

District Rule 4565 requires reductions from two additional categories (landfilling and land applying) when compared to SCAQMD Rule 1133.2. For the third category, composting, District staff determined it is not cost effective to require in-vessel (enclosed) composting.

**B. No rules that apply to biosolids, animal manure, and/or poultry litter operations were located for the air districts listed below**

- Amador County Air Pollution Control District (ACAPCD)
- Bay Area Air Quality Management District (BAAQMD)
- Eastern Kern County Air Pollution Control District (EKAPCD)
- El Dorado County Air Quality Management District
- Imperial County Air Pollution Control District (ICAPCD)
- Mojave Desert Air Quality Management District (MDAQMD)
- North Coast Unified Air Quality Management District (NCAQMD)
- Placer County Air Pollution Control District (PCAPCD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- San Diego County Air Pollution Control District (SDCAPCD)
- Ventura County Air Pollution Control District (VCAPCD)
- Yolo-Solano Air Quality Management District (YSAQMD)

### C. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms

The purpose of IDAPA 58.01.01 Sections 760-764 is to set forth requirements for the control of ammonia through best management practices (BMPs) for certain size dairy farms licensed by the Idaho State Department of Agriculture to sell milk for human consumption.

This regulation only applies to large dairies and does not apply to other agricultural facilities or facilities in which the primary activity is the production of compost. Therefore, it was determined that this regulation is not relevant to the current analysis since it does not specifically limit emissions from composting facilities.

## IV. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4565 meets BACM and MSM requirements for ammonia emissions from biosolids, animal manure, and poultry litter operations. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures.

**Major Sources of Ammonia**

The facilities listed below were identified as potential major sources of NH3 in the Valley. In all cases, the NH3 emissions from the facilities were entirely or primarily the direct result of the use of catalytic emission controls to reduce NOx emissions to acceptable levels as determined by regulatory agencies including, EPA, ARB, the District, and, in one case the California Energy Commission (CEC). Because the Valley is primarily a rural NOx-limited area, NOx reductions are the most critical element of District's plans to reach attainment with the federal ambient air quality standards for both PM2.5 and ozone. Therefore, controls that reduce NH3 while increasing NOx would increase the formation of PM2.5 and ozone in the Valley and would be detrimental to the goals of reaching attainment with the federal ambient air quality standards.

Facility Name: J.R. Simplot Company; District Facility #C-705
This facility produces fertilizers. The NH3 emissions from this facility are associated with the Nitric acid production plant at the facility. Although ammonia is used in the production of nitric acid, the vast majority of the ammonia introduced is consumed in the production of the nitric acid or recovered. The ammonia emissions from the nitric acid are the result of the use of a non-selective catalytic reduction (NSCR) system to reduce NOx emissions from the nitric acid plant. The tail gas from nitric acid plants contains large amounts of NOx and this plant uses NSCR to reduce NOx to comply with 40 CFR 60 Subpart G (Standards of Performance for Nitric Acid Plants) and federally-enforceable New and Modified Source Review (NSR) limits. The NSR permit for this facility includes conditions minimizing the allowable amount of NH3 slip with associated

emissions testing. Because the NH3 emissions are the direct result of the use of NSCR, which is required to comply with federal NSPS and NSR requirements, and reducing the amount of NH3 would increase NOx emissions, this facility is considered to satisfy BACM and MSM for NH3.

Facility Name: Covanta Delano Inc.; District Facility #S-75
This facility is a biomass power plant. The NH3 emissions from this facility are the result of the use of NH3 injection for Selective Non-Catalytic Reduction (SNCR) to control NOx from two biomass-fired boilers at the facility. Use of the SNCR to reduce NOx is required by the EPA-issued Prevention of Significant Deterioration (PSD) Permit PSD ATC SJ 90-01 and federally-enforceable NSR conditions and also required to comply with 40 CFR 60 Subpart Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units). The NSR permits state, "*Ammonia shall be injected into boiler at a rate, in pounds per ton of biomass fuel introduced into boiler, which results in compliance with the NOx emission limitation.*" Permit PSD ATC SJ 90-01 states "… *A SNCR system utilizing ammonia injection shall be incorporated within the boilers. Ammonia shall be injected continuously during all periods of operation at a rate which results in compliance with the NOx emission limits.*" Because a perfect reaction cannot be achieved, some excess NH3 must be injected in the boiler stacks to reduce NOx to acceptable levels and this excess unreacted NH3 escapes the stack as slip. The facility incurs a cost for all of the NH3 injected into the boiler stacks, so there is an incentive to minimize NH3 slip to reduce costs associated with compliance with the NOx limits. In addition, the NSR permits for the biomass-fired boilers include conditions limiting the allowable amount of NH3 slip.

The NH3 emissions from the biomass boilers are the direct result of the use of SNCR, which is required by NSR conditions and the EPA-issued PSD Permit PSD ATC SJ 90-01 and required to comply with the requirements of Federal NSPS. The NSR permits for the biomass-fired boilers include conditions limiting the allowable amount of NH3 slip with associated emissions testing, and further reducing the amount of NH3 could potentially increase NOx emissions; therefore, this facility is considered to satisfy BACM and MSM for NH3.

Facility Name: Northern California Power; District Facility #N-2697
This facility is a natural gas power plant. The NH3 emissions from this facility are the result of the use of NH3 injection for Selective Catalytic Reduction (SCR) to control NOx from two natural gas-fired turbines at the facility. Use of the SCR to reduce NOx is required by federally-enforceable NSR conditions and also required to comply with the federally-enforceable requirements of District Rule 4703 (Stationary Gas Turbines), which is included in the SIP. Because a perfect reaction cannot be achieved, some excess NH3 must be injected to reduce NOx to acceptable levels. The excess unreacted NH3 escapes the stack as slip. The facility incurs a cost for all of the NH3 injected into the stacks, so there is an incentive to minimize NH3 slip to reduce costs associated with the compliance with the NOx limits. In addition, the NSR permits for the natural gas-fired turbines include conditions limiting the allowable amount of NH3 slip.

The $NH_3$ emissions from the natural gas-fired turbines are the direct result of the use SCR, which is required by NSR conditions and required to comply with the federally-enforceable requirements of District Rule 4703. The NSR permits for the natural gas-fired turbines include conditions limiting the allowable amount of $NH_3$ slip and associated emissions testing, and further reducing the amount of $NH_3$ could potentially increase $NO_x$ emissions; therefore, this facility is considered to satisfy BACM and MSM for $NH_3$.

**Conclusion**

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that major sources of ammonia in the Valley satisfy BACM and MSM requirements for $NH_3$. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures.

**Table C-37 Emission Inventory Codes**

| Control Measure | Emission Inventory Codes |
|---|---|
| **Rule 4103** (Open Burning) | 670-660-0262-9842; 670-660-0262-9862; 670-660-0262-9874; 670-660-0262-9884; 670-660-0262-9888; 670-660-0262-9892; 670-662-0262-9878; 670-668-0200-9858; 670-668-0200-9872; 670-668-0200-9886; 670-995-0240-9848 |
| **Rule 4104** (Reduction of Animal Matter) | 420-995-6004-0000 |
| **Rule 4106** (Prescribed Burns) | 670-666-0200-0000; 670-670-0200-0000 |
| **Rule 4203** (Particulate Matter Emissions from the Incineration of Combustible Refuse) | 010-005-0243-0000 |
| **Rule 4204** (Cotton Gins) | 420-418-6028-0000; 420-420-6028-0000 |
| **Rule 4301** (Fuel Burning Equipment) | |
| **Rule 4307** (Boilers, Steam Generators and Process Heaters 2 – 5 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<br>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. |
| **Rule 4308** (Boilers, Steam Generators and Process Heaters 0.075 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. |

| Control Measure | Emission Inventory Codes |
|---|---|
| **Rule 4309** (Dryers) | 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; 130-132-0130-0000; 130-132-0136-0000; 310-320-0010-0000; 310-320-0110-0000; 310-320-0120-0000; 310-320-0130-0000; 310-320-0136-0000; 310-320-1600-0000; 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** (AERO for Boilers, Steam Generators, and Process Heaters >5 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; 060-005-0264-0000 |
| **Rule 4354** (Glass Melting Furnaces) | 460-460-7037-0000; 460-460-7038-0000; 460-460-7039-0000 |
| **Rule 4550** (Conservation Management Practices) | 620-614-5400-0000; 620-615-5400-0000;650-650-5400-0000; 650-651-5400-0000 |
| **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 4692** (Commercial Charbroiling) | 690-680-6000-0000 |
| **4693** (Bakery Ovens) | 420-412-6012-0000; 420-412-6037-0000 |
| **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; 060-045-0110-0000; 060-045-1200-0000 |
| **Rule 4802** (Sulfuric Acid Mist) | 410-400-2058-0000 |

| Control Measure | Emission Inventory Codes |
|---|---|
| **Rule 4901** (Wood Burning Fireplaces and Wood Burning Heaters) | 610-600-0230-0000; 610-602-0230-0000 |
| **Rule 4902** (Residential Water Heaters) | 610-608-0110-0000 |
| **Rule 4905** (Natural Gas – Fired, Fan Type Residential Central Furnace) | 610-606-0110-0000 |
| **Rule 8011** (General Requirements) | There is no specific emissions inventory associated with Rule 8011. |
| **Rule 8021** (Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities) | 630-622-5400-0000; 630-624-5400-0000; 630-626-5400-0000; 630-628-5400-0000; 630-634-5400-0000 |
| **Rule 8031** (Bulk Materials) | 430-436-7006-0000; 430-436-7078-0000; 430-995-7064-0000 |
| **Rule 8041** (Carryout and Trackout) | The EICs are included in Rule 8061 (Paved and Unpaved Roads). |
| **Rule 8051** (Open Areas) | 650-652-5400-0000 |
| **Rule 8061** (Paved and Unpaved Roads) | 640-635-5400-0000; 640-637-5400-0000; 640-639-5400-0000; 640-641-5400-0000; 640-643-5400-0000; 645-638-5400-0000; 645-640-5400-0000; 645-644-5400-0000; 645-648-5400-0000 |
| **Rule 8071** (Unpaved Vehicle Traffic) | 645-645-5400-0000; 645-647-5400-0000.<br>The ARB Emissions Inventory database does not contain emissions data on unpaved vehicle and equipment traffic areas. |
| **Rule 8081** (Ag Sources) | 645-646-5400-0000 |

| Control Measure | Emission Inventory Codes |
|---|---|
| **SC 001** (Source Category: Lawn Care Equipment) | 860-902-1100-4065; 860-902-1100-4094; 860-902-1100-4095; 860-902-1100-4102; 860-902-1100-4103; 860-902-1100-4112; 860-902-1100-4113; 860-902-1100-4124; 860-902-1100-4125; 860-902-1100-5672; 860-902-1100-5673; 860-902-1100-5684; 860-902-1100-5685; 860-902-1100-5692; 860-902-1100-5693; 860-902-1100-5704; 860-902-1100-5705; 860-902-1100-5724; 860-902-1100-5725; 860-902-1100-7604; 860-902-1100-7605; 860-902-1100-7614; 860-902-1100-7615; 860-902-1100-8104; 860-902-1100-8105; 860-902-1100-8112; 860-902-1100-8113; 860-902-1100-8344; 860-902-1100-8345; 860-902-1100-8352; 860-902-1100-8353; 860-902-1100-8364; 860-902-1100-8365; 860-902-1100-8372; 860-902-1100-8373; 860-902-1100-8384; 860-902-1100-8385; 860-902-1100-9074; 860-902-1100-9075; 860-902-1100-9542; 860-902-1100-9543; 860-902-1100-9554; 860-902-1100-9555; 860-902-1100-9834; 860-902-1100-9835; 860-903-1100-1394; 860-903-1100-1395; 860-903-1100-1404; 860-903-1100-1405; 860-903-1100-4084; 860-903-1100-4085; 860-903-1100-5744; 860-903-1100-5745; 860-903-1100-5754; 860-903-1100-5755; 860-903-1210-1190; 860-903-1210-1200; 860-903-1210-1210; 860-903-1210-1220; 860-903-1210-1230; 860-903-1210-1240; 860-903-1210-1250; 860-903-1210-1350; 860-903-1210-1380; 860-903-1210-4050; 860-903-1210-4070; 860-903-1210-4130; 860-903-1210-4140; 860-903-1210-4150; 860-903-1210-5710; 860-903-1210-5730; 860-903-1210-8390; 860-903-1210-8400; 860-903-1210-8410 |
| **SC 002** (Energy Efficiency) | None |
| **SC 003** (Fireworks) | None |
| **SC 004** (Sand and Gravel Operations) | 430-422-7078-0000; 430-426-0210-0000; 430-426-7078-0000; 430-426-7092-0000 |
| **SC 005** (Asphalt/Concrete Operations) | 430-424-7006-0000; 430-424-7050-0000; 430-429-7016-0000; 430-430-7016-0000; 430-430-7018-0000; 430-436-7006-0000; 430-995-7006-0000; 430-995-7012-0000; 430-995-7016-0000; 430-995-7018-0000; 430-995-7050-0000; 430-995-7072-0000 |
| **SC 006** (Almond Hulling/Shelling Operations) | 420-418-6003-0000 |
| **SC 007** (Pistachio Hulling/Shelling Operations) | The EIC is included in SC 006 |
| **SC 008** (Agricultural Material Screening/Shaking Operations) | None |
| **SC 009** (Tub Grinding Operations) | None |
| **SC 010** (Abrasive Blasting) | 430-428-6084-0000; 430-428-7000-0000; 430-428-7036-0000; 430-428-7078-0000; 430-428-7084-0000; 430-428-7088-0000; 430-428-7090-0000 |
| **SC 011** (Bakery Ovens) | N/A |

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# Appendix D

BACM and MSM for Mobile Sources
(Provided by ARB)

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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**Air Resources Board Mobile Source Control Program**
**Best Available Control Measures and Most Stringent Measures Assessment**

**Overview**

Given the severity of California's air quality challenges and the need for ongoing emission reductions, the Air Resources Board (ARB) has implemented the most stringent mobile source emissions control program in the nation. ARB's comprehensive program relies on four fundamental approaches:

- stringent emissions standards that minimize emissions from new vehicles and equipment;
- in-use programs that target the existing fleet and require the use of the cleanest vehicles and emissions control technologies;
- cleaner fuels that minimize emissions during combustion; and,
- incentive programs that remove older, dirtier vehicles and equipment and pay for early adoption of the cleanest available technologies.

This multi-faceted approach has spurred the development of increasingly cleaner technologies and fuels and achieved significant emission reductions across all mobile source sectors that go far beyond national programs or programs in other states. These efforts extend back to the first mobile source regulations adopted in the 1960s, and pre-date the federal Clean Air Act Amendments (Act) of 1970, which established the basic national framework for controlling air pollution. In recognition of the pioneering nature of ARB's efforts, the Act provides California unique authority to regulate mobile sources more stringently than the federal government by providing a waiver of preemption for its new vehicle emission standards under Section 209(b). This waiver provision preserves a pivotal role for California in the control of emissions from new motor vehicles, recognizing that California serves as a laboratory for setting motor vehicle emission standards. Since then, the ARB has consistently sought and obtained waivers and authorizations for its new motor vehicle regulations. ARB's history of progressively strengthening standards as technology advances, coupled with the waiver process requirements, ensures that California's regulations remain the most stringent in the nation. A list of regulatory actions ARB has taken since 1985 is provided at the end of this analysis to highlight the scope of ARB's actions to reduce mobile source emissions.

As a result of these efforts, ARB's programs to reduce emissions from passenger vehicles have resulted in vehicles on the road today that are significantly cleaner than they were twenty years ago. ARB's groundbreaking Advanced Clean Cars program is now providing the next generation of emission reductions in California, and ushering in a new zero emission passenger transportation system. In addition, California has adopted in-use regulations aimed at reducing emissions from on-road and off-road diesel engines by accelerating the penetration of the cleanest emission technologies into these fleets. Cleaner burning fuels also play an important role in reducing emissions from motor vehicles and engines as ARB has adopted a number of more stringent standards for fuels sold in California, including the Reformulated Gasoline program, low sulfur diesel requirements, and the Low Carbon Fuel Standard. These fuel standards, in combination with engine technology requirements, ensure that California's transportation system achieves the most effective emission reductions possible.

In addition to these regulatory efforts, ARB and the San Joaquin Valley Air Pollution Control District (District) implement incentive programs that invest significant amounts of funding to accelerate the purchase of cleaner technologies beyond those achieved by regulations alone. Combined, California's incentive programs have provided hundreds of millions of dollars dedicated to reducing emissions from both on- and off-road vehicles and equipment.

ARB and the District both operate highly effective and comprehensive incentive programs. Two of ARB's largest programs are the Proposition 1B (Prop 1B): Goods Movement Emission Reduction Program, and the Carl Moyer Memorial Air Quality Standards Attainment Program (Moyer). Eligible projects span the mobile source sector, and include cleaner on-road and off-road vehicles and equipment, marine, locomotive, lawn and garden, light-duty passenger vehicles, and agricultural equipment. To date, as part of Prop 1B ARB has awarded $718 million over multiple fiscal years to nine local agencies across the state that are impacted by freight movement, and $980 million under the Moyer program. Of these funds, $145 million each in Prop 1B and $145 million in Moyer (including matching funds) were awarded in the San Joaquin Valley. In addition to ARB's incentive funding, the District provides its own funding such as the Indirect Source Review and Voluntary Emission Reduction Agreements and Local Motor Vehicle Surcharge Fees. To date, the District has provided over $600 million in incentive funding, with a combined District and grant recipients matching funds investment of $1.2 billon. These programs help advance the pace of clean technology penetration, and provide for the most cost-effective, feasible degree of emission reductions possible.

The remainder of this document contains a description of State Implementation Plan (SIP) requirements related to assessment of emission control programs. This is followed by a demonstration of how the comprehensive scope of California's current mobile source control program, through a combination of emission standards, in-use requirements, cleaner fuel formulations, and incentive programs, represents the most stringent and far-reaching level of control being implemented in the United States today.

**BACM/MSM Requirements**

The particulate matter provisions in the Act specify a step-wise process for the required level of emission control in a SIP, depending upon the severity of the air quality problem and amount of time a nonattainment area needs to meet the PM2.5 standard. For a moderate PM2.5 nonattainment area the Act requires SIPs to provide for the implementation of all reasonably available control measures (RACM) as expeditiously as practicable, including at minimum reasonably available control technologies.
U.S. EPA has interpreted RACM to be those emission control measures that are

technologically and economically feasible and when considered in aggregate, would advance the attainment date by at least one year.

For a serious nonattainment area, best available control measures (BACM) are the required level of control. BACM is required for those sources with emissions that are a significant contributor to the nonattainment problem. U.S. EPA defines BACM to be the maximum degree of emission reductions achievable from a source or source category determined on a case-by-case basis considering energy, economic, and environmental impacts.

Following U. S. EPA guidance, the District developed a BACM significance level for sulfur oxides, nitrogen oxides, and PM2.5 combustion emissions (Table 1). The following mobile source categories in the San Joaquin Valley have emissions above NOx and PM2.5 significance levels: light- and medium-duty vehicles, heavy-duty vehicles, off-road vehicles, and farm equipment. None of the mobile source categories were above the significance level for SOx.

**Table 1**
**BACM Significance Levels**

| Emissions | Level of Significance (tpd) |
|---|---|
| Sulfur Oxide (SOx) Emissions | 1.0 |
| Nitrogen Oxide (NOx) Emissions | 13.1 |
| PM2.5 Combustion Emissions | 1.4 |

Serious areas that cannot achieve the standard by the serious area attainment date are allowed to request a five-year extension if they have BACM in place and the SIP demonstrates it includes most stringent measures (MSM). The Act specifies that MSM is the maximum degree of emission reduction that has been required or achieved from a source or source category in other SIPs or in practice in other states and can feasibly be implemented in the area.

**Review of ARB's Mobile Source Programs**

ARB conducted a BACM/MSM assessment for the mobile source categories under ARB's regulatory authority. Ocean Going Vessels have de minimis emission levels in the Valley and aircraft and locomotives are controlled at the federal level; therefore these sources were not included in this analysis. For the remaining mobile source categories, this assessment included:

- Documentation of California waivers and authorizations;
- Description of the scope and stringency of California's regulations and comparison to programs implemented at the federal level or in other states;
- Documentation of states that have been granted waivers to adopt California rules; and,

- Discussion of incentive programs and other initiatives that go beyond regulatory requirements to provide an enhanced level of emission reductions.

The results of this evaluation are described in the sections that follow.

***Waiver Approvals***

While the Act preempts most states from adopting emission standards and other emission-related requirements for new motor vehicles and engines, it allows California to seek a waiver or authorization from the federal preemption to enact emission standards and other emission-related requirements for new motor vehicles and engines and new and in-use off-road vehicles and engines, except for locomotives and engines used in farm and construction equipment which are less than 175 horsepower (hp). Over the years, California has received waivers and authorizations for over 100 regulations. The most recent California standards and regulations that have received waivers and authorizations are listed in Tables 2 and 3 below.

**Table 2**
**ARB Emission Standards Waivers**

| | |
|---|---|
| **Light- and Medium-Duty** | |
| Advanced Clean Cars (including ZEV and LEV III) | |
| **Heavy-duty** | |
| On-Board Diagnostics | Engine Manufacturer Diagnostics |
| Heavy-Duty Idling | Diesel Engine Standard |
| Malfunction and Diagnostics System | Gasoline Standard |

**Table 3**
**ARB Emission Standards Authorizations**

| | |
|---|---|
| **Heavy-Duty** | |
| Heavy-Duty Idling | New Compression Ignition Off-Road Engines |
| In-Use Off-Road Diesel Fleets | Yard Truck Regulation |
| Large Spark Ignition Fleet | Transport Refrigeration Unit (TRU) |
| Mobile Cargo Handling Equipment | Truck & Bus Regulation* (Off-road yard trucks and two-engine sweepers) |
| **Other** | |
| Off-Highway Recreational Vehicles | Portable Airborne Toxic Control Measures |
| Portable Equipment Registration Program | Small Off-Road Engines (Utility Lawn and Garden) |

* On May 23, 2013, ARB obtained an authorization from U.S. EPA to enforce adopted emission standards for off-road engines used in yard trucks and two-engine sweepers. ARB adopted the off-road emission standards as part of its “Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,” (commonly referred to as the Truck and Bus Regulation). The bulk of the regulation applies to in-use (non-new) heavy-duty diesel on-road motor vehicles with a gross vehicle weight rating (GVWR) in excess of 14,000 pounds, which are not subject to preemption under CAA section 209(a) and do not require a waiver under section 209(b).

### *Light- and Medium-Duty Vehicles*

The light- and medium-duty vehicle category is composed of passenger cars, light-duty trucks, and medium-duty trucks. This category is considered significant for the purpose of BACM, and current emissions are shown in Table 4 below.

**Table 4**
**Emissions from Light- and Medium-Duty Vehicles in the San Joaquin Valley**

| ARB Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Light-Duty Passenger** | 10.5 | 1.0 |
| **Light-Duty Truck 1** | 3.2 | 0.1 |
| **Light-Duty Truck 2** | 7.7 | 0.4 |
| **Medium-Duty Trucks** | 10.8 | 0.4 |
| **Total** | 32.2 | 1.9 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

ARB has a long history of programs addressing light- and medium-duty vehicles, dating back to the 1960s when California adopted the first tailpipe emission standards for hydrocarbons and carbon monoxide in the nation. ARB's current efforts encompass stringent emission standards and fuels regulations, requirements for on-board diagnostics, initiatives to facilitate a transformation of California's fleet to zero emissions technologies, and incentive programs to accelerate the retirement of older, dirtier vehicles and support development of a market for zero-emission vehicles.

Light- and medium-duty vehicles are currently regulated under California's Low-Emission Vehicle III (LEV III) and Zero-Emission Vehicle (ZEV) programs that are incorporated in the Advanced Clean Cars program. The Board established California's Low-Emission Vehicle (LEV) program in 1990 and the second-generation LEV II program in 1998. The LEV regulations established increasingly stringent tailpipe standards for passenger cars and trucks each model year through 2025. As a result, today's new vehicles are over 99 percent cleaner than their uncontrolled counterparts. In March 2014, U.S. EPA set Tier 3 standards for passenger vehicles that harmonized with California's LEV III standards.

ARB's Advanced Clean Cars (ACC) Program, approved in January 2012, is a pioneering approach of a 'package' of regulations, that while separate in construction, are related in terms of the synergy developed to address both ambient air quality needs and climate change goals. The ACC program combines the control of smog and soot causing pollutants, and greenhouse gas emissions into a single coordinated package of requirements for model years 2015 through 2025. In 2025, cars under the ACC program will emit 75 percent less smog-forming pollution than the average new car sold in 2012.

Additionally, ARB's ZEV regulation for passenger cars and light-duty trucks, first adopted as part of the original LEV program in 1990, has spurred commercialization of advanced clean cars and light-duty trucks. The ZEV regulation focuses primarily on zero-emission technology – battery electric vehicles, hydrogen fuel cell vehicles, and plug-in hybrid electric vehicles – in order to ensure that these low-emission technology vehicles transition from demonstration phase to full commercialization in a reasonable timeframe to meet long-term emission reductions goals. Conventional hybrid electric vehicles have now gained a significant market share in California, and the number of models offered for sale continues to expand. In-state ZEV ownership surpasses that of any other state or nation, and Californians own 40 percent of all ZEVs on the road in America. In addition, an increasing number of battery electric vehicles and plug-in hybrid electric vehicles have been introduced for sale, and fuel cell electric vehicles are beginning to be commercialized.

The LEV III element of the ACC program includes increasingly stringent criteria pollutant emission requirements for light-duty vehicles from 2015 through 2025. When fully phased-in, these requirements will achieve near-zero emission levels from new light-duty vehicles. In addition, the ACC program included amendments affecting the current ZEV regulation through the 2017 model year in order to enable manufacturers to successfully meet 2018 and subsequent model year requirements. The ZEV amendments for 2018 and subsequent model years in the ACC program are intended to achieve commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions.

The ACC Program will produce increasing benefits over time as new cleaner cars enter the fleet, displacing older and dirtier vehicles. In this manner, the benefits in 2023 will be realized through the cumulative reduction in emissions achieved by new cars entering the fleet in 2017 through 2023. This program will continue to provide benefits well after 2023 as vehicles meeting the new standards replace older, higher-emitting vehicles.

In addition, in 2012 Governor Brown issued an Executive Order establishing a goal of 1.5 million zero-emission vehicles on the road by 2025. The Executive Order directed the ARB to work with the California Energy Commission and the California Public Utilities Commission to establish benchmarks for ensuring the necessary charging infrastructure, and also specified that California's state vehicle fleet increase the number of its zero-emission vehicles through the normal course of fleet replacement so that at least 10 percent of fleet purchases of light-duty vehicles be zero-emission by 2015 and at least 25 percent of fleet purchases of light-duty vehicles be zero-emission by 2020.

Cleaner burning fuels are also integral to reducing emissions. California’s Reformulated Gasoline program (CaRFG) sets stringent standards producing cost-effective emission reductions from gasoline-powered vehicles. The CaRFG program was implemented in three increasingly more stringent phases. The final and current phase, Phase 3 CaRFG, eliminated methyl-tertiary-butyl-ether from California gasoline.

ARB is also active in implementing programs for consumers with older dirtier vehicles to retire them early. Replacing older, dirtier vehicles with new vehicles provides permanent emission reductions and accelerates the introduction of the cleanest technologies. ARB’s voluntary vehicle retirement or “car scrap” programs, like the Enhanced Fleet Modernization Program (EFMP), provide monetary incentives of $1,500 to vehicle owners to retire older, more polluting vehicles, and up to $9,000 for low-income consumers to scrap and replace their vehicle with a zero-emission vehicle. Approximately $30 million is available annually through 2015 to fund the EFMP via a $1 increase in vehicle registration fees. ARB developed the program in consultation with Bureau of Automotive Repair (BAR). The program is jointly administered by both BAR (for vehicle retirement) and the local air district (for vehicle replacement). In addition, ARB's Clean Vehicle Rebate Project is designed to promote the purchase of new battery electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles. Rebates of up to $5,000 per light-duty vehicle are available and approximately 90,000 rebates have been issued to date, totaling nearly $200 million in the State.

Other programs, in addition to vehicle retirement programs, help clean up the light-duty fleet. The Air Quality Improvement Program (AQIP), established by AB 118, is an ARB voluntary incentive program to fund clean vehicle and equipment projects. The Clean Vehicle Rebate Project (CVRP) is one of the current projects under AQIP. CVRP, started in 2009, is designed to accelerate widespread commercialization of zero-emission vehicles and plug-in hybrid electric vehicles by providing consumer rebates up to $2,500 to partially offset the higher cost of these advanced technologies.

As a result of ARB's efforts, and as provided for in the Act, a number of other states have now adopted ARB's LEV III and ZEV programs as listed below in Table 5. These states are also known as the "Section 177 States" in reference to this provision of the Act.

**Table 5**
**State's Adoption of ARB's Light- and Medium-Duty Vehicle Regulations**

| Section 177 States | 2012 ZEV | 2012 LEVIII |
|---|---|---|
| **Connecticut** | X | X |
| **Delaware** | | X |
| **Maine** | X | X |
| **Maryland** | X | X |
| **Massachusetts** | X | X |
| **New Jersey** | X | X |
| **New York** | X | X |
| **Oregon** | X | X |
| **Pennsylvania** | | X |
| **Rhode Island** | X | X |
| **Washington** | | X |
| **Vermont** | X | X |

Taken together, California's comprehensive suite of emission standards, fuel specifications, and incentive programs for on-road light- and medium-duty vehicles represent the most stringent level of control and achieve the maximum feasible emission reductions for this category in the nation.

### *Heavy-Duty Vehicles*

The heavy-duty vehicles category is composed of heavy-duty gas and diesel trucks, heavy-duty gas and diesel urban buses, school buses, and motor homes. Emissions from heavy-duty diesel trucks in the San Joaquin Valley are a significant BACM category (Table 6).

**Table 6**
**Emissions from Heavy-Duty Vehicles in SJV**

| Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Heavy Heavy-Duty Diesel Trucks** | 120.5 | 4.0 |
| **Medium Heavy-Duty Diesel Trucks** | 18.1 | 0.8 |
| **Total** | 138.6 | 4.8 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

California also has the most stringent and successful heavy-duty vehicle emissions control program in the nation. These regulatory efforts include not only requirements for increasingly tighter new engine standards, but also address vehicle idling, certification procedures, on-board diagnostics, and emissions control device verification. More stringent diesel fuel requirements further ensure that diesel engines are operating as cleanly as possible. The ARB has also adopted in-use requirements that provide substantial further emission reductions beyond those occurring anywhere else in the nation. These in-use requirements began with a focus on public fleets and solid waste collection vehicles, followed by drayage trucks, and now encompass all trucks operating in California. Together, they are designed to achieve an on-road heavy-duty diesel fleet with 2010 engine standards years ahead of a normal vehicle attrition rate. Substantial investments in incentive programs are providing further reductions by accelerating the turnover of the fleet ahead of regulatory requirements.

Examples of ARB's most recent regulations and efforts that provide for significant reductions well beyond current federal programs or programs in other states are listed below.

New Vehicle Standards

- Engine standards for 2007 and Subsequent Model Year Heavy-Duty Diesel Engines/Vehicles;
- 2005 Not-to-Exceed and Euro III European Stationary Source Cycle Supplemental Test Procedures;
- Heavy-Duty Vehicle and Engine Certification;
- Optional Reduced Emissions Standards for Heavy-Duty Engines;
- Heavy-Duty Hybrid Electric Vehicle Certification Procedures; and
- Heavy-Duty Vehicle and Engine On-Board Diagnostics Requirements.

A central element of ARB's heavy-duty diesel vehicle program is increasingly stringent standards for new trucks and urban buses, as shown in the Table 7. Through implementation of these standards, new heavy-duty trucks sold since 2010 emit 98 percent less NOx and PM2.5 than new trucks sold in 1986.

**Table 7**
**Phase-in of Truck Engine Standards**

| **Model Year** | **Applicable Standard (g/bhp-hr)** | |
|---|---|---|
| | **NOx** | **PM** |
| **1986 and older** | 10.7 | 0.60 |
| **1987-2006** | From 6.0 to 2.0 | From 0.6 to 0.1 |
| **2007-2009** | 1.1 | 0.01 |
| **2010** | 0.2 | 0.01 |

On August 26, 2005, ARB obtained a waiver from the federal preemption for the Engine standards for 2007 and Subsequent Model Year Heavy-Duty Diesel Engines/Vehicles regulation, generally aligning California's standards with the federal standards for 2007 and subsequent model year vehicles and engines. Thus California's current standards are equal to or more stringent than current federal standards.

Most recently, in ongoing efforts to go beyond federal standards and achieve further reductions, ARB adopted the Optional Reduced Emissions Standards for Heavy-Duty Engines regulation in 2014. This regulation establishes the new generation of optional NOx emission standards for heavy-duty engines which are 50 percent, 70 percent, and 90 percent lower than the current primary standard of 0.2 g/bhp-hr.

Requirements for vehicle certification demonstrate that emission control systems are durable, and that the exhaust emissions and evaporative emissions, as applicable, comply with the regulatory standards for the duration of the required useful life of the product. This demonstration is accomplished through durability and certification testing of the prototype certification engine or vehicle. Such demonstrations include the 2005 Not-to-Exceed and Euro III European Stationary Source Cycle Supplemental Test Procedures, Heavy-Duty Hybrid Electric Vehicle Certification Procedures, and Heavy-Duty Vehicle and Engine On-Board Diagnostics Requirement. These test procedures require the control of emissions during the majority of real world operating conditions, ensuring that in the future defect devices will no longer be employed and determining that vehicles are, in fact, heavy-duty hybrid electric vehicles. Finally, the Heavy-Duty Vehicle and Engine On-Board Diagnostics Requirement detect emission control system malfunctions as they occur by monitoring virtually every component and system that can cause increases in emissions.

While these requirements collectively ensure that new vehicles are as clean as possible, older, higher-emitting heavy-duty vehicles with long service lives can remain on the road for many years. To address this legacy fleet, ARB has adopted heavy-duty vehicle in-use control measures to significantly reduce PM2.5 and NOx emissions from existing diesel vehicles operating in California. These recent in-use control measures include:

- On-Road Heavy-Duty Diesel Vehicle (In-Use) Regulation;
- Drayage (Port or Rail Yard) Regulation;
- Public Agency and Utilities Regulation;
- Solid Waste Collection Vehicle Regulation;
- Heavy-Duty (Tractor-Trailer) Greenhouse Gas Regulation;
- ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling;
- Heavy-Duty Diesel Vehicle Inspection Program;
- Periodic Smoke Inspection Program;
- Fleet Rule for Transit Agencies;
- Lower-Emission School Bus Program; and
- Heavy-Duty Truck Idling Requirements.

Many of these ARB's in-use regulations focus on fleets by trade such as the Drayage, Public Agency and Utilities, and Solid Waste Collection Vehicle Regulations. Each of these regulations focuses on the unique duty cycles of these trades to maximize the emission reduction effectiveness. Along with these in-use trade-specific regulations, ARB also adopted the Periodic Smoke Inspection Program (PSIP) and Heavy-Duty Truck Idling Requirements. The PSIP requires that diesel and bus fleet owners conduct annual smoke opacity inspections of their vehicles and repair those with excessive smoke emissions to ensure compliance. As a follow up to the ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling, ARB approved the Heavy-Duty Truck Idling Requirements to further reduce emissions from NOx and PM2.5 by limiting idling of new and in-use sleeper berth equipped diesel trucks.

ARB's bus program is composed of the transit bus fleet rule, school bus idling program, and the lower-emission school bus program. Adopted in 2000, the Fleet Rule for Transit Agencies (Transit Fleet Rule) requires reductions in emissions from urban buses and transit fleet vehicles. In effect since 2003, the school bus airborne toxic control measure has limited bus and commercial motor vehicle idling near schools or at school bus destinations. The lower-emission school bus program provides grant funding for new, safer school buses and to install air pollution control equipment that are already on the road.

ARB's Cleaner In-Use Heavy-duty Truck Regulation (Truck and Bus Regulation) is one of the most significant elements in this suite of recent actions. This measure leverages the benefits provided by new truck emission standards by accelerating introduction of the cleanest trucks. The Truck and Bus Regulation was adopted in December 2008, and amended in December 2010 and December 2014. The rule represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available.

Starting in 2012, the Truck and Bus Regulation phases in requirements so that by 2014, nearly all vehicles operating in California will have PM emission controls, and by 2023 nearly all vehicles will meet 2010 model year engine emissions levels. The regulation applies to nearly all diesel fueled trucks and buses with a gross vehicle weight rating greater than 14,000 pounds that are privately or federally owned, including on-road and off-road agricultural yard goats, and privately and publicly owned school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases or rents affected vehicles. The regulation also establishes requirements for any in-state or out-of-state motor carrier, California-based broker, or any California resident who directs or dispatches vehicles subject to the regulation. Finally, California sellers of a vehicle subject to the regulation must disclose the regulation's potential applicability to buyers of the vehicles.

To further encourage the replacement of dirtier vehicles/engines with cleaner ones, ARB and the District have made extensive investments in incentive programs. The Proposition 1B: Goods Movement Reduction Program is a partnership between ARB and agencies to reduce air pollution emissions and health risk from freight movement along California's trade corridors through incentives. The Carl Moyer Program is a voluntary grant program, for various vehicles including on-road heavy-duty, which reduces air pollution from vehicles and equipment by providing incentive funds to private companies and public agencies to purchase cleaner-than-required engines, equipment, and emission reduction technologies. 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 Prop 1B. The District contracts with Valley dealerships and makes the review and approval process efficient and streamlined to provide vouchers to truck operators.

Only one other state, Texas, has received SIP credit for emission reductions from incentive programs. The Texas Clean Fleet Program encourages large fleets in Texas to replace light- and heavy-duty on-road diesel vehicles with alternative fuel vehicles. The Texas program currently has two-year funding of approximately $7.7 million. By comparison, in the San Joaquin Valley, $32 million is available for Prop 1B projects in the 2013/14 fiscal year and $12 million will be available for Carl Moyer projects in the 2014/15 fiscal year. To date, the Prop1B program has scrapped and replaced old on-road trucks with over 2,000 cleaner trucks in the SJV while the Carl Moyer Program has replaced over 200 trucks.

In addition to new engine and in-use standards, cleaner burning fuels represent an important component in reducing emissions from heavy-duty diesel trucks. The California diesel fuel program sets stringent standards for diesel fuel sold in California and produces cost-effective emission reductions from diesel-powered vehicles. Diesel fuel regulations in California set fuel mixture specifications for aromatic hydrocarbons and sulfur, and establish a lubricity standard. The program applies to sales of fuel used in on-road vehicles and off-road vehicles and locomotives in California.

Similar to the light-duty sector, as provided for in the Act, a number of other states have followed California's lead and adopted at least one of California's heavy-duty regulations. These states are listed below in Table 8.

**Table 8**
**States Adoption of ARB's Heavy-Duty Vehicle Regulation**

| Section 177 States | Heavy-Duty Diesel Engine Regulation |
|---|---|
| **Connecticut** | X |
| **Delaware** | X |
| **Georgia** | X |
| **Maine** | X |
| **Massachusetts** | X |
| **New Jersey** | X |
| **New York** | X |
| **North Carolina** | X |
| **Pennsylvania** | X |

In aggregate, ARB's heavy-duty diesel program goes beyond stringent tailpipe emission standards through in-use control measures, idling restrictions, certification and verification requirements, and the clean diesel fuel program. The in-use control measures are national models for aggressive and successful efforts to reduce in-use emissions and accelerate fleet turnover to cleaner engines. ARB's significant investment in incentive programs provides an additional mechanism to achieve maximum emission reductions from this source sector.

***Off-Road Vehicles and Engines***

The off-road equipment category is composed of off-road compression ignition (diesel) engines and equipment, small spark ignition off-road engines and equipment less than 25 hp (including lawn and garden equipment, and small industrial equipment), off-road large spark ignition (gasoline and liquefied petroleum gas) engines and equipment 25 hp and greater (including industrial equipment, forklifts, and portable generators), and airport ground support equipment. Requirements for the cargo handling equipment (CHE) subcategory are discussed separately. The off-road mobile source category is considered a significant BACM category (Table 9).

**Table 9**
**Emissions from Off-Road Equipment in SJV**

| Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Off-Road Equipment excluding CHE** | 19.2 | 1.1 |
| **Total** | 19.2 | 1.1 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

Similar to the on-road sectors, California has a comprehensive program for reducing emissions from off-road equipment that goes well beyond current requirements in place elsewhere in the nation. Regulations for off-road equipment include not only increasingly stringent standards for new off-road diesel engines, but also in-use requirements and idling restrictions. These in-use requirements are designed to accelerate the penetration of the cleanest equipment into California fleets beyond rates achieved elsewhere in the nation through new vehicle standards alone. Substantial investments in incentive programs are also facilitating additional turnover to cleaner engines to further maximize emission reductions.

New engine standard requirements vary according to the power rating of engines. Table 10 shows the schedule for phasing in tiered requirements for new off-road engines with a power rating between 175 and 300 hp. Beginning in 2014, new Tier 4 construction equipment with the power rating shown below must emit about 96 percent less NOx and PM than new Tier 1 equipment sold in the year 2000.

**Table 10**
**Phase-in of Off-Road Engine Standards**

| Model year | Level of Control | Applicable Emission Standard for New Off-road Engines 175<hp<300 g/bhp-hr | |
|---|---|---|---|
| | | NOx | PM |
| **1996-2002** | Tier 1 | 6.9 | 0.4 |
| **2003-2005** | Tier 2 | 4.9* | 0.15 |
| **2006-2010** | Tier 3 | 3.0* | 0.15 |
| **2011-2013** | Tier 4 interim | 1.5 | 0.015 |
| **2014+** | Tier 4 final | 0.3 | 0.015 |

*Reflects combined limit for non-methane hydrocarbons and NOx

U.S. EPA adopted the Tier 4 standards in May 2004. California's current standards were also adopted in 2004, and are equal in stringency to current federal standards.

However, large diesel off-road equipment typically remains in use for long periods of time. As with heavy-duty trucks, this long life means that newer, lower-emitting engines would be introduced into fleets relatively slowly. To address this, the Cleaner In-use Off-Road Equipment Regulation (Off-Road Regulation) was adopted in 2007, with amendments in 2010. U.S. EPA provided their authorization for this regulation in 2013.

Affected off-road equipment is used in construction, manufacturing, the rental industry, road maintenance, airport ground support, and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines.

The Off-Road Regulation is an extensive program designed to accelerate the penetration of the cleanest equipment into California's fleets. This regulation will significantly reduce emissions of diesel PM and NOx from the over 150,000 in-use off-road diesel vehicles that operate in California by requiring their owners to modernize their fleets and install exhaust retrofits. In 2015, this extensive program will have affected 10,447 vehicles used in 838 fleets by requiring owners to modernize their fleets by replacing older engines or vehicles with newer, cleaner models, retiring older vehicles or using them less often, or by applying retrofit exhaust controls.

The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The regulation also requires that all vehicles be reported to ARB and labeled, restricts the addition of older vehicles into fleets, and requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing verified exhaust retrofits. The requirements and compliance dates of the Off-Road Regulation vary by fleet size.

Funding from incentive programs such as Carl Moyer also provides an additional mechanism to achieve emission reductions from off-road sources. The Moyer Off-Road Voucher Incentive Program provides a streamlined approach to reduce emissions by replacing existing, high polluting equipment with newer, lower-emission equipment. The Moyer Program also provides incentives for off-road compression-ignition equipment, off-road large-spark equipment, and off-road equipment replacement.

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.

Finally, the Act allows other states to adopt ARB's regulations for off-road engine or off-road vehicles provided that such standards are identical to the ARB standards for which an authorization has been obtained. Other states are considering, but have not yet adopted, rules equivalent to the California off-road regulation.

The ARB first approved exhaust and evaporative emission standards for small off-road engines in 1990. This category includes handheld and nonhandheld lawn and garden and industrial equipment such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors. The 1990 regulations were implemented in two stages, with first tier standards taking effect in 1995 and second tier standards being implemented in 1999. In September 2003, ARB Board approved more stringent exhaust and evaporative standards for small off-road engines and also directed staff to evaluate the potential for the use of more zero-emissions equipment in this category.

In summary, California's off-road program goes beyond emission standards for new engines through comprehensive in-use requirements for legacy fleets. These in-use control measures are national models for aggressive and successful efforts to reduce in-use emissions and accelerate fleet turnover to cleaner engines. Similar to the on-road emission categories, incentive program funding provides an additional mechanism that achieves further emission reductions. Together, these approaches provide for the most stringent and comprehensive suite of emission reductions.

### *Farm Equipment*

The farm equipment category is composed of agricultural equipment that includes tractors, harvesting equipment, and sprayers and is considered a significant BACM category (Table 11).

**Table 11**
**Emissions from Farm Equipment in SJV**

| Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Farm Equipment** | 50.4 | 2.9 |
| **Total** | 50.4 | 2.9 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

As noted above, in 2004, U.S. EPA and California adopted equivalent standards that require additional reductions from off-road engines, including engines used in mobile agricultural equipment. These new engine standards will achieve substantial reductions in PM2.5 and NOx as new farm equipment is introduced into the fleet. Tier 4 engine technologies will not be introduced for all mobile agricultural equipment applications until about the 2020 timeframe. Therefore, to achieve maximum PM2.5 and NOx reduction benefits now, a significant investment in incentive funds is encouraging the mobile agricultural fleet in the San Joaquin Valley to upgrade to Tier 3 equipment, which will be further enhanced upon full introduction of Tier 4 engines. Since 2008, this effort has provided over $100 million in incentive funding for agricultural equipment from the Carl Moyer Program, District funding, and the USDA Natural Resources Conservation Service, contributing to the replacement of over 3000 pieces of equipment.

### *Cargo Handling Equipment*

As a subcategory of the off-road equipment category, cargo handling equipment (CHE) is used to transfer goods or perform maintenance and repair activities and includes equipment such as yard trucks (hostlers), rubber-tired gantry cranes, top handlers, side handlers, forklifts, and loaders at ports and intermodal rail yards. This category represents a small portion of the inventory and is not considered significant for BACM purposes (Table 12).

**Table 12**
**Emissions from Cargo Handling Equipment in SJV**

| Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Cargo Handling Equipment** | 0.1 | 0.0 |
| **Total** | 0.1 | 0.0 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

California's CHE regulation was adopted in 2005 and amended in 2011. ARB obtained authorization for the 2005 version of the regulation in 2012. ARB's CHE regulations set performance standards for engines in newly acquired, as well as in-use, mobile CHE at ports or intermodal rail yards in California. Prop 1B also funds cleaner port-related cargo handling equipment.

### *Other Mobile Sources*

The other mobile source category is composed of motorcycles, recreational boats, off-road recreational vehicles, and commercial harbor craft. This group of sources represents a small portion of the inventory and is not considered significant for BACM purposes (Table 13).

**Table 13**
**Emissions from Other Mobile Sources in SJV**

| Vehicle Category | NOx Emissions (tpd) | Direct PM2.5 Emissions (tpd) |
|---|---|---|
| **Motorcycles** | 1.0 | 0.0 |
| **Recreational Boats** | 1.6 | 0.4 |
| **Off-Road Recreational Vehicles** | 0.1 | 0.0 |
| **Commercial Harbor Craft** | 0.7 | 0.0 |
| **Total** | 3.4 | 0.5 |

Appendix B, 2015 Plan for the 1997 PM2.5 Standards

While representing a smaller share of the inventory, ARB has taken a comprehensive regulatory approach to provide ongoing emission reductions from sources in this sector. These efforts have focused on adoption of stringent new engine standards and ensuring that cleaner engines are introduced into the fleet at an accelerated pace.

Motorcycles for the most part are on-road two-wheeled, self-powered vehicles with engine displacements of 50 cubic centimeters (cc) or greater. First adopted in 1975, California's motorcycle regulation obtained its first waiver of preemption from U.S. EPA in 1976. ARB then obtained a waiver of preemption in 2006 for 1998 amendments. The 1975 regulation set emission standards for all motorcycles with engine displacements of at least 50 cc. The 1998 amendments affected only Class 3 motorcycles (280 cc or greater) and set a Tier I and Tier II standard for 2004 and 2008 model years, respectively. While ARB has the same emission standard as the federal standard, the California standard applies to engines starting in 2008 rather than 2010 under the federal requirement.

The recreational boat (marine) engine program is another important element in ARB's efforts to address emissions from all mobile source sectors. In 1998, ARB approved exhaust emission regulations for spark-ignition marine engines that accelerated implementation of the federal standards for 2006 engines for personal watercraft (PWC) and outboard (OB) marine engines in California to 2001. In 2001, ARB adopted Tier I and Tier II emission standards for inboard and stern-drive marine engines. In 2007, U.S. EPA granted California authorization to enforce ARB's regulations for OB/PWC engines and Tier I of the California inboard and stern-drive marine engine emissions standards. In 2011, U.S. EPA granted California authorization to enforce ARB's Tier II exhaust emission standards for spark ignited inboard and stern-drive marine engines. While ARB has the same exhaust emission standard as the federal standard, the California standard applies to engines starting in 2008 rather than 2010 under the federal requirement. In February 2015, ARB Board approved more stringent evaporative emission control design standards than those set forth by the U.S. EPA's 2008 rule for gasoline-fueled spark-ignition marine watercraft configured with engines greater than 30 kilowatts.

There are several types of commercial harbor craft (CHC) used in California, including crew and supply boats, charter fishing vessels, commercial fishing vessels, ferry/excursion vessels, pilot vessels, towboats or push boats, tug boats, and work boats. The CHC regulation pertains to the reduction of diesel PM and NOx. The Board adopted the first CHC regulation in 2007 that implemented in-use limits and upgraded engine requirements. For this regulation, ARB obtained an authorization of preemption in 2011 from U.S. EPA. In addition, the Board approved an amended CHC regulation in 2010, which extended the in-use engine requirements to other types of CHC, deleting certain exemptions, defining swing engines, clarifying certain in-use requirements, adding replacement engine exemptions, expanding compliance extension options, and allowing continued use of existing engines in certain circumstances. On November 24, 2014, U.S. EPA issued a notice of rulemaking for these amendments. Prop 1B also funds cleaner commercial harbor craft.

Off-road recreation vehicles or off-highway recreational vehicles (OHRV) primarily include off-highway motorcycles, all-terrain vehicles, and utility-terrain vehicles. In 1994, ARB adopted exhaust emission standards for OHRVs. At that time, there were no equivalent federal standards regulating exhaust emissions from the vehicles and engines covered by California's OHRV regulations. U.S. EPA granted authorization for ARB's 1994 OHRV regulations in 1996. ARB subsequently adopted three rounds of amendments to these regulations, the first in 1999, the second in 2003, and the third in 2006. All three amendments were granted authorization concurrently by U.S. EPA in 2014. In July 2013, ARB Board approved evaporative emission control standards for green sticker OHRVs.

The emission limits established for these other mobile source categories, coupled with U.S. EPA waivers and authorization of preemption establish that California's programs for motorcycles, recreational boats, off-road recreational vehicles, and commercial harbor craft sources meet the requirements for BACM and MSM and represent the most stringent and comprehensive approach for achieving ongoing emission reductions from these categories.

**Summary**

California's long history of comprehensive and innovative emissions control has resulted in the strongest mobile source control program in the nation. U.S. EPA has acknowledged the strength of these programs in their approval of ARB's regulations and through the waiver process. In addition, U.S. EPA has provided past determinations that ARB's mobile source control programs meet BACM and MSM requirements as part of their 2004 approval of the Valley's 2003 PM10 Plan:

> "We believe that the State's control programs constitute BACM at this time for the mobile source and fuels categories, since the State's measures reflect the most stringent emission control programs currently available, taking into account economic and technological feasibility."

Since then, ARB has continued to substantially enhance and accelerate reductions from our mobile source control programs through the implementation of more stringent engine emissions standards, in-use requirements, incentive funding, and other policies and initiatives as described in the preceding sections. These efforts not only ensure that all source sectors continue to achieve maximum emission reductions through implementation of the cleanest current technologies, but also promote the ongoing development of more advanced zero and near-zero technologies. As a result, California's mobile source control programs reflect the most stringent and feasible level of emissions control in the nation and fully meet the requirements for BACM and MSM.

**Air Resources Board Control Measures, 1985 - 2015**

| Board Action | Hearing Date |
|---|---|
| **Proposed Regulation for the Commercialization of Alternative Diesel Fuels (1 of 2):** proposed regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation. | 2/19/15 |
| **Evaporative Emission Control Requirements for Spark-Ignition Marine Watercraft:** proposed regulation for controlling evaporative emissions from spark-ignition marine watercraft. The proposed regulation will harmonize, to the extent feasible, with similar federal requirements, while adding specific provisions needed to support California's air quality needs. | 2/19/15 |
| **2015 Low Carbon Fuel Standard (LCFS) Amendments (1 of 2):** proposed regulation for a Low Carbon Fuel Standard that includes re-adoption of the existing Low Carbon Fuel Standard with updates and revisions. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation. | 2/19/15 |
| **CA Cap on GHG Emissions and Market-Based Compliance Mechanisms to Add the Rice Cultivation Projects and Updated U.S. Forest Projects Protocols (1 of 2):** updates to the Cap and Trade Regulation to include a new Rice Cultivation Compliance Offset Protocol and an update to the United States Forest Compliance Offset Protocol that would include project eligibility in parts of Alaska | 12/18/14 |
| **2014 Amendments to ZEV Regulation:** additional compliance flexibility to ZEV manufacturers working to bring advanced technologies to market | 10/23/14 |
| **LEV III Criteria Pollutant Requirements for Light- and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the HD Otto-Cycle and HD Diesel Test Procedures:** applies to the 2017 and subsequent model years | 10/23/14 |
| **Amendments to Mandatory Reporting Regulation for Greenhouse Gases:** further align reporting methods with USEPA methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program | 9/19/14 |
| **Amendments to the California Cap on Greenhouse Gas Emissions and Market Based Compliance Mechanisms** Technical revisions to Mandatory Reporting of Greenhouse Gas Emissions Regulation to further align reporting methods with U.S.EPA update methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program. | 9/18/14 |
| **Amendments to the AB 32 Cost of Implementation Fee Regulation:** proposed amendments to the regulation to make it consistent with the revised mandatory reporting regulation, to add potential reporting requirements, and to incorporate requirements within the mandatory reporting regulation to streamline reporting. | 9/18/14 |
| **Low Carbon Fuel Standard 2014 Update:** As a result of a California Court of Appeal decision, ARB will revisit the LCFS rulemaking process to meet certain procedural requirements of the APA and CEQA. Following incorporation of any modifications to the regulation, the Board will consider the proposed regulation for adoption at a second hearing held in the spring of 2015 | 7/24/14 |
| **Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines for On-Road Heavy-Duty Trucks** Revisions to 1) reduce surplus emission reduction period, 2) reduce minimum CA usage requirement, 3) prioritize on-road funding to small fleets, 4) include light HD vehicles 14000-19500 libs, and 5) clarify program specifications. | 7/24/14 |
| **Amendments to Enhanced Fleet Modernization (Car Scrap) Program:** amendments consistent with SB 459 which requires ARB to increase benefits for low-income California residents, promote cleaner replacement vehicles, and enhance emissions reductions. | 6/26/14 |
| **Proposed Approval of Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms -** Second hearing of two, continued from October 2013 | 4/24/14 |
| **Truck and Bus Rule Update --** Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen, and Other Criteria Pollutants From In-Use On-Road Diesel-Fueled Vehicles: increasing low-use vehicle thresholds, allowing owners to newly opt-in to existing flexibility provisions, adjusting "NOx exempt" vehicle provisions, and granting additional time for fleets in certain areas to meet PM filter requirements. | 4/24/14 |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Heavy-Duty GHG Phase I: On-Road Heavy-Duty GHG Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Reduced Emission Standards, Heavy-Duty Hybrid-Electric Vehicles Certification Procedure** New GHG standards for MD and HD engines and vehicles identical to those adopted by the USEPA in 2011 for MYs 2014-18. | 12/12/13 |
| **Agricultural equipment SIP credit rule** Incentive-funded projects must be implemented using Carl Moyer Program Guidelines; must be surplus, quantifiable, enforceable, and permanent, and result in emission reductions that are eligible for SIP credit | 10/25/13 |
| **Mandatory Report of Greenhouse Gas Emissions** Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources | 10/25/13 |
| **CA Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms** Technical revisions to the Mandatory Reporting of Greenhouse Gas Emissions Reg to further align reporting methods with U.S.EPA, update factors, and modify definitions to maintain consistency with the Cap and Trade program. | 10/25/13 |
| **Zero emission vehicle test procedures:** existing certification test procedures for plug-in hybrid vehicles need to be updated to reflect technology developments. The ZEV reg will require minor modifications to address clarity and implementation issues. | 10/24/13 |
| **Consumer Products: Antiperspirants, Deodorants, Test Method 310, Aerosol Coatings, Proposed Repeal of Hairspray Credit)** Amendments to require various consumer products to reformulate to reduce VOC or reactivity content to meet specified limits, and to clarify various regulatory provisions, improve enforcement, and add analytical procedures. | 9/26/13 |
| **Alternative fuel certification procedures** Amendments to current alternative fuel conversion certification procedures for motor vehicles and engines that will allow small volume conversion manufacturers to reduce the upfront demonstration requirements and allow systems to be sold sooner with lower certification costs than with the current process, beginning with MY 2018. | 9/26/13 |
| **Vapor Recovery for Gasoline Dispensing Facilities** Amendments to certification and test procedures for vapor recovery equipment used on cargo tanks and at gasoline dispensing facilities. | 7/25/13 |
| **Off-highway recreational vehicle evaporative emission control** Staff proposes to set evaporative emission standards to control hydrocarbon emissions from Off-Highway Recreational Vehicles. The running loss, hot soak, and diurnal performance standards can be met by using proven automobile type control technology | 7/25/13 |
| **Gasoline and diesel fuel test standards** Adopted amendments to add test standards for the measurement of prohibited oxygenates at trace levels specified in existing regulations | 1/25/13 |
| **LEV III and ZEV Programs for Federal Compliance Option** Adopted amendments to deem compliance with national GHG new vehicle standards in 2017-2025 as compliance with California GHG standards for the same model years | 11/15/12<br>12/6/12 EO |
| **Consumer products (automotive windshield washing fluid)** Adopted amendments to add portions of 14 California counties to the list of areas with freezing temperatures where 25% VOC content windshield washing fluid could be sold | 10/18/2012<br>EO 03/15/13 |
| **GHG mandatory reporting, Fee Regulation, and Cap and Trade 2012** Adopted amendments to eliminate emission verification for facilities emitting less than 25,000 MTCO2e and make minor changes in definitions and requirements | 9/20/12<br>11/2/12 EO |
| **Amendments to Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines** Approved amendments to the verification procedure used to evaluate diesel retrofits through emissions, durability, and field testing. Amendments will lower costs associated with required in-use compliance testing, streamline the in-use compliance process, and will extend time allowed to complete verifications. | 8/23/2012 EO 07/02/13 |
| **Amendments to On-Board Diagnostics (OBD I and II) Regulations** Approved amendments to the light- and medium-duty vehicle and heavy-duty engine OBD regulations. | 8/23/2012 EO 06/26/13 |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Cap and Trade: Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms, and Amendments Allowing Use of Compliance Instruments Issued by Linked Jurisdictions** Amends Cap-and-Trade and compliance mechanisms to add security to the market system and to aid staff in implementation. Amendments include first auction rules, offset registry, market monitoring provisions, and information gathering necessary for the financial services operator. | 6/28/12<br>7/31/12 EO |
| **Vapor recovery defect list** Adopted amendments to add defects and verification procedures for equipment approved since 2004, and make minor changes to provide clarity | 6/11/12 EO |
| **Tractor-Trailer GHG Regulation: Emergency Amendment** Adopted emergency amendment to correct a drafting error and delay the registration date for participation in the phased compliance option | 2/29/2012<br>2/29/12 EO |
| **Advanced Clean Cars (ACC) Regulation: Low-Emission Vehicles and GHG** Adopted more stringent criteria emission standards for MY 2015-2025 light and medium duty vehicles (LEV III), amended GHG emission standards for model year 2017-2025 light and medium duty vehicles (LEV GHG), amended ZEV Regulation to ensure the successful market penetration of ZEVs in commercial volumes, amended hydrogen fueling infrastructure mandate of the Clean Fuels Outlet regulation, and amended cert fuel for light duty vehicles from an MTBE-containing fuel to an E10 certification fuel. | 1/26/12 |
| **Zero Emission Vehicles (ZEV)** Adopted amendments to increase compliance flexibility, add two new vehicle categories for use in creating credits, increase credits for 300 mile FCVs, increase requirements for ZEVs and TZEVs, eliminate credit for PZEVs and AT PZEVs, expand applicability to smaller manufacturers, base ZEV credits on range, and make other minor changes in credit requirements | 1/26/12 |
| **Amendments to Low Carbon Fuel Standard Regulation** The amendments address several aspects of the regulation, including: reporting requirements, credit trading, regulated parties, opt-in and opt-out provisions, definitions, and other clarifying language. | 12/16/11<br>10/10/12 EO |
| **Amendments to Small Off-Road Engine and Tier 4 Off-Road Compression-Ignition Engine Regulations And Test Procedures; also "Recreational Marine" Spark-Ignition Marine Engine Amendments (Recreational Boats) adopted.** Aligns California test procedures with U.S. EPA test procedures and requires off-road CI engine manufacturers to conduct in-use testing of their entire product lines to confirm compliance with previously established Not-To-Exceed emission thresholds. | 12/16/2011<br>10/25/12 EO |
| **Regulations and Certification Procedures for Engine Packages used in Light-Duty Specially Constructed Vehicles (Kit Cars)** Ensures that certified engine packages, when placed into any Kit Car, would meet new vehicle emission standards, and be able to meet Smog Check requirements. | 11/17/11<br>9/21/12 EO |
| **Amendments to the California Reformulated Gasoline Regulations** Corrects drafting errors in the predictive model, deletes outdated regulatory provisions, updates the notification requirements, and changes the restrictions on blending CARBOB with other liquids. | 10/21/11<br>8/24/12 EO |
| **Amendments to the In-Use Diesel Transport Refrigeration Units (TRU) ATCM** Mechanisms to improve compliance rates and enforceability. | 10/21/11<br>8/31/12 EO |
| **Amendments to the AB 32 Cost of Implementation Fee Regulation** Clarifies requirements and regulatory language, revises definitions. | 10/20/11<br>8/21/12 EO |
| **Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation, Including Compliance Offset Protocols** Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols and multiple pathways for compliance. | 10/21/11<br>8/21/12 EO |
| **Amendments to the Regulation for Cargo Handling Equipment (CHE) at Ports and Intermodal Rail Yards (Port Yard Trucks Reg)** Provides additional compliance flexibility, and maintains anticipated emissions reductions. As applicble to yard trucks and two-engine sweepers. | 9/22/11<br>8/2/12 EO |
| **Amendments to the Enhanced Vapor Recovery Regulation for Gasoline Dispensing Facilities** New requirement for low permeation hoses at gasoline dispensing facilities. | 9/22/11<br>7/26/12 EO |
| **Amendments to Cleaner Main Ship Engines and Fuel for Ocean-Going Vessels** Adjusts the offshore regulatory boundary. Aligns very low sulfur fuel implementation deadlines with new federal requirements. | 6/23/11<br>9/13/12 EO |
| **Particulate Matter Emissions Measurement Allowance For Heavy-Duty Diesel In-Use Compliance Regulation** Emission measurement allowances provide for variability associated with the field testing required in the regulation. | 6/23/11<br>10/12/11 EO |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Low Carbon Fuel Standard Carbon Intensity Lookup Table Amendments**<br>Adds new pathways for vegetation-based fuels | 2/24/11<br>1/6/12 EO |
| **Amendments to Cleaner In-Use Heavy-Duty On-Road Diesel Trucks and LSI Fleets Regulations**<br>Amends five regulations to provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted. | 12/16/10<br>9/19/11 EO |
| **Tractor-Trailer GHG Regulation Amendment**<br>Enacts administrative changes to increase compliance flexibility and reduce costs | 12/16/10<br>10/26/11 EO |
| **Amendments to Cleaner In-Use Off-Road Diesel-Fueled Fleets Regulation**<br>Amendments provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted. | 12/16/10<br>10/28/11 EO |
| **In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities**<br>Amendments add flexibility to fleets' compliance schedules, mitigate the use of noncompliant trucks outside port and rail properties, and provide transition to the Truck and Bus regulation. | 12/16/10<br>9/19/11 EO |
| **Amendments to the Regulation for Mandatory Reporting of Greenhouse Gas Emissions**<br>Changes requirements to align with federal greenhouse gas reporting requirements adopted by US EPA. | 12/16/10<br>10/28/11 EO |
| **Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation**<br>Establishes framework and requirements for Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols. | 12/16/10<br>10/26/11 EO |
| **Amendments to the Consumer Products Regulation**<br>Amendments set new or lower VOC limits for some categories, prohibit certain toxic air contaminants, high GWP compounds, and surfactants toxic to aquatic species. Also changes Method 310, used to determine aromatic content of certain products. | 11/18/10<br>9/29/11 EO |
| **Amendment of the ATCM for Diesel Transportation Refrigeration Units (TRU)**<br>Amendments expand the compliance options and clarify the operational life of various types of TRUs. | 11/18/10<br>2/2/11 EO |
| **Amendments to the ATCM for Stationary Compression Ignition Engines**<br>Approved amendments to closely align the emission limits for new emergency standby engines in the ATCM with the emission standards required by the federal Standards of Performance. | 10/21/10<br>3/25/11 EO |
| **Diesel Vehicle Periodic Smoke Inspection Program**<br>Adopted amendments to exempt medium duty diesel vehicles from smoke inspection requirements if complying with Smog Check requirements | 10/21/10<br>8/23/11 EO |
| **Renewable Electricity Standard Regulation**<br>Approved a regulation that will require electricity providers to obtain at least 33% of their retail electricity sales from renewable energy resources by 2020. | 9/23/10 |
| **Energy Efficiency at Industrial Facilities**<br>Adopted standards for the reporting of GHG emissions and the feasibility of emissions controls by the largest GHG-emitting stationary sources | 7/22/10<br>5/9/11 EO |
| **Amendments to Commercial Harbor Craft Regulation**<br>Approved amendments to require the use of cleaner engines in diesel-fueled crew and supply, barge, and dredge vessels. | 6/24/10<br>4/11/11 EO |
| **Accelerated Introduction of Cleaner Line-Haul Locomotives**<br>Agreement with railroads sets prescribed reductions in diesel risk and target years through 2020 at four major railyards | 6/24/10 |
| **Amendments to New Passenger Motor Vehicle Greenhouse Gas Emission Standards**<br>Approved amendments deeming complinace with EPA's GHG standards as compliance with California's standards in 2012 through 2016 model years | 2/25/2010<br>03/29/10 |
| **Sulfur Hexafluoride (SF6) Regulation**<br>Approved a regulation to reduce emissions of sulfur hexafluoride (SF6), a high-GWP GHG, from high-voltage gas-insulated electrical switchgear. | 2/25/10<br>12/15/10 EO |
| **Amendments to the Statewide Portable Equipment Registration Regulation and Portable Engine ATCM**<br>Approved amendments that extend the deadline for removal of certain uncertified portable engines for one year. | 1/28/10<br>8/27/10 EO<br>12/8/10 EO |
| **Diesel Engine Retrofit Control Verification, Warranty, and Compliance Regulation Amendments**<br>Approved amendments to require per-installation compability assessment, performance data collection, and reporting of additional information, and enhance enforceaibility | 1/28/10<br>12/6/10 EO |
| **Stationary Equipment High-GWP Refrigerant Regulation**<br>Approved a regulation to reduce emissions of high-GWP refrigerants from stationary non-residential equipment. | 12/1/09<br>9/14/10 EO |

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**Air Resources Board Control Measures, 1985 - 2015**

| Board Action | Hearing Date |
|---|---|
| **Amendments to Limit Ozone Emissions from Indoor Air Cleaning Devices**<br>Adopted amendments to delay the labeling compliance deadlines by one to two years and to make minor changes in testing protocols | 12/9/09<br>7/30/10 EO |
| **Emission Warranty Information Reporting Regulation Amendments**<br>Repealed the 2007 regulation and readopted the 1988 regulation with amendments to implement adverse court decision | 11/19/09<br>9/27/10 EO |
| **Amendments to Maximum Incremental Reactivity Tables**<br>Added many new compounds and modified reactivity values for many existing compounds in the tables to reflect new research data | 11/3/09<br>7/23/10 EO |
| **AB 32 Cost of Implementation Fee Regulation** AB 32 authorizes ARB to adopt by regulation a schedule of fees to be paid by sources of greenhouse gas emissions regulated pursuant to AB 32. ARB staff will propose a fee regulation to support the administrative costs of AB 32 implementation. | 9/24/2009 05/06/10 EO |
| **Passenger Motor Vehicle Greenhouse Gas Limits Amendments**<br>Approved amendments granting credits to manufacturers for compliant vehicles sold in other states that have adopted California regulations | 9/24/09<br>2/22/10 EO |
| **Consumer Products Amendments**<br>Approved amendments that set new VOC limits for multi-purpose solvent and paint thinner products and lower the existing VOC limit for double phase aerosol air fresheners. | 9/24/09<br>8/6/10 EO |
| **Amendments to In-Use Off-Road Diesel-Fueled Fleets Regulation**<br>Approved amendments to implement legislatively directed changes and provide additional incentives for early action. | 7/23/09<br>12/2/09 EO<br>6/3/10 EO |
| **Methane Emissions from Municipal Solid Waste Landfills**<br>Approved a regulation to require smaller and other uncontrolled landfills to install gas collection and control systems, and also requires existing and newly installed systems to operate optimally. | 6/25/09<br>5/5/10 EO |
| **Cool Car Standards**<br>Approved a regulation requiring the use of solar management window glass in vehicles up to 10,000 lb GVWR. | 6/25/09 |
| **Enhanced Fleet Modernization (Car Scrap)**<br>Approved guidelines for a program to scrap up to 15,000 light duty vehicles statewide. | 6/25/09<br>7/30/10 EO |
| **Amendments to Heavy-Duty On-Board Diagnostics Regulations**<br>Approved amendments to the light and medium-duty vehicle and heavy duty engine OBD regulations. | 5/28/2009<br>4/6/10 EO |
| **Smog Check Improvements**<br>BAR adopted amendments to implement changes in state law and SIP commitments adopted by ARB between 1996 and 2007 | 5/7/09<br>by BAR<br>6/9/09 EO |
| **AB 118 Air Quality Improvement Program Guidelines** The Air Quality Improvement Program provides for up to $50 million per year for seven years beginning in 2009-10 for vehicle and equipment projects that reduce criteria pollutants, air quality research, and advanced technology workforce training. The AQIP Guidelines describe minimum administrative, reporting, and oversight requirements for the program, and provide general criteria for how the program shall be implemented. | 04/23/09<br>08/28/09 EO |
| **Pesticide Element** Reduce volatile organic compound (VOC) emissions from the application of agricultural field fumigants in the South Coast, Southeast Desert, Ventura County, San Joaquin Valley, and Sacramento Metro federal ozone nonattainment areas. | 4/20/09<br>10/12/09 EO (2)<br>8/2/11 EO |
| **Low Carbon Fuel Standard**<br>Approved new standards to lower the carbon content of fuels. | 4/20/09<br>11/25/09 EO |
| **Pesticide Element for San Joaquin Valley**<br>DPR Director approved pesticide ROG emission limit of 18.1 tpd and committed to implement restrictions on non-fumigant pesticide use by 2014 in the San Joaquin Valley | 4/7/09 DPR |
| **Tire Pressure Inflation Regulation**<br>Approved a regulation requiring automotive service providers to perform tire pressure checks as part of every service. | 3/26/09<br>2/4/10 EO |
| **Sulfur Hexafluoride from Non-Utility and Non-Semiconductor Applications**<br>Approved a regulation to phase out use of Sulfur Hexafluoride over the next several years. | 2/26/09<br>11/12/09 EO |
| **Semiconductor Operations**<br>Approved a regulation to set standards to reduce fluorinated gas emissions from the semiconductor and related devices industry. | 2/26/09<br>10/23/09 EO |
| **Plug-In Hybrid Electric Vehicles Test Procedure Amendments**<br>Amends test procedures to address plug-in-hybrid electric vehicles | 1/23/09<br>12/2/09 EO |
| **In-Use Off-Road Diesel-Fueled Fleets Amendments**<br>Makes administrative changes to recognize delays in the supply of retrofit control devices | 1/22/09 |
| **Small Containers of Automotive Refrigerant**<br>Approved a regulation to reduce leakage from small containers, adopt a container deposit and return program, and require additional container labeling and consumer education requirements. | 1/22/09<br>1/5/10 EO |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Aftermarket Critical Emission Parts on Highway Motorcycles**<br>Allows for the sale of certified critical emission parts by aftermarket manufacturers | 1/22/09<br>6/19/09 EO |
| **Heavy-Duty Tractor-Trailer Greenhouse Gas (GHG) Reduction**<br>Approved a regulation to reduce greenhouse gas emissions by improving long haul tractor and trailer efficiency through use of aerodynamic fairings and low rolling resistance tires. | 12/11/08<br>10/23/09 EO |
| **Cleaner In-Use Heavy-Duty Diesel Trucks (Truck and Bus Reg)**<br>Approved a regulation to reduce diesel particulate matter and oxides of nitrogen through fleet modernization and exhaust retrofits. Makes enforceability changes to public fleet, off-road equipment, and portable equipment regulations. | 12/11/08<br>10/19/09 EO<br>10/23/09 EO |
| **Large Spark-Ignition Engine Amendments**<br>Approved amendments to reduce evaporative, permeation, and exhaust emissions from large spark-ignition (LSI) engines equal to or below 1 liter in displacement. | 11/1/08<br>3/12/09 EO |
| **Small Off-Road Engine (SORE) Amendments**<br>Approved amendments to address the excessive accumulation of emission credits. | 11/21/08<br>2/24/10 EO |
| **Proposed AB 118 Air Quality Guidelines for the Air Quality Improvement Program and the Alternative and Renewable Fuel and Vehicle and Technology Program.** The California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (AB 118) requires ARB to develop guidelines for both the Alternative and Renewable Fuel and Vehicle Technology Program and the Air Quality Improvement Program to ensure that both programs do not adversely impact air quality. | 09/25/08 EO<br>05/20/09 |
| **Portable Outboard Marine Tanks and Components (part of Additional Evaporative Emission Standards)**<br>Approved a regulation that establishes permeation and emission standards for new portable outboard marine tanks and components. | 9/25/08<br>7/20/09 EO |
| **Cleaner Fuel in Ocean Going Vessels**<br>Approved a regulation that requires use of low sulfur fuel in ocean-going ship main engines, and auxiliary engines and boilers. | 7/24/08<br>4/16/09 EO |
| **Spark-Ignition Marine Engine and Boat Amendments**<br>Provides optional compliance path for > 500 hp sterndrive/inboard maring engines | 7/24/08<br>6/5/09 EO |
| **Consumer Products Amendments**<br>Approved amendments that add volatile organic compound (VOC) limits for seven additional categories and lower limits for twelve previously regulated categories. | 6/26/08<br>5/5/09 EO |
| **Zero emission vehicles**<br>Updated California's ZEV requirements to provide greater flexibility with respect to fuels, technologies, and simplifying compliance pathways. Amendments give manufacturers increased flexibility to comply with ZEV requirements by giving credit to plug-in hybrid electric vehicles and establishing additional ZEV categories in recognition of new developments in fuel cell vehicles and battery electric vehicles. | 3/27/08<br>12/17/08 EO |
| **Amendments to the Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines**<br>Adds verification requirements for control technologies that only reduce NOx emissions, new reduction classifications for NOx reducing technologies, new testing requirements, and conditional extensions for verified technologies | 1/24/08<br>12/4/08 EO |
| **Mandatory Report of Greenhouse Gas Emissions**<br>Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources | 12/6/07<br>10/12/08 EO |
| **Gaseous Pollutant Measurement Allowances for In-Use Heavy-Duty Diesel Compliance** Measurement accuracy margins are to be determined through an ongoing comprehensive testing program performed by an independent contractor. Amendments include these measurement accuracy margins into the regulation. | 12/6/07<br>10/14/08 EO |
| **Ocean-Going Vessels While at Berth (aka Ship Hotelling) - Auxiliary Engine Cold Ironing and Clean Technology**<br>Approved a regulation that reduces emissions from auxiliary engines on ocean-going ships while at-berth. | 12/6/07<br>10/16/08 EO |
| **In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities**<br>Approved a regulation that establishes emission standards for in-use, heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities. | 12/6/07<br>10/12/08 EO |
| **Commercial Harbor Craft**<br>Approved a regulation that establishes in-use and new engine emission limits for both auxiliary and propulsion diesel engines on ferries, excursion vessels, tugboats, and towboats. | 11/15/07<br>9/2/08 EO |
| **Suggested Control Measure for Architectural Coatings Amendments**<br>Approved amendments to reduce the recommended VOC content of 19 categories of architectural coatings | 10/26/07 |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Aftermarket Catalytic Converter Requirements**<br>Approved amendments that establish more stringent emission performance and durability requirements for used and new aftermarket catalytic converters offered for sale in California | 10/25/07<br>2/21/08 NOD |
| **Limiting Ozone Emissions from Indoor Air Cleaning Devices**<br>Approved ozone emission limit of 0.050 ppm for portable indoor air cleaning devices in response to requirements of AB 2276 (2006) | 9/27/07<br>8/7/08 EO |
| **Pesticide Commitment for Ventura County in 1994 SIP**<br>Approved substitution of excess ROG emission reductions from state motor vehicle program for 1994 SIP reduction commitment from pesticide application in Ventura County | 9/27/07<br>11/30/07 EO |
| **In-Use Off-Road Diesel Equipment**<br>Approved a regulation that requires off-road diesel fleet owners to modernize their fleets and install exhaust retrofits. | 7/26/07<br>4/4/08 EO |
| **Emission Control and Environmental Performance Label Regulations**<br>Approved amendments to add a Global Index Label and modify the formal of the Smog Index Label on new cars | 6/21/07<br>5/2/08 EO |
| **Vapor Recovery from Aboveground Storage Tanks**<br>Approved a regulation to establish new performance standards and specifications for the vapor recovery systems and components used with aboveground storage tanks. | 6/21/07<br>5/2/08 EO |
| **CaRFG Phase 3 amendments**<br>Approved amendments to mitigate the increases in evaporative emissions from on-road motor vehicles resulting from the addition of ethanol to gasoline. | 6/14/07<br>4/25/08 EO<br>8/7/08 EO |
| **Formaldehyde from Composite Wood Products**<br>Approved an ATCM to limit formaldehyde emissions from hardwood plywood, particleboard, and medium density fiberboard to the maximum amount feasible | 4/26/07<br>3/5/08 EO |
| **Portable equipment registration program (PERP) and airborne toxic control measure for diesel-fueled portable engines**<br>Approved amendments to allow permitting of Tier 0 portable equipment engines used in emergency or low use duty and to extend permitting of certain Tier 1 and 2 "resident" engines to 1/1/10 | 3/22/07<br>7/31/07 EO |
| **Perc Control Measure Amendments**<br>Approved amendments to the Perchloroethylene ATCM to prohibit new Perc dry cleaning machines beginning 2008 and phase out all Perc machines by 2023. | 1/25/07<br>11/7/07 EO |
| **Amendments to Emission Warranty Information Reporting & Recall Regulations**<br>Approved amendments that tighten the provisions for recalling vehicles for emissions-related failures, helping ensure that corrective action is taken to vehicles with defective emission control devices or systems. | 12/7/06<br>3/22/07<br>10/17/07 EO |
| **Voluntary accelerated vehicle retirement regulations**<br>Approved amendments that authorize the use of remote sensing to identify light-duty high emitters and that establish protocols for quantifying emissions reductions from high emitters proposed for retirement | 12/7/06 |
| **Emergency regulation for portable equipment registration program (PERP), airborne toxic control measures for portable and stationary diesel-fueled engines** | 12/7/06 |
| **Amendments to the Hexavalent Chromium ATCM**<br>Approved amendments that require use of best available control technology on all chrome plating and anodizing facilities. | 12/7/06 |
| **Consumer Products Regulation Amendments**<br>Approved amendments that set lower emission limits in 15 product categories. | 11/17/06<br>9/25/07 EO |
| **Requirements for Stationary Diesel In-Use Agricultural Engines**<br>Approved amendments to the stationary diesel engine ATCM which set emissions standards for in-use diesel agricultural engines. | 11/16/06<br>7/3/07 NOD |
| **Ships - Onboard Incineration**<br>Approved amendments to cruise ship incineration ATCM to include all oceangoing ships of 300 gross registered tons or more. | 11/16/06<br>9/11/07 EO |
| **Zero Emission Bus**<br>Approved amendments postponing the 15 percent purchase requirement three years for transit agencies in the diesel path and one to two years for transit agencies in the alternative fuel path, in order to keep pace with developments in zero emission bus technology, and adding an Advanced Demonstration requirement to offset emission losses. | 10/19/06<br>8/27/07 EO |
| **Distributed generation certification**<br>Approved amendments improving the emissions durability and testing requirements, addng waste gas emission standards, and eliminating a redundant PM standard in the current 2007 emission standards. | 10/19/06<br>5/17/07 NOD |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
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| **Heavy-Duty Diesel In-Use Compliance Regulation**<br>Approved amendments to the heavy-duty diesel engine regulations and test procedures to create a new in-use compliance program conducted by engine manufacturers. The amendments would help ensure compliance with applicable certification standards throughout an engine's useful life. | 9/28/06<br>7/19/07 NOD |
| **Revisions to OBD II and the Emission Warranty Regulations**<br>Approved amendments to the OBD II regulation to provide for improved emission control monitoring including air-fuel cylinder imbalance monitoring, oxygen sensor monitoring, catalyst monitoring, permanent fault codes for gasoline vehicles and new thresholds for diesel vehicles. | 9/28/06<br>8/9/07 EO |
| **Off-Highway Recreational Vehicle Amendments**<br>Approved amendments to the Off-Highway Recreational Vehicle Regulations including harmonizing evaporative emission standards with federal regulations, expanding the definition of ATVs, modifying labeling requirements, and adjusting riding seasons. | 7/20/06<br>6/1/07 EO |
| **Portable Equipment Registration Program (PERP) Amendments**<br>Approved amendments to the Statewide Portable Equipment Registration program that include installation of hour meters on equipment, and revisions to recordkeeping, reporting, and fees. | 6/22/06<br>11/13/06 NOD |
| **Heavy Duty Vehicle Service Information**<br>Approved amendments to the Service Information Rule to require manufacturers to make available diagnostic equipment and information for sale to the aftermarket. | 6/22/06<br>5/3/07 EO |
| **LEV II technical amendments**<br>Approved amendments to evaporative emission test procedures, four-wheel drive dynamometer provisions, and vehicle label requirements | 6/22/06<br>9/27/06 NOD |
| **Dry Cleaning ATCM Amendments**<br>Approved amendments to the Dry Cleaning ATCM to limit siting of new dry cleaners, phase out use of Perc at co-residential facilities, phase out higher emitting Perc sources at other facilities, and require enhanced ventilation at existing and new Perc facilities | 5/25/06 |
| **Forklifts and other Large Spark Ignition (LSI) Equipment**<br>Adopted a regulation to reduce emissions from forklifts and other off-road spark-ignition equipment by establishing more stringent standards for new equipment, and requiring retrofits or engine replacement on existing equipment. Adopts EPA's stamdards fpr 2007; adopts more stringent standards for 2010. | 5/25/06<br>3/2/07 EO |
| **Enhanced Vapor Recovery Amendments**<br>Approved amendments to the vapor recovery system regulation and adopted revised test procedures. | 5/25/06 |
| **Diesel Retrofit Technology Verification Procedure**<br>Approved amendments to the Diesel Emission In-use Control Strategy Verification Procedure to substitute a 30% increase limit in NOx concentration for an 80% reduction requirement from PM retrofit devices | 3/23/06<br>12/21/06 NOD |
| **Heavy duty vehicle smoke inspection program amendments**<br>Approved amendments to impose a fine on trucks not displaying a current compliance certification sticker | 1/26/06<br>12/4/06 EO |
| **Ocean-going Ship Auxiliary Engine Fuel**<br>Approved a regulation to require ships to use cleaner marine gas oil or diesel to power auxiliary engines within 24 nautical miles of the California coast. | 12/8/05<br>10/20/06 EO |
| **Diesel Cargo Handling Equipment**<br>Approved a regulation to require new and in-use cargo handling equipment at ports and intermodal rail yards to reduce emissions by utilizing best available control technology. | 12/8/05<br>6/2/06 EO |
| **Public and Utility Diesel Truck Fleets**<br>Approved a regulation to reduce diesel particulate matter emissions from heavy duty diesel trucks in government and private utility fleets. | 12/8/05<br>10/4/06 EO |
| **Cruise ships – Onboard Incineration**<br>Adopted an Air Toxic Control Measure to prohibit cruise ships from conducting onboard incineration within three nautical miles of the California coast. | 11/17/05<br>2/1/06 NOD |
| **Inboard Marine Engine Rule Amendments**<br>Approved amendments to the 2001 regulation to include additional compliance options for manufacturers. | 11/17/05<br>9/26/06 EO |
| **Heavy-Duty Diesel Truck Idling Technology**<br>Approved a regulation to limit sleeper truck idling to 5 minutes. Allows alternate technologies to provide cab heating/cooling and power. | 10/20/05<br>9/1/06 EO |
| **Automotive Coating Suggested Control Measure**<br>Approved an SCM for automotive coatings for adoption by air districts. The measure will reduce the VOC content of 11 categories of surface protective coatings. | 10/20/05 |
| **2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies**<br>Adopted amendments to align urban bus emission limits with on-road heavy duty truck emission limits and allow for the purchase of non-complying buses under the condition that bus turnover increase to offset NOx increases | 10/20/05<br>10/27/05<br>7/28/06 EO |
| **Portable fuel containers (part 2 of 2)**<br>Approved amendments to revise spout and automatic shutoff design | 9/15/05<br>7/28/06 EO |

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| **Portable Fuel Containers (part 1 of 2)**<br>Approved amendments to include kerosene containers in the definition of portable fuel containers | 9/15/05<br>11/9/05 NOD |
| **2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies**<br>Adopted amendments to require all transit agencies in SCAQMD to purchase only alternate fuel versions of new buses | 9/15/05<br>Superceded by<br>10/20/05 and<br>10/27/05 |
| **Reid vapor pressure limit emergency rule**<br>Approved amendments to relax Reid vapor pressure limit to accelerate fuel production for Hurricane Katrina victims | 9/8/05<br>Operative for<br>September and<br>October 2005 only |
| **Heavy-Duty Truck OBD**<br>Approved a regulation to require on-board diagnostic (OBD) systems for new gas and diesel trucks, similar to the systems on passenger cars. | 7/21/05<br>12/28/05 EO |
| **Definition of Large Confined Animal Facility**<br>Adopted a regulation to define the size of a large CAF for the purposes of air quality permitting and reduction of ROG emissions to the extent feasible | 6/23/05<br>4/13/06 EO |
| **ATCM for stationary complression ignition engines:** Approved emergency amendments (3/17/05) and permanent amendments (5/26/05) to relax the diesel PM emission limits on new stationary diesel engines to current off-road engine standards to respond to the lack of availability of engines meeting the original ATCM standard. | 3/17/05<br>5/26/05<br>7/29/05 EO |
| **Transit Fleet Rule**<br>Approved amendments to add emission limits for non-urban bus transit agency vehicles, require lower bus and truck fleet-average NOx and PM emission limits, and clarify emission limits for CO, NMHC, and formaldehyde | 2/24/05<br>10/19/05 NOD |
| **Thermal Spraying ATCM**<br>Approved a regulation to reduce emissions of hexavalent chromium and nickel from thermal spraying operations | 12/9/04<br>7/20/05 EO |
| **Tier 4 Standards for Small Off-Road Diesel Engines (SORE)**<br>Approved new emission standards for off-road diesel engines to be phased in between 2008 and 2015 | 12/9/04<br>10/21/05 EO |
| **Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard**<br>Adopted an emergency regulation delaying the lubricity standard compliance deadline by five months to respond to fuel pipeline contamination problems | 11/24/04<br>12/10/04 EO |
| **Enhanced vapor recovery compliance extension**<br>Approved amendments to the EVR regulation to extend the compliance date for onboard refueling vapor recovery compatibility to the date of EVR compliance | 11/18/04<br>2/11/05 EO |
| **CaRFG Phase 3 amendments**<br>Approved amendments correcting errors and streamlining requirements for comliance and enforcement of CaRFG Phase 3 regulations adopted in 1999 | 11/18/04 |
| **Clean diesel fuel for harborcraft and intrastate locomotives**<br>Approved a regulation that required harborcraft and locomotives operating solely within California to use clean diesel fuel. | 11/18/04<br>3/16/05 EO |
| **Nonvehicular Source, Consumer Product, and Architectural Coating Fee Regulation Amendment**<br>Approved amendments to fee regulations to collect supplemental fees when authorized by the Legislature | 11/18/04 |
| **Greenhouse gas limits for motor vehicles**<br>Approved a regulation that sets the first ever greenhouse gas emission standards on light and medium duty vehicles starting with the 2009 model year. | 9/24/04<br>8/4/05 EO |
| **Gasoline vapor recovery system equipment defects list**<br>Approved the addition of defects to the VRED list for use by compliance inspectors | 8/24/04<br>6/22/05 EO |
| **Unihose gasoline vapor recovery systems**<br>Approved an emergency regulation and an amendment to delay the compliance date for unihose installation to the date of dispenser replacement | 7/22/04<br>11/24/04 EO |
| **General Idling Limits for Diesel Trucks**<br>Approved a regulation that limits idling of heavy-duty diesel trucks operating in California to five minutes, with exceptions for sleeper cabs. | 7/22/04 |
| **Consumer Products**<br>Approved a regulation to reduce ROG emissions from 15 consumer products categories, prohibit the use of 3 toxic compounds in consumer products, ban the use of PDCB in certain products, allow for the use of Alternative Control Plans, and revise Test Method 310 | 6/24/04<br>5/6/05 EO |
| **Urban bus engines/fleet rule for transit agencies**<br>Approved amendments to allow for the purchase of hybrid diesel buses and revise the zero emission bus demonstration and purchase timelines | 6/24/04 |
| **Engine Manufacturer Diagnostics**<br>Approved a regulation that would require model year 2007 and later heavy duty truck engines to be equipped with engine diagnostic systems to detect malfunctions of the emission control system. | 5/20/04 |
| **Chip Reflash**<br>Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module. | 3/25/04<br>3/21/05 EO |

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| **Portable equipment registration program (PERP)**<br>Approved amendments to allow uncertified engines to be registered until December 31, 2005, to increase fees, and to modify administrative requirements | 2/26/04<br>1/7/05 EO<br>6/21/05 EO |
| **Portable Diesel Engine ATCM**<br>Adopted a regulation to reduce diesel PM emissions from portable engines through a series of emission standards that increase in stringency through 2020 | 2/26/04<br>1/4/05 EO |
| **California motor vehicle service information rule**<br>Adopted amendments to allow for the purchase of heavy duty engine emission-related service information and diagnostic tools by independent service facilities and aftermarket parts manufacturers. | 1/22/04<br>5/20/04 |
| **Transportation Refrigeration Unit ATCM**<br>Adopted a regulation to reduce diesel PM emissions from transport refrigeration units by establishing emission standards and facility reporting requirements to streamline inspections | 12/11/03<br>2/26/04<br>11/10/04 EO |
| **Diesel engine verification procedures**<br>Approved amendments that reduced warranty coverage to the engine only, delayed the NOx reduction compliance date to 2007, added requirements for proof-of-concept testing for new technology, and harmonized durability requirements with those of EPA | 12/11/03<br>2/26/04<br>10/17/04 |
| **Chip Reflash**<br>Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module. | 12/11/03<br>3/27/04<br>3/21/05 EO |
| **Revised tables of maximum incremental reactivity values**<br>Approved the addition of 102 more chemicals with associated maximum incremental reactivity values to existing regulation allowing these chemicals to be used in aerosol coating formulations | 12/3/03 |
| **Stationary Diesel Engines ATCM**<br>Adopted a regulation to reduce diesel PM emissions from stationary diesel engines through the use of clean fuel, lower emission standards, operational practices | 11/20/03<br>12/11/03<br>2/26/2004<br>9/27/04 EO |
| **Solid waste collection vehicles**<br>Adopted a regulation to reduce toxic diesel particulate emissions from solid waste collection vehicles by over 80 percent by 2010. This measure is part of ARB's plan to reduce the risk from a wide range of diesel engines throughout California. | 9/25/03<br>5/17/04 EO |
| **Small off-road engines (SORE)**<br>Adopted more stringent emission standards for the engines used in lawn and garden and industrial equipment, such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors. | 9/25/03<br>7/26/04 EO |
| **Off-highway recreational vehicles**<br>Changes to riding season restrictions | 7/24/03 |
| **Clean diesel fuel**<br>Adopted a regulation to reduce sulfur levels and set a minimum lubricity standard in diesel fuel used in vehicles and off-road equipment in California, beginning in 2006. | 7/24/03<br>5/28/04 EO |
| **Ozone Transport Migitation Amendments**<br>Adopted amendments to require upwind districts to (1) have the same no-net-increase permitting thresholds as downwind districts, and (2) adopt "all feasible measures" | 5/22/03<br>10/2/03 NOD |
| **Zero emission vehicles**<br>Updated California's ZEV requirements to support the fuel cell car development and expand sales of advanced technology partial ZEVs (like gasoline-electric hybrids) in the near-term, while retaining a role for battery electric vehicles. | 3/27/03<br>12/19/03 EO |
| **Heavy duty gasoline truck standards**<br>Aligned its existing rules with new, lower federal emission standards for gasoline-powered heavy-duty vehicles starting in 2008. | 12/12/02<br>9/23/03 EO |
| **Low emission vehicles II**<br>Minor administrative changes | 12/12/02<br>9/24/03 EO |
| **Gasoline vapor recovery systems test procudures**<br>Approved amendments to add advanced vapor recovery technology certification and testing standards | 12/12/02<br>7/1/03 EO<br>10/21/03 EO |
| **CaRFG Phase 3 amendments**<br>Approved amendments to allow for small residual levels of MTBE in gasoline while MTBE is being phased out and replaced by ethanol | 12/12/02<br>3/20/03 EO |
| **School bus Idling**<br>Adopted a measure requiring school bus drivers to turn off the bus or vehicle engine upon arriving at a school and restart it no more that 30 seconds before departure in order to limit children's exposure to toxic diesel particulate exhaust. | 12/12/02<br>5/15/03 EO |
| **California Interim Certification Procedures for 2004 and Subsequent Model Year Hybrid-Electric Vehicles in the Urban Transit Bus and Heavy-Duty Vehicle Classes Regulation Amendment**<br>Adopted amendments to allow diesel-path transit agencies to purchase alternate fuel buses with higher NOx limits, establish certification procedures for hybrid buses, and require lower fleet-average PM emission limits | 10/24/02<br>9/2/03 EO |

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| **CaRFG Phase 3 amendments**<br>Approved amendments delaying removal of MTBE from gasoline by one year to 12/31/03 | 7/25/02<br>11/8/02 EO |
| **Diesel retrofit verification procedures, warranty, and in-use compliance requirements**<br>Adopted regulations to specify test procedures, warranty, and in-use compliance of diesel engine PM retrofit control devices | 5/16/02<br>3/28/03 EO |
| **On-board diagnostics for cars**<br>Adopted changes to the On-Board Diagnostic Systems (OBD II) regulation to improve the effectiveness of OBD II systems in detecting motor vehicle emission-related problems. | 4/25/02<br>3/7/03 EO |
| **Voluntary accelerated light duty vehicle retirement regulations**<br>Establishes standards for a voluntary accelerated retirement program | 2/21/02<br>11/18/02 EO |
| **Residential burning**<br>Adopted a measure to reduce emissions of toxic air contaminants from outdoor residential waste burning by eliminating the use of burn barrels and the outdoor burning of residential waste materials other than natural vegetation | 2/21/02<br>12/18/02 EO |
| **California motor vehicle service information rule**<br>Adopted regulations to require light- and medium-duty vehicle manufacturers to offer for sale emission-related service information and diagnostic tools to independent service facilities and aftermarket parts manufacturers | 12/13/01<br>7/31/02 EO |
| **Vapor recovery regulation amendments**<br>Adopted amendments to expand the list of specified defects requiring equipment to be removed from service | 11/15/01<br>9/27/02 EO |
| **Distributed generation guidelines and regulations**<br>Adopted regulations requiring the permitting by ARB of distributed generation sources that are exempt from air district permitting and approved guidelines for use by air districts in permitting non-exempt units | 11/15/01<br>7/23/02 EO |
| **Low emission vehicle regulations (LEV II)**<br>Approved amendments to apply PM emission limits to all new gasoline vehicles, extend gasoline PZEV emission limits to all fuel types, and streamline the manufacturer certification process | 11/15/01<br>8/6/02 EO |
| **Gasoline vaport recovery systems test methods and compliance procedures**<br>Adopted amendments to add test methods for new technology components, streamline test methods for liquid removal equipment, and*** | 10/25/01<br>7/9/02 EO |
| **Heavy-duty diesel trucks**<br>Adopted amendments to emissions standards to harmonize with EPA regulations for 2007 and subsequent model year new heavy-duty diesel engines | 10/25/01 |
| **Automotive coatings**<br>Adopted Air Toxic Control Measure which prohibits the sale and use in California of automotive coatings that contain hexavalent chromium or cadmium. | 9/20/01<br>9/2/02 EO |
| **Inboard and sterndrive marine engines**<br>Lower emission standards for 2003 and subsequent model year inboard and sterndrive gasoline-powered engines in recreational marine vessels. | 7/26/01<br>6/6/02 EO |
| **Asbestos from construction, grading, quarrying, and surface mining**<br>Adopted an Airborne Toxic Control Measure for construction, grading, quarrying, and surface mining operations requiring dust mitigation for construction and grading operations, road construction and maintenance activities, and quarries and surface mines to minimize emissions of asbestos-laden dust | 7/26/01<br>6/7/02 EO |
| **Zero emission vehicle infrastructure and standardization of electric vehicle charging equipment**<br>Adopted amendments to the ZEV regulation to alter the method of quantifying production volumes at joint-owned facilities and to add specifications for standardized charging equipment | 6/28/01<br>5/10/02 EO |
| **Pollutant transport designation**<br>Adopted amendments to add two transport couples to the list of air basins in which upwind areas are required to adopt permitting thresholds no less stringent than those adopted in downwind areas | 4/26/01 |
| **Zero emission vehicle regulation amendments**<br>Adopted amendments to reduct the numbers of ZEVs required in future years, add a PZEV category and grant partial ZEV credit, modify the ZEV range credit, allow hybrid-electric vehicles partial ZEV credit, grant ZEV credit to advanced technology vehicles, and grant partial ZEV credit for several other minor new programs | 1/25/01<br>12/7/01 EO<br>4/12/02 EO |
| **Heavy duty diesel engines supplemental test procedures**<br>Approved amendments to extend "Not-To-Exceed" and EURO III supplemental test procedure requirements through 2007 when federal requirements will included these tests | 12/7/00 |
| **Light and medium duty low emission vehicle alignment with federal standards**<br>Approved amendments that require light and medium duty vehicles sold in California to meet the more restrictive of state or federal emission standards | 12/7/00<br>12/27/00 EO |
| **Exhaust emission standards for heavy duty gas engines**<br>Adopted amendments that establish 2005 emission limits for heavy duty gas engines that are equivalent to federal limits | 12/7/00<br>12/27/00 EO |
| **CaRFG Phase 3 amendments**<br>Approved amendments to regulate the replacement of MTBE in gasoline with ethanol | 11/16/00<br>4/25/01 EO |
| **CaRFG Phase 3 test methods**<br>Approved amendments to gasoline test procedures to quantify the olefin content and gasoline distillation temperatures | 11/16/00<br>7/11/01 EO<br>8/28/01 EO |

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| **Antiperspirant and deordorant regulations**<br>Adopted amendments to relax a 0% VOC limit to 40% VOC limit for aerosol antiperspirants | 10/26/00 |
| **Diesel risk reduction plan**<br>Adopted plan to reduce toxic particulate from diesel engines through retrofits on existing engines, tighter standards for new engines, and cleaner diesel fuel. | 9/28/00 |
| **Conditional rice straw burning regulations**<br>Adopted regulations to limit rice straw burning to fields with demonstrated disease rates reducing production by more than 5 percent | 9/28/00 |
| **Asbestos from unpaved roads**<br>Tightened an existing Air Toxic Control Measure to prohibit the use of rock containing more than 0.25% asbestos on unsurfaced roads | 7/20/00 |
| **Architectural coatings**<br>Approved amendments to replace mass-based VOC limits with reactivity-based limits, add a table of Maximum Incremental Reactivity values, add limits for polyolefin adhesion promoters, prohibit use of certain toxic solvents, and make other minor changes | 6/22/00<br>5/1/01 EO |
| **Consumer products aerosol adhesives**<br>Adopted amendments to delete a 25% VOC limit by 2002, add new VOC limits for six categories of adhesives, prohibit the use of toxic solvents, and add new labeling and reporting requirements | 5/25/00<br>3/14/01 EO |
| **Automotive care products**<br>Approved an Air Toxic Control Measure to eliminate use of perchloroethylene, methylene chloride, and trichloroethylene in automotive products such as brake cleaners and degreasers. | 4/27/00<br>2/28/01 EO |
| **Enhanced vapor recovery emergency regulation**<br>Adopted a four-year term for equipment certifications | 5/22/01 EO |
| **Enhanced vapor recovery**<br>Adopted amendments to require the addition of components to reduce spills and leakage, adapt to onboard varpor recovery systems, and continuously monitor system operation and report equipment leaks immediately | 3/23/00<br>7/25/01 EO |
| **Agricultural burning smoke management**<br>Adopted amendments to add marginal burn day designations, require day-specific burn authrorizations by districts, and smoke management plans for larger prescribed burn projects | 3/23/00<br>1/22/01 EO |
| **Urban transit buses**<br>Adopted a public transit bus fleet rule and emissions standards for new urban buses that mandates a lower fleet-average NOx emission limit, PM retrofits, lower sulfur fuel use, and purchase of specified percentages of zero emission buses in future years | 1/27/00<br>2/24/00<br>11/22/00 EO<br>5/29/01 EO |
| **Small Off-Road (diesel) Equipment (SORE)**<br>Adopted amendments to conform with new federal requirements for lower and engine power-specific emission limits, and for the averaging, banking, and trading of emissions among SORE manufacturers | 1/28/00 |
| **CaRFG Phase 3 MTBE phase out**<br>Adopted regulations to enable refiners to produce gasoline without MTBE while preserving the emissions benefits of Phase 2 cleaner burning gasoline | 12/9/99<br>6/16/00 EO |
| **Consumer products – mid-term measures II**<br>Adopted a regulation which adds emission limits for 2 new categories and tightens emission limits for 15 categories of consumer products | 10/28/99 |
| **Portable fuel cans**<br>Adopted a regulation requiring that new portable fuel containers, used to refuel lawn and garden equipment, motorcycles, and watercraft, be spill-proof beginning in 2001 | 9/23/99<br>7/6/00 EO |
| **Clean fuels at service stations**<br>Adopted amendments rescinding requirements applicable to SCAB in 1994-1995, modifying the formula for triggering requirements, and allowing the Executive Officer to make adjustments to the numbers of service stations required to provide clean fuels | 7/22/99 |
| **Gasoline vapor recovery**<br>Adopted amendments to certification and test methods | 6/24/99 |
| **Reformulated gasoline oxygenate**<br>Adopted amendments rescinding the requirement for wintertime oxygenate in gasoline sold in the Lake Tahoe Air Basin and requiring the statewide labeling of pumps dispensing gasoline containing MTBE | 6/24/99 |
| **Marine pleasurecraft**<br>Adopted regulations to control emissions from spark-ignition marine engines, specifically, outboard marine engines and personal watercraft | 12/11/98<br>2/17/00 EO<br>6/14/00 EO |
| **Voluntary accelerated light duty vehicle retirement**<br>Adopted regulation setting standards for voluntary accelerated retirement program | 12/10/98<br>10/22/99 EO |

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| **Off-highway recreational vehicles and engines**<br>Approved amendments to allow non-complying vehicles to operate in certain seasons and in certain ORV-designated areas | 12/10/98<br>10/22/99 EO |
| **On-road motorcycles**<br>Amended on-road motorcycle regulations, to lower the tailpipe emission standards for ROG and NOx | 12/10/98 |
| **Portable equipment registration program (PERP)**<br>Approved amendments to exclude non-dredging equipment operating in OCS areas and equipment emitting hazardous pollutants, include NSPS Part OOO rock crushers, require SCR emission limits and onshore emission offsets from dredging equipment operating in OCS areas, set catalyst emission limits for gasoline engines, and relieve certain retrofitted engines from periodic source testing | 12/10/98 |
| **Liquid petroleum gas motor fuel specifications**<br>Approved amendment rescinding 5% propene limit and extending 10% limit indefinitely | 12/11/98 |
| **Reformulated gasoline**<br>Approved amendments to rescind the RVP exemption for fuel with 10% ethanol and allow for oxygen contents up to 3.7% if the Predictive Model weighted emissions to not exceed original standards | 12/11/98 |
| **Consumer products**<br>Adopted amendments to add new VOC test mothods, to modify Method 310 to quantify low vapor pressure VOC (LVP-VOC) constituents, and to exempt LVP-VOC from VOC content limits | 11/19/98 |
| **Consumer products**<br>Approved amendments to extend the 1999 VOC compliance deadline for several aerosol coatings, antiperspirants and deodorants, and other consumer products categories to 2002, to exempt methyl acetate from the VOC definition, and make other minor changes | 11/19/98 |
| **Low-emission vehicle program (LEV II)**<br>Adopted regulations adding exhaust emission standards for most sport utility vehicles, pick-up trucks and mini-vans, lowering tailpipe standards for cars, further reducing evaporative emission standards, and providing additional means for generating zero-emission vehicle credits | 11/5/98<br>9/17/99 EO |
| **Off-road engine aftermarket parts**<br>Approved imiplementation of a new program to test and certify aftermarket parts in gasoline and diesel, light-duty through heavy duty, engines used in off-road vehicles and equipment | 11/19/98<br>10/1/99 EO<br>7/18/00 EO |
| **Off-road spark ignition engines**<br>Adopted new emission standards for small and large spark ignition engines for off-road equipment, a new engine certification program, an in-use compliance testing program, and a three-year phase-in for large LSI | 10/22/98 |
| **Gasoline deposit control additives**<br>Adopted amendments to decertify pre-RFG additives, tighten the inlet valve deposit limits, add a combustion chamber deposit limit, and modify the test procedures to align with the characteristics of reformulated gasoline formulations | 9/24/98<br>4/5/99 EO |
| **Stationary source test methods**<br>Adopted amendments to stationary source test methods to align better with federal methods | 8/27/98<br>7/2/99 EO |
| **Locomotive MOA for South Coast**<br>Memorandum of agreement (MOA) signed by ARB, U.S. EPA, and major railroads to concentrate cleaner locomotives in the South Coast by 2010 and fulfill a 1994 ozone SIP commitment | 7/2/98 |
| **Gasoline vapor recovery**<br>Adopted amendments to certification and test methods to add methods for onboard refueling vapor recovery, airport refuelers, and underground tank interconnections, and make minor changes to existing methods | 5/21/98<br>8/27/98 |
| **Reformulated gasoline**<br>Approved amendments to rescind the wintertime oxygenate requirement, allow for sulfur content averaging, and make other minor technical amendments | 8/27/98 |
| **Ethylene oxide sterilizers**<br>Adopted amendments to the ATCM to streamline source testing requirements, add EtO limits in water effluent from control devices, and make other minor changes | 5/21/98 |
| **Chrome platers**<br>Adopted amendments to ATCM to harmonize with requirements of federal NESHAP standards for chrome plating and chromic acid anodizing facilities | 5/21/98 |
| **On-road heavy-duty vehicles**<br>Approved amendments to align on-road heavy duty vehicle engine emission standards with EPA's 2004 standards and align certification, testing, maintenance, and durability requirements with those of EPA | 4/23/98<br>2/26/99 EO |
| **Small off-road engines (SORE)**<br>Approved amendments to grant a one-year delay in implementation, relaxation of emissions standards for non-handheld engines, emissions durability requirements, averaging/banking/trading, harmonization with the federal diesel engine regulation, and modifications to the production line testing requirements | 3/26/98 |
| **Heavy duty vehicle smoke inspection program**<br>Adopted amendments to require annual smoke testing, set opacity limits, and exempt new vehicles from testing for the first four years | 12/11/97<br>3/2/98 EO |
| **Consumer products (hairspray credit program)**<br>Adopted standards for the granting of tradable emission reduction credits achieved by sales of hairspray products having VOC contents less than required limits | 11/13/97 |

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| Board Action | Hearing Date |
|---|---|
| **Light-duty vehicle off-cycle emissions**<br>Adopted standards to control excess emissions from aggressive driving and air conditioner use in light duty vehicles and added two light duty vehicle test methods for certification of new vehicles under these standards | 7/24/97<br>3/19/98 EO |
| **Consumer products**<br>Adopted amendments to add VOC limits to 18 categories of consumer products used in residential and industrial cleaning, automobile maintenance, and commercial poisons | 7/24/97 |
| **Enhanced evaporative emissions standards**<br>Adopted amendments extending the compliance date for ultra-small volume vehicle manufacturers by one year | 5/22/97 |
| **Emission reduction credit program**<br>Adopted standards for District establishment of ERC programs including certification, banking, use limitation, and reporting requirements | 5/22/97 |
| **Lead as a toxic air contaminant**<br>Adopted an amendment to designate inorganic lead as a toxic air contaminant | 4/24/97 |
| **Consumer products (hair spray)**<br>Adopted amendments to (1) delay a January 1, 1998, compliance deadline to June 1, 1999, (2) require progress plans from manufacturers, and (3) authorize the Executive Officer to require VOC mitigation when granting variances from the June 1, 1999 deadline | 3/27/97 |
| **Portable engine registration program (PERP)**<br>Adopted standards for (1) the permitting of portable engines by ARB and (2) District recognition and enforcement of permits | 3/27/97 |
| **Liquefied petroleum gas**<br>Adopted amendments to extend the compliance deadline from January 1, 1997, to January 1, 1999, for the 5% propene limit in liquefied petroleum gas used in motor vehicles | 3/27/97 |
| **Onboard diagnostics, phase II**<br>Adopted amendments to extend the phase-in of enhanced catalyst monitoring, modify misfire detection requirements, add PVC system and thermostat monitoring requirements, and require manufacturers to sell diagnostic tools and service information to repair shops | 12/12/96 |
| **Consumer products**<br>Adopted amendments to delay 25% VOC compliance date for aerosol adhesives, clarify portions of the regulation, exempt perchloroethylene from VOC definition, extend the sell-through time to three years, and add perchloroethylene reporting requirements | 11/21/96 |
| **Consumer products (test method)**<br>Adopted an amendment to add Method 310 for the testing of VOC content in consumer products | 11/21/96 |
| **Pollutant transport designation**<br>Adopted amendments to modify transport couples from the Broader Sacramento area and add couples to the newly formed Mojave Desert and Salton Sea Air Basins | 11/21/96 |
| **Diesel fuel certification test methods**<br>Approved amendments specifying the test methods used for quantifying the constituents of diesel fuel | 10/24/96<br>6/4/97 EO |
| **Wintertime requirements for utility engines & off-highway vehicles:** optional hydrocarbon and NOx standards for snowthrowers and ice augers, raising CO standard for specialty vechiles under 25hp | 9/26/96 |
| **Large off-road diesel Statement of Principles**<br>National agreement between ARB, U.S. EPA, and engine manufacturers to reduce emissions from heavy-duty off-road diesel equipment four years earlier than expected in the 1994 SIP for ozone | 9/13/96 |
| **Regulatory improvement initiative**<br>Rescinded two regulations relating to fuel testing in response to Executive Order W-127-95 | 5/30/96 |
| **Zero emission vehicles**<br>Adopted amendments to eliminate zero emission vehicle quotas between 1998 and 2002, and approved MOUs with seven automobile manufacturers to accelerate release of lower emission "49 state" vehicles | 3/28/96<br>7/24/96 EO |
| **CaRFG variance requirements**<br>Approved amendments to add a per gallon fee on non-compliant gasoline covered by a variance and to made administrative changes in variance processing and extension | 1/25/96<br>2/5/96 EO<br>4/2/96 EO |
| **Utility and lawn and garden equipment engines**<br>Adopted an amendment to relax the CO standard from 300 to 350 ppm for Class I and II utility engines | 1/25/96 |
| **National security exemption of military tactical vehicles:** such vehicles would not be required to adhere to exhaust emission standards | 12/14/95 |
| **CaRFG regulation amendments**<br>Approved amendments to allow for downstream addition of oxygenates and expansion of compliance options for gasoline formulation | 12/14/95 |
| **Required additives in gasoline (deposit control additives):** terms, definitions, reporting requirements, and tes procedures for compliance are to be clarified | 11/16/95 |
| **CaRFG test method amendments**<br>Approved amendments to designate new test methods for benzene, aromatic hydrocarbon, olefin, and sulfur content of gasoline | 10/26/95 |
| **Motor vehicle inspection and maintenance program:** handled by BAR | 10/19/95<br>by BAR |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Antiperspirants and deordorants, consumer products, and aerosol coating products:** ethanol exemption for all products, modifications to aerosol special requirements, modifications for regulatory language consistency, modifications to VOC definition. | 9/28/95 |
| **Low emission vehicle (LEV III) standards:** reactivity adjustment factors, introduction of medium-duty ULEVs, window labels, and certification requirements and test procedures for LEVs | 9/28/95 |
| **Medium- and heavy-duty gasoline trucks**<br>Expedited introduction of ultra-low emission medium-duty vehicles and lower NOx emission standards for heavy-duty gasoline trucks to fulfill a 1994 ozone SIP commitment | 9/1/95 |
| **Retrofit emission standards:** all vehicle classes to be included in the alternate durability test plan, kit manufacturers to be allowed two years to validate dterioration factors under the test plan, update retrofit procedures allowing manufacturers to disable specific OBDs if justified by law. | 7/27/95 |
| **Gasoline vapor recovery systems:** adopts revised certification and test procedures | 6/29/95 |
| **Onboard refueling vapor recovery standards:** 1998 and subsequent MY engine cars, LD trucks, and MD trucks less then 8500 GVWR | 6/29/1995<br>4/24/96 EO |
| **Heavy duty vehicle exhaust emission standards for NOx:** amendments to standards and test procedures for 1985 and subsequent MY HD engines, amendments to emission control labels, amendments to Useful Life definition and HD engines and in-use vehicle recalls | 6/29/95 |
| **Aerosol coatings regulation**<br>Adopted regulation to meet California Clean Air Act requirements and a 1994 ozone SIP commitment | 3/23/95 |
| **Periodic smoke inspection program:** delays start of PSIP from 1995 to 1996 | 12/8/94 |
| **Onboard diagnostics phase II:** amendments to clarify reg language, ensure maximum effectiveness, and address manufacturer concerns regarding implementation. | 12/8/94 |
| **Alternative control plan (ACP) for consumer products:** a voluntary, market-based VOC emissions cap upon a grouping of consumer products, flexible by manufacturer, that will minimize overall costs of emission reduction methods and programs. | 9/22/94 |
| **Diesel fuel certification:** new specifications for diesel engine certification fuel, amended oxygen specification for CNG certification fuel, and amended commercial motor vehicle liquefied petroleum gas regulations. | 9/22/94 |
| **Utility and lawn and garden equipment (UGLE) engines:** modification to emission test procedures, ECLs, defects warranty, quality-audit testing, and new engine compliance testing. | 7/28/94 |
| **Evaporative emissions standards and test procuedures**<br>Adopted evaporative emissions standards for medium-duty vehicles | 2/10/94 |
| **Off-road recreational vehicles**<br>Adopted emission control regulations for off-road motorcycles, all-terrain vehicles, go-karts, golf carts, and specialty vehicles | 1/1/94 |
| **Perchloroethylene from dry cleaners**<br>Adopted measure to control perchloroethylene emissions from dry cleaning operations | 10/1/93 |
| **Wintertime oxygenate program:** amendments to the control time period for San Luis Obispo County, exemption for small retailers bordering Nevada, flexibility in gasoline delivery time, calibration of ethanol blending equipment, gasoline oxygen content test method | 9/9/93 |
| **Onboard diagnostic phase II** | 7/9/93 |
| **Urban transit buses**<br>Amended regulation to tighten state NOx and particulate matter (PM) standards for urban transit buses beyond federal standards beginning in 1996 | 6/10/93 |
| **1-year implementation delay in emission standards for utility engines** | 4/8/93 |
| **Non-ferrous metal melting**<br>Adopted Air Toxic Control Measure for emissions of cadmium, arsenic, and nickel from non-ferrous metal melting operations | 1/1/93 |
| **Certifications requirements for low emission passenger cars, light-duty trucks & medium duty vehicles** | 1/14/93 |
| **Airborne toxic control measure for emissions of toxic metals from non-ferrous metal melting** | 12/10/92 |
| **Periodic self-inspection program**<br>Implemented state law establishing a periodic smoke self-inspection program for fleets operating heavy-duty diesel-powered vehicles | 12/10/92 |
| **Notice of general public interest for consumer products** | 11/30/92 |
| **Substitute fuel or clean fuel incorporated test procedures** | 11/12/92 |
| **New vehicle testing using CaRFG Phase 2 gasoline**<br>Approved amendments to require the use of CaRFG Phase 2 gasoline in the certification of exhaust emissions in new vehicle testing | 8/13/92 |

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Air Resources Board Control Measures, 1985 - 2015

| Board Action | Hearing Date |
|---|---|
| **Standards and test procedures for alternative fuel retrofit systems** | 5/14/92 |
| **Alternative motor vehicle fuel certification fuel specification** | 3/12/92 |
| **Heavy-duty off-road diesel engines**<br>Adopted the first exhaust emission standards and test procedures for heavy-duty off-road diesel engines beginning in 1996 | 1/9/92 |
| **Consumer Products - Tier II**<br>Adopted Tier II of regulations to reduce emissions from consumer products | 1/9/92 |
| **Wintertime oxygen content of gasoline**<br>Adopted regulation requiring the addition of oxygenates to gasoline during winter to satisfy federal Clean Air Act mandates for CO nonattainment areas | 12/1/91 |
| **CaRFG Phase 2**<br>Adopted CaRFGPphase 2 specifications including lowering vapor pressure, reducing the sulfur, olefin, aromatic, and benzene content, and requiring the year-round addition of oxygenates to achieve reductions in ROG, NOx, CO, oxides of sulfur (SOx) and toxics | 11/1/91 |
| **Low emissions vehicles amendments revising reactivity adjust factor (RAF) provisions and adopting a RAF for M85 transitional low emission vehicles** | 11/14/91 |
| **Onboard diagnostic, phase II** | 11/12/91 |
| **Onboard diagnostics for light-duty trucks and light & medium-duty motor vehicles** | 9/12/91 |
| **Utility and lawn & garden equipment**<br>Adopted first off-road mobile source controls under the California Clean Air Act regulating utility, lawn and garden equipment | 12/1/90 |
| **Control for abrasive blasting** | 11/8/90 |
| **Roadside smoke inspections of heavy-duty vehicles**<br>Adopted regulations implementing state law requiring a roadside smoke inspection program for heavy-duty vehicles | 11/8/90 |
| **Consumer Products Tier I**<br>Adopted Tier I of standards to reduce emissions from consumer products | 10/11/90 |
| **CaRFG Phase I**<br>Adopted CaRFG Phase I reformulated gasoline regulations to phase-out leaded gasoline, reduce vapor pressure, and require deposit control additives | 9/1/90 |
| **Low-emission vehicle (LEV) and clean fuels**<br>Adopted the landmark LEV/clean fuel regulations which called for the gradual introduction of cleaner cars in California. The regulations also provided a mechanism to ensure the availability of alternative fuels when a certain number of alternative fuel vehicles are sold | 9/1/90 |
| **Evaporative emissions from vehicles**<br>Modified test procedure to include high temperatures (up to 105 F) and ensure that evaporative emission control systems function properly on hot days | 8/9/90 |
| **Dioxins from medical waste incinerators**<br>Adopted Airborne Toxic Control Measure to reduce dioxin emissions from medical waste incinerators | 7/1/90 |
| **CA Clean Air Act guidance for permitting**<br>Approved California Clean Air Act permitting program guidance for new and modified stationary sources in nonattainment areas | 7/1/90 |
| **Consumer products BAAQMD** | 6/14/90 |
| **Medium duty vehicle emission standards**<br>Adopted three new categories of low emission MDVs, required minimum percentages of production, and established production credit and trading | 6/14/90 |
| **Medium-duty vehicles**<br>Amended test procedures for medium-duty vehicles to require whole-vehicle testing instead of engine testing. This modification allowed enforcement of medium-duty vehicle standards through testing and recall | 6/14/90 |
| **Ethylene oxide sterilizers**<br>Adopted Airborne Toxic Control Measure to reduce ethylene oxide emissions from sterilizers and aerators | 5/10/90 |
| **Asbestos in serpentine rock**<br>Adopted Airborne Toxic Control Measure for asbestos-containing serpentine rock in surfacing applications | 4/1/90 |
| **Certification procedure for aftermarket parts** | 2/8/90 |
| **Antiperspirants and deodorants**<br>Adopted first consumer products regulation, setting standards for antiperspirants and deodorants | 11/1/89 |
| **Residential woodstoves**<br>Approved suggested control measure for the control of emissions from residential wood combustion | 11/1/89 |
| **On-Board Diagnostic Systems II**<br>Adopted regulations to implement the second phase of on-board diagnostic requirements which alert drivers of cars, light-trucks and medium-duty vehicles when the emission control system is not functioning properly | 9/1/89 |
| **Cars and light-duty trucks**<br>Adopted regulations to reduce ROG and CO emissions from cars and light trucks by 35 percent | 6/1/89 |
| **Architectural coatings**<br>Approved a suggested control measure to reduce ROG emissions from architectural coatings | 5/1/89 |

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**Air Resources Board Control Measures, 1985 - 2015**

| Board Action | Hearing Date |
|---|---|
| **Chrome from cooling towers**<br>Adopted Airborne Toxic Control Measure to reduce hexavalent chromium emissions from cooling towers | 3/1/89 |
| **Reformulated Diesel Fuel**<br>Adopted regulations requiring the use of clean diesel fuel with lower sulfur and aromatic hydrocarbons beginning in 1993 | 11/1/88 |
| **Vehicle Recall**<br>Adopted regulations implementing a recall program which requires auto manufacturers to recall and fix vehicles with inadequate emission control systems (Vehicles are identified through in-use testing conducted by the ARB) | 9/1/88 |
| **Suggested control measure for oil sumps**<br>Approved a suggested control measure to reduce emissions from sumps used in oil production operations | 8/1/88 |
| **Chrome platers**<br>Adopted Airborne Toxic Control Measure to reduce emissions of hexavalent chromium emissions from chrome plating and chromic acid anodizing facilities | 2/1/88 |
| **Suggested control measure for boilers**<br>Approved suggested control measure to reduce NOx emissions from industrial, institutional, and commercial boilers, steam generators and process heaters | 9/1/87 |
| **Benzene from service stations**<br>Adopted Airborne Toxic Control Measure to reduce benzene emissions from retail gasoline service stations (Also known as Phase II vapor recovery) | 7/1/87 |
| **Agricultural burning guidelines**<br>Amended existing guidelines to add provisions addressing wildland vegetation management | 11/1/86 |
| **Heavy-duty vehicle certification**<br>Amended certification of heavy-duty diesel and gasoline-powered engines and vehicles to align with federal standards | 4/1/86 |
| **Cars and light-duty trucks**<br>Adopted regulations reducing NOx emissions from passenger cars and light-duty trucks by 40 percent | 4/1/86 |
| **Sulfur in diesel fuel**<br>Removed exemption for small volume diesel fuel refiners | 6/1/85 |
| **On-Board Diagnostics I**<br>Adopted regulations requiring the use of on-board diagnostic systems on gasoline-powered vehicles to alert the driver when the emission control system is not functioning properly | 4/1/85 |
| **Suggested control measure for wood coatings**<br>Approved a suggested control measure to reduce emissions from wood furniture and cabinet coating operations | 3/1/85 |
| **Suggested control measure for resin manufacturing**<br>Approved a suggested control measure to reduce ROG emissions from resin manufacturing | 1/1/85 |

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# Appendix E

Incentive and Other Non-Regulatory Strategies

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix E: Incentive and Other Non-Regulatory Strategies

Reduction of emissions through regulatory efforts alone will not bring the San Joaquin Valley Air Basin (Valley) into attainment of the national ambient air quality standards. The San Joaquin Valley Air Pollution Control District (District) has increasingly relied on its advocacy efforts to secure state and federal funding sources, and locally-generated funding to implement incentive programs that have become a crucial component of the District's overall strategy for achieving the emissions reductions necessary to bring the Valley into attainment. In addition to incentive programs, the District has also implemented a number of other non-regulatory measures to reduce emissions, including implementation of a technology advancement program, establishing legislative priorities, and implementing an extensive community outreach and education program.

## E.1 DISTRICT INCENTIVE PROGRAMS

Incentive programs are an integral part of the District's efforts to reduce emissions. These programs provide an effective way to accelerate emissions reductions and encourage technology advancement, particularly from mobile sources, a sector not directly under the District's regulatory jurisdiction. Given that 85% of the NOx emissions in the Valley come from mobile sources, these successful voluntary incentive grant programs help the Valley achieve highly cost-effective emissions reductions beyond the District's regulatory bounds 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 appropriated $156 million in incentive funding in the 2014–2015 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, grant recipients have provided $526,600,794 in matching funds, with a combined District and grant recipient funding investment of $1.2 Billion. These investments have been made to purchase, replace, or retrofit thousands of pieces of equipment, including:

- 6,667 Agricultural Engine Repowers
- 2,296 Tractor Replacement Program
- 6,388 Wood Stove Replacements
- 56 Agricultural Utility Vehicles
- 3 Advanced Transit & Transportation Projects
- 6 Alternative-Fuel Infrastructure Projects
- 18 Bicycle Infrastructure Projects
- 177 Commercial Lawn and Garden Projects
- 2,234 New Alternative-Fuel Light Duty Vehicles (Public & Private)
- 12 E-Mobility Projects
- 50 Electric Forklifts
- 15 Alternative Fuel Fueling Stations
- 57 Hybrid and Zero-Emission Truck and Bus Voucher Incentive Projects

- 3,910 Lawn Mower Replacements
- 41 Locomotives
- 1 Marine Vessel
- 1,473 Off-Road Engine Repower/Retrofits
- 5,082 Heavy-Duty On-Road Truck Repowers, Retrofits, Purchases and Replacements
- 2,563 School Bus Retrofits and Replacements
- 78 School Bus Tank Replacement
- 15 Technology Advancement Program
- 12 Transit Pass Projects
- 87,512 Van Pool Subsidy Projects

The District's incentive programs continue to be 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 extensively with the U.S. Environmental Protection Agency (EPA), California Air Resources Board (ARB) and the United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) to develop the mechanism to take credit in state implementation plans (SIP) for emission reductions generated through incentive programs that satisfy the four federal criteria for SIP creditability – surplus, quantifiable, enforceable and permanent.

## E.1.1 Incentive Funding

The District is engaged at every level of state and federal government to craft policy and funding targets that account for the Valley's unique challenges and need to accelerate emissions reductions, particularly from sources not under the District's regulatory authority. Toward that end, the District is working closely with the Valley's legislative delegation to ensure that the Valley's needs are well represented in discussions of where to focus funding throughout the state and the region as a whole. In addition, the District is focused on how to effectively allocate the limited funding received for its incentive programs.

### *E.1.1.1 Funding Sources*

The District continues to dedicate significant effort to ensure that the Valley receives its share of state and federal incentive funds through a variety of sources. In addition to aggressively pursuing funding from state funding sources such as the Carl Moyer Program and Lower-Emission School Bus Program, the District has been very successful in securing grants from the highly-competitive federal Diesel Emissions reductions Act (DERA) and the state Assembly Bill (AB) 118 Air Quality Improvement Program (AQIP). Currently, the District is actively engaged with ARB and the California Energy Commission (CEC) to ensure that the Valley is well represented in projects selections from the Greenhouse Gas Reduction Fund totaling over $1 billion per year.

The District derives its current incentive funding from a range of local, state and federal funding sources. These funding sources contain restrictions on the types of projects that may be funded, funding limitations, expenditure deadlines, and administrative approach for distribution. These requirements vary significantly from one funding source to another, resulting in a complex matrix of funding categories and program requirements. Some of the key funding sources currently available to the District include:

**Carl Moyer Funding -** The Carl Moyer program has been an on-going and reliable source of funding since 1998. The Carl Moyer program was established in 2004 with the adoption of AB 923 and Senate Bill (SB) 1107; the latter provided increased and continued funding through 2014 and expanded the program to include light-duty vehicle projects and agricultural sources of air pollution. In total, the District receives approximately $9 million per year in Carl Moyer funding. Recent legislation extended Carl Moyer funding until 2024.

**State AB 118 Funding -** In 2007, the California legislature approved AB 118: the California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007. AB 118 provides approximately $200 million annually through 2015 for three new programs to fund air quality improvement projects and develop and deploy technology and alternative and renewable fuels. The bill creates a dedicated revenue stream for the programs through increases to the smog abatement, vehicle registration, and vessel registration fees. AB 118 is designed to reduce emissions of criteria pollutants and greenhouse gas emissions and to deploy advanced technology. Most AB 118 programs are administered on a statewide basis. While the District has administered some of the AB 118 programs for the state, these programs have not been a significant portion of the District's incentive program revenue. However, in the future, these funds may be more important, particularly as the District becomes more involved in technology advancement projects. Recent legislation extended AB 118 funding until 2024.

**Proposition 1B Goods Movement Emission Reduction Program -** The single largest source of funding for the District's incentive programs is the Proposition 1B program, which uses bond funds for a variety of state transportation priorities. The District aggressively pursued its share of Proposition 1B funding, and the Valley will receive approximately $250 million over the life of the program. The District will receive its last allocation of Proposition 1B funding in fiscal year 2015-2016.

**Local Motor Vehicle Surcharge Fees –** Through the passage of Assembly Bill 2522 in 2008 and in recognition of the need for additional funding to assist the Valley attain federal ambient air quality standards, the District was provided with the authority to generate grant revenues through the adoption of motor vehicle surcharges for the purpose of funding emission reduction projects. In October 2010, the District acted on this authority and adopted a $12 per motor vehicle surcharge. This revenue source was then targeted to address the Valley's unmatched challenges in meeting ever-tightening federal standards as well as providing a more equitable manner to satisfy the federal mandates for ozone nonattainment penalties under section 185. These revenues have been reinvested in the Valley to reduce emissions through a variety of incentive grant programs that have replaced or retrofitted trucks, passenger vehicles, school buses, transit buses, and other mobile sources of emissions.

The District has now had two consecutive years of no violations of the 1-hour ozone standard, and has requested that EPA find the Valley in attainment and lift the section 185 penalties. If successful, this would return local control over the decision relating to the need and quantity of motor vehicle surcharges under AB 2522. Given the identified need for continued incentive funding as a means for expediting attainment of the 1997 federal PM2.5 standard and garnering the needed attainment extension, the District is proposing to use a portion of these motor vehicle surcharge revenues to fund an emission reduction commitment in the plan. Therefore, it is recommended that the AB 2522 motor vehicle surcharge be discontinued if and when the Governing Board makes a decision that such revenues are no longer necessary to meet the federal mandates for attaining the national ambient air quality standards.

### *E.1.1.2 Incentive Strategy*

Each of the funding sources administered by the District includes different guidelines and statutory requirements for using the funds. Beyond the specific guidelines of each funding source, the District considers the following common factors when deciding how and where to spend incentive funds:

**Cost-effectiveness** – An important factor when considering where to invest District funds is determining which types of projects and programs will give the District the greatest return on its investment. This is typically represented in dollars per ton of emissions reduced. While cost-effectiveness is a primary factor, the District also considers projects that may not have the highest cost-effectiveness, but that provide other benefits, such as the advancement of new technology or community involvement.

**Inventory of available projects** – This factor is critical in all District incentive programs. To date, the District has been extremely successful in designing programs that have broad appeal and applicability across multiple industries. Over the past 10 years, this level of interest has resulted in a substantial backlog of eligible projects waiting for funding. Unfortunately, many of those on waiting lists have since moved into a regulated class, making them ineligible for funding, in most cases. As a result, the District must continue to not only work within the existing regulations to find cost-effective, surplus project categories, but also to focus future funding in areas where a significant inventory of eligible projects still exists.

**Required expenditure timeframes** – Each funding source that the District administers generally requires obligation and expenditure by certain deadlines. These deadlines greatly impact funding priorities and choice of projects. The District may prioritize a funding category over others because of the timeframe associated with a particular funding source. For instance, priority may be given to certain projects that can reasonably be expected finish prior to the deadline for that specific fund over other projects of equal relevance or cost-effectiveness, but with longer expected completion times. Again, the flexibility of this option works in concert with the dynamic nature of the incentive programs, projects, expenditure deadlines.

**Upcoming regulatory deadlines** – To ensure that incentive programs obtain the maximum SIP-creditable emissions reductions, the District performs a thorough analysis of all local, state, and federal regulations relating to the target categories. In addition, the District works proactively with the regulating agencies during the rule development process to understand the potential impacts of that rule on incentive projects and to ensure that opportunities for early incentive funding are maximized. These analyses determine which types of projects can be funded, for how long projects can be funded, which also impacts the potential cost-effectiveness of those projects.

**Health benefits** – In addition to emissions reductions needed to attain air quality standards, the District also seeks incentive projects that provide direct health benefits to Valley residents. For instance, the District's Lower-Emission School Bus Program reduces exposure to children from toxic diesel particulates, even though this source is not one of the largest sources of regional particulate pollution.

**Promoting technology advancement** – Funding projects that demonstrate and advance new emission reduction technologies will be essential for meeting increasingly stringent air quality standards given the Valley's existing challenges. The District's adoption of the Technology Advancement Program emphasizes the priority given to this area.

**Environmental Justice** – The District places a strong emphasis in providing funding in a manner that benefits environmental justice communities. The District has worked cooperatively with the Environmental Justice Advisory Group to understand the Valley's environmental justice issues and to craft programs that reduce emissions in these areas.

**Community involvement/benefits** – The District develops and administers programs with an emphasis on community involvement. Some examples of these are the Clean-Green-Yard-Machine program, Drive Clean! Rebate program, Burn Cleaner program, Transit Pass Subsidy program, and the Polluting-Automobile Scrap and Salvage program.

### *E.1.1.3 Statutory Constraints on Incentive Funding*

The District's current incentive funding comes from a range of local, state, and federal funding sources. Each funding source places restrictions on the types of projects that may be funded, the funding limits, expenditure deadlines, and the administrative approach for distribution. These requirements vary significantly from one funding source to another, resulting in a complex matrix of funding categories and program requirements. Some key examples are listed below:

**Proposition 1B Goods Movement** – Funding for this program must be dedicated to heavy duty trucks and locomotives. The program procedures require that a Request-for-Proposals (RFP) process is used and that the most cost-effective projects are funded first.

**Lower-Emission School Bus** – Funding for this program must be allocated to school bus replacements or retrofits. The program requires that all retrofits be prioritized and that the oldest buses are replaced first.

**Carl Moyer** – Funding is predominately used for heavy-duty diesel equipment projects. The program has strict funding caps and cost-effectiveness requirements.

**DMV Funds** – Funding must be used primarily for on-road and off-road mobile sources. Portions of funds must follow state Carl Moyer and Lower-Emission School Bus guidelines.

**Advanced Emission Reduction Option Funds** – Funding is for emission reduction incentive projects. The District's Governing Board has discretion as to where to apply these funds using the District's annual budget process to allocate this funding.

**Indirect Source Review (ISR) Funds** – Funding preference is given to emissions reductions opportunities near development projects.

#### *E.1.1.4 SIP Creditability of Incentive Programs (Rule 9610)*

Historically, states and local air agencies have not been able to obtain SIP credit for incentive-based emissions reductions. When given SIP credit, incentive-based emissions reductions can be used alongside regulatory-based emissions reductions to meet federal Clean Air Act (CAA) requirements, such as demonstrating attainment with federal air quality standards at a future date or demonstrating that emissions reductions meet federal SIP reasonable further progress requirements. Given the heavy investment from the public and private sectors in replacing equipment under these voluntary incentives, establishing a general framework to receive SIP credit for these emissions reductions was critical for ensuring the continued success of these programs. Working together with EPA, ARB, and the USDA-NRCS, the District adopted Rule 9610 (State Implementation Credit for Emission Reductions Generated Through Incentive Programs) on June 20, 2013. District Rule 9610 establishes the administrative mechanism through which the District and ARB take SIP credit for emissions reduced through incentives. EPA proposed a limited approval of Rule 9610 in May 2014[1] and finalized that approval on April 9, 2015.[2]

### E.1.2 Incentive 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. District staff will continue to expand on the success

[1] Revision to the California State Implementation Plan; San Joaquin Valley Unified Air Pollution Control District; Quantification of Emission Reductions from Incentives. 79 Fed. Reg. 96 pp. 25650-28658. (2014, May 19) http://www.gpo.gov/fdsys/pkg/FR-2014-05-19/pdf/2014-11481.pdf

[2] Revision to the California State Implementation Plan; San Joaquin Valley Unified Air Pollution Control District; Quantification of Emission Reductions from Incentives. 80 Fed. Reg. 68 pp. 19020-19033. (2015, April 9) http://www.gpo.gov/fdsys/pkg/FR-2015-04-09/pdf/2015-07972.pdf

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:

### E.1.2.1 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.

### E.1.2.2 Agricultural Pumping Engines

The District provides up to 85% funding for farmers looking to replace older, dirtier diesel engines with low-emission Tier 4 engines or zero-emission electric motors. Agriculture accounts for a majority of the local economy, and 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 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 (PUC) 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 fifteen years, the District has funded the replacement of over 6,600 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. The District will consider pursuing a renewed public/private collaborative partnership similar to the previously mentioned partnership to provide further incentives for replacing remaining agricultural internal combustion engines with electric motors, potentially including assistance for line extensions for remotely located wells.

For a typical irrigation pump project, the District will verify that the old engine is operational and eligible. If so, the engine owner is offered the incentive and has the new engine or motor installed, making sure that the old engine is sufficiently disabled. The District conducts a post-inspection prior to payment to document the new engine or motor's specifications and to ensure the emissions reductions are accurate. Ongoing monitoring and reporting ensures the projects meet contracted emissions reductions targets.

### *E.1.2.3 Agricultural Equipment*

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.

The District has funded the repower and replacement of over 3,500 off-road agricultural vehicles, with more projects currently in the queue. It is estimated 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.

In both repower and replacement projects, the farmer enters into an agreement with the District to replace the old, dirty engine or vehicle with newer, cleaner technology. The District first performs a pre-inspection to determine that the equipment and engine are operational. Then a final inspection is performed to verify the new equipment, as well as witness the old equipment and engine's destruction at a District-approved recycling or scrapping facility, ensuring the old equipment and engine will never be put back into service. Ongoing monitoring and reporting ensure the expected emissions reductions and operation of the equipment meet the grant agreement requirements.

### *E.1.2.4 Locomotives*

The emissions from goods movement are a significant source of diesel particulate matter (PM) in the Valley and the state, and many of the larger cities in the Valley are home to locomotive rail yards. Locomotives, in particular, present a considerable health risk from diesel PM emissions. Residential areas located close to rail yards have shown a significant increase in cancer risk and can equal or exceed the regional background or regional health risk levels. 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, the Federal Diesel Air Shed Grant, and DERA funding.

The District has funded the repower or replacement of 41 locomotives, with more projects currently in the queue. One of the major benefits to the locomotive repower and replacement program is increased efficiency and longevity as a result of the revolutionary GenSet engine technology. The GenSet system uses multiple smaller off-road tier-4 emission level engines mounted on a single chassis. This system allows for each of the engines to be fired up individually so that in low-power demand situations only one of the engines can be used, helping to reduce unnecessary emissions. In addition, this system comes equipped with idle reduction technology that will shut down the engine during periods of inactivity.

The District funds locomotive repower or replacement projects through an RFP procurement process, and reviews and selects recipients based on established scoring criteria. During the pre-inspections, all necessary locomotive engine information is verified by District inspectors and documented in digital photographs. Upon verification of all information, the District enters into an agreement with the recipient for the project. Once the replacement switcher locomotive engine has been purchased and the original engine has been dismantled, the recipient will complete and return the claim-for-payment packet, and a post-inspection is performed, prior to payment, to verify the new information. Monitoring and reporting continue for the duration of the agreement to ensure the emissions reductions expected from the project occur.

#### *E.1.2.5 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, thus creating cost savings that offset a portion of the additional equipment cost. Eligible projects are funded with federal, state, and local sources, including Carl Moyer Program funds and motor vehicle surcharge fees.

The District has funded 50 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.

The forklift program is an over-the-counter program, in that applications are continually accepted on a first-come-first-served basis. Contrary to many of the off-road or agricultural components in the Heavy-Duty Engine Program, a pre-inspection is not required for the new electric forklift component (LSI retrofits are pre-inspected to ensure emissions are real and quantifiable). After contracts are awarded and the new equipment is purchased and installed, post-inspections are performed to ensure emissions reductions are accurately recorded and ongoing monitoring and reporting are required to ensure the emissions reductions occur.

### *E.1.2.6 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 2,216 school buses and replace 494 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.

Eligible school buses are selected based on specific program requirements, including replacing the oldest models first. After determining eligibility, school districts are awarded contracts that provide a reasonable time period for project completion. A claim-for-payment form must also be submitted before funds can be awarded.

### *E.1.2.7 Community Incentives*

While all of the District’s incentive programs are open to residents of the Valley, there are a number of programs, such as the Heavy-Duty Engine Program and the Proposition 1B Goods Movement Emission Reduction Incentive Program, that are specifically designed for Valley businesses. These programs focus on replacing or retrofitting large diesel-powered equipment such as trucks, tractors, and agricultural irrigation pump engines. These programs are highly efficient and extremely cost-effective. Of equal importance, the District currently operates several incentive programs designed for the general public. These programs 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 high-polluting wood-burning devices and open hearth fireplaces to cleaner alternatives such as natural gas fired devices, and EPA certified wood and pellet stoves. In 2014 the District implemented additional upgrades to the Burn Cleaner Program to make it more accessible and to increase the incentive amounts with great success. Through this program, the District offers a financial incentive to Valley residents with an increased incentive amount available to low-income qualified applicants through a streamlined voucher program that involves partnering with interested retailers. The program has upgraded over 6,380 wood-burning devices, and continues to receive a steady stream of applicants.

**Polluting Automobile Scrap and Salvage (PASS) –** The PASS program currently offers financial incentives for participants to repair or replace their high emitting vehicle and formerly provided funding for a vehicle retirement option. To date the program has replaced 310 high-emitting vehicles with newer, cleaner vehicles, retired 504 additional vehicles, and repaired 13,931 vehicles. The PASS program has primarily been supported with locally generated incentive funds; however, a portion of the funding for vehicle repairs was funded through the Reformulated Gasoline Settlement Fund created as a result of an antitrust class action. The District expects funding for additional vehicle replacement projects to be provided through the State's Enhanced Fleet Modernization Program.

**Clean-Green-Yard-Machine (CGYM) –** The CGYM program helps clean the Valley's air through incentives for residents to retire their old high-polluting 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. The CGYM program has successfully replaced over 3,910 gas lawn mowers with clean electric models.

**Drive Clean! Rebate Program – Drive Clean! Rebate Program –** This grant program encourages Valley residents to drive advanced, clean vehicles, including electric and other alternative-fueled vehicles. Since the launch of the Drive Clean! Rebate Program in March 2012, the District has issued 1,322 rebates, totaling more than $3.5 million in grant funding.

**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 4$^{th}$ celebrations.

**Public Benefit Grants Program –** The Public Benefit Grants Program is one of the District's newest incentive programs and provides funding to Valley cities, counties, and other public agencies for a wide variety of clean-air, public-benefit projects. Eligible applicants are 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 mechanics 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.

The current incentive priorities are reflected in the 2014-2015 District Budget's incentive spending plan and include funding for the following incentives:

**Community Incentives**
Drive Clean! Rebate Program (passenger vehicles)
Vehicle Scrap and Repair (Tune In Tune Up)
Burn Cleaner (residential woodburning)
Lawn Mower Replacement
REMOVE (vanpools, bikepaths, etc.)

**Goods Movement**
Proposition 1B Heavy Duty Trucks
Locomotives

**Heavy Duty Equipment Programs**
Agricultural Equipment Replacement
Agricultural Irrigation Pumps
Truck Voucher and Reuse
Construction Equipment Replacement
Refuse Fleet Replacement

**Advanced Transportation/Vehicles**
Public Benefit Grants
Hybrid Voucher Program (HVIP "Plus-Up")

**School Bus Replacement and Retrofit**
School Bus Replacement/Retrofit
Statewide Retrofit Program

**Regional Assistance**
Greenhouse Gas Mitigation Assistance

**Technology Advancement**
Technology Advancement Program
Zero-Emission Commercial Lawn and Garden

## E.2 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 will require 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 District's ozone and PM2.5 attainment plans.

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 California Air Resources Board (ARB) and the South Coast Air Quality Management District (SCAQMD) to prepare a document to outline a common vision for attainment of federal air quality standards, as well as 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.

### E.2.1 Technology Focus Areas

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

I. **Renewable Energy**. Renewable energy projects will focus on overcoming the barriers that prevent the use or adoption of zero-emission renewable energy sources or reduce emissions from renewable energy systems to make them cleaner than comparable non-renewable alternatives.

II. **Waste Solutions**. Waste solutions will 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.

III. **Mobile Sources**. Mobile source projects will demonstrate zero- or near-zero-emissions solutions to mobile source categories with emphasis on goods and people movement, off-road equipment, or agricultural equipment.

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. Throughout implementation of this PM2.5 plan and future air quality plans, the District will continue to evaluate and, if necessary, update these technology focus areas to address to the Valley's air quality challenges.

### E.2.2 Future Demonstration Projects

In 2014, the District solicited proposals for projects, received 35 proposals, and expects the total funding for selected project to be approximately $4 million. 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 than those that do not.

### E.2.3 Demonstration Projects in Process

The District's Technology Advancement Program has had four rounds of funding and received over 130 proposals for clean technology projects. As of 2013, the District selected 27 of the proposed projects for funding, for over $7 million in support of clean technology demonstrations. The following 11 projects, out of the 27 selected, are in process and moving forward, or completed with reports posted to the District's web page:

***Engine, Fuel, and Emissions Engineering, Inc. (EF&EE)***
***Renewable Energy and Waste Solutions Technology Focus Areas***
The EF&EE project is demonstrating a compact SCR device on a biogas-powered engine to be installed at Joseph Gallo Farms in Atwater, CA. Source testing has shown the system operating at ultra-low NOx levels[3]. The system includes advanced exhaust thermal controls, monitoring, and reductant metering equipment to prevent ammonia slip and reduce or eliminate the need for an ammonia slip catalyst. The slip catalyst is the primary source of NOx emissions in other SCR systems, and this new systems thermal control with advanced metering is significantly NOx emissions.

This new technology has a low cost relative to the emission reductions, result in good cost-effectiveness. Additionally, EF&EE theorizes that the exhaust thermal management necessary for the advanced catalyst optimization will have the result of making the catalyst resistant to siloxanes in the source gas. Additional demonstration

[3] *Demonstration Of A Compact SCR™ System Meeting 0.07 lb/MWh Nox In A Biogas Engine Final Report.* Report from the contract team. (2014, June 24). Funded by and prepared for the San Joaquin Valley Technology Advancement Program. Available at: http://valleyair.org/grants/documents/technologyadvancement/C-4236_EF&EE_FinalReport.pdf

will be necessary to determine if this siloxane tolerance will allow for a more cost-effective application of this technology to other waste gas sources such as wastewater treatment plants and landfill gas.

The technology demonstrated has the potential to impact a large number of biogas projects in the Valley, and with statewide efforts being made to increase the number of biogas projects, this project is highly relevant to our planning process and offers additional co-benefits in greenhouse gas reductions.

***Association of Compost Producers***
***Mobile Sources and Waste Solutions Technology Focus Area***

The Association of Compost Producers has designed and tested an aerated static pile method of composting for a large-scale composting facility. The system consists of three components: substitution of diesel-powered loaders with electronic conveyor systems to build piles; the use of solar-powered electric blowers to replace diesel-powered windrow turners during the active phase of composting; and the use of finished compost biofilter covers, which reduce VOC emissions.

The prototype aerated static pile method and conventional windrows of the same age and feedstock were maintained for one month, during which time emissions of VOCs, ammonia and greenhouse gases were sampled using flux chambers.[4] Emissions from the prototype method during the active composting phase were significantly reduced for total non-methane, VOCs, ammonia, and NOx compared to the control windrows. The project also reduced the amount of fuel, water, and land necessary for active-phase composting.

***Sun-Maid Growers of California***
***Waste Solutions Technology Focus Area***

Sun-Maid Growers has modified and tested a mobile prototype device called the Burn Boss® Air Curtain Burner. Sun-Maid tested this device as an alternative to typical open burning practices for paper raisin trays, in order to reduce visible smoke emissions as well as PM2.5 resulting from the burning of paper raisin trays used during the grape harvest. The technology has been shown to significantly reduce visible smoke and $NO_X$ emissions compared to open burning[5]. The grape harvest coincides with District's highest ozone levels; reductions of these emissions greatly benefit air quality.

***Solar Storage Company***
***Renewable Energy Technology Focus Area***

The Solar Storage Company project will demonstrate a renewable solar-power generation system as an alternative to diesel power for agricultural irrigation pumping systems, especially those systems in remote locations. The demonstration system uses a thermal-solar concentration system with two reciprocating steam engines and a

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[4] *Greenwaste Compose Site Emissions Reductions from Solar-Powered Aeration and Biofilter Layer.* Report from the contract team. (2013, May 14). Funded by and prepared for the San Joaquin Valley Technology Advancement Program. Available at: http://www.valleyair.org/Grant_Programs/TAP/documents/C-15636-ACP/C-15636_ACP_FinalReport.pdf

[5] *Evaluation of Burner Boss ® Air Curtain Burner. Project Number C-15612-A.* Available at: http://www.valleyair.org/Grant_Programs/TAP/documents/C-15612-SunMaid/C-15612_Sun-Maid_FinalReport.pdf

pressurized steam storage system. This technology will provide an alternative to electrifying pumping systems, which is not cost-effective in situations where electricity is not close by or infrastructure is not in place. The project will be installed in parallel with a diesel backup-power system to operate the pump at times when there is a need for emergency freeze protection occurring with two cloudy days in a row. Meteorological conditions that prevent the solar use in such cases are rare and only accounts for 1% of the pumping time of a typical agricultural irrigation pump. As a result, the project will result in a 99% reduction in emissions including diesel particulates, $NO_X$, and greenhouse gasses.

This project has potential for reducing criteria pollutant emissions, as well as the potential to reduce greenhouse gases, while expanding renewable energy options. Successful demonstration of the technology may prove a low-cost thermal storage alternative for additional applications, thus reducing the barrier to adoption of solar thermal technology.

***California Bioenergy***
***Renewable Energy and Waste Solutions Technology Focus Areas***
The California Bioenergy project will optimize and expand the emissions control systems used at the Bidart Dairy digester in Bakersfield, California. The digester gas system currently uses a non-selective catalytic reduction (NSCR) system. The project will tune the NSCR system to achieve very low $NO_X$ emissions and install a second after-treatment system that uses hydrogen selective catalytic reduction to reach near-zero $NO_X$ emissions.

The District is interested in the success of clean bioenergy production through the use of biowaste, particularly in terms of developing ultra-low-$NO_X$ technologies to mitigate the potential impact from the large-scale development of these types of projects. Projects such as this one, if successful, move the Valley closer to that goal. The ability of digester projects like this to reduce greenhouse gas emissions provides co-benefits important for program acceptance.

***US Hybrid Corporation***
***Mobile Sources Technology Focus Area***
US Hybrid, in collaboration with CALSTART, will to convert a Terex wheel loader to plug-in hybrid operation for fuel savings and emission reductions. Hybrid-electric technology, which is already available in the light-duty vehicle category, has only recently been applied to off-road vehicles. This project will advance the use of this technology for this off-road category and quantify the emission reductions associated with the system. The wheel loader will be tested at Maddox Farms, a dairy located in Fresno County. The hybridized vehicle includes electric-only operation, idle elimination, and power for electric attachments.

The outcome of this project has the potential to affect a large segment of the off-road vehicle emissions inventory and is very relevant to the attainment planning process. Additionally, the expected fuel savings will also reduce the long-term cost of ownership for the technology.

***Electricore, Inc.***
***Mobile Sources Technology Focus Area***

Electricore, Inc. will build and demonstrate a zero-emission, completely autonomous agricultural spray vehicle. Electricore will work with Trexa, LLC, who has developed a low-cost, commercial, electric off-road vehicle platform that will be combined with a commercial orchard pull-rig agricultural spray trailer. Electricore will oversee the demonstration at Paramount Farms in Kern County. The vehicle will operate autonomously based on robotics developed by the Robotics Institute at Carnegie Mellon University.

Successful implementation of this technology could have an impact on the inventory of emissions from agricultural tractors, which are numerous in the Valley. Likewise, the reduced fuel use and the associated greenhouse gas reductions provide co-benefits beyond criteria pollutant emissions reductions.

***US Hybrid Corporation***
***Mobile Sources Technology Focus Area***

US Hybrid, in partnership with CALSTART and Roush, will demonstrate a plug-in electric-hybrid propane utility truck using a Ford F-250 truck base. US Hybrid will demonstrate and test the utility truck at Maddox Farms near Riverdale, California. The demonstration and testing will identify $NO_X$ emission reductions, greenhouse gas reductions, and fuel savings.

The outcome of this project has the potential to affect a large segment of the on-road vehicle emissions inventory in light of the extensive use of utility trucks in agriculture and other industries. Likewise, the reduced fuel usage, use of propane, and the associated greenhouse gas reductions provides co-benefits beyond criteria pollutant emissions reductions. The expected fuel savings will also reduce the long-term cost of ownership for the technology.

***City of Manteca***
***Mobile Sources Technology Focus Area***

The City of Manteca will demonstrate two new Autocar Xpeditor E3 refuse vehicles fitted with Parker RunWise advanced series hybrid-drive technology to reduce diesel fuel consumption, associated $NO_X$, and other emissions, by up to 45%. The City will purchase the trucks from Autocar and subcontract with infoWedge to install monitoring equipment and collect data from the hybrid truck and a conventional diesel truck, for comparison purposes. infoWedge will characterize the drive cycle; monitor a 30-day demonstration of the hybrid truck; monitor and report emissions testing; and monitor long-term (6 months) demonstration to evaluate usage patterns, fuel consumptions, and maintenance needs.

Successful implementation of this project will show the ability to reduce emissions through reduced fuel use in the medium heavy-duty diesel truck off-road category. The reduced diesel fuel use also reduces greenhouse gas emissions and lowers overall, long-term operating costs for end users.

***Capstone Turbine Corporation***
***Mobile Sources Technology Focus Area***

Capstone Turbine Corporation is demonstrating a class 7 CNG-powered turbine range extender electric truck. The truck features an all-electric traction drive system, capable of handling the transient load requirements while the microturbine operates at its optimal modes for range extension. The electrical system will also be capable of operating a truck refrigeration unit eliminating the use of an auxiliary power unit.

Leslie’s Floral in Bakersfield will demonstrate the demonstration unit in deliveries ranging from Fresno to Bakersfield. This will demonstrate both the benefit of this level of hybridization as well as the ability for the unit to handle longer over the road driving conditions.

***Biogas & Electric, LLC***
***Renewable Energy and Waste Solutions Technology Focus Areas***

Biogas & Electric is demonstrating its NOxRx engine after-treatment system at the Bakersfield Wastewater Treatment Plant #3. The NOxRx system is based on wet scrubber technology, using fluids from the digester as the scrubbing liquor. Since the technology is not catalyst based it would be resistant to gas impurities that would be expensive to remove as is necessary other competing technologies. The goal of the project is to demonstrate a system with low operational costs capable of meeting ultra-low NOx emissions.

***Transportation Power, Inc.***
***Mobile Sources Technology Focus Area***

Transportation Power, Inc. is demonstrating a zero-emission electric yard tractor for use at IKEA’s distribution center in Lebec. The electric yard tractor would replace diesel rigs currently used to move trailers around the facility. Key innovations that will be demonstrated with this project include improved vehicle efficiency and battery charging capability. This will enable the tractors to support the demanding two-shift tractor operations at the regional distribution center, with 8-10 hour shifts and only about 1 1/2 hour between shifts.

***Colony Energy Partners***
***Renewable Energy and Waste Solutions Technology Focus Areas***

Colony Energy Partners is in the process of developing the Tulare Anaerobic Digester Facility and proposes to develop and demonstrate a novel packaged hardware system for gas purification and injection into the natural gas pipeline. The packaged hardware will have a smaller footprint, and enable much simpler future installations. Gas cleaning systems, which are used to upgrade biogas to pipeline quality for export to the utility, prevent emissions from the alternative use of the gas in power production systems. Development of a packaged combination of hardware capable of cost-effective gas purification may provide an option for reducing future emissions from power generation that use gas from digester systems.

***The Greenstation LLC***
***Mobile Sources Technology Focus Area***
The Greenstation is demonstrating a backpack battery powered leaf blower in Fresno and Visalia using the most advanced battery and blower technology available designed for commercial use. The project will integrate the blower units into the daily institutional grounds maintenance schedules and demonstrate the technology will be capable of replacing high emitting gasoline powered leaf blowers in commercial lawn maintenance operations. Given the neighborhood-level impacts of conventional gas powered lawn maintenance equipment, development of zero emissions alternatives has the potential of providing significant health benefits to Valley residents and lawn care workers.

### E.2.4 Interagency Collaborative Demonstration Projects

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

***Restaurant Charbroiler Technology Partnership***
***Emission Control Device Manufacturers, Restaurants, and South Coast Air Quality Management District (South Coast)***
A variety of technologies for capturing emissions from under-fired charbroilers have been developed or improved in recent years. To prove these technologies at working restaurants and to ease the transition to these controls, the District is seeking a small group of Valley restaurant partners to participate in a new demonstration program. Participating restaurants will be provided funding for the full cost of purchasing, installing, and maintaining installed systems during a demonstration period covering two years of operation. The District opened a request for qualifications to identify eligible equipment manufacturers on May 7, 2014, and has identified a list of eligible devices and manufacturers. Work is ongoing with partner restaurants to install and demonstrate these systems.

These demonstrations will build upon previous and ongoing laboratory testing focused on control technology for under-fired charbroilers. South Coast released a program opportunity notice for this testing project in October 2011 to solicit proposals from control device manufacturers. District staff assisted in reviewing the submitted proposals and making recommendations on which manufacturers should be allowed to submit their device to the testing protocol at the University of California, Riverside College of Engineering - Center for Environmental Research and Technology test kitchen facility. This technology demonstration effort is testing promising prototype emission control devices, which will support future regulatory efforts at both South Coast and the District.

***Zero-Emission Commercial Lawn and Garden Equipment Demonstration***
***California Air Resources Board***
The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program will provide eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals (participants) who conduct business

within the Valley. The cordless zero-emission lawn and garden equipment must be designated commercial-grade and used by commercial landscape professionals to complete multiple small to large gardening tasks over an eight-hour workday period. Eligible equipment may include, but is not limited to, lawn mowers, edgers, trimmers/brush cutters, hedge clippers, blowers/vacuums, sweepers, and chainsaws.

The District opened a Request for Applications on August 20, 2012. Participating equipment manufacturers/vendors (technology demonstrators) were responsible for providing the equipment; training to participants on the safe and efficient operation of the equipment and maintenance; and providing materials necessary for daily operation. The participants were to use the equipment in real-world settings to verify equipment durability and performance, battery capacity, and battery charge time. In addition, the participants were responsible for providing monthly data and feedback to the District and technology demonstrators and may have the opportunity to keep the equipment upon submittal of all required data and information for the program. The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program successfully ended in June 2013 with a total of 4 technology demonstrators, 60 participants and 445 pieces of equipment for in-use testing. The program demonstrated the performance and durability of electric equipment in non-residential applications to accelerate marked acceptance and build upon the progress already made in the residential sector.

***Natural Gas-Fired, Fan-Type Central Furnaces with Reduced $NO_X$ Emissions South Coast Air Quality Management District***

South Coast conducted a demonstration project focused on prototype natural gas-fired fan-type central furnaces with reduced $NO_X$ 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 $NO_X$ central furnaces was initiated with the November 2009 amendment of South Coast Rule 1111 (NOx Emissions from Natural Gas-fired, Fan type Central Furnaces). The District co-funded this technology assessment with the SCAQMD and Southern California Gas Company (SoCal Gas). The District provided $50,000, SCAQMD provided $1 million, and SoCal Gas provided $450,000 in funding. The technology assessment project was completed in the first quarter of 2014.

The goal of this technology assessment was to demonstrate reduced $NO_X$ furnaces capable of meeting an emissions goal of 14 nanograms $NO_X$ per joule of useful heat. Based on the results of the furnace demonstration project, the technology required to meet new NOx standards will be available by 2015. As a result of the study findings, the District amended Rule 4905 in January 2015 and incorporated more stringent NOx emissions limits for units subject to the rule and expanded applicability to include units installed on commercial buildings and on manufactured homes.

***Vision for Clean Air: A Framework for Air Quality and Climate Planning***
***South Coast Air Quality Management District and California Air Resources Board***
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 air basin. 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 2011, ARB, with the assistance of the District and South Coast AQMD, developed 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 2019, 2023, 2035, and 2050. These 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.

## E.3 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. With persistence, the District has secured support and additional incentive funding for programs critical to emissions reductions in the Valley. The legislative platform includes both legislative priorities and positions on anticipated federal legislation. The following is a summary of the legislative priorities and District positions on anticipated federal legislation. For complete details refer to the District's legislative strategy, adopted in January 2015.[6]

[6] SJVAPCD. *Item Number 10: Approve the District's 2015 Legislative Platform and take positions on anticipated federal air quality legislative proposals.* (22, January 2015). Available at: http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2015/January/final/10.pdf

### E.3.1 Streamline Implementation of the Clean Air Act

Since its adoption, the Clean Air Act has led to significant improvements in air quality and public health benefits throughout the nation. However, as an area in the nation with mature local air quality management programs, the Valley has reached the point of diminishing returns. After more than 20 years since the last amendments to the CAA in 1990, experience shows that many well-intentioned provisions are leading to unintended adverse consequences. The antiquated provisions of the Clean Air Act are now leading to confusion, and lack of updated congressional directive has rendered courts as 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 clean-up and timely action. The District recommends the CAA be amended to allow for consideration of the following critical factors in establishing attainment deadlines and implementation milestones for new standards:

- Upcoming health standards and associated deadlines are impossible to meet.
- The current five year review of standards is too short and has led to overlapping requirements and chaotic transitions between standards.
- Requiring contingency measures in extreme nonattainment areas is irrational and unnecessary.
- Section 185 of the CAA, which requires businesses in “Severe” and “Extreme” non-attainment areas to pay non-attainment penalty fees, is unfair and ineffective.
- The CAA requirements for Severe and Extreme ozone nonattainment areas to address vehicle-related emissions growth must be clarified.
- Transition to health risk-based approach in lieu of the current mass based approach.

### E.3.2 Increase State Subvention Funding to Provide More Support for Unfunded Mandates

Local air pollution control and air quality management districts receive subvention funds to support important local air program activities. These funds are allocated from the Motor Vehicle Account through the budget of the California Environmental Protection Agency, under the Air Resources Board section. Local subvention funds were initially provided in 1972, and were increased several times to address the costs of inflation. Despite a significant increase in unfunded mandates, for over twenty years there have been no adjustments for inflation, or added responsibilities. The District, therefore, supports an increase in subvention funds to help offset increases in costs and responsibility. The District currently receives $900,000 per year which is less than 2% of the District’s annual operating budget.

### E.3.3 Policies/Guidelines for the Carl Moyer Program

The Carl Moyer Program has been a valuable source of incentive funds to obtain voluntary emissions reductions from mobile sources of emissions. Assembly Bill 8 was recently adopted to extend funding for the Carl Moyer program through 2023. The following policies should guide the state as new guidelines/requirements are developed for the program through the new sunset date:

- The focus of the Carl Moyer Program should continue to be the reduction of criteria pollutants. Efforts to include greenhouse gas emissions projects should only be considered as co-benefits to projects that are principally designed for the reduction of criteria pollutant emissions.
- Regional funding formulas should continue to utilize a region's non-attainment status, and the severity of the air quality problem, as the primary factor in determining the regional breakdown of statewide Carl Moyer funding.
- With respect to regulatory deadlines, incentive funding should be decoupled from regulatory enforcement. Projects that provide cost-effective and surplus emission reductions should be eligible for funding regardless of compliance status with respect to regulatory deadlines.

### E.3.4 Cap and Trade Revenues

The cap and trade program implemented 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 Cap and Trade Program generates in excess of $1 billion annually. The state allocates these funds to programs across a number of state agencies. The following overarching policies should be applied as the state considers funding projects and programs from the Greenhouse Gas Reduction Fund:

- Projects funded with Cap and Trade revenues should achieve greenhouse gas reductions, with priority given to projects that achieve reductions in criteria pollutants as well.
- A portion of Cap and Trade revenues should be directed to projects in areas that are already disproportionately impacted by air pollution.
- Policies should be put in place to ensure that programs funded with Cap and Trade revenues meet or exceed the provisions of Senate Bill 535 that require a minimum of 25% of the Cap and Trade revenue be spent to benefit disadvantaged communities and that 10% of the revenue be spent in those communities. In determining what communities are disadvantaged, the state is required to prioritize communities that face significant environmental challenges as well as economic challenges.

### E.3.5 Oppose Climate Change Measures that Result in Public Health Detriment Due to Increases in Criteria or Toxic Air Emissions

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 reasonable climate protection measures that reduce greenhouse gas emissions as well as toxic and criteria pollutants. The District will oppose climate change measures that are detrimental to public health by leading to increases in toxic or criteria pollutant emissions in already impacted areas.

### E.3.6 Disadvantaged Community Policies

The Valley is home to a number of disadvantaged communities that deserve care and attention. The District will adhere to the following principles in pursuing efforts to identify and address the needs of these communities:

- The District will support measures that improve quality of life and economic welfare. In identifying communities of need, both socioeconomic and environmental impacts should be considered. The District supports CalEPA's California Communities Environmental Health Screening tool (CalEnviroScreen) as the appropriate tool for identifying disadvantaged communities.
- The District considers poverty as a key factor contributing to diminished public health and will oppose efforts that lead to "redlining" these communities and inhibit economic growth.
- The District will support efforts to target additional state and federal resources to mitigate issues faced in disadvantaged communities.
- The District will oppose measures that dilute local control by diverting local revenues or the authority over the expenditure of local resources to the state or federal government. Reduced local control will weaken local enforcement programs. Local agencies are better suited to efficiently and effectively identify and address community needs.

### E.3.7 Seek Funding and Other Support from ARB and EPA to Install and Operate Additional Air Quality Monitoring Instruments throughout the Valley

The District operates one of the most extensive air monitoring networks in the nation. Data from these monitors is utilized to measure progress and assess the need for further reductions needed to attain federal air quality standards established by EPA. The District is also committed to providing accurate and timely air quality information to educate and empower the public to protect themselves during poor air quality episodes. This is accomplished utilizing the air monitoring data through the District's first-in-the-nation Real-Time Air Advisory Network (RAAN).

Installation, operation and maintenance of the Districts air monitoring network is resource intensive. The District's annual operating appropriation for air monitoring is approximately $2.9 million. The increase in federal mandates relating to air monitoring (more monitors and more labor intensive QA/QC and reporting procedures for existing monitors) combined with the need for more monitoring capabilities to satisfy the District's initiative to provide neighborhood by neighborhood air quality information require additional resources.

### E.3.8 Support Efforts that Provide for Cost-Effective Alternatives to Open Burning of Agricultural Waste

In 2003, state law was amended to require the District to the limit open burning of agricultural material in accordance with a phased-in schedule of deadlines. In addition to those requirements, the state law authorizes the District to postpone the burn prohibition dates for specific types of agricultural material if the District makes three specific determinations and the ARB concurs. The determinations are: (1) there are no economically feasible alternatives to open-burning of the specific type of material; (2) open-burning the specific type of material will not cause or substantially contribute to a violation of a federal air quality standard; and (3) there is no long-term federal or state funding commitment for the continued operation of biomass facilities in the Valley or the development of alternatives to burning. Working closely with the stakeholders over the years to identify economically feasible alternatives to open burning of various agricultural materials, the District has achieved an 80% reduction in agricultural burning.

Given current energy policy in California, biomass power facilities, which are one of the primary alternatives to agricultural burning, are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking and that the prices being offered for new contracts are too low to support their operations.

The District will support efforts to help level the playing field and provide fair competition between biomass plants and other renewable sources of power. The District will also support research and development of alternatives to the open burning of agricultural waste.

### E.3.9 Technology Advancement

The Valley is classified as an Extreme non-attainment area for ozone. This means that that technology does not currently exist to bring the region into attainment of the federal ozone standard. Meeting the newest air quality standards will require transformative measures and technologies to achieve near zero emissions. In order to further develop technology to close the gap in required emissions reductions, the District operates a Technology Advancement Program. Along with its own resources, the District is seeking state and federal assistance to advance technology in the following areas:

- Mobile sources projects that demonstrate zero- or near-zero-emissions solutions to mobile source categories with emphasis on goods and people movement, off-road equipment, or agricultural equipment.

- Renewable energy projects that focus on overcoming the barriers that prevent the use or adoption of zero-emission renewable energy sources or reduce emissions from renewable energy systems to make them cleaner than comparable non-renewable alternatives.
- Waste solutions projects that 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.

### E.3.10 Support Adequate Resources and Policies to Reduce the Impact of Wildfires and their Attendant Public Health Impact

Wildfires result in significant loss of life and property. Air pollution generated from wildfires is enormous and well exceeds the total industrial and mobile source emissions in the Valley. These emissions result in significant adverse public health impacts in the Valley and in many regions throughout California. In the summer of 2008, California experienced a record number of wildfires, and 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. Historically clean rural areas throughout the state and in the Valley experienced their worst air quality in decades, and pollutant levels and the number of daily exceedances of the health-based standards were significantly higher than ever before in recorded history.

Reducing wildfires and the resulting air pollutants requires a sustained and multi-faceted approach that employs effective measures to reduce fuel supplies and adequate resources to manage fires when they occur. The District supports policies and initiatives that would encourage rapid disposal of the fuel supply, including the following:

- Additional financial and staffing resources for public and private land managers to conduct prescribed burning as an effective means for reducing fuel supplies that lead to large and uncontrollable wildfires.
- Additional resources to manage wildfires when they occur.
- 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.
- 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.

### E.3.11 District Positions on Anticipated Federal Legislation

It is expected that Congress will attempt to guide clean air policies by influencing EPA actions through its agency oversight and budgetary authorities. A key focus of these efforts is expected to be actions relating to EPA's ability to set new air quality standards and provide more congressional guidance relating to EPA's definition and treatment of exceptional events. The following are three bills expected to be re-introduced in the coming Congress. The District supported these bills last year and would support them again if they are re-introduced.

**CASE Act:** The Clean Air Strong Economies (CASE) Act by Congressman Olson, Texas. The CASE Act requires that EPA not propose a national primary or secondary ambient air quality standard for ozone that is lower than the existing standard until at least 85 percent of the counties that were nonattainment areas under that standard achieve full compliance with the standard. Additionally, the CASE Act would require that EPA take into consideration feasibility and cost when setting standards and include in the regulatory impact analysis for the proposed and final rule at least one analysis that does not include any calculation of benefits resulting from reducing emissions of any pollutant other than ozone.

**ORDEAL Act:** The Ozone Regulatory Delay and Extension of Assessment Length (ORDEAL) Act by Senator Jeff Flake, Arizona and Congressman Matt Salmon, Arizona. The ORDEAL Act would lengthen the period between when EPA would review and set a new ozone standard from the current five year interval to ten years.

State and local air agencies are mandated to develop measures to meet federal ambient air quality standards that were set without considering the economic costs. The Act also sets attainment deadlines and implementation milestones that do not fully take into account natural environment (climate, geography, topography), magnitude of the needed emission reductions, availability of technology (maturity of existing control program, time needed to develop new technologies), economic feasibility, and pollution transport from other regions and countries.

Continued effort to develop cost-effective measures in areas such as the Valley where businesses are already subject to the toughest air regulations in the nation is extremely difficult. In fact, both the District and the South Coast Air Quality Management District concluded that technology did not exist to meet even the 1997 8-hour ozone standard. Meeting the new standards that approach background pollution concentrations require transformative measures that need sufficient time to be planned and implemented. For instance, meeting the latest ozone standard requires eliminating all emissions associated with fossil fuel combustion. The deployment of necessary technology and massive fueling infrastructure is virtually impossible before the current deadline of 2032. More realistic attainment timelines would allow time for technologies to advance and businesses to develop capital improvement programs to incorporate those technologies in an economically feasible fashion. Additionally, efforts to accurately assess the incremental costs and benefits of new standards would better inform policy makers when reviewing new standards.

Currently, in the Valley, there are six active State Implementation Plans (SIP) in place for ozone and PM, including one for a standard that was revoked. Furthermore, the District is mandate to adopt four additional plans in the next two to three years. There is a great deal of overlap, confusion, and redundancy as multiple plans for the same pollutant are at play.

**CLEER Act:** Commonsense Legislative Exceptional Events Reform (CLEER) Act by Senator Flake, Arizona and Congressman Olson, Texas (Attachment D). These bills were introduced last year and the House bill was cosponsored by Congressman McCarthy and 22 other members of Congress. The bills streamline EPA's exceptional events approval and appeal process. At the District's request, the House bill was amended to include language that clarified that the prolonged and extraordinary drought and related weather conditions similar to those faced by the Valley in 2013/14 should be considered Exceptional Events.

## E.4 COMMUNITY OUTREACH

The District's outreach programs are integral to the development, implementation, and success of attaining federal air quality standards. In addition, engaging the public in efforts to reduce emissions is a key element of the District's attainment strategy. Education increases public support for new and controversial regulations. The District's education and information program has expanded and evolved over the years. The following outreach programs are just some of the District's programs related to health-based PM2.5 control measures and strategies.

### E.4.1 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 air basin, localized air quality often deviates from these generalized, county-wide, daily forecasts. Access to real-time data generated from the air quality monitor closest to a particular location compensates for 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 air basin. 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 it is now available to all Valley residents.

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. The knowledge that exercise magnifies the health risks of PM2.5 exposure motivated the District to develop the RAAN program. Heavy breathing, as during exercise, allows air pollutants, especially the smallest particles (those less than 0.1 microns (PM0.1), also referred to as ultrafine particles), to more easily penetrate the alveolar region of the lungs. Particles that make it to this region are absorbed directly into the body's bloodstream. A

2003 study[7] found that during moderate exercise, 80% of inhaled PM0.1 were deposited in the lungs, compared to 60% lung retention while a person is at rest. However, because the volume of air exchanged per minute increased substantially during exercise, overall PM0.1 deposition increases by as much as 450%.

Anyone can subscribe to RAAN at no charge through the District's website (www.valleyair.org); 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.

### E.4.2 Real-Time Outdoor Activity Risk (ROAR)

To support the expanded RAAN program, the District developed the Real-time Outdoor Activity Risk (ROAR) scale. The levels of this scale provide 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 that is 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.

### E.4.3 Web-Based Archived Air Quality System (WAAQS)

Following-up on the success of the RAAN program, the District develop a system that would provide air quality conditions on a neighborhood by neighborhood scale as opposed to being limited to only the readings from monitors. This project was organized through the following phased approach:

| | |
|---|---|
| Phase I | Establish Algorithms and/or modeling techniques for Quantifying Neighborhood Level Particulate and Ozone Concentrations |
| Phase II | Provide Historical Air Quality Trends at the Neighborhood Level |
| Phase III | Provide Real-time Air Quality Data at the Neighborhood Level |

**Phase I:** Phase I of this project was completed in 2014 and established a modeling technique for quantifying neighborhood level ozone and PM2.5 concentrations. The District has already used this modeling technique to generate neighborhood level ozone and PM2.5 concentrations for each of the approximately 3,600 grid cells (4 km x 4 km) that make up the San Joaquin Valley dating back to 1990. This data is being used as the foundation for providing historical air quality information under Phase II of this project.

[7] Daigle, C.C., Chalupa, D.C., Gibb, F.R., Morrow, P.E., Oberdörster, G., Utell, M.J., and Frampton, M.W. (2003). Ultrafine Particle Deposition in Humans During Rest and Exercise. *Inhalation Toxicology*, 15, 539–552. DOI:10.1080/08958370390205065

**Phase II:** Under Phase II, the District committed to provide an online tool to the public that will allow residents to view historical air quality information for their neighborhood by simply entering an address of their choosing. This newly developed system has been named the Web-Based Archived Air Quality System (WAAQS). The neighborhood level air quality statistics that will be provided to the public consist of the following:

- Number of days with Good air quality
- Number of days with Unhealthy air quality
- Days over federal standards for ozone and PM2.5
- Neighborhood air quality compared to trends for the County and San Joaquin Valley

The District released a beta version of the online web page to the public on March 1, 2015. The District will accept and consider comments and recommendations in a continuous effort to improve the information provided on the web page.

**Phase III.** The launch of Phase III in 2016 will give the public access to real-time air quality information on a neighborhood by neighborhood basis and ensure that Valley residents have the most detailed and accurate information with which to make decisions regarding outdoor activity.

### E.4.4 Check Before You Burn

The Check-Before-You-Burn outreach program is critical to the implementation of District Rule 4901—Wood Burning Fireplaces and Wood Burning Heaters. Rule 4901 was adopted in 2003 and, along with the Check-Before-You-Burn program, is credited with reducing levels of PM2.5 emissions during the winter season to historically low levels. The rule and outreach program was amended in 2008 and again in 2014 to reflect more stringent federal health-based standards, and together they have achieved the highest level of public recognition and compliance of any District program, with 80% of Valley residents professing awareness of it based on a 2014 public survey.[8] According to the same survey, 59 percent of the respondents (Valley-wide) with wood-burning devices never used them. These statistics are a testament to heightened public awareness resulting from the District's multilingual, multimedia, targeted public outreach campaigns.

Annual Check-Before-You-Burn outreach campaigns feature District Governing Board members in outdoor, radio, and video media speaking to the public about how to get involved in clean air activities. The District also uses extensive social media posts (Facebook and Twitter) to reach even more segments of the Valley's population. In addition, the District's toll-free information line and website receives thousands of "hits"

[8] San Joaquin Valley Air Pollution Control District: Memorandum to SJVUAPCD Governing Board, District's Public Opinion Survey Relating to Residential Wood Burning and Other Habits of Valley Residents. Fresno, CA: Public Governing Board Meeting, March 20, 2014. Available at http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2014/march/final/09.pdf

during the wood-burning season, specifically to access wood-burning forecast information.

### E.4.5 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. Many of the 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).

Components of the Health Air Living message include *Blue Sky, Brown Sky; It's Up To You* kids activity kits aimed at elementary school students and their parents; 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.

## E.5 ADDITIONAL STRATEGIES

Non-regulatory strategies help accelerate attainment and have been an important part of recent District air quality attainment plans. The following strategies are supported by the District as alternative methods to reduce emissions in the Valley.

### E.5.1 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.[9] This policy identifies the District's commitment to fostering energy efficiency and clean energy alternatives as opportunities for emissions reductions. 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.

[9] 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

### E.5.2 Eco-driving

Finding ways through education and outreach to reduce emissions from mobile sources in the Valley is critical to attainment of federal air quality standards. 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 informational activities conducted by the District, an Eco-Driving program could be encompassed under the Healthy Air Living umbrella.

### E.5.3 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.[10] 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 adopting policies and practices to make green purchasing and contracting a routine part of their operations.

### E.5.4 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*[11] is a guideline for considering clean energy options in the Valley that discuss, and provide

[10] SJVAPCD. *Green Purchasing and Contracting: A guide to reducing environmental impacts through the procurement process.* Available at http://www.valleyair.org/Programs/FastTrack/2011/GreenPurchasingReport4-6-11%20_2_.pdf.
[11] SJVAPCD. *Alternative Energy: On the Fast Track to Clean Air. A Guide for Considering Clean Energy Options in the San Joaquin Valley.* Available at http://www.valleyair.org/Programs/FastTrack/2011/Alternative%20Energy.pdf

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.

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# Appendix F

Attainment Demonstration
(Provided by ARB)

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix F: Attainment Demonstration (Provided by ARB)

## F.1 OVERVIEW

The 2008 San Joaquin Valley (SJV or Valley) State Implementation Plan (SIP or Plan) reflected an attainment deadline of April 5, 2015 for the 15 µg/m$^3$ annual and 65 µg/m$^3$ 24-hour $PM_{2.5}$ standards. Through ongoing implementation of the control strategy contained in the Plan, the Valley met the 65 µg/m$^3$ 24-hour standard in 2010, and only a few locations remained above the 15 µg/m$^3$ annual standard as of 2012. However, meteorological conditions associated with the current drought resulted in unusually high $PM_{2.5}$ levels during the winter of 2013/2014. Due to nearly two months without rainfall, a majority of days during December 2013 and January 2014 recorded $PM_{2.5}$ concentrations greater than 35 µg/m$^3$, a nearly threefold increase over the prior winter. These elevated wintertime concentrations affected both 24-hour and annual average design values, especially in the central and southern Valley. As a result, the Valley will not meet the Moderate nonattainment area April 2015 attainment deadline.

This updated attainment demonstration provides for expeditious attainment of the standards under the assumption that these adverse meteorological conditions occur again in the future. The new attainment demonstration uses the fundamental chemistry and associated response of different $PM_{2.5}$ constituents to emission controls reflected in the approved modeling in the 2008 $PM_{2.5}$ SIP. This modeling science is coupled with air quality data reflecting the drought impacts, 2013 design values and $PM_{2.5}$ chemical composition, along with emission reductions expected through 2018 (24-hour standard) and 2020 (annual standard).

The attainment demonstration includes the benefits of ARB and District control programs that provide ongoing emission reductions. Continued implementation of these control programs provides new emission reductions each year, resulting in a forecasted 38 percent decrease in $NO_x$ emissions and an eight percent decrease in $PM_{2.5}$ emissions between 2012 and 2020.

The $NO_x$ reductions result from ongoing implementation of both new vehicle standards for passenger and heavy-duty diesel vehicles and equipment, as well as rules accelerating the turnover of legacy diesel fleets. Implementation of stringent requirements for new off-road engines and in-use off road equipment lead to further $NO_x$ reductions, along with District rules addressing stationary source $NO_x$ emissions. $PM_{2.5}$ emission reductions result from ongoing implementation of diesel on- and off-road equipment measures as well as the District's recently strengthened rule for wood-burning fireplaces and heaters. These measures, along with additional reductions from enhancements to the District's commercial charbroiling rule slated for adoption in 2016 provide the necessary control strategy to bring the entire Valley into attainment of the 24-hour standard by 2018, and the annual standard by 2020 (Table 1 in Section D).

## F.2 MODELING APPROACH

The attainment demonstration approach for the current SIP is based on modeling conducted for the 2008 $PM_{2.5}$ Plan, which addressed both the annual and 24-hour $PM_{2.5}$ standards. The atmospheric dynamics and associated response to emission reductions represented in this modeling, coupled with 2013 design values (DV) and chemical composition, was used to project future (2020 for the annual standard and 2018 for the 24-hour standard) design values. Photochemical modeling for the 2008 $PM_{2.5}$ SIP was conducted following the U.S. EPA guidance (2007 U.S. EPA)[1] and was approved by U.S. EPA in 2011 (76 FR 69896, 76 FR 41338). While subsequent modeling was conducted for the attainment demonstration for the 2006 24-hour $PM_{2.5}$ standard of 35 $\mu g/m^3$, this effort was based on modeling conducted only for the first and fourth quarters of the year. Thus it was not suitable for addressing the annual average standard as part of the current SIP update.

The 2008 SIP modeling simulations used the Community Multiscale Air Quality (CMAQ) Modeling System, a “one-atmosphere” system that treats major atmospheric and land processes, plus a range of emissions species in a comprehensive framework. The version of CMAQ used in the 2008 Plan included California-specific updates as described in Liang and Kaduwela (2005)[2]. The meteorological inputs to CMAQ were generated using the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model (MM5). MM5 is designed to simulate or predict atmospheric motions at small scale.

This work included two gridded modeling domains (Figure F-1). The first modeling domain (“CCAQS”) covers the Central Valley and its surroundings with 63 x 63 lateral 12 km grid cells (CCAQS domain) for each vertical layer. This domain extends from the Pacific Ocean in the west to the Mojave Desert and Western Nevada in the East and runs from the northern Sacramento Valley to the Tehachapi Mountains in the south. The second domain (“SJV’) is nested within the CCAQS domain covers the SJV with 80 x 89 lateral 4 km grid cells. Vertically, both domains include 15 layers of varying thicknesses up to the top of the meteorological domain (100 millibar (mb)). The CCAQS domain provided the initial and boundary conditions for the SJV domain.

MM5 was set up for a 14-month simulation (December 1999 - January 2001) with three nested gridded domains. Vertically, the domains included 30 layers and extended up to 100 mb. The two outer domains defined the atmospheric initial and boundary conditions for the area at large scale, while the innermost grid resolved the fine details of atmospheric motions within the SJV domain.

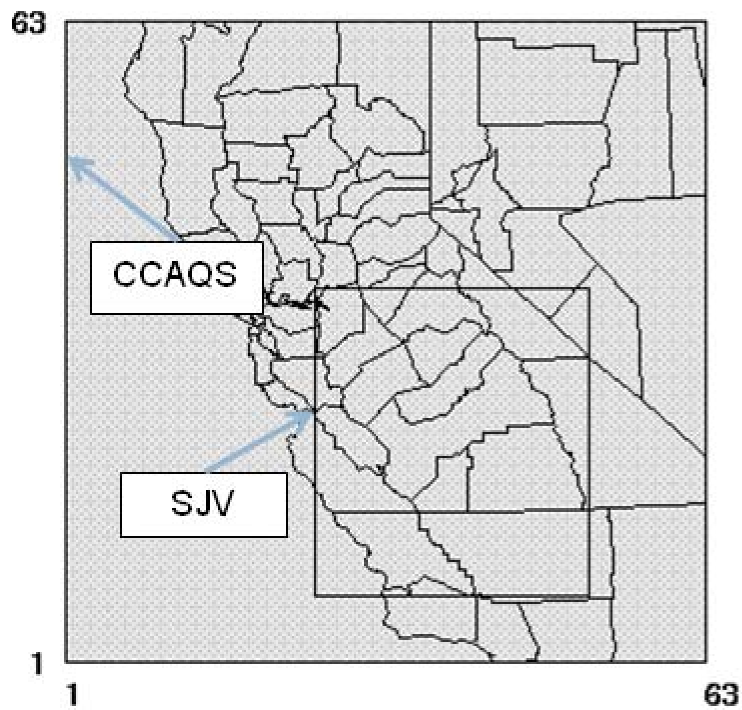
Photochemical modeling was conducted for an entire year. Gridded, hourly, chemically speciated emissions of combined stationary, mobile, area, and biogenic sources were developed as inputs to CMAQ for the 2005 base year and the 2014 future year. The

[1] 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.
[2] Liang, J. and A. Kaduwela, 2005: Microdevelopment of CMAQ for California Regional Particulate-Matter Air Quality Study. Proceedings of the 4th Annual CMAS Models-3 Users’ Conference; September 26-28, 2005, Chapel-Hill, NC.

2014 inventory included expected emission reductions from the State and local controls proposed in the 2008 $PM_{2.5}$ SIP. The resulting modeled relative response factors (RRFs) for each $PM_{2.5}$ species between 2005 and 2014 were then used to project 2006 design values and chemical composition to 2014 using U.S. EPA's Speciated Modeled Attainment Test (SMAT).

Further description of the photochemical modeling conducted for the 2008 $PM_{2.5}$ SIP is provided in the "Regional Air Quality Modeling to the 2008 $PM_{2.5}$ Plan" Appendix to the Plan: (http://www.arb.ca.gov/planning/sip/sjvpm25/Appendix%20A-SJV%20Modeling.pdf), and ARB Modeling Documents posted at: http://www.arb.ca.gov/planning/sip/sjvpm25/sjvpm25.htm.

**Figure F-1 Modeling Domains**




CCAQS domain has 63x63 12 km grid cells and the SJV domain has 80x89 4 km grid cells. Both domains have telescopic vertical grid structure with 15 layers extending to 100 mb.

## F.3 MODELING METHODOLOGY

To assess the representativeness of the 2008 SIP modeling for capturing the dynamics and response to emission reductions for the updated attainment demonstration, ARB staff evaluated both the meteorological characteristics, as well as the chemical composition used in the two modeling efforts. The types of meteorological conditions conducive to $PM_{2.5}$ formation in 2013/2014 were similar to the 2000/2001 meteorological conditions simulated in the 2008 SIP. These factors include the presence of persistent ridges that result in warm air aloft and strong stability with limited mixing, cool morning temperatures, and low wind speeds. Although the persistence of these meteorological conditions in 2013/2014 resulted in an increased number of days with high concentrations, the underlying meteorological factors driving elevated $PM_{2.5}$ concentrations were similar to 2000/2001. In addition, as described in Attachment A to this Appendix, the $PM_{2.5}$ chemical composition used in the 2008 $PM_{2.5}$ modeling was very similar to 2013, indicating common atmospheric chemistry regimes. Therefore, the 2008 $PM_{2.5}$ SIP modeling response to emission reduction, applied to 2013 DVs, provides a suitable basis for the updated attainment demonstration.

To ensure consistency with the approved 2008 $PM_{2.5}$ SIP modeling, the current effort uses a single DV representing 2013 based on ambient measurements during 2011-2013. The base emission year is the middle year of 2012, with future emission years of 2020 for the annual standard attainment demonstration, and 2018 for the 24-hour standard demonstration.

Due to the differences in base years (2005 vs. 2012) and future years (2014 vs. 2018 or 2020), the RRFs calculated for the 2008 modeling cannot be used directly in the current Plan. Thus, the updated modeling uses scaled RRFs presented in the following equation.

$$RRF_{12-20} = \left[1 - (1 - RRF_{05-14}) \times \frac{\%\Delta E_{12-20}}{\%\Delta E_{05-14}}\right]$$

Here,

$$\%\Delta E_{12-20} = \frac{E_{12} - E_{20}}{E_{12}} \times 100\% \; and \; \%\Delta E_{05-14} = \frac{E_{05} - E_{14}}{E_{05}} \times 100\%,$$

where, $E_j$ is the total emissions for a given emissions component for year j ( = 2005, 2012, 2014, and 2020). That is, quantities in the above equation represent percent emissions changes for the current and 2008 Plans. Similarly, $RRF_{i\text{-}k}$ represents RRF values for the current (2012-2020) and 2008 Plans (2005-2014).

In the 2008 $PM_{2.5}$ SIP, 2004-2006 concentrations of ammonium ion, nitrate ion, sulfate ion, organic carbon, elemental carbon, and geologic material were calculated using the Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach (SANDWICH) method. The current plan uses the same SANDWICH method to calculate these components for 2011-2013 speciation measurements made at Bakersfield (California Street), Visalia (North Church Street), Fresno ($1^{st}$ Street and Garland), and Modesto ($14^{th}$ Street). The particle bound water (PBW) was calculated using the e-AIM method that is more accurate than the parameterized equation for PBW. These components (except for PBW) were then projected to the future using the scaled RRFs. PBW is calculated again for the future concentrations.

For those $PM_{2.5}$ monitors that were not collocated with speciation monitors, the composition measured at one of the four speciation sites was assigned (Table F-1). In the 2008 $PM_{2.5}$ SIP, analysis of CRPAQS field study data was used to identifying which sites had similar chemical composition profiles. In the current study, proximity and similarity between sites were also considered. Based on these criteria, the composition at Bakersfield-California was used to represent Bakersfield-Planz. Similarly, Fresno-

Garland composition was used to represent Fresno-Hamilton, Clovis, and Tranquility. Visalia composition was used for Hanford, and Modesto composition was used for sites at Stockton, Manteca, Turlock, and Merced.

Planning inventories were used to calculate the scaling factors for RRFs (viz. $\%\Delta E_{12-20}/\%\Delta E_{05-14}$). Nitrate and ammonium ion RRFs were scaled using $NO_x$ emission reductions, and sulfate ion RRFs were scaled using $SO_x$ emission reductions. The justification for using $NO_x$ for both the ammonium and nitrate ions relies on the fact that sulfate ion concentrations are minor and therefore ammonium ion scales mainly with the nitrate ion. Source-level emissions profiles were applied to the PM2.5 planning inventory to calculate the PM2.5 chemical constituents of organic carbon, elemental carbon, and geologic material.

## F.4 MODELING RESULTS

Eight of the fifteen sites in the SJV recorded 2013 DVs over the annual $PM_{2.5}$ standard of 15 µg/m$^3$ (Table F-1). The higher DVs occurred in the Valley's southern region (including the Bakersfield and Visalia as well as Hanford) and the central region (around the Fresno urban area and Madera). Only one site in the northern region (Turlock) measured a 2013 DV over the standard. All sites in the SJV recorded 2013 DVs at or below the 24-hour standard of 65 µg/m$^3$.

Table F-1 lists the projected 2020 annual and 2018 24-hr DVs determined through the previously described modeling methodology. In 2020, all sites in the Valley are projected to attain the annual standard. For those sites that exceeded the standard, the projected 2020 DVs range from 12.5 µg/m$^3$ to 15.0 µg/m$^3$.

The implementation of new reductions from California's on-going emission control programs will provide the major portion of emission reductions needed to attain the annual $PM_{2.5}$ standard by 2020. Further emission reductions from the District's recently tightened residential wood combustion rule coupled with further control from commercial cooking operations slated for adoption in 2016, complement the $PM_{2.5}$ emission reductions needed for the SJV to attain the annual standard in 2020.

As shown on Table F-1, modeling results indicate these control programs will result in 2018 24-hour design values ranging between 24 µg/m$^3$ and 52 µg/m$^3$. For sites with 2013 design values over 60 µg/m$^3$, the modeled 2018 design values range between 46 µg/m$^3$ and 52 µg/m$^3$ (71-80 percent of the standard).

## F.5 CONSIDERATION OF 2014 AIR QUALITY

The drought-related meteorological conditions that affected PM2.5 concentrations in the San Joaquin Valley during 2013 continued into 2014. Although complete data for 2014 is not yet available, this section provides a preliminary assessment of 2014 air quality data in relation to the attainment demonstration.

Despite the ongoing persistence of the drought, air quality conditions in 2014 generally improved at most locations, particularly in the northern and central portions of the Valley. This is an indication that although drought conditions are continuing, progress is resuming as a result of ongoing emission reductions. However, because 2014 design values will reflect the impact of multiple years of drought, a comparison to the 2013 design values used in the attainment demonstration is expected to be mixed, with some locations recording design values that are slightly lower, and other locations recording design values that are slightly higher. Based on an assessment of the PM2.5 levels predicted for 2020 as well as ongoing trends and analyses, consideration of 2014 design values is expected to remain consistent with the current attainment demonstration. However, ARB and the District will continue to monitor the impacts of the drought and its relationship to future PM2.5 attainment needs.

## F.6 UNMONITORED AREAS

A screening analysis designed to assess the possibility of unmonitored violations of the annual $PM_{2.5}$ NAAQS was presented in the 2008 $PM_{2.5}$ Plan. An annual-averaged modeled $PM_{2.5}$ field was generated for the entire modeling domain. This field was then scrutinized to see if there would be gradients in the field that would give rise to higher values away from monitors if this field were to be used to adjust the interpolated annual-averaged design value field. The analysis found there are no areas with steep gradients that would result in higher design values than those measured at monitors.

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**Table F-1 Projected 2020 Annual and 2018 24-hour Design Values**

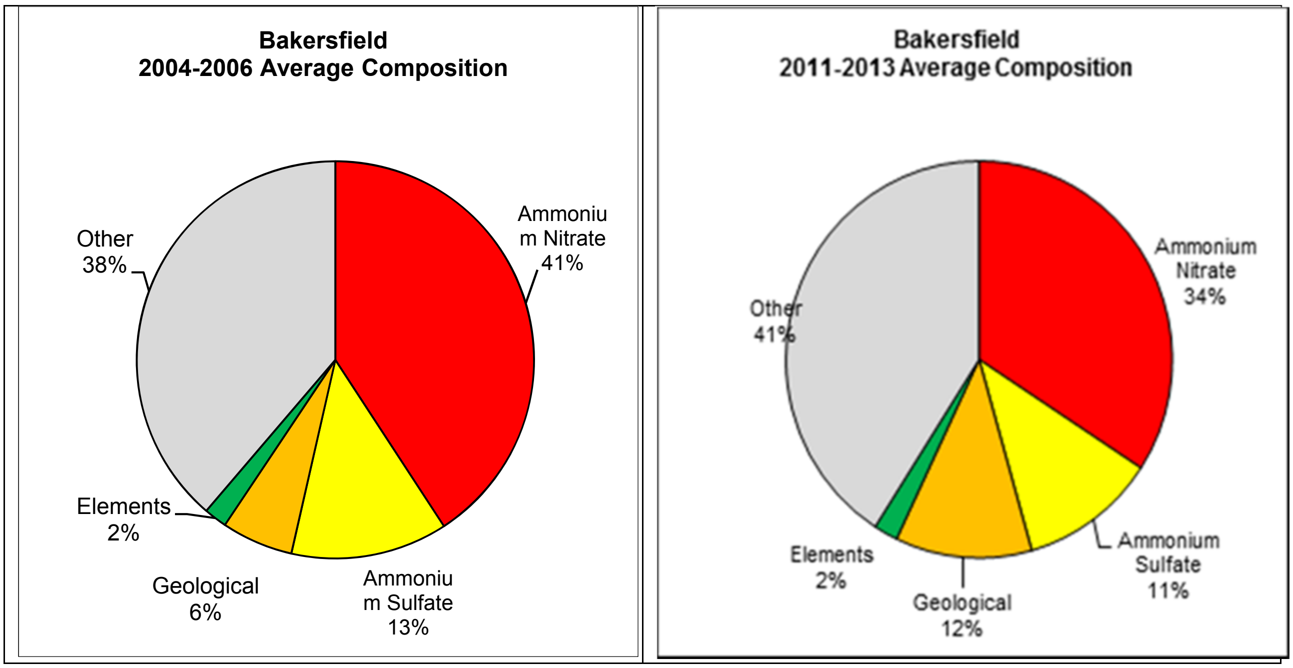
| Monitoring Site | AQS Site ID | Type | Speciation | 2013 Ann. DV[3] | 2020 Ann. DV with Rules[4] | 2013 24-hr DV[5] | 2018 24-hr DV with Rules[6] |
|---|---|---|---|---|---|---|---|
| Bakersfield - California Street | 060290014 | FRM | Bakersfield-California | 16.4 | 13.7 | 64.6 | 51.6 |
| Bakersfield - 410 E Planz | 060290016 | FRM | Bakersfield-California | 17.0[3] | 14.3 | 55.8[3] | 44.9 |
| Clovis - N Villa Avenue | 060195001 | FRM | Fresno-1st | 16.4[4] | 13.3 | 57.6[4] | 45.3 |
| Fresno - 1st Street/Garland[7] | | FRM | Fresno-1st | 15.4[5] | 12.5 | 62.0[5] | 49.3 |
| Fresno - Hamilton and Winery | 060195025 | FRM | Fresno-1st | 14.7 | 12.0 | 63.5 | 50.3 |
| Hanford-S Irwin Street | 060311004 | FEM-BAM | Visalia - N Church | 17.0 | 13.9 | 60.2 | 45.8 |
| Madera | 060392010 | FEM-BAM | Fresno-1st | 18.1 | 15.0 | 52.3 | 41.4 |
| Manteca-530 Fishback Rd | 060772010 | FEM-BAM | Modesto 14th | 10.2 | 8.7 | 36.7 | 32.1 |
| Merced - 2334 M Street | 060472510 | FRM | Modesto 14th | 11.1 | 9.2 | 49.2 | 40.3 |
| Merced – S Coffee Ave | 060470003 | FEM | Modesto 14th | 13.3 | 11.0 | 41.8 | 34.8 |
| Modesto - 14th Street | 060990005 | FRM | Modesto 14th | 13.6 | 11.5 | 50.6 | 42.2 |
| Stockton - Hazelton Street | 060771002 | FRM | Modesto 14th | 13.8 | 12.0 | 45.0 | 39.0 |
| Tranquility | 060192009 | FEM-BAM | Fresno-1st | 7.9 | 6.6 | 30.0 | 23.9 |
| Turlock-S Minaret Street | 060990006 | FEM-BAM | Modesto 14th | 15.7 | 13.2 | 52.7 | 43.8 |
| Visalia - N Church Street | 061072002 | FRM | Visalia - N Church | 16.6 | 13.5 | 55.7 | 42.5 |

[3] Design values equal to or less than 15.0 µg/m$^3$ attain the annual $PM_{2.5}$ standard
[4] Design values equal to or less than 65.4 µg/m$^3$ attain the 24-hour $PM_{2.5}$ standard
[5] Does not include 167.3 µg/m$^3$ measured on May 05, 2013 (supporting documentation provided in Attachment B)
[6] Clovis 2013 DV is based on combined FRM/FEM BAM data
[7] 2013 DV is based on 2011 data for Fresno-1st (060190011) and 2012/2013 data for Fresno-Garland (060190008)

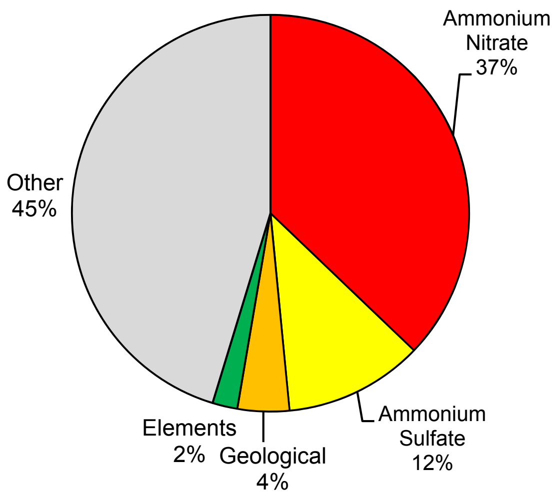
## Attachment A: Trends in PM2.5 Composition

To assess the representativeness of the atmospheric chemistry regime included in the 2008 SIP modeling for simulating conditions experienced in 2013, ARB staff compared the chemical composition of ambient PM2.5 collected during the periods represented by the two SIPs. The 2008 modeling reflected speciation for 2004-2006 while the current plan reflects 2011-2013. Speciation data is available for four sites in the Valley: Bakersfield, Fresno, Modesto, and Visalia. In this analysis, organic and elemental carbon are combined with “other” because the measurement technique for the organic and elemental carbon components have changed between the two three-year windows. The relative composition for each site during these two periods is shown in Figure F-2 below.

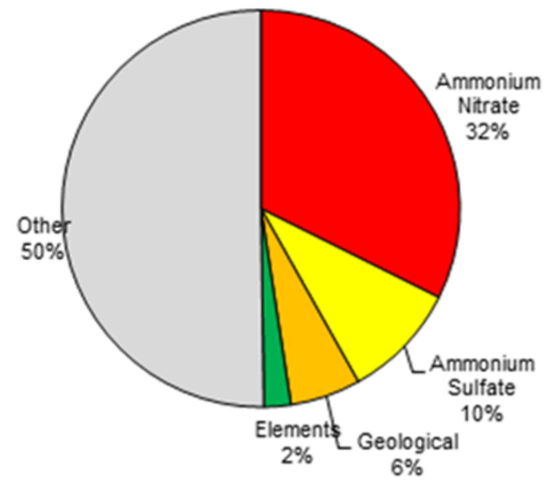
**Figure F-2 Average PM2.5 Percent Composition During 2004-2006 Compared to 2011-2013**



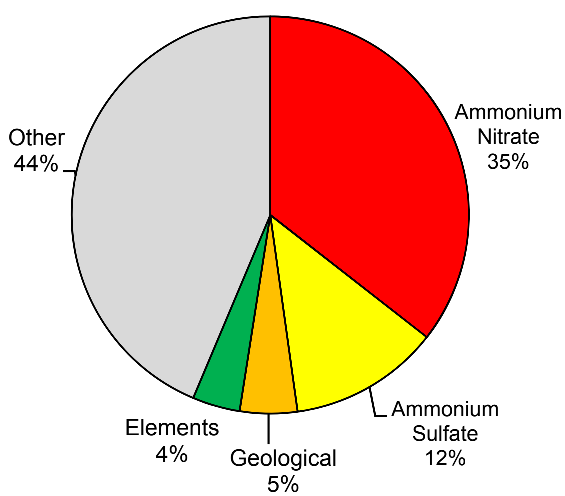
**Fresno**
**2004-2006 Average Composition**



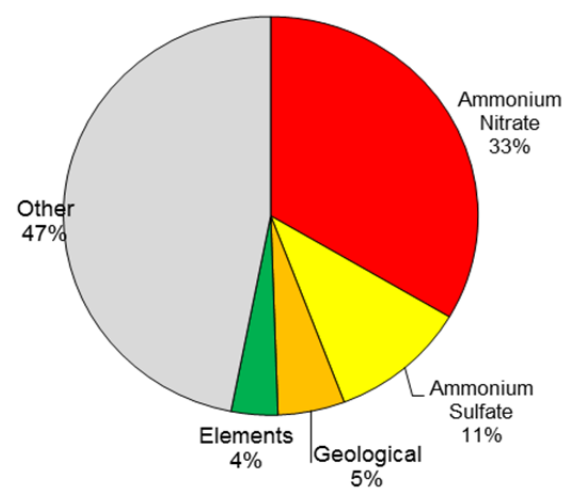

**Fresno**
**2011-2013 Average Composition**

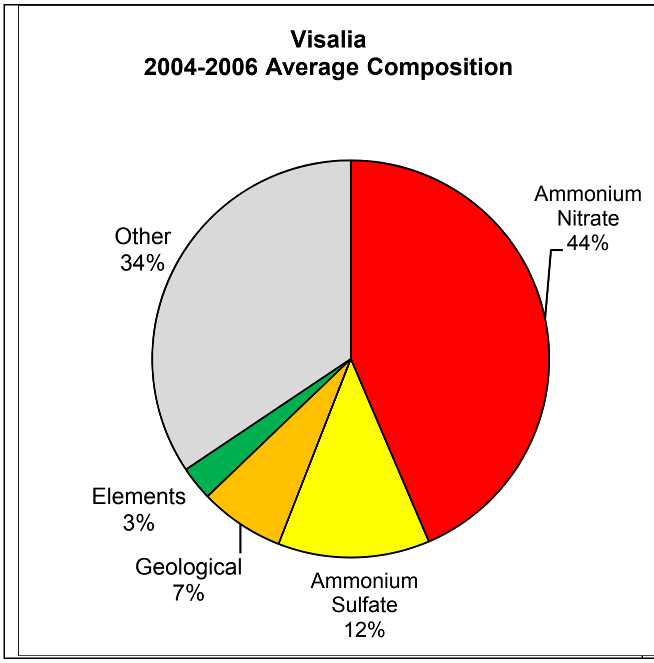


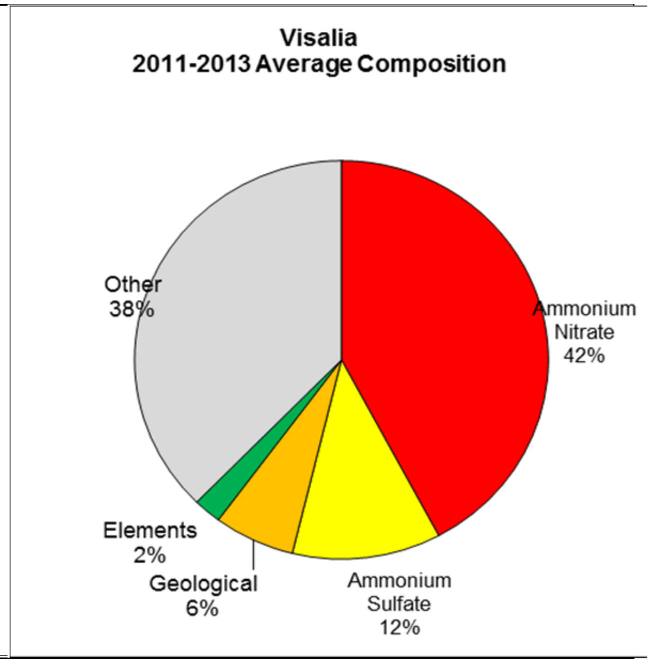

**Modesto**
**2004-2006 Average Composition**




**Modesto**
**2011-2013 Average Composition**






At all sites, ammonium nitrate and organic/elemental carbon as represented in the "other" category are the largest constituents in both periods. For Modesto and Visalia, the relative composition is nearly identical for the two three-year periods shown. At Bakersfield and Fresno, ammonium nitrate has decreased slightly, with a corresponding increase in other and geological. However, at both sites, the overall composition between the two three-year periods is very similar and therefore supports a conclusion that there have not been any major shifts in atmospheric chemistry regimes in SJV.

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## Attachment B: Assessment of the Representativeness of the PM2.5 Value Recorded at the Bakersfield-Planz Monitoring Site on May 5, 2013

### A. Overview

On May 5, 2013, a $PM_{2.5}$ concentration of 167.3 µg/m$^3$ was measured at the Bakersfield-Planz monitoring site. A concentration of this magnitude is extremely unusual, especially during the spring/summer when $PM_{2.5}$ concentrations are typically low. Further, all other Bakersfield $PM_{2.5}$ monitors recorded concentrations that were substantially lower, consistent with levels typical for the Valley during this time of year. Meteorological analysis shows that high winds on May 5, 2013 may have resulted in microscale $PM_{2.5}$ impacts at Bakersfield-Planz that are atypical from measured concentrations at the Bakersfield-Planz site and other nearby sites during similar events. Elemental analysis of particulates collected on the filter indicated an extraordinarily high concentration of elements associated with windblown dust. This unusual measured concentration indicates that the sample collected on May 5, 2013 was not representative of the broader spatial scale the Bakersfield-Planz monitor is intended to capture.

Based on the following analysis, ARB staff is therefore excluding the value of 167.3 µg/m$^3$ from use in the modeling analysis for the SJV 2015 $PM_{2.5}$ Plan. ARB and the District are also pursuing further analysis of this event by engaging the Department of Public Health to conduct a more thorough examination of the filter media. The results of this analysis will be closely evaluated and aide in future planning efforts.

### B. Representativeness of Bakersfield-Planz $PM_{2.5}$ Data

Air quality planning begins with evaluating pollutant concentrations measured at air monitoring stations and comparing those measurements to established air quality standards. In practice, monitors are only capable of sampling a relatively small portion of the atmosphere in the immediate vicinity around the inlet. However, the samples are intended to be representative of concentrations over a larger area as defined by the spatial scale of the monitoring site.

The Bakersfield-Planz monitoring site is identified as neighborhood scale, meaning that $PM_{2.5}$ measurements are expected to be representative of air quality within an area that has relatively homogenous land use ranging from 0.5 to 4.0 kilometers around the monitor. If measurements at the site are overwhelmed by local dust sources and driven by unusual meteorological events atypical of the area, the measurements may no longer be considered representative of air quality within the broader area around the monitor.

***San Joaquin Valley Seasonal $PM_{2.5}$ Concentrations***

$PM_{2.5}$ concentrations throughout the Valley follow the same seasonal pattern. During the low concentration season (primarily April through September), concentrations are generally below 25 to 30 µg/m$^3$ Valley-wide. A measured concentration of 167.3 µg/m$^3$

in May is therefore extraordinarily unusual. Evaluating days where wind speeds were similar in magnitude shows that PM2.5 values measured during those days were much lower than the 167.3 µg/m$^3$ measured on May 5, 2013.

Data presented in Table 1 illustrates the typical observed pattern and shows the highest $PM_{2.5}$ concentrations recorded between April and September in the Valley over the last 14 years. Apart from the May 5, 2013 value, flagged data, and an anomalous reading in April 2010, other recorded $PM_{2.5}$ values are consistently low during the April to September time period.

**Table F-2 Highest SJV $PM_{2.5}$ Concentrations - April thru September 2000-2013 (µg/m$^3$)**

| Year | April | May | June | July | August | September |
|---|---|---|---|---|---|---|
| **2000** | 31.4 | 20 | 27.1 | 28.1 | 23 | 33 |
| **2001** | 27.3 | 21.6 | 19.3 | 43 | 17.3 | 18.5 |
| **2002** | 40 | 20.7 | 25.4 | 25.5 | 49 | 19.6 |
| **2003** | 15 | 18 | 20.3 | 25.3 | 23.2 | 31.5 |
| **2004** | 28 | 18.6 | 15.4 | **63.1** | 19 | 20.7 |
| **2005** | 30.6 | 18 | 21.7 | 31 | 24 | 19.4 |
| **2006** | 23 | 23.7 | 23.7 | 32 | 22.6 | 42.5 |
| **2007** | 28 | 30.5 | 21.3 | **103.8** | 20.5 | 52 |
| **2008** | 32.3 | 36 | 99.3 | **60.8** | 28.3 | 36.5 |
| **2009** | 31.3 | 24.4 | 26.5 | 25.8 | 31.9 | 28 |
| **2010** | **107.8*** | 21 | 23.2 | **92.2** | 25.8 | 37.8 |
| **2011** | 33.2 | 23.6 | 38.4 | 33.2 | 20 | 29.3 |
| **2012** | 29.7 | 21.9 | 23.4 | 31 | 19.7 | 29.4 |
| **2013** | 24.9 | **167.3** | 28.3 | 40.1 | 39.1 | 26.8 |

**Bakersfield-California BAM recorded a 26.9 µg/m$^3$ daily average; FRM value not available*

Fireworks (Data flagged in AQS)
Fires (Data flagged in AQS)
Highest Concentrations at Planz

On May 5, 2013 all other monitoring sites in the Valley measured $PM_{2.5}$ typical of the low concentration season. Measurements ranged from 9.9 µg/m$^3$ to 24 µg/m$^3$ (Table 2). The Bakersfield-California monitoring site recorded 24, 23, and 26 µg/m$^3$ on the $PM_{2.5}$ Federal Reference Method monitor, and primary and collocated Beta Attenuation Monitors, respectively. As seen in Table 2, the Bakersfield-Planz site recorded the highest 24-hour average $PM_{2.5}$ concentration in the Valley on May 5, 2013, with levels an order of magnitude higher than any other site.

**Table F-3 $PM_{2.5}$ FRM and FEM Concentrations in the San Joaquin Valley on May 5, 2013**

| ***Site Name*** | ***Avg. 24-Hr $PM_{2.5}$ Concentration ($\mu g/m^3$)*** |
|---|---|
| Fresno-Garland | 10.3 |
| Tranquility-32650 West Adams Avenue | 10.3 |
| Clovis-North Villa Avenue | 10.8 |
| ***Bakersfield-410 E Planz Road*** | ***167.3*** |
| Bakersfield-5558 California Avenue | 24 |
| Hanford-South Irwin Street | 9.9 |
| Madera-28261 Avenue 14 | 16.2 |
| Merced-South Coffee Avenue | 10 |
| Manteca-530 Fishback Road | 12.7 |
| Stockton-Hazelton Street | 15.9 |
| Turlock-South Minaret Street | 10.4 |
| Modesto-14th Street | 11.4 |

***Elemental Species Composition***

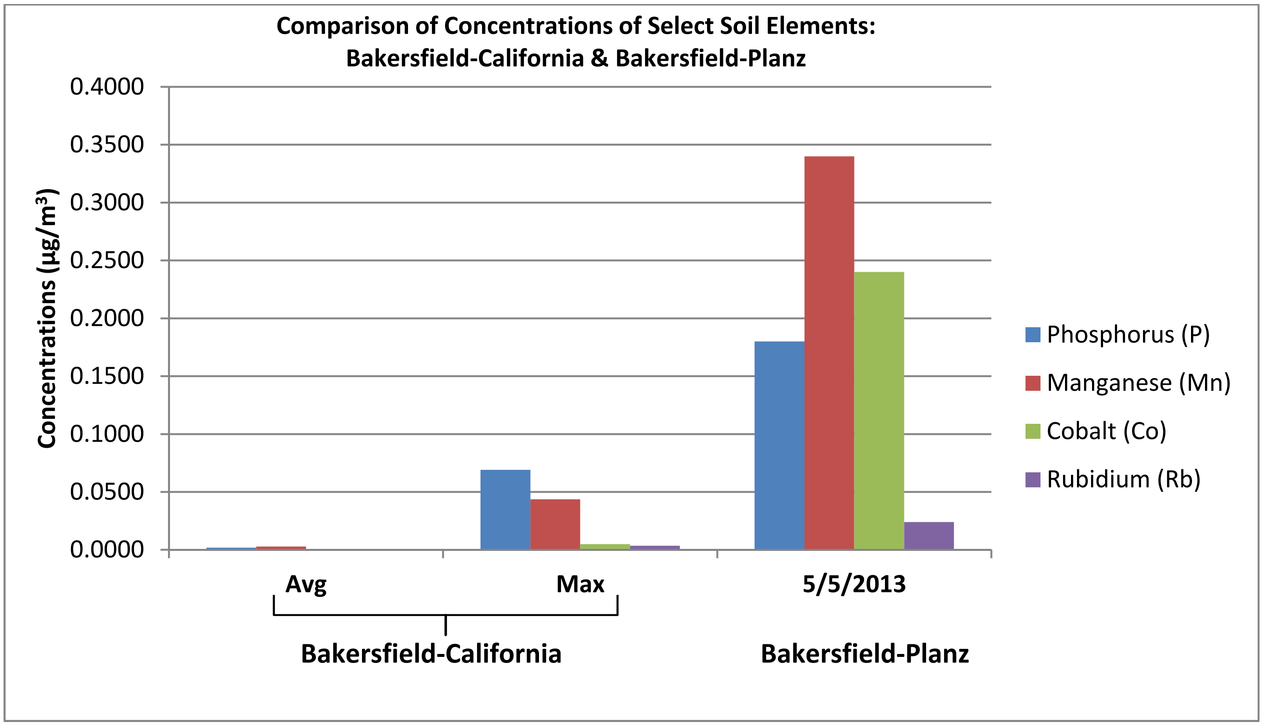
To further evaluate the representativeness of the May 5, 2013 sample, ARB's Monitoring and Laboratory Division analyzed the FRM filter using X-Ray Fluorescent Spectroscopy (XRF). The analysis revealed that the $PM_{2.5}$ mass was heavily dominated by fugitive dust. In order to estimate the fugitive dust contribution to the total $PM_{2.5}$ mass, ARB staff used the IMPROVE formula:

$$(2.2 \text{ x Al}) + (2.49 \text{ x Si}) + (1.63 \text{ x Ca}) + (2.42 \text{ x Fe}) + (1.94 \text{ x Ti})$$

The fugitive dust concentration, estimated at 107.7 $\mu g/m^3$, far exceeded the values typically seen in the $PM_{2.5}$ size fraction. The recorded value of 107.7 $\mu g/m^3$ was over four times higher than the next highest value of 26.2 $\mu g/m^3$ observed in the entire California network based on 14 years of available data. The PM2.5 fraction of fugitive dust is generally low, and PM2.5 concentrations during high wind events are thus typically not nearly as high as the May 5, 2013 reading.

Concentrations of total elemental species were also unusually high, about 6.6 $\mu g/m^3$. Some of these species, such as cobalt, manganese, phosphorus, and rubidium, reached levels not previously measured in the State. These unusual concentration levels suggest that, along with fugitive dust, elemental species in the soil, combined with other chemical species, were deposited onto the filter. Figure 1 below compares average and maximum concentrations for select species historically measured at Bakersfield-California to what was measured at Bakersfield-Planz on May 5, 2013.

### Figure F-3 Comparison of Concentrations of Select Soil Elements: Bakersfield-California & Bakersfield-Planz



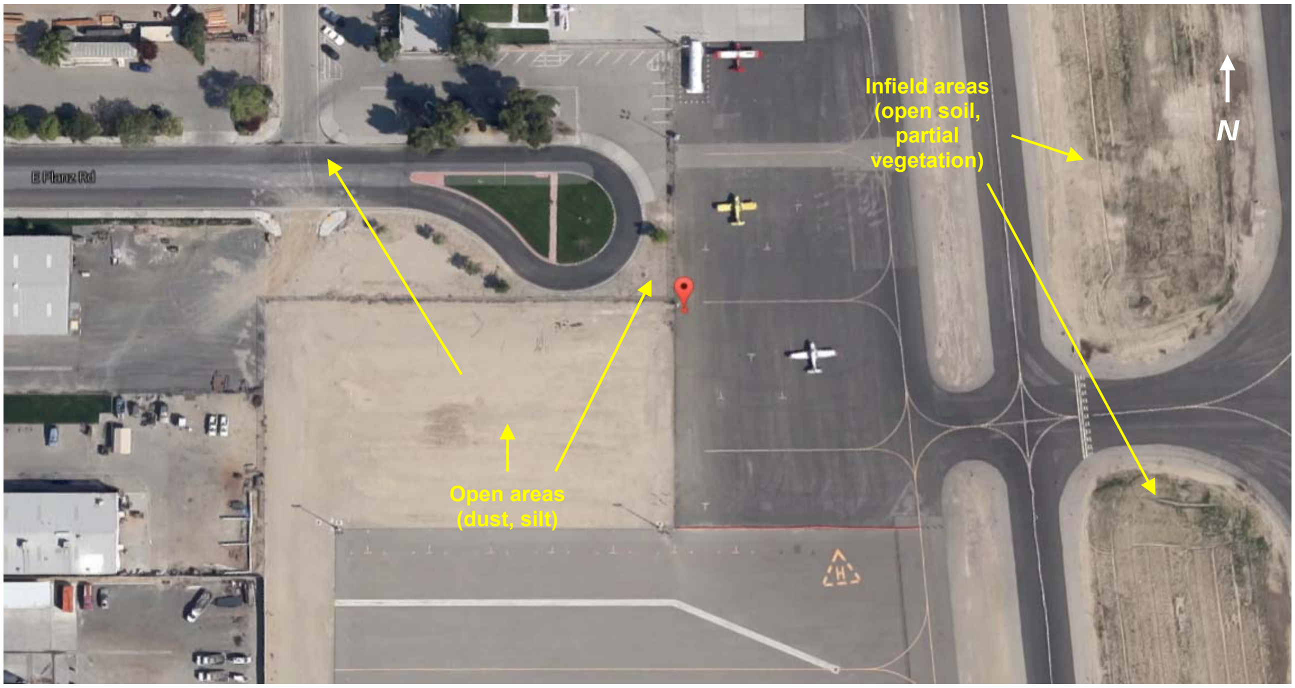

## C. Potential Fugitive Dust Sources Impacting the Bakersfield-Planz Site

To evaluate the potential influence of local fugitive dust sources on the Bakersfield-Planz monitor on May 5, 2013, the location of open soil areas, stationary sources, and known dust-generating activities were reviewed relative to the monitoring site. This information, coupled with observations of potential dust sources made by District enforcement staff on December 18, 2014, is summarized below.

The Bakersfield-Planz monitor is located on the grounds of the Bakersfield Municipal Airport, a city-owned airport used for private, civil aviation. The airport also includes a helicopter landing area near the monitor and helicopters are known to periodically use the airport. As shown in Figures 2 and 3 below, the monitor is closely surrounded on several sides by open areas with the potential of emitting dust during high wind events. These open parcels of land are located to the east, west, and south of the monitor and include the airport infield areas between taxiways and runways. Dust sources located nearest to the monitor have the greatest potential impact because dust particles do not remain suspended and deposit quickly. Additionally, as discussed above, the PM2.5 fraction of fugitive dust is generally low; therefore, the abnormally high value of 167.3 µg/m$^3$ measured on May 5, 2013 is unusual. ARB and the District are pursuing further analysis of this value through a more thorough examination of the filter media.

**Figure F-4 Bakersfield-Planz $PM_{2.5}$ FRM Monitor[8]**

**Figure F-5 Aerial Photo of Bakersfield Municipal Airport[9]**




[8] Photo taken looking west
[9] Red marker indicates monitor location

Additional potential sources of fugitive dust in the broader area surrounding the airport were also evaluated through field investigation by District enforcement staff. A review of aerial photos, combined with field investigations, indicate that additional potential dust-emitting sources in the area are present to the east and southeast of the Bakersfield Municipal Airport (Figure 4). These sources are subject to District rules for controlling fugitive dust from construction and demolition activities; handling, storage and transport of storage of bulk materials; disturbed open areas; paved and unpaved roads; and off-field agricultural sources.

**Figure F-6 Aerial Photo of Bakersfield Municipal Airport - Potential nearby Fugitive Dust Sources*** ***(Red marker indicates monitor location)***

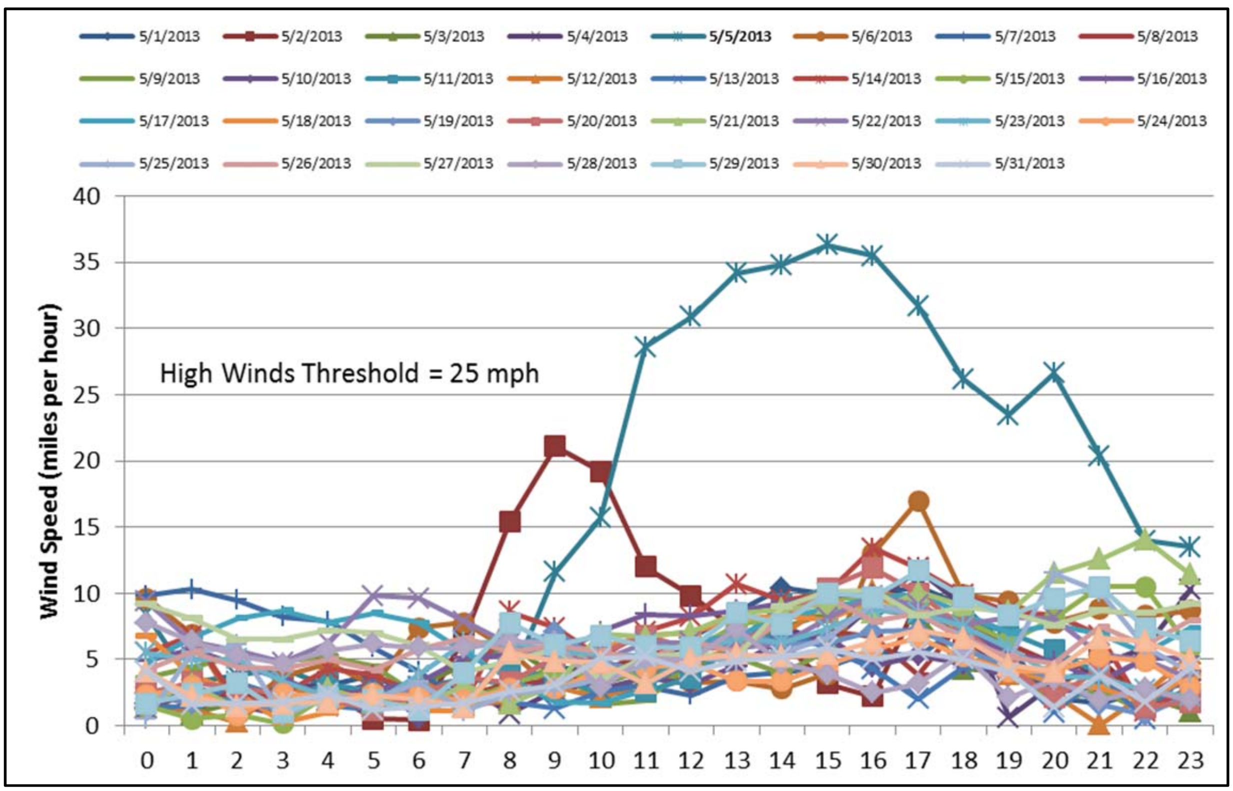

**For reference, the distance from the monitor to the Trucking Yard is approximately 1 kilometer*

No violations of District fugitive dust rules were documented at any nearby dust emitting facilities in Figure 4 on May 5, 2013. Based on this assessment of fugitive dust sources surrounding the monitor, the likely source of total particulate mass is from the open areas immediately adjacent to the monitor, reflecting a localized microscale impact. However, due to the significance difference in readings from nearby monitors, other factors may have contributed to the unusually high reading at Planz.

## D. Meteorology at the Bakersfield-Planz Monitoring Site

An evaluation of Bakersfield area meteorology indicates that high winds measured at the airport are the expected cause of the localized dust impact on May 5. Wind speed data for the Bakersfield-Municipal Airport monitoring site was used to assess winds at Bakersfield-Planz. The Bakersfield-Municipal Airport meteorological site is located on the northern edge of the airport property, approximately one-half mile from the Bakersfield-Planz monitor. Strong winds on May 5, 2013 included 9 hours (including eight consecutive hours) exceeding 25 miles per hour (mph), in excess of U.S. EPA's Interim Exceptional Events Guidelines threshold of 25 mph,[10] and far in excess of the San Joaquin Valley's Exceptional Event threshold of 17 mph as established in prior EPA-approved Exceptional Event submissions. Figure 5 illustrates the difference between wind speeds on May 5, 2013 and a typical day in May of 2013.
By contrast, wind speeds were notably lower at the Bakersfield-California monitoring station, located about 4 miles from Bakersfield-Planz.

**Figure F-7 May 2013 Wind Speeds at Bakersfield-Planz by Hour**




To evaluate wind speeds on May 5, 2013, relative to other significant wind event days at Bakersfield-Planz, wind speed data were reviewed from the first day meteorological

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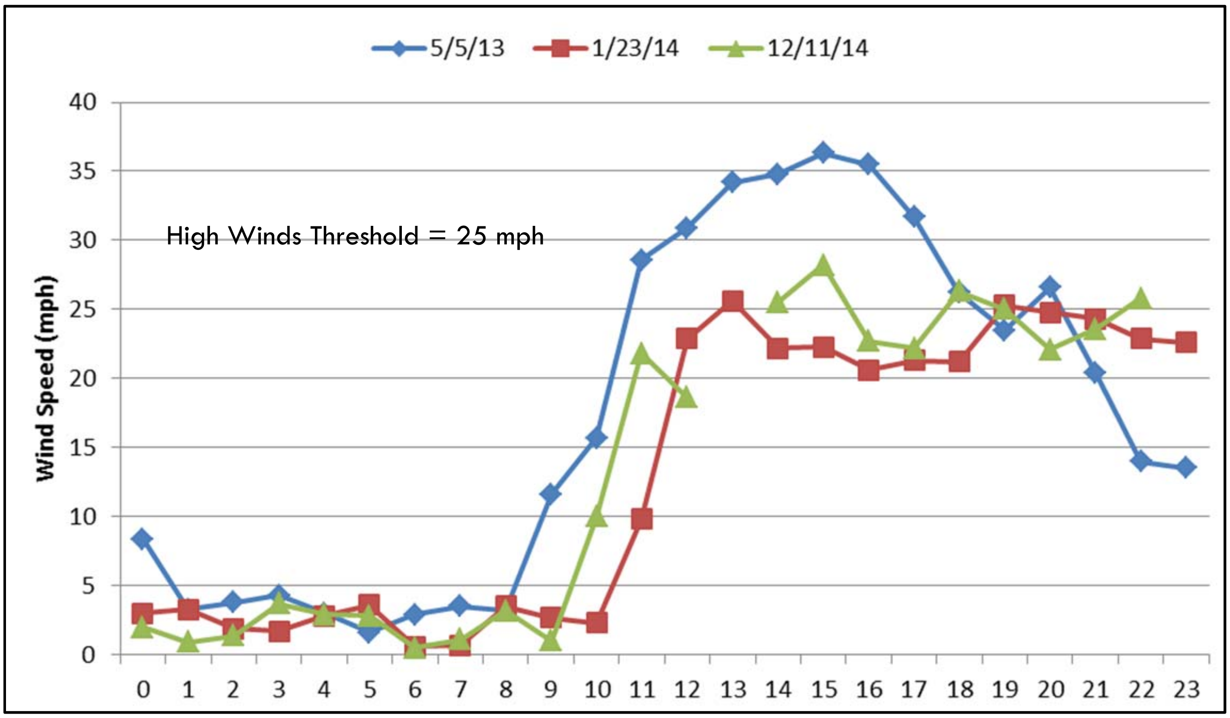
[10] Page, Stephen D. (May 10, 2013). *Interim Guidance to Implement Requirements for the Treatment of Air Quality Monitoring Data Influenced by Exceptional Events* [Memorandum]. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency.

data were collected at the Bakersfield-Municipal Airport site on September 11, 2012, through December 31, 2014. During that 2 year and 3 month period, there were 3 days that included sustained winds over 25 mph (Figure 7). Among these high wind days, May 5, 2013, had over 8 hours with winds in excess of 25 mph, a significantly greater amount of time than the next highest day of December 11, 2014, with about 4 hours of sustained winds over 25 mph.

It should be noted that May 5, 2013 was the only high wind day during the dry season in the San Joaquin Valley. The other high wind days occurred during winter months, when moisture in the ground would minimize the potential for fugitive dust to become airborne. $PM_{2.5}$ concentrations were measured only on one of these winter days, January 23, 2014, and reached 49.7 µg/m$^3$, which is fairly typical for PM2.5 concentrations during winter in the Valley.

**Figure F-8 Days with High Wind Speeds at Bakersfield-Planz by Hour**




The available meteorological data indicate that May 5, 2013 was highly unusual in terms of wind speed and the duration of high winds as compared with other days in which wind speed was measured at the airport.

## E. Conclusion

In summary, comparison of the 167.3 µg/m$^3$ concentration measured on May 5, 2013, to values typical for this season as well as comparison to values measured throughout the Valley on the same day, combined with the record high fugitive dust and elemental species concentrations, indicate that the monitor was impacted by microscale sources that are not representative of the neighborhood spatial scale the monitor is intended to represent. Therefore, this value is not included in modeling analysis for the San Joaquin Valley 2015 $PM_{2.5}$ Plan. ARB and the District are pursuing further analysis of this event in order to conduct a more thorough examination of the filter media. The results of this analysis will be closely evaluated and aide in future planning efforts.

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# Appendix G

New Source Review (NSR) and Emission Reduction Credits (ERCs)

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# Appendix G: New Source Review (NSR) and Emission Reduction Credits (ERCs)

## G.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-2012 for the modeling used in this PM2.5 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 in the SJVAB.

## G.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

<u>Growth Estimates</u>: 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 PM 2.5 SIP Planning Projections (2015 SJV MSM PM2.5 SIP Version 1.01). 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 G-1 through G-4 show total projected growth from stationary sources of 0.877 tons/day of directly emitted PM2.5, and, for PM2.5 precursors, growth of 1.957 tons/day of NOx, 0.695 tons/day of SOx, and 11.532 tons/day of VOC, for the period of 2012 through 2020. Ammonia is not included in the analysis. Although a PM2.5 precursor, ERCs are not issued for ammonia, so no accounting for ammonia ERCs is necessary or appropriate. 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 CEPAM projected inventory for 2020 shown in the table does incorporate the projected growth (both positive and negative) as well as the expected controls from the measures contained in prior plans. Notwithstanding slight rounding errors, the projected 2020 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 PM2.5 plan are not incorporated in these projections, and do not affect the amount of offsets estimated to mitigate the projected growth.

Emissions Offset Requirements: Under District's New Source Review Rule 2201, new sources with emissions exceeding the following level must offset their emissions:

| | |
|---|---|
| NOx …………………………….. | 20,000 lbs/year |
| VOC…………………………….. | 20,000 lbs/year |
| PM10……………………………. | 29,200 lbs/year |
| SOx……………………………… | 54,750 lbs/year |

Additionally, for existing facilities with emissions meeting or exceeding the above levels, any increase in emissions that is not due solely to increased utilization allowed by their current permits must be offset.

Also, PM2.5 offsets would be required for any new major PM2.5 source (exceeding 70 tons per year of direct PM2.5 emissions), or for major modifications at existing major PM2.5 sources (emissions increases of 20,000 lbs PM2.5 per year at an existing major PM2.5 source). The 70 tons per year of direct PM2.5 emissions offset threshold was selected as the District will be adopting a revised New Source Review Rule 2201 this year that will revise the PM2.5 major source threshold from the current 100 tons per year to 70 tons per year, in accordance with the District's request for classification as Serious Non-attainment of the 1997 PM2.5 standard.

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 any expected changes in 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 due to facility modifications would require offsets.

The quantity of required offsets was then established by multiplying the expected growth in emissions for each source category (from CEPAM) 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, and to all off-site VOC and NOx offsetting. For calendar years 2010 through 2014, the average offset ratio for all permitting actions varied from 1.5:1 for NOx, to 1.44:1 for SOx, to 1.54:1 PM10, to 1.48:1 for VOC. The District has therefore used a distance ratio of 1.54 for all pollutants for this analysis. Tables G-1 through G-4 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 G-5 for a current list of District-issued ERCs, as of February 2015. These ERCs and future ERCs (and any ERCs generated from them) are available to be used in the District's NSR program.

The expected ERC usage after 2012 and through 2020, as shown in Tables G-1 through G-4, has been estimated in this plan as follows:

| | Expected ERC Use (tpd) | Growth (tpd) |
|---|---|---|
| PM 2.5 | 0.62 | 0.88 |
| NOx | 1.36 | 1.96 |
| SOx | 0.43 | 0.70 |
| VOC | 6.50 | 11.53 |

As shown above, the quantity of pre-baseline offsets (conservatively considering all ERCs used to be pre-baseline ERCs) that are expected to be used between 2012 and 2020 ("Expected ERC Use" column) is less than the plan's estimated growth in emissions for each pollutant ("Growth" column).

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 PM 2.5 standards. As discussed in Chapter 6, the District also satisfies the requirement for reasonable further progress with the above-mentioned projected inventories and without taking credit for the ERCs required of and provided by new and modified stationary sources permitted during this period.

Safeguards to assure plan integrity despite the use of pre-baseline credits: 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 use of such credits and disallowing the use of pre-baseline credits in permitting actions when the above-specified growth levels are reached. The second column of the table above lists expected ERC use for stationary source growth, for each pollutant. The third column of the table above lists the cap on stationary source growth, for each pollutant. In addition, Rule 2201 allows the use of interpollutant trading amongst criteria pollutants and their precursors upon the appropriate scientific demonstration of an adequate trading ratio. These caps also apply to the use of VOC, NOx, and SOx ERCs in their application as offsets for direct emissions and in their use as PM 2.5 precursor interpollutant offsets. Thus, to the extent that precursor ERCs are used to offset PM 2.5 increases, these same ERCs will no longer be available to offset direct increases of these same precursors. At this time, EPA has not approved an interpollutant trading ratio for PM2.5 precursors. Until EPA approves such ratios, the District will not allow the use of precursor ERCs to offset PM2.5

emissions increases. The appropriate proportion of PM10 credits used as PM 2.5 credits for offsetting purposes will be included in the PM 2.5 cap. These ERC usage caps replace any caps established in prior plans.

- 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 higher 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 Stationary Source Review Rule. In particular, this plan does not reduce the 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 G-1 Estimated PM2.5 Growth, Control, and Estimated Offset Use

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| **FUEL COMBUSTION** | | | | | | | | |
| ELECTRIC UTILITIES | 1.270 | 0.00% | 0.000 | 0.03% | 0.000 | 1.209 | 50 | 0.000 |
| COGENERATION | 0.546 | 34.46% | 0.188 | -0.05% | 0.000 | 0.734 | 50 | 0.094 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 1.708 | 0.00% | 0.000 | -0.01% | 0.000 | 1.429 | 80 | 0.000 |
| PETROLEUM REFINING (COMBUSTION) | 0.078 | 0.00% | 0.000 | 0.00% | 0.000 | 0.078 | 80 | 0.000 |
| MANUFACTURING AND INDUSTRIAL | 0.131 | 0.38% | 0.000 | 0.00% | 0.000 | 0.131 | 25 | 0.000 |
| FOOD AND AGRICULTURAL PROCESSING | 0.731 | 0.00% | 0.000 | -30.21% | -0.221 | 0.489 | 20 | 0.000 |
| SERVICE AND COMMERCIAL | 0.463 | 5.68% | 0.026 | 0.00% | 0.000 | 0.489 | 25 | 0.007 |
| OTHER (FUEL COMBUSTION) | 0.018 | 1.63% | 0.000 | -44.59% | -0.008 | 0.009 | 25 | 0.000 |
| TOTAL PM2.5: FUEL COMBUSTION | **4.945** | | **0.215** | | **-0.229** | **4.568** | | **0.101** |
| **WASTE DISPOSAL** | | | | | | | | |
| SEWAGE TREATMENT | 0.007 | 15.38% | 0.001 | 0.00% | 0.000 | 0.008 | 25 | 0.000 |
| LANDFILLS | 0.113 | 15.71% | 0.018 | 0.00% | 0.000 | 0.130 | 50 | 0.009 |
| INCINERATORS | 0.012 | 11.29% | 0.001 | 0.00% | 0.000 | 0.014 | 25 | 0.000 |
| SOIL REMEDIATION | 0.001 | 28.57% | 0.000 | 0.00% | 0.000 | 0.001 | 25 | 0.000 |
| OTHER (WASTE DISPOSAL) | 0.006 | 14.55% | 0.001 | 0.00% | 0.000 | 0.006 | 25 | 0.000 |
| TOTAL PM2.5: WASTE DISPOSAL | **0.138** | | **0.021** | | **0.000** | **0.159** | | **0.010** |
| **CLEANING AND SURFACE COATINGS** | | | | | | | | |
| LAUNDERING | 0.001 | 7.69% | 0.000 | 0.00% | 0.000 | 0.001 | 25 | 0.000 |
| DEGREASING | 0.022 | 14.80% | 0.003 | 0.00% | 0.000 | 0.026 | 50 | 0.002 |
| COATINGS AND RELATED PROCESS SOLVENTS | 0.218 | 19.91% | 0.043 | 0.00% | 0.000 | 0.261 | 25 | 0.011 |
| PRINTING | 0.007 | 20.29% | 0.001 | 0.00% | 0.000 | 0.008 | 10 | 0.000 |
| ADHESIVES AND SEALANTS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 10 | 0.000 |
| OTHER (CLEANING/SURFACE CTNGS) | 0.008 | 11.84% | 0.001 | 0.00% | 0.000 | 0.009 | 50 | 0.000 |
| TOTAL PM2.5: CLEANING AND SURFACE COATINGS | **0.256** | | **0.049** | | **0.000** | **0.305** | | **0.013** |

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| **PETROLEUM PRODUCTION AND MARKETING** | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.044 | 0.00% | 0.000 | 0.00% | 0.000 | 0.0366 | 80 | 0.000 |
| PETROLEUM REFINING | 0.086 | 0.00% | 0.000 | 0.00% | 0.000 | 0.0862 | 80 | 0.000 |
| PETROLEUM MARKETING | 0.003 | 15.38% | 0.000 | 0.00% | 0.000 | 0.003 | 80 | 0.000 |
| OTHER (PETROLEUM PRODUCTION AND MARKETING) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 80 | 0.000 |
| TOTAL PM2.5: PETROLEUM PRODUCTION AND MARKETING | **0.133** | | **0.000** | | **0.000** | **0.1262** | | **0.000** |
| **INDUSTRIAL PROCESSES** | | | | | | | | |
| CHEMICAL | 0.2138 | 12.86% | 0.027 | 0.00% | 0.000 | 0.2413 | 25 | 0.007 |
| FOOD AND AGRICULTURE | 0.8292 | 14.60% | 0.121 | -1.10% | -0.009 | 0.9396 | 50 | 0.061 |
| MINERAL PROCESSES | 1.3693 | 23.33% | 0.319 | 0.00% | 0.000 | 1.6887 | 50 | 0.160 |
| METAL PROCESSES | 0.0513 | 17.93% | 0.009 | 0.00% | 0.000 | 0.0605 | 80 | 0.007 |
| WOOD AND PAPER | 0.258 | 0.00% | 0.000 | -0.04% | 0.000 | 0.2576 | 50 | 0.000 |
| GLASS AND RELATED PRODUCTS | 0.3325 | 21.50% | 0.071 | -0.03% | 0.000 | 0.404 | 50 | 0.036 |
| ELECTRONICS | 0.004 | 22.50% | 0.001 | 0.00% | 0.000 | 0.0049 | 25 | 0.000 |
| OTHER (INDUSTRIAL PROCESSES) | 0.2319 | 18.15% | 0.042 | 0.00% | 0.000 | 0.274 | 25 | 0.011 |
| **TOTAL PM2.5: INDUSTRIAL PROCESSES** | **3.29** | | **0.592** | | **-0.009** | **3.8706** | | **0.281** |
| **TOTAL PM2.5: STATIONARY SOURCES** | **8.762** | | **0.877** | | **-0.239** | **9.029** | | **0.624*** |

*Offset distance ratio of 1.54:1 used for all pollutants, calculated only on the "Total (Pollutant)" lines.

Emissions Inventory used: CEPAM 2015 SJV MSM PM2.5 SIP Ver 1.01

**Table G-2 Estimated NOx Growth, Control, and Estimated Offset Use**

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| **FUEL COMBUSTION** | | | | | | | | |
| ELECTRIC UTILITIES | 4.236 | 1.05% | 0.044 | -0.61% | -0.026 | 4.255 | 50 | 0.022 |
| COGENERATION | 1.562 | 28.86% | 0.451 | -0.08% | -0.001 | 2.013 | 50 | 0.225 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 2.750 | 0.00% | 0.000 | -13.62% | -0.375 | 1.988 | 80 | 0.000 |
| PETROLEUM REFINING (COMBUSTION) | 0.191 | 0.00% | 0.000 | -14.42% | -0.028 | 0.164 | 100 | 0.000 |
| MANUFACTURING AND INDUSTRIAL | 5.268 | 0.02% | 0.001 | -1.13% | -0.060 | 5.211 | 30 | 0.000 |
| FOOD AND AGRICULTURAL PROCESSING | 11.827 | 0.00% | 0.000 | -56.86% | -6.725 | 5.031 | 30 | 0.000 |
| SERVICE AND COMMERCIAL | 4.603 | 5.97% | 0.275 | -2.67% | -0.123 | 4.753 | 30 | 0.082 |
| OTHER (FUEL COMBUSTION) | 0.715 | 1.76% | 0.013 | -34.38% | -0.246 | 0.426 | 25 | 0.003 |
| TOTAL NOx: FUEL COMBUSTION | **31.153** | | **0.784** | | **-7.583** | **23.841** | | **0.334** |
| **WASTE DISPOSAL** | | | | | | | | |
| SEWAGE TREATMENT | 0.033 | 17.58% | 0.006 | 0.00% | 0.000 | 0.039 | | 0.000 |
| LANDFILLS | 0.168 | 14.63% | 0.025 | 0.00% | 0.000 | 0.193 | | 0.000 |
| INCINERATORS | 0.038 | 12.83% | 0.005 | 0.00% | 0.000 | 0.043 | 50 | 0.002 |
| SOIL REMEDIATION | 0.005 | 9.43% | 0.000 | 0.00% | 0.000 | 0.006 | | 0.000 |
| OTHER (WASTE DISPOSAL) | 0.001 | 7.69% | 0.000 | 0.00% | 0.000 | 0.001 | | 0.000 |
| TOTAL NOx: WASTE DISPOSAL | **0.246** | | **0.036** | | **0.000** | **0.282** | | **0.002** |
| **CLEANING AND SURFACE COATINGS** | | | | | | | | |
| LAUNDERING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| DEGREASING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| COATINGS AND RELATED PROCESS SOLVENTS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| PRINTING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| ADHESIVES AND SEALANTS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| OTHER (CLEANING AND SURFACE COATINGS) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| TOTAL NOx: CLEANING AND SURFACE COATINGS | **0** | | **0.000** | | **0.000** | **0** | | **0.000** |
| **PETROLEUM PRODUCTION AND MARKETING** | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.355 | 0.00% | 0.000 | 0.00% | 0.000 | 0.297 | 100 | 0.000 |
| PETROLEUM REFINING | 0.011 | 0.00% | 0.000 | 0.00% | 0.000 | 0.011 | 80 | 0.000 |
| PETROLEUM MARKETING | 0.039 | 20.93% | 0.008 | 0.00% | 0.000 | 0.047 | 80 | 0.006 |
| OTHER (PETROLEUM PRODUCTION AND MARKETING) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 80 | 0.000 |
| TOTAL NOx: PETROLEUM PRODUCTION AND MARKETING | **0.405** | | **0.008** | | **0.000** | **0.355** | | **0.006** |
| **INDUSTRIAL PROCESSES** | | | | | | | | |
| CHEMICAL | 0.304 | 12.78% | 0.039 | 0.00% | 0.000 | 0.342 | 25 | 0.010 |
| FOOD AND AGRICULTURE | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 10 | 0.000 |
| MINERAL PROCESSES | 0.199 | 22.93% | 0.046 | 0.00% | 0.000 | 0.245 | 25 | 0.011 |
| METAL PROCESSES | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 10 | 0.000 |
| WOOD AND PAPER | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| GLASS AND RELATED PRODUCTS | 6.043 | 17.29% | 1.045 | -37.21% | -2.249 | 4.383 | 50 | 0.522 |
| ELECTRONICS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| OTHER (INDUSTRIAL PROCESSES) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 25 | 0.000 |
| **TOTAL NOx: INDUSTRIAL PROCESSES** | **6.547** | | **1.129** | | **-2.249** | **4.971** | | **0.544** |
| **TOTAL NOx: STATIONARY SOURCES** | **38.350** | | **1.957** | | **-9.831** | **29.4483** | | **1.365*** |

*Offset distance ratio of 1.54:1 used for all pollutants, calculated only on the "Total (Pollutant)" lines.

Emissions Inventory used: CEPAM 2015 SJV MSM PM2.5 SIP Ver 1.01

**Table G-3 Estimated SOx Growth, Control, and Estimated Offset Use**

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| **FUEL COMBUSTION** | | | | | | | | |
| ELECTRIC UTILITIES | 0.587 | 4.41% | 0.026 | -0.44% | -0.003 | 0.611 | 50 | 0.013 |
| COGENERATION | 0.184 | 50.27% | 0.092 | -0.05% | 0.000 | 0.277 | 50 | 0.046 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 0.733 | 0.00% | 0.000 | -57.93% | -0.425 | 0.258 | 80 | 0.000 |
| PETROLEUM REFINING (COMBUSTION) | 0.021 | 0.00% | 0.000 | -47.57% | -0.010 | 0.011 | 100 | 0.000 |
| MANUFACTURING AND INDUSTRIAL | 0.826 | 0.96% | 0.008 | -3.91% | -0.032 | 0.802 | 25 | 0.002 |
| FOOD AND AGRICULTURAL PROCESSING | 0.253 | 0.00% | 0.000 | -59.98% | -0.152 | 0.098 | 10 | 0.000 |
| SERVICE AND COMMERCIAL | 0.348 | 4.08% | 0.014 | -7.89% | -0.027 | 0.334 | 25 | 0.004 |
| OTHER (FUEL COMBUSTION) | 0.003 | 7.41% | 0.000 | -44.44% | -0.001 | 0.002 | | 0.000 |
| TOTAL SOx: FUEL COMBUSTION | **2.955** | | **0.141** | | **-0.650** | **2.392** | | **0.065** |
| **WASTE DISPOSAL** | | | | | | | | |
| SEWAGE TREATMENT | 0.065 | 17.49% | 0.011 | 0.00% | 0.000 | 0.076 | | 0.000 |
| LANDFILLS | 0.069 | 14.27% | 0.010 | 0.00% | 0.000 | 0.079 | | 0.000 |
| INCINERATORS | 0.010 | 12.24% | 0.001 | 0.00% | 0.000 | 0.011 | 25 | 0.000 |
| SOIL REMEDIATION | 0.001 | 16.67% | 0.000 | 0.00% | 0.000 | 0.001 | | 0.000 |
| OTHER (WASTE DISPOSAL) | 0.001 | 14.29% | 0.000 | 0.00% | 0.000 | 0.001 | | 0.000 |
| TOTAL SOx: WASTE DISPOSAL | **0.146** | | **0.023** | | **0.000** | **0.168** | | **0.000** |
| **CLEANING AND SURFACE COATINGS** | | | | | | | | |
| LAUNDERING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| DEGREASING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| COATINGS AND RELATED PROCESS SOLVENTS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| PRINTING | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| ADHESIVES AND SEALANTS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| OTHER (CLEANING AND SURFACE COATINGS) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| TOTAL SOx: CLEANING AND SURFACE COATINGS | **0** | | **0.000** | | **0.000** | **0** | | **0.000** |
| **PETROLEUM PRODUCTION AND MARKETING** | | | | | | | | |
| OIL AND GAS PRODUCTION | 0.203 | 0.00% | 0.000 | 0.00% | 0.000 | 0.170 | 90 | 0.000 |
| PETROLEUM REFINING | 0.008 | 0.00% | 0.000 | 0.00% | 0.000 | 0.008 | 100 | 0.000 |

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| PETROLEUM MARKETING | 0.001 | 11.11% | 0.000 | 0.00% | 0.000 | 0.001 | | 0.000 |
| OTHER (PETROLEUM PRODUCTION AND MARKETING) | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | 80 | 0.000 |
| TOTAL SOx: PETROLEUM PRODUCTION AND MARKETING | **0.212** | | **0.000** | | **0.000** | **0.179** | | **0.000** |
| **INDUSTRIAL PROCESSES** | | | | | | | | |
| CHEMICAL | 0.764 | 12.82% | 0.098 | 0.00% | 0.000 | 0.862 | 25 | 0.024 |
| FOOD AND AGRICULTURE | 0.375 | 15.65% | 0.059 | 0.00% | 0.000 | 0.434 | 50 | 0.029 |
| MINERAL PROCESSES | 0.364 | 22.92% | 0.083 | 0.00% | 0.000 | 0.447 | 25 | 0.021 |
| METAL PROCESSES | 0.003 | 23.08% | 0.001 | 0.00% | 0.000 | 0.003 | 25 | 0.000 |
| WOOD AND PAPER | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| GLASS AND RELATED PRODUCTS | 1.959 | 13.90% | 0.272 | -10.13% | -0.198 | 1.975 | 50 | 0.136 |
| ELECTRONICS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| OTHER (INDUSTRIAL PROCESSES) | 0.103 | 18.32% | 0.019 | 0.00% | 0.000 | 0.121 | 25 | 0.005 |
| **TOTAL SOx: INDUSTRIAL PROCESSES** | **3.567** | | **0.532** | | **-0.198** | **3.842** | | **0.216** |
| **TOTAL SOx: STATIONARY SOURCES** | **6.880** | | **0.695** | | **-0.848** | **6.5818** | | **0.432*** |

*Offset distance ratio of 1.54:1 used for all pollutants, calculated only on the “Total (Pollutant)” lines.

Emissions Inventory used: CEPAM 2015 SJV MSM PM2.5 SIP Ver 1.01

## Table G-4 Estimated VOC Growth, Control, and Estimated Offset Use

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| **FUEL COMBUSTION** | | | | | | | | |
| ELECTRIC UTILITIES | 0.211 | 0.00% | 0.000 | 0.05% | 0.000 | 0.189 | 50 | 0.000 |
| COGENERATION | 0.487 | 14.02% | 0.068 | -0.04% | 0.000 | 0.555 | 50 | 0.034 |
| OIL AND GAS PRODUCTION (COMBUSTION) | 1.172 | 0.00% | 0.000 | -0.01% | 0.000 | 0.981 | 95 | 0.000 |
| PETROLEUM REFINING (COMBUSTION) | 0.097 | 0.00% | 0.000 | 0.00% | 0.000 | 0.097 | 100 | 0.000 |
| MANUFACTURING AND INDUSTRIAL | 0.179 | 1.01% | 0.002 | 0.00% | 0.000 | 0.181 | 25 | 0.000 |
| FOOD AND AGRICULTURAL PROCESSING | 1.043 | 0.00% | 0.000 | -40.81% | -0.426 | 0.599 | 10 | 0.000 |
| SERVICE AND COMMERCIAL | 0.577 | 7.20% | 0.042 | 0.00% | 0.000 | 0.618 | 25 | 0.010 |
| OTHER (FUEL COMBUSTION) | 0.049 | 1.44% | 0.001 | -41.20% | -0.020 | 0.025 | 10 | 0.000 |
| TOTAL VOC: FUEL COMBUSTION | **3.8134** | | **0.112** | | **-0.446** | **3.245** | | **0.045** |
| **WASTE DISPOSAL** | | | | | | | | |
| SEWAGE TREATMENT | 0.032 | 17.39% | 0.006 | 0.00% | 0.000 | 0.038 | 25 | 0.001 |
| LANDFILLS | 1.511 | 17.26% | 0.261 | -0.01% | 0.000 | 1.772 | 50 | 0.130 |
| INCINERATORS | 0.011 | 12.73% | 0.001 | 0.00% | 0.000 | 0.012 | | 0.000 |
| SOIL REMEDIATION | 0.106 | 10.51% | 0.011 | 0.00% | 0.000 | 0.117 | 10 | 0.001 |
| OTHER (WASTE DISPOSAL) | 21.369 | 18.24% | 3.898 | -3.74% | -0.799 | 24.327 | 25 | 0.974 |
| TOTAL VOC: WASTE DISPOSAL | **23.029** | | **4.177** | | **-0.799** | **26.266** | | **1.107** |
| **CLEANING AND SURFACE COATINGS** | | | | | | | | |
| LAUNDERING | 0.088 | 12.80% | 0.011 | 0.00% | 0.000 | 0.100 | 0 | 0.000 |
| DEGREASING | 1.528 | 6.40% | 0.098 | -0.01% | 0.000 | 1.626 | 10 | 0.010 |
| COATINGS AND RELATED PROCESS SOLVENTS | 7.834 | 18.43% | 1.444 | -0.70% | -0.055 | 9.220 | 50 | 0.722 |
| PRINTING | 4.840 | 15.15% | 0.733 | 0.00% | 0.000 | 5.574 | 25 | 0.183 |
| ADHESIVES AND SEALANTS | 0.562 | 0.00% | 0.000 | 0.00% | 0.000 | 0.511 | 25 | 0.000 |
| OTHER (CLEANING AND SURFACE COATINGS) | 6.167 | 19.14% | 1.180 | -0.02% | -0.001 | 7.347 | 50 | 0.590 |

| SUMMARY CATEGORY NAME | 2012 Emissions Tons/day | Growth Factor (%) | Estimated Growth (tons/day) | Control Factor (%) | Reductions (tons/day) | 2020 Emissions Tons/day | Percent Requiring Offsets | Estimated Offsets* (tons/day) |
|---|---|---|---|---|---|---|---|---|
| TOTAL VOC: CLEANING AND SURFACE COATINGS | **21.020** | | **3.467** | | **-0.056** | **24.377** | | **1.505** |
| **PETROLEUM PRODUCTION AND MARKETING** | | | | | | | | |
| OIL AND GAS PRODUCTION | 25.935 | 0.00% | 0.000 | 0.00% | 0.000 | 21.708 | 80 | 0.000 |
| PETROLEUM REFINING | 0.793 | 0.00% | 0.000 | 0.00% | 0.000 | 0.793 | 90 | 0.000 |
| PETROLEUM MARKETING | 7.676 | 15.93% | 1.223 | -6.65% | -0.510 | 8.299 | 40 | 0.489 |
| OTHER (PETROLEUM PRODUCTION AND MARKETING) | 0.016 | 10.43% | 0.002 | 0.00% | 0.000 | 0.018 | 80 | 0.001 |
| TOTAL VOC: PETROLEUM PRODUCTION AND MARKETING | **34.420** | | **1.224** | | **-0.510** | **30.818** | | **0.490** |
| **INDUSTRIAL PROCESSES** | | | | | | | | |
| CHEMICAL | 4.796 | 12.81% | 0.614 | 0.03% | 0.001 | 5.4105 | 25 | 0.154 |
| FOOD AND AGRICULTURE | 10.935 | 15.81% | 1.729 | 0.01% | 0.001 | 12.6637 | 50 | 0.864 |
| MINERAL PROCESSES | 0.233 | 22.92% | 0.053 | 0.00% | 0.000 | 0.2869 | 25 | 0.013 |
| METAL PROCESSES | 0.160 | 3.19% | 0.005 | 0.00% | 0.000 | 0.1651 | 25 | 0.001 |
| WOOD AND PAPER | 0.010 | 0.00% | 0.000 | 0.00% | 0.000 | 0.0097 | 25 | 0.000 |
| GLASS AND RELATED PRODUCTS | 0.020 | 14.00% | 0.003 | 0.00% | 0.000 | 0.0228 | 50 | 0.001 |
| ELECTRONICS | 0 | 0.00% | 0.000 | 0.00% | 0.000 | 0 | | 0.000 |
| OTHER (INDUSTRIAL PROCESSES) | 0.801 | 18.35% | 0.147 | 0.01% | 0.000 | 0.9479 | 25 | 0.037 |
| **TOTAL VOC: INDUSTRIAL PROCESSES** | **16.955** | | **2.552** | | **0.003** | **19.507** | | **1.071** |
| **TOTAL VOC: STATIONARY SOURCES** | **99.237** | | **11.532** | | **-1.809** | **104.2129** | | **6.497*** |

*Offset distance ratio of 1.54:1 used for all pollutants, calculated only on the "Total (Pollutant)" lines.

Emissions Inventory used: CEPAM 2015 SJV MSM PM2.5 SIP Ver 1.01

**Table G-5 List of Emission Reduction Credits PM10 and PM2.5 Precursors**

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| SWANSON HULLING | N | 10 | 4 | PM10 | 0 | 0 | 2984 | 0 |
| WESTERN STONE PRODUCTS, INC. | N | 17 | 4 | PM10 | 513 | 513 | 558 | 558 |
| H. J. HEINZ COMPANY, L.P. | N | 21 | 4 | PM10 | 0 | 60 | 180 | 60 |
| CAMPBELL SOUP SUPPLY CO. | N | 31 | 4 | PM10 | 0 | 434 | 1064 | 0 |
| AERA ENERGY LLC | S | 32 | 4 | PM10 | 0 | 0 | 69 | 120 |
| HOGAN MANUFACTURING, INC | N | 34 | 4 | PM10 | 1972 | 4031 | 2344 | 2712 |
| CALMAT OF FRESNO | C | 40 | 4 | PM10 | 75 | 359 | 165 | 553 |
| J.R. SIMPLOT | C | 44 | 4 | PM10 | 15147 | 14971 | 12295 | 12625 |
| SALIDA HULLING ASSOCIATION | N | 44 | 4 | PM10 | 0 | 0 | 12246 | 0 |
| BROWN SAND INC | N | 46 | 4 | PM10 | 1107 | 1474 | 840 | 1099 |
| CLEAN HARBORS BUTTONWILLOW, LLC | S | 49 | 4 | PM10 | 567 | 573 | 580 | 580 |
| CALMAT CO. | C | 50 | 4 | PM10 | 15 | 16 | 23 | 24 |
| WEST ISLAND COTTON GROWERS INC | C | 55 | 4 | PM10 | 0 | 0 | 0 | 4365 |
| DEL MONTE FOODS MODESTO PLANT 1 | N | 58 | 4 | PM10 | 0 | 0 | 8410 | 0 |
| H. J. HEINZ COMPANY | N | 60 | 4 | PM10 | 0 | 42 | 226 | 4 |
| AMERICAN MOULDING & MILLWORK | N | 63 | 4 | PM10 | 1106 | 701 | 809 | 471 |
| CRAYCROFT BRICK COMPANY | C | 71 | 4 | PM10 | 50 | 40 | 39 | 40 |
| CHEVRON USA INC | S | 77 | 4 | PM10 | 3067 | 2768 | 2607 | 3422 |
| CALAVERAS MATERIALS INC | C | 89 | 4 | PM10 | 45 | 41 | 47 | 38 |
| J G BOSWELL COMPANY OIL MILL | C | 92 | 4 | PM10 | 670 | 460 | 648 | 916 |
| J G BOSWELL COMPANY OIL MILL | C | 93 | 4 | PM10 | 2810 | 2418 | 2082 | 4097 |
| THE NESTLE COMPANY INC | N | 93 | 4 | PM10 | 5602 | 5688 | 4414 | 7118 |
| H & H COTTON GINNING COMPANY | C | 105 | 4 | PM10 | 0 | 0 | 0 | 9954 |
| SC JOHNSON HOME STORAGE INC | C | 107 | 4 | PM10 | 326 | 315 | 281 | 269 |
| CASTLE AIRPORT AVIATION & DEVELOP CENTER | N | 109 | 4 | PM10 | 6262 | 6332 | 6402 | 6402 |
| LOS BANOS GRAVEL GROUP, ASPHLT | N | 125 | 4 | PM10 | 85 | 162 | 376 | 168 |
| P-R FARMS, INC. | C | 126 | 4 | PM10 | 0 | 0 | 357 | 180 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CAMPBELL SOUP COMPANY | N | 127 | 4 | PM10 | 416 | 289 | 261 | 308 |
| ECKERT FROZEN FOODS | N | 133 | 4 | PM10 | 5 | 20 | 72 | 14 |
| CHEVRON USA PRODUCTION INC | S | 147 | 4 | PM10 | 50 | 57 | 46 | 46 |
| R M WADE & COMPANY | C | 152 | 4 | PM10 | 14 | 17 | 17 | 16 |
| BRITZ INCORPORATED | C | 159 | 4 | PM10 | 0 | 0 | 0 | 715 |
| GALLO GLASS COMPANY | N | 161 | 4 | PM10 | 23150 | 22909 | 24274 | 22565 |
| AERA ENERGY LLC | S | 202 | 4 | PM10 | 123 | 100 | 70 | 88 |
| PARAMOUNT FARMS | N | 206 | 4 | PM10 | 0 | 0 | 65 | 52685 |
| CALPINE CORPORATION | N | 208 | 4 | PM10 | 715 | 8177 | 6581 | 715 |
| POHL ALMOND HULLING | N | 212 | 4 | PM10 | 0 | 0 | 4279 | 8511 |
| AERA ENERGY LLC | S | 215 | 4 | PM10 | 403 | 362 | 361 | 406 |
| CALAVERAS MATERIALS INC. | C | 233 | 4 | PM10 | 243 | 652 | 759 | 479 |
| RIO BRAVO FRESNO | C | 244 | 4 | PM10 | 1000 | 0 | 0 | 0 |
| AERA ENERGY LLC | S | 254 | 4 | PM10 | 1093 | 1174 | 0 | 913 |
| AERA ENERGY LLC | S | 255 | 4 | PM10 | 4184 | 1519 | 0 | 1074 |
| AERA ENERGY LLC | S | 256 | 4 | PM10 | 10145 | 5624 | 0 | 0 |
| AERA ENERGY LLC | S | 259 | 4 | PM10 | 1483 | 1747 | 0 | 705 |
| AERA ENERGY LLC | S | 260 | 4 | PM10 | 1858 | 1946 | 286 | 633 |
| AERA ENERGY LLC | S | 272 | 4 | PM10 | 806 | 760 | 721 | 693 |
| PARAMOUNT FARMS, INC. | C | 288 | 4 | PM10 | 1000 | 1000 | 36000 | 12000 |
| CALPINE CORPORATION | N | 297 | 4 | PM10 | 0 | 0 | 101 | 66394 |
| AERA ENERGY LLC | S | 319 | 4 | PM10 | 449 | 650 | 497 | 499 |
| NAS LEMOORE | C | 330 | 4 | PM10 | 17 | 17 | 17 | 17 |
| CHEVRON USA INC | C | 331 | 4 | PM10 | 3766 | 3767 | 3767 | 3767 |
| CHEVRON USA INC | C | 339 | 4 | PM10 | 11300 | 11300 | 11301 | 11301 |
| WESTSIDE FARMERS COOP. GIN | C | 352 | 4 | PM10 | 0 | 0 | 0 | 33444 |
| CHEVRON U S A INC | S | 357 | 4 | PM10 | 137 | 116 | 114 | 153 |
| LIDESTRI FOODS, INC | N | 391 | 4 | PM10 | 0 | 0 | 1056 | 0 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| J D HEISKELL & COMPANY | S | 415 | 4 | PM10 | 643 | 322 | 356 | 1039 |
| MONTEREY RESOURCES, INC. | S | 432 | 4 | PM10 | 906 | 918 | 753 | 837 |
| TURLOCK IRRIGATION DISTRICT | N | 433 | 4 | PM10 | 0 | 0 | 0 | 4720 |
| CALPINE CORPORATION | C | 448 | 4 | PM10 | 1067 | 1067 | 1067 | 1067 |
| CALPINE CORPORATION | C | 449 | 4 | PM10 | 82 | 28 | 373 | 674 |
| LAWRENCE LIVERMORE NATL. LAB | N | 464 | 4 | PM10 | 8 | 3 | 0 | 6 |
| BRITZ GIN PARTNERSHIP | S | 475 | 4 | PM10 | 0 | 0 | 0 | 4259 |
| CALIFORNIA DAIRIES | N | 498 | 4 | PM10 | 273 | 313 | 128 | 186 |
| LA PALOMA GENERATING COMPANY | N | 500 | 4 | PM10 | 11695 | 16203 | 9929 | 8254 |
| CANDLEWICK YARNS | C | 507 | 4 | PM10 | 11 | 9 | 7 | 7 |
| TURLOCK IRRIGATION DISTRICT | C | 510 | 4 | PM10 | 0 | 0 | 0 | 6430 |
| OWENS-BROCKWAY GLASS CONTAINER | N | 517 | 4 | PM10 | 0 | 0 | 0 | 490 |
| DOLE PACKAGED FOODS LLC | N | 520 | 4 | PM10 | 5 | 20 | 72 | 14 |
| HURON GINNING CO | C | 521 | 4 | PM10 | 8 | 373 | 186 | 631 |
| GENERAL CABLE INDUSTRIES, LLC | C | 524 | 4 | PM10 | 2 | 1 | 2 | 1 |
| BRITZ AG FINANCE CO., INC. | C | 558 | 4 | PM10 | 0 | 0 | 0 | 5780 |
| BRITZ AG FINANCE CO., INC. | C | 559 | 4 | PM10 | 0 | 0 | 0 | 35897 |
| CORCORAN IRRIGATION DISTRICT | C | 560 | 4 | PM10 | 75 | 77 | 74 | 44 |
| ARDAGH GLASS INC | C | 572 | 4 | PM10 | 18 | 18 | 18 | 18 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 575 | 4 | PM10 | 0 | 0 | 108 | 0 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 576 | 4 | PM10 | 0 | 203 | 181 | 0 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 577 | 4 | PM10 | 710 | 860 | 899 | 899 |
| BRITZ INCORPORATED | C | 586 | 4 | PM10 | 0 | 0 | 0 | 19720 |
| MODESTO TALLOW CO INC | N | 599 | 4 | PM10 | 254 | 228 | 279 | 271 |
| OAKWOOD LAKE RESORT | N | 601 | 4 | PM10 | 0 | 9 | 15 | 0 |
| GENERAL MILLS OPERATIONS, INC | N | 608 | 4 | PM10 | 178 | 0 | 385 | 298 |
| OLDUVAI GORGE, LLC | N | 611 | 4 | PM10 | 0 | 0 | 3830 | 1915 |
| OLDUVAI GORGE, LLC | N | 619 | 4 | PM10 | 1138 | 1137 | 1084 | 1053 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| WESTERN MILLING, LLC | C | 621 | 4 | PM10 | 152 | 152 | 152 | 152 |
| CHEVRON U S A INC | S | 629 | 4 | PM10 | 24 | 21 | 21 | 21 |
| DIAMOND FOODS INCORPORATED | N | 645 | 4 | PM10 | 49 | 0 | 4 | 0 |
| KINGS RIVER CONSERVATION DISTRICT | C | 649 | 4 | PM10 | 0 | 0 | 0 | 138 |
| UNITED STATES GYPSUM COMPANY | N | 659 | 4 | PM10 | 0 | 0 | 0 | 23209 |
| UNITED STATES GYPSUM COMPANY | N | 660 | 4 | PM10 | 0 | 0 | 0 | 23515 |
| WESTERN MILLING, LLC | C | 670 | 4 | PM10 | 0 | 0 | 0 | 10844 |
| CONAGRA CONSUMER FROZEN FOODS | N | 672 | 4 | PM10 | 135 | 48 | 91 | 137 |
| H. J. HEINZ COMPANY | N | 694 | 4 | PM10 | 0 | 0 | 1372 | 0 |
| CANANDAIGUA WINE COMPANY INC | C | 702 | 4 | PM10 | 423 | 422 | 449 | 411 |
| CHEVRON USA INC | S | 702 | 4 | PM10 | 1861 | 1881 | 1902 | 1902 |
| AVENAL POWER CENTER, LLC | N | 721 | 4 | PM10 | 0 | 0 | 3215 | 0 |
| AVENAL POWER CENTER, LLC | N | 723 | 4 | PM10 | 0 | 0 | 985 | 0 |
| ANDERSON CLAYTON CORPORATION | N | 737 | 4 | PM10 | 979 | 0 | 0 | 19767 |
| STOCKTON EAST WATER DISTRICT | N | 763 | 4 | PM10 | 214 | 299 | 301 | 271 |
| OLDUVAI GORGE, LLC | C | 789 | 4 | PM10 | 0 | 0 | 0 | 40000 |
| AERA ENERGY LLC | S | 790 | 4 | PM10 | 153 | 102 | 117 | 167 |
| OLDUVAI GORGE, LLC | C | 796 | 4 | PM10 | 0 | 0 | 0 | 6382 |
| BAR VP DAIRY | C | 797 | 4 | PM10 | 0 | 0 | 0 | 2180 |
| BAR VP DAIRY | C | 798 | 4 | PM10 | 0 | 0 | 0 | 3204 |
| THE DOW CHEMICAL COMPANY | N | 799 | 4 | PM10 | 73 | 82 | 83 | 72 |
| BAR VP DAIRY | C | 799 | 4 | PM10 | 0 | 0 | 0 | 4111 |
| AERA ENERGY LLC | S | 802 | 4 | PM10 | 734 | 1218 | 47 | 623 |
| OLDUVAI GORGE, LLC | C | 814 | 4 | PM10 | 0 | 0 | 0 | 5468 |
| CERTAINTEED CORPORATION | C | 816 | 4 | PM10 | 600 | 600 | 600 | 600 |
| RANCHERS COTTON OIL | C | 817 | 4 | PM10 | 1327 | 1325 | 1323 | 1323 |
| UNITED STATES GYPSUM COMPANY | C | 818 | 4 | PM10 | 0 | 0 | 0 | 18935 |
| RIVERSIDE DAIRY | C | 819 | 4 | PM10 | 1225 | 409 | 0 | 3469 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| RIVERSIDE DAIRY | C | 820 | 4 | PM10 | 4335 | 0 | 0 | 6111 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 826 | 4 | PM10 | 71 | 67 | 60 | 68 |
| UNITED STATES GYPSUM COMPANY | C | 827 | 4 | PM10 | 0 | 0 | 0 | 4000 |
| UNITED STATES GYPSUM COMPANY | C | 828 | 4 | PM10 | 0 | 0 | 0 | 2848 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 829 | 4 | PM10 | 68 | 72 | 85 | 69 |
| UNITED STATES GYPSUM COMPANY | C | 829 | 4 | PM10 | 0 | 0 | 0 | 1649 |
| UNITED STATES GYPSUM COMPANY | C | 830 | 4 | PM10 | 0 | 0 | 0 | 5824 |
| UNITED STATES GYPSUM COMPANY | C | 831 | 4 | PM10 | 0 | 0 | 0 | 5395 |
| UNITED STATES GYPSUM COMPANY | C | 832 | 4 | PM10 | 0 | 0 | 0 | 5112 |
| UNITED STATES GYPSUM COMPANY | C | 833 | 4 | PM10 | 1006 | 44 | 0 | 943 |
| UNITED STATES GYPSUM COMPANY | C | 834 | 4 | PM10 | 0 | 0 | 0 | 6788 |
| UNITED STATES GYPSUM COMPANY | C | 835 | 4 | PM10 | 0 | 0 | 0 | 5357 |
| UNITED STATES GYPSUM COMPANY | C | 836 | 4 | PM10 | 0 | 0 | 0 | 6688 |
| UNITED STATES GYPSUM COMPANY | C | 837 | 4 | PM10 | 0 | 0 | 0 | 18959 |
| BIG WEST OF CA, LLC | N | 837 | 4 | PM10 | 0 | 0 | 1322 | 0 |
| BIG WEST OF CA, LLC | N | 838 | 4 | PM10 | 0 | 0 | 320 | 0 |
| UNITED STATES GYPSUM COMPANY | C | 838 | 4 | PM10 | 0 | 0 | 0 | 5098 |
| UNITED STATES GYPSUM COMPANY | C | 839 | 4 | PM10 | 0 | 0 | 0 | 5476 |
| UNITED STATES GYPSUM COMPANY | C | 840 | 4 | PM10 | 0 | 0 | 0 | 3470 |
| UNITED STATES GYPSUM COMPANY | C | 841 | 4 | PM10 | 0 | 0 | 0 | 2642 |
| UNITED STATES GYPSUM COMPANY | C | 842 | 4 | PM10 | 0 | 0 | 0 | 3471 |
| UNITED STATES GYPSUM COMPANY | C | 843 | 4 | PM10 | 0 | 0 | 0 | 7953 |
| UNITED STATES GYPSUM COMPANY | C | 845 | 4 | PM10 | 0 | 0 | 0 | 10655 |
| UNITED STATES GYPSUM COMPANY | C | 846 | 4 | PM10 | 0 | 0 | 0 | 11928 |
| EAGLE VALLEY GINNING LLC | N | 847 | 4 | PM10 | 0 | 0 | 0 | 29098 |
| UNITED STATES GYPSUM COMPANY | C | 847 | 4 | PM10 | 0 | 0 | 0 | 26284 |
| BRIAN R. ANDERSON INC. | C | 854 | 4 | PM10 | 0 | 0 | 0 | 20729 |
| KODA FARMS | C | 856 | 4 | PM10 | 0 | 0 | 0 | 1396 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 862 | 4 | PM10 | 1257 | 1129 | 1090 | 1193 |
| AERA ENERGY LLC | S | 863 | 4 | PM10 | 5 | 5 | 10 | 9 |
| BRITZ GIN PARTNERSHIP II | C | 871 | 4 | PM10 | 0 | 0 | 0 | 10903 |
| FRITO-LAY INC | N | 888 | 4 | PM10 | 0 | 0 | 2339 | 0 |
| FRITO-LAY INC | N | 890 | 4 | PM10 | 61 | 0 | 0 | 0 |
| VAN GRONINGEN ORCHARDS | N | 894 | 4 | PM10 | 0 | 0 | 2306 | 1327 |
| AVENAL POWER CENTER, LLC | C | 896 | 4 | PM10 | 80 | 80 | 80 | 80 |
| VARCO PRUDEN BUILDINGS, INC. | N | 898 | 4 | PM10 | 3827 | 4258 | 7700 | 6665 |
| CALIFORNIA SPRAY DRY CO | N | 904 | 4 | PM10 | 508 | 686 | 481 | 556 |
| AERA ENERGY LLC | S | 913 | 4 | PM10 | 846 | 548 | 530 | 785 |
| OLAM | N | 919 | 4 | PM10 | 500 | 1387 | 1737 | 15 |
| EVOLUTION MARKETS INC. | C | 941 | 4 | PM10 | 0 | 0 | 0 | 41215 |
| CALPINE CORPORATION | C | 942 | 4 | PM10 | 50845 | 67976 | 8408 | 841 |
| ANDERSEN RACK SYSTEMS, INC | N | 950 | 4 | PM10 | 300 | 303 | 306 | 306 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 952 | 4 | PM10 | 254 | 230 | 240 | 228 |
| ANDERSON CLAYTON CORP/IDRIA #1 | C | 959 | 4 | PM10 | 0 | 0 | 0 | 26896 |
| CHEVRON USA INC | C | 966 | 4 | PM10 | 144 | 144 | 144 | 144 |
| AERA ENERGY LLC | S | 983 | 4 | PM10 | 503 | 106 | 151 | 756 |
| COUNTY LINE GIN | C | 997 | 4 | PM10 | 0 | 0 | 0 | 8549 |
| AERA ENERGY LLC | S | 1006 | 4 | PM10 | 991 | 1085 | 445 | 696 |
| AERA ENERGY LLC | S | 1008 | 4 | PM10 | 80 | 100 | 30 | 21 |
| AERA ENERGY LLC | S | 1010 | 4 | PM10 | 1975 | 2028 | 0 | 2074 |
| CALPINE ENERGY SERVICES, L.P. | C | 1010 | 4 | PM10 | 1029 | 0 | 0 | 13916 |
| AERA ENERGY LLC | S | 1012 | 4 | PM10 | 350 | 748 | 479 | 91 |
| AERA ENERGY LLC | S | 1013 | 4 | PM10 | 269 | 2280 | 694 | 170 |
| THE ENVIRONMENTAL RESOURCES TRUST, INC | C | 1013 | 4 | PM10 | 418 | 418 | 418 | 418 |
| TKV CONTAINERS, INC. | C | 1015 | 4 | PM10 | 0 | 349 | 349 | 0 |
| ARDAGH GLASS INC | N | 1017 | 4 | PM10 | 0 | 0 | 0 | 167 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| WEST ISLAND COTTON GROWERS INC | C | 1017 | 4 | PM10 | 607 | 0 | 1193 | 1800 |
| LOS GATOS TOMATO PRODUCTS | C | 1021 | 4 | PM10 | 0 | 24 | 0 | 0 |
| AERA ENERGY LLC | S | 1026 | 4 | PM10 | 278 | 579 | 252 | 201 |
| WESTSIDE FARMERS COOP #2 & #3 | C | 1038 | 4 | PM10 | 3311 | 0 | 0 | 37809 |
| J R SIMPLOT COMPANY | C | 1039 | 4 | PM10 | 988 | 1900 | 877 | 1470 |
| AERA ENERGY LLC | S | 1040 | 4 | PM10 | 0 | 961 | 467 | 0 |
| KODA FARMS, INC. | N | 1042 | 4 | PM10 | 0 | 0 | 0 | 5180 |
| VALLEY GRAIN/AZTECA MILLING | C | 1042 | 4 | PM10 | 0 | 0 | 0 | 2847 |
| NAS LEMOORE | C | 1050 | 4 | PM10 | 7799 | 3198 | 5638 | 1626 |
| MARTIN ANDERSON | C | 1051 | 4 | PM10 | 32 | 48 | 28 | 2 |
| LA PALOMA GENERATING CO, LLC | C | 1055 | 4 | PM10 | 0 | 0 | 0 | 360 |
| AERA ENERGY LLC | S | 1057 | 4 | PM10 | 72 | 81 | 66 | 65 |
| FARMERS FIREBAUGH GINNING CO. | C | 1061 | 4 | PM10 | 6374 | 0 | 0 | 9215 |
| GRANITE CONSTRUCTION COMPANY | C | 1065 | 4 | PM10 | 0 | 0 | 0 | 2 |
| FRITO-LAY, INC. | C | 1068 | 4 | PM10 | 69 | 70 | 67 | 63 |
| FRITO-LAY, INC. | C | 1069 | 4 | PM10 | 286 | 280 | 268 | 259 |
| E & J GALLO WINERY | C | 1071 | 4 | PM10 | 32 | 32 | 31 | 29 |
| PARAMOUNT FARMS, INC | N | 1084 | 4 | PM10 | 27 | 1770 | 275 | 275 |
| H. J. HEINZ COMPANY | N | 1085 | 4 | PM10 | 72 | 73 | 63 | 31 |
| INGREDION INCORPORATED | N | 1086 | 4 | PM10 | 1392 | 853 | 1662 | 1400 |
| AERA ENERGY LLC | S | 1091 | 4 | PM10 | 97 | 119 | 120 | 121 |
| E & B NATURAL RESOURCES | N | 1097 | 4 | PM10 | 775 | 775 | 775 | 775 |
| SPRECKELS SUGAR COMPANY | C | 1112 | 4 | PM10 | 0 | 6074 | 7699 | 3185 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1115 | 4 | PM10 | 51 | 40 | 67 | 47 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1116 | 4 | PM10 | 136 | 113 | 42 | 96 |
| FREEPORT-MCMORAN OIL & GAS, LLC | N | 1131 | 4 | PM10 | 0 | 0 | 0 | 510 |
| DIAMOND PET FOOD PROCESSORS OF RIPON | N | 1136 | 4 | PM10 | 5198 | 5320 | 5320 | 5442 |
| FRITO-LAY, INC. | C | 1136 | 4 | PM10 | 0 | 0 | 0 | 699 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| OLDUVAI GORGE, LLC | N | 1146 | 4 | PM10 | 651 | 288 | 1073 | 376 |
| CHEVRON USA, INC. | C | 1147 | 4 | PM10 | 136 | 140 | 95 | 131 |
| KOCH SUPPLY & TRADING LP | N | 1154 | 4 | PM10 | 165 | 308 | 333 | 5030 |
| KOCH SUPPLY & TRADING LP | N | 1156 | 4 | PM10 | 0 | 4710 | 4761 | 4191 |
| KOCH SUPPLY & TRADING LP | N | 1161 | 4 | PM10 | 0 | 0 | 0 | 8300 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1169 | 4 | PM10 | 398 | 398 | 225 | 398 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1171 | 4 | PM10 | 0 | 0 | 173 | 0 |
| SC JOHNSON HOME STORAGE INC | C | 1173 | 4 | PM10 | 271 | 360 | 355 | 366 |
| F & T FARMS | C | 1177 | 4 | PM10 | 0 | 0 | 0 | 17034 |
| BERRY PETROLEUM COMPANY | N | 1188 | 4 | PM10 | 3130 | 2927 | 2181 | 3135 |
| BERRY PETROLEUM COMPANY | N | 1189 | 4 | PM10 | 0 | 3905 | 3905 | 7810 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1200 | 4 | PM10 | 5 | 5 | 10 | 0 |
| BERRY PETROLEUM COMPANY | N | 1206 | 4 | PM10 | 0 | 6024 | 9030 | 2588 |
| PARAMOUNT FARMS, INC. | C | 1207 | 4 | PM10 | 0 | 0 | 188 | 20 |
| FRESNO/CLOVIS REGIONAL WWTP | C | 1211 | 4 | PM10 | 5 | 5 | 4 | 4 |
| BERRY SEED & FEED COMPANY | N | 1223 | 4 | PM10 | 17557 | 15262 | 16796 | 18901 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1227 | 4 | PM10 | 23 | 69 | 108 | 96 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1236 | 4 | PM10 | 0 | 0 | 0 | 2 |
| DEL MONTE FOODS MODESTO PLANT 1 | N | 1238 | 4 | PM10 | 221 | 189 | 388 | 83 |
| OLDUVAI GORGE, LLC | C | 1250 | 4 | PM10 | 0 | 0 | 0 | 1785 |
| SAN JOAQUIN FACILITIES MGMT | S | 1253 | 4 | PM10 | 27 | 30 | 32 | 30 |
| HANFORD L P | C | 1264 | 4 | PM10 | 1031 | 1497 | 1105 | 869 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1274 | 4 | PM10 | 85 | 0 | 375 | 329 |
| BERRY PETROLEUM COMPANY | C | 1277 | 4 | PM10 | 2334 | 2168 | 2254 | 2251 |
| E & B NATURAL RESOURCES | N | 1282 | 4 | PM10 | 725 | 725 | 725 | 537 |
| TAUBER OIL COMPANY | C | 1284 | 4 | PM10 | 0 | 0 | 0 | 1 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1288 | 4 | PM10 | 0 | 0 | 0 | 1409 |
| BERRY PETROLEUM COMPANY | N | 1288 | 4 | PM10 | 15750 | 15750 | 15750 | 15750 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| PILKINGTON NORTH AMERICA, INC | N | 1289 | 4 | PM10 | 9505 | 9322 | 9357 | 10678 |
| SENECA RESOURCES | C | 1297 | 4 | PM10 | 0 | 0 | 0 | 4231 |
| SENECA RESOURCES CORP | C | 1299 | 4 | PM10 | 0 | 0 | 0 | 4130 |
| SENECA RESOURCES CORP | C | 1300 | 4 | PM10 | 1130 | 1039 | 1076 | 1135 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1306 | 4 | PM10 | 0 | 0 | 0 | 2180 |
| KERN RIVER HOLDINGS, INC. | C | 1309 | 4 | PM10 | 0 | 0 | 0 | 5583 |
| KERN RIVER HOLDINGS, INC. | C | 1310 | 4 | PM10 | 0 | 0 | 0 | 6417 |
| KOCH SUPPLY & TRADING LP | C | 1311 | 4 | PM10 | 0 | 0 | 0 | 2881 |
| MACPHERSON OIL COMPANY | C | 1318 | 4 | PM10 | 0 | 0 | 0 | 3352 |
| OLDUVAI GORGE, LLC | C | 1319 | 4 | PM10 | 0 | 0 | 0 | 25891 |
| MACPHERSON OIL COMPANY | C | 1321 | 4 | PM10 | 0 | 0 | 0 | 8 |
| PARAMOUNT FARMS | S | 1349 | 4 | PM10 | 0 | 0 | 0 | 6679 |
| PARAMOUNT FARMS | S | 1350 | 4 | PM10 | 0 | 0 | 0 | 37321 |
| AERA ENERGY LLC | S | 1424 | 4 | PM10 | 787 | 1901 | 1476 | 380 |
| PARAMOUNT FARMS | S | 1446 | 4 | PM10 | 0 | 0 | 1088 | 18586 |
| AERA ENERGY LLC | S | 1476 | 4 | PM10 | 262 | 0 | 0 | 74 |
| AERA ENERGY LLC | S | 1477 | 4 | PM10 | 455 | 0 | 0 | 128 |
| CHEVRON USA INC | S | 1485 | 4 | PM10 | 1890 | 1911 | 1932 | 1932 |
| SAN JOAQUIN FACILITIES MGMT | S | 1509 | 4 | PM10 | 7 | 9 | 9 | 9 |
| CALPINE CORPORATION | S | 1577 | 4 | PM10 | 489 | 0 | 0 | 23085 |
| CALPINE CORPORATION | S | 1683 | 4 | PM10 | 0 | 0 | 0 | 1462 |
| CALPINE CORPORATION | S | 1689 | 4 | PM10 | 0 | 0 | 0 | 2604 |
| CALPINE CORPORATION | S | 1693 | 4 | PM10 | 1091 | 1103 | 1115 | 1115 |
| SAN JOAQUIN FACILITIES MGMT | S | 1735 | 4 | PM10 | 23 | 20 | 15 | 12 |
| AERA ENERGY LLC | S | 1927 | 4 | PM10 | 1854 | 2703 | 2734 | 2332 |
| AERA ENERGY LLC | S | 2025 | 4 | PM10 | 1028 | 714 | 726 | 684 |
| CALIFORNIA DAIRIES, INC. | S | 2152 | 4 | PM10 | 0 | 0 | 0 | 99 |
| CRIMSON RESOURCE MANAGEMENT | S | 2161 | 4 | PM10 | 20 | 17 | 12 | 24 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALIFORNIA DAIRIES, INC. | S | 2204 | 4 | PM10 | 0 | 0 | 0 | 405 |
| COUNTY OF SAN JOAQUIN SOLID WASTE DIV | S | 2264 | 4 | PM10 | 0 | 0 | 0 | 471 |
| COUNTY OF SAN JOAQUIN SOLID WASTE DIV | S | 2266 | 4 | PM10 | 0 | 0 | 0 | 1000 |
| COUNTY OF SAN JOAQUIN SOLID WASTE DIV | S | 2267 | 4 | PM10 | 0 | 0 | 0 | 8813 |
| CHEVRON USA INC (REFINERY) | S | 2275 | 4 | PM10 | 490 | 1911 | 1932 | 532 |
| FOSTER FARMS, PORTERVILLE PLANT | S | 2337 | 4 | PM10 | 40 | 40 | 40 | 40 |
| AERA ENERGY LLC | S | 2361 | 4 | PM10 | 4 | 1 | 0 | 2 |
| VANDERHAM WEST | S | 2410 | 4 | PM10 | 0 | 0 | 0 | 5765 |
| VANDERHAM WEST | S | 2411 | 4 | PM10 | 0 | 0 | 0 | 7592 |
| VANDERHAM WEST | S | 2412 | 4 | PM10 | 0 | 0 | 7 | 3945 |
| VANDERHAM WEST | S | 2413 | 4 | PM10 | 9 | 0 | 0 | 4701 |
| OLDUVAI GORGE, LLC | S | 2482 | 4 | PM10 | 0 | 0 | 0 | 7471 |
| M CARATAN INC | S | 2516 | 4 | PM10 | 0 | 0 | 14 | 3 |
| UNITED STATES GYPSUM COMPANY | S | 2543 | 4 | PM10 | 0 | 0 | 0 | 8032 |
| AERA ENERGY LLC | S | 2575 | 4 | PM10 | 2301 | 1770 | 0 | 548 |
| UNITED STATES GYPSUM COMPANY | S | 2576 | 4 | PM10 | 0 | 0 | 0 | 5078 |
| UNITED STATES GYPSUM COMPANY | S | 2577 | 4 | PM10 | 0 | 0 | 350 | 17130 |
| UNITED STATES GYPSUM COMPANY | S | 2578 | 4 | PM10 | 0 | 0 | 0 | 14051 |
| UNITED STATES GYPSUM COMPANY | S | 2580 | 4 | PM10 | 1340 | 0 | 0 | 0 |
| UNITED STATES GYPSUM COMPANY | S | 2581 | 4 | PM10 | 2953 | 0 | 0 | 8168 |
| UNITED STATES GYPSUM COMPANY | S | 2582 | 4 | PM10 | 0 | 0 | 0 | 2736 |
| UNITED STATES GYPSUM COMPANY | S | 2583 | 4 | PM10 | 87 | 0 | 721 | 10072 |
| UNITED STATES GYPSUM COMPANY | S | 2584 | 4 | PM10 | 0 | 0 | 0 | 6407 |
| WESTERN MILLING LLC | S | 2634 | 4 | PM10 | 0 | 0 | 0 | 579 |
| KERN OIL & REFINING CO. | S | 2649 | 4 | PM10 | 3313 | 3812 | 3561 | 5082 |
| TAFT PRODUCTION COMPANY | S | 2670 | 4 | PM10 | 1914 | 1959 | 2000 | 2000 |
| ARDAGH GLASS INC | S | 2705 | 4 | PM10 | 0 | 0 | 0 | 118 |
| AERA ENERGY LLC | S | 2774 | 4 | PM10 | 443 | 368 | 369 | 489 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 2782 | 4 | PM10 | 61 | 60 | 58 | 63 |
| EVOLUTION MARKETS INC. | S | 2876 | 4 | PM10 | 0 | 0 | 0 | 46954 |
| CALPINE CORPORATION | S | 2877 | 4 | PM10 | 421 | 0 | 176 | 0 |
| EVOLUTION MARKETS INC. | S | 2878 | 4 | PM10 | 0 | 0 | 0 | 11831 |
| TULE RIVER CO-OP GIN INC | S | 2913 | 4 | PM10 | 0 | 0 | 0 | 484 |
| BUTTONWILLOW GINNING CO | S | 2937 | 4 | PM10 | 0 | 0 | 0 | 28460 |
| BAKERSFIELD CITY WOOD SITE | S | 2969 | 4 | PM10 | 18 | 24 | 26 | 22 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 3036 | 4 | PM10 | 29 | 29 | 29 | 29 |
| ELBOW ENTERPRISES INC | S | 3071 | 4 | PM10 | 0 | 0 | 0 | 19406 |
| SOC RESOURCES INC | S | 3089 | 4 | PM10 | 5 | 4 | 4 | 4 |
| CALPINE ENERGY SERVICES, L.P. | S | 3090 | 4 | PM10 | 751 | 812 | 634 | 694 |
| CALPINE ENERGY SERVICES, L.P. | S | 3091 | 4 | PM10 | 0 | 0 | 0 | 7210 |
| KODA FARMS MILLING, INC. | S | 3196 | 4 | PM10 | 0 | 0 | 0 | 856 |
| KODA FARMS MILLING, INC. | S | 3197 | 4 | PM10 | 0 | 0 | 0 | 3144 |
| CALPINE CORPORATION | S | 3198 | 4 | PM10 | 0 | 0 | 0 | 8699 |
| GENERAL MILLS, INC | S | 3218 | 4 | PM10 | 0 | 0 | 0 | 4525 |
| CHEVRON USA PRODUCTION INC | S | 3228 | 4 | PM10 | 74 | 85 | 147 | 56 |
| AERA ENERGY LLC | S | 3265 | 4 | PM10 | 1591 | 0 | 0 | 0 |
| SHAFTER-WASCO GINNING COMPANY | S | 3268 | 4 | PM10 | 0 | 0 | 0 | 4695 |
| CALPINE CORPORATION | S | 3288 | 4 | PM10 | 0 | 0 | 987 | 8059 |
| CRIMSON RESOURCE MANAGEMENT | S | 3392 | 4 | PM10 | 1745 | 1292 | 1258 | 941 |
| FRITO-LAY, INC. | S | 3412 | 4 | PM10 | 7136 | 7320 | 7507 | 7506 |
| FRITO-LAY, INC. | S | 3414 | 4 | PM10 | 0 | 0 | 0 | 6935 |
| FRITO-LAY, INC. | S | 3416 | 4 | PM10 | 0 | 8 | 306 | 310 |
| FRITO-LAY, INC. | S | 3417 | 4 | PM10 | 0 | 0 | 0 | 2531 |
| FRITO-LAY, INC. | S | 3418 | 4 | PM10 | 5000 | 5000 | 5000 | 5000 |
| FRITO-LAY, INC. | S | 3419 | 4 | PM10 | 132 | 132 | 133 | 134 |
| FRITO-LAY, INC. | S | 3437 | 4 | PM10 | 210 | 288 | 195 | 174 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| FRITO-LAY, INC. | S | 3453 | 4 | PM10 | 17 | 68 | 208 | 207 |
| ALON BAKERSFIELD REFINING | S | 3462 | 4 | PM10 | 1584 | 1877 | 1791 | 1974 |
| ALON BAKERSFIELD REFINING | S | 3463 | 4 | PM10 | 2445 | 2476 | 2506 | 2506 |
| ALON BAKERSFIELD REFINING | S | 3464 | 4 | PM10 | 2500 | 2500 | 2500 | 2500 |
| CHEVRON USA PRODUCTION INC | S | 3533 | 4 | PM10 | 101 | 106 | 124 | 122 |
| MOLYCORP MINERALS, LLC | S | 3539 | 4 | PM10 | 373 | 329 | 313 | 238 |
| CHEVRON USA INC | S | 3544 | 4 | PM10 | 1086 | 1185 | 913 | 966 |
| SOUTH VALLEY GINS INC | S | 3554 | 4 | PM10 | 0 | 0 | 0 | 8671 |
| CHEVRON USA INC | S | 3598 | 4 | PM10 | 23958 | 18336 | 24959 | 21380 |
| CHEVRON USA INC | S | 3604 | 4 | PM10 | 699 | 1081 | 1219 | 805 |
| LAND O' LAKES, INC. | S | 3625 | 4 | PM10 | 711 | 455 | 821 | 719 |
| AGRI-CEL INC | S | 3631 | 4 | PM10 | 31 | 38 | 35 | 4 |
| CHEVRON USA INC | S | 3679 | 4 | PM10 | 5317 | 2839 | 3598 | 5227 |
| KODA FARMS MILLING, INC. | S | 3796 | 4 | PM10 | 0 | 0 | 0 | 4820 |
| MID-VALLEY COTTON GROWERS INC | S | 3803 | 4 | PM10 | 0 | 0 | 0 | 2128 |
| SHAFTER HAY & CUBE LLC | S | 3804 | 4 | PM10 | 0 | 691 | 1099 | 154 |
| PACTIV, LLC | S | 3865 | 4 | PM10 | 33 | 29 | 7 | 15 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 3996 | 4 | PM10 | 76 | 26 | 48 | 52 |
| KRAFT FOODS GROUP INC | S | 4033 | 4 | PM10 | 8 | 70 | 112 | 71 |
| BRUCE CARTER INDUSTRIES, INC. | S | 4038 | 4 | PM10 | 14 | 18 | 16 | 2 |
| VECTOR ENVIRONMENTAL, INC. | S | 4039 | 4 | PM10 | 58 | 70 | 66 | 8 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | S | 4097 | 4 | PM10 | 327 | 327 | 327 | 327 |
| FREEPORT-MC MORAN OIL & GAS | S | 4105 | 4 | PM10 | 0 | 0 | 0 | 8500 |
| KOCH SUPPLY & TRADING LP | S | 4148 | 4 | PM10 | 0 | 0 | 0 | 18971 |
| KOCH SUPPLY & TRADING LP | S | 4149 | 4 | PM10 | 0 | 0 | 0 | 3789 |
| KOCH SUPPLY & TRADING LP | S | 4150 | 4 | PM10 | 0 | 0 | 0 | 1956 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4196 | 4 | PM10 | 428 | 318 | 748 | 875 |
| CHEVRON USA INC | S | 4202 | 4 | PM10 | 1144 | 1194 | 1244 | 1244 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4211 | 4 | PM10 | 895 | 877 | 1115 | 1107 |
| WESTERN MILLING LLC | S | 4220 | 4 | PM10 | 0 | 0 | 0 | 3065 |
| CRESTWOOD WEST COAST LLC | S | 4241 | 4 | PM10 | 16 | 48 | 30 | 8 |
| BERRY PETROLEUM COMPANY, LLC | S | 4274 | 4 | PM10 | 0 | 0 | 0 | 508 |
| CHEVRON U S A INC | S | 4304 | 4 | PM10 | 711 | 831 | 839 | 1007 |
| MESA VERDE TRADING CO., INC | S | 4309 | 4 | PM10 | 4439 | 67 | 0 | 1328 |
| KERN DELTA CO LLC | S | 4317 | 4 | PM10 | 0 | 0 | 0 | 26563 |
| SENECA RESOURCES | S | 4345 | 4 | PM10 | 0 | 0 | 0 | 4466 |
| FREEPORT-MC MORAN OIL & GAS | S | 4367 | 4 | PM10 | 0 | 0 | 0 | 12000 |
| CHEVRON USA INC | S | 4377 | 4 | PM10 | 297 | 912 | 1284 | 1251 |
| TRI-CITY GROWERS INC | S | 4392 | 4 | PM10 | 1694 | 0 | 0 | 7175 |
| E&B NATURAL RESOURCES MGMT | S | 4401 | 4 | PM10 | 0 | 0 | 0 | 12000 |
| OLDUVAI GORGE, LLC | S | 4402 | 4 | PM10 | 0 | 0 | 0 | 2789 |
| TEXACO EXPLOR & PROD INC | S | 20250361 | 4 | PM10 | 41 | 43 | 37 | 40 |
| WESTERN STONE PRODUCTS, INC. | N | 17 | 2 | NOx | 543 | 543 | 619 | 619 |
| TRIANGLE PACIFIC CORPORATION | N | 18 | 2 | NOx | 187 | 54 | 54 | 161 |
| H. J. HEINZ COMPANY, L.P. | N | 21 | 2 | NOx | 0 | 1026 | 3112 | 1060 |
| COTTON ASSOCIATES, INC | S | 25 | 2 | NOx | 0 | 0 | 0 | 157 |
| CALMAT OF FRESNO | C | 40 | 2 | NOx | 74 | 355 | 163 | 547 |
| J.R. SIMPLOT | C | 44 | 2 | NOx | 3942 | 3873 | 3402 | 2891 |
| BROWN SAND INC | N | 46 | 2 | NOx | 90 | 98 | 46 | 83 |
| CALMAT CO. | C | 50 | 2 | NOx | 104 | 111 | 154 | 159 |
| LEPRINO FOODS COMPANY | C | 60 | 2 | NOx | 7878 | 7985 | 7810 | 7898 |
| CRAYCROFT BRICK COMPANY | C | 71 | 2 | NOx | 417 | 336 | 328 | 332 |
| CHEVRON USA INC | S | 77 | 2 | NOx | 2038 | 1840 | 1733 | 2274 |
| LINN OPERATING, INC | S | 84 | 2 | NOx | 1648 | 1666 | 1685 | 1685 |
| GROWERS COOP | S | 88 | 2 | NOx | 0 | 0 | 22 | 406 |
| CALAVERAS MATERIALS INC | C | 89 | 2 | NOx | 284 | 257 | 294 | 236 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| THE BEVERAGE SOURCE | N | 92 | 2 | NOx | 220 | 800 | 520 | 900 |
| LEPRINO FOODS | N | 108 | 2 | NOx | 2335 | 2529 | 2412 | 2143 |
| CASTLE AIRPORT AVIATION & DEVELOP CENTER | N | 109 | 2 | NOx | 38954 | 39386 | 39819 | 39819 |
| LOS BANOS GRAVEL GROUP, ASPHLT | N | 125 | 2 | NOx | 23 | 113 | 359 | 120 |
| CAMPBELL SOUP COMPANY | N | 127 | 2 | NOx | 1515 | 454 | 409 | 924 |
| ECKERT FROZEN FOODS | N | 133 | 2 | NOx | 146 | 545 | 2047 | 395 |
| J.G. BOSWELL CO. (EL RICO) | C | 135 | 2 | NOx | 14 | 4 | 0 | 40 |
| 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 |
| KRAFT FOODS INC | C | 149 | 2 | NOx | 284 | 284 | 284 | 284 |
| R M WADE & COMPANY | C | 152 | 2 | NOx | 326 | 373 | 379 | 370 |
| 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 |
| LINN OPERATING, INC | S | 188 | 2 | NOx | 5175 | 5197 | 5494 | 4871 |
| AERA ENERGY LLC | C | 219 | 2 | NOx | 1738 | 1923 | 2100 | 1931 |
| CHEVRON USA INC | C | 221 | 2 | NOx | 2311 | 2557 | 2792 | 2567 |
| SUN GARDEN-GANGI CANNING CO LL | N | 222 | 2 | NOx | 0 | 0 | 12886 | 540 |
| CALAVERAS MATERIALS INC. | C | 233 | 2 | NOx | 1265 | 3371 | 3913 | 2469 |
| HANSEN BROTHERS | C | 249 | 2 | NOx | 0 | 0 | 0 | 256 |
| PARAMOUNT FARMS, INC | N | 284 | 2 | NOx | 3670 | 3580 | 3488 | 3488 |
| SOUTHERN CALIFORNIA GAS CORPORATION | N | 299 | 2 | NOx | 0 | 1311 | 1415 | 0 |
| LINN OPERATING, INC | S | 301 | 2 | NOx | 3010 | 2818 | 2052 | 3565 |
| CITY OF VISALIA | N | 317 | 2 | NOx | 0 | 0 | 7160 | 0 |
| CHEVRON USA INC | C | 331 | 2 | NOx | 23739 | 23739 | 23740 | 23740 |
| VINTAGE PETROLEUM | N | 346 | 2 | NOx | 0 | 165 | 1432 | 14 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | C | 364 | 2 | NOx | 30130 | 29673 | 29217 | 29217 |
| KRAFT FOODS INC | C | 386 | 2 | NOx | 9774 | 9883 | 9992 | 9992 |
| KRAFT FOODS INC | C | 387 | 2 | NOx | 5 | 5 | 4 | 4 |
| LIDESTRI FOODS, INC | N | 391 | 2 | NOx | 0 | 0 | 1527 | 0 |
| PILKINGTON NORTH AMERICA, INC | N | 410 | 2 | NOx | 272 | 4 | 43 | 275 |
| MODESTO IRRIGATION DISTRICT | N | 430 | 2 | NOx | 0 | 0 | 273 | 0 |
| MONTEREY RESOURCES, INC. | S | 432 | 2 | NOx | 2053 | 2081 | 1707 | 1898 |
| CHEVRON USA INC | S | 436 | 2 | NOx | 12891 | 9861 | 9530 | 10101 |
| LAWRENCE LIVERMORE NATL. LAB | N | 464 | 2 | NOx | 83 | 31 | 0 | 61 |
| AERA ENERGY LLC | S | 470 | 2 | NOx | 3478 | 4930 | 5390 | 5212 |
| BAKER COMMODITIES INC | N | 482 | 2 | NOx | 1194 | 1194 | 1196 | 1194 |
| CONAGRA CONSUMER FROZEN FOODS | N | 487 | 2 | NOx | 356 | 163 | 243 | 300 |
| CHEVRON USA INC | S | 496 | 2 | NOx | 5160 | 233 | 1734 | 4212 |
| CANDLEWICK YARNS | C | 507 | 2 | NOx | 90 | 77 | 63 | 58 |
| THE NESTLE COMPANY INC | N | 508 | 2 | NOx | 2975 | 2444 | 1853 | 3352 |
| CLARK BROTHERS-DERRICK GIN | C | 511 | 2 | NOx | 0 | 0 | 0 | 43 |
| LA PALOMA GENERATING COMPANY | N | 514 | 2 | NOx | 0 | 9612 | 22455 | 0 |
| H. J. HEINZ COMPANY | N | 534 | 2 | NOx | 0 | 360 | 3207 | 0 |
| BRITZ AG FINANCE CO., INC. | C | 557 | 2 | NOx | 0 | 0 | 0 | 232 |
| CORCORAN IRRIGATION DISTRICT | C | 560 | 2 | NOx | 352 | 356 | 321 | 209 |
| DIAMOND FOODS INCORPORATED | N | 573 | 2 | NOx | 1 | 1 | 0 | 0 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 575 | 2 | NOx | 0 | 4693 | 10418 | 3569 |
| R F MACDONALD | C | 579 | 2 | NOx | 0 | 8 | 0 | 0 |
| BRITZ INCORPORATED | C | 586 | 2 | NOx | 0 | 0 | 0 | 381 |
| MODESTO TALLOW CO INC | N | 599 | 2 | NOx | 364 | 328 | 400 | 391 |
| OAKWOOD LAKE RESORT | N | 601 | 2 | NOx | 0 | 117 | 188 | 0 |
| GENERAL MILLS OPERATIONS, INC | N | 610 | 2 | NOx | 52 | 3 | 0 | 100 |
| CHEVRON U S A INC | S | 629 | 2 | NOx | 2316 | 2041 | 2088 | 1975 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALIFORNIA DAIRIES, INC. | C | 635 | 2 | NOx | 22 | 22 | 22 | 22 |
| WESTLAKE FARMS INC | C | 645 | 2 | NOx | 0 | 0 | 0 | 498 |
| KINGS RIVER CONSERVATION DISTRICT | C | 647 | 2 | NOx | 0 | 0 | 1029 | 0 |
| CALIFORNIA DAIRIES, INC. | C | 658 | 2 | NOx | 0 | 0 | 102 | 75 |
| AERA ENERGY LLC | S | 662 | 2 | NOx | 9433 | 18919 | 3766 | 817 |
| UNITED STATES GYPSUM COMPANY | N | 662 | 2 | NOx | 308 | 36838 | 15649 | 308 |
| CHEVRON USA PRODUCTION INC | S | 674 | 2 | NOx | 507 | 781 | 226 | 485 |
| CALIFORNIA DAIRIES, INC. | C | 677 | 2 | NOx | 450 | 126 | 472 | 315 |
| AERA ENERGY LLC | C | 681 | 2 | NOx | 26900 | 26900 | 26900 | 26900 |
| CHEMICAL WASTE MANAGEMENT, INC | N | 687 | 2 | NOx | 7 | 7 | 6 | 6 |
| DAIRY FARMERS OF AMERICA, INC. | C | 689 | 2 | NOx | 0 | 0 | 253 | 0 |
| VALLEY AIR CONDITIONING & REPAIR INC | C | 693 | 2 | NOx | 0 | 0 | 108 | 0 |
| H. J. HEINZ COMPANY | N | 694 | 2 | NOx | 0 | 43 | 2570 | 0 |
| CHEVRON USA INC LOST HILLS GP | S | 704 | 2 | NOx | 5564 | 5626 | 5687 | 5687 |
| CALIFORNIA DAIRIES, INC. | N | 707 | 2 | NOx | 0 | 1270 | 1363 | 226 |
| JOHN T HOPPER | C | 712 | 2 | NOx | 0 | 55 | 295 | 56 |
| PLAINS LPG SERVICES, L.P. | C | 717 | 2 | NOx | 1024 | 1024 | 1023 | 1023 |
| 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 |
| NORTHERN CALIFORNIA POWER AGENCY | N | 751 | 2 | NOx | 0 | 0 | 10015 | 0 |
| NORTHERN CALIFORNIA POWER AGENCY | N | 752 | 2 | NOx | 0 | 791 | 835 | 0 |
| PACIFIC COAST PRODUCERS | N | 753 | 2 | NOx | 195 | 605 | 3088 | 312 |
| PASTORIA ENERGY LLC | C | 755 | 2 | NOx | 2525 | 1011 | 0 | 2038 |
| STOCKTON EAST WATER DISTRICT | N | 763 | 2 | NOx | 2654 | 3705 | 3750 | 3359 |
| GALLO GLASS COMPANY | N | 768 | 2 | NOx | 14634 | 12268 | 15814 | 10504 |
| EVOLUTION MARKETS INC. | N | 776 | 2 | NOx | 875 | 927 | 771 | 876 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| OLDUVAI GORGE, LLC | N | 782 | 2 | NOx | 1085 | 1097 | 1109 | 1109 |
| AERA ENERGY LLC | S | 784 | 2 | NOx | 7140 | 3993 | 228 | 0 |
| LOVELACE & SONS FARMING | C | 807 | 2 | NOx | 0 | 0 | 0 | 257 |
| UNITED STATES GYPSUM COMPANY | C | 818 | 2 | NOx | 0 | 0 | 0 | 734 |
| DIAMOND FOODS INCORPORATED | N | 826 | 2 | NOx | 4443 | 2607 | 2618 | 0 |
| SAPUTO CHEESE USA INC. | N | 834 | 2 | NOx | 1810 | 1810 | 1810 | 1810 |
| CALIFORNIA DAIRIES | N | 836 | 2 | NOx | 2298 | 1078 | 961 | 841 |
| AERA ENERGY LLC | S | 838 | 2 | NOx | 442 | 218 | 338 | 338 |
| 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 |
| EAGLE VALLEY GINNING LLC | N | 847 | 2 | NOx | 0 | 0 | 0 | 427 |
| E & J GALLO WINERY | N | 849 | 2 | NOx | 0 | 14 | 111 | 0 |
| CONAGRA CONSUMER FROZEN FOODS | N | 856 | 2 | NOx | 0 | 0 | 1749 | 0 |
| AERA ENERGY LLC | S | 865 | 2 | NOx | 6713 | 6788 | 6863 | 6863 |
| BRITZ GIN PARTNERSHIP II | C | 871 | 2 | NOx | 0 | 0 | 0 | 585 |
| WELLHEAD POWER PANOCHE, LLC. | C | 874 | 2 | NOx | 0 | 3 | 3 | 0 |
| KERN OIL & REFINING COMPANY | N | 878 | 2 | NOx | 24 | 19 | 32 | 24 |
| KERN OIL & REFINING COMPANY | N | 879 | 2 | NOx | 156 | 188 | 224 | 202 |
| AERA ENERGY LLC | S | 883 | 2 | NOx | 632 | 160 | 2073 | 2061 |
| AVENAL POWER CENTER, LLC | C | 899 | 2 | NOx | 2243 | 2243 | 2243 | 2243 |
| GALLO GLASS COMPANY | N | 900 | 2 | NOx | 63691 | 64821 | 66246 | 61340 |
| AVENAL POWER CENTER, LLC | C | 902 | 2 | NOx | 13879 | 6131 | 1086 | 8539 |
| CITY OF TULARE | N | 902 | 2 | NOx | 0 | 436 | 436 | 471 |
| CALPINE ENERGY SERVICES, L.P. | N | 903 | 2 | NOx | 5833 | 5834 | 5834 | 5833 |
| CALIFORNIA SPRAY DRY CO | N | 904 | 2 | NOx | 267 | 353 | 369 | 328 |
| SENECA RESOURCES | N | 906 | 2 | NOx | 183 | 517 | 517 | 517 |
| CHEVRON USA INC | S | 909 | 2 | NOx | 3990 | 3412 | 3474 | 3072 |
| EVOLUTION MARKETS INC. | C | 944 | 2 | NOx | 0 | 298 | 1590 | 300 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| EVOLUTION MARKETS INC. | C | 945 | 2 | NOx | 0 | 286 | 1530 | 289 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 952 | 2 | NOx | 114 | 106 | 125 | 125 |
| GALLO GLASS COMPANY | N | 966 | 2 | NOx | 63525 | 46849 | 57176 | 61929 |
| CHEVRON USA INC | C | 966 | 2 | NOx | 2 | 2 | 2 | 2 |
| NORTHROP GRUMMAN CORPORATION | N | 992 | 2 | NOx | 2000 | 2000 | 2000 | 2000 |
| OLDUVAI GORGE, LLC | C | 998 | 2 | NOx | 0 | 0 | 0 | 815 |
| E & J GALLO WINERY | N | 1011 | 2 | NOx | 625 | 625 | 625 | 625 |
| E & J GALLO WINERY | N | 1012 | 2 | NOx | 545 | 545 | 545 | 545 |
| CALPINE ENERGY SERVICES, L.P. | C | 1014 | 2 | NOx | 302 | 0 | 0 | 852 |
| TKV CONTAINERS, INC. | C | 1015 | 2 | NOx | 0 | 13 | 14 | 0 |
| SOUTHERN CALIF GAS CO | S | 1016 | 2 | NOx | 283 | 288 | 289 | 289 |
| STRATAS FOODS LLC | C | 1020 | 2 | NOx | 0 | 0 | 0 | 108 |
| LOS GATOS TOMATO PRODUCTS | C | 1021 | 2 | NOx | 0 | 4 | 0 | 0 |
| NORTHERN CALIFORNIA POWER AGENCY | N | 1028 | 2 | NOx | 0 | 274 | 790 | 147 |
| PARAMOUNT FARMS, INC. | C | 1035 | 2 | NOx | 0 | 0 | 155 | 334 |
| WESTSIDE FARMERS COOP #2 & #3 | C | 1038 | 2 | NOx | 109 | 0 | 0 | 1122 |
| CALPINE ENERGY SERVICES, L.P. | C | 1040 | 2 | NOx | 0 | 0 | 0 | 684 |
| NAS LEMOORE | C | 1048 | 2 | NOx | 26 | 26 | 25 | 25 |
| CHEVRON U.S.A. INC. | N | 1051 | 2 | NOx | 15566 | 8173 | 19366 | 19259 |
| MARTIN ANDERSON | C | 1051 | 2 | NOx | 52 | 77 | 45 | 3 |
| 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 |
| HYDROGEN ENERGY CA LLC | C | 1058 | 2 | NOx | 10100 | 10100 | 10100 | 10100 |
| G.I.C. FINANCIAL SERVICES, INC. | C | 1059 | 2 | NOx | 21900 | 21900 | 21900 | 21900 |
| 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 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 1064 | 2 | NOx | 5126 | 5705 | 5881 | 6709 |
| 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 |
| E & J GALLO WINERY | C | 1071 | 2 | NOx | 612 | 605 | 563 | 535 |
| H. J. HEINZ COMPANY | N | 1085 | 2 | NOx | 69 | 70 | 60 | 30 |
| AERA ENERGY LLC | S | 1092 | 2 | NOx | 348 | 242 | 246 | 236 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 1099 | 2 | NOx | 0 | 13703 | 12649 | 0 |
| 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 |
| MODESTO IRRIGATION DISTRICT | C | 1111 | 2 | NOx | 0 | 0 | 74 | 5923 |
| SPRECKELS SUGAR COMPANY | C | 1112 | 2 | NOx | 0 | 3701 | 5023 | 2200 |
| NORTHERN CALIFORNIA POWER AGENCY | C | 1132 | 2 | NOx | 0 | 137 | 122 | 117 |
| KRAFT FOODS INC | C | 1138 | 2 | NOx | 0 | 0 | 0 | 1632 |
| CHEVRON USA, INC. | C | 1147 | 2 | NOx | 56 | 57 | 39 | 53 |
| 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 |
| PHILLIPS 66 PIPELINE LLC | C | 1163 | 2 | NOx | 0 | 0 | 17 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1165 | 2 | NOx | 456 | 465 | 456 | 456 |
| OLDUVAI GORGE, LLC | N | 1174 | 2 | NOx | 61177 | 57625 | 59600 | 61400 |
| OLDUVAI GORGE, LLC | N | 1184 | 2 | NOx | 2154 | 287 | 335 | 1351 |
| MACPHERSON OIL COMPANY | C | 1195 | 2 | NOx | 73 | 73 | 73 | 73 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| OXY USA, INC | N | 1196 | 2 | NOx | 0 | 396 | 665 | 0 |
| CANANDAIGUA WINE COMPANY INC | C | 1203 | 2 | NOx | 354 | 358 | 380 | 334 |
| BERRY PETROLEUM COMPANY | N | 1204 | 2 | NOx | 0 | 0 | 2915 | 0 |
| SAN JOAQUIN VALLEY CONCENTRATES | C | 1209 | 2 | NOx | 13 | 13 | 12 | 15 |
| FRESNO/CLOVIS REGIONAL WWTP | C | 1211 | 2 | NOx | 65 | 65 | 65 | 65 |
| VINTAGE PRODUCTION CALIFORNIA LLC | N | 1211 | 2 | NOx | 443 | 443 | 443 | 435 |
| CALIFORNIA HEAVY OIL, INC. | N | 1219 | 2 | NOx | 0 | 162 | 162 | 0 |
| E & J GALLO WINERY | N | 1221 | 2 | NOx | 9542 | 9542 | 10501 | 9541 |
| DARLING INGREDIENTS INC. | N | 1225 | 2 | NOx | 0 | 51 | 107 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1231 | 2 | NOx | 186 | 186 | 186 | 186 |
| CALIFORNIA HEAVY OIL, INC. | N | 1233 | 2 | NOx | 0 | 87 | 131 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1235 | 2 | NOx | 3614 | 0 | 0 | 0 |
| KERN OIL & REFINING COMPANY | C | 1243 | 2 | NOx | 3081 | 4129 | 2703 | 716 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1245 | 2 | NOx | 1219 | 0 | 0 | 0 |
| SAN JOAQUIN FACILITIES MGMT | S | 1253 | 2 | NOx | 459 | 509 | 544 | 481 |
| CHEVRON USA INC | S | 1256 | 2 | NOx | 45238 | 45741 | 46244 | 46244 |
| MACPHERSON OIL COMPANY | N | 1256 | 2 | NOx | 1955 | 1955 | 1955 | 1955 |
| OLDUVAI GORGE, LLC | N | 1257 | 2 | NOx | 837 | 923 | 1010 | 1010 |
| TAUBER OIL COMPANY | N | 1267 | 2 | NOx | 500 | 500 | 500 | 500 |
| NORTHERN CALIFORNIA POWER AGENCY | C | 1268 | 2 | NOx | 0 | 0 | 2196 | 1831 |
| PARAMOUNT FARMS INTERNATIONAL LLC | C | 1270 | 2 | NOx | 770 | 770 | 770 | 770 |
| AERA ENERGY LLC | S | 1270 | 2 | NOx | 4586 | 4637 | 4688 | 4688 |
| E & J GALLO WINERY | N | 1270 | 2 | NOx | 1276 | 909 | 1275 | 1275 |
| E & J GALLO WINERY | N | 1272 | 2 | NOx | 0 | 0 | 0 | 953 |
| BERRY PETROLEUM COMPANY | C | 1276 | 2 | NOx | 0 | 6728 | 1787 | 0 |
| TAUBER OIL COMPANY | N | 1277 | 2 | NOx | 2500 | 2500 | 2500 | 2500 |
| INGREDION INCORPORATED | N | 1278 | 2 | NOx | 35860 | 23235 | 31589 | 34804 |
| ANDERSON CLAYTON CORP/IDRIA #1 | C | 1279 | 2 | NOx | 0 | 0 | 0 | 754 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| BERRY PETROLEUM COMPANY | N | 1288 | 2 | NOx | 15750 | 15750 | 15750 | 15750 |
| PILKINGTON NORTH AMERICA, INC | N | 1289 | 2 | NOx | 91237 | 90502 | 97677 | 98027 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1291 | 2 | NOx | 6000 | 6000 | 6000 | 6000 |
| DARLING INGREDIENTS INC | C | 1298 | 2 | NOx | 0 | 0 | 0 | 270 |
| PARAMOUNT FARMS INTERNATIONAL LLC | C | 1313 | 2 | NOx | 10770 | 10770 | 10770 | 10770 |
| KERN RIVER HOLDINGS, INC. | C | 1314 | 2 | NOx | 4500 | 4500 | 4500 | 4500 |
| SAN JOAQUIN REFINING COMPANY | C | 1322 | 2 | NOx | 1595 | 1595 | 1595 | 1595 |
| GUARDIAN INDUSTRIES CORP | C | 1323 | 2 | NOx | 13415 | 12627 | 12627 | 12627 |
| CHEVRON U S A INC | S | 1325 | 2 | NOx | 260 | 118 | 276 | 211 |
| PARAMOUNT FARMS, INC. | C | 1327 | 2 | NOx | 0 | 930 | 2965 | 1965 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1329 | 2 | NOx | 428 | 428 | 428 | 428 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1335 | 2 | NOx | 456 | 456 | 456 | 456 |
| CHEVRON USA INC | S | 1419 | 2 | NOx | 4875 | 4928 | 4983 | 4983 |
| SENECA RESOURCES | S | 1427 | 2 | NOx | 88 | 57 | 76 | 98 |
| CHEVRON U S A INC | S | 1428 | 2 | NOx | 1968 | 1990 | 2011 | 2011 |
| AERA ENERGY LLC | S | 1437 | 2 | NOx | 42372 | 49588 | 46800 | 43954 |
| CHEVRON USA INC | S | 1445 | 2 | NOx | 17602 | 20114 | 20328 | 15867 |
| CHEVRON USA INC LOST HILLS GP | S | 1470 | 2 | NOx | 780 | 789 | 797 | 797 |
| AERA ENERGY LLC | S | 1476 | 2 | NOx | 1242 | 0 | 0 | 350 |
| AERA ENERGY LLC | S | 1477 | 2 | NOx | 2153 | 0 | 0 | 607 |
| CHEVRON USA INC | S | 1487 | 2 | NOx | 11663 | 11793 | 11923 | 11923 |
| SAN JOAQUIN FACILITIES MGMT | S | 1509 | 2 | NOx | 34 | 45 | 45 | 45 |
| PASTORIA ENERGY FACILITY, LLC | S | 1543 | 2 | NOx | 10354 | 8381 | 11018 | 11467 |
| CHEVRON USA INC | S | 1605 | 2 | NOx | 5672 | 7143 | 7028 | 6447 |
| ELK HILLS POWER LLC | S | 1622 | 2 | NOx | 1373 | 1389 | 1404 | 1404 |
| BUILDING MATERIALS MFG. CORP. (DBA GAF) | S | 1662 | 2 | NOx | 5832 | 5840 | 5848 | 5848 |
| SAN JOAQUIN FACILITIES MGMT | S | 1735 | 2 | NOx | 9 | 8 | 6 | 4 |
| AERA ENERGY LLC | S | 1821 | 2 | NOx | 5974 | 7291 | 7466 | 4158 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 1851 | 2 | NOx | 914 | 455 | 0 | 1154 |
| AERA ENERGY LLC | S | 1935 | 2 | NOx | 474 | 508 | 543 | 543 |
| CHEVRON USA INC | S | 1967 | 2 | NOx | 973 | 955 | 855 | 984 |
| ELK HILLS POWER LLC | S | 1994 | 2 | NOx | 12485 | 12624 | 12762 | 12762 |
| AERA ENERGY LLC | S | 2023 | 2 | NOx | 1108 | 636 | 737 | 993 |
| CHEVRON USA INC | S | 2031 | 2 | NOx | 5694 | 4723 | 4406 | 0 |
| KERN LAKE COOP GIN | S | 2074 | 2 | NOx | 0 | 0 | 0 | 309 |
| CHEVRON USA INC | S | 2111 | 2 | NOx | 7823 | 15506 | 21032 | 12182 |
| HILMAR CHEESE COMPANY | S | 2138 | 2 | NOx | 0 | 0 | 0 | 1070 |
| CON AGRA FOOD INGREDIENTS, CO | S | 2201 | 2 | NOx | 6 | 6 | 5 | 5 |
| CRIMSON RESOURCE MANAGEMENT | S | 2251 | 2 | NOx | 316 | 272 | 186 | 375 |
| MEMORIAL MEDICAL CENTER | S | 2268 | 2 | NOx | 2550 | 2550 | 2550 | 2550 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 2286 | 2 | NOx | 1278 | 2194 | 2438 | 2438 |
| CALIFORNIA DAIRIES, INC. | S | 2293 | 2 | NOx | 32 | 33 | 32 | 32 |
| AERA ENERGY LLC | S | 2361 | 2 | NOx | 30 | 4 | 0 | 12 |
| CHEVRON USA INC | S | 2456 | 2 | NOx | 32003 | 32799 | 31884 | 32561 |
| M CARATAN INC | S | 2516 | 2 | NOx | 0 | 0 | 189 | 46 |
| FARMERS COOPERATIVE GIN INC | S | 2533 | 2 | NOx | 0 | 0 | 0 | 598 |
| ELBOW ENTERPRISES INC | S | 2535 | 2 | NOx | 0 | 0 | 0 | 1168 |
| SAN JOAQUIN FACILITIES MGMT | S | 2537 | 2 | NOx | 71 | 0 | 0 | 0 |
| SAN JOAQUIN FACILITIES MGMT | S | 2539 | 2 | NOx | 597 | 0 | 0 | 307 |
| UNITED STATES GYPSUM COMPANY | S | 2543 | 2 | NOx | 0 | 0 | 0 | 311 |
| CALNEV PIPE LINE LLC | S | 2553 | 2 | NOx | 1886 | 1886 | 1886 | 1886 |
| KERN OIL & REFINING CO. | S | 2653 | 2 | NOx | 94 | 277 | 91 | 215 |
| KAWEAH DELTA DISTRICT HOSPITAL | S | 2657 | 2 | NOx | 100 | 441 | 536 | 667 |
| CALIFORNIA DAIRIES, INC | S | 2731 | 2 | NOx | 50 | 0 | 24 | 1282 |
| EVOLUTION MARKETS INC. | S | 2738 | 2 | NOx | 1696 | 3526 | 1536 | 1221 |
| EVOLUTION MARKETS INC. | S | 2740 | 2 | NOx | 0 | 27355 | 0 | 0 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 2774 | 2 | NOx | 5817 | 4899 | 4757 | 8181 |
| AERA ENERGY LLC | S | 2782 | 2 | NOx | 329 | 323 | 318 | 341 |
| OLDUVAI GORGE, LLC | S | 2802 | 2 | NOx | 3233 | 0 | 0 | 5000 |
| AVENAL POWER CENTER, LLC | S | 2814 | 2 | NOx | 6121 | 13869 | 18914 | 11461 |
| UNITED STATES GYPSUM COMPANY | S | 2815 | 2 | NOx | 39560 | 6703 | 27282 | 33352 |
| 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 |
| 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 |
| AVENAL POWER CENTER, LLC | S | 2955 | 2 | NOx | 51000 | 51000 | 51000 | 51000 |
| BAKERSFIELD CITY WOOD SITE | S | 2969 | 2 | NOx | 1564 | 2135 | 2265 | 1857 |
| GLOBAL AMPERSAND LLC | S | 2976 | 2 | NOx | 239 | 239 | 239 | 239 |
| LOCKHEED MARTIN | S | 2990 | 2 | NOx | 3000 | 3000 | 3000 | 3000 |
| LOCKHEED MARTIN | S | 3079 | 2 | NOx | 1160 | 1840 | 1500 | 1500 |
| CALIFORNIA STATE PRISON - CORCORAN | S | 3112 | 2 | NOx | 135 | 137 | 137 | 138 |
| CALPINE ENERGY SERVICES, L.P. | S | 3138 | 2 | NOx | 0 | 0 | 0 | 760 |
| CHEVRON USA INC | S | 3156 | 2 | NOx | 12415 | 12563 | 12710 | 12710 |
| CHEVRON USA INC (REFINERY) | S | 3208 | 2 | NOx | 28667 | 29255 | 29842 | 29842 |
| GENERAL MILLS, INC | S | 3217 | 2 | NOx | 0 | 0 | 0 | 30 |
| CHEVRON USA PRODUCTION INC | S | 3228 | 2 | NOx | 139 | 161 | 275 | 104 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3249 | 2 | NOx | 89 | 208 | 73 | 157 |
| BERRY PETROLEUM COMPANY, LLC | S | 3256 | 2 | NOx | 239 | 239 | 239 | 239 |
| AERA ENERGY LLC | S | 3267 | 2 | NOx | 5519 | 3439 | 0 | 2156 |
| SHAFTER-WASCO GINNING COMPANY | S | 3268 | 2 | NOx | 0 | 0 | 0 | 232 |
| HYDROGEN ENERGY CALIFORNIA, LLC | S | 3273 | 2 | NOx | 120500 | 120500 | 120500 | 120500 |
| CALPINE ENERGY SERVICES, L.P. | S | 3277 | 2 | NOx | 6400 | 0 | 3870 | 1876 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALPINE CORPORATION | S | 3298 | 2 | NOx | 2103 | 9681 | 19140 | 9076 |
| AERA ENERGY LLC | S | 3312 | 2 | NOx | 2432 | 4568 | 1346 | 162 |
| LAND O' LAKES, INC. | S | 3326 | 2 | NOx | 214 | 166 | 214 | 214 |
| HOLMES WESTERN OIL CORPORATION | S | 3377 | 2 | NOx | 1633 | 1632 | 1632 | 1632 |
| CRIMSON RESOURCE MANAGEMENT | S | 3388 | 2 | NOx | 4704 | 3393 | 3449 | 2696 |
| CRIMSON RESOURCE MANAGEMENT | S | 3389 | 2 | NOx | 95 | 299 | 319 | 166 |
| CITY OF TULARE | S | 3398 | 2 | NOx | 501 | 0 | 0 | 0 |
| CRIMSON RESOURCE MANAGEMENT | S | 3441 | 2 | NOx | 5 | 4 | 4 | 5 |
| ALON BAKERSFIELD REFINING | S | 3460 | 2 | NOx | 4645 | 5658 | 5190 | 4325 |
| ALON BAKERSFIELD REFINING | S | 3461 | 2 | NOx | 1425 | 1689 | 1612 | 1776 |
| CHEVRON USA PRODUCTION INC | S | 3533 | 2 | NOx | 181 | 188 | 224 | 219 |
| CALPINE CORPORATION | S | 3541 | 2 | NOx | 0 | 242 | 0 | 0 |
| CHEVRON USA INC | S | 3544 | 2 | NOx | 3027 | 3303 | 2542 | 2691 |
| SOUTH VALLEY GINS INC | S | 3554 | 2 | NOx | 0 | 0 | 0 | 192 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 3586 | 2 | NOx | 0 | 1512 | 6228 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 3588 | 2 | NOx | 1847 | 0 | 0 | 0 |
| CHEVRON USA INC | S | 3604 | 2 | NOx | 1948 | 3037 | 3398 | 2243 |
| LAND O' LAKES, INC. | S | 3625 | 2 | NOx | 618 | 473 | 646 | 602 |
| AGRI-CEL INC | S | 3631 | 2 | NOx | 54 | 67 | 63 | 8 |
| AERA ENERGY LLC | S | 3689 | 2 | NOx | 76465 | 88497 | 87135 | 83102 |
| TURLOCK IRRIGATION DISTRICT | S | 3707 | 2 | NOx | 3442 | 2862 | 2277 | 2277 |
| SENECA RESOURCES | S | 3718 | 2 | NOx | 0 | 118 | 0 | 0 |
| CHEVRON USA INC | S | 3735 | 2 | NOx | 43881 | 44422 | 44964 | 44964 |
| FRITO-LAY, INC. | S | 3763 | 2 | NOx | 287 | 442 | 182 | 53 |
| FRITO-LAY, INC. | S | 3765 | 2 | NOx | 7432 | 7619 | 7790 | 7789 |
| 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 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 3819 | 2 | NOx | 6000 | 6000 | 6000 | 6000 |
| AERA ENERGY LLC | S | 3831 | 2 | NOx | 8498 | 5583 | 30 | 1326 |
| LIBERTY COMPOSTING INC | S | 3855 | 2 | NOx | 925 | 925 | 925 | 925 |
| PACTIV, LLC | S | 3863 | 2 | NOx | 233 | 199 | 51 | 109 |
| 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 |
| BRUCE CARTER INDUSTRIES, INC. | S | 4038 | 2 | NOx | 25 | 31 | 29 | 4 |
| VECTOR ENVIRONMENTAL, INC. | S | 4039 | 2 | NOx | 102 | 125 | 117 | 15 |
| BREITBURN OPERATING LP | S | 4057 | 2 | NOx | 7 | 9 | 7 | 6 |
| AERA ENERGY LLC | S | 4063 | 2 | NOx | 573 | 515 | 438 | 663 |
| AERA ENERGY LLC | S | 4064 | 2 | NOx | 359 | 564 | 674 | 586 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4088 | 2 | NOx | 80 | 80 | 80 | 80 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4093 | 2 | NOx | 159 | 0 | 0 | 0 |
| FREEPORT-MC MORAN OIL & GAS | S | 4098 | 2 | NOx | 13229 | 10050 | 6765 | 15163 |
| FREEPORT-MC MORAN OIL & GAS | S | 4099 | 2 | NOx | 10010 | 10691 | 10155 | 6716 |
| FREEPORT-MC MORAN OIL & GAS | S | 4100 | 2 | NOx | 1411 | 73 | 1449 | 2071 |
| MACPHERSON OIL COMPANY | S | 4132 | 2 | NOx | 145 | 145 | 145 | 145 |
| E&B NATURAL RESOURCES MGMT | S | 4136 | 2 | NOx | 0 | 0 | 424 | 1580 |
| E&B NATURAL RESOURCES MGMT | S | 4138 | 2 | NOx | 0 | 1217 | 2714 | 2156 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4142 | 2 | NOx | 17881 | 18426 | 18973 | 18974 |
| E&B NATURAL RESOURCES MGMT | S | 4153 | 2 | NOx | 2080 | 0 | 0 | 0 |
| PASTORIA ENERGY FACILITY, LLC | S | 4163 | 2 | NOx | 164079 | 166154 | 168230 | 169711 |
| NORTHERN CALIFORNIA POWER AGENCY | S | 4180 | 2 | NOx | 0 | 0 | 0 | 1865 |
| FREEPORT-MC MORAN OIL & GAS | S | 4193 | 2 | NOx | 4630 | 4632 | 4633 | 4633 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4196 | 2 | NOx | 109 | 69 | 138 | 148 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| BERRY PETROLEUM COMPANY, LLC | S | 4204 | 2 | NOx | 830 | 830 | 830 | 830 |
| BERRY PETROLEUM COMPANY, LLC | S | 4205 | 2 | NOx | 0 | 1432 | 15919 | 8622 |
| BERRY PETROLEUM COMPANY, LLC | S | 4208 | 2 | NOx | 3548 | 3548 | 3548 | 3548 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4211 | 2 | NOx | 13364 | 14303 | 18022 | 17508 |
| MIDWAY PEAKING LLC | S | 4234 | 2 | NOx | 283 | 283 | 496 | 354 |
| CRESTWOOD WEST COAST LLC | S | 4236 | 2 | NOx | 47 | 137 | 86 | 23 |
| CRESTWOOD WEST COAST LLC | S | 4240 | 2 | NOx | 125 | 125 | 125 | 125 |
| CRESTWOOD WEST COAST LLC | S | 4242 | 2 | NOx | 14 | 14 | 14 | 14 |
| BERRY PETROLEUM COMPANY, LLC | S | 4265 | 2 | NOx | 4332 | 1450 | 4332 | 1569 |
| BERRY PETROLEUM COMPANY, LLC | S | 4267 | 2 | NOx | 11433 | 0 | 0 | 0 |
| AERA ENERGY LLC | S | 4284 | 2 | NOx | 90667 | 81037 | 29972 | 74455 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | S | 4291 | 2 | NOx | 542 | 542 | 542 | 308 |
| CHEVRON U S A INC | S | 4304 | 2 | NOx | 1983 | 2317 | 2340 | 2807 |
| KERN DELTA CO LLC | S | 4315 | 2 | NOx | 0 | 0 | 0 | 622 |
| SENECA RESOURCES | S | 4327 | 2 | NOx | 1750 | 1750 | 1750 | 1750 |
| SENECA RESOURCES | S | 4333 | 2 | NOx | 1750 | 1750 | 1750 | 1750 |
| ALON BAKERSFIELD REFINING | S | 4334 | 2 | NOx | 95700 | 98089 | 100530 | 100530 |
| DARLING INGREDIENTS INC. | S | 4346 | 2 | NOx | 911 | 860 | 804 | 641 |
| TAUBER OIL COMPANY | S | 4356 | 2 | NOx | 1500 | 1500 | 1500 | 1500 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4360 | 2 | NOx | 1476 | 1476 | 1476 | 1477 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4361 | 2 | NOx | 1476 | 1476 | 1476 | 1476 |
| FREEPORT-MC MORAN OIL & GAS | S | 4366 | 2 | NOx | 148 | 148 | 148 | 148 |
| FREEPORT-MC MORAN OIL & GAS | S | 4368 | 2 | NOx | 3462 | 3463 | 3463 | 3462 |
| TAUBER OIL COMPANY | S | 4369 | 2 | NOx | 1479 | 2396 | 1701 | 1445 |
| CHEVRON USA INC | S | 4373 | 2 | NOx | 133903 | 133903 | 133903 | 133903 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4390 | 2 | NOx | 6684 | 5862 | 4959 | 6369 |
| TRI-CITY GROWERS INC | S | 4392 | 2 | NOx | 54 | 0 | 0 | 229 |
| E&B NATURAL RESOURCES MGMT | S | 4399 | 2 | NOx | 2750 | 2750 | 2750 | 2750 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| OLDUVAI GORGE, LLC | S | 4400 | 2 | NOx | 16013 | 2379 | 3930 | 5762 |
| PACIFIC GAS & ELECTRIC COMPANY | S | 4404 | 2 | NOx | 30 | 16 | 55 | 63 |
| AERA ENERGY LLC | S | 4422 | 2 | NOx | 6370 | 2050 | 2897 | 6316 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4434 | 2 | NOx | 0 | 5255 | 2832 | 6776 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4436 | 2 | NOx | 1735 | 332 | 662 | 1082 |
| SAN JOAQUIN REFINING COMPANY | S | 4452 | 2 | NOx | 0 | 1 | 1 | 0 |
| E&B NATURAL RESOURCES MGMT | S | 4460 | 2 | NOx | 0 | 2153 | 0 | 0 |
| E&B NATURAL RESOURCES MGMT | S | 4462 | 2 | NOx | 0 | 0 | 102 | 0 |
| E&B NATURAL RESOURCES MGMT | S | 4464 | 2 | NOx | 1339 | 0 | 0 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4468 | 2 | NOx | 14600 | 15334 | 16073 | 16071 |
| SIERRA POWER CORPORATION | S | 2910001 | 2 | NOx | 2115 | 2138 | 2162 | 2162 |
| TEXACO EXPLOR & PROD INC | S | 20250361 | 2 | NOx | 7037 | 7356 | 6314 | 6778 |
| CHEVRON USA INC | S | 20410281 | 2 | NOx | 3806 | 3765 | 3765 | 3848 |
| CHEVRON USA INC | S | 40410441 | 2 | NOx | 20385 | 20612 | 20838 | 20838 |
| WESTERN STONE PRODUCTS, INC. | N | 17 | 5 | SOx | 636 | 636 | 725 | 725 |
| CALIFORNIA OLIVE GROWERS | C | 21 | 5 | SOx | 10 | 10 | 10 | 10 |
| COTTON ASSOCIATES, INC | S | 25 | 5 | SOx | 0 | 0 | 0 | 1 |
| CAMPBELL SOUP SUPPLY CO. | N | 31 | 5 | SOx | 0 | 52 | 128 | 0 |
| DUNCAN ENTERPRISES | C | 33 | 5 | SOx | 3 | 3 | 3 | 2 |
| CALMAT OF FRESNO | C | 40 | 5 | SOx | 25 | 120 | 55 | 185 |
| BUILDERS CONCRETE, INC. | C | 41 | 5 | SOx | 8 | 8 | 8 | 8 |
| J.R. SIMPLOT | C | 44 | 5 | SOx | 172151 | 202801 | 128181 | 209413 |
| BROWN SAND INC | N | 46 | 5 | SOx | 3 | 3 | 2 | 3 |
| J G BOSWELL CO. (SEED STORAGE) | C | 47 | 5 | SOx | 2 | 1 | 2 | 2 |
| CALMAT CO. | C | 50 | 5 | SOx | 39 | 41 | 58 | 59 |
| H. J. HEINZ COMPANY | N | 60 | 5 | SOx | 0 | 0 | 32 | 0 |
| CRAYCROFT BRICK COMPANY | C | 71 | 5 | SOx | 2 | 2 | 2 | 2 |
| ANDERSON CLAYTON CORP/KEARNY | C | 75 | 5 | SOx | 0 | 0 | 0 | 28 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSON CLAYTON CORP/SETTER | C | 76 | 5 | SOx | 0 | 0 | 0 | 3 |
| ANDERSON CLAYTON CORP/FIVE PTS | C | 78 | 5 | SOx | 0 | 0 | 0 | 31 |
| ANDERSON CLAYTON CORP/SAN JOAQ | C | 79 | 5 | SOx | 0 | 0 | 0 | 22 |
| ANDERSON CLAYTON CORP/TRANQLTY | C | 80 | 5 | SOx | 0 | 0 | 0 | 2 |
| ANDERSON CLAYTON CORP/CORCORAN | C | 81 | 5 | SOx | 0 | 0 | 0 | 2 |
| GROWERS COOP | S | 88 | 5 | SOx | 0 | 0 | 0 | 3 |
| THE NESTLE COMPANY INC | N | 93 | 5 | SOx | 2491 | 39 | 48 | 6273 |
| WESTERN COTTON SERVICES | S | 98 | 5 | SOx | 0 | 0 | 0 | 27 |
| SUN GARDEN-GANGI CANNING CO LL | N | 100 | 5 | SOx | 0 | 0 | 23440 | 4 |
| CASTLE AIRPORT AVIATION & DEVELOP CENTER | N | 109 | 5 | SOx | 3179 | 3214 | 3249 | 3249 |
| LOS BANOS GRAVEL GROUP, ASPHLT | N | 125 | 5 | SOx | 4 | 22 | 72 | 24 |
| CAMPBELL SOUP COMPANY | N | 127 | 5 | SOx | 18 | 13 | 11 | 13 |
| SAN JOAQUIN VALLEY ENERGY | N | 129 | 5 | SOx | 391 | 555 | 565 | 244 |
| ECKERT FROZEN FOODS | N | 133 | 5 | SOx | 1 | 3 | 9 | 8 |
| ANDERSON CLAYTON CORPORATION | N | 135 | 5 | SOx | 0 | 0 | 0 | 1 |
| J.G. BOSWELL CO. (EL RICO) | C | 135 | 5 | SOx | 2 | 1 | 0 | 5 |
| SJVEP I, L.P. (CHOW II) | C | 137 | 5 | SOx | 298 | 263 | 274 | 342 |
| NAS LEMOORE | C | 138 | 5 | SOx | 16 | 6 | 13 | 4 |
| GENERAL MILLS OPERATIONS, INC | N | 139 | 5 | SOx | 2 | 2 | 2 | 2 |
| CRANBROOK ASSOCIATES LLC | N | 140 | 5 | SOx | 24 | 24 | 391 | 31 |
| CHEVRON USA PRODUCTION INC | S | 147 | 5 | SOx | 3 | 3 | 2 | 3 |
| R M WADE & COMPANY | C | 152 | 5 | SOx | 2 | 2 | 2 | 2 |
| WESTSIDE FARMERS COOP. GIN | C | 164 | 5 | SOx | 0 | 0 | 0 | 37 |
| CHEVRON USA INC | S | 171 | 5 | SOx | 17 | 17 | 16 | 17 |
| ANDERSON CLAYTON CORP. | N | 181 | 5 | SOx | 0 | 0 | 0 | 1 |
| PG & E ENERGY TRADING POWER LP | N | 200 | 5 | SOx | 8 | 999 | 321 | 8 |
| FIBREBOARD CORP. | N | 209 | 5 | SOx | 9 | 7 | 4 | 10 |
| CALAVERAS MATERIALS INC. | C | 233 | 5 | SOx | 998 | 2716 | 3181 | 1989 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSON CLAYTON CORP/MURRAY | C | 234 | 5 | SOx | 0 | 0 | 0 | 6 |
| HANSEN BROTHERS | C | 249 | 5 | SOx | 0 | 0 | 0 | 2 |
| ANDERSON CLAYTON CORP/IDRIA #2 | C | 250 | 5 | SOx | 0 | 0 | 0 | 42 |
| INGREDION INCORPORATED | N | 264 | 5 | SOx | 39050 | 39050 | 39050 | 39050 |
| AERA ENERGY LLC | S | 272 | 5 | SOx | 1735 | 2907 | 1810 | 2494 |
| AERA ENERGY LLC | S | 284 | 5 | SOx | 19831 | 12103 | 6514 | 16106 |
| PARAMOUNT FARMS, INC. | C | 291 | 5 | SOx | 0 | 0 | 8 | 1 |
| DUNAVANT OF CALIFORNIA | C | 297 | 5 | SOx | 22 | 29 | 19 | 25 |
| ANDERSON CLAYTON CORP | S | 314 | 5 | SOx | 0 | 0 | 0 | 2 |
| ANDERSON CLAYTON CORP/PLSNT VA | C | 326 | 5 | SOx | 0 | 0 | 0 | 22 |
| NAS LEMOORE | C | 330 | 5 | SOx | 1 | 1 | 1 | 1 |
| CHEVRON USA INC | C | 331 | 5 | SOx | 1576 | 1577 | 1577 | 1577 |
| ANDERSON CLAYTON CORP/DAIRYLAN | C | 332 | 5 | SOx | 0 | 0 | 0 | 9 |
| ANDERSON CLAYTON CORP/SUNSET | C | 333 | 5 | SOx | 0 | 0 | 0 | 6 |
| ANDERSON CLAYTON CORP/MURIT #1 | C | 334 | 5 | SOx | 0 | 0 | 0 | 9 |
| ANDERSON CLAYTON CORP/NAPA GIN | C | 335 | 5 | SOx | 0 | 0 | 0 | 6 |
| ANDERSON CLAYTON CORP/MURIT #2 | C | 336 | 5 | SOx | 0 | 0 | 0 | 9 |
| CHEVRON USA INC | C | 339 | 5 | SOx | 4730 | 4730 | 4731 | 4731 |
| CHEVRON U S A INC | S | 357 | 5 | SOx | 6 | 5 | 5 | 7 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 373 | 5 | SOx | 2 | 2 | 2 | 2 |
| LIDESTRI FOODS, INC | N | 391 | 5 | SOx | 0 | 0 | 84 | 0 |
| AERA ENERGY LLC | S | 395 | 5 | SOx | 4836 | 5200 | 5928 | 5651 |
| INTERLAKE MATERIAL HANDLING | N | 414 | 5 | SOx | 8 | 8 | 7 | 8 |
| SEMI TROPIC COOP GIN | S | 426 | 5 | SOx | 0 | 0 | 0 | 2 |
| NRG POWER MARKETING INC | C | 426 | 5 | SOx | 16 | 13 | 5 | 15 |
| ANDERSON CLAYTON CORP/EL DORAD | C | 427 | 5 | SOx | 0 | 0 | 0 | 3 |
| ANDERSON CLAYTON CORP/KERMAN | C | 428 | 5 | SOx | 0 | 0 | 0 | 48 |
| MONTEREY RESOURCES, INC. | S | 432 | 5 | SOx | 32 | 32 | 26 | 29 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 436 | 5 | SOx | 79 | 72 | 66 | 66 |
| VALLEY AIR CONDITIONING & REPAIR INC | C | 438 | 5 | SOx | 41 | 105 | 154 | 162 |
| MINTURN CO-OP GIN | N | 441 | 5 | SOx | 0 | 0 | 0 | 31 |
| ANDERSON CLAYTON CORP/KINGSRIV | C | 460 | 5 | SOx | 0 | 0 | 0 | 4 |
| LAWRENCE LIVERMORE NATL. LAB | N | 464 | 5 | SOx | 30 | 11 | 0 | 22 |
| ANDERSON CLAYTON CORP | S | 471 | 5 | SOx | 0 | 0 | 0 | 1 |
| ANDERSON CLAYTON CORP/DAIRYLND | C | 472 | 5 | SOx | 0 | 0 | 0 | 21 |
| CONAGRA CONSUMER FROZEN FOODS | N | 489 | 5 | SOx | 7 | 4 | 5 | 6 |
| ANDERSON CLAYTON CORP. | N | 499 | 5 | SOx | 0 | 0 | 0 | 24 |
| PARAMOUNT FARMS, INC. | C | 501 | 5 | SOx | 26 | 81 | 126 | 112 |
| VALLEY AIR CONDITIONING & REPAIR INC | C | 502 | 5 | SOx | 7 | 22 | 36 | 30 |
| CANDLEWICK YARNS | C | 507 | 5 | SOx | 5 | 5 | 4 | 4 |
| CLARK BROTHERS-DERRICK GIN | C | 511 | 5 | SOx | 0 | 0 | 0 | 3 |
| LODI GAS STORAGE LLC | N | 515 | 5 | SOx | 5 | 5 | 5 | 5 |
| DOLE PACKAGED FOODS LLC | N | 520 | 5 | SOx | 1 | 3 | 9 | 8 |
| NAVERUS INC | N | 526 | 5 | SOx | 1 | 1 | 1 | 1 |
| COIT RANCH | C | 532 | 5 | SOx | 0 | 0 | 0 | 4 |
| COALINGA FARMERS CO-OP GIN | C | 537 | 5 | SOx | 0 | 0 | 0 | 14 |
| AERA ENERGY LLC | S | 548 | 5 | SOx | 2803 | 26 | 0 | 0 |
| AERA ENERGY LLC | S | 556 | 5 | SOx | 1379 | 869 | 781 | 989 |
| BRITZ AG FINANCE CO., INC. | C | 557 | 5 | SOx | 0 | 0 | 0 | 33 |
| CORCORAN IRRIGATION DISTRICT | C | 560 | 5 | SOx | 4 | 5 | 4 | 3 |
| UNIVERSITY ENERGY SERVICES | S | 561 | 5 | SOx | 63 | 54 | 59 | 61 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 575 | 5 | SOx | 1 | 39 | 115 | 24 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 576 | 5 | SOx | 0 | 175 | 161 | 0 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 577 | 5 | SOx | 42 | 57 | 61 | 61 |
| BRITZ INCORPORATED | C | 586 | 5 | SOx | 0 | 0 | 0 | 11 |
| WESTSIDE FARMERS COOP GIN #6 | C | 592 | 5 | SOx | 10 | 0 | 0 | 71 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| MODESTO IRRIGATION DISTRICT | C | 599 | 5 | SOx | 2078 | 1671 | 0 | 0 |
| MODESTO TALLOW CO INC | N | 599 | 5 | SOx | 20 | 18 | 22 | 22 |
| OAKWOOD LAKE RESORT | N | 601 | 5 | SOx | 0 | 0 | 1 | 0 |
| BAR 20 PARTNERS LTD | N | 612 | 5 | SOx | 0 | 0 | 79 | 0 |
| BAR 20 PARTNERS LTD | N | 617 | 5 | SOx | 0 | 0 | 304 | 0 |
| GRIMMIUS CATTLE COMPANY | N | 636 | 5 | SOx | 21307 | 28000 | 6627 | 20577 |
| BAR VP DAIRY | N | 638 | 5 | SOx | 0 | 0 | 0 | 32 |
| BAR VP DAIRY | N | 639 | 5 | SOx | 10 | 10 | 0 | 7 |
| BAR VP DAIRY | N | 640 | 5 | SOx | 0 | 0 | 16147 | 0 |
| DIAMOND FOODS INCORPORATED | N | 645 | 5 | SOx | 2699 | 2294 | 2340 | 1357 |
| WESTLAKE FARMS INC | C | 645 | 5 | SOx | 0 | 0 | 0 | 29 |
| DANELL BROTHERS INC | N | 682 | 5 | SOx | 10000 | 10000 | 10000 | 10000 |
| H. J. HEINZ COMPANY | N | 694 | 5 | SOx | 0 | 0 | 117 | 0 |
| ANDERSON CLAYTON-MARICOPA GIN | S | 697 | 5 | SOx | 0 | 0 | 0 | 3 |
| SUNLAND REFINING CORPORATION | S | 698 | 5 | SOx | 1293 | 1123 | 1211 | 1241 |
| ANDERSON CLAYTON CORP/BUTTE | C | 699 | 5 | SOx | 0 | 0 | 0 | 31 |
| CANANDAIGUA WINE COMPANY INC | C | 702 | 5 | SOx | 33 | 34 | 35 | 32 |
| EVOLUTION MARKETS INC. | N | 711 | 5 | SOx | 0 | 0 | 4595 | 4591 |
| EVOLUTION MARKETS INC. | N | 713 | 5 | SOx | 19238 | 23422 | 0 | 0 |
| ANDERSON CLAYTON CORPORATION | N | 737 | 5 | SOx | 0 | 0 | 0 | 3 |
| LATON CO-OP GIN, INC. | C | 746 | 5 | SOx | 0 | 0 | 0 | 3 |
| CANTUA COOPERATIVE GIN, INC. | C | 760 | 5 | SOx | 0 | 0 | 0 | 4 |
| AVENAL POWER CENTER, LLC | N | 762 | 5 | SOx | 21000 | 21000 | 21000 | 21000 |
| STOCKTON EAST WATER DISTRICT | N | 763 | 5 | SOx | 8 | 10 | 11 | 9 |
| OLDUVAI GORGE, LLC | N | 769 | 5 | SOx | 13 | 12 | 12 | 12 |
| BAR 20 PARTNERS LTD | N | 778 | 5 | SOx | 0 | 0 | 1 | 0 |
| OLDUVAI GORGE, LLC | N | 786 | 5 | SOx | 46 | 46 | 40 | 36 |
| AERA ENERGY LLC | S | 790 | 5 | SOx | 2 | 1 | 1 | 2 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSON CLAYTON CORP/BURREL | C | 806 | 5 | SOx | 3 | 0 | 0 | 7 |
| BAR VP DAIRY | C | 810 | 5 | SOx | 250 | 1096 | 0 | 682 |
| BAR VP DAIRY | C | 811 | 5 | SOx | 919 | 0 | 117 | 80 |
| UNITED STATES GYPSUM COMPANY | C | 818 | 5 | SOx | 0 | 0 | 0 | 5 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 826 | 5 | SOx | 5 | 5 | 4 | 5 |
| CALPINE ENERGY SERVICES, L.P. | N | 841 | 5 | SOx | 3041 | 1167 | 5891 | 3122 |
| AERA ENERGY LLC | S | 841 | 5 | SOx | 26339 | 26631 | 26924 | 26924 |
| CALPINE CORPORATION | N | 844 | 5 | SOx | 6925 | 7045 | 7164 | 7164 |
| AERA ENERGY LLC | S | 847 | 5 | SOx | 153 | 227 | 173 | 72 |
| EAGLE VALLEY GINNING LLC | N | 847 | 5 | SOx | 0 | 0 | 0 | 3 |
| ANDERSON CLAYTON CORP/HANFORD | C | 863 | 5 | SOx | 0 | 0 | 0 | 4 |
| AERA ENERGY LLC | S | 863 | 5 | SOx | 6 | 7 | 13 | 12 |
| BRITZ GIN PARTNERSHIP II | C | 871 | 5 | SOx | 0 | 0 | 0 | 4 |
| EVOLUTION MARKETS INC. | C | 882 | 5 | SOx | 0 | 0 | 0 | 23 |
| RON/ROSALINDA VANDER WEERD | C | 883 | 5 | SOx | 0 | 3800 | 3800 | 0 |
| RON/ROSALINDA VANDER WEERD | C | 884 | 5 | SOx | 3750 | 0 | 66 | 3751 |
| CHEVRON USA INC | S | 891 | 5 | SOx | 2712 | 2742 | 2773 | 2773 |
| CALPINE ENERGY SERVICES, L.P. | N | 893 | 5 | SOx | 0 | 0 | 0 | 52748 |
| CALIFORNIA SPRAY DRY CO | N | 904 | 5 | SOx | 15 | 21 | 22 | 19 |
| PANOCHE GINNING CO | C | 904 | 5 | SOx | 0 | 0 | 0 | 5 |
| CHEVRON USA INC | S | 906 | 5 | SOx | 2470 | 2498 | 2526 | 2526 |
| CHEVRON USA INC | S | 907 | 5 | SOx | 1527 | 1306 | 1330 | 1176 |
| OLAM | N | 917 | 5 | SOx | 7118 | 18526 | 23007 | 910 |
| MOLYCORP MINERALS, LLC | N | 938 | 5 | SOx | 8250 | 8250 | 8250 | 8250 |
| MOLYCORP MINERALS, LLC | N | 939 | 5 | SOx | 21899 | 23000 | 0 | 14704 |
| MADERA CO-OP GIN, INC. | C | 943 | 5 | SOx | 0 | 0 | 0 | 2 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 952 | 5 | SOx | 3 | 3 | 3 | 3 |
| FARMERS FIREBAUGH GINNING CO. | C | 956 | 5 | SOx | 2 | 0 | 0 | 6 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSON CLAYTON CORP/IDRIA #1 | C | 959 | 5 | SOx | 0 | 0 | 0 | 53 |
| CHEVRON USA INC | C | 966 | 5 | SOx | 2 | 2 | 2 | 2 |
| CALIFORNIA DAIRIES, INC. | N | 986 | 5 | SOx | 9000 | 9000 | 9000 | 9000 |
| AERA ENERGY LLC | S | 989 | 5 | SOx | 0 | 2808 | 0 | 0 |
| MODESTO IRRIGATION DISTRICT | N | 989 | 5 | SOx | 23945 | 25082 | 12500 | 0 |
| AERA ENERGY LLC | S | 998 | 5 | SOx | 735 | 0 | 0 | 0 |
| AERA ENERGY LLC | S | 1000 | 5 | SOx | 138 | 2811 | 489 | 10 |
| AERA ENERGY LLC | S | 1001 | 5 | SOx | 275 | 583 | 0 | 0 |
| KERMAN CO-OP GIN & WAREHOUSE 1 | C | 1002 | 5 | SOx | 0 | 0 | 0 | 2 |
| DTE STOCKTON, LLC | N | 1007 | 5 | SOx | 0 | 0 | 27720 | 0 |
| THE ENVIRONMENTAL RESOURCES TRUST, INC | C | 1013 | 5 | SOx | 9823 | 9823 | 9823 | 9823 |
| TKV CONTAINERS, INC. | C | 1015 | 5 | SOx | 0 | 0 | 1 | 0 |
| LOS GATOS TOMATO PRODUCTS | C | 1021 | 5 | SOx | 0 | 1 | 0 | 0 |
| NORTHERN CALIFORNIA POWER AGENCY | N | 1022 | 5 | SOx | 0 | 0 | 5751 | 0 |
| AERA ENERGY LLC | S | 1032 | 5 | SOx | 28371 | 72172 | 48856 | 9900 |
| WESTSIDE FARMERS COOP #2 & #3 | C | 1038 | 5 | SOx | 1 | 0 | 0 | 10 |
| ANDERSON CLAYTON CORP | S | 1045 | 5 | SOx | 0 | 0 | 0 | 3 |
| MARTIN ANDERSON | C | 1051 | 5 | SOx | 18 | 27 | 16 | 1 |
| AERA ENERGY LLC | S | 1057 | 5 | SOx | 4 | 5 | 4 | 3 |
| HYDROGEN ENERGY CA LLC | C | 1058 | 5 | SOx | 24500 | 24500 | 24500 | 24500 |
| G.I.C. FINANCIAL SERVICES, INC. | C | 1059 | 5 | SOx | 70500 | 70500 | 70500 | 70500 |
| AERA ENERGY LLC | S | 1071 | 5 | SOx | 10682 | 10682 | 10682 | 10682 |
| E & J GALLO WINERY | C | 1071 | 5 | SOx | 1 | 2 | 1 | 1 |
| AERA ENERGY LLC | S | 1072 | 5 | SOx | 5 | 4 | 4 | 4 |
| AERA ENERGY LLC | S | 1073 | 5 | SOx | 2 | 2 | 2 | 2 |
| AERA ENERGY LLC | S | 1075 | 5 | SOx | 0 | 1 | 0 | 0 |
| AERA ENERGY LLC | S | 1076 | 5 | SOx | 12 | 11 | 13 | 11 |
| AERA ENERGY LLC | S | 1077 | 5 | SOx | 79 | 176 | 164 | 173 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1079 | 5 | SOx | 0 | 0 | 0 | 936 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1080 | 5 | SOx | 0 | 0 | 9774 | 0 |
| H. J. HEINZ COMPANY | N | 1085 | 5 | SOx | 6 | 6 | 4 | 3 |
| INGREDION INCORPORATED | N | 1086 | 5 | SOx | 51681 | 26912 | 37684 | 61746 |
| OLDUVAI GORGE, LLC | N | 1087 | 5 | SOx | 63898 | 63775 | 13652 | 13652 |
| AERA ENERGY LLC | S | 1091 | 5 | SOx | 57 | 70 | 71 | 71 |
| RON VANDER WEERD/ROSALINDA VANDER WEERD | N | 1108 | 5 | SOx | 0 | 0 | 6702 | 0 |
| SPRECKELS SUGAR COMPANY | C | 1112 | 5 | SOx | 0 | 26875 | 37739 | 16268 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1118 | 5 | SOx | 250 | 250 | 250 | 250 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1129 | 5 | SOx | 212 | 212 | 212 | 212 |
| FREEPORT-MCMORAN OIL & GAS, LLC | N | 1130 | 5 | SOx | 35 | 35 | 33 | 33 |
| AERA ENERGY LLC | S | 1133 | 5 | SOx | 436 | 877 | 687 | 281 |
| CHEVRON USA, INC. | C | 1147 | 5 | SOx | 7 | 7 | 5 | 6 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1150 | 5 | SOx | 250 | 250 | 250 | 250 |
| ANDERSON CLAYTON CORP | S | 1171 | 5 | SOx | 0 | 0 | 0 | 3 |
| PANOCHE ENERGY CENTER, LLC | N | 1177 | 5 | SOx | 2784 | 0 | 0 | 1787 |
| PANOCHE ENERGY CENTER, LLC | N | 1179 | 5 | SOx | 0 | 0 | 24703 | 0 |
| BERRY PETROLEUM COMPANY | N | 1185 | 5 | SOx | 2 | 302 | 0 | 0 |
| BERRY PETROLEUM COMPANY | N | 1186 | 5 | SOx | 0 | 0 | 2603 | 0 |
| BERRY PETROLEUM COMPANY | N | 1187 | 5 | SOx | 2600 | 0 | 0 | 2603 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1201 | 5 | SOx | 1598 | 0 | 0 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1215 | 5 | SOx | 4612 | 4612 | 4612 | 4612 |
| HOLLY COMMERCE CENTER LLC | N | 1226 | 5 | SOx | 0 | 2146 | 1749 | 1492 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1233 | 5 | SOx | 61 | 55 | 49 | 49 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1234 | 5 | SOx | 6 | 0 | 16 | 17 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1235 | 5 | SOx | 22 | 22 | 22 | 22 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1237 | 5 | SOx | 23884 | 21221 | 14279 | 24460 |
| DEL MONTE FOODS MODESTO PLANT 1 | N | 1238 | 5 | SOx | 17 | 15 | 43 | 8 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| TAUBER OIL COMPANY | N | 1240 | 5 | SOx | 90 | 90 | 90 | 90 |
| FREEPORT-MCMORAN OIL & GAS, LLC | N | 1243 | 5 | SOx | 2087 | 2087 | 2087 | 2087 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1249 | 5 | SOx | 3933 | 3933 | 3932 | 3932 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1259 | 5 | SOx | 132 | 132 | 132 | 132 |
| OLDUVAI GORGE, LLC | N | 1262 | 5 | SOx | 762 | 60023 | 0 | 0 |
| ANDERSON CLAYTON CORP | S | 1262 | 5 | SOx | 0 | 0 | 0 | 2 |
| ANDERSON CLAYTON CORP | S | 1263 | 5 | SOx | 1 | 0 | 0 | 3 |
| OLDUVAI GORGE, LLC | N | 1264 | 5 | SOx | 46372 | 2294 | 0 | 0 |
| TWIN EAGLE RESOURCE MANAGEMENT, LLC | N | 1265 | 5 | SOx | 0 | 12555 | 0 | 0 |
| TWIN EAGLE RESOURCE MANAGEMENT, LLC | N | 1266 | 5 | SOx | 9370 | 0 | 0 | 0 |
| BERRY PETROLEUM COMPANY | C | 1275 | 5 | SOx | 936 | 3295 | 936 | 880 |
| E & J GALLO WINERY | C | 1280 | 5 | SOx | 20 | 20 | 21 | 21 |
| CALIFORNIA RESOURCES ELK HILLS, LLC. | N | 1280 | 5 | SOx | 1704 | 1702 | 1702 | 1702 |
| E & J GALLO WINERY | C | 1281 | 5 | SOx | 2603 | 2603 | 2603 | 2603 |
| SAPUTO CHEESE USA INC | N | 1286 | 5 | SOx | 945 | 945 | 945 | 945 |
| ELEMENT MARKETS, LLC | N | 1287 | 5 | SOx | 230 | 230 | 230 | 230 |
| BERRY PETROLEUM COMPANY | N | 1288 | 5 | SOx | 9800 | 9800 | 9800 | 9800 |
| PILKINGTON NORTH AMERICA, INC | N | 1289 | 5 | SOx | 33330 | 33017 | 37136 | 36864 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1295 | 5 | SOx | 6500 | 6500 | 6500 | 6500 |
| AERA ENERGY LLC | S | 1295 | 5 | SOx | 1289 | 2983 | 696 | 488 |
| GUARDIAN INDUSTRIES CORP | C | 1296 | 5 | SOx | 5466 | 5466 | 5466 | 5466 |
| HANFORD L P | C | 1304 | 5 | SOx | 5661 | 5603 | 5405 | 7631 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1307 | 5 | SOx | 2910 | 2910 | 2910 | 2910 |
| TAUBER OIL COMPANY | C | 1308 | 5 | SOx | 2090 | 2090 | 2090 | 2090 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1325 | 5 | SOx | 4493 | 4493 | 4493 | 4493 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1331 | 5 | SOx | 76 | 76 | 76 | 76 |
| CALIFORNIA RESOURCES PRODUCTION CORP. | C | 1333 | 5 | SOx | 280 | 280 | 280 | 280 |
| AERA ENERGY LLC | S | 1339 | 5 | SOx | 102863 | 63756 | 0 | 10468 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| AERA ENERGY LLC | S | 1476 | 5 | SOx | 21 | 0 | 0 | 6 |
| AERA ENERGY LLC | S | 1477 | 5 | SOx | 36 | 0 | 0 | 10 |
| CHEVRON USA INC | S | 1485 | 5 | SOx | 1890 | 1911 | 1931 | 1931 |
| CHEVRON USA INC | S | 1542 | 5 | SOx | 25189 | 21032 | 18790 | 30130 |
| AERA ENERGY LLC | S | 1865 | 5 | SOx | 5592 | 4295 | 5749 | 5942 |
| ELK HILLS POWER LLC | S | 1950 | 5 | SOx | 496 | 306 | 118 | 118 |
| AERA ENERGY LLC | S | 2008 | 5 | SOx | 85594 | 40615 | 57148 | 91993 |
| AERA ENERGY LLC | S | 2010 | 5 | SOx | 0 | 3320 | 0 | 0 |
| AERA ENERGY LLC | S | 2019 | 5 | SOx | 582 | 589 | 597 | 597 |
| KERN LAKE COOP GIN | S | 2074 | 5 | SOx | 0 | 0 | 0 | 14 |
| AERA ENERGY LLC | S | 2361 | 5 | SOx | 542 | 71 | 2 | 215 |
| KERN OIL & REFINING CO. | S | 2387 | 5 | SOx | 7500 | 7500 | 7500 | 7500 |
| CHEVRON USA INC | S | 2454 | 5 | SOx | 9938 | 15295 | 38474 | 24993 |
| OLDUVAI GORGE, LLC | S | 2483 | 5 | SOx | 0 | 0 | 1600 | 0 |
| GRIMMIUS CATTLE COMPANY | S | 2504 | 5 | SOx | 6693 | 0 | 21373 | 7423 |
| M CARATAN INC | S | 2516 | 5 | SOx | 0 | 0 | 2 | 0 |
| FARMERS COOPERATIVE GIN INC | S | 2533 | 5 | SOx | 0 | 0 | 0 | 4 |
| ELBOW ENTERPRISES INC | S | 2535 | 5 | SOx | 0 | 0 | 0 | 33 |
| UNITED STATES GYPSUM COMPANY | S | 2543 | 5 | SOx | 0 | 0 | 0 | 9 |
| OLDUVAI GORGE, LLC | S | 2604 | 5 | SOx | 0 | 0 | 0 | 6 |
| RICHARD OPPEDYK | S | 2620 | 5 | SOx | 2750 | 2750 | 2750 | 2750 |
| EVOLUTION MARKETS INC. | S | 2632 | 5 | SOx | 11102 | 11225 | 11348 | 11348 |
| SOUTH LAKES DAIRY | S | 2638 | 5 | SOx | 300 | 300 | 300 | 300 |
| OLDUVAI GORGE, LLC | S | 2671 | 5 | SOx | 1744 | 1744 | 1744 | 1744 |
| TAFT PRODUCTION COMPANY | S | 2672 | 5 | SOx | 1695 | 1733 | 1771 | 1771 |
| TULE RIVER CO-OP GIN INC | S | 2682 | 5 | SOx | 0 | 0 | 0 | 3 |
| MODESTO IRRIGATION DISTRICT | S | 2686 | 5 | SOx | 25188 | 2688 | 78 | 8578 |
| OLDUVAI GORGE, LLC | S | 2692 | 5 | SOx | 22146 | 30918 | 8240 | 22190 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| COVANTA DELANO INC | S | 2721 | 5 | SOx | 890 | 916 | 941 | 941 |
| EVOLUTION MARKETS INC. | S | 2741 | 5 | SOx | 0 | 0 | 8706 | 0 |
| EVOLUTION MARKETS INC. | S | 2742 | 5 | SOx | 5836 | 1652 | 9106 | 19927 |
| EVOLUTION MARKETS INC. | S | 2743 | 5 | SOx | 0 | 0 | 2666 | 551 |
| PASTORIA ENERGY FACILITY, LLC | S | 2744 | 5 | SOx | 11324 | 11450 | 11576 | 11576 |
| EVOLUTION MARKETS INC. | S | 2750 | 5 | SOx | 0 | 0 | 0 | 28 |
| RON/ROSALINDA VANDER WEERD | S | 2751 | 5 | SOx | 6250 | 6200 | 6134 | 6249 |
| AVENAL POWER CENTER, LLC | S | 2788 | 5 | SOx | 5 | 7 | 3 | 6 |
| AVENAL POWER CENTER, LLC | S | 2789 | 5 | SOx | 6 | 14 | 12 | 8 |
| AVENAL POWER CENTER, LLC | S | 2790 | 5 | SOx | 12862 | 491 | 0 | 8499 |
| AVENAL POWER CENTER, LLC | S | 2791 | 5 | SOx | 92179 | 23666 | 69157 | 96288 |
| RIVER RANCH FARMS | S | 2930 | 5 | SOx | 4702 | 0 | 0 | 11853 |
| CHEVRON USA INC | S | 2934 | 5 | SOx | 11539 | 16868 | 23727 | 33544 |
| BUTTONWILLOW GINNING CO | S | 2937 | 5 | SOx | 0 | 0 | 0 | 4 |
| BAKERSFIELD CITY WOOD SITE | S | 2969 | 5 | SOx | 3 | 5 | 5 | 4 |
| GLOBAL AMPERSAND LLC | S | 2978 | 5 | SOx | 29 | 0 | 0 | 0 |
| MID-VALLEY COTTON GROWERS INC | S | 2989 | 5 | SOx | 0 | 0 | 0 | 4 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 3035 | 5 | SOx | 2 | 2 | 4 | 4 |
| CALIFORNIA DAIRIES, INC | S | 3058 | 5 | SOx | 1401 | 1401 | 1399 | 1399 |
| OLDUVAI GORGE, LLC | S | 3069 | 5 | SOx | 2062 | 2222 | 2381 | 2381 |
| CALPINE ENERGY SERVICES, L.P. | S | 3075 | 5 | SOx | 5080 | 12043 | 7319 | 15177 |
| CHEVRON USA INC | S | 3082 | 5 | SOx | 15520 | 13060 | 10088 | 5442 |
| SOC RESOURCES INC | S | 3089 | 5 | SOx | 94 | 89 | 87 | 90 |
| KERN OIL & REFINING CO. | S | 3106 | 5 | SOx | 78598 | 78599 | 51520 | 78598 |
| R W MARTELLA | S | 3108 | 5 | SOx | 0 | 351 | 351 | 922 |
| CHEVRON USA INC | S | 3154 | 5 | SOx | 22988 | 23243 | 23499 | 23499 |
| CHEVRON USA PRODUCTION INC | S | 3228 | 5 | SOx | 11 | 13 | 22 | 8 |
| VANDERHAM WEST | S | 3233 | 5 | SOx | 1453 | 1452 | 1452 | 1452 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| SHAFTER-WASCO GINNING COMPANY | S | 3268 | 5 | SOx | 0 | 0 | 0 | 19 |
| HYDROGEN ENERGY CALIFORNIA, LLC | S | 3275 | 5 | SOx | 42000 | 42000 | 42000 | 42000 |
| CALPINE ENERGY SERVICES, L.P. | S | 3279 | 5 | SOx | 1625 | 0 | 0 | 1339 |
| CALPINE ENERGY SERVICES, L.P. | S | 3281 | 5 | SOx | 3875 | 5500 | 5500 | 4161 |
| CALPINE ENERGY SERVICES, L.P. | S | 3294 | 5 | SOx | 4000 | 4000 | 4000 | 4000 |
| AERA ENERGY LLC | S | 3310 | 5 | SOx | 281 | 227 | 223 | 281 |
| CALPINE ENERGY SERVICES, L.P. | S | 3348 | 5 | SOx | 9536 | 6336 | 6163 | 6545 |
| LAND O' LAKES, INC. | S | 3352 | 5 | SOx | 158 | 835 | 687 | 274 |
| CALPINE ENERGY SERVICES, L.P. | S | 3356 | 5 | SOx | 24000 | 24000 | 24000 | 24000 |
| AERA ENERGY LLC | S | 3363 | 5 | SOx | 21065 | 27266 | 29310 | 28564 |
| CITY OF TULARE | S | 3396 | 5 | SOx | 26 | 26 | 26 | 26 |
| FRITO-LAY, INC. | S | 3423 | 5 | SOx | 137 | 176 | 113 | 64 |
| FRITO-LAY, INC. | S | 3427 | 5 | SOx | 8 | 8 | 9 | 9 |
| ALON BAKERSFIELD REFINING | S | 3465 | 5 | SOx | 5548 | 5771 | 4951 | 5990 |
| AERA ENERGY LLC | S | 3525 | 5 | SOx | 1902 | 1902 | 1902 | 1902 |
| CHEVRON USA PRODUCTION INC | S | 3533 | 5 | SOx | 1 | 1 | 1 | 1 |
| CHEVRON USA INC | S | 3544 | 5 | SOx | 33 | 36 | 29 | 30 |
| SOUTH VALLEY GINS INC | S | 3554 | 5 | SOx | 0 | 0 | 0 | 5 |
| JR SIMPLOT COMPANY | S | 3570 | 5 | SOx | 688 | 715 | 742 | 742 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 3593 | 5 | SOx | 494 | 494 | 492 | 492 |
| CHEVRON USA INC | S | 3604 | 5 | SOx | 22 | 33 | 37 | 24 |
| LAND O' LAKES, INC. | S | 3625 | 5 | SOx | 5 | 5 | 6 | 5 |
| AGRI-CEL INC | S | 3631 | 5 | SOx | 12 | 14 | 13 | 1 |
| 3H CATTLE COMPANY | S | 3672 | 5 | SOx | 0 | 14 | 0 | 0 |
| AERA ENERGY LLC | S | 3685 | 5 | SOx | 52466 | 53256 | 54044 | 54044 |
| TURLOCK IRRIGATION DISTRICT | S | 3709 | 5 | SOx | 29865 | 14110 | 0 | 32286 |
| SENECA RESOURCES | S | 3720 | 5 | SOx | 0 | 0 | 0 | 20 |
| FRITO-LAY, INC. | S | 3767 | 5 | SOx | 5203 | 5000 | 8796 | 8796 |

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|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| FOSTER FARMS, SPERRY RANCH | S | 3795 | 5 | SOx | 175 | 175 | 0 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3823 | 5 | SOx | 4956 | 4956 | 4954 | 4954 |
| AERA ENERGY LLC | S | 3833 | 5 | SOx | 16508 | 18345 | 2147 | 8994 |
| MACPHERSON OIL COMPANY | S | 3927 | 5 | SOx | 0 | 3 | 13 | 4 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4016 | 5 | SOx | 325 | 0 | 0 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4017 | 5 | SOx | 5 | 0 | 0 | 0 |
| BRUCE CARTER INDUSTRIES, INC. | S | 4038 | 5 | SOx | 5 | 7 | 6 | 1 |
| VECTOR ENVIRONMENTAL, INC. | S | 4039 | 5 | SOx | 22 | 27 | 25 | 3 |
| VANDER WOUDE DAIRY | S | 4055 | 5 | SOx | 3613 | 0 | 3800 | 3160 |
| BREITBURN OPERATING LP | S | 4056 | 5 | SOx | 16 | 20 | 16 | 13 |
| FREEPORT-MC MORAN OIL & GAS | S | 4102 | 5 | SOx | 5 | 5 | 3 | 3 |
| CALPINE ENERGY SERVICES, L.P. | S | 4165 | 5 | SOx | 4332 | 1562 | 709 | 3781 |
| NORTHERN CALIFORNIA POWER AGENCY | S | 4182 | 5 | SOx | 1504 | 0 | 9485 | 9940 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4196 | 5 | SOx | 8 | 5 | 14 | 15 |
| CHEVRON USA INC | S | 4200 | 5 | SOx | 7613 | 17935 | 24182 | 23612 |
| BERRY PETROLEUM COMPANY, LLC | S | 4203 | 5 | SOx | 3134 | 3076 | 3134 | 3190 |
| BERRY PETROLEUM COMPANY, LLC | S | 4209 | 5 | SOx | 3 | 2 | 2 | 2 |
| BERRY PETROLEUM COMPANY, LLC | S | 4210 | 5 | SOx | 2325 | 2325 | 2325 | 2325 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4211 | 5 | SOx | 13 | 12 | 16 | 16 |
| E & J GALLO WINERY | S | 4214 | 5 | SOx | 1750 | 1750 | 1750 | 1750 |
| E & J GALLO WINERY | S | 4215 | 5 | SOx | 6377 | 6377 | 6376 | 6376 |
| TAUBER OIL COMPANY | S | 4216 | 5 | SOx | 123 | 123 | 124 | 124 |
| FREEPORT-MC MORAN OIL & GAS | S | 4218 | 5 | SOx | 674 | 350 | 28 | 28 |
| CRESTWOOD WEST COAST LLC | S | 4238 | 5 | SOx | 290 | 290 | 290 | 290 |
| BERRY PETROLEUM COMPANY, LLC | S | 4272 | 5 | SOx | 4606 | 5021 | 4825 | 6146 |
| AERA ENERGY LLC | S | 4286 | 5 | SOx | 16674 | 26211 | 11387 | 5910 |
| BAR VP HEIFER RANCH | S | 4289 | 5 | SOx | 0 | 1 | 49 | 50 |
| CHEVRON U S A INC | S | 4304 | 5 | SOx | 11 | 13 | 13 | 15 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| KERN DELTA CO LLC | S | 4313 | 5 | SOx | 0 | 0 | 0 | 15 |
| KERN DELTA CO LLC | S | 4318 | 5 | SOx | 0 | 0 | 0 | 4 |
| SENECA RESOURCES | S | 4325 | 5 | SOx | 800 | 800 | 800 | 800 |
| SENECA RESOURCES | S | 4331 | 5 | SOx | 800 | 800 | 800 | 800 |
| ALON BAKERSFIELD REFINING | S | 4332 | 5 | SOx | 10129 | 20405 | 17374 | 23791 |
| CHEVRON U S A INC | S | 4375 | 5 | SOx | 32630 | 33083 | 33538 | 33538 |
| TRI-CITY GROWERS INC | S | 4392 | 5 | SOx | 2 | 0 | 0 | 6 |
| AERA ENERGY LLC | S | 4424 | 5 | SOx | 101854 | 66432 | 0 | 24770 |
| TWIN EAGLE RESOURCE MANAGEMENT, LLC | S | 4425 | 5 | SOx | 13197 | 17604 | 0 | 0 |
| SAN JOAQUIN REFINING COMPANY | S | 4450 | 5 | SOx | 3 | 2 | 2 | 2 |
| E&B NATURAL RESOURCES MGMT | S | 4458 | 5 | SOx | 0 | 827 | 0 | 0 |
| E & J GALLO WINERY | N | 2 | 1 | VOC | 9 | 9 | 26 | 28 |
| LIVE OAK LIMITED | S | 3 | 1 | VOC | 198 | 200 | 202 | 202 |
| WESTERN STONE PRODUCTS, INC. | N | 17 | 1 | VOC | 6 | 6 | 7 | 7 |
| H. J. HEINZ COMPANY, L.P. | N | 21 | 1 | VOC | 0 | 60 | 180 | 60 |
| COTTON ASSOCIATES, INC | S | 25 | 1 | VOC | 0 | 0 | 0 | 8 |
| DUNCAN ENTERPRISES | C | 33 | 1 | VOC | 26 | 26 | 27 | 18 |
| CALMAT OF FRESNO | C | 40 | 1 | VOC | 2 | 11 | 5 | 17 |
| BUILDERS CONCRETE, INC. | C | 41 | 1 | VOC | 35 | 35 | 35 | 35 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 42 | 1 | VOC | 1 | 1 | 1 | 1 |
| J.R. SIMPLOT | C | 44 | 1 | VOC | 83 | 82 | 70 | 64 |
| BROWN SAND INC | N | 46 | 1 | VOC | 2 | 2 | 1 | 2 |
| CALMAT CO. | C | 50 | 1 | VOC | 2 | 2 | 3 | 3 |
| ANDERSON CLAYTON CORP/STRATFOR | C | 56 | 1 | VOC | 0 | 0 | 0 | 4 |
| H. J. HEINZ COMPANY | N | 60 | 1 | VOC | 0 | 23 | 129 | 0 |
| LEPRINO FOODS COMPANY | C | 60 | 1 | VOC | 137 | 139 | 136 | 138 |
| SEQUOIA FOREST INDUSTRIES | C | 67 | 1 | VOC | 2 | 9 | 0 | 6 |
| CRAYCROFT BRICK COMPANY | C | 71 | 1 | VOC | 24 | 20 | 19 | 19 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| SEQUOIA FOREST INDUSTRIES | C | 72 | 1 | VOC | 7 | 0 | 1 | 1 |
| ANDERSON CLAYTON CORP/HANFORD | C | 74 | 1 | VOC | 0 | 0 | 0 | 5 |
| ANDERSON CLAYTON CORP/KEARNY | C | 75 | 1 | VOC | 0 | 0 | 0 | 7 |
| ANDERSON CLAYTON CORP/SETTER | C | 76 | 1 | VOC | 0 | 0 | 0 | 7 |
| CHEVRON USA INC | S | 77 | 1 | VOC | 42 | 38 | 36 | 47 |
| CALIFORNIA-WASHINGTON CAN CO. | N | 77 | 1 | VOC | 2664 | 0 | 0 | 1583 |
| ANDERSON CLAYTON CORP/FIVE PTS | C | 78 | 1 | VOC | 0 | 0 | 0 | 8 |
| ANDERSON CLAYTON CORP/SAN JOAQ | C | 79 | 1 | VOC | 0 | 0 | 0 | 5 |
| ANDERSON CLAYTON CORP/TRANQLTY | C | 80 | 1 | VOC | 0 | 0 | 0 | 12 |
| ANDERSON CLAYTON CORP/CORCORAN | C | 81 | 1 | VOC | 0 | 0 | 0 | 15 |
| GROWERS COOP | S | 88 | 1 | VOC | 0 | 0 | 1 | 15 |
| CALAVERAS MATERIALS INC | C | 89 | 1 | VOC | 92 | 83 | 95 | 76 |
| THE NESTLE COMPANY INC | N | 93 | 1 | VOC | 997 | 1820 | 1874 | 1007 |
| LOS BANOS GRAVEL GROUP, ASPHLT | N | 125 | 1 | VOC | 16 | 81 | 258 | 86 |
| CAMPBELL SOUP COMPANY | N | 127 | 1 | VOC | 84 | 58 | 52 | 61 |
| ECKERT FROZEN FOODS | N | 133 | 1 | VOC | 3 | 11 | 41 | 8 |
| ANDERSON CLAYTON CORPORATION | N | 135 | 1 | VOC | 0 | 0 | 0 | 5 |
| J.G. BOSWELL CO. (EL RICO) | C | 135 | 1 | VOC | 1 | 0 | 0 | 1 |
| GENERAL MILLS OPERATIONS, INC | N | 139 | 1 | VOC | 16 | 13 | 13 | 19 |
| WESTSIDE FARMERS COOP. GIN | C | 164 | 1 | VOC | 0 | 0 | 0 | 31 |
| CHEVRON USA INC | S | 165 | 1 | VOC | 2970 | 3003 | 3036 | 3036 |
| ANDERSON CLAYTON CORP. | N | 181 | 1 | VOC | 0 | 0 | 0 | 6 |
| FIBREBOARD CORP. | N | 209 | 1 | VOC | 41 | 34 | 16 | 45 |
| AERA ENERGY LLC | C | 219 | 1 | VOC | 268 | 297 | 324 | 298 |
| CHEVRON USA INC | C | 221 | 1 | VOC | 357 | 395 | 431 | 396 |
| CALAVERAS MATERIALS INC. | C | 233 | 1 | VOC | 148 | 410 | 483 | 300 |
| ANDERSON CLAYTON CORP/MURRAY | C | 234 | 1 | VOC | 0 | 0 | 0 | 12 |
| HANSEN BROTHERS | C | 249 | 1 | VOC | 0 | 0 | 0 | 13 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSON CLAYTON CORP/IDRIA #2 | C | 250 | 1 | VOC | 0 | 0 | 0 | 9 |
| ARCO PIPELINE FACILITY | C | 271 | 1 | VOC | 419 | 417 | 417 | 417 |
| CHEVRON USA INC | C | 277 | 1 | VOC | 2209 | 2209 | 2209 | 2209 |
| PACIFIC GAS & ELECTRIC CO. | C | 280 | 1 | VOC | 21981 | 68020 | 71348 | 53244 |
| PARAMOUNT FARMS, INC. | C | 291 | 1 | VOC | 0 | 0 | 63 | 12 |
| ANDERSON CLAYTON CORP | S | 314 | 1 | VOC | 0 | 0 | 1 | 18 |
| MID-VALLEY COTTON GROWERS INC | S | 317 | 1 | VOC | 0 | 0 | 0 | 6 |
| ANDERSON CLAYTON CORP/PLSNT VA | C | 326 | 1 | VOC | 0 | 0 | 0 | 18 |
| CHEVRON USA INC | C | 331 | 1 | VOC | 1220 | 1220 | 1221 | 1221 |
| ANDERSON CLAYTON CORP/DAIRYLAN | C | 332 | 1 | VOC | 0 | 0 | 0 | 7 |
| ANDERSON CLAYTON CORP/SUNSET | C | 333 | 1 | VOC | 0 | 0 | 0 | 5 |
| ANDERSON CLAYTON CORP/MURIT #1 | C | 334 | 1 | VOC | 0 | 0 | 0 | 7 |
| ANDERSON CLAYTON CORP/NAPA GIN | C | 335 | 1 | VOC | 0 | 0 | 0 | 5 |
| ANDERSON CLAYTON CORP/MURIT #2 | C | 336 | 1 | VOC | 0 | 0 | 0 | 7 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 373 | 1 | VOC | 9 | 11 | 13 | 11 |
| APTCO LLC | N | 390 | 1 | VOC | 1370 | 1266 | 1618 | 948 |
| LIDESTRI FOODS, INC | N | 391 | 1 | VOC | 0 | 0 | 389 | 0 |
| APTCO LLC | N | 397 | 1 | VOC | 12104 | 11748 | 9416 | 0 |
| CHEVRON USA INC | S | 410 | 1 | VOC | 5 | 7 | 11 | 15 |
| SEMI TROPIC COOP GIN | S | 426 | 1 | VOC | 1 | 0 | 1 | 28 |
| ANDERSON CLAYTON CORP/EL DORAD | C | 427 | 1 | VOC | 1 | 0 | 0 | 17 |
| ANDERSON CLAYTON CORP/KERMAN | C | 428 | 1 | VOC | 0 | 0 | 0 | 11 |
| SILGAN CONTAINERS LODI MFG CORP | N | 431 | 1 | VOC | 5103 | 3464 | 3573 | 3865 |
| MINTURN CO-OP GIN | N | 441 | 1 | VOC | 0 | 0 | 0 | 20 |
| ANDERSON CLAYTON CORP/KINGSRIV | C | 460 | 1 | VOC | 2 | 0 | 0 | 31 |
| LAWRENCE LIVERMORE NATL. LAB | N | 464 | 1 | VOC | 2 | 1 | 0 | 1 |
| SHELL CALIFORNIA PIPELINE COMPANY LLC | C | 467 | 1 | VOC | 185 | 0 | 0 | 0 |
| ANDERSON CLAYTON CORP | S | 471 | 1 | VOC | 0 | 0 | 0 | 9 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| LOS ANGELES CNTY SANITATION DIST NO.2 | N | 472 | 1 | VOC | 5953 | 6019 | 6086 | 6086 |
| ANDERSON CLAYTON CORP/DAIRYLND | C | 472 | 1 | VOC | 0 | 0 | 0 | 13 |
| MODESTO IRRIGATION DISTRICT | N | 479 | 1 | VOC | 0 | 0 | 305 | 0 |
| CALIFORNIA DAIRIES | N | 497 | 1 | VOC | 33 | 33 | 33 | 33 |
| ANDERSON CLAYTON CORP. | N | 499 | 1 | VOC | 0 | 0 | 0 | 15 |
| CANDLEWICK YARNS | C | 507 | 1 | VOC | 23 | 20 | 16 | 14 |
| CLARK BROTHERS-DERRICK GIN | C | 511 | 1 | VOC | 0 | 0 | 0 | 2 |
| DOLE PACKAGED FOODS LLC | N | 520 | 1 | VOC | 3 | 11 | 41 | 8 |
| CASTLE AIRPORT AVIATION & DEVELOP CENTER | N | 523 | 1 | VOC | 31801 | 32175 | 32549 | 32549 |
| COIT RANCH | C | 532 | 1 | VOC | 0 | 0 | 0 | 8 |
| COALINGA FARMERS CO-OP GIN | C | 537 | 1 | VOC | 0 | 0 | 0 | 8 |
| APTCO LLC | N | 540 | 1 | VOC | 5000 | 5000 | 5000 | 5000 |
| DART CONTAINER CORPORATION | C | 555 | 1 | VOC | 30481 | 26626 | 14213 | 50680 |
| BRITZ AG FINANCE CO., INC. | C | 557 | 1 | VOC | 0 | 0 | 0 | 8 |
| CORCORAN IRRIGATION DISTRICT | C | 560 | 1 | VOC | 154 | 163 | 159 | 90 |
| UNIVERSITY ENERGY SERVICES | S | 561 | 1 | VOC | 63 | 54 | 59 | 61 |
| DIAMOND FOODS INCORPORATED | N | 572 | 1 | VOC | 126 | 45 | 138 | 120 |
| VALERO LP | N | 578 | 1 | VOC | 2372 | 2372 | 2372 | 2371 |
| BRITZ INCORPORATED | C | 586 | 1 | VOC | 0 | 0 | 0 | 21 |
| WESTSIDE FARMERS COOP GIN #6 | C | 592 | 1 | VOC | 6 | 0 | 0 | 44 |
| MODESTO TALLOW CO INC | N | 599 | 1 | VOC | 184 | 165 | 202 | 196 |
| OAKWOOD LAKE RESORT | N | 601 | 1 | VOC | 0 | 72 | 115 | 0 |
| WESTERN COTTON SERVICES | S | 606 | 1 | VOC | 0 | 0 | 0 | 9 |
| TURLOCK IRRIGATION DISTRICT | C | 607 | 1 | VOC | 297 | 297 | 297 | 297 |
| CHEVRON U S A INC | S | 629 | 1 | VOC | 48 | 42 | 43 | 41 |
| LINN OPERATING, INC | S | 645 | 1 | VOC | 128 | 130 | 131 | 131 |
| DIAMOND FOODS INCORPORATED | N | 645 | 1 | VOC | 1695 | 1419 | 1451 | 783 |
| WESTLAKE FARMS INC | C | 645 | 1 | VOC | 0 | 0 | 0 | 18 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 647 | 1 | VOC | 235 | 699 | 540 | 95 |
| HOLMES WESTERN OIL CORPORATION | N | 652 | 1 | VOC | 324 | 326 | 311 | 301 |
| HOLMES WESTERN OIL CORPORATION | N | 653 | 1 | VOC | 30 | 30 | 25 | 24 |
| CHEVRON USA INC (REFINERY) | S | 657 | 1 | VOC | 35011 | 35399 | 35788 | 35788 |
| UNITED STATES GYPSUM COMPANY | N | 661 | 1 | VOC | 15000 | 16335 | 16334 | 12331 |
| APTCO LLC | C | 663 | 1 | VOC | 0 | 147 | 788 | 148 |
| AERA ENERGY LLC | S | 663 | 1 | VOC | 544 | 495 | 483 | 454 |
| APTCO LLC | C | 664 | 1 | VOC | 0 | 149 | 796 | 150 |
| APTCO LLC | C | 665 | 1 | VOC | 0 | 141 | 758 | 143 |
| SOUTHERN CALIF GAS CO | S | 671 | 1 | VOC | 570 | 576 | 583 | 583 |
| CHEVRON USA PRODUCTION INC | S | 674 | 1 | VOC | 5779 | 5851 | 5903 | 5902 |
| AERA ENERGY LLC | C | 679 | 1 | VOC | 11014 | 11468 | 11508 | 11211 |
| CALIFORNIA DAIRIES, INC. | C | 683 | 1 | VOC | 0 | 0 | 454 | 0 |
| APTCO LLC | C | 684 | 1 | VOC | 0 | 138 | 241 | 139 |
| CLEAN HARBORS BUTTONWILLOW, LLC | S | 685 | 1 | VOC | 31195 | 31541 | 31888 | 31888 |
| H. J. HEINZ COMPANY | N | 694 | 1 | VOC | 0 | 0 | 701 | 0 |
| ANDERSON CLAYTON-MARICOPA GIN | S | 697 | 1 | VOC | 0 | 0 | 0 | 25 |
| ANDERSON CLAYTON CORP/BUTTE | C | 699 | 1 | VOC | 0 | 0 | 0 | 19 |
| CHEVRON USA INC | S | 703 | 1 | VOC | 2084 | 2107 | 2130 | 2130 |
| AVENAL POWER CENTER, LLC | N | 724 | 1 | VOC | 0 | 0 | 241 | 0 |
| AVENAL POWER CENTER, LLC | N | 725 | 1 | VOC | 0 | 0 | 709 | 0 |
| ANDERSON CLAYTON CORPORATION | N | 737 | 1 | VOC | 1 | 0 | 0 | 16 |
| MODESTO IRRIGATION DISTRICT | N | 739 | 1 | VOC | 0 | 0 | 27 | 0 |
| LATON CO-OP GIN, INC. | C | 746 | 1 | VOC | 0 | 0 | 0 | 8 |
| CANTUA COOPERATIVE GIN, INC. | C | 760 | 1 | VOC | 0 | 0 | 0 | 38 |
| STOCKTON EAST WATER DISTRICT | N | 763 | 1 | VOC | 1627 | 2271 | 2299 | 2059 |
| TRC OPERATION COMPANY, INC. | S | 767 | 1 | VOC | 394 | 399 | 403 | 403 |
| PACIFIC PIPELINE SYSTEM, LLC | S | 776 | 1 | VOC | 28 | 67 | 77 | 34 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| THE DOW CHEMICAL COMPANY | N | 799 | 1 | VOC | 218 | 212 | 236 | 224 |
| ANDERSON CLAYTON CORP/BURREL | C | 806 | 1 | VOC | 14 | 0 | 0 | 42 |
| UNITED STATES GYPSUM COMPANY | C | 818 | 1 | VOC | 0 | 0 | 0 | 40 |
| HOLMES WESTERN OIL CORPORATION | C | 823 | 1 | VOC | 0 | 0 | 0 | 10 |
| PHOENIX BIO INDUSTRIES LLC | C | 824 | 1 | VOC | 500 | 500 | 500 | 500 |
| DIAMOND FOODS INCORPORATED | N | 828 | 1 | VOC | 1495 | 671 | 1063 | 1914 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 829 | 1 | VOC | 57 | 60 | 72 | 58 |
| EAGLE VALLEY GINNING LLC | N | 847 | 1 | VOC | 0 | 0 | 0 | 23 |
| SEALED AIR CORPORATION | C | 851 | 1 | VOC | 19000 | 19000 | 19000 | 19000 |
| APTCO LLC | N | 854 | 1 | VOC | 3141 | 4397 | 2894 | 0 |
| CONAGRA CONSUMER FROZEN FOODS | N | 858 | 1 | VOC | 5 | 0 | 0 | 8 |
| ANDERSON CLAYTON CORP/HANFORD | C | 863 | 1 | VOC | 0 | 0 | 0 | 36 |
| PACIFIC GAS & ELECTRIC CO. | N | 868 | 1 | VOC | 926 | 5826 | 5035 | 615 |
| AERA ENERGY LLC | S | 868 | 1 | VOC | 724 | 735 | 729 | 672 |
| BRITZ GIN PARTNERSHIP II | C | 871 | 1 | VOC | 0 | 0 | 0 | 32 |
| APTCO LLC | S | 872 | 1 | VOC | 9 | 8 | 9 | 9 |
| ASV WINES, INC. | N | 892 | 1 | VOC | 0 | 0 | 189 | 0 |
| AVENAL POWER CENTER, LLC | C | 897 | 1 | VOC | 45 | 45 | 45 | 45 |
| VARCO PRUDEN BUILDINGS, INC. | N | 898 | 1 | VOC | 5404 | 6473 | 10921 | 8632 |
| AVENAL POWER CENTER, LLC | C | 898 | 1 | VOC | 5480 | 6496 | 4696 | 6616 |
| ANDERSON CLAYTON CORP | C | 903 | 1 | VOC | 0 | 0 | 0 | 4 |
| CALIFORNIA SPRAY DRY CO | N | 904 | 1 | VOC | 40 | 53 | 55 | 49 |
| PANOCHE GINNING CO | C | 904 | 1 | VOC | 0 | 0 | 0 | 49 |
| TEXACO EXPLOR & PROD INC | S | 904 | 1 | VOC | 492 | 551 | 403 | 459 |
| OLAM | N | 920 | 1 | VOC | 0 | 0 | 3 | 0 |
| CALPINE ENERGY SERVICES, L.P. | N | 927 | 1 | VOC | 10503 | 10981 | 11573 | 11536 |
| MALIBU BOATS LLC | N | 942 | 1 | VOC | 13753 | 22879 | 14803 | 14093 |
| MADERA CO-OP GIN, INC. | C | 943 | 1 | VOC | 0 | 0 | 0 | 11 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| ANDERSEN RACK SYSTEMS, INC | N | 950 | 1 | VOC | 7335 | 7335 | 7335 | 7335 |
| HERSHEY CHOCOLATE & CONF. CORP | N | 952 | 1 | VOC | 5 | 5 | 6 | 6 |
| FARMERS FIREBAUGH GINNING CO. | C | 956 | 1 | VOC | 16 | 0 | 0 | 47 |
| ANDERSON CLAYTON CORP/IDRIA #1 | C | 959 | 1 | VOC | 0 | 0 | 0 | 76 |
| CHEVRON USA INC | C | 966 | 1 | VOC | 6 | 6 | 6 | 6 |
| 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 |
| KERMAN CO-OP GIN & WAREHOUSE 1 | C | 1002 | 1 | VOC | 0 | 0 | 0 | 13 |
| TKV CONTAINERS, INC. | C | 1015 | 1 | VOC | 0 | 83 | 83 | 0 |
| ARDAGH GLASS INC | N | 1019 | 1 | VOC | 0 | 0 | 0 | 135 |
| LOS GATOS TOMATO PRODUCTS | C | 1021 | 1 | VOC | 0 | 3 | 0 | 0 |
| WESTSIDE FARMERS COOP #2 & #3 | C | 1038 | 1 | VOC | 5 | 0 | 0 | 57 |
| ENRON OIL & GAS COMPANY | S | 1044 | 1 | VOC | 5516 | 5576 | 5638 | 5638 |
| LAND O' LAKES, INC. | C | 1044 | 1 | VOC | 258 | 0 | 0 | 683 |
| ANDERSON CLAYTON CORP | S | 1045 | 1 | VOC | 0 | 0 | 0 | 22 |
| NAS LEMOORE | C | 1046 | 1 | VOC | 1607 | 453 | 1066 | 59 |
| CHEVRON USA INC | S | 1049 | 1 | VOC | 3461 | 0 | 0 | 0 |
| MARTIN ANDERSON | C | 1051 | 1 | VOC | 8699 | 12348 | 6585 | 90 |
| AERA ENERGY LLC | S | 1058 | 1 | VOC | 8179 | 8280 | 8354 | 8353 |
| PACTIV CORPORATION | N | 1062 | 1 | VOC | 27192 | 27192 | 27192 | 27192 |
| CITY OF TULARE | C | 1063 | 1 | VOC | 0 | 107 | 678 | 109 |
| LOS ANGELES CNTY SANITATION DIST NO.2 | N | 1068 | 1 | VOC | 269 | 1452 | 271 | 426 |
| E & J GALLO WINERY | C | 1071 | 1 | VOC | 23 | 22 | 21 | 20 |
| TESORO LOGISTICS OPERATIONS LLC | N | 1078 | 1 | VOC | 1539 | 1539 | 1539 | 1537 |
| CALPINE CORPORATION | C | 1080 | 1 | VOC | 2235 | 2037 | 1988 | 2251 |
| ARDAGH GLASS INC | C | 1082 | 1 | VOC | 0 | 0 | 0 | 7 |
| CANANDAIGUA WINE COMPANY INC | C | 1085 | 1 | VOC | 21 | 17 | 30 | 15 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| H. J. HEINZ COMPANY | N | 1085 | 1 | VOC | 52 | 53 | 45 | 23 |
| OILDALE ENERGY LLC | S | 1096 | 1 | VOC | 100 | 100 | 100 | 100 |
| MODESTO IRRIGATION DISTRICT | C | 1109 | 1 | VOC | 4342 | 4331 | 4373 | 4371 |
| SPRECKELS SUGAR COMPANY | C | 1112 | 1 | VOC | 0 | 767 | 1032 | 454 |
| TURLOCK IRRIGATION DISTRICT | C | 1116 | 1 | VOC | 1080 | 1080 | 1079 | 1079 |
| ASV WINES | C | 1120 | 1 | VOC | 0 | 20 | 551 | 21 |
| 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 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1125 | 1 | VOC | 179 | 179 | 179 | 179 |
| AERA ENERGY LLC | S | 1138 | 1 | VOC | 162 | 233 | 2 | 25 |
| AERA ENERGY LLC | S | 1142 | 1 | VOC | 39631 | 39976 | 40411 | 40489 |
| CHEVRON USA, INC. | C | 1147 | 1 | VOC | 77 | 79 | 54 | 74 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1153 | 1 | VOC | 885 | 885 | 885 | 885 |
| AERA ENERGY LLC | S | 1162 | 1 | VOC | 713 | 719 | 730 | 730 |
| EQUILON ENTERPRISES LLC | N | 1167 | 1 | VOC | 23 | 3 | 20 | 19 |
| ANDERSON CLAYTON CORP | S | 1171 | 1 | VOC | 3 | 0 | 0 | 24 |
| SC JOHNSON HOME STORAGE INC | C | 1173 | 1 | VOC | 1055 | 1415 | 1403 | 1447 |
| 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 |
| CALIFORNIA RESOURCES PRODUCTION CORP | N | 1193 | 1 | VOC | 1604 | 1604 | 1604 | 1604 |
| PILKINGTON NORTH AMERICA, INC | N | 1198 | 1 | VOC | 79 | 78 | 99 | 93 |
| BERRY PETROLEUM COMPANY | N | 1202 | 1 | VOC | 66 | 66 | 66 | 66 |
| SILGAN CONTAINERS MANUFAC CORP | C | 1208 | 1 | VOC | 4279 | 3921 | 3042 | 3166 |
| FRESNO/CLOVIS REGIONAL WWTP | C | 1211 | 1 | VOC | 6 | 6 | 5 | 5 |
| VINTAGE PRODUCTION CALIFORNIA LLC | N | 1213 | 1 | VOC | 163 | 163 | 163 | 163 |
| E & J GALLO WINERY | C | 1229 | 1 | VOC | 8075 | 8075 | 8041 | 8040 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| DEL MONTE FOODS MODESTO PLANT 1 | N | 1238 | 1 | VOC | 82 | 71 | 116 | 28 |
| TAUBER OIL COMPANY | N | 1239 | 1 | VOC | 234 | 203 | 211 | 182 |
| PACTIV, LLC | N | 1241 | 1 | VOC | 23529 | 14812 | 15264 | 14520 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1241 | 1 | VOC | 892 | 0 | 1736 | 2684 |
| MACPHERSON OIL COMPANY | N | 1252 | 1 | VOC | 1536 | 1536 | 1536 | 1043 |
| OLDUVAI GORGE, LLC | N | 1253 | 1 | VOC | 12553 | 995 | 3976 | 0 |
| MACPHERSON OIL COMPANY | N | 1254 | 1 | VOC | 0 | 0 | 0 | 493 |
| HOLMES WESTERN OIL CORPORATION | N | 1259 | 1 | VOC | 1209 | 1208 | 1208 | 1208 |
| OLDUVAI GORGE, LLC | N | 1260 | 1 | VOC | 1589 | 287 | 2514 | 1004 |
| ANDERSON CLAYTON CORP | S | 1262 | 1 | VOC | 1 | 0 | 0 | 19 |
| ANDERSON CLAYTON CORP | S | 1263 | 1 | VOC | 9 | 0 | 0 | 24 |
| FREEPORT-MCMORAN OIL & GAS, LLC | C | 1272 | 1 | VOC | 2299 | 2271 | 2242 | 2243 |
| CONOCOPHILLIPS COMPANY | N | 1276 | 1 | VOC | 1445 | 766 | 67 | 0 |
| CHEMICAL WASTE MANAGEMENT, INC | N | 1284 | 1 | VOC | 5785 | 0 | 0 | 10355 |
| AERA ENERGY LLC | S | 1476 | 1 | VOC | 190 | 0 | 0 | 54 |
| AERA ENERGY LLC | S | 1477 | 1 | VOC | 329 | 0 | 0 | 93 |
| FOSTER FOOD PRODUCTS | S | 1501 | 1 | VOC | 432 | 437 | 442 | 442 |
| FOSTER FOOD PRODUCTS | S | 1502 | 1 | VOC | 68 | 63 | 58 | 58 |
| AERA ENERGY LLC | S | 1587 | 1 | VOC | 26 | 28 | 26 | 26 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1593 | 1 | VOC | 3128 | 3163 | 3197 | 3197 |
| CALPINE CORPORATION | S | 1666 | 1 | VOC | 0 | 0 | 0 | 9 |
| AERA ENERGY LLC | S | 1681 | 1 | VOC | 10 | 10 | 10 | 10 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1703 | 1 | VOC | 394 | 1333 | 1998 | 1038 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1706 | 1 | VOC | 2314 | 5505 | 6449 | 2760 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1708 | 1 | VOC | 1664 | 3970 | 4474 | 1890 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1710 | 1 | VOC | 1655 | 4021 | 5103 | 2114 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1713 | 1 | VOC | 1093 | 2620 | 3078 | 1181 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1714 | 1 | VOC | 1290 | 3038 | 3527 | 1472 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1717 | 1 | VOC | 1239 | 3804 | 4274 | 1639 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1719 | 1 | VOC | 928 | 1948 | 2037 | 1118 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1722 | 1 | VOC | 1132 | 2723 | 3230 | 1359 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1723 | 1 | VOC | 1723 | 4185 | 4934 | 2003 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1725 | 1 | VOC | 1169 | 2764 | 3251 | 1348 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1726 | 1 | VOC | 1603 | 3911 | 4662 | 1932 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1727 | 1 | VOC | 1061 | 2580 | 3064 | 1240 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1728 | 1 | VOC | 1692 | 4025 | 4596 | 2098 |
| SOUTHERN CALIF GAS CO | S | 1739 | 1 | VOC | 1322 | 1337 | 1354 | 1352 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1754 | 1 | VOC | 0 | 653 | 619 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1773 | 1 | VOC | 379 | 0 | 0 | 468 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1775 | 1 | VOC | 604 | 591 | 0 | 577 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1777 | 1 | VOC | 419 | 454 | 0 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1778 | 1 | VOC | 0 | 1021 | 0 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1779 | 1 | VOC | 0 | 656 | 559 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1780 | 1 | VOC | 0 | 1678 | 0 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1782 | 1 | VOC | 454 | 464 | 398 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 1783 | 1 | VOC | 587 | 2 | 35 | 4 |
| CHEVRON USA INC | S | 1793 | 1 | VOC | 1420 | 1443 | 1335 | 1334 |
| VISALIA WASTEWATER TREATMENT | S | 1837 | 1 | VOC | 5067 | 2634 | 4107 | 4614 |
| CHEVRON USA INC LOST HILLS GP | S | 1847 | 1 | VOC | 2764 | 2793 | 2825 | 2825 |
| AERA ENERGY LLC | S | 1874 | 1 | VOC | 40 | 10 | 1 | 22 |
| CHEVRON USA INC | S | 1878 | 1 | VOC | 230 | 136 | 143 | 82 |
| AERA ENERGY LLC | S | 1880 | 1 | VOC | 360 | 591 | 251 | 0 |
| CHEVRON USA INC | S | 1912 | 1 | VOC | 225 | 238 | 250 | 250 |
| MONTEREY RESOURCES, INC. | S | 1983 | 1 | VOC | 708 | 720 | 557 | 640 |
| APTCO LLC | S | 1990 | 1 | VOC | 1306 | 1709 | 1829 | 1157 |
| KERN LAKE COOP GIN | S | 2074 | 1 | VOC | 0 | 0 | 0 | 134 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 2107 | 1 | VOC | 651 | 638 | 666 | 666 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2120 | 1 | VOC | 55 | 794 | 1411 | 55 |
| AERA ENERGY LLC | S | 2136 | 1 | VOC | 3772 | 3393 | 3836 | 3913 |
| LOS ANGELES COUNTY SANITATION DISTRICT 2 | S | 2147 | 1 | VOC | 12500 | 12500 | 12500 | 12500 |
| CRIMSON RESOURCE MANAGEMENT | S | 2161 | 1 | VOC | 54 | 49 | 31 | 63 |
| AERA ENERGY LLC | S | 2237 | 1 | VOC | 5394 | 5463 | 5539 | 5539 |
| TRC CYPRESS GROUP LLC | S | 2292 | 1 | VOC | 1412 | 1412 | 1412 | 1412 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2301 | 1 | VOC | 55 | 1046 | 1416 | 172 |
| SHELL PIPELINE COMPANY LP | S | 2303 | 1 | VOC | 0 | 658 | 431 | 0 |
| AERA ENERGY LLC | S | 2361 | 1 | VOC | 27 | 4 | 0 | 11 |
| CHEVRON USA INC | S | 2373 | 1 | VOC | 11698 | 11110 | 8970 | 9796 |
| CHEVRON USA INC | S | 2430 | 1 | VOC | 2459 | 2142 | 1336 | 1543 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2488 | 1 | VOC | 9 | 4650 | 5387 | 2519 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2490 | 1 | VOC | 0 | 2806 | 3570 | 1534 |
| M CARATAN INC | S | 2516 | 1 | VOC | 0 | 0 | 26 | 6 |
| FARMERS COOPERATIVE GIN INC | S | 2533 | 1 | VOC | 0 | 0 | 0 | 39 |
| ELBOW ENTERPRISES INC | S | 2535 | 1 | VOC | 0 | 0 | 0 | 70 |
| UNITED STATES GYPSUM COMPANY | S | 2543 | 1 | VOC | 0 | 0 | 0 | 17 |
| MALIBU BOATS LLC | S | 2555 | 1 | VOC | 5000 | 5000 | 5000 | 5000 |
| 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 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2623 | 1 | VOC | 0 | 895 | 988 | 68 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2625 | 1 | VOC | 22 | 110 | 96 | 68 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 2627 | 1 | VOC | 52 | 52 | 52 | 52 |
| BERRY PETROLEUM COMPANY, LLC | S | 2642 | 1 | VOC | 284 | 0 | 0 | 0 |
| CHEMICAL WASTE MANAGEMENT, INC. | S | 2645 | 1 | VOC | 1513 | 2602 | 2033 | 2038 |
| KAWEAH DELTA DISTRICT HOSPITAL | S | 2656 | 1 | VOC | 460 | 738 | 828 | 938 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 2674 | 1 | VOC | 1848 | 1848 | 1848 | 1848 |
| CHEVRON USA INC | S | 2675 | 1 | VOC | 1835 | 1835 | 1835 | 1835 |
| TULE RIVER CO-OP GIN INC | S | 2682 | 1 | VOC | 0 | 0 | 0 | 13 |
| TULARE CITY WASTEWATER PLANT | S | 2697 | 1 | VOC | 60 | 60 | 60 | 87 |
| CHEVRON USA INC | S | 2708 | 1 | VOC | 1605 | 1634 | 1664 | 1664 |
| AERA ENERGY LLC | S | 2725 | 1 | VOC | 65082 | 65830 | 66578 | 66578 |
| E&B NATURAL RESOURCES MGMT | S | 2773 | 1 | VOC | 7 | 12 | 5 | 9 |
| AERA ENERGY LLC | S | 2774 | 1 | VOC | 8176 | 5745 | 5185 | 3973 |
| AERA ENERGY LLC | S | 2782 | 1 | VOC | 44 | 43 | 42 | 46 |
| UNITED STATES GYPSUM COMPANY | S | 2816 | 1 | VOC | 20000 | 20000 | 20000 | 20000 |
| BAR 20 PARTNERS LTD | S | 2915 | 1 | VOC | 445 | 419 | 50 | 45 |
| BUTTONWILLOW GINNING CO | S | 2937 | 1 | VOC | 0 | 0 | 0 | 40 |
| AERA ENERGY LLC | S | 2939 | 1 | VOC | 6264 | 3536 | 3647 | 6483 |
| AVENAL POWER CENTER, LLC | S | 2951 | 1 | VOC | 12500 | 12500 | 12500 | 12500 |
| BAKERSFIELD CITY WOOD SITE | S | 2969 | 1 | VOC | 46 | 59 | 61 | 52 |
| AVENAL POWER CENTER, LLC | S | 2988 | 1 | VOC | 0 | 69 | 0 | 0 |
| MID-VALLEY COTTON GROWERS INC | S | 2989 | 1 | VOC | 0 | 0 | 0 | 16 |
| INTERNATIONAL PAPER COMPANY | S | 2995 | 1 | VOC | 875 | 875 | 875 | 875 |
| SOUTH KERN INDUSTRIAL CENTER LLC | S | 3006 | 1 | VOC | 0 | 190 | 382 | 0 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3053 | 1 | VOC | 137 | 139 | 140 | 140 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3077 | 1 | VOC | 121 | 123 | 124 | 124 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3078 | 1 | VOC | 81 | 82 | 83 | 83 |
| AERA ENERGY LLC | S | 3110 | 1 | VOC | 21914 | 22310 | 22708 | 22708 |
| CALPINE CORPORATION | S | 3116 | 1 | VOC | 1440 | 1546 | 1621 | 1621 |
| CILION, INC. | S | 3132 | 1 | VOC | 13000 | 13000 | 13000 | 13000 |
| CHEVRON USA INC | S | 3148 | 1 | VOC | 181 | 163 | 274 | 216 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3166 | 1 | VOC | 842 | 2545 | 2372 | 659 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3169 | 1 | VOC | 193 | 2665 | 3573 | 520 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| SAN JOAQUIN FACILITIES MGMT | S | 3210 | 1 | VOC | 33767 | 28482 | 32565 | 37850 |
| AERA ENERGY LLC | S | 3223 | 1 | VOC | 16 | 16 | 16 | 17 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3225 | 1 | VOC | 648 | 1755 | 1926 | 805 |
| VANDERHAM WEST | S | 3235 | 1 | VOC | 240 | 240 | 240 | 240 |
| CALPINE ENERGY SERVICES, L.P. | S | 3261 | 1 | VOC | 4454 | 4972 | 3890 | 4155 |
| SHAFTER-WASCO GINNING COMPANY | S | 3268 | 1 | VOC | 0 | 0 | 0 | 13 |
| AERA ENERGY LLC | S | 3272 | 1 | VOC | 2642 | 2701 | 2759 | 2759 |
| CALPINE ENERGY SERVICES, L.P. | S | 3283 | 1 | VOC | 0 | 150 | 171 | 0 |
| LAND O' LAKES, INC. | S | 3284 | 1 | VOC | 527 | 893 | 642 | 0 |
| CALPINE ENERGY SERVICES, L.P. | S | 3292 | 1 | VOC | 4804 | 6146 | 6632 | 3338 |
| NUSTAR ENERGY LP | S | 3299 | 1 | VOC | 1000 | 1000 | 1000 | 1000 |
| CALPINE ENERGY SERVICES, L.P. | S | 3300 | 1 | VOC | 4636 | 4705 | 4774 | 4771 |
| HYDROGEN ENERGY CALIFORNIA, LLC | S | 3305 | 1 | VOC | 14625 | 14625 | 14625 | 14625 |
| AERA ENERGY LLC | S | 3308 | 1 | VOC | 2266 | 1066 | 1090 | 2320 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3327 | 1 | VOC | 24 | 24 | 24 | 24 |
| BREA OIL COMPANY, INC. | S | 3355 | 1 | VOC | 149 | 391 | 193 | 112 |
| PLAINS LPG SERVICES LP | S | 3367 | 1 | VOC | 356 | 2023 | 2767 | 1433 |
| CALPINE ENERGY SERVICES, L.P. | S | 3368 | 1 | VOC | 1500 | 1500 | 1500 | 1500 |
| ELEMENT MARKETS LLC | S | 3370 | 1 | VOC | 5 | 4 | 4 | 4 |
| CILION INC. | S | 3373 | 1 | VOC | 2978 | 2979 | 2979 | 2978 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3379 | 1 | VOC | 386 | 6020 | 8655 | 1509 |
| CRIMSON RESOURCE MANAGEMENT | S | 3386 | 1 | VOC | 67 | 138 | 142 | 94 |
| CRIMSON RESOURCE MANAGEMENT | S | 3387 | 1 | VOC | 23009 | 20107 | 19072 | 13925 |
| CHEVRON USA INC | S | 3400 | 1 | VOC | 1903 | 2425 | 2836 | 2947 |
| CHEVRON U S A INC | S | 3404 | 1 | VOC | 171 | 202 | 232 | 232 |
| 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 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| FRITO-LAY, INC. | S | 3430 | 1 | VOC | 76 | 96 | 74 | 72 |
| SENECA RESOURCES | S | 3440 | 1 | VOC | 0 | 0 | 0 | 339 |
| CRIMSON RESOURCE MANAGEMENT | S | 3441 | 1 | VOC | 13 | 4 | 13 | 22 |
| CHEVRON USA INC | S | 3449 | 1 | VOC | 578 | 601 | 626 | 626 |
| AERA ENERGY LLC | S | 3451 | 1 | VOC | 20480 | 438 | 2608 | 1572 |
| ARDAGH GLASS INC | S | 3498 | 1 | VOC | 0 | 0 | 0 | 34 |
| 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 |
| CHEVRON USA INC | S | 3518 | 1 | VOC | 1780 | 1780 | 1780 | 1780 |
| CHEVRON USA PRODUCTION INC | S | 3533 | 1 | VOC | 6 | 4 | 9 | 8 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3536 | 1 | VOC | 44 | 2319 | 3256 | 356 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3538 | 1 | VOC | 0 | 2333 | 3325 | 626 |
| CHEVRON USA INC | S | 3544 | 1 | VOC | 346 | 378 | 292 | 308 |
| SOUTH VALLEY GINS INC | S | 3554 | 1 | VOC | 0 | 0 | 0 | 10 |
| CALPINE ENERGY SERVICES, L.P. | S | 3555 | 1 | VOC | 5000 | 5000 | 5000 | 5000 |
| HYDROGEN ENERGY CALIFORNIA, LLC | S | 3557 | 1 | VOC | 11437 | 11438 | 11438 | 11437 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 3574 | 1 | VOC | 145 | 2915 | 4020 | 260 |
| CHEVRON USA INC | S | 3604 | 1 | VOC | 223 | 345 | 388 | 256 |
| HYDROGEN ENERGY CALIFORNIA, LLC | S | 3605 | 1 | VOC | 7937 | 7938 | 7938 | 7937 |
| LAND O' LAKES, INC. | S | 3625 | 1 | VOC | 57 | 43 | 59 | 55 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3627 | 1 | VOC | 3730 | 3448 | 3015 | 3510 |
| AGRI-CEL INC | S | 3631 | 1 | VOC | 21495 | 26078 | 24122 | 2902 |
| BERRY PETROLEUM COMPANY, LLC | S | 3649 | 1 | VOC | 1427 | 6355 | 4508 | 738 |
| BERRY PETROLEUM COMPANY, LLC | S | 3653 | 1 | VOC | 1307 | 1307 | 1307 | 1308 |
| ALON BAKERSFIELD REFINING | S | 3663 | 1 | VOC | 38947 | 38947 | 38947 | 38948 |
| AERA ENERGY LLC | S | 3687 | 1 | VOC | 17245 | 18573 | 17870 | 17768 |
| KERN OIL & REFINING CO. | S | 3693 | 1 | VOC | 952 | 966 | 951 | 1099 |
| CHEVRON USA INC | S | 3701 | 1 | VOC | 25142 | 25559 | 25976 | 25976 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| DTE STOCKTON, LLC | S | 3715 | 1 | VOC | 1450 | 1450 | 1450 | 1450 |
| CHEVRON USA INC | S | 3722 | 1 | VOC | 127895 | 129399 | 130902 | 130902 |
| HUNTER EDISON OIL DEVELOPMENT | S | 3723 | 1 | VOC | 2186 | 2256 | 2234 | 2282 |
| BRONCO WINE COMPANY | S | 3732 | 1 | VOC | 125 | 125 | 125 | 125 |
| NORTHERN CALIFORNIA POWER AGENCY | S | 3744 | 1 | VOC | 240 | 103 | 0 | 0 |
| E&B NATURAL RESOURCES MGMT | S | 3791 | 1 | VOC | 7500 | 7500 | 7500 | 7500 |
| PLAINS LPG SERVICES LP | S | 3793 | 1 | VOC | 583 | 583 | 583 | 583 |
| SAN JOAQUIN FACILITIES MGMT | S | 3801 | 1 | VOC | 228 | 225 | 223 | 223 |
| CHEVRON USA INC | S | 3811 | 1 | VOC | 3947 | 4032 | 4121 | 4125 |
| PACTIV, LLC | S | 3862 | 1 | VOC | 1513 | 1972 | 1571 | 1510 |
| CHEVRON USA INC | S | 3869 | 1 | VOC | 40200 | 41125 | 42051 | 42047 |
| O'NEILL VINTNERS & DISTILLERS | S | 3886 | 1 | VOC | 404 | 404 | 404 | 404 |
| CHEVRON USA INC | S | 3905 | 1 | VOC | 5284 | 5380 | 5476 | 5475 |
| AERA ENERGY LLC | S | 3919 | 1 | VOC | 178503 | 181091 | 183734 | 183787 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3947 | 1 | VOC | 83 | 2429 | 3196 | 464 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 3951 | 1 | VOC | 75129 | 76311 | 77494 | 77493 |
| BERRY PETROLEUM COMPANY, LLC | S | 3958 | 1 | VOC | 9428 | 9428 | 9428 | 9428 |
| BERRY PETROLEUM COMPANY, LLC | S | 4000 | 1 | VOC | 8 | 1433 | 8 | 8 |
| CHEVRON USA INC | S | 4004 | 1 | VOC | 460 | 466 | 471 | 470 |
| HOLMES WESTERN OIL CORPORATION | S | 4032 | 1 | VOC | 216 | 562 | 641 | 200 |
| BRUCE CARTER INDUSTRIES, INC. | S | 4038 | 1 | VOC | 10031 | 12170 | 11257 | 1354 |
| VECTOR ENVIRONMENTAL, INC. | S | 4039 | 1 | VOC | 40127 | 48678 | 45027 | 5416 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4049 | 1 | VOC | 32 | 796 | 1783 | 481 |
| HECK CELLARS | S | 4053 | 1 | VOC | 9715 | 9715 | 9715 | 9715 |
| BREITBURN OPERATING LP | S | 4059 | 1 | VOC | 15 | 19 | 16 | 13 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4062 | 1 | VOC | 26 | 178 | 115 | 66 |
| AERA ENERGY LLC | S | 4063 | 1 | VOC | 157 | 140 | 120 | 181 |
| AERA ENERGY LLC | S | 4064 | 1 | VOC | 98 | 154 | 184 | 160 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| CHEVRON USA INC | S | 4066 | 1 | VOC | 1281 | 1477 | 1673 | 1673 |
| CHEVRON USA INC | S | 4068 | 1 | VOC | 522 | 567 | 615 | 615 |
| G3 ENTERPRISES | S | 4076 | 1 | VOC | 183 | 183 | 182 | 182 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4080 | 1 | VOC | 0 | 255 | 0 | 0 |
| FREEPORT-MC MORAN OIL & GAS | S | 4106 | 1 | VOC | 821 | 821 | 822 | 822 |
| FREEPORT-MC MORAN OIL & GAS | S | 4107 | 1 | VOC | 840 | 840 | 840 | 840 |
| CHEVRON USA INC | S | 4110 | 1 | VOC | 90 | 93 | 83 | 66 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4140 | 1 | VOC | 19 | 2065 | 2847 | 12 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4145 | 1 | VOC | 330 | 398 | 459 | 413 |
| THE WINE GROUP LLC | S | 4147 | 1 | VOC | 250 | 250 | 249 | 249 |
| SFPP, L.P. | S | 4188 | 1 | VOC | 2374 | 2374 | 2372 | 2372 |
| BAKERSFIELD CRUDE TERMINAL, LLC | S | 4189 | 1 | VOC | 3821 | 3819 | 9800 | 5042 |
| BAKERSFIELD CRUDE TERMINAL, LLC | S | 4190 | 1 | VOC | 877 | 878 | 30 | 0 |
| BAKERSFIELD CRUDE TERMINAL, LLC | S | 4191 | 1 | VOC | 8302 | 8303 | 3170 | 7958 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4196 | 1 | VOC | 74 | 74 | 74 | 74 |
| CHEVRON USA INC | S | 4198 | 1 | VOC | 37461 | 38412 | 39324 | 39358 |
| BERRY PETROLEUM COMPANY, LLC | S | 4206 | 1 | VOC | 9000 | 9000 | 3744 | 8656 |
| BERRY PETROLEUM COMPANY, LLC | S | 4207 | 1 | VOC | 0 | 0 | 5256 | 344 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4211 | 1 | VOC | 10584 | 10957 | 14277 | 13713 |
| SHELL OIL PRODUCTS US | S | 4223 | 1 | VOC | 0 | 20 | 3 | 3 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4228 | 1 | VOC | 443 | 456 | 316 | 463 |
| MIDWAY PEAKING LLC | S | 4233 | 1 | VOC | 0 | 0 | 0 | 10 |
| CRESTWOOD WEST COAST LLC | S | 4237 | 1 | VOC | 7 | 22 | 14 | 4 |
| CRESTWOOD WEST COAST LLC | S | 4239 | 1 | VOC | 197 | 24 | 0 | 1 |
| SHELL OIL PRODUCTS US | S | 4251 | 1 | VOC | 431 | 460 | 493 | 492 |
| KERN OIL & REFINING CO. | S | 4254 | 1 | VOC | 2106 | 2106 | 2106 | 2106 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4256 | 1 | VOC | 87 | 19 | 0 | 4 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4258 | 1 | VOC | 0 | 1513 | 676 | 0 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| E & J GALLO WINERY | S | 4260 | 1 | VOC | 2125 | 2124 | 2085 | 1965 |
| CRESTWOOD WEST COAST LLC | S | 4293 | 1 | VOC | 1079 | 1108 | 1139 | 1137 |
| KERN OIL & REFINING CO. | S | 4295 | 1 | VOC | 126 | 126 | 126 | 126 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4297 | 1 | VOC | 0 | 2124 | 2849 | 0 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4302 | 1 | VOC | 10500 | 10500 | 10500 | 10500 |
| CHEVRON U S A INC | S | 4304 | 1 | VOC | 226 | 264 | 267 | 320 |
| MESA VERDE TRADING CO., INC | S | 4307 | 1 | VOC | 4 | 0 | 0 | 1 |
| KERN DELTA CO LLC | S | 4311 | 1 | VOC | 0 | 0 | 0 | 17 |
| KERN DELTA CO LLC | S | 4314 | 1 | VOC | 0 | 0 | 0 | 38 |
| SENECA RESOURCES | S | 4323 | 1 | VOC | 1500 | 1500 | 1500 | 1500 |
| SENECA RESOURCES | S | 4329 | 1 | VOC | 1500 | 1500 | 1500 | 1500 |
| ALON BAKERSFIELD REFINING | S | 4330 | 1 | VOC | 34595 | 35394 | 35803 | 35711 |
| SHELL OIL PRODUCTS US | S | 4336 | 1 | VOC | 61 | 33 | 0 | 0 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4342 | 1 | VOC | 101 | 505 | 1112 | 101 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4348 | 1 | VOC | 0 | 2138 | 3271 | 7 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4350 | 1 | VOC | 738 | 4013 | 5529 | 908 |
| DELTA TRADING L P | S | 4352 | 1 | VOC | 4947 | 5044 | 5138 | 5142 |
| E & J GALLO WINERY | S | 4354 | 1 | VOC | 16065 | 16065 | 16065 | 16065 |
| CHEVRON USA INC | S | 4355 | 1 | VOC | 6428 | 6428 | 6428 | 6428 |
| FREEPORT-MC MORAN OIL & GAS | S | 4364 | 1 | VOC | 24 | 24 | 24 | 24 |
| G3 ENTERPRISES | S | 4371 | 1 | VOC | 137 | 137 | 137 | 136 |
| CHEVRON USA INC | S | 4379 | 1 | VOC | 4124 | 4209 | 4295 | 3637 |
| E & J GALLO WINERY | S | 4381 | 1 | VOC | 827 | 771 | 816 | 805 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4388 | 1 | VOC | 846 | 4119 | 5670 | 1044 |
| TRI-CITY GROWERS INC | S | 4392 | 1 | VOC | 3 | 0 | 0 | 14 |
| KERN OIL & REFINING CO. | S | 4394 | 1 | VOC | 808 | 808 | 808 | 808 |
| KERN RIVER HOLDINGS, INC. | S | 4395 | 1 | VOC | 3125 | 3125 | 3125 | 3125 |
| GUARDIAN INDUSTRIES CORP | S | 4396 | 1 | VOC | 1625 | 1625 | 1625 | 1625 |

| Current ERC Certificate Holder | ERC Number | | | Pollutant | Reductions (lb/qtr) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
| FREEPORT-MC MORAN OIL & GAS | S | 4397 | 1 | VOC | 1675 | 1676 | 1676 | 1675 |
| TAUBER OIL COMPANY | S | 4398 | 1 | VOC | 2918 | 2992 | 3083 | 3093 |
| CHEVRON USA INC | S | 4410 | 1 | VOC | 102560 | 103836 | 105202 | 105223 |
| EVERGREEN BEVERAGE PACKAGING | S | 4412 | 1 | VOC | 5 | 6 | 4 | 5 |
| E & J GALLO WINERY | S | 4414 | 1 | VOC | 2761 | 2761 | 2783 | 2783 |
| AERA ENERGY LLC | S | 4416 | 1 | VOC | 50898 | 51327 | 52471 | 53438 |
| MACPHERSON OIL COMPANY | S | 4419 | 1 | VOC | 2 | 2 | 2 | 2 |
| AERA ENERGY LLC | S | 4427 | 1 | VOC | 9278 | 10340 | 11923 | 9208 |
| INGREDION INCORPORATED | S | 4428 | 1 | VOC | 2000 | 2000 | 2000 | 2000 |
| TAUBER OIL COMPANY | S | 4429 | 1 | VOC | 3000 | 3000 | 3000 | 3000 |
| CALIFORNIA RESOURCES PRODUCTION CORP | S | 4432 | 1 | VOC | 0 | 116 | 741 | 0 |
| PACIFIC ETHANOL VISALIA | S | 4438 | 1 | VOC | 2273 | 2271 | 2270 | 2264 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4440 | 1 | VOC | 74 | 74 | 74 | 74 |
| E & J GALLO WINERY | S | 4442 | 1 | VOC | 7039 | 7032 | 7025 | 7013 |
| AERA ENERGY LLC | S | 4444 | 1 | VOC | 118983 | 120436 | 121890 | 121890 |
| SAN JOAQUIN FACILITIES MGMT | S | 4446 | 1 | VOC | 0 | 0 | 13 | 8 |
| SAN JOAQUIN FACILITIES MGMT | S | 4448 | 1 | VOC | 34 | 8 | 34 | 39 |
| VINTAGE PRODUCTION CALIFORNIA LLC | S | 4454 | 1 | VOC | 170 | 170 | 170 | 170 |
| CALIFORNIA RESOURCES ELK HILLS, LLC | S | 4470 | 1 | VOC | 55150 | 63829 | 66405 | 61718 |
| ELEMENT MARKETS LLC | S | 4471 | 1 | VOC | 725 | 725 | 725 | 725 |
| BIG WEST OF CA LLC LIQUIDATING TRUST | S | 4472 | 1 | VOC | 666733 | 658957 | 683403 | 688163 |
| E & J GALLO WINERY | S | 4480 | 1 | VOC | 16946 | 16904 | 16875 | 16857 |

# Appendix H

## Summary of Significant Comments and Responses

*2015 Plan for the 1997 PM2.5 Standard*
SJVUAPCD

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# SUMMARY OF SIGNIFICANT COMMENTS MARCH 17, 2015 PROPOSED *2015 PLAN FOR THE 1997 PM2.5 STANDARD*

## EPA REGION IX COMMENTS:

No comments were received from EPA.

## ARB COMMENTS:

No comments were received from ARB.

## PUBLIC COMMENTS:

No comments were received from the public.

# SUMMARY OF SIGNIFICANT COMMENTS
# MARCH 4, 2015 DRAFT *2015 PLAN FOR THE 1997 PM2.5 STANDARD*

## EPA REGION IX COMMENTS:

No comments were received from EPA.

## ARB COMMENTS:

No comments were received from ARB.

## PUBLIC COMMENTS:
Comments were received from the following:

Agricultural Producers and Processors (APP)[1]
Central California Environmental Justice Network (CCEJN)
Central Valley Air Quality Coalition (CVAQ)
City of Fresno Planning (COF)
Dairy Cares (DC)[2]
Medical Advocates for Healthy Air (MAHA)
Sandra Brock (Brock)
Southern California Gas Company (SCGC)

1. **COMMENT:** Will GAMAQI be updated to reflect the change in the definition of a major source for PM2.5 from 100 tons per year (tpy) to 70 tpy for NSR level? (COF)

   **RESPONSE:** The GAMAQI does not refer to any major source definition or thresholds for NSR. Therefore, revisions to the GAMAQI are not necessary.

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[1] Agricultural Producers and Processers: Comments were submitted on behalf of the following agricultural agencies, representing agricultural producers and processors throughout the Valley: African American Farmers of California, California Blueberry Association, California Citrus Mutual, California Cotton Ginners Association, California Cotton Growers Association, California Farm Bureau Federation, California Fresh Fruit Association, Corcoran Irrigation District, Fresno County Farm Bureau, Kings County Farm Bureau, Kern County Farm Bureau, Milk Producers Council, National Hmong American Farmers, Nisei Farmers League, Stanislaus County Farm Bureau, Tulare County Farm Bureau, Tulare Lake Basin Water Storage District, Tulare Lake Drainage District, Tulare Lake Resource Conservation District, Western Agricultural Processors Association, Western Growers Association, Delta Lands Reclamation District No. 770, El Rico Reclamation District No. 1618, Homeland Reclamation District No. 780, North Central Reclamation District No. 2071, South Central Reclamation District 2125, Tulare Lake Reclamation District 749, Peoples Ditch Company, Last Chance Water Ditch Company, Tulare Lake Canal Company, Southeast Water Company

[2] Dairy Cares is a coalition of dairy and milk producer and processor organizations and cooperatives including: Western United Dairymen, California Dairy Campaign, Milk Producers Council, California Farm Bureau Federation, California Cattlemen's Association, California Dairies, Inc., Dairy Farmers of America-Western Area Council, Hilmar Cheese Company, and Land O'Lakes, Inc.

2. **COMMENT:** The District should consider offering incentives to lead agencies to implement subdivision ordinances that prohibit wood burning of any type and that prohibit the creation of more dirt roads. (Brock)

   **RESPONSE:** The incentive programs operated by the District are typically created under specific guidelines to ensure the emissions reductions achieved by these programs are cost-effective, enforceable, and quantifiable. Incentives for implementing ordinances to prohibit wood burning or dirt roads would be difficult to quantify and may not be cost-effective. Additionally, the District already regulates the installation of wood burning fireplaces and wood burning heaters through density requirements in Rule 4901, and implements wood burning curtailments during poor air quality episodes through the Check Before You Burn program. Similarly, District Rule 8061 already limits fugitive dust emissions from paved and unpaved roads by implementing control measures and design criteria.

3. **COMMENT:** The claim that the Valley is NOx-limited is insufficiently supported. The District should revise *the 2015 PM2.5 Plan* to include ammonia controls because ammonia is a major precursor for PM2.5. (CVAQ, MAHA)

   **RESPONSE:** The plan control strategy achieves the emissions necessary to bring the Valley into attainment, primarily through PM2.5 and NOx emissions reductions. Most areas of the Valley will reach attainment well before 2020. The District's incentive programs, public outreach, and other innovative strategies will help expedite air quality improvements as this plan is implemented. Although the plan shows expeditious attainment and includes a comprehensive control strategy for direct PM2.5 emissions and significant PM2.5 precursors, the District and ARB explored the effectiveness of ammonia reductions in reducing PM2.5 concentrations.

   The review of extensive science on this subject and previous modeling conducted conclude that reducing ammonia emissions is orders of magnitude less effective in reducing PM2.5 concentrations than reducing directly emitted PM2.5 or NOx emissions. There is a relative abundance of ammonia compared to nitric acid, and the amount of nitric acid drives the ultimate formation of ammonium nitrate. Because of this regional surplus in ammonia, even substantial ammonia emissions reductions yield a relatively small reduction in nitrate. Reductions in nitrate concentrations of 30% to 50% were realized through a 50% reduction in NOx. Modeling a 50% reduction in ammonia, while unrealistic and not technologically achievable, would only realize less than 5% reductions in nitrate concentrations.

   Despite the fact that ammonia is an insignificant PM2.5 precursor in the Valley, the District evaluated current ammonia controls in Appendix C (BACM and MSM for Stationary and Area Sources) of this plan. The analyses show that the Valley's ammonia emissions have been significantly reduced through stringent District regulations and current regulations implement BACM and MSM in the Valley. The District has already reduced ammonia emissions from CAFs, the largest source of ammonia emissions under its jurisdiction, by over 100 tons per day through adoption of Rule 4570 (Confined Animal Facilities), the most stringent rule of its kind in the nation. The District did not find any additional feasible measures that could significantly reduce ammonia emissions.

4. **COMMENT:** Why has the District not achieved the same NOx reductions for this plan from stationary sources as ARB has achieved from mobile sources? (CCEJN)

**RESPONSE:** The District has implemented a comprehensive regulatory control strategy for over twenty years. Since 1992, the District has adopted over 600 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. As a result of these extensive efforts and significant investments from Valley businesses, the emissions in the Valley from stationary sources have been reduced by 80% or more.

ARB and EPA have regulatory authority over mobile sources of emissions in the Valley. As demonstrated in Figures 2-4 and 2-5 (see Chapter 2) the majority of the remaining emissions in the Valley are generated by mobile sources. In part due to the success of prohibitory rule efforts implemented by the District on stationary and area sources; in fact, mobile sources are now responsible for 85% of NOx emissions in the Valley (see Appendix B).

5. **COMMENT:** Explain the difference between Best Available Control Measures (BACM) and Lowest Achievable Emissions Rate (LAER), and whether it is possible to implement LAER instead of BACM. (CCEJN)

**RESPONSE:** EPA defines BACM as the maximum degree of emissions reductions achievable from a source or source category, which is determined on a case-by-case basis considering energy, economic, and environmental impacts. LAER, on the other hand, is the most stringent emissions control that is technologically feasible and does not take into consideration any economic impacts or rather the cost effectiveness of a potential control measure.

Within Appendix C of this plan, the District has examined every source category in the Valley for any potential opportunities for additional emissions reductions, which included reviewing LAER levels of control. However, since EPA's definitions for BACM and Most Stringent Measures (MSM) state that air districts should account for the economic feasibility of all potential BACM or MSM, the District evaluated the cost effectiveness (in dollars per year, per ton of emissions reduced per year) of all technologically feasible control measures to determine if there were additional measures not already implemented in the District that qualify as BACM and/or MSM.

Aside from this planning process, the District also evaluates LAER through the new source review (NSR) process, per District Rule 2201 (New and Modified Stationary Source Review Rule). Anytime there is a new or modified stationary source of air pollution, the respective source is required to implement Best Available Control Technology (BACT) levels of control for their new or modified equipment. To determine what qualifies as BACT, the District examines all LAER controls and then evaluates the cost effectiveness of the potential measure to see if it qualifies as BACT for that particular source.

Given the high cost effectiveness of BACT/BACM controls, most air districts only enforce such stringent and costly requirements on new sources. However, due to the District's unique air quality challenges, the District has enforced BACT/BACM levels of emissions controls on numerous retrofitted sources for years through these stringent permitting provisions and multi-generational rules.

6. **COMMENT:** Provide more detail on the composition of ammonium, sodium, nitrate, etc., specifically for confined animal facilities (CAFs). Also, there are incentives for agricultural equipment, but when are agricultural equipment rules coming? (CVAQ)

**RESPONSE:** Information on the general composition of PM2.5 in the San Joaquin Valley can be found in Chapter 3 of the *2015 Plan for the 1997 PM2.5 Standard*. Figure 3-2 (page 3-12) of the plan shows the average annual compositions of PM2.5 in Fresno and Bakersfield. Recently, research has been undertaken to better characterize PM emissions from CAFs. The research available has indicated that the majority of directly emitted PM from CAFs is larger than PM2.5. In addition, most of directly emitted PM from CAFs is expected to occur in the dry summer months, rather than the winter months when the San Joaquin Valley has the highest concentrations of PM2.5.

As discussed in the plan, ammonium nitrate and ammonium sulfate are not directly emitted, but rather are formed through secondary atmospheric reactions between precursors. As discussed in Chapter 2, Section 2.6 of the plan, because the formation of secondary ammonia particulate is limited by other precursors, ammonia is not a significant precursor to PM2.5 values in the San Joaquin Valley. Although ammonia is not a significant precursor to PM2.5 values in the Valley, the District has adopted stringent regulations that have reduced ammonia emissions (e.g. Rule 4565 - Biosolids, Animal Manure, and Poultry Litter Operations, Rule 4566 - Organic Material Composting, and Rule 4570 - and Confined Animal Facilities - Rule 4570). The District has already reduced ammonia emissions from CAFs, the largest source of ammonia emissions under its jurisdiction, by over 100 tons per day through adoption of Rule 4570 (Confined Animal Facilities), the most stringent rule of its kind in the nation. Please reference Section C.41 (Ammonia Controls) in Appendix C of this plan for additional information.

Lastly, ARB is currently undertaking a rule making process to regulate agricultural equipment, and the District is supportive of that effort.

**7.** **COMMENT:** CNG engines are available that achieve greater emission reductions than the 2010 truck standards. The District should consider requiring greater reductions than those required in the 2010 truck standards by requiring or incentivizing the use of natural gas trucks. (SCG)

**RESPONSE:** The District is actively encouraging the continued development and certification of cleaner natural gas engines. Through the Technology Advancement Program, the District is partnering with an engine manufacturer for demonstration and durability testing of an advanced natural gas engine to be certified to an optional NOx standard which is 90% cleaner than the current engine standard. Additionally, the program is demonstrating natural gas/electric hybrid projects in both class 4 and class 7 trucks, highlighting the benefit of natural gas in those categories. The District is also considering additional methods to incentivize and encourage natural gas vehicles in the Valley.

**8.** **COMMENT:** How do wildfires and controlled burns affect PM2.5 levels and attainment of the federal standards? Also, what is the District's involvement with agencies such as Bureaus of Land Management for large controlled burning? The District should do more outreach to rural areas for controlled burns. (COF)

**RESPONSE:** With the Valley being surrounded by mountain ranges, wildfires have the potential to have a significant impact on PM2.5 levels and subsequently affect the region's ability to reach attainment of the federal PM2.5 standards. However, wildfires are considered "Exceptional Events" by EPA and outside of the control of the District. The recorded PM2.5 levels affected by these emissions can be removed from the regulatory data set used to determine compliance with the PM2.5 standards. This exceptional event process requires that extensive documentation be provided to EPA to support the event's impact on the recorded values, showing that the high values would not have occurred "but for" the added emissions from the wildfire event.

The emissions from controlled burns constitute a significantly smaller PM2.5 fraction compared to wildfires, and usually have minimal and temporary impact on any nearby air quality monitors, if any. Controlled burns also play a critical role in reducing the fuel loading within these mountain ranges and help prevent catastrophic wildfires from potentially occurring. Controlled burning activities are regulated by the District under Rule 4106 (Prescribed Burning and Hazard Reduction Burning).

The District works in close coordination with the National Forest Service, the National Park Service, and other Land Management Agencies (LMAs) to strategically approve controlled burns only on days when air quality and atmospheric dispersion conditions are favorable. The District and LMAs also work together to minimize the potential smoke impacts to nearby communities from these burning activities. Through partnership with the District, the LMAs ensure that nearby communities are aware when a controlled burn is being planned for the area through the posting of information in public spaces, local publications, town hall meetings, electronic media, etc. The information shared assists the residents to plan appropriately while considering the potential temporary air quality impacts in the area. The District will continue to work closely with the LMAs in making sure that the public is made aware of future controlled burn projects in advance of their planned ignition.

**9.** **COMMENT:** We support the District's prioritization of control strategies that will result in the greatest human health benefits. We appreciate the District's willingness to consider incentives for conservation tillage. We also support more natural gas trucks, especially if running on renewable natural gas such as can be generated with dairy manure. (DC)

**RESPONSE:** The District appreciates the comments above and will continue to evaluate potential control strategies under the District's Health Risk Reduction Strategy.

The District also supports efforts to reduce emissions through innovative approaches through its technology advancement program and through on-going research efforts.

**10.** **COMMENT:** Rule 9510 (Indirect Source Review) was last updated in 2005; additional emissions could be reduced by expanding the rule's applicability. The District should also eliminate the option for businesses to pay fees in lieu of mitigation measures and should require them to meet a minimum emissions level before paying fees. In addition, the District should increase the emissions reductions required for projects and add PM2.5 emissions limits. (CVAQ)

**RESPONSE:** Rule 9510 does not allow all project proponents to pay fees in lieu of mitigation requirements. The rule recognizes that while project design and CEQA mitigation requirements are land-use decisions that are outside the scope of the District's direct regulatory authority, it is possible through the use of increased fees to encourage better project design, leading to lower emissions.

In regards to the emissions reductions required for projects, Rule 9510 currently requires that all emissions above certain thresholds be mitigated through the District's emission reduction incentive grant programs via the payment of fees to the District. Those fees are established at levels that the District demonstrates, on an annual basis, to be sufficient to mitigate the full targeted emissions for projects subject to the rule.

Lastly, adding a specific PM2.5 component to the rule would not result in reduced PM2.5 emissions because the rule already targets PM10 emissions. PM2.5 is a subset of PM10, and for combustion sources, PM10 is nearly 100% PM2.5. In fact, the sources of emissions reductions obtained through the District's incentive programs are nearly 100% combustion sources, including both mobile and stationary sources. Therefore, by targeting PM10 sources, Rule 9510 also effectively addresses PM2.5 emissions.

**11.** **COMMENT:** The District should revise Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters) to eliminate wood burning when the Valley is expected to exceed the 2006 PM2.5 NAAQS of 35 $\mu g/m^3$. (CVAQ)

**RESPONSE:** Based on the latest amendments (September 2014), Rule 4901 is the most stringent wood burning curtailment rule in the nation. Residential wood-burning with unregistered devices are no longer allowed when an area's forecasted PM2.5 concentration is expected to be greater than or equal to 20 $\mu g/m^3$ which comprise over 95% of wood burning emissions. This threshold is lower compared to past years when it was set at 30 $\mu g/m^3$. As such, this threshold is much lower than the 2006 and 2012 federal 24-hour average PM2.5 standard of 35 $\mu g/m^3$. Allowing the cleanest wood burning heaters to be used between 20 and 65 $\mu g/m^3$ provides significant motivation to Valley residents for transitioning away from older higher polluting devices to the cleanest wood burning heaters. A registered wood burning heater pollutes at least twenty times less than a wood burning fireplace; therefore, encouraging this transition reduces emissions beyond those that could be accomplished by only reducing the curtailment threshold to 20 $\mu g/m^3$. The latest amendments to Rule 4901 will achieve an estimated reduction of 5.1 tons per day of PM2.5 emissions.

**12.** **COMMENT:** The District should implement fleet rules for publicly-owned vehicles in the Valley. The District's current fleet rule applies to school buses, but the SCAQMD fleet rules apply to buses, light-, medium-, and heavy-duty public fleet vehicles, airport ground transportation such as taxis and shuttles, and street sweepers. (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, including a first of its kind rule to quantify emissions reductions from incentive programs for SIP creditability. 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.

13. **COMMENT:** ARB should develop enforceable agricultural equipment regulations as soon as possible to accelerate attainment of the 1997 PM2.5 NAAQS in the Valley. (CVAQ)

    **RESPONSE:** The District recognizes the need for additional emissions reductions from mobile agricultural equipment to address not only the 1997 PM2.5 NAAQS, but the newer, more stringent federal 2006 PM2.5 NAAQS and 2012 PM2.5 NAAQS. As such, the District will continue to work with ARB and the agricultural industry to develop regulations for mobile agricultural equipment (under ARB's regulatory authority) to increase the use of the cleanest technologies as they become available in the San Joaquin Valley.

14. **COMMENT:** The District Conservation Management Practices rule (Rule 4550) should be updated to reflect current practices, practices that overlap with other agency regulations should not be elective or be used to evidence rule compliance. Menu items regarding surface control in all agricultural operations should be uniform and consolidated into a single section applicable to all operations regardless of category (crops, cows, and poultry). The number of options a regulated entity can choose to show compliance must be increased significantly. Many of these practices are BACM and should no longer be available as options. (CVAQ)

    **RESPONSE:** The District evaluates the effectiveness of Control Management Practices (CMPs) on a regular basis, as illustrated on the District's web page under Requirements for Agricultural Operations. While Rule 4550 has been successful in reducing both PM10 and PM2.5 emissions, recent studies have indicated that the PM2.5 fraction of emissions makes up a small portion of the total particulate emissions from agricultural operations. Additionally, particulate emissions from agricultural operations are geologic in nature. These geologic particulate emissions make up a relatively small portion of the overall PM2.5 concentrations during the winter season and have relatively low toxicity when compared to the organic carbon fraction of PM2.5 and to re-suspended road dust. Given the relatively low contribution that emissions from this category make to the Valley's PM2.5 concentrations and current stringent requirements under Rule 4550, the District has not identified any additional rule amendment opportunities for further emission reductions from source categories subject to CMP requirements to include in this plan. As demonstrated above, Rule 4550 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category.

However, the District is leaving no stone unturned and is committing to reevaluate Rule 4550 for all feasible opportunities for additional emissions reductions, if any, in the context of the upcoming PM2.5 plans in 2016/2017.

**15.** **COMMENT:** Emission reductions that the District intends to use from incentive programs under Rule 9610 are not SIP-creditable. (CVAQ)

**RESPONSE:** Incentive programs are an integral part of the emission reduction efforts of the District. These programs have invested over $1 billion in public/private funding towards incentive-based emission reduction projects that have reduced over 100,000 tons of NOx, VOC, and PM2.5 emissions since 1992. District incentive programs have been modeled on effective state incentive programs like the Carl Moyer Program. Enforceability has already been built into the District incentive programs through requirements that include pre and post project equipment inspections, monitoring, and reporting. Rule 9610 provides the mechanism for the District to take credit for these surplus, quantifiable, and enforceable emissions reductions. EPA approved Rule 9610 on February 26, 2015, finding that incentive-based emissions reductions are fully SIP-creditable.

**16.** **COMMENT:** The District should improve its public outreach process. (CVAQ)

**RESPONSE:** The District appreciates the recommendations for further outreach opportunities. The *2015 PM2.5 Plan* was prepared through an involved public process that provided multiple opportunities for the general public and interested stakeholders to offer suggestions and comments for improving and strengthening the plan. The District has worked closely with these various stakeholders, including its partner agencies ARB and EPA, environmental and community advocacy groups, and business representatives to share information regarding the plan, and to receive comments and suggestions.

Numerous opportunities were provided for public input during District Governing Board public hearings, Citizen’s Advisory Committee public meetings and Environmental Justice Advisory Group public meetings. The District also met with interested advocacy and industry representatives throughout the plan development process to address specific questions and comments, and solicit further suggestions for control strategies. The District held a public workshop for this plan on March 4, 2015 at the District’s offices in Modesto, Fresno, and Bakersfield and by webcast, with many participants attending and providing feedback. The District also posted the *Proposed 2015 PM2.5 Plan* on the District’s webpage on March 17, 2015 for a 30-day public noticing period.

**17.** **COMMENT:** PM2.5 geologic emissions from agricultural operations are insignificant and attempts to control these emissions are unwarranted. There continues to be artificially high emissions of PM2.5 attributed to “farming operations". There has been significant research on PM2.5 emissions from agricultural sources, including studies conducted in the Valley, which should be incorporated wherever and whenever possible. Results of the multi-year study of cotton gin emissions under the USDA indicate only 2.4% of total suspended particulate are PM2.5. Emissions from almond harvesting operations report PM2.5 emissions to be in a range of 1.1% to 1.6%. Additionally, ARB determined in 1995 that "geological material" made up less than 1% of the total source contributions. (APP, DC)

**RESPONSE:** As described further in Appendix C of this plan, under Rule 4550 (Conservation Management Practices), the PM2.5 fraction of emissions makes up a small portion of the total particulate emissions from agricultural operations. Additionally, particulate emissions from agricultural operations are geologic in nature, make up a relatively small portion of the overall PM2.5 concentrations during the winter season, and have relatively low toxicity relative to the organic carbon fraction of PM2.5 and to re-suspended road dust.[3] Accordingly, particulate emissions from agricultural sources do not play a significant role with regard to attainment of the PM2.5 standards addressed by this plan, and Rule 4550 is primarily a PM10 reduction strategy.

Given the relatively low contribution that emissions from this category make to the Valley's PM2.5 concentrations and current stringent requirements under Rule 4550, the District has not identified any additional rule amendment opportunities for further emission reductions from source categories subject to CMP requirements to include in this plan. It is also questionable that further opportunities for reducing PM2.5 emissions exist.

However, in developing plans for the new and existing National Ambient Air Quality Standards, the District will leave no stone unturned to evaluate and identify further opportunities to advance attainment of the ever-tightening National Ambient Air Quality Standards. Any opportunities identified to reduce emissions towards meeting these tougher standards may also help expedite attainment with the 1997 PM2.5 standard addressed by this plan. In developing these plans, the District will reevaluate all of its existing regulations and will explore all potential measures for all source categories. As such, the District commits to evaluate all feasible opportunities for additional emissions reductions from Rule 4550, if any.

**18. COMMENT:** Windblown dust is not an issue for the Valley, especially for PM2.5. According to USDA documents, wind erosion occurs when wind speed reaches 13 mph, which rarely occurs in the Valley and when it does occur, it does not lead to exceedances of the federal standard. It has been found that only a fraction of suspendable particles are transportable particles and in the absence

[3] Rogge, W. F., Hildemann, L. M., Mazurek, M. A., Cass, G. R. and Simoneit, B. R. T. *Sources of Fine Organic Aerosol—3. Road Dust, Tire Debris, and Organometallic Brake Lining Dust—Roads as Sources and Sinks*. Environmental Science & Technology 27(9), 1892-1904. 1993.

of violent winds there is little, if any, residual or continuing source of energy to sustain vertical motion and transport of these emissions. The District must not require additional control measures of agricultural sources located in rural areas. (APP)

**RESPONSE:** The Valley experiences wind-blown dust events from time to time typically during the spring and fall seasons when weather disturbances are most common. These events are less likely to occur during the long stagnation periods of the summer and winter. When soil conditions are dry, strong wind events often entrain coarse particulate matter into the atmosphere, carrying the pollution long distances across the Valley. This phenomenon has the potential to create higher concentrations of PM10 in its path of impact.

Although these events primarily cause higher PM10 concentrations, there are rare instances where PM2.5 concentrations become elevated. In addition to the rarity of elevated PM2.5 concentrations, the PM2.5 values recorded during the strong stagnation periods of the winter season are usually much higher than those recorded during wind events. Because of this, the Valley's PM2.5 design values are driven primarily by high winter-time concentrations, mostly due to organic carbon and the secondary formation of ammonium nitrate. Comparatively, the geologic component of the Valley's peak PM2.5 concentrations is only a fraction of the mass formed through secondary processes and other sources. As a result, the wind events experienced in the Valley are not a significant contributor to the PM2.5 attainment challenges for the region, and placing further controls on this source would not make a substantial difference in the District's PM2.5 design values.

**19.** **COMMENT:** We appreciate the District's inclusion of incentive programs as a viable emissions reduction strategy for NOx and PM2.5. We ask the District to include specific references to the USDA-NRCS and their California Air Quality EQIP Fund Pool for Particulate Matter Reduction for their incentives to reduce PM emissions. We support additional funding for agricultural trucks for early adoption and we commit to working with the District to seek out additional funds and help promote an incentive based program for agricultural trucks. (APP)

**RESPONSE:** The District appreciates the vast economic resources dedicated from USDA-NRCS and EQIP to incentivize zero and near-zero emitting technologies in the Valley. Chapter 7 (Attainment Strategy) includes a discussion of the collaboration between EPA, ARB, USDA-NRCS, and the District to adopt Rule 9610 (State Implementation Credit for Emission Reductions Generated Through Incentive Programs) on June 20, 2013 and effectively establish the administrative mechanism through which the District and ARB can take SIP credit for emissions reduced through these types of incentives previously provided by USDA-NRCS.

In addition, the District supports additional funding to help incentivize the replacement of agricultural trucks in the Valley. The District has included a commitment to fund $10 million dollars for the replacement of heavy duty trucks in the Valley between 2016 and 2020, and ARB has also committed to do their part by committing to provide additional reductions in emissions for sources under their control. ARB staff will propose a commitment on actions for key truck sectors in the Valley to better ensure benefits from the Truck and Bus regulation and pursue opportunities for the replacement of trucks certified to the State's optional low-NOx standard. The District will continue to work closely with ARB on this issue.

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