4.2 AIR QUALITY

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Clean air is a vital resource to public health and welfare, to the local agricultural economy, and to the quality of life. Air pollution adversely affects public health, diminishes the production and quality of agricultural crops, reduces visibility, degrades materials, and damages native vegetation. This section discusses regional air quality in the San Joaquin Valley Air Basin and sources and quantities of air emissions expected from new or expanded dairies allowed under the Kings County Revised Draft Dairy Element (Element).

SETTING

CLIMATIC CONDITIONS

Kings County is located in the San Joaquin Valley Air Basin, which is defined by the Sierra Nevada to the east, the Coast Ranges to the west, and the Tehachapi mountains to the south. The surrounding topographic features restrict air movement through and out of the basin and, as a result, impede the dispersion of pollutants from the basin. Inversion layers are formed in the San Joaquin Valley Air Basin throughout the summer and winter; an inversion layer is created when a mass of warm dry air sits over cooler air near the ground, preventing vertical dispersion of pollutants from the air mass below. During the summer, the San Joaquin Valley experiences daytime temperature inversions at elevations from 2,000 to 2,500 feet above the valley floor; during the winter months, inversions occur from 500 to 1,000 feet above the valley floor (SJVUAPCD, 1998).

The average summer high temperature in Kings County is in the upper 90° F (degrees Fahrenheit) range; during the summer, wind rose data for the valley indicate that the wind usually originates from the north end of the San Joaquin Valley and flows in a southeasterly direction. During winter months, the average temperature in the County is in the low 50° F; wind flows from the south end of the San Joaquin Valley toward the north. Low wind speeds and low inversion layers during the winter result in high carbon monoxide and particulate matter concentrations (National Climatic Data Center, undated).

AIR QUALITY STANDARDS AND LEGISLATION

Federal

National Ambient Air Quality Standards

National ambient air quality standards (NAAQS) for six criteria pollutants (carbon monoxide, ozone, particulate matter, nitrogen dioxide, sulfur dioxide, and lead) have been established by the Administrator of the U.S. Environmental Protection Agency (EPA) according to the mandate of the 1970 Federal Clean Air Act (CAA) (Table 4.2-1). In July 1997, EPA promulgated new NAAQS for ozone and particulate matter with a diameter less

than or equal to 2.5 microns ($PM_{2.5}$) (Table 4.2-1). The existing 1-hour ozone standard (0.12 ppm) will eventually be phased out and replaced with an 8-hour standard of 0.08 ppm.[1] The new $PM_{2.5}$ standard has been established for both an annual average and 8-hour periods.

TABLE 4.2-1: **National and State Ambient Air Quality Standards**

Pollutant	Averaging Period	California Standards	Federal Standards
Ozone	8 hours	--	0.08 ppm
	1 hour	0.09 ppm	0.12 ppm
Carbon monoxide	8 hours	9.0 ppm	9.0 ppm
	1 hour	20.0 ppm	35.0 ppm
Nitrogen dioxide	Annual	--	0.053 ppm
	1 hour	0.25 ppm	--
Sulfur dioxide	Annual	--	0.03 ppm
	24 hours	0.04 ppm	0.14 ppm
	1 hour	0.25 ppm	--
Suspended particulate matter;	Annual arithmetic mean	--	50.0 $\mu g/m^3$
diameter $\leq$ 10 microns (PM_{10})	Annual geometric mean	30.0 $\mu g/m^3$	--
	24 hours	50.0 $\mu g/m^3$	150.0 $\mu g/m^3$
Suspended particulate matter;	Annual	--	15.0 $\mu g/m^3$
diameter $\leq$ 2.5 microns ($PM_{2.5}$)	24 hours	--	65.0 $\mu g/m^3$
Hydrogen sulfide	1 hour	0.03 ppm	--
Lead	Calendar quarter	--	1.5 $\mu g/m^3$
	30-day	1.5 $\mu g/m^3$	--

Source: SJVUAPCD, 1998.

Notes: ppm = parts per million.
$\mu g/m^3$ = micrograms per cubic meter.
-- = Not available

The CAA and subsequent Federal Clean Air Act Amendments of 1977 and 1990 require geographical areas to be designated as in attainment or nonattainment with the national

[1] In February 2001, the U.S. Supreme Court unanimously overturned a lower court opinion voiding the revised NAAQS for ozone and $PM_{2.5}$. However, the case must first go back to the U.S. Court of Appeals for resolution of other issues not decided by the Supreme Court. In addition, the Supreme Court is requiring EPA to develop a new implementation plan for ozone (California Environmental Insider, 2001).

ambient air quality standards. A geographical area is considered to be in attainment if the air pollutant level for that area meets the corresponding national standard; geographical areas for which an air pollutant exceeds the corresponding national standard are classified as nonattainment areas. State Implementation Plans (SIP) must be developed for nonattainment areas to identify strategies for achieving attainment of the national standard.

The San Joaquin Valley is currently in nonattainment for the Federal standards for ozone and particulate matter with an aerodynamic diameter less than or equal to ten microns (PM_{10}). The air basin is designated as a "serious" nonattainment area for PM_{10} and a "severe" nonattainment area for ozone. As a result, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) has prepared PM_{10} and ozone attainment demonstration plans; these plans identify the regulatory framework necessary to bring the San Joaquin Valley into compliance with the Federal ozone and PM_{10} standards.

The PM_{10} attainment demonstration plan was approved by the California Air Resources Board (CARB) on 26 June 1997 and constitutes the PM_{10} SIP for the San Joaquin Valley. In September 1999, the EPA proposed simultaneous limited approval and limited disapproval of Regulation VIII rules in the PM_{10} SIP for the San Joaquin Valley. EPA proposed a limited disapproval because several of the rules were considered to be deficient in complying with the control measure requirements of the Federal Clean Air Act. Among other deficiencies, EPA indicated that control measures need to be revised to include control and test methods that are practical and effective to demonstrate that the emission control techniques selected by SJVUAPCD will actually provide sufficient reduction in PM_{10} emissions. The discussion of Regulation VIII rule deficiencies are contained in EPA's Technical Support Document dated 31August 1999. In response to EPA's disapproval, SJVUAPCD prepared a draft report proposing amendments to Regulation VIII.

The ozone attainment demonstration plan was incorporated into CARB's 1994 ozone SIP; CARB's ozone SIP also includes attainment demonstration plans for nonattainment areas other than the San Joaquin Valley and statewide measures intended to attain the Federal ozone standard. The 1994 ozone SIP was approved by EPA on 25 September 1996.

Methane

Regulatory requirements for the reduction or control of methane emissions have not been established on the Federal, State, or local levels. However, EPA prepares methane emission source inventories on an ongoing basis, as required by the CAA amendments. The five major anthropogenic sources of methane in the United States have been identified to be (in order of contribution) landfills, domesticated livestock, natural gas and oil production, coal mining, and livestock manure (U.S. EPA, 1999). Methane has been determined to be the second most significant greenhouse gas (following carbon dioxide) that contributes to

global warming. The effects of greenhouse gases have been recognized as a worldwide problem and international efforts are being made to reduce the emission of these gases.

In 1988, the United Nations established the Intergovernmental Panel on Climate Change to evaluate the impacts of global warming and to develop strategies that nations could implement to curtail global climate change. In 1992, the United States joined with other countries around the world in signing the United Nations' Framework Convention on Climate Change agreement; the goal of the agreement was to control greenhouse gas emissions, including methane.[2]

As a result, the Climate Change Action Plan was developed to address the reduction of greenhouse gases in the United States. The plan consists of more than 50 voluntary programs, including the Ruminant[3] Livestock Efficiency Program (RLEP) and AgSTAR Program. The RLEP, developed by EPA in coordination with the U.S. Department of Agriculture (USDA), provides a series of improved livestock production practices that could readily be implemented to reduce methane emissions from ruminant animals. The AgSTAR Program, developed by EPA, USDA, and U.S. Department of Energy, encourages the use of methane recovery technologies at confined animal feeding operations that manage manure as liquids or slurries to reduce methane emissions (U.S. EPA, 1997).

California

The California Air Resources Board (CARB) is responsible for enforcing the Federally-required SIP in an effort to achieve and maintain the national ambient air quality standards. In addition, CARB has established State Ambient Air Quality Standards (SAAQS) for the criteria pollutants (Table 4.2-1) as well as for other pollutants for which there are no corresponding Federal standards. The SAAQS for the criteria pollutants are equal to or more stringent than the Federal standards. CARB is responsible for assigning air basin attainment and nonattainment designations in California.

Analogous to the CAA and its amendments, the 1988 California Clean Air Act (CCAA) requires areas within the State to be designated as attainment or nonattainment with the SAAQS. The CCAA similarly requires that plans be prepared for nonattainment areas describing strategies to achieve the SAAQS.

[2] The agreement was ratified by the U.S. Senate in October 1992 (Breidenich, 1999).

[3] Ruminant animals have a four-chamber digestive system that converts otherwise unusable plant materials into nutritious food and fiber as well as methane; ruminant animals include cattle, sheep, buffalo, and goats.

The San Joaquin Valley is currently in nonattainment for the State ozone and PM_{10} standards; the urban area of Fresno located in the San Joaquin Valley is also in nonattainment for the State carbon monoxide standard (SJVUAPCD, 1998). In 1991, the SJVUAPCD prepared an air quality attainment plan for the San Joaquin Valley to establish the regulatory framework necessary to bring the San Joaquin Valley into compliance with the State ozone and carbon monoxide standards; this plan was last updated in 1994.[4] As previously mentioned, the EPA proposed a simultaneous limited approval and limited disapproval of Regulation VIII rules in the PM_{10} SIP for the San Joaquin Valley in September 1999. In response, SJVUAPCD prepared a draft report proposing amendments to Regulation VIII (SJVUAPCD, 2000).

In addition, CARB is required to prepare a statewide emission inventory under Section 39607(b) of the California Health and Safety Code. The most recent emission inventory was conducted for 2000 and includes stationary sources, areawide sources, and mobile sources and included inventories for various pollutants, including reactive organic gases (ROG) and PM_{10}. Table 4.2-2 provides the emissions inventory prepared for Kings County. The CARB emissions inventory does not include emissions generated from specific sources. For example, PM_{10} emissions from fugitive dust at unpaved dairy corrals are not included as a specific source.

Approximately 27.8 tons per day (10,151 tons per year) of ROG and 37 tons per day (13,520 tons per year) of PM_{10} were emitted from the stationary, area, and mobile sources in 2000, according to the inventory. Of this amount, 3.59 tons per day (1,310 tons per year) of ROG and 2.06 tons per day (752 tons per year) of PM_{10} are from stationary sources, 13.3 tons per day (4,855 tons per year) of ROG and 34.19 tons per day (12,479 tons per year) of PM_{10} are from areawide sources, and 10.9 tons per day (3,986 tons per year) of ROG and 0.79 ton per day (288 tons per year) of PM_{10} are from mobile sources.

TABLE 4.2-2: **2000 Estimated Average Emissions Inventory, Kings County**

Category	ROG		PM_{10}	
	tpd	tpy	tpd	tpy
Stationary Sources				
Fuel Combustion[1]	0.23	84	0.47	172
Waste Disposal	1.07	391	–	–
Cleaning and Surface Coatings[2]	0.67	245	–	–
Petroleum Production and Marketing[3]	0.56	204	–	–
Industrial Processes[4]	1.06	387	1.59	580
Subtotal	3.59	1,310	2.06	752

[4] Although the San Joaquin Valley is currently in nonattainment for the State PM_{10} standard, the SJVUAPCD is currently not required to prepare a State Implementation Plan to attain the PM_{10} State standard.

Table 4.2-2 - ***continued***

Category	ROG		PM_{10}	
	tpd	tpy	tpd	tpy
Areawide Sources				
Solvent Evaporation[5]	3.86	1,409	–	–
Residential Fuel Combustion (miscellaneous)	0.14	51	0.28	102
Farming Operations (miscellaneous)[6]	7.51	2,741	12.66	4,621
Construction and Demolition (miscellaneous)	–	–	0.91	332
Paved Road Dust (miscellaneous)	–	–	2.02	737
Unpaved Road Dust (miscellaneous)	–	–	7.51	2,741
Fugitive Windblown Dust (miscellaneous)	–	–	7.91	2,887
Fires	–	–	0.01	4
Waste Burning and Disposal (miscellaneous)	1.77	646	2.84	1,037
Cooking	0.02	7	0.05	18
Subtotal	13.3	4,855	34.19	12,479
Mobile Sources				
On-road Motor Vehicles	6.62	2,416	0.30	110
Aircraft	3.42	1,248	0.21	77
Trains	0.01	4	–	–
Recreational Boats	0.05	18	–	–
Off-Road Recreational Vehicles	0.06	22	–	–
Off-Road Equipment	0.29	106	0.06	22
Farm Equipment[7]	0.47	172	0.22	80
Subtotal	10.9	3,986	0.79	288
TOTAL	**27.8**	**10,151**	**37.0**	**13,520**

Source: CARB, ~~1998~~ 2000

Notes: tpd = tons per day
tpy = tons per year
– = not available or less than 0.05 ton per day.
ROG = reactive organic gases
PM_{10} = particulate matter with an aerodynamic diameter of 10 microns or less.

1 Stationary fuel combustion sources include manufacturing and industrial and food and agricultural processing.
2 Includes degreasing, coatings and related process solvents, and other (cleaning and surface coatings).
3 Includes oil and gas production and petroleum marketing.
4 Includes chemical, food and agriculture, and mineral processes.
5 Includes consumer products, architectural coatings and related process solvent, and pesticides/fertilizers.
6 Farming operations generate particulate matter during land preparation, harvest operations, growing season operations, cattle feedlots, and other farming-related activities; ROG emissions are from livestock waste decomposition. However, according to CARB, the ROG emissions included in this inventory may not reflect accurate conditions due to the difficulty in obtaining accurate livestock population data for the County (Shimp, 2000).
7 The source of PM_{10} and ROG emissions is from light and heavy duty equipment used in farming-related activities; in addition farm equipment also generates approximately 767 tons per year of nitrogen oxide.

In November 2000, CARB prepared a report to the legislature that provided emission estimates of select pollutants for all the counties in the San Joaquin Valley air basin. The report included emission estimates for ammonia, PM_{10}, ROG, NOx, CO, and methane. The emission estimates were classified by the following sources: dairy operations; other livestock; other agriculture; stationary; areawide; motor vehicles, and natural. The estimated emissions for dairy operations in Kings County were: 7,600 tons per year of ammonia, 90 tons per year of PM_{10}, 2,600 tons per year of ROG, and 8,300 tons per year of methane (CARB, 2001).

Ammonia emissions for dairy operations were based on an emission factor (74 pounds per head per year) developed from a 1997 field study in the San Joaquin Valley by Terry James, et al. (James, et al., 1997). The dairy cattle population used for the ammonia emission estimates was based on the 1997 calendar year.

PM_{10} emissions for dairy operations exclusively represented potential releases from windblown dust at dairy pasture land. The emissions did not include PM_{10} emissions that would be generated from movement of dairy cattle at unpaved corrals.[5] The PM_{10} emissions were based on: 1) a rough assumption on the fraction of pasture land occupied by dairy cattle; and 2) the 1998 calendar year dairy cattle population data generated by the SJVUAPCD (Benjamin, 2001a). The data are routinely submitted to CARB for inclusion in the California Emission Inventory Database.

ROG and methane emissions for dairy operations were based on the 1998 calendar year data generated by the SJVUAPCD and emission factors established in CARB's Emission Inventory Procedural Manual, Methods for Assessing Area Source Emissions.[6] However, CARB's estimates for ROG and methane emissions from livestock waste include emissions generated from other livestock sources (e.g., swine, horses, poultry), and not exclusively from dairy animals (Benjamin, 2001b). In addition, the CARB study did not estimate methane emissions generated from the cattle digestion process.

The report concluded that dairy operations accounted for 91 percent of the methane emissions generated in Kings County. The report also indicated dairy operations contribute 58, 25, and 1 percent of the total ammonia, ROG, and PM_{10} generated in Kings County (CARB, 2001). The estimated percentages would be expected to be modified when all sources of emissions can be quantified.

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[5] According to CARB, PM_{10} emission estimates were based solely on what was reported in their California Emission Inventory Database, which is limited to windblown dust from pasture land. CARB indicated that PM_{10} emissions from dairy corrals were not estimated since corresponding PM_{10} emission factors were not reported in the California Emission Inventory Database (Benjamin, 2001a).

[6] A discussion of this methodology is provided in the Existing Conditions subsection of this analysis.

San Joaquin Valley Unified Air Pollution Control District

The San Joaquin Valley Air Basin includes all of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare counties, and a portion of Kern County (SJVUAPCD, 1998). The SJVUAPCD was formed in 1992 and has jurisdiction over air quality issues in the San Joaquin Valley Air Basin. Agricultural and livestock operations are exempt by State law from permitting requirements but are responsible for following prohibitory rules. The SVJUAPCD and CARB have joint responsibility for attaining and maintaining the State and Federal ambient air quality standards in the San Joaquin Valley Air Basin.

In March 2000, the SJVUAPCD prepared a draft staff report identifying Best Available Control Measures (BACM) Amendments to SJVUAPCD's Regulation VIII, Fugitive PM_{10} Prohibitions. The purposes of the amendments were to address the deficiencies in the current Regulation VIII identified by the U.S. EPA and to fulfill the district's commitment to upgrade Regulation VIII from Reasonably Available Control Measures (RACM) to BACM. The SJVUAPCD proposes to "sunset" the existing Regulation VIII rules and replace them with amended rules described in the draft staff report. The SJVUAPCD has not specified a "sunset" date.

The amendments include eight ~~proposed~~ adopted rules to be incorporated into Regulation VIII. The ~~proposed~~ rules address administrative requirements (rule 8011), construction, demolition, excavation, extraction, landfill, and other earth moving activities (rule 8021), bulk materials (rule 8031), carryout and trackout (rule 8041), open areas and vacant lots (rule 8051), paved and unpaved roads (rule 8061), unpaved vehicle and equipment traffic areas (rule 8071), and off-site agricultural sources[7,8] (rule 8081). The report indicated that the SJVUAPCD has not yet completed its research projects to determine appropriate regulatory control strategies for on-field agricultural sources[9] (e.g., tilling, land preparation, and harvesting) and strongly encouraged owners/operators of on-field agricultural sources

[7] ~~Proposed~~ Rule 8011 defines an agricultural source as any activity or portion of land associated with the commercial growing of crops or the raising of fowl or animals.

[8] According to ~~proposed~~ rule 8011, an off-field agricultural source is defined as any agricultural source that also meets the definition of: construction; excavation; outdoor handling, storage and transport of bulk material; paved road; unpaved road; or unpaved vehicle or traffic equipment area; open areas and vacant lots; or generates carryout or trackout.

[9] According to ~~proposed~~ rule 8011, on-field agricultural source is defined as any agricultural source that is not an off-field agricultural source, including: activities conducted solely for the purpose of preparing land for the growing of crops or the raising of fowl or animals, such as brush or timber clearing, grubbing, scraping, ground excavation, land leveling, grading, turning under stalks, disking, or tilling; drying or pre-cleaning of agricultural crop material on the field where it was harvested; handling or storage of agricultural crop material that is baled, cubed, pelletized, or long-stemmed on the field where it was harvested; and disturbances of cultivated land as a result of planting, fertilizing, or harvesting.

to apply voluntary best management practices outlined by the district and the Natural Resource Conservation Service. The SJVUAPCD ~~recently revised the March 2000 report, which will be available for public review sometime in spring~~ adopted the amendments in November 2001.

The SJVUAPCD is also currently working with CARB and other parties (i.e., industry) on the development of the California Regional $PM_{10}/PM_{2.5}$ Air Quality Study (CRPAQS), a comprehensive program of monitoring, emissions inventory development, data analysis, and modeling of particulate matter, specifically PM_{10} and $PM_{2.5}$. The purpose of the study is intended to provide an improved understanding of PM_{10} and $PM_{2.5}$, establish a strong scientific foundation for informed decision making, and to prepare efficient and cost-effective emission control strategies to achieve the PM_{10} and $PM_{2.5}$ standards in central California. The study includes particulate matter associated with agricultural and livestock operations, including dairy facilities. The study is expected to be completed in 2003.

In addition, the SJVUAPCD is currently working with CARB on the development of the Central California Ozone Study (CCOS); the study area extends from Redding in the north to the Mojave Desert in the south, and from the Pacific Ocean in the west to the Sierra Nevada in the east. The primary objective of this study is to obtain a suitable database for grid-based, photochemical modeling. The California Air Resources Board (CARB) and air pollution control districts will use this database to apply photochemical models to examine the effects of emissions on ozone concentrations and to prepare the demonstration of attainment for the ozone standard for nonattainment areas in central California. Data were collected between December 1999 and February 2001. Over the next two years, the data will be evaluated and eventually included in the database system.

Kings County

The Kings County Right to Farm Ordinance (Kings County Code of Ordinances, Chapter 14, Article III, Section 14-38) indicates that it is the County's policy to "*protect agricultural land, operations, and facilities from conflicting uses due to the encroachment of incompatible, non-agricultural uses of the land in agricultural areas of the county*," and to "*advise developers, owners, and subsequent purchasers of property in the County of the inherent potential inconveniences and discomforts often associated with agricultural activities and operations, including, but not limited to, equipment and animal noise; farming activities conducted on a 24-hour a day, 7-day a week basis; odors from manure, fertilizers, pesticides, chemicals, or other sources; the aerial and ground application of chemicals and seeds; dust; flies and other insects; and smoke from agricultural operations.*"

The ordinance also indicates that no lawful agricultural activity, operation, or facility "*conducted for commercial agricultural purposes in a manner consistent with proper and accepted customs and standards as established and followed by similar agricultural operations in the same*

locality, shall be or become a nuisance, private or public, due to any changed condition in or about the locality, including, but not limited to, the encroachment of non-agricultural uses such as rural residences." The ordinance requires that all approvals for rezonings, land divisions, zoning permits, and residential building permits in the County shall include a condition that notice and disclosure of this policy be given to subsequent owners and occupants of the property, and that transfers of property also include the notice.

AMBIENT AIR QUALITY

The San Joaquin Valley Air Basin is approximately 250 miles long and averages 35 miles in width. The width of the Valley in the area of the project averages about 50 to 60 miles. It is the second largest air basin in California and has some of the most severe air pollution problems in the State. The following is a description of the sources, physical and health effects, and the air basin's attainment status, where appropriate, for air pollutants.

Permanent air quality monitoring stations currently operating in the County are the Van Dorsten station in Corcoran, Patterson station in Corcoran, and South Irwin Street station in Hanford. The Patterson station was opened in 1996 to replace the Van Dorsten station; the criteria pollutant monitored at the two stations is PM_{10}. The criteria pollutants monitored at the Hanford station are PM_{10}, ozone, and nitrogen dioxide. The air quality data for the last three available years (1998 to 2000) are summarized in Table 4.2-3.

Ozone (O_3), also known as smog, is not emitted directly into the environment. Ozone is generated from complex chemical reactions that occur in the presence of sunlight. One of the primary components of the chemical reactions is nitrogen oxide (NOx), which is referred to as an ozone precursor. NOx generators in the San Joaquin Valley include mobile sources, solvents, and fuel combustion. Ozone exposure causes eye irritation and damage to lung tissue in humans. Ozone also harms vegetation, reduces crop yields, and accelerates deterioration of paints, finishes, rubber products, plastics, and fabrics. The San Joaquin Valley Air Basin is currently in nonattainment for the Federal and State standards for ozone.

Unlike ozone, **carbon monoxide** (CO) is released directly into the atmosphere by stationary and mobile sources. CO is an odorless, colorless gas formed by the incomplete combustion of fuels. CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood when inhaled at high concentrations. ~~Only the urban area of Fresno is currently in nonattainment for the State CO standard. In 1998, the urbanized areas of Fresno, Stockton, Modesto, and Bakersfield were reclassified from nonattainment to~~

~~attainment status for the Federal CO standard.[10]~~ The San Joaquin Valley Air Basin is currently in attainment for both State and Federal CO standards.

TABLE 4.2-3: **Summary of Air Quality Data, 1998 - 2000**

Pollutant	Standard		1998	1999	2000
Van Dorsten and Patterson Stations (in Corcoran)					
PM_{10}	State 24-hours (50 µg/m^3)	Days over standard	6/13	NA/43	NA/13
	Federal 24-hours (150 µg/m^3)	Days over standard	0/0	NA/2	NA/0
	State annual geometric mean (30 µg/m^3)	Annual geometric mean concentration (µg/m^3)	24.0/ 32.8	NA/ 41.3	NA/ 35.4
	Federal annual arithmetic mean (50 µg/m^3)	Annual arithmetic mean concentration (µg/m^3)	29.5/ 41.9	NA/ 53.2	NA/ 41.5
South Irwin Street Station (in Hanford)					
PM_{10}	State 24-hours (50 µg/m^3)	Days over standard	15	17	7
	Federal 24-hours (150 µg/m^3)	Days over standard	0	0	0
	State annual geometric mean (30 µg/m^3)	Annual geometric mean concentration (µg/m^3)	29.8	41.6	36.4
	Federal annual mean (50 µg/m^3)	Annual mean concentration (µg/m^3)	39.2	53.4	39.8
Ozone	State 1-hour (0.09 ppm)	Days over standard	27	28	43
	Federal 1-hour (0.12 ppm)	Days over standard	3	2	0
		Highest 1-hour concentration (ppm)	0.14	0.14	0.124
Ozone	Federal 8-hour (0.08 ppm)	Days over standard	31	25	48
		Highest 8-hour concentration (ppm)	0.11	0.11	0.11
Nitrogen dioxide	State 1-hour (0.09 ppm)	Days over standard	0	0	0
	Federal 1-hour (0.12 ppm)	Days over standard	0	0	0
		Highest 1-hour concentration (ppm)	0.09	0.09	0.06

Source: CARB, 1998 and undated(a)

Notes: µg/m^3 = micrograms per cubic meter.
xx/yy = Van Dorsten Avenue data/Patterson data.
na = Not available.
Values in parentheses indicate corresponding standard.

[10] ~~Based on personal communication between Mr. Joe O'Bannon, San Joaquin Valley Unified Air Pollution Control District, and Ms. Rhodora Del Rosario, BASELINE Environmental Consulting, on 10 March 1999.~~

PM_{10} is released directly into the atmosphere by stationary and mobile sources. PM_{10} consists of a wide range of solid and liquid particles, including smoke, dust, aerosols, and metallic oxides. PM_{10} consists of coarse and fine particulates. The coarse fraction contains particulates greater than 2.5 microns and less than or equal to 10 microns; the fine fraction contains particulates less than or equal to 2.5 microns and is known as $PM_{2.5}$. Exposure to coarse fraction particulates can aggravate respiratory conditions, such as asthma. Major sources of PM_{10} include vehicles, power generation, industrial processing, wood burning, road dust, construction/farming activities, and fugitive windblown dust. The 2000 PM_{10} emission inventory for the San Joaquin Valley Air Basin indicated that fugitive windblown dust from undeveloped areas, farming operations, and unpaved road dust were the three leading sources of PM_{10} (SJVUAPCD, 2000). The San Joaquin Valley Air Basin is currently in nonattainment for the Federal and State PM_{10} standards.

$PM_{2.5}$, the fine fraction of PM_{10}, is generated by combustion processes and by chemical reactions taking place in the air. Fine fraction particulates can penetrate the deepest part of the lungs. Exposure to fine particulates has been linked to health problems, including asthma, bronchitis, acute and chronic respiratory symptoms (e.g., shortness of breath and painful breathing), and premature deaths. The elderly, individuals with cardiopulmonary disease, and children appear to be at greatest risk (U.S. EPA, 1998a and 2000). None of the air basins has been designated as attainment or nonattainment for the $PM_{2.5}$ standard due to the current lack of $PM_{2.5}$ data and the recent adoption of the $PM_{2.5}$ standard. As of the preparation of this EIR, the U.S. Court of Appeals for the District of Columbia Circuit has ruled that the new $PM_{2.5}$ standard was improperly adopted; the district is in the process of determining the course of action for $PM_{2.5}$.

$PM_{2.5}$ is classified as either primary or secondary particulates. Both primary and secondary $PM_{2.5}$ can travel over large distances. Primary $PM_{2.5}$ is considered either carbonaceous or geological (crustal). Primary $PM_{2.5}$ predominantly consists of carbonaceous $PM_{2.5}$, which is generated from combustion of fossil fuels or biomass. Carbonaceous $PM_{2.5}$ combustion sources include gasoline and diesel exhaust, wood stoves and fireplaces, land clearing, prescribed burning of wild land, and wild fires. Geological (crustal) $PM_{2.5}$ makes up a minor amount of primary $PM_{2.5}$. Geological (crustal) $PM_{2.5}$ is generated from fugitive emission sources, including paved and unpaved roads, dust, crustal material from construction activities, agricultural tilling, wind erosion, and other crustal sources.

Secondary $PM_{2.5}$ is created through atmospheric heterogeneous (gas to particle) reactions of gaseous SOx and NOx precursor emissions. The reactions involve chemical and physical interactions with the precursor emissions in the atmosphere. Data collected in the San Joaquin Valley indicate that agricultural sources of ammonia react with nitric acid to form ammonium nitrate particles, which are in the $PM_{2.5}$ range (EIIP, 1999). A study conducted in the San Joaquin Valley in 1998 indicated that the formation of ammonium nitrate is