CHAPTER 8

FUTURE AIR QUALITY - DESERT NONATTAINMENT AREAS

INTRODUCTION

The 1990 federal Clean Air Act revised the planning requirements for many areas that have not attained National Ambient Air Quality Standards. The South Coast Air Quality Management District (District) has jurisdiction over the South Coast Air Basin (Basin), and the desert portions of Los Angeles and Riverside counties in the Mojave Desert Air Basin and Salton Sea Air Basin, respectively (see Figure 1-1). However, AB 2666 (Knight) created the Antelope Valley Air Pollution Control District beginning on July 1, 1997. Until then, the District will continue to address the planning requirements for the Antelope Valley. The Antelope Valley, located in the desert portion of Los Angeles county, and the Coachella Valley, located in the desert portion of Riverside county, both exceed the federal ozone standard. The Antelope Valley is unclassified for PM_{10}. The Coachella Valley has attained the federal PM_{10} standards and a maintenance plan is currently being developed as a separate plan.

The federal Clean Air Act requires that the Antelope Valley and Coachella Valley:

- identify specific emission reduction goals;
- demonstrate reasonable further progress in VOC emission reductions;
- demonstrate attainment of the federal ozone standard by November 15, 2007; and
- provide contingency measures or actions in the event of a failure to attain or to meet interim milestones.

This AQMP revision addresses these requirements and satisfies the State Implementation Plan requirements under Title I of the Clean Air Act (CAA).

STATEMENT OF PROBLEM

There are a number of circumstances that are unique to the Antelope and Coachella valleys which make it difficult to develop a local control strategy that satisfies CAA requirements. For example, with little in the way of local emissions, and with the significant growth projected for both desert areas it is difficult to satisfy the reasonable further progress requirements of the CAA. There is strong evidence that pollutant transport from the South Coast Air Basin to the Antelope and Coachella valleys is the primary cause of the ozone nonattainment status of both areas. As a result, the District believes that aggressive control of the South Coast Air Basin emissions is an effective strategy to substantially improve air quality in the Antelope and Coachella valleys. Each of these issues is addressed in further detail below.

Regulatory Requirements

State Implementation Plan requirements under Title I of the CAA depend on the severity of the nonattainment problem. For the Antelope Valley and the Coachella Valley, the CAA requirements for moderate through severe areas must be addressed. Thus, the areas are subject to the reasonable further progress requirements of the CAA, as discussed in Chapter 6 for the South Coast Air Basin; these requirements are intended to ensure that each ozone nonattainment area provide for sufficient VOC emission reductions to attain the ozone national ambient air quality standard. These requirements are more difficult to meet for areas with low existing emissions and significant population growth, since the VOC reductions are relative to the 1990 emissions and activity levels. For example, the CAA requires three percent VOC emission reductions beginning in 1997. If an area experiences population growth such that VOC emissions increase by 15 percent over 1990 levels, then the area must develop regulations that achieve VOC reductions of at least 18 percent (i.e., the 3 percent rate-of-progress requirement plus the 15 percent increase from population growth). The expected population growth for the Antelope and Coachella valleys is significant; thus the rate-of-progress requirements of the CAA cannot be met for either area unless further local controls are implemented.

The CAA also requires that "severe-17" ozone nonattainment areas, such as the Antelope and Coachella valleys, demonstrate attainment of the federal ozone air quality standard by November 15, 2007 using a U.S. EPA-recommended photochemical grid model and EPA-approved modeling techniques. The South Coast Air Basin modeling domain, as shown in Figure 8-1, was expanded to include the Antelope Valley and Coachella Valley so that this CAA requirement could be addressed. It is clear from available data that federal ozone standard exceedances in the Antelope and Coachella valleys largely result from pollutant transport from the upwind South Coast Air Basin. Photochemical grid modeling for the 1994 AQMP, using the U.S. EPA-approved Urban Airshed Model, shows that attainment of the ozone standard is possible with the proposed control strategy described in the 1994 AQMP for the South Coast Air Basin, and control of locally generated emissions via state and federal regulations. This Plan carries forward the 1994 AQMP control approach for the Antelope and Coachella valleys.

Population Growth

Both the Antelope Valley and the Coachella Valley are rapidly growing areas, as shown in Table 8-1. By 2020, the population in the Antelope Valley is expected to nearly triple from 1990 levels and the Coachella Valley population is projected to more than double. It is clearly more challenging to meet the rate-of-progress requirements of the CAA in such rapidly growing areas.

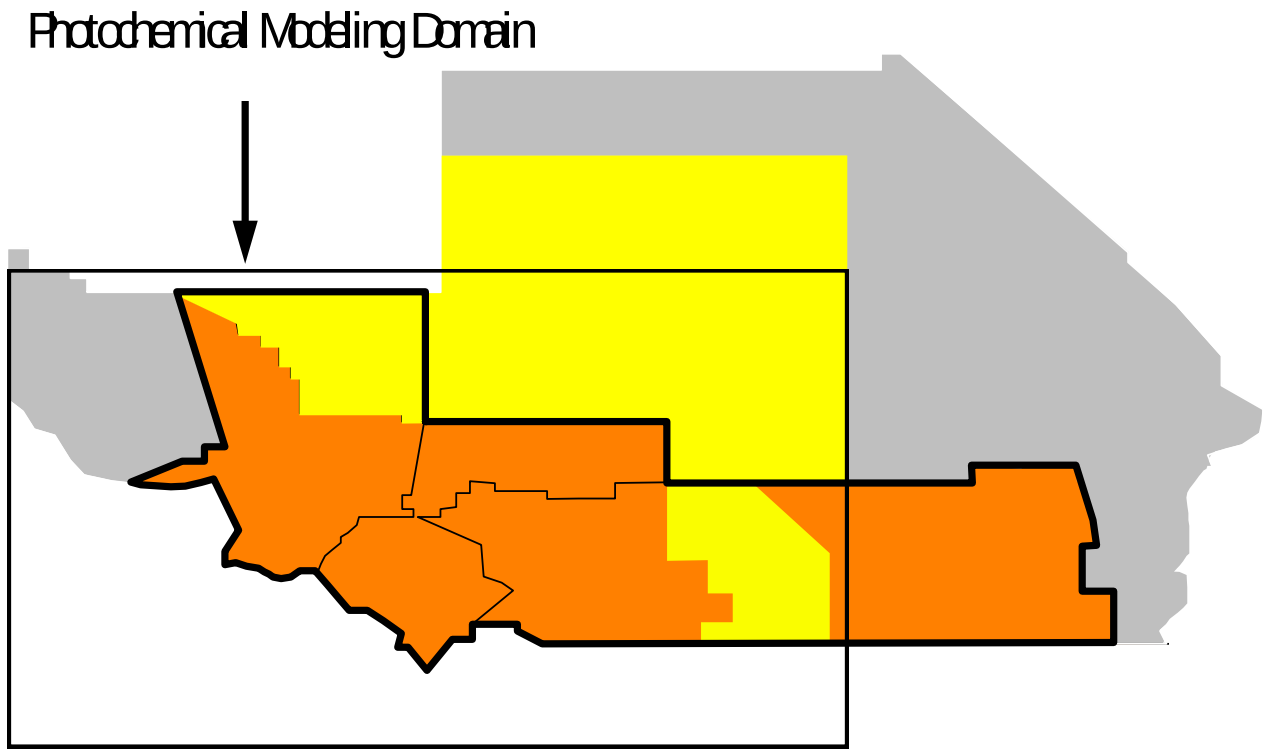

FIGURE 8-1

Modeling Domain

[Note: A New District (Antelope Valley Air Pollution Control District) was Formed in September 1996 and Will Be Effective on July 1, 1997.]

TABLE 8-1

Historical Population and Population Forecasts

Area	1980	1990	2000	2010	2020
South Coast Air Basin	~10,500,000	13,022,000	14,798,000	16,653,000	18,926,000
Antelope Valley	101,000	235,000	375,000	532,000	706,000
Coachella Valley	139,000	267,000	319,000	389,000	475,000

Pollutant Transport

The following pollutant transport pathways from the South Coast Air Basin to the Mojave Desert and Salton Sea air basins have been identified: 1) through Newhall Pass to the Antelope Valley; and 2) through Banning Pass to the Coachella Valley.[1] The transport pathway to the Coachella Valley has been an intensely studied phenomenon. An experiment to study this transport pathway concluded that the South Coast Air Basin was the source of the observed high oxidant levels in the Coachella Valley.[2] Transport from Anaheim to Palm Springs was directly identified with an inert sulfur hexafluoride tracer release[3]. The most comprehensive study to date of transport from the South Coast Air Basin to the Mojave Desert and Salton Sea air basins confirmed the transport pathways to both Antelope and Coachella valleys.[4]

Ozone pollutant transport to the Antelope and Coachella valleys can be demonstrated by examining ozone exceedance frequencies as a function of distance from the source areas. Figures 8-2 and 8-3, respectively, show the frequency of exceedances of the federal one-hour ozone standard by hour for the period 1991 to 1995. Figure 8-2 represents the transport route to the Antelope Valley beginning at the primary source region of downtown Los Angeles through Burbank and Santa Clarita and ending at Lancaster in the Antelope Valley. The Coachella Valley transport route is represented in Figure 8-3, starting at Pico Rivera near the source region and passing through Fontana and Banning and finally through Banning Pass to Palm Springs in the Coachella Valley. Note in both figures that near the source region exceedances occur most frequently at mid-day (noon to 1:00 p.m.) during the peak of incoming solar radiation and therefore the peak of ozone production. As one goes downwind of the source region, exceedances occur later and later in the day as the ozone cloud is transported downwind. For example, at Lancaster exceedances occur most frequently at 3:00 to 4:00 p.m. and Palm Springs exceedances occur most frequently at 6:00 p.m. If these peaks were locally generated they would be occurring near mid-day and not in the late afternoon or early evening.

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1 R.W. Keith. 1980. A Climatological Air Quality Profile: California's South Coast Air Basin. Staff Report, South Coast Air Quality Management District.

2 E.K. Kauper. 1971. Coachella Valley Air Quality Study. Final Report, Pollution Res. & Control Corp., Riverside County Contract & U.S. Public Health Service Grant No. 69-A-0610 RI.

3 P.J. Drivas and F.H. Shair . 1974. A Tracer Study of Pollutant Transport in the Los Angeles Area. Atmos. Environ. **8**: 1155-1163.

4 T.B. Smith et al. 1983. The Impact of Transport from the South Coast Air Basin on Ozone Levels in the Southeast Desert Air Basin. CARB Research Library Report No. ARB-R-83-183. ARB Contract to MRI/Caltech.

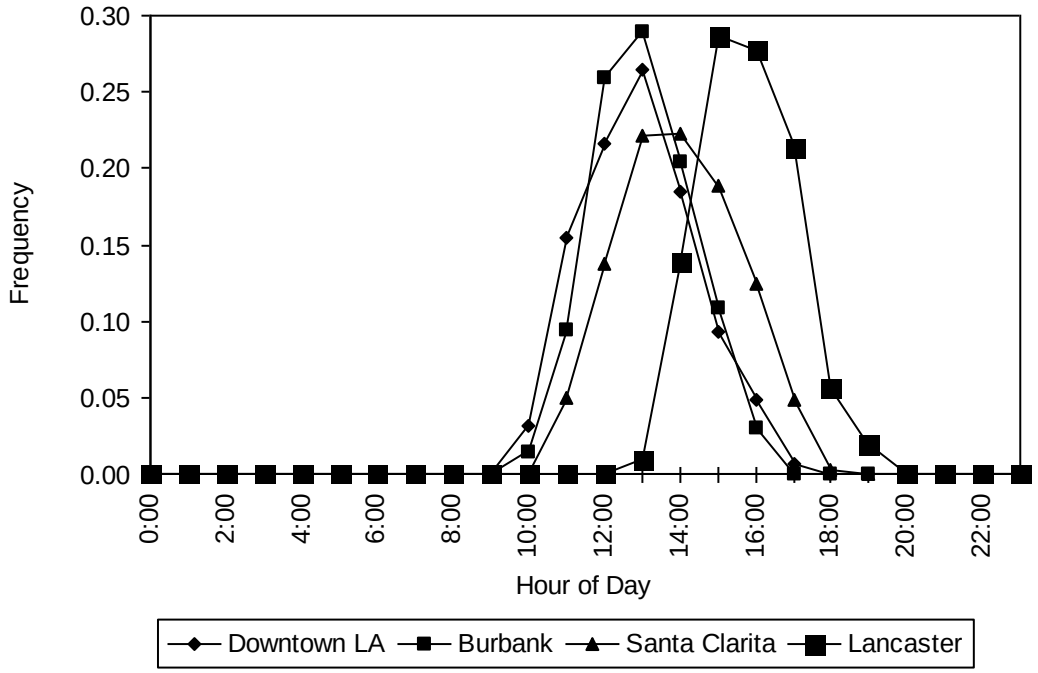


FIGURE 8-2

Frequency of Federal Ozone Exceedances Along the Antelope Valley Transport Route, 1991-95

Ozone is transported these long distances at fairly high concentrations for two reasons. Control of VOCs in the South Coast Air Basin has caused the location of the daily maximum ozone to move eastward; thus more pollutants which have not reacted are carried to greater distances. The VOC control program in the South Coast Air Basin has reduced VOC emissions to the extent that photochemical reaction rates of formation of ozone have also slowed. Greater amounts of emissions (although, overall, these emissions are lower) are transported downwind as a result. In addition, ozone formed in the South Coast Air Basin could remain above the standards during transport in the downwind areas since there are fewer oxides of nitrogen sources to react with ozone during the nighttime hours.

Table 8-2 compares the 1993 emission inventories of the South Coast Air Basin with those for the Antelope Valley and the Coachella Valley. The South Coast Air Basin emissions, upwind of the Antelope and Coachella valleys, overwhelm the locally-generated emissions. Depending on the pollutant, emissions in the South Coast Air Basin are 11 (for PM_{10}) to 99 (for SO_x) times greater than emissions in the Antelope Valley and 5 (for PM_{10}) to 50 (for SO_x) times greater than emissions in the Coachella Valley. It is clear that improved air quality in these areas depends on reduced emissions in the South Coast Air Basin. This is illustrated by the trends in ozone air quality described in the following section.

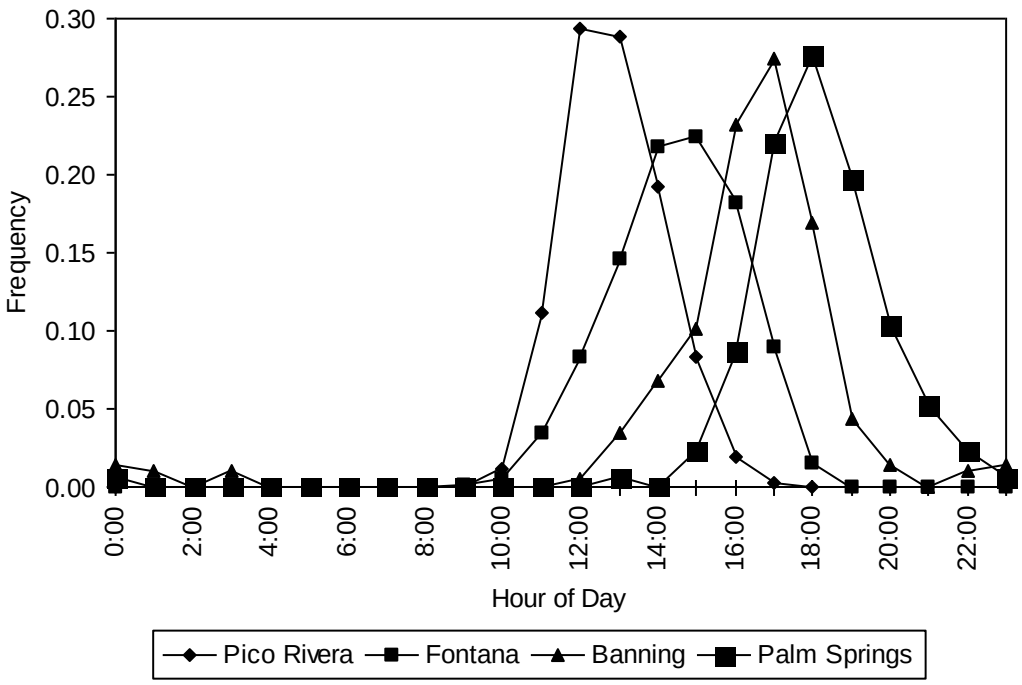


FIGURE 8-3

Frequency of Federal Ozone Exceedances Along the Coachella Valley Transport Route, 1991-95

TABLE 8-2

Comparison of 1993 Annual Average Emissions

	Emission Rate (tons/day)				
Area	VOC	NOx	CO	SOx	PM10
South Coast Air Basin	1239	1194	7045	79	416
Antelope Valley	28	30	168	1	28
Coachella Valley	40	54	270	1	88

Trends in Ozone Air Quality

Ozone air quality trends since 1980 are shown in Figures 8-4 and 8-5 for stations along the Antelope and Coachella Valley transport routes, respectively. The statistic used here to illustrate trends is the average of the 30 highest daily maximum one-hour ozone concentrations in each year, referred to as the "Top 30 Mean." This statistic has been identified and recommended by the ARB[5] as a good trend indicator. Over this time period population growth in the Antelope and Coachella valleys was much greater than that in the South Coast Air Basin, as shown in Table 8-2. Since emissions are directly related to population for many source categories, emissions growth was also greater in the Antelope and Coachella valleys relative to the South Coast Air Basin. However, the downward trend in the Top 30 Means at Lancaster and Palm Springs parallels the trend of the upwind stations which are in the South Coast Air Basin. This observation confirms the conclusion that ozone air quality in the Antelope and Coachella valleys is largely due to transport from the upwind source region of the South Coast Air Basin and that attainment in the valleys is only possible with emission reductions in the Basin.

[5] ARB. 1992. Ozone Air Quality Trends (1981-1990).

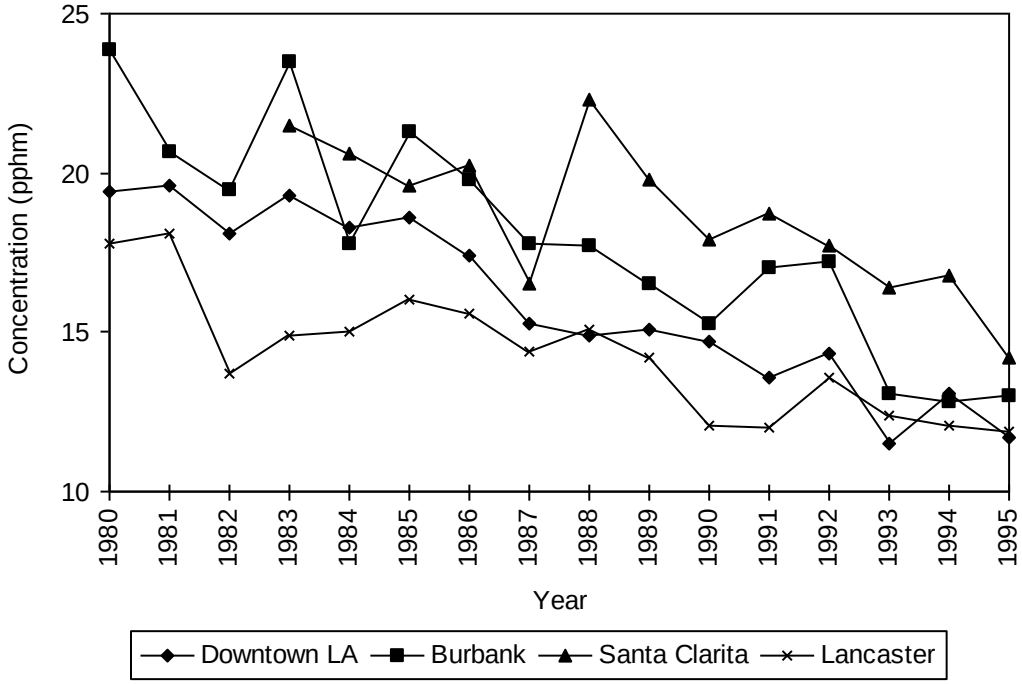


FIGURE 8-4
Mean of the Top 30 Daily Peak Ozone Concentrations - Antelope Valley Transport Route

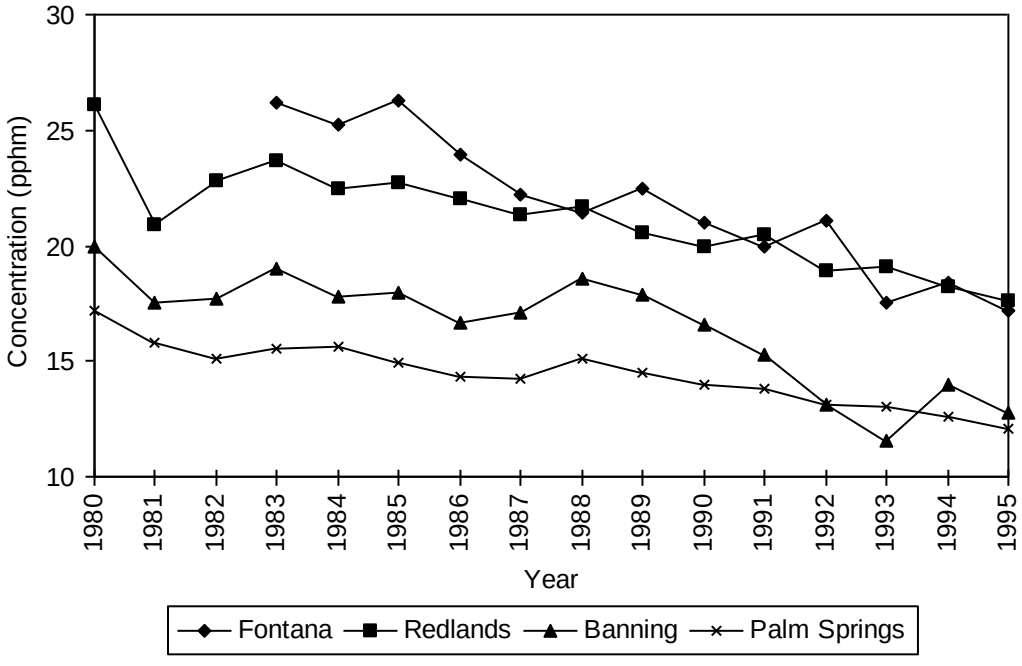


FIGURE 8-5
Mean of the Top 30 Daily Peak Ozone Concentrations - Coachella Valley Transport Route

Figures 8-6 and 8-7 illustrate just how effective the District's control strategy has been in reducing the number of federal one-hour ozone exceedances in the Antelope and Coachella valleys since 1980. The number of exceedance days by month in 1980, 1985, 1990, and 1995 for Lancaster and Palm Springs are shown in Figures 8-6 and 8-7, respectively. Both the number of days per month exceeding the standard and the number of months in which exceedances are observed have dropped dramatically since 1980. In 1980, Lancaster experienced exceedances in eight months of the year and Palm Springs experienced exceedances in seven months of the year. By 1995, the number of months with exceedances had dropped to only three months.

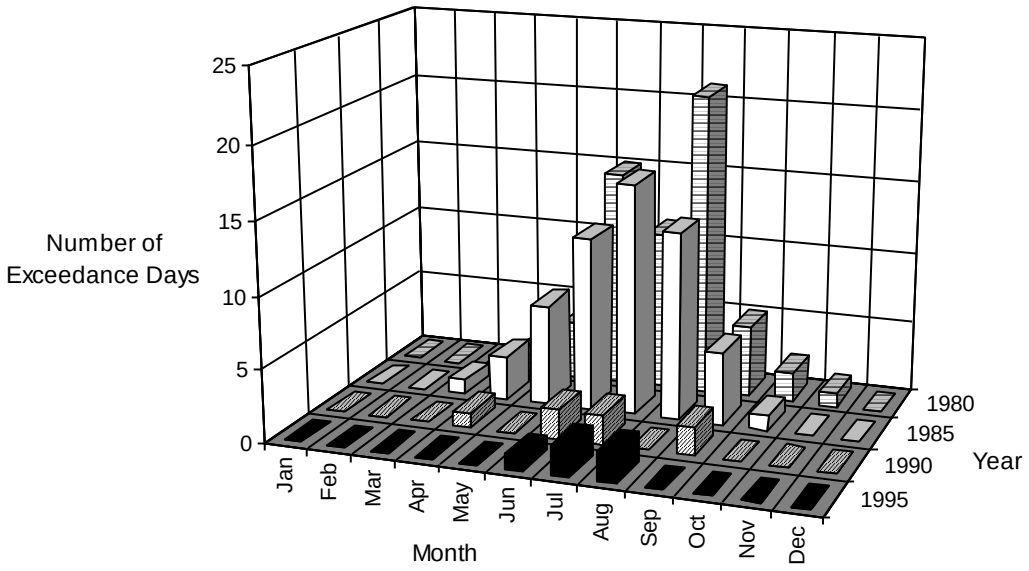


FIGURE 8-6

Federal Exceedance Days by Month and Year at Lancaster

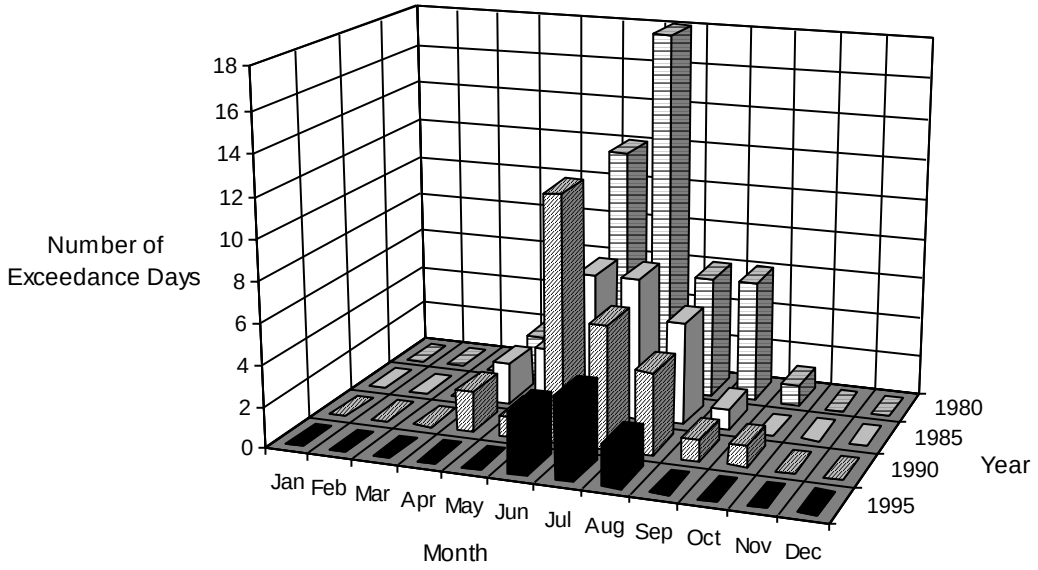


FIGURE 8-7

Federal Exceedance Days by Month and Year at Palm Springs

ATTAINMENT DEMONSTRATION

Air quality modeling is an integral part of the planning process to achieve clean air. The CAA requires that ozone nonattainment areas designated as serious and above be required to use a photochemical grid model to demonstrate attainment. The photochemical grid model (or air quality simulation model) recommended by the U.S. EPA for ozone analyses is the Urban Airshed Model with the Carbon Bond Mechanism IV chemistry (UAM). UAM is an urban-scale, three-dimensional, grid-type, numerical simulation model. It is designed for computing ozone concentrations under short-term, episodic conditions lasting one to three days. UAM is also the recommended model for ozone analysis by the ARB.

It is desirable to perform ozone air quality analyses using several different meteorological episodes. Chapter 5 describes the meteorological episodes used to project future air quality. Performance evaluations of the four meteorological episodes are discussed in Technical Report V-B of the 1994 AQMP.

Future-year air quality projections in the Antelope and Coachella valleys are presented in detail in Appendix V; the results are summarized in Figure 8-8 for the Antelope Valley and Figure 8-9 for the Coachella Valley. The peak predicted ozone concentrations are shown for the baseline and controlled 2007 simulations for each of the four meteorological

episodes modeled. "Baseline" assumes no further control beyond existing rules and regulations and "Control" assumes implementation of the proposed control strategy described in Chapters 4 and 7. As illustrated, the federal ozone standard, shown by a solid horizontal line at 12 pphm in the figures, will be exceeded in one of the four episodes in the Antelope Valley and in two of the four episodes in the Coachella Valley if the AQMP control is not implemented. However, with the implementation of the control strategy, the federal one-hour ozone air quality standard is attained for all four episodes in both the Antelope and Coachella valleys.

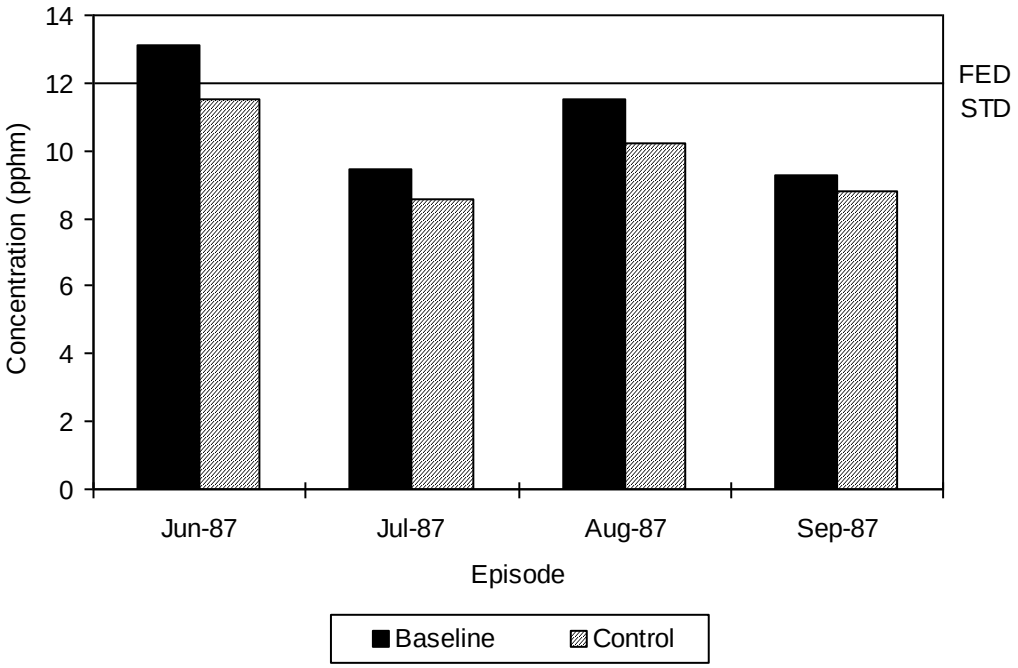


FIGURE 8-8

Maximum Predicted Ozone Concentrations for 2007 in the Antelope Valley With and Without Implementation of the 1997 AQMP Control Strategy

POST-1996 VOC RATE-OF-PROGRESS REQUIREMENTS

The reasonable further progress requirements in the CAA are intended to ensure that each ozone nonattainment area provide for sufficient precursor emission reductions to attain the ozone National Ambient Air Quality Standard. More specifically, Section 182(c)(2) requires that each serious and above ozone nonattainment area achieve actual VOC emission reductions of at least three percent per year averaged over each consecutive 3-year period beginning six years after enactment of the Act until the area's attainment date (i.e., November 15, 2007 for the Antelope and Coachella valleys). This is called the "post-1996 rate-of-progress" requirement of the CAA.

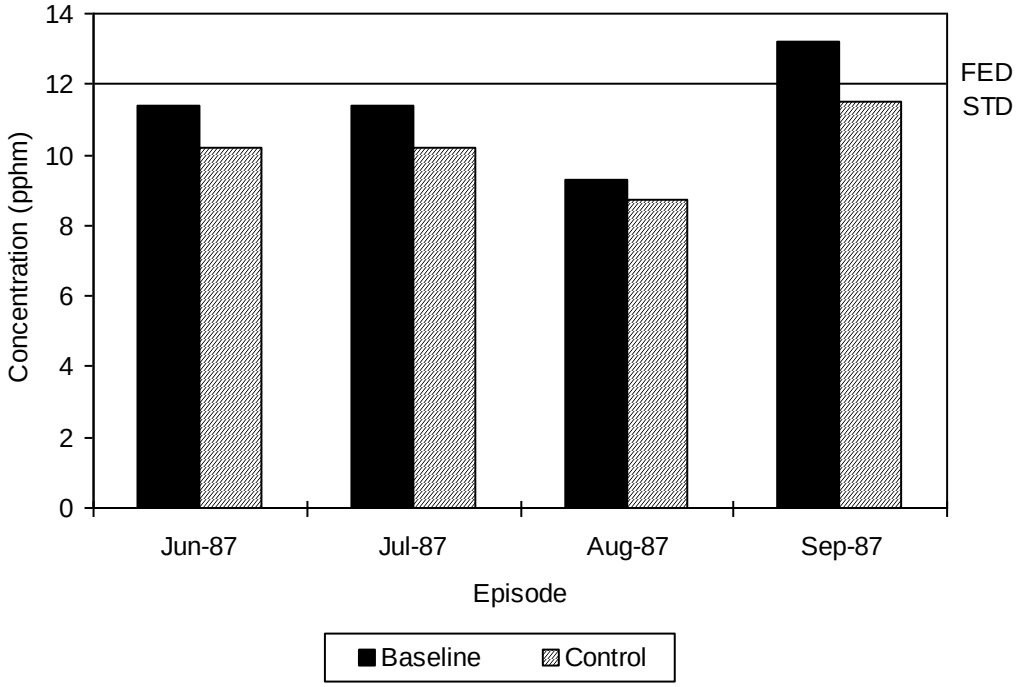


FIGURE 8-9

Maximum Predicted Ozone Concentrations for 2007 in the Coachella Valley With and Without Implementation of the 1997 AQMP Control Strategy

According to Section 182(c)(2)(C), actual NO_x emission reductions which occur after 1990 can be used to meet post-1996 VOC emission reduction requirements provided the NO_x reductions satisfy the following criteria. First, the control strategy used to demonstrate attainment must consist of both VOC and NO_x control measures. More specifically, the mix of VOC and NO_x emission reductions used to satisfy the post-1996 rate-of-progress requirements of the CAA must be consistent with the controlled VOC and NO_x emission levels used in the modeling demonstration. And lastly, the combined annual VOC and NO_x reductions must average 3 percent per year.

As mentioned a number of times in this chapter, poor ozone air quality in the Antelope and Coachella valleys is primarily due to transport of ozone and its precursors from the upwind source region of the South Coast Air Basin and attainment in these downwind valleys is only possible with substantial emission reductions in the Basin. With this in mind, the proposed control strategy consists of two components: 1) an aggressive control strategy for VOC and NO_x emission sources in the South Coast Air Basin; and 2) control of locally generated emissions via proposed control measures implemented by state and federal actions.

The District's approach to satisfying the post-1996 rate-of-progress requirement is presented in Appendix V; Figures 8-10 (Antelope Valley) and 8-11 (Coachella Valley)

summarize the results. At each milestone year (1999, 2002, 2005, and 2007) the following VOC and NO_x emission levels are shown:

- the target level (termed "Target Level" in the figures);
- the projected uncontrolled baseline (termed "Projected Baseline" in the figures); and
- the controlled emissions - statewide mobile and stationary control measures and control measures for federally regulated sources (termed "Controlled Emissions" in the figures).

The rate-of-progress results for the Antelope Valley are shown in Figure 8-10. The proposed reduction rates by milestone year are shown in Table 8-3. These rates were determined by applying all the creditable VOC reductions at each milestone and providing sufficient NO_X reductions to satisfy the VOC emission reduction requirements of Section 182(c)(2). Comparing the baseline emissions with the target levels for each milestone year indicates that additional emission reductions are necessary to achieve target levels as illustrated in Figure 8-10. However, with the implementation of the state and federal control measures, the post-1996 rate-of-progress requirements are satisfied at all milestone years as shown by the controlled emission levels in Figure 8-10.

TABLE 8-3

Percent VOC and NO_x Reductions for the
Antelope Valley Post-1996 Rate of Progress Plan

Milestone Year	VOC	NO_x	CAA*
1999	15.0	9.0	24.0
2002	0.5	8.5	9.0
2005	5.0	4.0	9.0
2007	0.5	5.5	6.0

* The percent VOC and NO_x reductions must equal the CAA percent reduction requirements listed here.

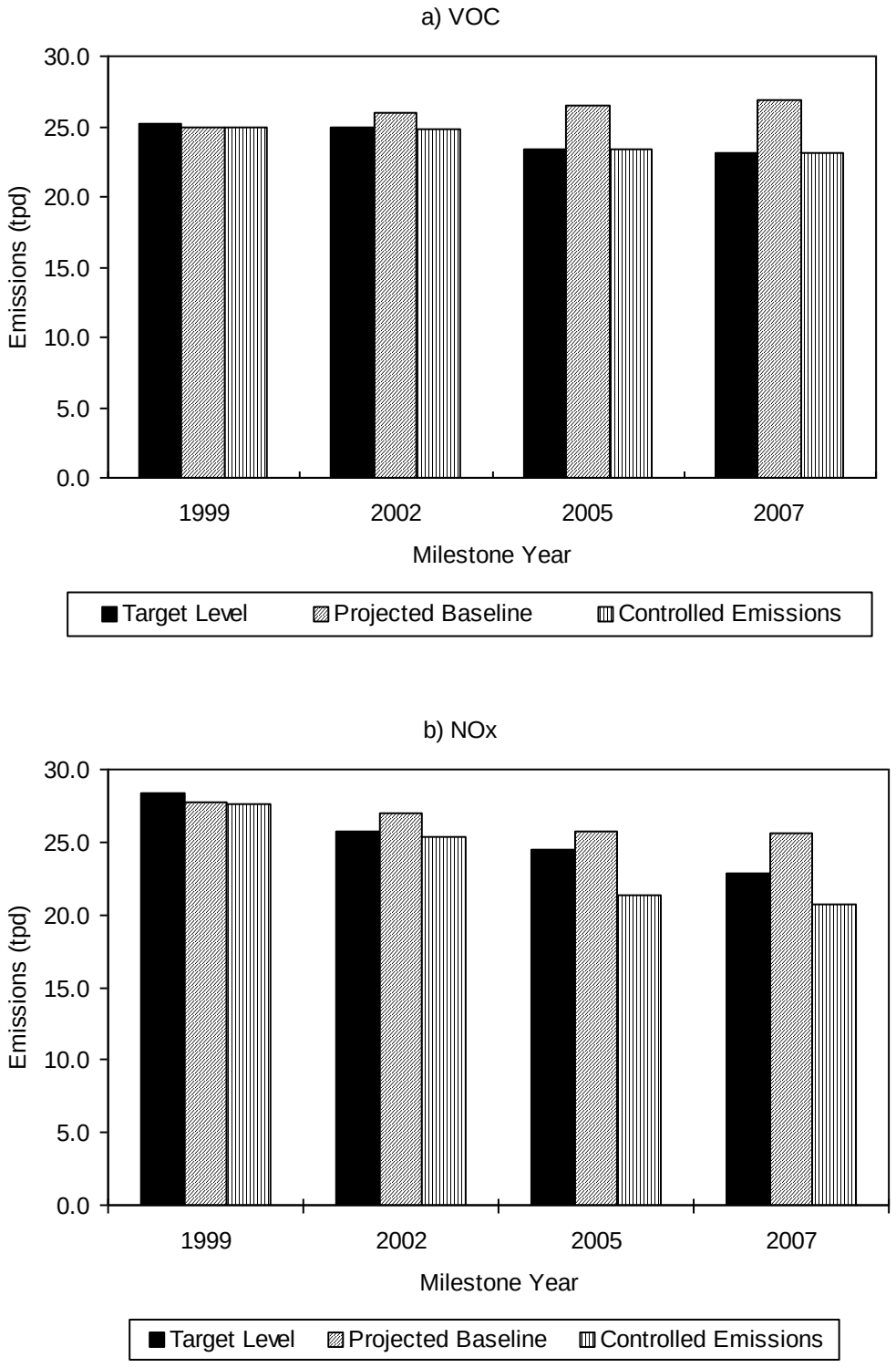


FIGURE 8-10

Comparison of Baseline and Controlled (a) VOC and (b) NO_x Emissions and CAA Target Levels - Antelope Valley

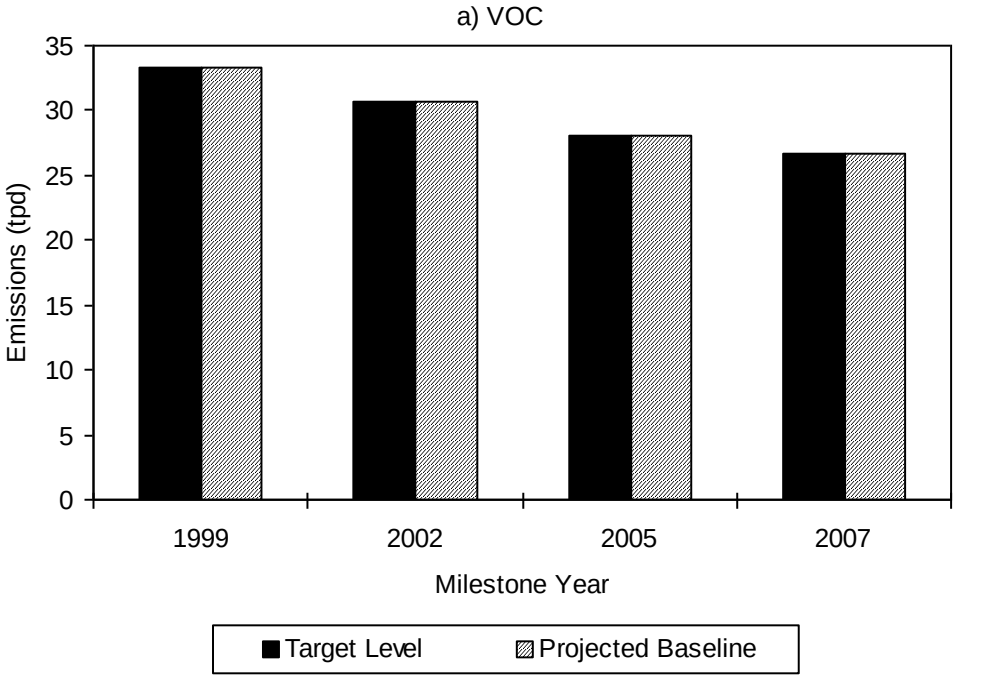
As shown in Figure 8-11, the VOC and NO_x emission reductions from existing District and ARB rules are sufficient to meet the CAA rate-of-progress requirements for the Coachella Valley. The rate-of-progress requirements for all milestone years are met by a combination of VOC and NO_x reductions from existing District and ARB rules. The proposed reduction rates by milestone year are shown in Table 8-4. The control strategy provides additional VOC and NO_x reductions for all the years beginning with 1999. The projected emission reductions beyond the target levels can be used as contingency in the event of a milestone failure.

TABLE 8-4

Percent VOC and NO_x Reductions for the
Coachella Valley Post-1996 Rate of Progress Plan

Milestone Year	VOC	NO_x	CAA*
1999	16.3	7.7	24.0
2002	6.5	2.5	9.0
2005	6.4	2.6	9.0
2007	3.0	3.0	6.0

* The percent VOC and NO_x reductions must equal the CAA percent reduction requirements listed here.



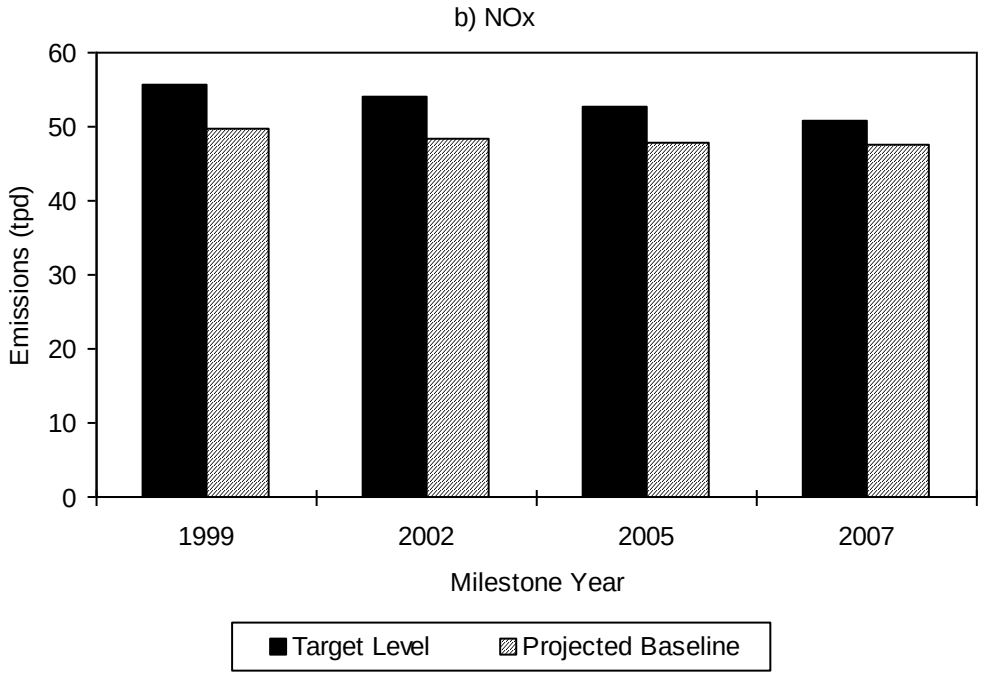


FIGURE 8-11

Comparison of Baseline and Controlled (a) VOC and (b) NO_x Emissions and CAA Target Levels - Coachella Valley

SUMMARY OF COACHELLA VALLEY PM_{10} PLAN

Introduction

The Coachella Valley is currently designated nonattainment for PM_{10}. Unlike the Basin, where PM_{10} exceedances are due primarily to PM_{10} precursor pollutants, the Coachella Valley's elevated PM_{10} levels are strongly tied to local fugitive dust problems. Accordingly, instead of relying on District rulemaking to achieve attainment, previous planning documents have proposed local control to meet the area's air quality objectives. This approach allows local Coachella Valley governments, industry, and citizens to take an active part in improving the Valley's air quality. As a result of this approach, various local dust control programs and two District "backstop" rules have been developed. These programs have resulted in significant improvements in the Valley's air quality.

Background

Under the 1990 federal Clean Air Act (CAA), the Coachella Valley was originally designated as a "moderate" PM_{10} nonattainment area. In response to CAA requirements for "moderate" areas, the District developed the "State Implementation Plan for PM_{10} in the Coachella Valley" (90-CVSIP) which was adopted by the Governing Board in November 1990. The 90-CVSIP proposed implementation of reasonably available control measures (RACM) for fugitive dust sources no later than December 10, 1993. Modeling contained in the 90-CVSIP demonstrated attainment of the national ambient air quality standards (NAAQS) for PM_{10} would occur by December 31, 1995, one year after the statutory limit for moderate nonattainment areas.

The CAA specifies that any area which cannot attain the standards by December 1994 would subsequently be reclassified as a "serious" nonattainment area. In January 1993, the U.S. EPA completed its initial redesignation process, and included the Coachella Valley among five nationwide areas redesignated as "serious," effective February 8, 1993. The CAA further specifies that a SIP revision is due within 18 months of the redesignation date (i.e., August 8, 1994) and that a demonstration of attainment must be submitted within four years of the redesignation date (i.e., February 8, 1997). Among other requirements, the "serious" area SIP must ensure the implementation of "best available control measures" (BACM). The District prepared and later adopted the 1994 Coachella Valley PM_{10} SIP revision (94-CVSIP) in July of 1994.

1997 PM_{10} Maintenance Plan

Under the CAA, an area can be redesignated as attainment if, among other requirements, the U.S. EPA determines that the NAAQS have been attained. Section 175A of the CAA states that any district that submits a request under Section 107(d) for redesignation of a

nonattainment area to attainment must submit a revision of the applicable SIP that demonstrates attainment for at least 10 years after the redesignation. U.S. EPA guidance states that a determination of compliance with the NAAQS must be based on three complete, consecutive calendar years of quality-assured air quality monitoring data[6]. Air quality is monitored at two locations in the Coachella Valley and results indicate that there were no PM_{10} exceedances in 1993 or 1994. In 1995, the 24-hour standard was exceeded once and this led to an exceedance of the annual average standard. This exceedance occurred on a day where the maximum hourly wind gusts exceeded 50 mph for each hour of the day.

The U.S. EPA has recently developed a natural events policy[7] that permits, under certain circumstances, the exclusion of air quality data attributable to uncontrollable natural events (e.g., volcanic activity, wildland fires, and high wind events). With the exclusion of air quality data from the one 24-hour exceedance in 1995, the Coachella Valley has experienced three consecutive years without an exceedance of the PM_{10} standards and, consequently, would be eligible for redesignation to attainment. Based on the supporting meteorological data regarding the one high wind event in 1995, the District is preparing a maintenance plan for the Coachella Valley. In accordance with U.S. EPA guidance, the major elements of the plan are as follows:

- a demonstration of attainment with the PM_{10} standards based on the three most recent years of ambient data;
- a maintenance plan, including contingency measures, to ensure continued attainment for the next ten years; and
- a Natural Events Action Plan pursuant to the Natural Events Policy.

The Coachella Valley Maintenance plan will be prepared as a separate document. It will be released for public review and submitted to the U.S. EPA in lieu of the attainment demonstration prior to February 8, 1997.

CONCLUSIONS

The Antelope Valley and the Coachella Valley are designated as “severe-17” ozone nonattainment areas and as such must demonstrate reasonable further progress and attainment according to federal Clean Air Act requirements. The District’s proposed control strategy includes two components: a strategy for the South Coast Air Basin as described in Chapter 4 and control of locally generated emissions in the Antelope Valley

[6] U.S. EPA, *Memorandum to Division Directors, Subject: Procedures for Processing Requests to Redesignate Areas to Attainment,* Office of Air Quality Planning and Standards, Research Triangle Park, page 2, September 4, 1992.

[7] U.S. EPA, Memorandum from Mary Nichols, Assistant Administrator, Subject: Areas Affected by PM10 Natural Events, May 30, 1996.

and Coachella Valley via regulations at the state and federal level. Photochemical grid modeling, using a U.S. EPA-approved model and methodologies, demonstrates that the federal one-hour ozone standard will be met by November 15, 2007 for the Coachella Valley as required by the CAA. However, the federal ozone air quality standard will be met in the Antelope Valley by 2010. For PM_{10}, the Antelope Valley is an unclassified area with no current planning requirements; for the Coachella Valley, a PM_{10} maintenance plan will be submitted with a request to U.S. EPA for redesignation to attainment status.