CHAPTER 5

FUTURE AIR QUALITY

INTRODUCTION

Air quality modeling is an integral part of the planning process to achieve clean air. As mentioned in Chapter 1, the submittal of the 1994 California Ozone SIP served as the ozone attainment demonstration for the South Coast Air Basin and those portions of the Southeast Desert Modified Nonattainment Area which are under the District's jurisdiction. The attainment demonstrations provided in this Plan reflect the updated emissions baseline estimates, new technical information and enhanced air quality modeling techniques, and the control strategy provided in Chapter 4.

The Basin is currently in nonattainment for nitrogen dioxide[1], PM_{10}, ozone, and carbon monoxide. Three of these pollutants - nitrogen dioxide, PM_{10}, and ozone - are linked to common precursor emissions. The District's goal is to develop an integrated control strategy which: 1) ensures that ambient air quality standards for all criteria pollutants are met by the established deadlines in the federal Clean Air Act (CAA); and 2) achieves an appropriate rate of reduction in excess exposure to PM_{10} and ozone over the next five to ten years. The overall control strategy is designed so that efforts to achieve the standard for one criteria pollutant do not cause the deterioration of another. A three-step modeling process was originally developed in the 1989 AQMP to develop the control strategy. The three-step process begins with an analysis of future nitrogen dioxide air quality, followed by PM_{10} air quality, and lastly, future ozone air quality. Air quality analyses under the 1997 AQMP are performed in keeping with this three-step modeling approach.

While attainment of all federal criteria pollutant air quality standards is the goal of all AQMP revisions, previous AQMP revisions placed greater emphasis on ozone air quality modeling due to the complex chemical and physical interactions of volatile organic compounds (VOCs) and oxides of nitrogen. However, over the past ten years, a better understanding of the complex nature of PM_{10} formation has led to a need to acquire enhanced technical information on PM_{10} and particulate air quality modeling techniques.

The control strategy to meet federal and state carbon monoxide standards is independent of the nitrogen dioxide/PM_{10}/ozone strategy. A photochemical grid model is used to project future carbon monoxide (CO) air quality. As mentioned previously, the Basin has not exceeded the federal annual standard for nitrogen dioxide since 1991 and the state one-hour standard has not been exceeded since 1993. Air quality modeling is provided here to demonstrate continuing maintenance of the federal and state nitrogen dioxide standards. Visibility impairment analyses are also performed even though neither the CAA nor the California Clean Air Act (CCAA) specifically require that visibility be addressed for planning purposes.

[1] The nonattainment designation for NO_2 is based on the current federal classification, but the basin met both the federal and state NO_2 standards since 1993.

Detailed information on the modeling approach, data gathering, model development and enhancement, model application, and interpretation of results is presented in Appendix V. The following sections summarize the results of the modeling efforts. Future air quality projections for the Antelope Valley and Coachella Valley are presented in Chapter 8 and Appendix V.

MODELING APPROACH

Nitrogen Dioxide

A linear rollback approach is used to evaluate future nitrogen dioxide concentrations. It assumes that the ambient concentrations above background levels are directly proportional to the emissions in the immediately adjacent areas. In mathematical terms, the rollback relationship can be written as follows:

$$C_p = [(C_b - k) \cdot Q_p/Q_b] + k \quad (1)$$

where C_p and C_b are the future year and baseline oxides of nitrogen (NO_x) concentrations, respectively, Q_p and Q_b are the future year and baseline NO_x emission rates, respectively, and k denotes the background. For the nitrogen dioxide analysis, the background concentrations are assumed negligible.

Projections are made for several key locations in the Basin representative of areas with recent nitrogen dioxide violations. Future-year annual average nitrogen dioxide concentrations were determined from projected total NO_x concentrations using averaged NO_2/NO_x ratios for the period 1992 to 1994 at each of the locations. The reader is referred to Appendix V for additional details on the technical approach.

PM_{10}

Within the Basin, PM_{10} particles are either directly emitted into the atmosphere (e.g., primary particles), or are formed through atmospheric chemical reactions from precursor gases (e.g., secondary particles). Primary PM_{10} includes road dust, diesel soot, combustion products, and other sources of fine particles. Secondary products, such as sulfates, nitrates, and complex carbon compounds are formed from reactions with oxides of sulfur, oxides of nitrogen, VOCs, and ammonia.

Because of the dual nature of PM_{10}, a combination of different modeling techniques (receptor and photochemical grid models) is used to estimate the source contributions to ambient PM_{10} levels as measured at different monitoring sites. In addition, the air quality projections using the various modeling techniques are compared to a modified emissions rollback method (similar to that described for nitrogen dioxide, except that the rollback is

performed on a component-by-component basis) to provide assurance that the modeling techniques are giving directionally appropriate conclusions. This speciated rollback methodology is described in more detail in Appendix V. It should be noted that this methodology cannot distinguish between primary and secondary carbon as compared to measured organic carbon levels. Since the distinction between primary and secondary organics can only be estimated, the speciated rollback technique was applied under two assumptions: primary carbon domination and secondary carbon domination.

The following section summarizes the PM_{10} modeling studies conducted in preparation for this Plan. Details of the PM_{10} modeling are presented in Appendix V.

PM_{10} Technical Enhancement Program (PTEP) Modeling Studies

Due to the complex nature of PM_{10}, a variety of air quality modeling techniques can be used. Nonreactive PM_{10} components such as fugitive dust can be estimated using chemical mass balance or source-receptor techniques where fingerprinting of various source profiles is necessary to identify source contributions. In addition, dispersion models (both 2-dimensional and 3-dimensional) can also be used to estimate nonreactive PM_{10} component concentrations. Traditionally, simple linear rollback techniques (such as that used for nitrogen dioxide) are used to estimate nonreactive PM_{10} components also. For PM_{10} components that are secondary in nature (i.e., species formed through chemical transformation), air quality models which have the capability to handle PM_{10} chemical and physical processes. Many of these models have been developed under research sponsorship and have not been extensively applied to-date.

In 1995, the District embarked on a PM_{10} Technical Enhancement Program (PTEP) to acquire new PM_{10} air quality models or enhance the current PM_{10} models in order to project future-year PM_{10} concentrations. Several projects were undertaken including the acquisition of an episodic aerosol model, a fugitive dust model, a source apportionment model, enhancements to the chemical mass balance (CMB) source profiles, and updating the secondary sulfate and nitrate chemistry used in the particle-in-cell dispersion model. These projects provided a suite of PM_{10} air quality modeling techniques that could be used to assess PM_{10} air quality.

Since the 1989 AQMP, the District has been applying a particle-in-cell (PIC) dispersion model to examine annual secondary sulfate and nitrate concentrations. The PIC model has limited capabilities in examining large regions (beyond the boundaries of the South Coast Air Basin) due to the model's formulation and simple treatment of meteorology. As part of the PTEP, the District embarked on modifying the Urban Airshed Model (UAM), the photochemical grid model used for ozone air quality analysis. The UAM is a proven air quality model capable of modeling large complex regions. However, the chemical mechanism in the UAM does not estimate secondary sulfate and nitrate concentrations. As such, the PTEP sponsored the enhancement of a set of empirical relationships between precursor emissions and sulfate and nitrate formation. (A similar set of empirical relationships was developed for the PIC model.) The enhanced empirical relationships are

incorporated into the UAM replacing the ozone photochemical mechanism. Model performance evaluations with the 1995 PTEP ambient measurements indicate that the modified UAM (known as UAM/LC) provides reasonable estimates of the annual sulfate and nitrate concentrations. In addition, the UAM/LC has the ability to model primary PM_{10} emissions. While the UAM/LC was developed to estimate annual sulfate and nitrate concentrations, the UAM/LC can also be used for shorter-term sulfate and nitrate concentrations. However, intensive efforts must be undertaken to prepare meteorological and air quality inputs needed to perform the model evaluation. The UAM/LC model evaluations are discussed in Appendix V.

Previous AQMP revisions also used the Chemical Mass Balance (CMB) model to assess source-receptor relationships. The CMB relies on source profiles to relate the contributions from various sources to measurements at a given location. As part of the PTEP, some of the CMB speciation profiles were updated.

In order to analyze local fugitive dust impacts, the PTEP identified a need for a fugitive dust model. The fugitive dust model has the capability to analyze fugitive dust impacts on a very localized area which is smaller than the resolution of most more complex 3-dimensional grid models. The PTEP envisioned that if the episodic aerosol model tended to underestimate fugitive dust concentrations, then the fugitive dust model results would substitute the fugitive dust results of the episodic aerosol model.

The third air quality model in the suite of PM_{10} air quality models is the source apportionment model. The source apportionment model provides the additional capability to analyze the impacts of various sources at a given location. While the source apportionment model can simulate 24-hour PM_{10} concentrations, the primary purpose of the model is to evaluate different control strategies and the relative contributions from the sources affected by the control strategies.

To analyze 24-hour PM_{10} concentrations, an episodic aerosol model application study was sponsored under the PTEP. The episodic aerosol model has been under development since 1989 with sponsorship from both the District and the Air Resources Board (ARB). The episodic aerosol model has the capability to model all major PM_{10} species. However, since the model is a 3-dimensional grid model, it is inherently a resource intensive model and cannot readily be used to estimate 24-hour PM_{10} concentrations. While the PTEP project advanced the state-of-science of episodic aerosol model development, at this time, continued research is needed before the model can be relied upon as the primary approach to simulate 24-hour PM_{10} concentrations. In addition, techniques must be developed to expand the episodic PM_{10} concentration estimates to an annual average value.

Draft working papers for the 1997 AQMP provide discussions on each of the PTEP modeling projects.

AQMP Modeling Approach

Receptor models require specific knowledge about the chemical components of the ambient PM_{10} samples and of all sources emitting primary PM_{10}. Special studies were conducted to develop a data base and a comprehensive library of chemical profiles for specific sources of PM_{10} emissions. Using the CMB model, ambient PM_{10} concentrations at each site can be apportioned according to the contributing sources.

For secondary PM_{10} components (sulfates and nitrates) and primary PM_{10} emissions, the UAM/LC is used to project annual concentrations in the South Coast Air Basin and Coachella Valley. Based on the change in PM_{10} concentrations from the base year and future-year projected by the UAM/LC, the projected future-year 24-hour PM_{10} concentrations can also be estimated.

Using the CMB and the UAM/LC, the major secondary PM_{10} components: nitrates, sulfates, secondary organics, and the primary, nonreactive, components can be estimated.

These models are used in combination with emissions projections to determine future PM_{10} air quality for a given future-year baseline or control scenario. For secondary organics, a linear rollback technique is applied to the CMB results to obtain future year projections while the UAM/LC is used to project the other components. Measurements from the five PTEP monitoring stations are used (Los Angeles, Anaheim, Diamond Bar, Rubidoux, and Fontana). The 1995 annual PM_{10} concentrations represent the PM_{10} design values for the South Coast Air Basin and all future-year PM_{10} air quality projections are compared to the 1995 concentrations. Detailed discussions of the model results are provided in Appendix V.

Ozone

The CAA requires that ozone nonattainment areas designated as serious and above 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 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. Only one episode was modeled for the 1989 AQMP. Since then, measurement data from the 1987 Southern California Air Quality Study (SCAQS) (Lawson, 1990) became available for modeling purposes. For the 1991 AQMP, three ozone meteorological episodes were used to predict future air quality; two meteorological episodes during the SCAQS were used to complement the single episode from the 1989 AQMP. For the 1994 AQMP, two additional episodes are added to the analysis.

For the 1997 AQMP, the first modeling episode developed for the 1989 AQMP (the June 5-7, 1985 episode) is dropped from further use since the meteorological conditions rarely occur in the Basin. The current form of the federal ozone air quality standard allows for one exceedance per year to account for these rare meteorological events. As such, a peak ozone concentration due to meteorological conditions in the June 1985 episode would be accounted for in the current form of the standard. In addition, the U.S. EPA modeling guidelines recommend that meteorological episodes from 1987 to present be used for attainment demonstration Table 5-1 lists the four meteorological episodes used for ozone air quality analysis, along with their peak measured ozone concentrations in the South Coast Air Basin, Antelope Valley, and Coachella Valley.

TABLE 5-1

Ozone Meteorological Episodes Used for the Ozone Attainment Demonstration

	Peak Concentration Peak (pphm)			
Episode	South Coast A.B.	Antelope Valley	Coachella Valley	Introduced in the
August 26-28, 1987	29	10	16	1991 AQMP
June 23-25, 1987	24	15	16	1991 AQMP
July 13-15, 1987	25	12	16	1994 AQMP
September 7-9, 1987	33	12	15	1994 AQMP

Performance evaluations of the four meteorological episodes are provided in the 1994 AQMP and the detailed UAM results for the various future year baseline and control scenarios are presented in Appendix V.

Carbon Monoxide

The CAA requires the use of an areawide model to describe the accumulation of emissions over several hours and kilometers within the region, as well as estimates of roadway impacts within a few hundred meters of the roadway intersection. Based on U.S. EPA modeling guidelines, the UAM is used for the areawide analysis, and CAL3QHC, a roadway intersection model, is used to calculate carbon monoxide concentrations near the intersection. The UAM results are used to evaluate the effectiveness of control measures in attaining the federal 8-hour air quality standard for carbon monoxide in the year 2000. Carbon monoxide attainment demonstrations were submitted to the U.S. EPA in 1992 and 1994. Since that time, newer emission estimates have become available. Thus, the 1997 AQMP contains a revised attainment demonstration which will replace the prior submittals. A complete description of the modeling analysis is presented in Appendix V.

Visibility

Future-year visibility in the Basin is projected using the results derived from a regression analysis of visibility with air quality measurements. The regression data set consisted of aerosol composition data collected during a special monitoring program conducted concurrently with visibility data collection (prevailing visibility observations from airports and visibility measurements from District monitoring stations). A full description of the visibility analysis is given in Technical Report V-C of the 1994 AQMP.

FUTURE AIR QUALITY

Nitrogen Dioxide

Under the federal Clean Air Act, the Basin must comply with the federal annual nitrogen dioxide air quality standard by November 15, 1995 [Section 192(b)]. Since the annual standard is based on the calendar year, attainment must be demonstrated for calendar year 1994. As discussed in Chapter 2, the Basin has met the federal annual standard the last four years (i.e., 1992 through 1995) and the state one-hour standard the last two years (i.e., 1994 and 1995). The modeling results discussed next show that the Basin will continue to meet federal and state nitrogen dioxide standards.

Figure 5-1 presents the predicted annual average nitrogen dioxide concentrations for 2000 and 2010 with and without controls. Maximum 1-hour nitrogen dioxide concentrations are projected from the baseline maximum 1-hour concentrations using linear rollback. The predicted maximum 1-hour nitrogen dioxide concentrations for the future-year baseline conditions with and without controls are shown in Figure 5-2.

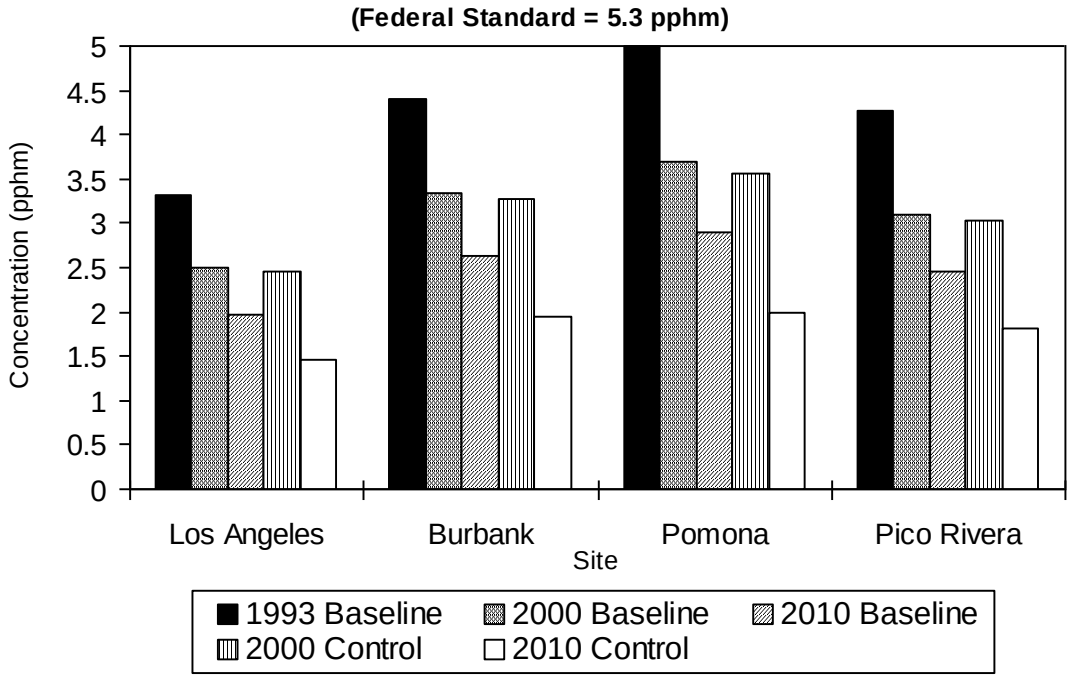


FIGURE 5-1

Annual Average NO_2 Concentration Projections

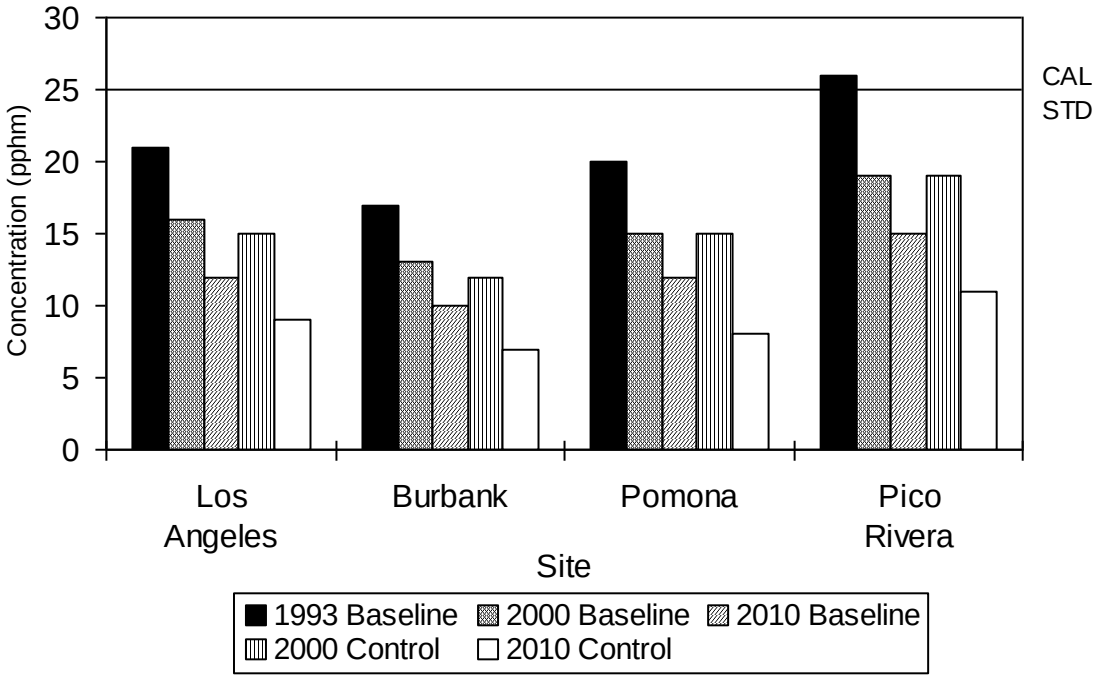


FIGURE 5-2

Maximum 1-Hour NO_2 Concentration Projections

The trend analysis was performed using the highest nitrogen dioxide concentrations observed in the last three-year period. Based on the more recent nitrogen dioxide measurements as discussed in Chapter 2, nitrogen dioxide concentrations continue to decrease over time.

The results indicate that the federal annual nitrogen dioxide standard will be met throughout the Basin through the year 2010 without additional emission controls. However, implementation of proposed controls after 1997 would further reduce nitrogen dioxide concentrations in the Basin.

Based on projected future-year maximum 1-hour nitrogen dioxide concentrations assuming no further controls, the Basin will be in compliance with the state 1-hour standard through the year 2010. Implementation of proposed controls after 1997 would further reduce nitrogen dioxide concentrations in the Basin.

PM_{10}

Under the federal Clean Air Act, the Basin must comply with the federal PM_{10} air quality standards by December 31, 2001 [Section 188(c)(2)]. A five-year extension could be granted if attainment cannot be demonstrated and several other conditions are satisfied [Section 188(e)]. Figures 5-3 and 5-4 depict future annual average PM_{10} air quality projections at five PM_{10} monitoring sites compared to federal and state annual PM_{10} standards, respectively. Although each standard is based on an annual average, separate calculations are required because the federal standard is based on an arithmetic average, whereas the state standard is based on a geometric average. In general, geometric averages are slightly less than arithmetic averages. Shown in each figure are the estimated baseline conditions for the years 1995, 2000, 2006 and 2010, along with projections for 2000, 2006, and 2010 with control measures in place. All areas will attain the federal annual standard by the year 2000, except Rubidoux, which will be in compliance by 2006. Relative to the state annual standard ($\mu g/m^3$), Los Angeles, Anaheim, and Diamond Bar are projected to attain by 2006. Rubidoux and Fontana will not be in compliance by 2010.

The projections for the 24-hour state and federal standards are shown in Figure 5-5. The results are similar to those for the annual standards. All areas will be in attainment of the federal 24-hour standard (150 $\mu g/m^3$), except Rubidoux, which will be in compliance by 2006. With respect to the state 24-hour standard (50 $\mu g/m^3$), none of the sites will be in attainment by 2010.

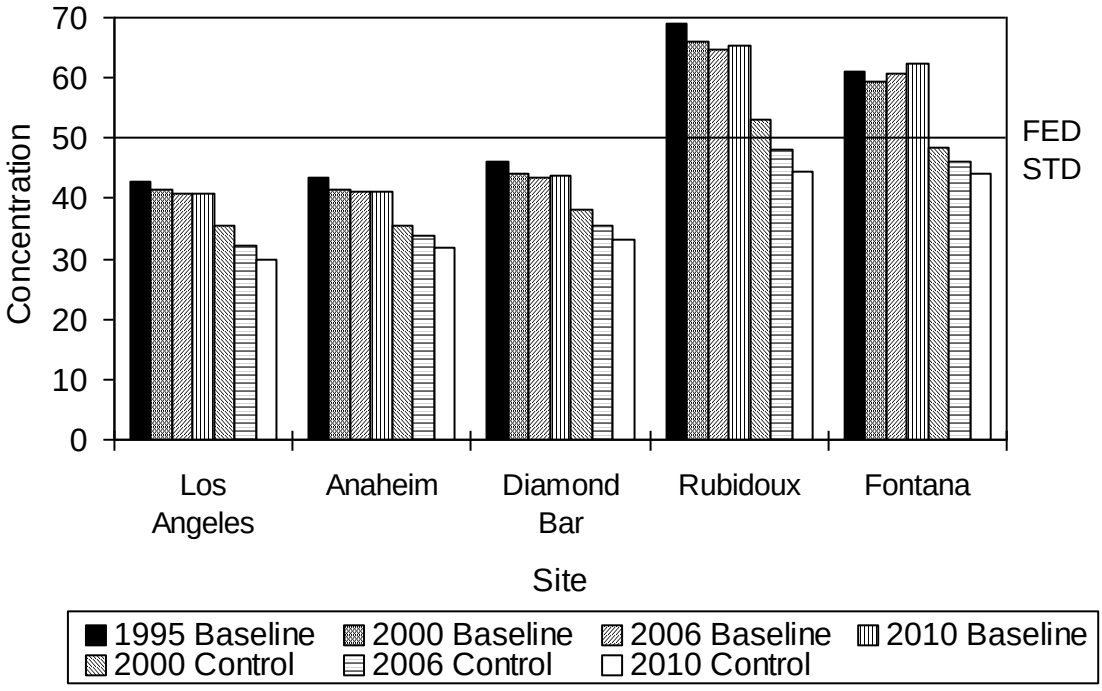


FIGURE 5-3

Annual Arithmetic Average PM_{10} Concentrations

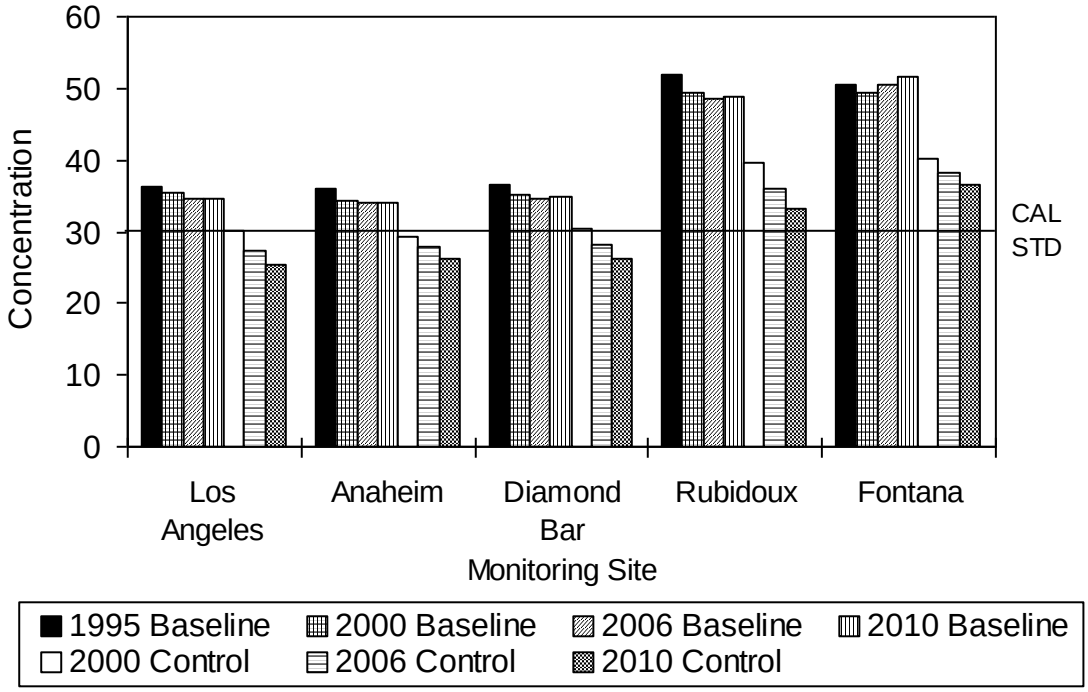


FIGURE 5-4

Annual Geometric Average PM_{10} Concentrations

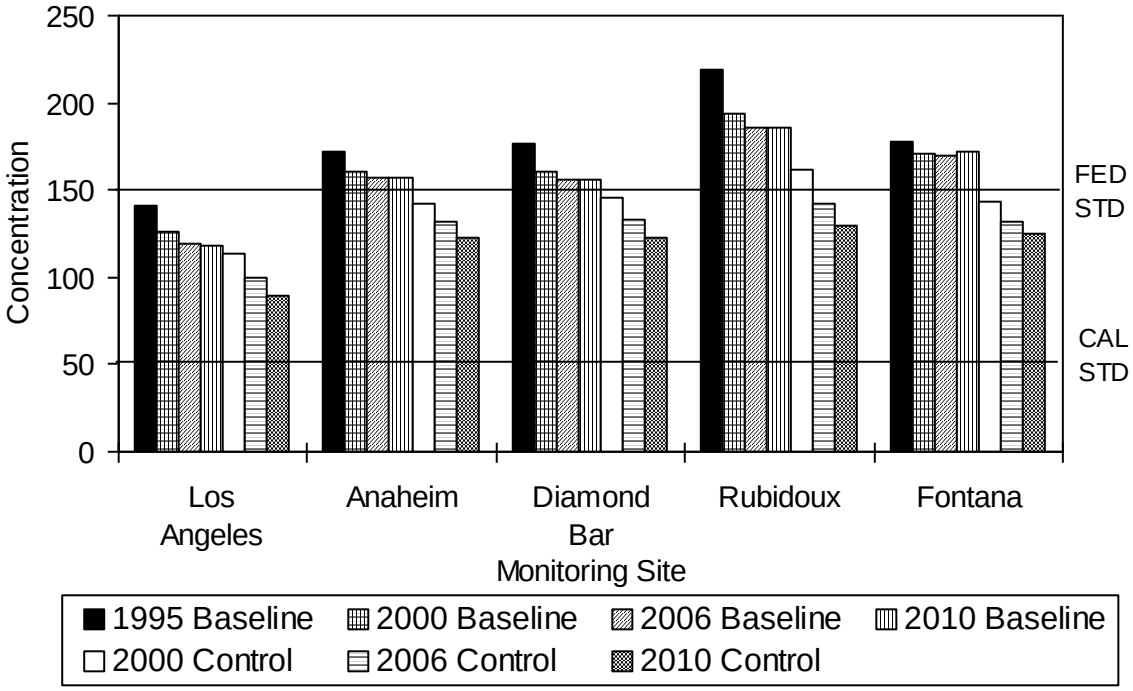


FIGURE 5-5

Maximum 24-Hour PM_{10} Concentrations

Ozone

As the only ozone nonattainment area designated as extreme, the Basin must comply with the federal ozone air quality standard by November 15, 2010. The attainment demonstration shown here addresses this requirement. As discussed earlier, four meteorological episodes are used in the ozone attainment demonstration. The modeling results for each of the episodes exhibit similar ozone air quality projections. The results for the June 23-25, 1987 and August 26-28, 1987 episodes are presented here since these two episodes are more limiting than the other two episodes (i.e., July 13-15, 1987 and September 7-9, 1987). The modeling results for all episodes are presented in Appendix V.

The ozone modeling discussion that follows is divided into two sections: projected baseline concentrations and predicted controlled concentrations. The baseline projections assume no further controls in the future years and the predicted controlled concentrations assume the implementation of the 1997 AQMP control strategy at the appropriate level for the year modeled.

Table 5-2 shows the total VOC and NO_x emissions in the Basin on the first day of the June 23-25, 1987 episode. The emissions presented in Table 5-2 are episode-specific and therefore differ from the planning inventories reported in Chapter 3. The modeling results indicate that without additional controls, there will be some air quality improvement

relative to peak ozone concentrations from 1987 to 2010 as VOC emissions decrease. However, after 2010 the ozone air quality is projected to degrade slightly.

TABLE 5-2

Precursor Emissions and Model-Predicted Ozone Concentrations

Year/Scenario	VOC	NO_x	Peak Ozone concentration* (pphm)
1987 Historical Year	1976	1379	24**
2000 Baseline	974	924	15.0
2010 Baseline	905	739	15.1
2000 Control	919	899	14.6
2010 Control	402	502	11.8

* Peak ozone concentrations for future years are for the last day of the June 1987 episode.
** Peak measured ozone concentration.

The VOC emission reductions are due mainly to decreases in mobile source emissions whereas the oxides of nitrogen emissions decrease more slowly due to increases in off-road activities (see Chapter 3 for a discussion of future-year emission estimates).

Figure 5-6 depicts the predicted baseline basinwide maximum ozone without further AQMP measures for the June and August 1987 meteorological episodes modeled. As shown, basinwide peak ozone concentrations are on the order of 15-16 pphm from 2000 to 2010. Similar modeling results are seen for the other two 1987 meteorological episodes (see Appendix V).

Control Strategy Impacts

Figure 5-7 shows the predicted Basinwide maximum ozone for the June and August 1987 meteorological episodes for the years 2000, and 2010, with proposed emission controls in place. The maximum ozone concentrations and emission levels are also presented in Table 5-2. The results indicate that the proposed control strategy will almost eliminate health advisories ($\geq$ 15 pphm) around the year 2000 and will bring the entire Basin into compliance with the federal ozone standard by the year 2010. Regional maximum ozone concentrations in the year 2010 will be between 9 and 12 pphm for the four meteorological episodes. With implementation of the proposed control strategy, the peak ozone value for the June 1987 episode is 11.8 pphm.

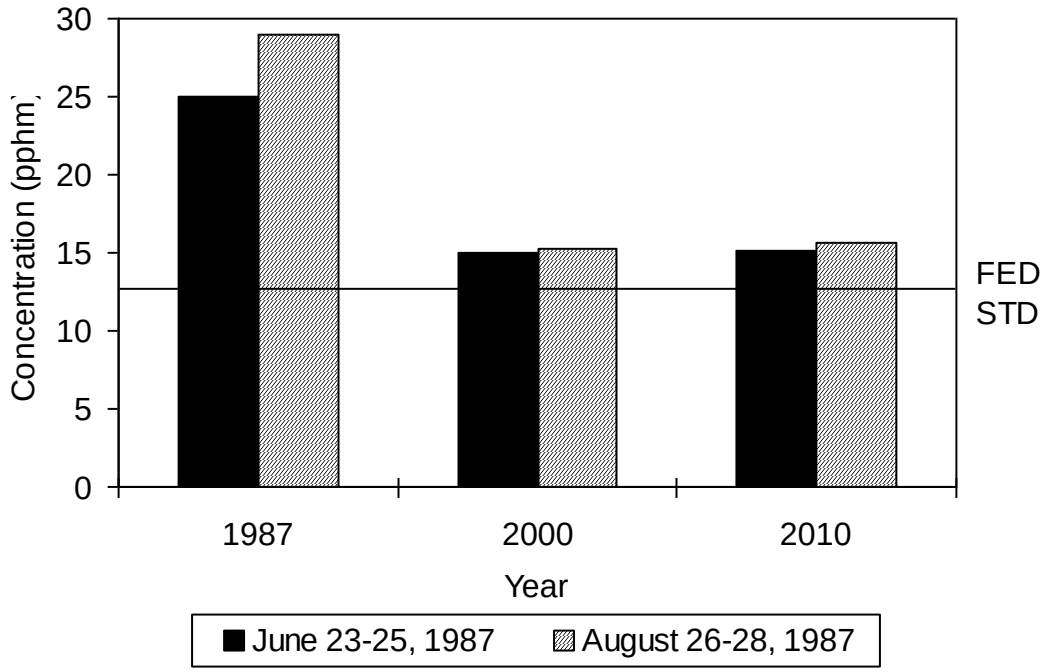


FIGURE 5-6

Baseline Basinwide Maximum Ozone Concentrations

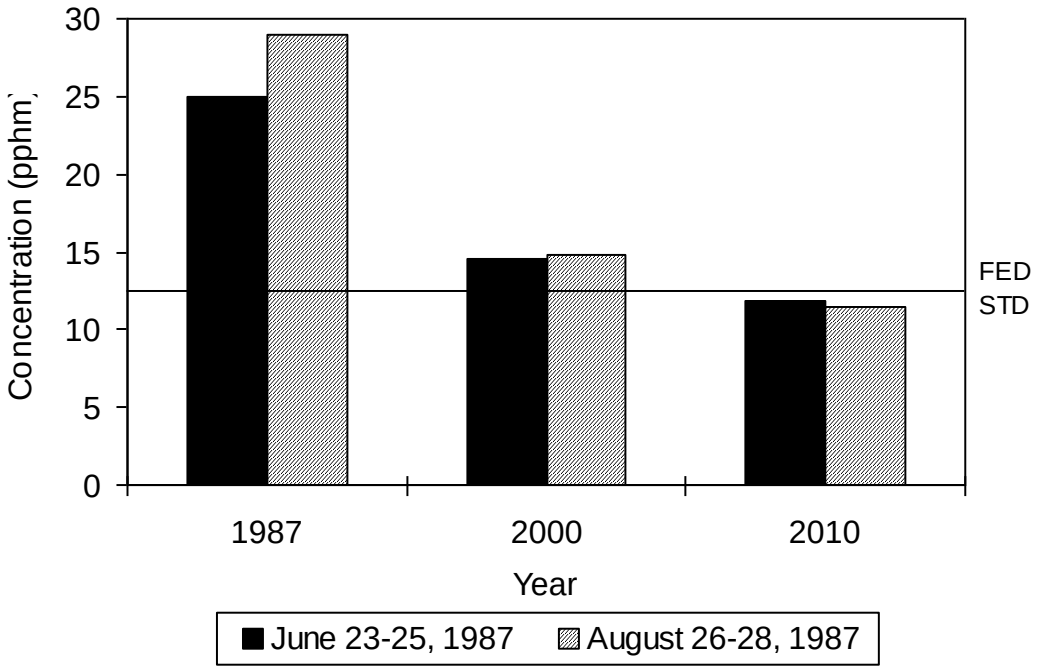


FIGURE 5-7

Basinwide Maximum Ozone Concentration with Proposed Emissions Controls

Spatial distributions of maximum ozone concentrations for the 1987 historical year are shown in Figure 5-8. Future year ozone air quality projections for 2000 and 2010 with and without implementation of all control measures are presented in Figures 5-9 and 5-10, respectively. The predicted ozone concentration will be significantly reduced in the future years in all parts of the Basin, the Mojave Desert Air Basin, and the Salton Sea Air Basin with the implementation of proposed control measures in the South Coast Air Basin. Similar results occur for the other meteorological episodes.

Assessment of Mobile Emission Uncertainties

As discussed in the 1994 AQMP, recent studies indicate that current and historical on-road mobile source emissions may be underestimated by as much as 60 percent for VOCs and 8 percent for oxides of nitrogen. For the 1997 AQMP, an updated version of the emissions factor program (EMFAC7G) indicates that all on-road motor vehicle precursor emissions have increased compared to the on-road motor vehicle emissions estimated in the 1994 AQMP. However, the emission increases are still uncertain given the uncertainties in the transportation model assumptions and the assumptions inherent to the current on-road motor vehicle emissions estimation procedures. As faster computer systems become available, more sophisticated procedures for estimating on-road motor vehicle emissions will also become available.

Future-year emission estimates for on-road mobile sources will most likely be more accurate as emission controls become more efficient. As newer on-road vehicles are introduced, on-road emissions are expected to decrease and deterioration rates will be smaller. It is not expected that future-year on-road emissions will be as grossly underestimated. Future AQMP revisions will reassess the impacts of the mobile source underestimations as newer revisions to the mobile source estimations become available.

Assessment of Weekend Emissions Effects

In recent years ambient ozone measurements indicate a faster decrease in Stage I episodes (days with ozone concentrations greater than 20 pphm) on weekdays compared to weekends. To address concerns that future ozone exceedances may occur more often on weekends, a sensitivity analysis using the June 1987 and August 1987 ozone meteorological episodes was conducted. Since meteorology varies independent of the day of the week, differences between weekday and weekend emissions are likely key. During the work week, stationary source emissions are higher as more businesses operate. Motor vehicle emissions peak in the morning and evening rush hours. On weekends, stationary source emissions are lower and motor vehicle emissions build up to a plateau level sustained through much of the day. Sufficient information to generate a weekend stationary and area source emissions inventory are available. However, information on on-road mobile vehicle travel patterns are not readily available. As a sensitivity analysis, typical weekend traffic patterns (by hour) were used to create an

hourly emissions pattern for a weekend day and a Friday traffic pattern was used to create a typical Friday early afternoon commute traffic pattern. In addition, an assumption that 50 percent of the heavy-duty truck emissions do not occur on weekends was made to represent less commercial activity on weekends. The estimated weekend inventory was used as the emissions for the third day of the air quality simulation and the Friday inventory was used as the second day's emissions. The results of the sensitivity analysis show that the federal air quality standard is still attained with the 1997 AQMP control strategy. Further work is needed to fully quantify the weekend episode phenomena. In addition, the field measurement program proposed for summer 1997 will provide additional information on weekend effects for future AQMP revisions.

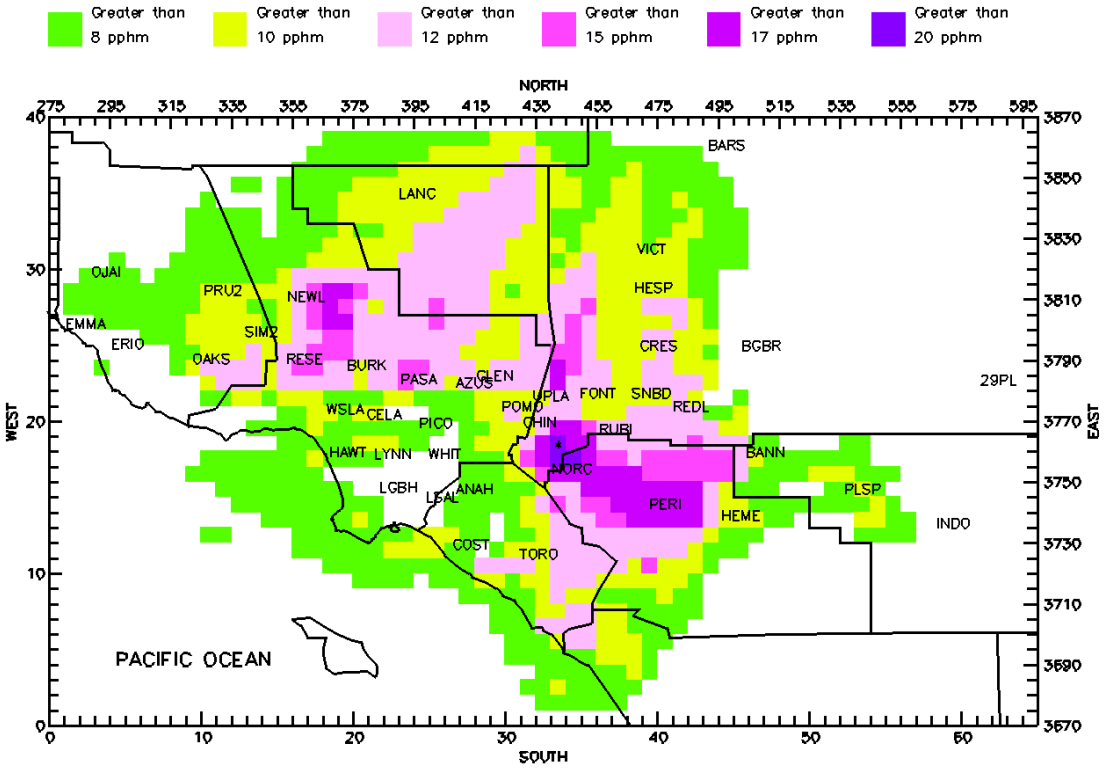
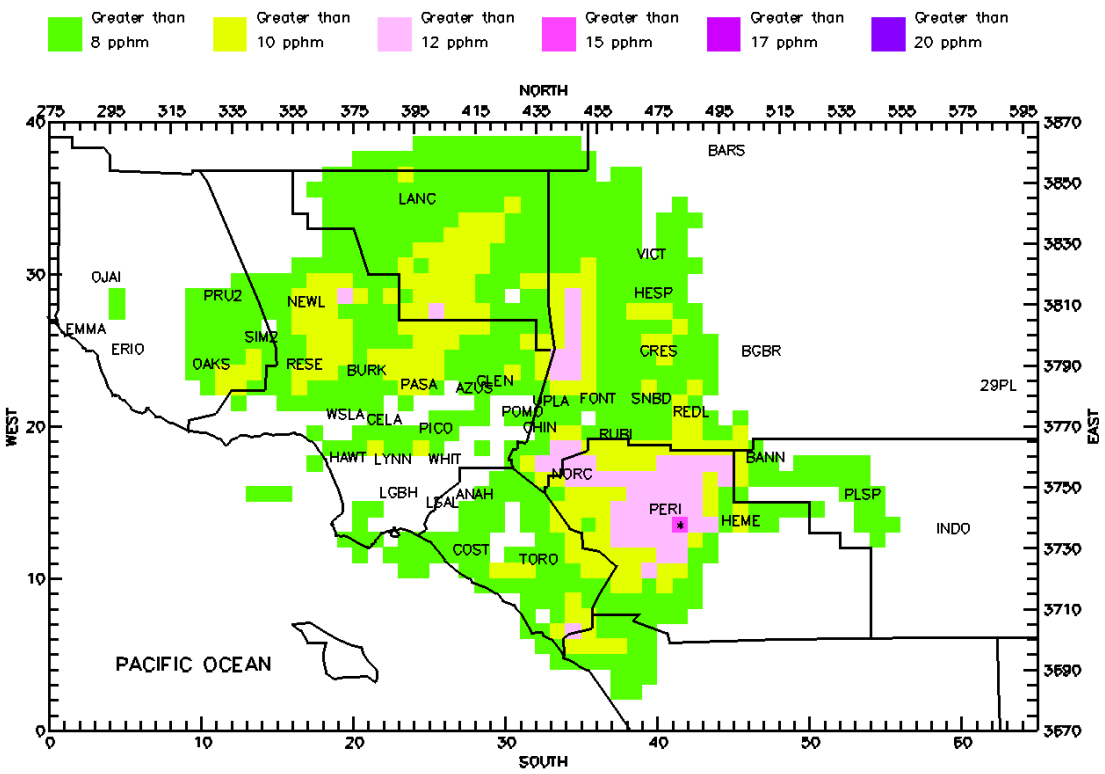
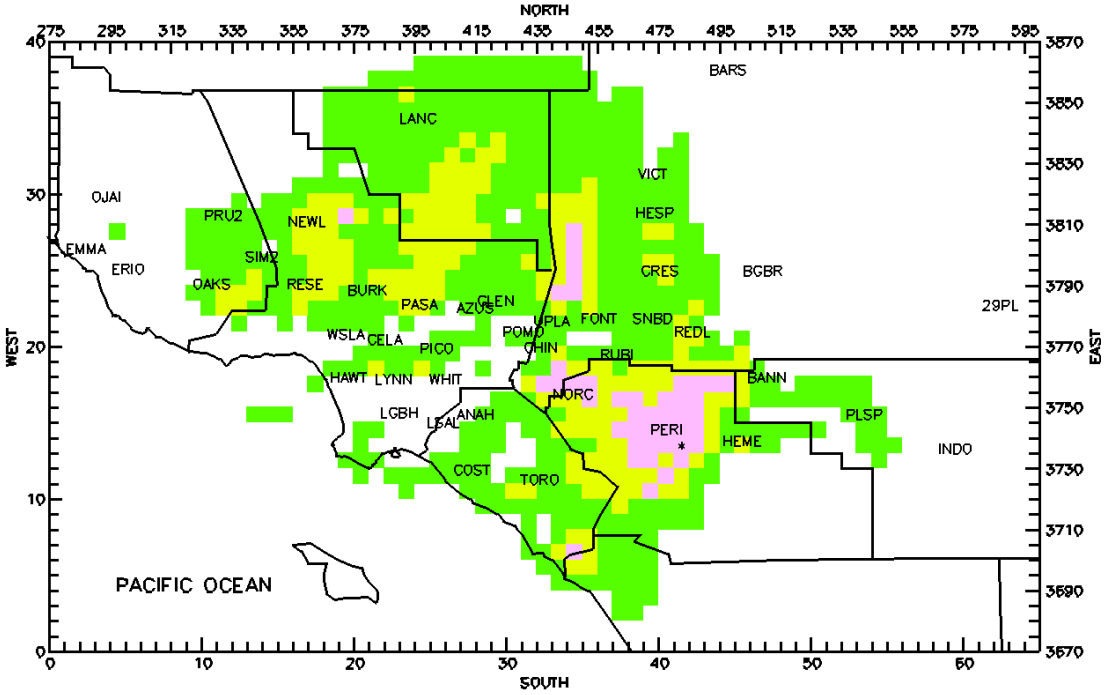


FIGURE 5-8

Model-Predicted Maximum Hourly Ozone Concentrations
in the South Coast Air Basin in 1987



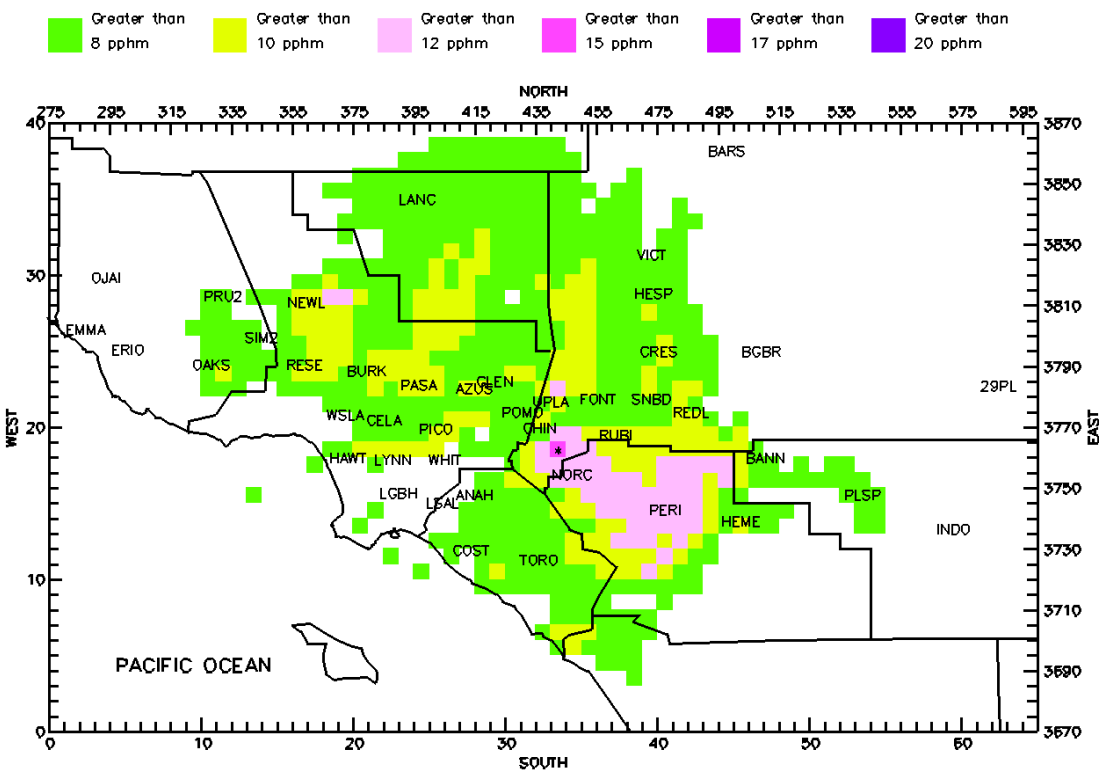
(a) Baseline (with rules adopted as of September 1996)



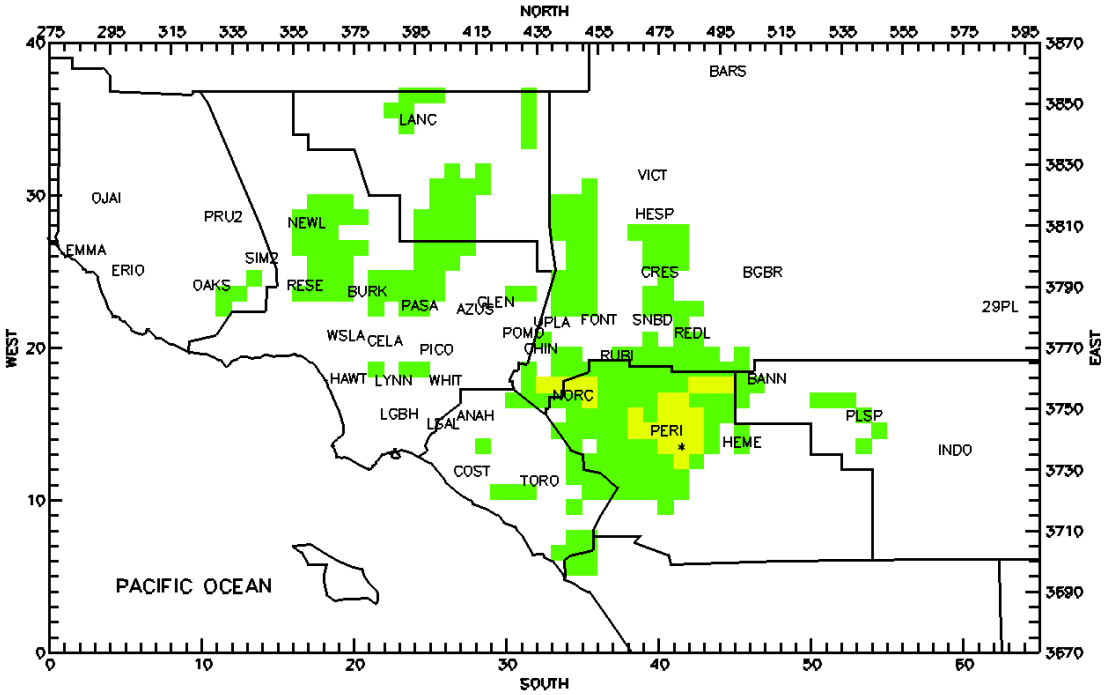
(b) Controlled (with implementation of proposed control measures)

FIGURE 5-9

Model-Predicted Maximum Hourly Ozone Concentrations
in the South Coast Air Basin in 2000



(a) Baseline (with rules adopted as of September 1996)



(b) Controlled (with implementation of proposed control measures)

FIGURE 5-10

Model-Predicted Maximum Hourly Ozone Concentrations
in the South Coast Air Basin in 2010

Carbon Monoxide

As discussed earlier, future carbon monoxide air quality projections are based on a UAM analysis. A carbon monoxide meteorological episode for 1989 was chosen for modeling as part of the 1993 Federal Attainment Plan for Carbon Monoxide. This Plan uses the same December 6-7, 1989 episode with a recorded 1-hr carbon monoxide concentration of 31 ppm and an 8-hr concentration of 21.8 ppm. These were the highest recorded values over the most recent years. Table 5-3 summarizes the carbon monoxide projections by 2000 with implementation of short- and intermediate-term control measures. Attainment of both the federal and state carbon monoxide air quality standards is projected in 2000 without any additional controls.

TABLE 5-3

Carbon Monoxide Emissions and Model-Predicted Concentrations

Year/Scenario	Episode-Specific Emissions (tons/day)	8-hr Maximum Concentration (ppm)	1-hr Maximum Concentration (ppm)
1989 Baseline	9140	22.1	26.1
2000 Baseline	4511	7.7	10.7
2000 Control	4349	7.4	10.3

State 1-hr CO standard = 20 ppm
State 8-hr CO standard = 9.0 ppm
Federal 8-hr CO standard = 9 ppm

Visibility

The results of the visibility analysis for Rubidoux are illustrated in Figure 5-11. Without the proposed AQMP control measures, annual average visibility is projected to improve at Rubidoux from the current average of 6 miles to 7 miles in the year 2010.

With the implementation of all proposed emission controls for 2010, the annual average visibility would improve to about 11 miles at Rubidoux.

SUMMARY AND CONCLUSIONS

Figure 5-12 shows the model-predicted regional peak concentrations for the four nonattainment criteria pollutants, as percentages of the most stringent federal standard, for the years 2000, 2006, and 2010, (with and without further emission controls). Figure 5-13 shows similar information related to the most stringent California state standards.

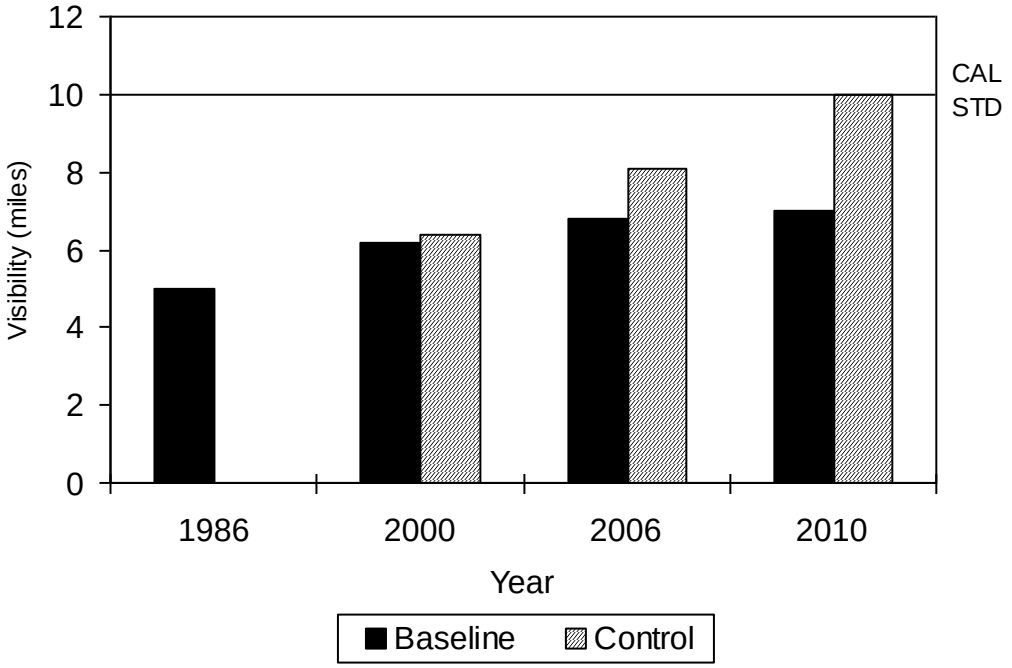


FIGURE 5-11

Annual Average Daytime Visibility Projections at Rubidoux

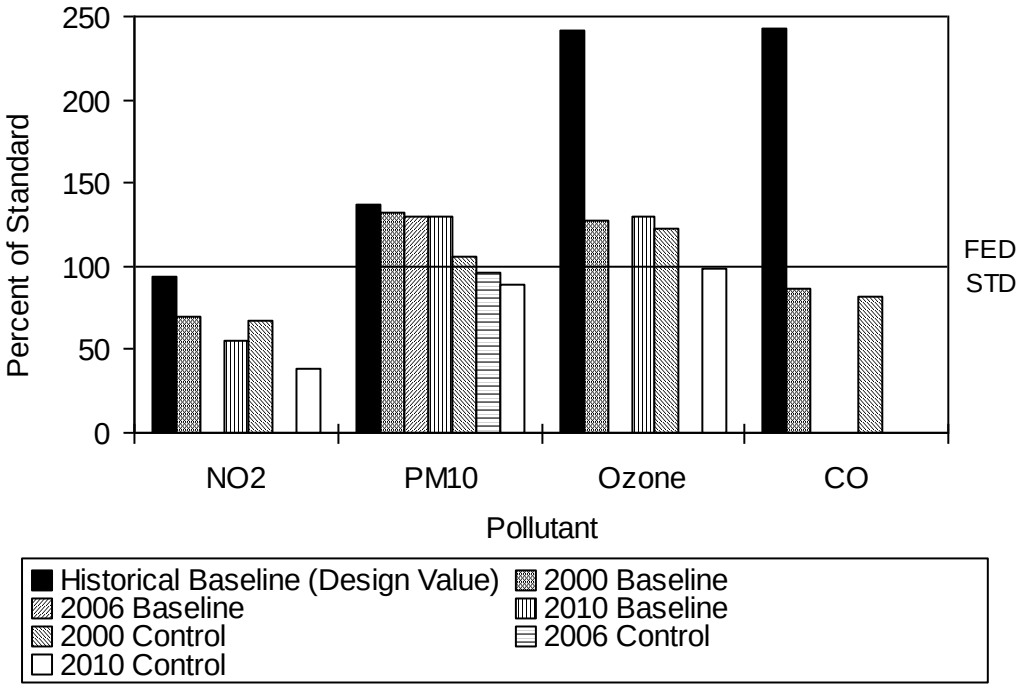


FIGURE 5-12

Projection of Future Air Quality in the Basin in Comparison with the Most Stringent Federal Standards

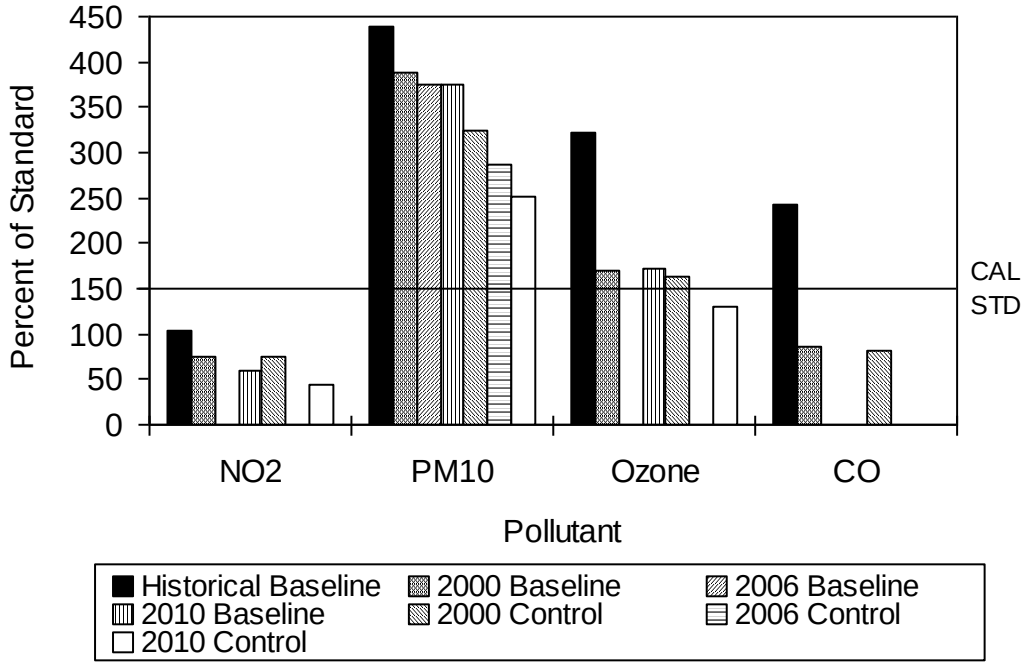


FIGURE 5-13

Projection of Future Air Quality in the Basin in Comparison with Most Stringent California State Standards

Table 5-4 summarizes the expected year for attainment of the various federal and state standards for the four pollutants analyzed. As shown, the Basin will be in compliance with federal and state standards for all pollutants except the state ozone and PM_{10} standards by the year 2010.

TABLE 5-4

Expected Year of Compliance with State and Federal Standards for the Four Criteria Pollutants

Pollutant	Standard	Concentration Level	Expected Compliance Year
Ozone	NAAQS 1-hour	12 pphm	2010
	CAAQS 1-hour	9 pphm	beyond 2010
PM_{10}	NAAQS Annual	50 ug/m^3	2006
	NAAQS 24-hour	150 ug/m^3	2000
	CAAQS Annual	30 ug/m^3	beyond 2010
	CAAQS 24-hour	50 ug/m^3	beyond 2010
CO	NAAQS 8-hour	9 ppm	2000
	NAAQS 1-hour	35 ppm	1990*
	CAAQS 8-hour	9 ppm	2000
	CAAQS 1-hour	20 ppm	Achieved
NO_2	NAAQS annual	5.34 pphm	Achieved
	CAAQS 1-hour	25 pphm	Achieved

* The Basin has been achieving the federal 1-hour CO air quality standard since 1990. However, the Basin is still considered nonattainment until the 8-hour CO air quality standard is achieved.

BASIN EMISSIONS CARRYING CAPACITY (EMISSIONS BUDGET)

The District is required to separately identify the emission reductions and corresponding type and degree of implementation measures required to meet federal and state ambient air quality standards. Section 40463(b) of the California State Health and Safety Code specifies that, with the active participation of the Southern California Association of Governments, a South Coast Air Basin emission carrying capacity for each state and federal ambient air quality standard shall be established by the South Coast District Board for each formal review of the Plan and shall be updated to reflect new data and modeling results.

A carrying capacity is defined as the maximum level of emissions which enable the attainment and maintenance of an ambient air quality standard for a pollutant. Emission carrying capacity for state standards shall not be a part of the State Implementation Plan requirements of the Clean Air Act for the South Coast Air Basin.

Emission carrying capacity as defined in the Health and Safety Code is an overly simplistic measure of the Basinwide allowable emission levels for specific ambient air quality standards. It is highly dependent on the spatial and temporal pattern of the emissions. Because of the multicomponent nature of PM_{10}, carrying capacity for the contributing emittants can vary significantly. For ozone and secondary PM_{10} components, the carrying capacity is a non-linear function among their precursors.

The federal Clean Air Act requires that plans contain an emissions budget which represents the remaining emissions levels that achieve the applicable attainment deadline. Based on the modeling results, a set of carrying capacities can be defined corresponding to federal and state ambient air quality standards for carbon monoxide, nitrogen dioxide, PM_{10}, and ozone. VOC and oxides of nitrogen are used for ozone. Table 5-5 shows the emissions carrying capacities for the Basin to meet federal air quality standards. These estimates are based on emission patterns estimated for each of the federal attainment years (i.e., 2000 for carbon monoxide, 2006 for PM_{10}, and 2010 for ozone).

PROJECTED EMISSION TRENDS THROUGH 2010

Figures 5-14 through 5-17 show the projected emission trends for both NO_x and VOC through the year 2010. Depicted are scenarios for the baseline cases (e.g., no further rules), and for the controlled cases (with the 1997 AQMP Measures). Categories are described slightly different than most emission inventory summaries in that permitted sources (e.g., those emission sources which are permitted with the District) are specifically delineated. These figures show that emission levels continue to decrease through the year 2010, especially for the controlled case, when attainment with the federal ozone standard is expected. For VOCs, emissions are initially dominated by mobile sources, but in the later periods area sources will become a more dominant fraction. For NO_x emissions, mobile sources are expected to be the dominant source through the entire period.

TABLE 5-5

Emissions Carrying Capacity Estimations[1]
for the South Coast Air Basin (tons/day)

a) Carbon Monoxide Attainment Strategy (2000)

Emission Category	CO
Stationary	294
On-Road	3125
Off-Road	1549
Overall Control Strategy to meet NAAQS	4968

b) PM_{10} Attainment Strategy (2006)

Emission Category	VOC	NO_x	SO_x	PM_{10}
Stationary	341	96	13	271
On-Road	187	350	16	14
Off-Road	95	189	37	16
Overall Control Strategy to meet NAAQS	623	635	66	301

c) Ozone Attainment Strategy (2010)

Emission Category	VOC	NO_x
Stationary	268	88
On-Road	81	278
Off-Road	64	164
Overall Control Strategy to meet NAAQS	413	530

[1] Values rounded to the nearest integer.

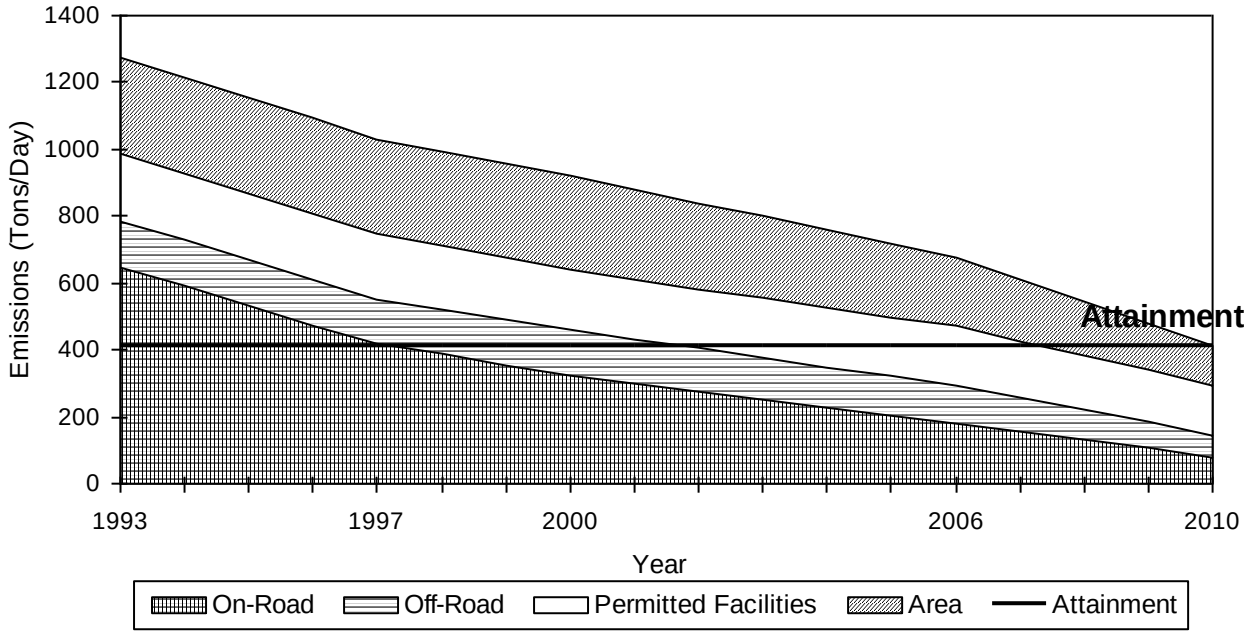


FIGURE 5-14

VOC Emissions - Baseline Scenario

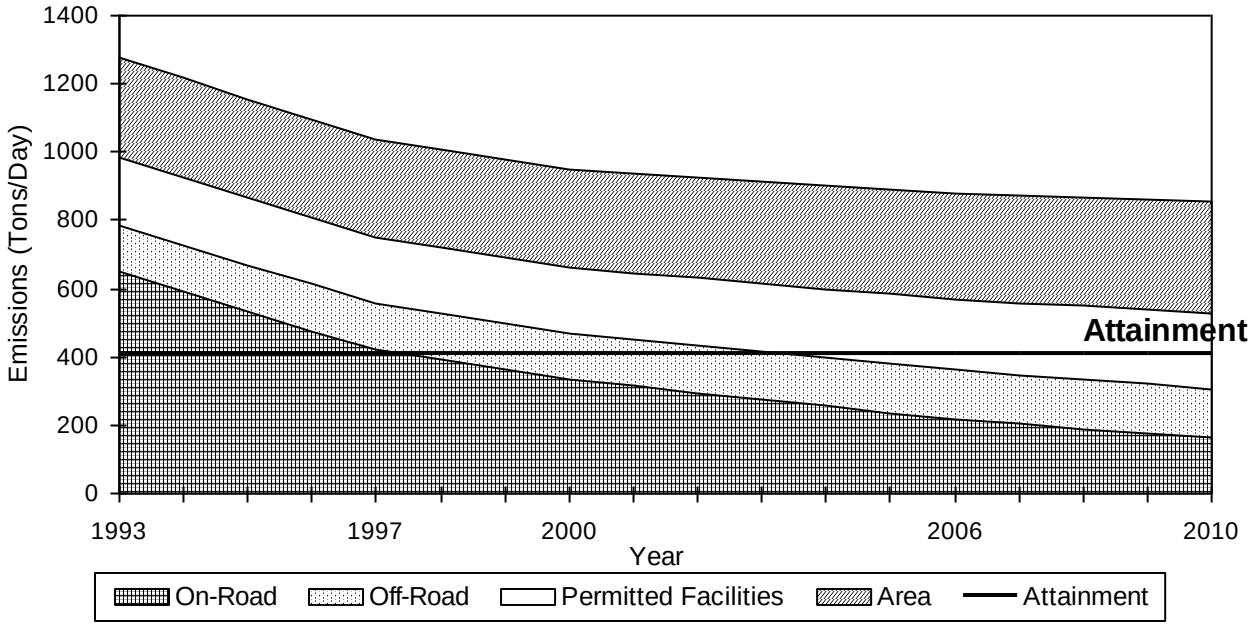


FIGURE 5-15

VOC Emissions - Under 1997 AQMP

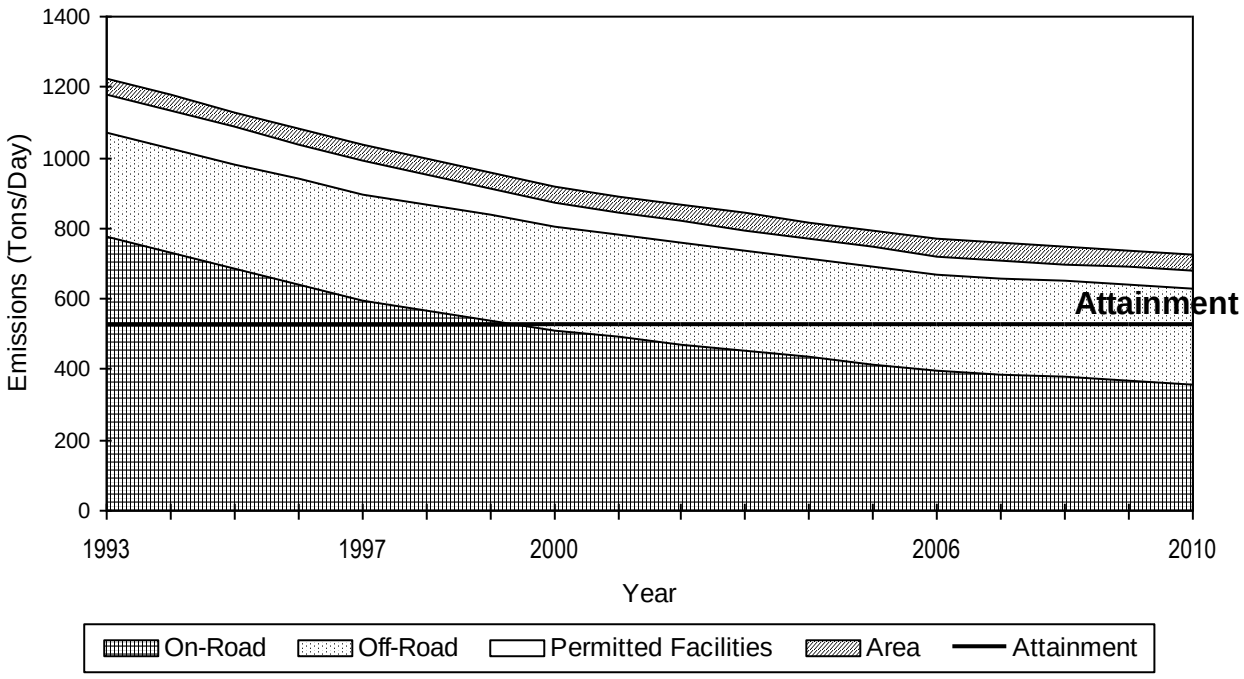


FIGURE 5-16

NO_x Emissions - Baseline Scenario

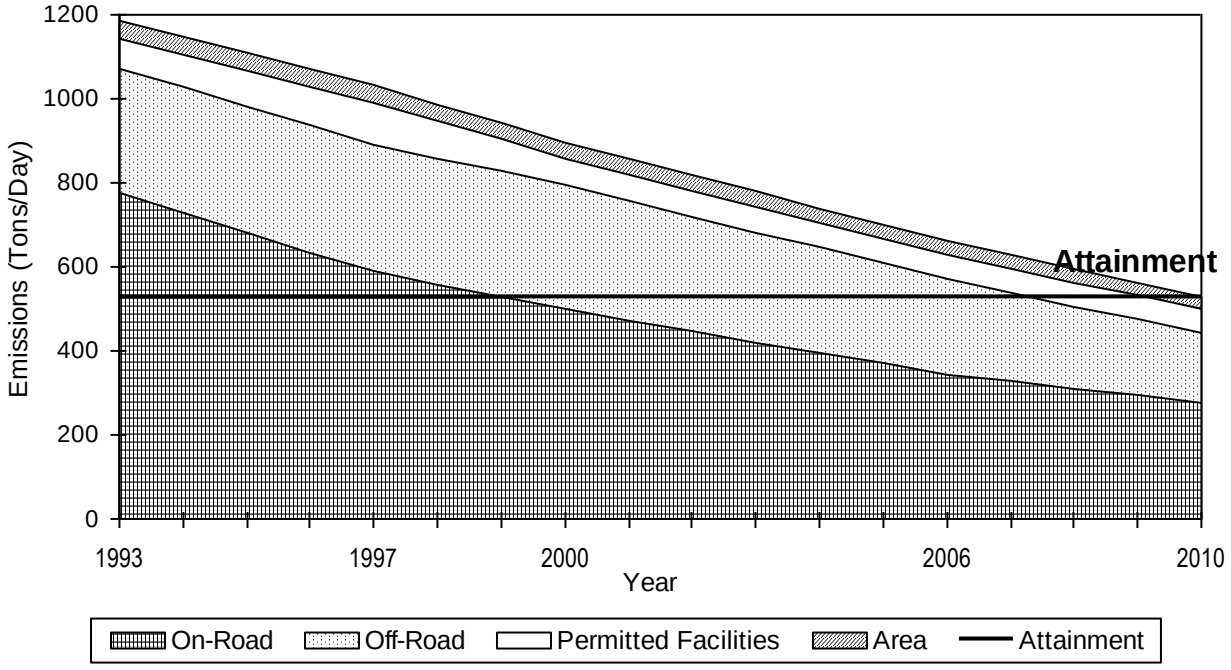


FIGURE 5-17

NO_x Emissions - Under 1997 AQMP