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 1997 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 designated nonattainment for PM_{10}, ozone, and carbon monoxide. Two of these pollutants - 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 expeditious rate of reduction towards the state air quality standards. The overall control strategy is designed so that efforts to achieve the standard for one criteria pollutant do not cause unnecessary deterioration of another. A three-step modeling process was originally crafted in the 1989 AQMP to develop the control strategy. The three-step process began with an analysis of future nitrogen dioxide air quality, followed by PM_{10} air quality, and lastly, future ozone air quality. Subsequent attainment of the nitrogen dioxide standard in 1995 reduced the number of steps in the modeling process to two: analysis of future PM10 air quality followed by the future 1-hour ozone air quality. Air quality analyses under the 2003 AQMP are performed in keeping with this two-step modeling approach. However, future efforts to achieve the PM2.5 and 8-hour average ozone standards deserve consideration in the selection of the overall air quality standards.

The control strategy to meet federal and state carbon monoxide standards is independent of the PM10/ozone strategy. A photochemical grid model is used to project regional future carbon monoxide (CO) air quality. An additional "hot-spot" analysis is required to assess impacts at intersections. Both analyses are performed in the 2003 AQMP to update the 1997 Revision of the Carbon Monoxide Attainment Demonstration (CO Plan). It is important to note that the Basin did not exceed the federal 8-hour average carbon monoxide standard in 2001 and exceeded the standard only once in 2002. Thus, the Basin has met the criteria for attainment of the federal 8-hour average carbon monoxide standard. The 2003 CO Plan will serve as a replacement for the 1997 CO Plan that lapsed in 2000 and will provide the basis for a future maintenance plan for the Basin pending submission of a petition for redesignation of attainment status.

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 ozone air quality projections for the Coachella Valley are presented in Chapter 8 and in Appendix V.

MODELING APPROACH

PM10

Within the Basin, PM10 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 PM10 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.

In the 1997 AQMP a combination of different modeling techniques (receptor and photochemical grid models) were used to estimate the source contributions to ambient PM10 levels as measured at different monitoring sites. In addition, the air quality projections using the various modeling techniques were compared to a modified emissions rollback method (performed on a component-by-component basis) to provide assurance that the modeling techniques are giving directionally appropriate conclusions.

Of the modeling methodologies evaluated for the 1997 AQMP, a photochemical grid model application using the Urban Airshed Model with a flexible chemistry mechanism (UAM-FCM) coupled with an empirical linear chemistry module (LC) proved to be the most promising means to calculate annual average PM10 concentrations (excluding the secondary organic component). The UAM/LC methodology built upon the particle-in-cell (PIC) dispersion model approach used by the District since 1989 to examine annual primary particulates, ammonium, secondary sulfate and nitrate concentrations. UAM/LC model performance was evaluated for 1995 against speciated particulate data acquired from the PM10 Technical Enhancement Program (PTEP). (A detailed description of the PTEP monitoring program is provided in Appendix V of the 1997 AQMP. Receptor modeling using the Chemical Mass Balance (CMB) model with enhanced source profiles to estimate secondary organic particulate formation completed the model simulation package to estimate the primary and secondary PM10 components.

A second methodology that coupled the UAM-FCM with a full gas phase and aerosol chemistry mechanism, the UAM-AERO model, was evaluated for potential episodic PM10 prediction. While this methodology showed promise, the data resources required for the episodic model application were extensive for extended application. Since the 1997 AQMP, efforts have been made to modify the UAM/LC to incorporate full gas phase chemistry with the empirical aerosol mechanism for long-term (LT) for annual applications. The resulting UAMAERO-LT was also extended to incorporate PM2.5 air quality prediction capability.

The newly developed UAMAERO-LT model is a simplified version of the UAM-AERO model. The detailed thermodynamic routine (ISOROPIA) of the UAM-AERO model was replaced with the parameterized inorganic gas/aerosol partitioning module. The secondary organic aerosol formation scheme was replaced with a condensed version of the Carnegie Melon University secondary organic aerosol module. The CMU module treats organic products as semi-volatile species and employs an equilibrium approach to the gas/aerosol partitioning of these species. In addition, the detailed particle-sizing scheme used in the UAM-AERO model was also replaced by an observation-based, two size (fine and coarse) particle-sizing scheme for secondary aerosols. UAMAERO-LT utilizes a full Carbon Bond IV gas-phase chemical mechanism and simulates the formation of particulate nitrate, sulfate, ammonium, organic carbon, elemental carbon and other primary particles.

For the 2003 AQMP, UAMAERO-LT model was used to simulate 1995 meteorological and air quality data to determine Basin annual average PM10 and PM2.5 concentrations. Model performance was evaluated against speciated particulate PTEP (PM10 and PM2.5) air quality data as well as Source Selective Inlet (SSI) High-Vol PM10 data measured at the District's air monitoring network from 1995. The future year attainment demonstration was analyzed for 2006, the target set by the federal CAA. Additional PM2.5 model simulations are provided for 2010 to scope the potential reductions needed to meet the new fine particulate standards.

The UAMAERO-LT simulations incorporated several changes in model applications compared to the UAM/LC analyses. The vertical structure was increased to 5 layers (compared with the 2-layer analysis of UAM/LC). The temperature structure aloft was also modified to reflect a more comprehensive field of daily, diurnal mixing heights. Finally, the simulations benefited from enhancements made to the emissions inventory including updated ammonia emissions, improved specification of primary road and fugitive dust emissions and better allocation of those emissions through GIS land use mapping.

While UAMAERO-LT is the desired tool to simulate Basin annual average PM10 and PM2.5 concentrations, the model is not run with detailed, temperature-corrected day-specific emissions. As a consequence, the annual model simulations are not suited for projecting maximum 24-hour average PM10 and PM2.5 concentrations. Speciated linear rollback is used to simulate peak 24-hour average concentrations at five key PTEP monitoring locations having detailed profiles of particulate components for the days when the 1995 Basin maximum concentrations were observed.

The following section summarizes the PM10 modeling approach conducted in preparation for this Plan. Details of the PM10 modeling are presented in Appendix V.

AQMP Modeling Approach

The 2003 AQMP annual average PM_{10} modeling employs a deterministic approach to demonstrate attainment of the PM_{10} in 2006. UAMAERO-LT simulations were conducted for the 1995 base year meteorology and emissions to determine model performance when compared to the speciated ambient PM10 and PM2.5 monitoring data. Performance comparisons were conducted for the ammonium, nitrates, sulfates, secondary organic matter, elemental carbon, primary and total particulate mass for five PTEP monitoring sites (Los Angeles, Anaheim, Diamond Bar, Rubidoux, and Fontana). Additional performance comparisons are conducted for the SSI particulate mass at 19 District sites that routinely measured SSI Hi-Vol data to demonstrate the representativeness of the modeling simulation throughout the modeling domain.

UAMAERO-LT is used in combination with emissions projections to determine PM_{10} air quality for the 2006 future-year baseline and controlled scenario. A weight of evidence demonstration is provided in Appendix V to address future year PM10 predictions at "hot spot" grids, where the particulate emissions have significant uncertainty. A supplemental PM2.5 simulation is provided for the 2010 future-year control scenario to quantify the extent of additional emissions reduction needed to meet the PM2.5 beyond that date. The results of the 2010 PM2.5 concentrations are presented in Chapter 10.

All future-year PM10 air quality projections are compared to the 1995 concentrations. The 1995 Basin maximum annual average PM_{10} concentration was equivalent to the 1995 design value (69 $\mu g/m^3$ for 1993-1995). The 2001 PM10 design value for the South Coast Air Basin is approximately 6 percent lower than that of 1995 at 65 $\mu g/m^3$ (averaged for 1999-2001).

Linear rollback on particulate component species is used to assess future year 24-hour maximum PM10 concentrations at the five PTEP monitoring sites. Observed 24-hour average maximum PM10 for 1995 are used to anchor the rollback calculation for future year impacts. For Rubidoux, the 1995 second maximum PM_{10} concentration (206 µg/m3) observed in 1995 is used for the analysis since the peak 24-hour average (219 µg/m3) occurred during a “Santa Ana” high wind day. The peak concentration, (April 9, 1995), has not been tagged as a natural event in the AIRS data set since the policy did not take effect until 1997. It is useful to note that the 24-hour PM10 standard has been exceeded on only 16 days since 1995 with 10 of those days being high wind events. In addition, since 1997, only high wind events have caused the 24-hour standard to be exceeded.

Projected controlled emissions for 2006 and 2010 are used to determine future 24-hour maximum PM10 at the five key monitoring stations. Detailed discussions of all 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. In the 1997 AQMP, UAM, the photochemical model at that time recommended by the U.S. EPA guidance (40 CFR Part 51, Appendix W), was used with the CB-IV chemistry package for the Basin ozone attainment demonstration and supporting analyses. 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. On April 15, 2003, the final revisions to Appendix W were published in the Federal Register. Revised Appendix W removed UAM as the sole recommended model by EPA for ozone analysis, and in its place did not name a successor. Revised Appendix W promotes the use of models employing state-of-the-art advances in science.

For the 2003 AQMP, UAM with the Carbon Bond IV (CB-IV) chemistry is used to demonstrate future year (2010) attainment of the 1-hour federal ozone standard. Experience gained in implementing UAM and interpreting the impacts of the simulation results in prior AQMPs provides the current application with a large measure of confidence. This is demonstrated both in the model's ability to simulate peak ozone concentrations for a new historical meteorological episode (discussed later) and in the capacity of the model to estimate observed Basin maximum ozone concentrations for 2002, as a "mid-course" evaluation. Performance statistics and model inputs are discussed extensively in Appendix V.

Regardless, while UAM has been selected as the primary modeling tool for the 2003 AQMP, the California Photochemical Grid Model (CALGRID) [Yamartino, et. Al, 1989) using SAPRC99 chemistry was also evaluated for its potential to simulate base and future year ozone to demonstrate Basin attainment of the federal one hour standard. CALGRID is a regional scale, three dimensional, grid type model that embodies several enhancements in layer structure, advection and dispersion schemes not found in UAM. CALGRID has been used for selected ozone attainment demonstrations nationwide and has been used in ozone analyses in other countries. The SAPRC99 chemistry reflects the state of the science in chemical mechanisms with its enhanced treatment of reactivity and interaction of additional chemical species. An expert panel of air quality researchers was convened to review the 2003 AQMP modeling efforts. Their general recommendation supported the transition to the CALGRID/SAPRC99 modeling system.

A discussion of the CALGRID/SAPRC99 modeling system and its performance is provided as attachment A-7 to Appendix V. In general, model performance for error and bias is good, however, the model was unable to simulate peak base year ozone concentrations (approximately 12 percent lower than observations) using the same emissions as the UAM. It was assumed that the tendency to under predict in the base year would carry through to future year simulations and result in the underestimation of emission reductions needed to meet the federal standard. (The CALGRID 2010 simulations are presented as part of a technical report in Attachment-7 of Appendix V. When the CALGRID projected 2010 ozone concentrations for the two control options are scaled for under prediction in the base year, the adjusted predicted ozone carrying capacity is essentially equivalent to the UAM ozone projections. As a consequence, the carrying capacity would not change).

Like CALGRID/SAPRC99, the Comprehensive Air Quality Model with Extensions (CAMx) [Environ, 2002], with SAPRC99 chemistry, was also evaluated as a possible modeling tool for the AQMP attainment demonstration; however it also was unable to simulate base year peak ozone concentrations. (CAMx with CB-IV chemistry is being run in a low reactivity mode to support of the carbon monoxide attainment demonstration to take advantage of its layer structure meteorological and dispersion advection schemes). As a consequence, UAM was used for the 2003 AQMP regional ozone simulations. However, based on the expert review panel recommendations, the District is committed toward using the CALGRID/SAPRC99 modeling system in the future.

It is desirable to perform ozone air quality analyses using several different meteorological episodes. Only one episode was modeled for the 1989 AQMP. For the 1991 AQMP, three ozone meteorological episodes were used to predict future air quality; two meteorological episodes during the 1987 Southern California Air Quality Study (SCAQS) (Lawson, 1990) were used to complement the single episode from the 1989 AQMP. For the 1994 AQMP, two additional SCAQS episodes were added to the analysis and for the 1997 AQMP, the first modeling episode developed for the 1989 AQMP (the June 5-7, 1985 episode) was removed from further use since such meteorological conditions rarely occur in the Basin.

The Southern California Ozone Study (SCOS97) [Jackson, et.al., 1998, Doislager, 1998, among others] measured ozone, precursor and meteorological data for several episode periods during the summer and fall of 1997. The monitoring program took place approximately one and a half years after the implementation of California Phase-II fuel reformulation. The goal of SCOS97 was to provide comprehensive air quality and meteorological data for the purpose of evaluating state of the art meteorological and air quality models for use in attainment demonstrations. While intensive field monitoring during SCOS97 captured several ozone meteorological episodes including a weekend episode, the period beginning August 3-7, 1997 produced the Basin second maximum concentration (0.188 ppm). This meteorological episode has been selected for the current attainment demonstration. One additional candidate episode was considered for the attainment demonstration, (July 16, 1998), however, when evaluated using statistical ranking, the July 1998 episode, like the June 1985 episode, was determined to be rare event ranked at the 99.9th percentile of the episode distribution with an expected frequency of less than once four years.

The current form of the federal ozone air quality standard allows for the standard to be exceeded once per year to account for these rare meteorological events. As such, a peak ozone concentration due to meteorological conditions in the June 1985 or July 1998 episodes would not be accounted for in the current form of the standard. In addition, EPA modeling guidelines recommend that meteorological episodes used for attainment demonstration is no older than ten years. The August 1997 SCOS97 episode satisfies these criteria.

Table 5-1 lists the primary meteorological episode (August 1997) used for ozone air quality analysis including the peak measured ozone concentrations in the South Coast Air Basin, the Mojave Desert Air Basin and the Coachella Valley portion of the Salton

Sea Air Basin. One additional SCAQS episode (August 1987) is carried forward from the 1997 AQMP to provide continuity between AQMP attainment demonstrations. The August 1997 episode is comprised of "Type-1" high potential, meteorological days categorized by the classification system used in previous attainment demonstration (Appendix V-P, 1989 AQMP). While it is desirable to have meteorological episodes from several categories, the "Type-1" meteorology has accounted for 52 percent of all days exceeding the federal 1-hour standard, averaged from 1996-2002. With the continuing trend of reduced precursor emissions it is expected that the percentage of days exceeding the standard having "Type-1" meteorology will increase and eventually become the sole path to high ozone concentrations in the Basin. Nonetheless, UAM future air quality projections are included for the August 1987 SCAQS episode that features days in meteorological categories other than "Type-1."

TABLE 5-1

Ozone Meteorological Episodes Used for the Ozone Attainment Demonstration

	Peak Concentration Peak (pphm)			
Episode	South Coast	Mojave Desert	Salton Sea. - Coachella Valley	Introduced in the
August 26-28, 1987	29	13	16	1991 AQMP
August 3-7, 1997	19	14	16	2003 AQMP

The baseline performance evaluation of the 1987 meteorological episode is provided in the 1994 AQMP. A comprehensive description of the UAM modeling system including, air quality and meteorological inputs and the performance evaluation using the 1997 August SCOS episode for the base and future year simulations is provided in Appendix V.

Carbon Monoxide

The CAA requires the use of an area wide model to describe the accumulation of emissions over several hours and kilometers within the region. CAMx, a fixed layer, regional simulation model, is used for the area wide analysis. CAL3QHC, a roadway intersection model, is used to calculate carbon monoxide concentrations near the intersection. CAMx and CAL3QHC were both simulated for a new meteorological modeling episode, October 31-November 1, 1997, during the SCOS97 monitoring program. The SCOS97 episode replaces the December 1989 episode and ranks second in observed peak carbon monoxide concentrations (17.0 ppm 8-hour average) in the post Phase II fuel reformulation period (1996 - 2002).

Previous carbon monoxide attainment demonstrations were submitted to the U.S. EPA in 1992, 1994 and 1997 to bring the Basin into attainment with the federal standard in 2000. In 2000, the CO standard was exceeded in the Basin on three days, leaving the

Basin in non-attainment status. At that time, a request to EPA for an extension of the attainment date to 2002 was planned to be included in the 2000 revision to the AQMP. However delays in the availability of newer on-road mobile emissions estimates (EMFAC2002) forced a postponement of the plan submittal until 2003. As a consequence, the carbon monoxide attainment demonstration provided in the 1997 AQMP has lapsed.

To meet this void, the 2003 AQMP contains a revised CO Plan that jointly uses ambient monitoring data and modeling results for 2002 and emissions projections for future years to provide a weight of evidence demonstration that will replace the prior submittals. The CAMx and CAL3QHC modeling results are used to demonstrate the progress made towards attaining the federal 8-hour air quality standard for carbon monoxide in the year 2002. The 2002 observed carbon monoxide concentrations, coupled with the 2002 modeled air quality and the EMFAC2002 projected seven percent annual carbon monoxide emissions reductions for the Basin serve as a weight of evidence demonstration of compliance to the federal standard. 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

PM10

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)]. As indicated in Chapter 1, the District has formally requested U.S. EPA to grant the five-year extension. Figure 5-1 depicts future annual average PM10 air quality projections at five PM10 monitoring sites having comprehensive particulate species characterization compared to federal and state annual PM10 standards, respectively. Shown in the figure are the estimated baseline conditions for the years 1995, 2006 and 2010, along with projections for 2006, and 2010 with control measures in place. All sites will attain the federal annual standard by the year 2006. None of the sites will meet the recently revised state annual PM10 standard (20 $\mu g/m^3$ based on a geometric average) by 2010.

The projections for the 24-hour state and federal standards are shown in Figure 5-2. The results are similar to those for the annual standards. All areas will be in attainment of the federal 24-hour standard (150 μg/m^3) by 2006. With respect to the state 24-hour standard (50 μg/m^3), none of the sites will be in attainment by 2010.

Ozone

As an 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, two meteorological episodes August 3-7, 1997 and August 26-28, 1987 are used in the ozone attainment demonstration. 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 2003 AQMP control strategy at the appropriate level for the year modeled.

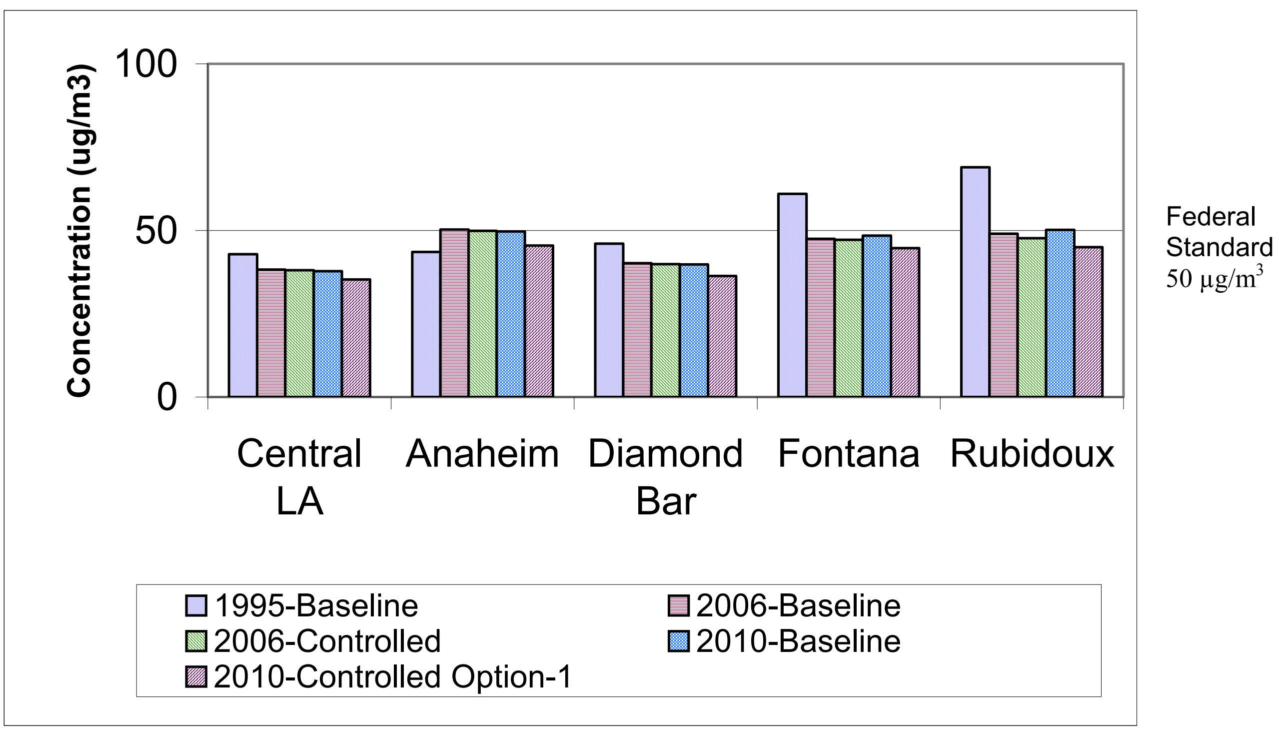

FIGURE 5-1

Annual Arithmetic Average PM10 Concentrations

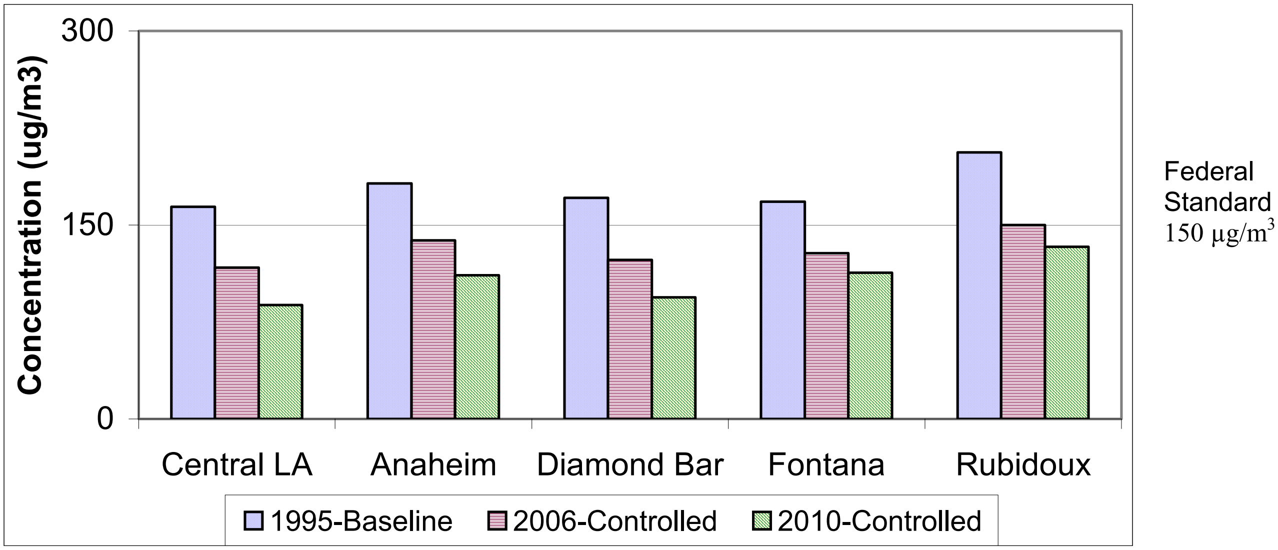

FIGURE 5-2

Maximum 24-Hour PM_{10} Concentrations

Table 5-2 shows the total VOC and NO_x emissions in the Basin and projected maximum 1-hour average ozone concentrations for August 5th and 6th, the most restrictive days of the 1997 episode and August 27th and 28th, the most restrictive days of the 1987 episode. The emissions presented in Table 5-2 are episode-specific and therefore differ from the planning inventories reported in Chapter 3. Baseline emissions and the predicted Basin maximum ozone concentrations are presented for 2002, 2007 and 2010. The 2002 baseline ozone simulation provides a "mid-course" evaluation of model performance. The predicted 1-hour maximum concentrations simulated for the two meteorological episodes compare well with the 2002 annual basin maximum concentration (169 ppb) that was observed on a day having statistically similar meteorological conditions to the August 5, 1997 episode.

Baseline predictions for 2007 serve a dual capacity: The 2007 simulation is required to assess transport to the Mojave Desert Air Basin and is directly used in the Coachella Valley portion of the Salton Sea Air Basin ozone attainment demonstration. (The Coachella Valley Plan and ozone attainment demonstration is discussed further in Chapter 8. Impacts to the Mojave Desert Air Basin are discussed in Appendix V). In addition, the 2007 simulation serves and a second "mid-course" evaluation of the modeling in response to expected reductions in VOC and NOx.

TABLE 5-2

Basin Precursor Emissions and UAM-Predicted Ozone Concentrations

Year/Scenario	Precursor Emissions (Tons Per Day)		Peak Ozone concentration (ppb)		Peak Ozone concentration (ppb)	
			Aug 5th	Aug 6th	Aug 27th	Aug 28th
	VOC	NO_x	1997	1997	1987	1987
1997 Historical Year	1262	1283	199	193	143	173
2002 Baseline	919	1075	162*	168*	127*	153*
2007 Baseline	710	892	146	153	116	139
2010 Baseline	671	764	153	148	120	136

* Predicted peak ozone concentrations for August 5th, 1997 and August 28th, 1987 meteorological episodes for 2002 baseline emissions are provided as "mid-course" estimations of model performance The modeled concentrations are compared to an observed 2002 Basin maximum ozone concentration of 169 ppb which occurred under similar meteorological conditions.

Figure 5-3 depicts the predicted baseline basinwide maximum ozone without further AQMP measures for the two meteorological episodes modeled. As shown, basinwide peak ozone concentrations are on the order of 140 - 150 ppb from 2002 to 2010, regardless of the meteorological episode simulated.

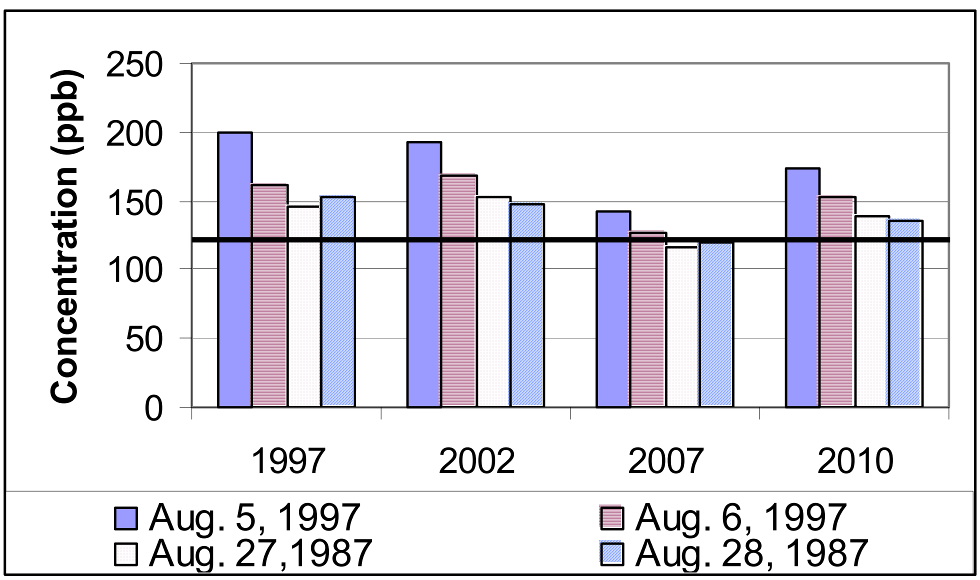

FIGURE 5-3

Baseline Basinwide 1-Hour Maximum Ozone Concentrations

Control Strategy Impacts

Two options for controlled emissions are presented in Table 5-3 reflecting differing penetrations of NOx and VOC controls by the year 2010. Option-1 presents the District's proposed control strategy needed to attain the federal 1-hour standard. Option-1 holds NOx emissions held at the 1997/99 SIP levels. This low NOx plan is designed to ensure progress towards lowering Basin PM2.5 concentrations.

A secondary backstop control strategy that demonstrates attainment using the same air quality model, atmospheric chemistry, and episodes, but utilizes a different mix of VOC and NOx reductions was also simulated. This strategy assumes no additional NOx or VOC emission reduction measures from sources under federal jurisdiction. Under this scenario, the NOx emissions target would be adjusted to cover the loss of federal reductions, while the VOC target would stay the same for ozone attainment in 2010. The effect of using the primary (Option-1) and backstop (Option-2) control strategies on the mix of VOC and NOx reductions that result in attainment are shown in Table 5-3.

Figure 5-4 shows the predicted Basin-wide maximum ozone for the two meteorological episodes for 2010, with the two proposed emission control strategies in place. The results indicate that both proposed control strategies 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 98 and 124 ppb.

Figure 5-5 shows the predicted Basin-wide 8-hour average maximum ozone for the two meteorological episodes for 2010, with the two proposed emission control strategies in place. The results indicate that neither both proposed control strategies will bring the entire Basin into compliance with the federal ozone standard (80 ppb) by the year 2010. The impact of the two strategies is discussed further in Chapter 10.

TABLE 5-3

Precursor Emissions and Model-Predicted Ozone Concentrations

Scenario	Precursor* Emissions (Tons Per Day)		Peak Ozone concentration (ppb)		Peak Ozone concentration (ppb)	
			Aug 5th	Aug 6th	Aug 27th	Aug 28th
	VOC	NO_x	1997	1997	1987	1987
Controlled Emissions: Option-1	313	541	123	120	98	111
Controlled Emissions Option-2	314	619	123	124	98	112

* Day specific emissions for August 5, 1997

The spatial distribution of maximum ozone concentrations for the 1997 historical year is shown in Figure 5-6. Future year ozone air quality projections for 2010 with and without implementation of all control measures are presented in Figures 5-7 through 5-9. Figure 5-8 depicts the spatial distribution of maximum predicted ozone for control scenario Option-1 while Option-2 is presented in Figure 5-9. 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.

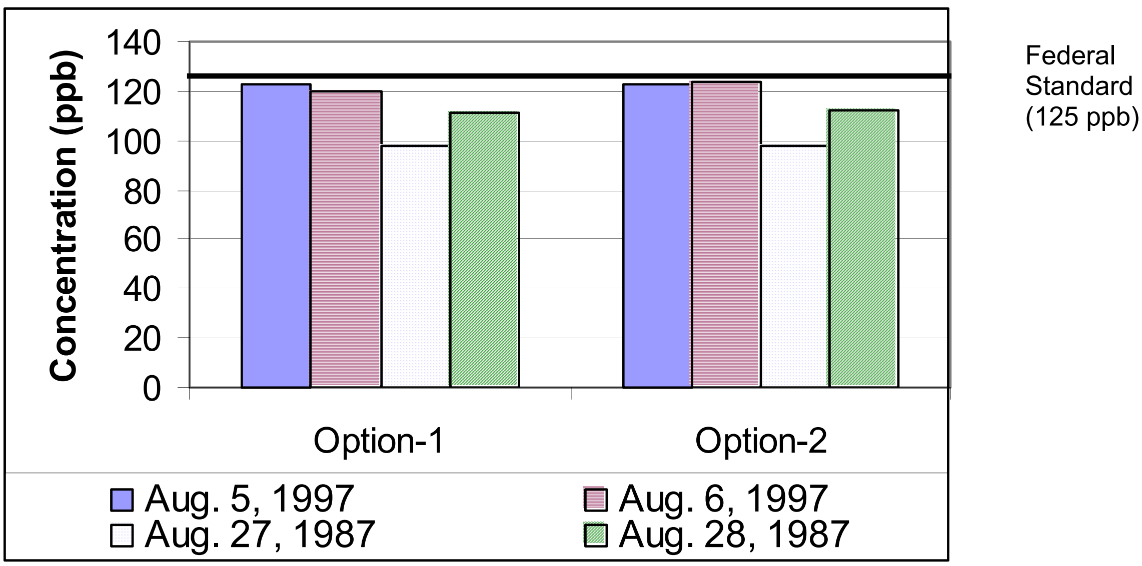

FIGURE 5-4

2010 Basinwide Maximum 1-Hour Average Ozone Concentrations:
District Proposed Emissions Control Scenario: Option-1, and
Backstop Emissions Control Scenario: Option-2

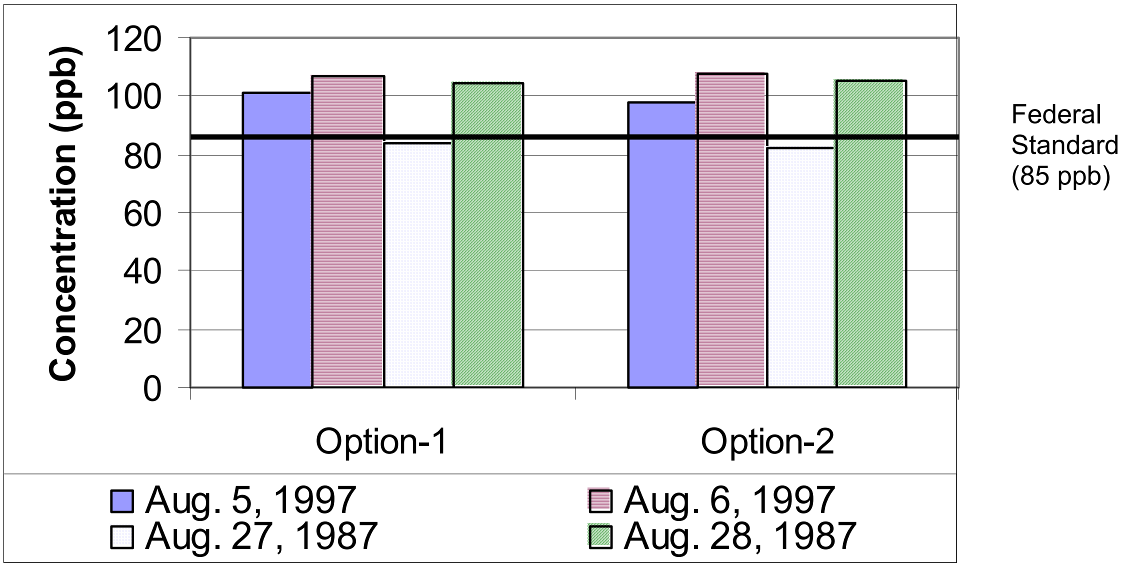

FIGURE 5-5

2010 Basinwide Maximum 8-Hour Average Ozone Concentration:
District Proposed Emissions Control Scenario: Option-1, and
Backstop Emissions Control Scenario: Option-2

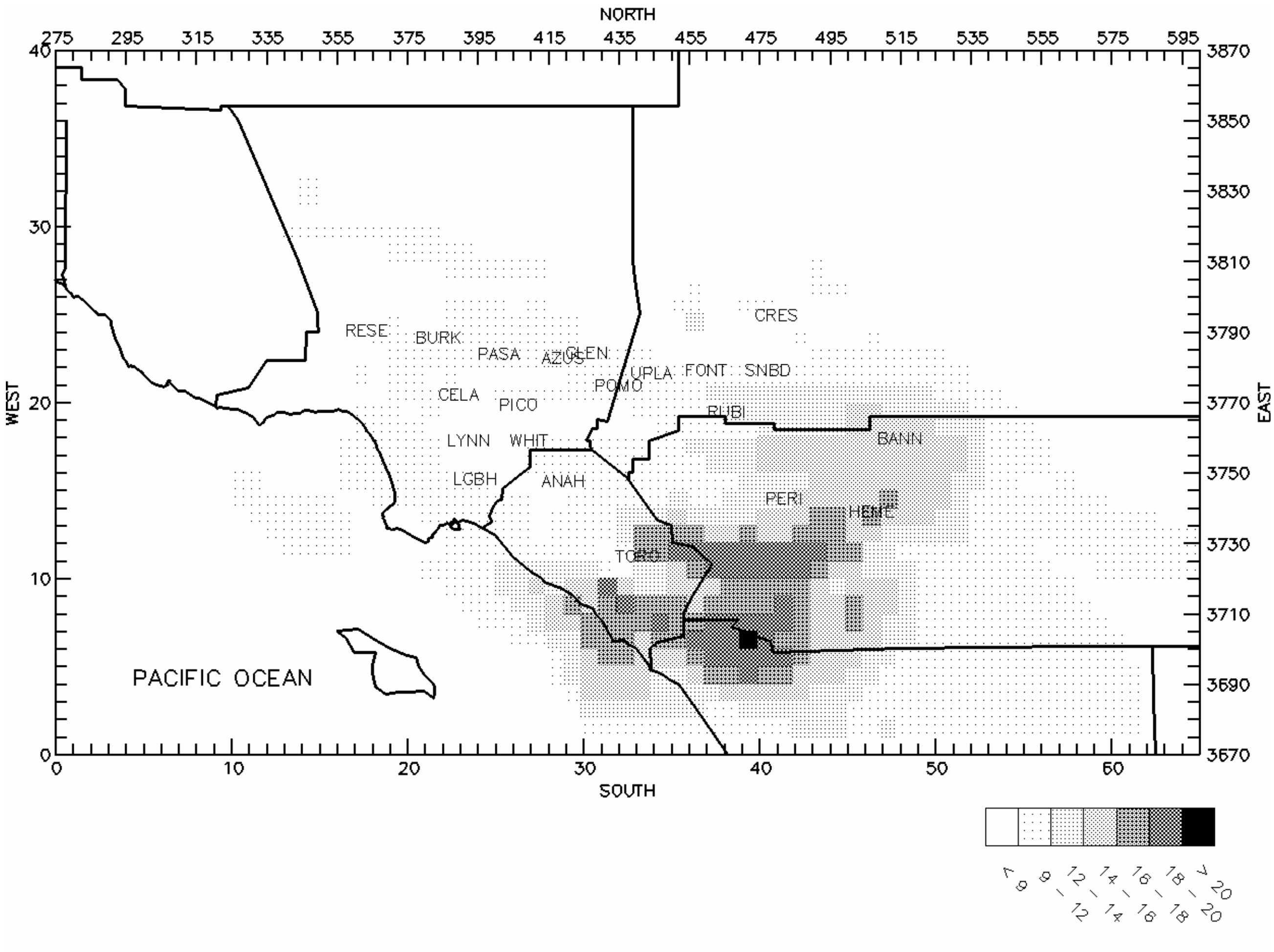

FIGURE 5-6

Model-Predicted Maximum Hourly Ozone Concentrations in 1997

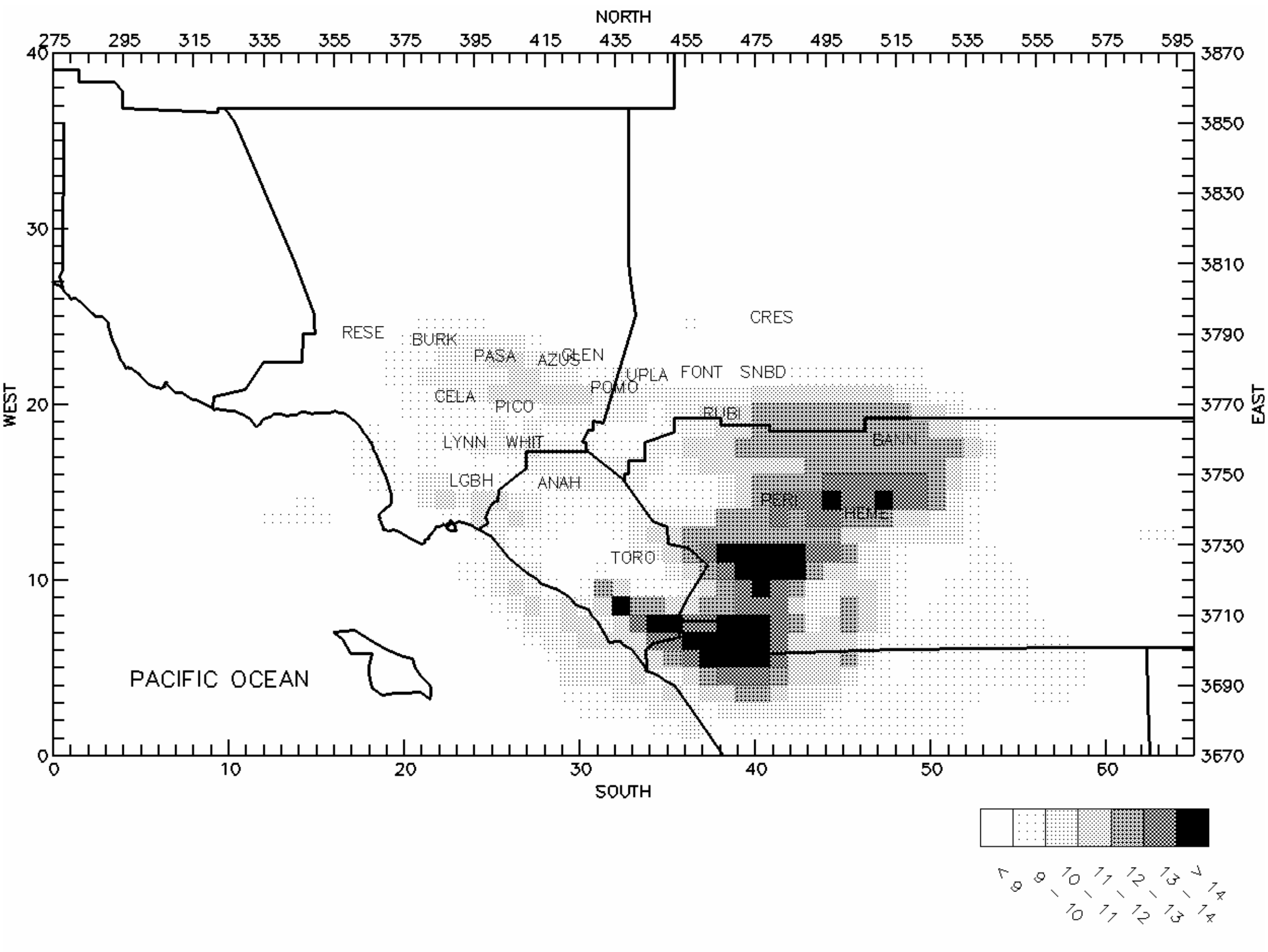

FIGURE 5-7

Model-Predicted Maximum Hourly Ozone Concentrations
in 2010 (with rules adopted as of September 2002)

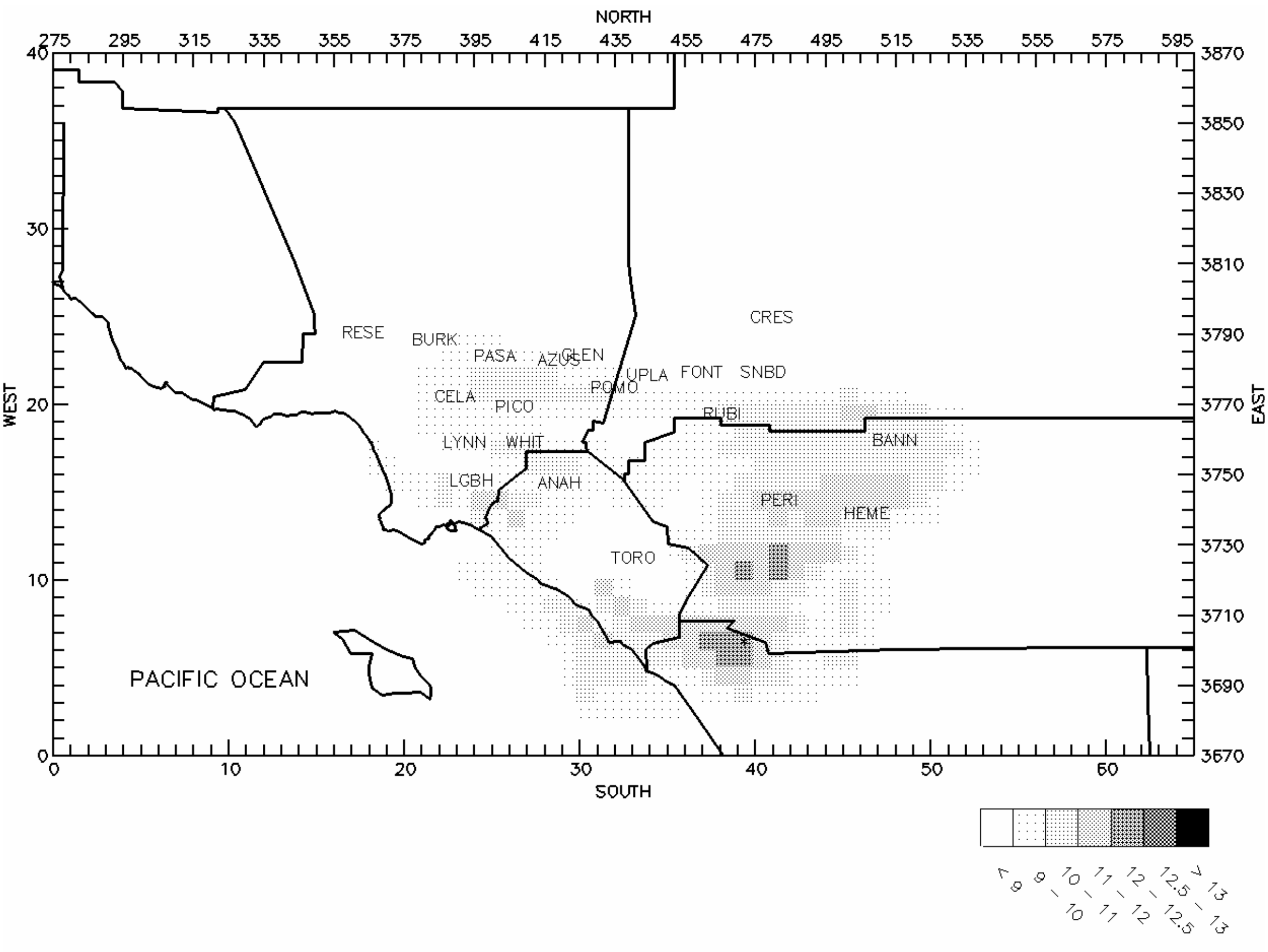

FIGURE 5-8

Model-Predicted Maximum Hourly Ozone Concentrations in 2010: Control Option-1

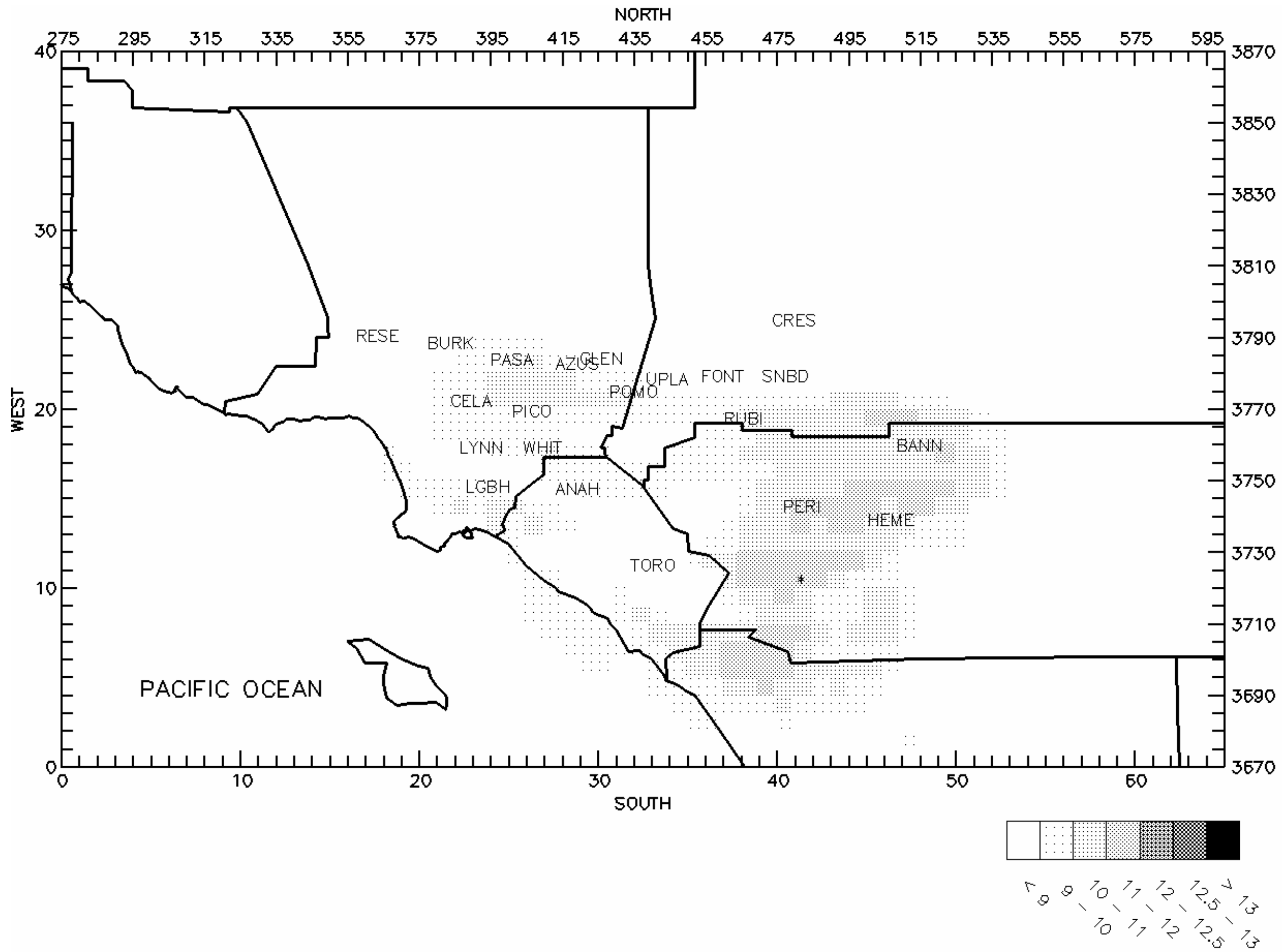

FIGURE 5-9

Model-Predicted Maximum Hourly Ozone Concentrations in 2010: Control Option-2

Carbon Monoxide

As discussed earlier, based on carbon monoxide air quality monitoring conducted during 2001 and 2002, the South Coast Air Basin has technically met the federal carbon monoxide criteria for attainment. The predicted 2002 maximum 8-hour average CO concentrations coupled with the projected trend of reduced on-road carbon monoxide emissions serve as a replacement for 1997 CO Plan and provides the basis for a CO maintenance plan.

The carbon monoxide air quality projections are based on CAMx and CAL3QHC simulations analysis for the fall meteorological episode. The October 31-November 1, 1997 episode recorded maximum 1-hour and 8-hour average carbon monoxide concentrations of 19.0 ppm and 17.0 ppm, respectively. These were the highest recorded values in the Basin since 1996. Table 5-4 summarizes the carbon monoxide emissions and predicted concentrations for 1997 and 2002. (All control measures implemented through October, 2002 are included in the baseline emissions). The 2002 predicted 8-hour average maximum concentration closely matches the maximum observed carbon monoxide concentration measured at Lynwood in 2002 (10.1 ppm on January 8th). However, the concentration exceeds the federal and state levels by a marginal amount.

Figure 5-10 depicts the trend of EMFAC2002 projected carbon monoxide emissions for 1997 through 2005. On-road CO emissions from vehicles that are the primary contributors to urban carbon monoxide episodes are projected to decrease by an average of seven percent per year in 2003 through 2006. Total CO emissions reductions for all categories are projected to be reduced approximately 6 percent per year through 2006. Using liner rollback, the base on the projected reduction in CO emissions, the predicted carbon monoxide maximum 8-hour concentration is expected to be reduced to below the federal standard of 9.4 ppm in 2003 and below the California standard of 9.0 ppm in 2004. The continued reductions in carbon monoxide emissions are expected to maintain the attainment of the federal 8-hour standard demonstrated through observations in 2001 and 2002.

TABLE 5-4

Carbon Monoxide Emissions and Model-Predicted Concentrations

Year/Scenario	CO-Planning Inventory (tons/day)	8-hr Maximum Concentration (ppm)	1-hr Maximum Concentration (ppm)
1997 Baseline	6460	14.9	16.7
2002 Baseline	4835	9.9	10.8
2003 Predicted	4527	9.1	9.9
2004 Predicted	4278	8.4	9.2
2005 Predicted	4029	7.8	8.5

State 1-hr CO standard = 20 ppm
State 8-hr CO standard = 9.0 ppm
Federal 8-hr CO standard = 9.5 ppm

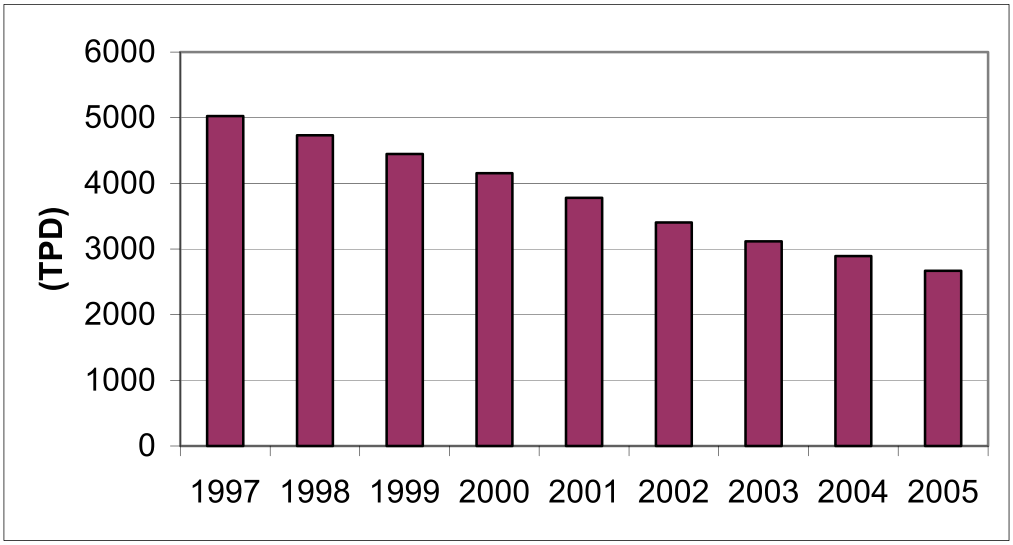

FIGURE 5-10

EMFAC2002 Projected On-Road Carbon Monoxide Emissions for 1997 Through 2005

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 to approximately 7.9 miles in the year 2010.

With the implementation of all proposed emission controls for 2010, the annual average visibility would improve to over 9 miles at Rubidoux

SUMMARY AND CONCLUSIONS

Figure 5-12 shows the model-predicted regional peak concentrations for the three nonattainment criteria pollutants, as percentages of the most stringent federal standard, for the years 2002, 2006, and 2010, (with and without further emission controls). Figure 5-13 shows similar information related to the most stringent California state standards.

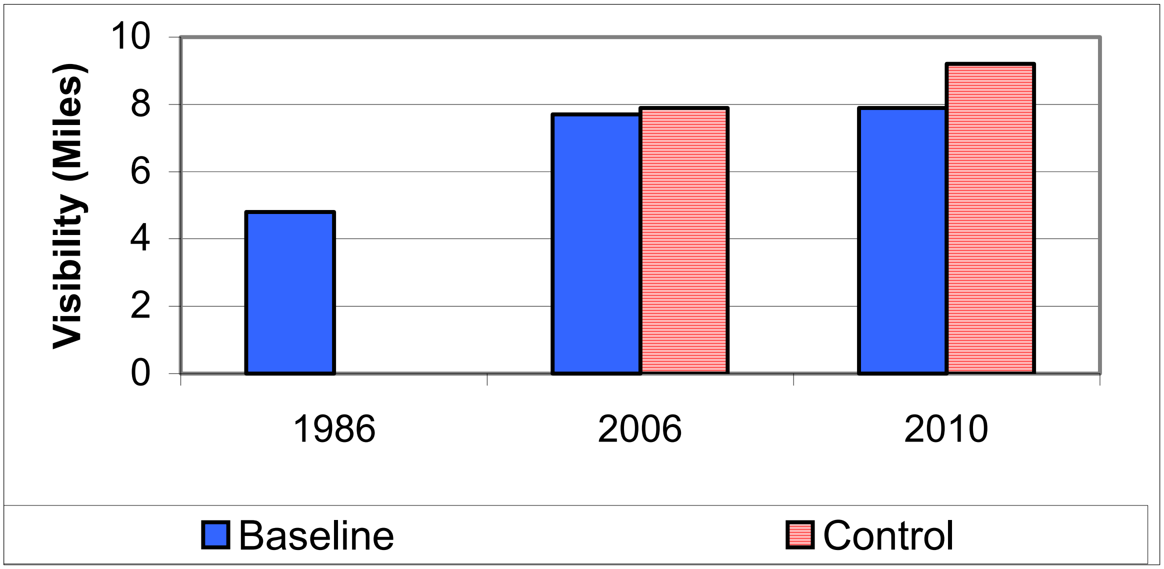

FIGURE 5-11

Annual Average Daytime Visibility Projections at Rubidoux

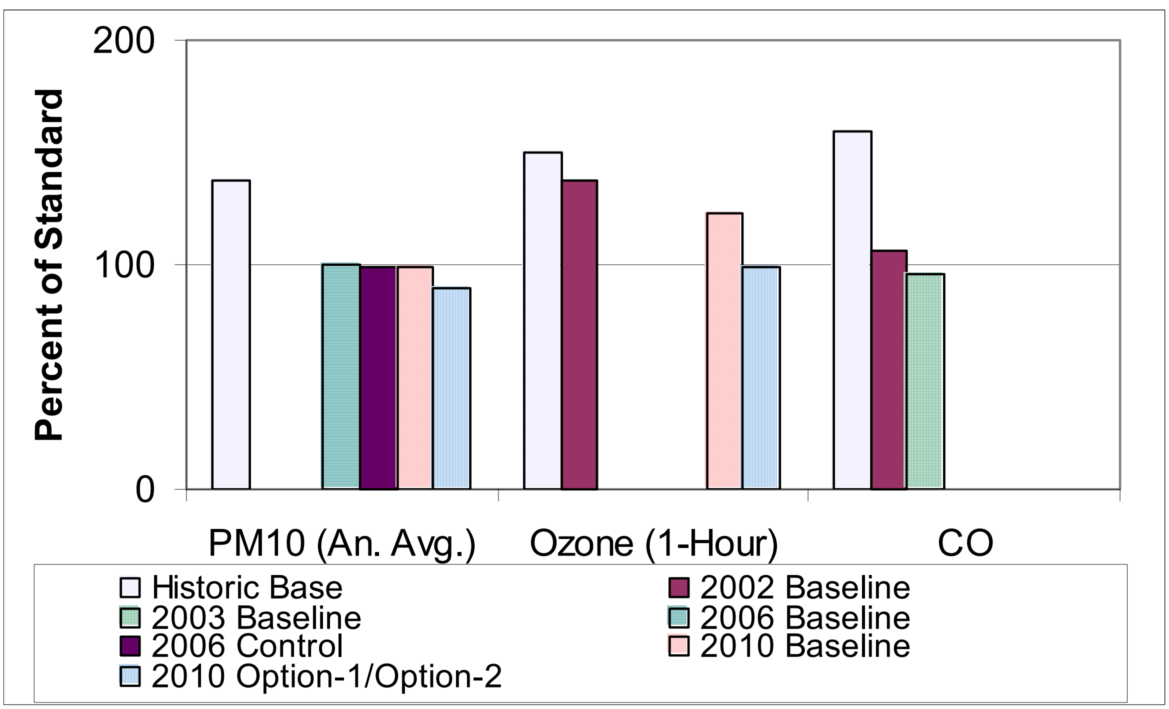

FIGURE 5-12

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

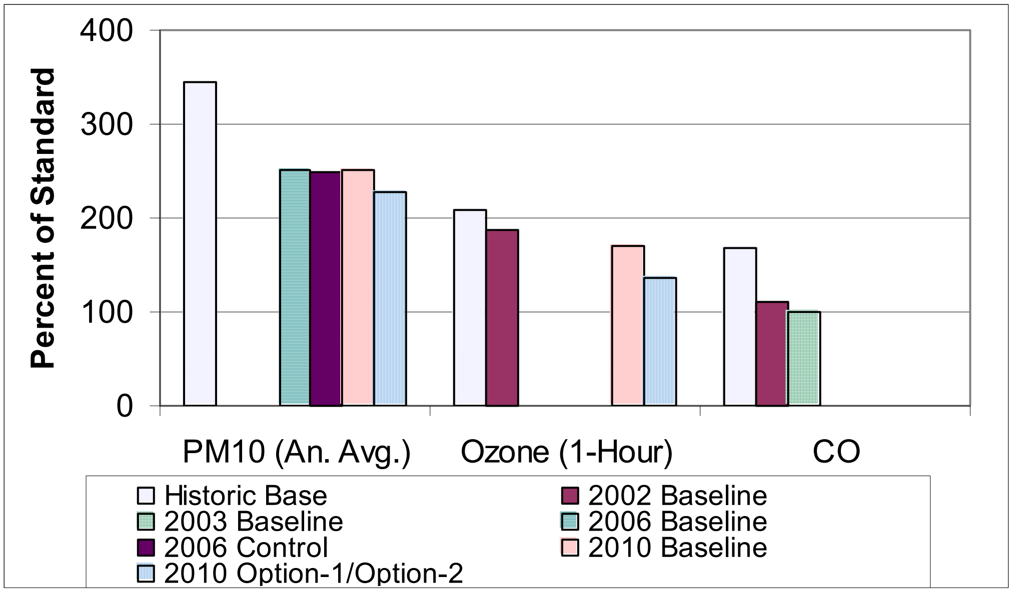

FIGURE 5-13

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

Table 5-5 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 5-5

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	125 ppb	2010
	CAAQS 1-hour	90 ppb	beyond 2010
PM_{10}	NAAQS Annual	50 ug/m^3	2006
	NAAQS 24-hour	150 ug/m^3	2000
	CAAQS Annual	20 ug/m^3	beyond 2010
	CAAQS 24-hour	50 ug/m^3	beyond 2010
CO	NAAQS 8-hour	9 ppm	Achieved*
	NAAQS 1-hour	35 ppm	Achieved*
	CAAQS 8-hour	9 ppm	2004
	CAAQS 1-hour	20 ppm	Achieved

* The Basin has been achieving the federal 1-hour CO air quality standard since 1990. In 2002, the Basin achieved the 8-hour CO air quality standard. The Basin is still considered nonattainment until a petition for redesignation is submitted by the state and is approved by EPA.

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 that 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 multi-component 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 that 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, PM10, and ozone. VOC and oxides of nitrogen are used for ozone. PM_{10} additionally requires reductions of sulfur oxides and directly emitted PM10. Carbon monoxide is based solely on carbon monoxide emissions. Table 5-6 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., 2003 for carbon monoxide, 2006 for PM_{10}, and 2010 for ozone Option-1 and Option-2).

Comments were raised during the public review period for the plan regarding the various combinations of carrying capacity for the ozone attainment demonstration. More specifically the question posed was what maximum NOx loading and its corresponding VOC level as a carrying capacity could the Basin tolerate while (1) attaining the ozone standard in 2010 and (2) attaining the PM10 standard in 2006 and maintaining that standard in 2010. Staff conducted a series of ozone and particulate matter simulations to generate isopleths of predicted concentration as a function of NOx and VOC emissions to attempt to answer the question. The results of the analysis indicate that the carrying capacity provided in Control Option-2 represents the approximate upper bound for NOx emissions to achieve the ozone standard.

PROJECTED EMISSION TRENDS THROUGH 2010

Figures 5-14 through 5-17 show the projected emission trends for both NOx 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 Option-1 2003 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 NOx emissions, mobile sources are expected to be the dominant source through the entire period.

TABLE 5-6

Emissions Carrying Capacity Estimations for the South Coast Air Basin (tons/day) based on the Planning Inventory

a) Carbon Monoxide Attainment Strategy to meet NAAQS (2003)

Emission Category	CO
Point	47
Area	323
On-Road	3088
Off-Road	1040
Overall Control Strategy	4497

b) PM_{10} Attainment Strategy to meet NAAQS (2006)

Emission Category	VOC	NOx	SOx	PM10
Point	65	48	16	13
Area	216	46	1	238
On-Road	252	549	5	19
Off-Road	139	291	36	21
Overall Control Strategy	673	935	57	291

c) Ozone Attainment Strategy to meet NAAQS (2010) Option-1

Emission Category	VOC	NOx
Point	67	50
Area	113	33
On-Road	65	256
Off-Road	65	190
Overall Control Strategy	310	529

d) Ozone Attainment Strategy to meet NAAQS (2010) Option-2

Emission Category	VOC	NOx
Point	67	50
Area	113	33
On-Road	66	270
Off-Road	67	244
Overall Control Strategy	313	597

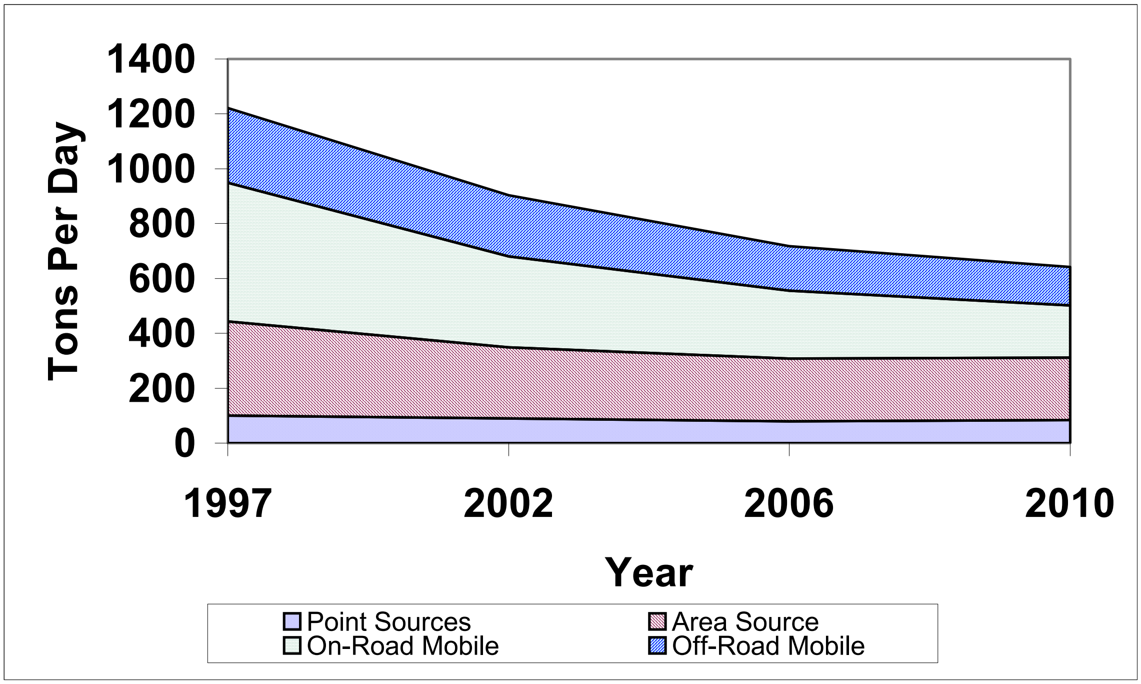

FIGURE 5-14

VOC Emissions - Baseline Scenario

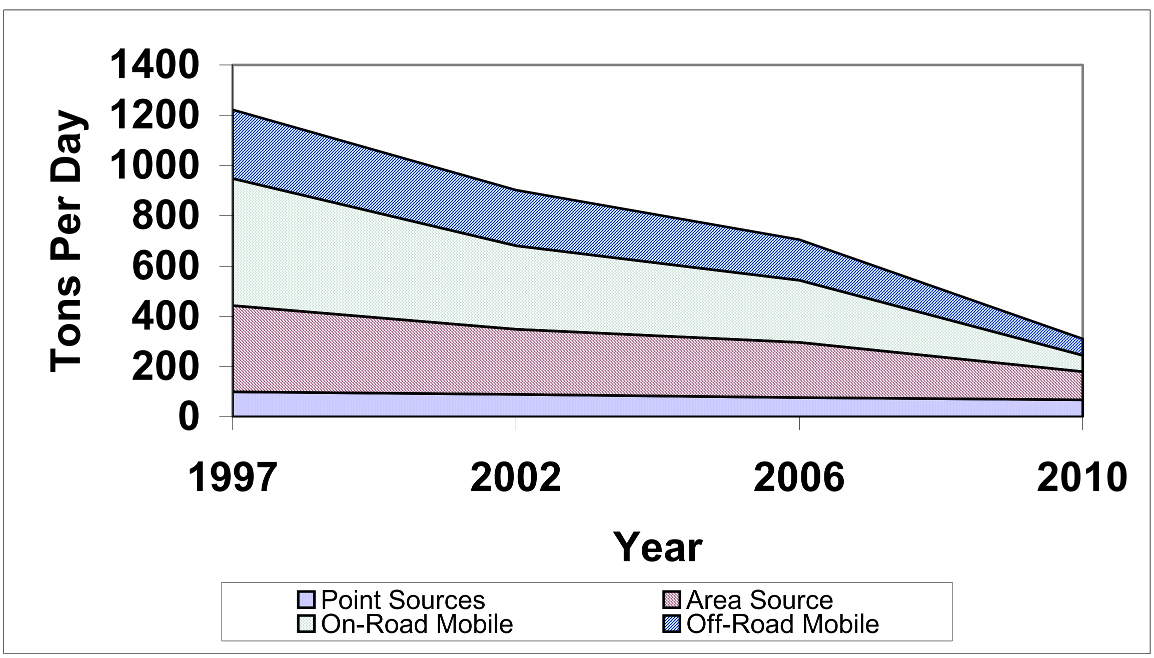

FIGURE 5-15

VOC Emissions - Under 2003 AQMP: Option-1*

* Under Option-2, the VOC emissions are maintained at the same level.

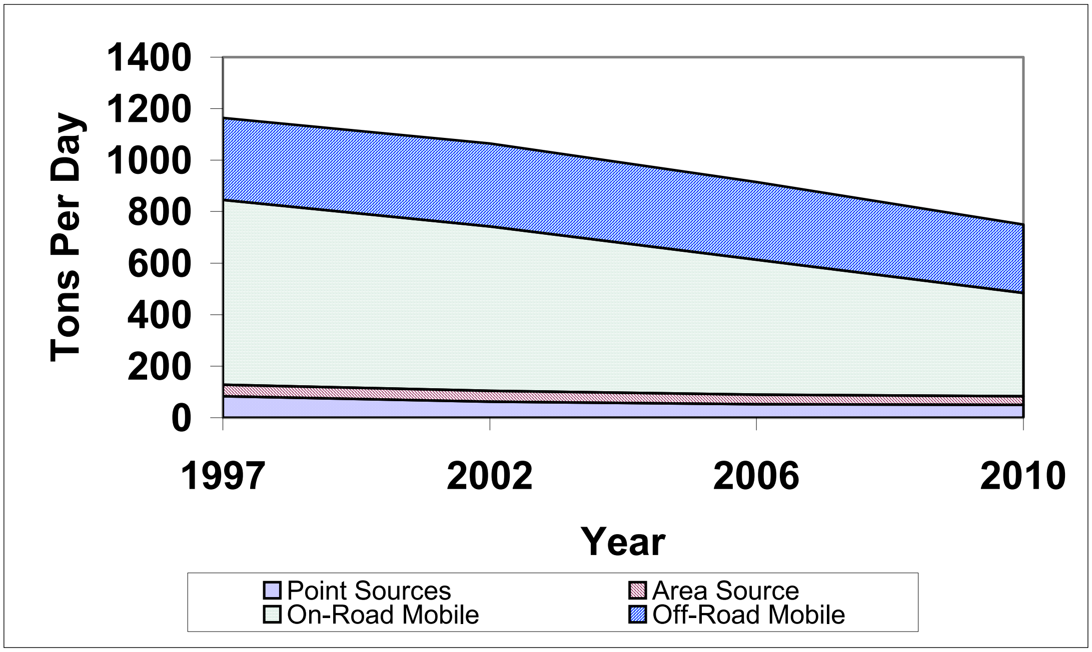

FIGURE 5-16

NOx Emissions - Baseline Scenario

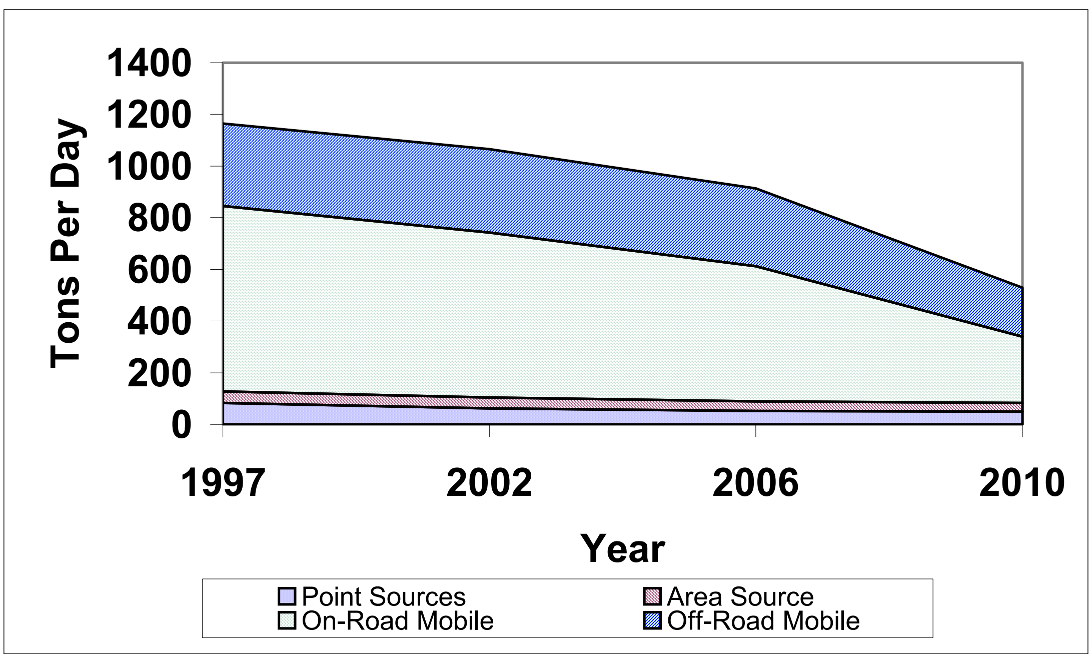

FIGURE 5-17

NOx Emissions - Under 2003 AQMP: Option-1*

* Under Option-2, NOx emissions would be raised by 68 tons per day.