CHAPTER 10

LOOKING BEYOND CURRENT REQUIREMENTS

INTRODUCTION

This Chapter presents additional analyses which are not required under law to be included in the AQMP, but are presented here for informational purposes because they have significant future implications to the region's ability to reach clean air. Specifically this chapter discusses uncertainties associated with the technical analysis provided in the AQMP; provides a first look at the year 2020; and lastly, offers a preliminary analysis regarding the new federal PM2.5 and 8-hour ozone ambient air quality standards.

UNCERTAINTIES ASSOCIATED WITH THE TECHNICAL ANALYSIS

As with any plan update there are uncertainties associated with the technical analysis. The following paragraphs describe the primary contributors to such uncertainties as well as some of the safeguards build-in to the air quality planning process to manage and control such uncertainties.

Demographic and Growth Projections

Uncertainties exist in the demographic and growth projections for the future base years. As projections are made to longer periods (i.e., over ten or more years), the uncertainty of the projections become greater. Examples of activities that may contribute to these types of uncertainties include the rate and the type of new sources locating in the Basin and their geographic distribution, future year residential construction, military base reuse and their air quality impact, and economic prosperity.

Input Elements to Air Quality Models

In addition to the above, there are also uncertainties in the technical information gathered for the air quality analysis. There are three major input elements associated with any air quality modeling analysis: ambient air quality monitoring data; meteorological measurements; and emissions inventory. All three input elements have various levels of uncertainties impacting the technical analysis.

Ambient Air Quality Monitoring Data

Generally, ambient air quality measurements are within plus or minus half of a unit of measurement (e.g., for ozone usually reported in units of pphm would be accurate to within ±0.5 pphm). Due to this uncertainty, the Basin's ozone attainment status based on ambient monitoring data would be achieved if all ozone monitors reported ozone concentration levels less than or equal to 12.4 pphm.

Meteorological Measurements

Air Quality models have to rely on reliable meteorological input data to accurately simulate future ambient concentration levels. There are uncertainties associated with meteorological measurements and model input parameters, such as averaging of instantaneous wind speeds and directions to hourly averaged values, and directional consistency during low (stagnant) wind conditions.

Emissions Inventory

As discussed in Chapter 3, large uncertainties in the mobile source emissions inventory estimates have been observed as evident with the latest EMFAC2002 release. On-road mobile source emission estimates have increased with each new EMFAC release. On-road mobile source emissions have inherent uncertainties also with the current methodologies used to estimate vehicle activity such as vehicle miles traveled. Stationary (or point) source emission estimates have less associated uncertainties compared to area source emission estimates. Major stationary sources report emissions annually whereas area source emissions are, in general, estimated based on production or usage information. Area source emissions including paved road dust and fugitive dust have significant uncertainties in the estimation of particulate (PM10) emissions due to the methodologies used for estimation, temporal loading and weather impacts.

Air Quality Models

The air quality models used for ozone and particulate air quality analysis are sophisticated, complex 3-dimensional models that utilize 3-dimensional meteorological models, complex chemical mechanisms that accurately simulate ambient reactions of pollutants and sophisticated numerical methods to solve complex mathematical equations that lead to the prediction of ambient air quality concentrations. There are uncertainties with the development of the meteorological data input to the 3-dimentional meteorological models, such as the estimation of 3-dimensional wind fields from a limited number of meteorological measurements collected at various locations throughout the Basin. While air quality models progressively became more sophisticated in employing improved chemical reaction modules that more accurately simulate the complex ambient chemical reaction mechanisms of the various pollutants, such improved modules are still based on limited experimental data which carry associated uncertainties. In order to predict ambient air quality concentrations, air quality models rely on the application of sophisticated numerical methods to solve complex mathematical equations that govern the highly complex physical and chemical processes that also have associated uncertainties.

Are There Any Safeguards Against Uncertainties?

Yes. While completely eliminating uncertainties is an impossible task, there are a number of features and practices build-into the air quality planning process that manage and control such uncertainties and preserve the integrity of an air quality management plan.

It should be noted that uncertainties run in two directions and comparisons with recent year projections show that the air quality is improving at a greater rate than was projected. This would indicate that uncertainties have not significantly affected the integrity of the Plan to date.

Furthermore, the concerns regarding uncertainties in the technical analysis are reduced with future AQMP revisions. Each AQMP revision employs the best available technical information available. Under state law, the AQMP revision process is a dynamic process with revisions occurring every three years. The AQMP revision represents a "snapshot in time" providing the progress achieved since the previous AQMP revision and efforts still needed in order to attain air quality standards.

Under the federal Clean Air Act, a state implementation plan (SIP) is prepared for each criteria pollutant. The SIP is not updated on a routine basis under the federal Clean Air Act. However, the federal Clean Air Act recognizes that uncertainties do exist and provides safeguards if a nonattainment area does not meet an applicable milestone or attain federal air quality standards by their applicable dates. Contingency (or backstop) measures are required in the AQMP and must be developed into regulations such that they will take effect if a nonattainment area does not meet an applicable milestone or attainment date. In addition, federal sanctions may be imposed until an area meets applicable milestone targets.

In 1996, U.S. EPA released an updated guidance document on the use of modeled results to demonstrate attainment of the federal ozone air quality standard[1] The guidance document recognized that there will be uncertainties with ozone modeling analysis. For severe and extreme ozone nonattainment areas, the U.S. EPA recommends that at least one "mid-course" review of air quality, emissions and modeled data be conducted. A second review, shortly before the attainment date, should be conducted also. Such actions will occur in the South Coast Air Quality Management District.

1 U.S. EPA, Guidance on Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS, EPA-454/B-95-007, June 1996

A FIRST LOOK AT THE YEAR 2020 OZONE AIR QUALITY

With continued growth in the South Coast Air Basin beyond 2010, concerns have been raised whether the South Coast Air Basin can maintain the federal ozone air quality standard. As such, an ozone air quality analysis for 2020 was performed. Data on the projected growth in the Basin and surrounding areas were provided by SCAG.

The future year (2020) ozone air quality projections suggest that additional emissions reductions will be required to offset growth to maintain the 1-hour ozone standard and attain the 8-hour ozone standard. Mobile source emissions projections through 2020 indicate that continued reductions in VOC and NOx will occur as newer vehiles are introduced. NOx reductions will be most significant between 2010 and 2020 with VOC reductions having a smaller role. Growth in the area source category will act to offset the mobile source VOC reductions by 2020 to reverse the trend of lowering ambient ozone concentrations.

NEW FEDERAL AIR QUALITY STANDARDS FOR OZONE AND FINE PARTICULATES

In July 1997, U.S. EPA promulgated new national ambient air quality standards for ozone and particulate matter.

As part of the requirements of the CAA, every five years the U.S. EPA must review the ambient air quality standards and propose revisions, if necessary, to “protect public health with an adequate margin of safety,” based on the latest, best-available science. This review process includes a comprehensive evaluation of the latest health studies; a redrafting, if appropriate, of the relevant pollutant criteria document; and a staff report recommending the position of the U.S. EPA staff relative to the air quality standards. Further, these documents and U.S. EPA staff recommendation are reviewed by a panel of independent experts authorized by the CAA, the Clean Air Science Advisory Committee (CASAC).

In promulgating the new standards, U.S. EPA followed the elaborate review process described above, which took several years to complete. The evaluation of thousands of peer-reviewed scientific studies led to the conclusion that existing standards for the two pollutants, ozone and particulates, were not adequately protective of public health and resulted in the promulgation of the new standards. The studies indicated that for ozone, longer exposures at levels below the existing 1-hour standard were found to cause significant health effects, including asthma attacks, breathing and respiratory problems, loss of lung function, and possible long-term lung damage and lowered immunity to disease. With respect to particulate matter, the studies indicated that exposure to particles smaller than those that were being regulated by U.S. EPA were found to lodge deeply in the lungs and cause premature deaths and respiratory problems.

On June 2, 2003, EPA published in the Federal Register its "Proposed Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard," 68 Fed.Reg. 32801-32870. As part of that proposal, EPA solicits comment on a proposal to revoke the present 1-hour ozone standard either in whole or in part one year after EPA designates the 8-hour ozone nonattainment areas. (68 Fed.Reg. 32019.) It is expected that EPA will designate the 8-hour ozone nonattainment areas by April 15, 2004. (68 Fed.Reg. 32808.) EPA is extremely unlikely to finalize this rule before the 2003 AQMP is adopted and submitted to EPA. At present, it is uncertain whether, when, or to what extent EPA will revoke the existing 1-hour ozone standard. Therefore, the 2003 AQMP assumes the 1-hour ozone standard will remain in effect for the foreseeable future.

What are the Health Concerns?

A brief summary of the effects associated with these pollutant exposures at levels observable in Southern California is presented. A more detailed discussion of health effects is provided in Appendix I.

<u>Ozone</u>

People exercising outdoors, children and persons with preexisting lung disease such as asthma are considered to be susceptible sub-groups for ozone effects. Identified in human and/or animal studies with varying exposure duration the adverse health effects which are either induced by ozone or associated with ambient ozone exposures include: breathing pattern changes; reduction in breathing capacity and exercise performance; increase in airway resistance; susceptibility to infections; excess hospital admissions and emergency room visits; and acute inflammation of the respiratory tract including some cellular changes.

The lowest range of ozone exposure within which lung functional changes (decrease in breathing lung volumes and increase in airway resistance) are observed is 0.08 to 0.12 ppm for 6-8 hours under moderate exercising conditions. Under similar exposure conditions, biochemical indicators of lung inflammation are induced in healthy adults exposed to ozone in the range of 0.08 to 0.10 ppm. Excess hospital admissions and emergency room visits are observed when hourly ozone concentrations are as low as 0.08 to 0.10 ppm. Thus, the attainment of the current NAAQS (0.12 ppm) is not likely to prevent all the adverse effects indicated from ozone exposure.

Particulate Matter

The major categories of adverse health effects associated with PM10 include: increase in mortality associated with acute and chronic exposures; exacerbation of preexisting respiratory and cardiovascular diseases leading to an increase in hospital admissions and emergency room visits; school absences; work loss days and restricted activity days; changes in lung function and structure; and altered lung defense mechanisms.

A review and statistical analysis of recent population studies published on acute adverse effects of PM10 indicates that an incremental increase of PM10 by 10 $\mu g/m^3$ can lead to a significant increase in both mortality and morbidity risks. The elderly, people with preexisting respiratory and/or cardiovascular disease(s) and children appear to be most susceptible to the effects of PM10. These findings suggest that even when an area meets the existing NAAQS for PM10 the community is likely to continue to have the adverse impact from ambient PM10 exposures.

A limited number of studies which have employed both PM10 and PM2.5 indices for pollution suggest that the adverse effects show a better correlation with the latter. A growing consensus exists among the scientific community that the fine fraction of PM10 is relatively more toxic than the coarse fraction and is responsible for the majority of PM10 effects observed.

In addition, U.S. EPA in its recent PM10 NAAQS review has concluded that the difference in exposure relationships, and the strong likelihood of fine mode fraction of PM10 being significant contributors to PM-related health effects in sensitive populations, are sufficient to justify the consideration of fine and coarse mode particles in PM10 as separate classes of pollutants. Hence, U.S. EPA has recommended additional PM2.5 NAAQS.

What is the New Federal Ozone Standard?

As a result of this review, U.S. EPA is phasing out and replacing the current 1-hour primary ozone standard with a new 8-hour standard to protect against longer exposure periods. (Areas currently exceeding the federal 1-hour standard are still commited to demonstrating attainment in accordance with their scheduled date). The new ozone standard is set at a concentration of 0.08 parts per million (ppm) and represents a tightening of the existing 1-hour ozone standard which is set at 0.12 ppm. Under the form of the standard adopted by U.S. EPA, areas are allowed to disregard their three worst measurements every year and average their fourth highest measurements over three years to determine if they meet the standard.

What are the new Federal PM Standards?

For particulate matter, U.S. EPA established a new annual and a 24-hour standard for the finest fraction of particulates, PM2.5 (particles less than 2.5 micrometers) to complement the existing PM10 standards. The new annual PM2.5 standard is set at 15 micrograms per cubic meter and the new 24-hour PM2.5 standard is set at 65 micrograms per cubic meter. The annual component of the standard was set to provide protection against typical day-to-day exposures as well as longer-term exposures, while the daily component protects against more extreme short-term events. For the new 24-hour PM2.5 standard, the form of the standard is based on the 98^{th} percentile of 24-hour PM2.5 concentrations measured in a year (averaged over three years) at the monitoring site with the highest measured values in an area. This form of the standard will reduce the impact of a single high exposure event that may be due to unusual meteorological conditions and thus provide a more stable basis for effective control programs.

While U.S. EPA has retained the current annual PM10 standard of 50 micrograms per cubic meter, it has modified the form of the 24-hour PM10 standard set at 150 micrograms per cubic meter. More specifically, U.S. EPA revised the 1-expected-exceedance form of the current standard with a 99^{th} percentile form, averaged over three years.

Implementation of the New Federal Standards

Although the promulgation of the new standards for ozone and fine particulates is complete, U.S. EPA has yet to promulgate the air quality designations of the various regions for the new ozone and PM2.5 standards. Under a consent decree that was reached in response to a lawsuit that was filed by several environmental groups, U.S. EPA has agreed to finalize its designations for the 8-hour ozone standard by 2004. In an effort to harmonize the implementation of both the 8-hour ozone and PM2.5 standards, the U.S. EPA will also attempt to complete its designations for the PM2.5 standard by the end of 2004.

The state implementation plans that will incorporate attainment demonstrations with the new 8-hour and PM2.5 standards are expected to be required within three years of the air quality designations or by 2007. Therefore, the current regulatory control strategies will continue to focus on attaining the 1-hour ozone standard with the recognition that these controls will have benefits toward attaining the 8-hour ozone and PM2.5 standards. The U.S. EPA is considering several options in transitioning from the 1-hour to the 8-hour standard, while ensuring that no backsliding will occur. Based on the recent consent decree guidance, it is most likely that the Basin will have to meet the federal PM2.5 standards by 2014 and the 8-hour ozone standard by 2021.

Assessment of the New Federal Standards

Ozone

The District has evaluated the differences between the current 1-hour standard and the new 8-hour standard for both 2001 (observed) and 2010 (predicted) ozone for this comparison. These differences are summarized in Table 10-1. Currently, the 1-hour standards are exceeded by 58 percent. The maximum 8-hour would exceed the new standard by 80 percent. Future year projections show that the 1-hour standard would be met in 2010, but the maximum 8-hour standard would still be exceeded by 35 percent. Because federal guidance has not yet been developed for modeling attainment demonstrations of a 4th highest value, a projection of the 4th highest 8-hour average ozone concentration cannot be made at this time.

TABLE 10-1

Comparison of Ozone Standards

Option	Standard (ppm)	Observed Max Value (ppm)	% above Std.	Predicted Max Value (ppm)	% above Std.	Predicted Max Value (ppm)	% above Std
		2001		2010 Option-1		2010 Option-2	
1-hour (maximum)	0.12	0.190	58	0.123	Met	0.124	Met
8-hour (maximum)	0.08	0.144	80	0.107	34	0.108	35
8-hour (4th highest)	0.08	0.139	74	*	*	*	*

*Future-year federal guidance for attainment demonstration not available.

Particulate Matter

The annual average PM2.5 standard is set at 15 μg/m^3, and the 24-hour average PM2.5 standard is set at 65 μg/m^3.

A comparison of the current PM10 standards and the new PM2.5 standards for 2001 and 2006 are shown in Table 10-2. The 2001 values are derived from the measurements sampled through the routine Basin PM10 air monitoring. The 2006 $PM_{2.5}$ values are estimated from the particulate modeling applications (discussed in Chapter 5 and Appendix V). Currently, the 24-hour average PM10 standard is exceeded by 46 percent. This maximum exceedance occurred under high-wind "Santa Ana" conditions. The annual standard is exceeded by 26 percent. Attainment for both PM10 standards can be demonstrated by 2006.

For the new 24-hour average and annual standards, PM2.5 in 2001 will be exceeded by 51 and 107 percent respectively. In 2006 the 24-hour average PM2.5 standard would be exceeded by 49 percent and the annual average standard would be exceeded 95 percent. For the 2010 Option-1 control strategy, the 24-hour average PM2.5 standard would be exceeded by 5 percent and the annual average PM2.5 is estimated to be exceeded by 80 percent. The annual average PM2.5 for the Option-2 is expected to be approximately 81 percent above the federal standard and the 24-hour average PM2.5 standard would be exceeded by 9 percent. For both control scenarios, the 2010 PM10 federal standard is expected to be met.

It is also important in looking into the future to understand the significant components of PM2.5 as projected for the year 2006. These are shown in Figure 10-1. The ammonium and nitrate portions represent the dominant fraction of PM2.5 on both an annual and episodic (24-hour) basis. Note, too, that the crustal component, as identified within the category labeled “others,” and which represents a significant fraction of PM10, plays a very small role in the PM2.5 picture. For the 24-hour standard, it is evident that significant reductions in ammonium nitrate will be needed over and above the current PM10 control strategy in order to attain a possible PM2.5 standard. Appreciable reductions will also be needed for both organic and elemental carbon, the former from VOC emissions and the latter from soot emissions, primarily from diesel exhaust.

TABLE 10-2

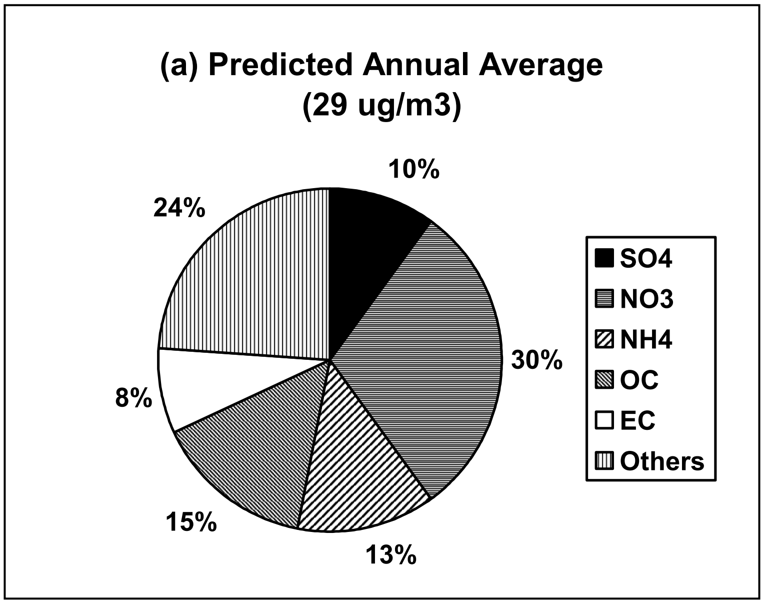
Comparison of Particulate Matter Standard

Option	Standard (µg/m^3)	Observed Max Value (µg/m^3)	% above Std.	Predicted Max Value (µg/m^3)	% above Std	Predicted Max Value (µg/m^3)	% above Std	Predicted Max Value (µg/m^3)	% above Std
		2001		2006		2010 Option-1		2010 Option-2	
Current PM_{10} (24-hour)	150	219*	46	150	Met	133	Met	137	Met
Current PM_{10} (Annual)	50	63	26	49	Met	45	Met	46	Met
New $PM_{2.5}$ (24-hour)	65	98	51	97	49	68	5	71	9
New $PM_{2.5}$ (Annual)	15	31	107	29	95	27	80	27	81

* The 24-hour Basin maximum average of 219 (µg/m3) occurred under high wind conditions And reflect the contributions of fugitive wind blown dust.

NEW STATE PM AIR QUALITY STANDARDS

On June 2002, CARB also adopted new, stricter standards for particulate matter that would affect both the corse as well as fine particulate fraction. The newly adopted standards reduced the PM10 annual average standard from 30 microgram per cubic meter to 20 micrograms per cubic meter and retained the 24-hour PM10 standard of 50 micrograms per cubic meter. The new PM2.5 annual average standard was set at 12 micrograms per cubic meter. In addition, CARB also revised the monitoring methods for these standards, and delayed action on the proposed 24-hour PM2.5 standard in light of the recent findings related to statistical issues in several key short-term exposure health effects studies. Obviously, achieving these standards poses an even greater challenge than meeting the new federal 8-hour ozone and PM2.5 standards.



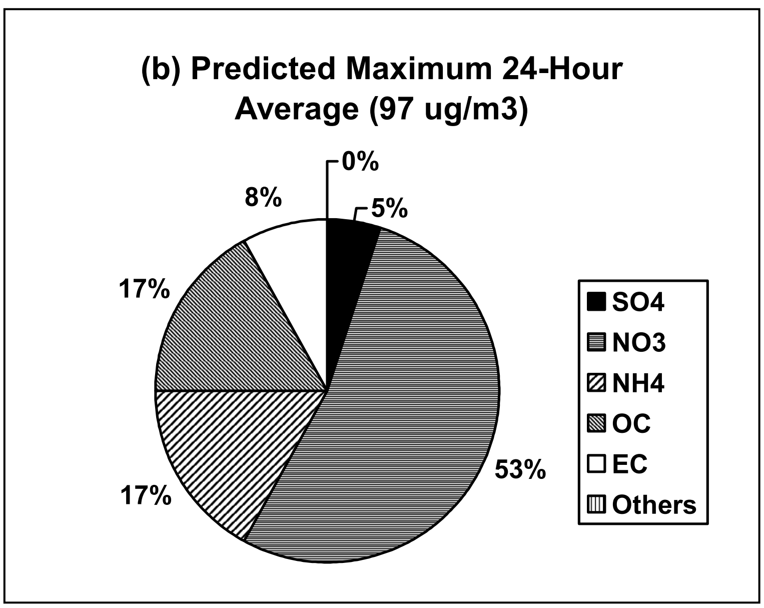


FIGURE 10-1

Estimated PM2.5 Components in 2006