APPENDIX A

ASSESSMENT METHODOLOGY

Introduction

Costs

Benefits

Secondary Impacts

INTRODUCTION

The socioeconomic assessment of the draft 1997 AQMP is divided into three segments: cost, benefit, and employment and other impacts. The following describes how each segment is assessed.

COSTS

Table A-1 lists, in the modified draft 1997 AQMP, the 68 short-, intermediate-, and long-term stationary and mobile measures and shows, for each measure, whether cost data are available. Cost data are not available for those measures where emission reductions are not quantifiable, control methods or control efficiencies are undetermined, or direct costs of control technology are not quantifiable.

Quantifiable Control Costs

Of the 68 short-, intermediate-, and long-term measures, cost data have been developed for 25. In some cases, costs are estimated for combined measures. In addition to the 25 measures, the draft socioeconomic analysis also includes three more quantified measures which have been deleted from the modified draft 1997 AQMP. They are CTS-02A (Electronic Components Manufacturing), CTS-02C (Solvent Cleaning Operations), and FUG-02 (Wastewater Systems). The latter two measures have been adopted as rules after the release of the draft 1997 AQMP.

Direct costs from complying with the requirements of control measures include capital expenditures on control equipment, annual operating and maintenance costs for the equipment, costs of low-polluting (e.g. reformulated) materials, and potential savings related to new requirements. Investments in transportation projects, their annual operating and maintenance costs, and the resulting savings in automobile operating and maintenance costs from these projects are also accounted for.

Cost estimates for TCM-01, transportation improvements, are carried over from the 1994 AQMP. If updated cost estimates become available from SCAG they will be included in the final version of this document. The costs of all mobile source "M" measures, including those measures under the responsibility of EPA, are developed based on assumptions provided by ARB. Control cost estimates for all other measures are based on information from equipment vendors, raw material manufacturers, and affected industries.

Projected Control Costs

Cost-effectiveness, which represents the cost to reduce a ton of pollutant, is developed for each control measure with data on costs and emission reductions. Based on the discounted cash flow methodology, a four percent real interest rate is used to convert all

TABLE A-1

Modified Draft 1997 AQMP Control Measures

Measure No. Modified Draft 1997 AQMP	Control Measure Title	Cost Data Available	No Cost Data
	STATIONARY SOURCE MEASURES		
DPR-01	Emission Reductions from Pesticide Application (formerly FIP-10)		1
BACM-01ABC	Emission Reductions from Paved Roads (R403)	X	
BACM-03	Further Emission Reductions from Unpaved Roads (Rule 403)	X	
BACM-04	Emission Reductions from Agricultural Activities (R403)	X	
BACM-06	Further Emission Reductions from Fugitive Dust Sources to meet BACM	X	
CMB-02B	Control of Emissions from Small Boiler and Process Heater	X	
*CMB-01	Phase II RECLAIM (NOx, SOx)		
*CMB-03	Area Source Credits Program		1
*CMB-04	Area Source Credits for Energy Conservation/Efficiency		1
CMB-06	Emission Stds. for New Commercial & Residential Water Heaters (NOx)	X	
*CMB-07	Emission Reductions from Petroleum Refinery Flares		1
CMB-09	Emission Reductions from Petroleum Refinery FCCU's		1
CP-02	Mid Term Consumer Product Measure		1
CTS-02E	Further Emission Reductions from Adhesives (R1168)	X	
CTS-02H	Further Emission Reductions on Metal Parts and Products (R1107)	X	
CTS-02M	Further Emission Reductions from Plastic, Rubber, Glass Coatings (R1145)	X	
CTS-02N	Further Emission Reductions from Solvent Degreaser (R1122)	X	
CTS-02O	Further Emission Reductions from Usage of Solvents (R442)	X	
*CTS-03	Consumer Product Education Labeling Program		
*CTS-04	Public Awareness/Education Programs-Area Sources		
CTS-07	Further Emission Reductions of Architectural Coatings (R1113)	X	
*FLX-01	Intercredit Trading Program		
*FLX-02	Air Quality Investment Program		
*FUG-03	Further Emission Reductions from Floating Roof Tanks		2
FUG-04	Further Emission Reductions from Fugitive Sources (R1173)		1
*MSC-01	Promotion of Lighter Color Roofing, Road Materials, Tree Planting Programs		
*MSC-02	In-Use Compliance Program for Air Pollution Control Equipment		
*MSC-03	Promotion of Catalyst-Surface Coating Tech. Programs for Air Cond. Units		1
PRC-01	Emission Reductions from Woodworking Operations	X	
PRC-03	Emission Reductions from Restaurant Operations	X	
WST-01	Emission Reductions from Livestock Waste		1
*WST-02	Emission Reductions from Composting Operations		1
*WST-03	Emission Reductions from Waste Burning (Rule 444)		1
WST-04	Disposal of Materials Containing VOC		1
*FSS-04	Emission Charges of $5,000/ton of VOC for Stationary Sources > 10 tons/year		
ADV-CP-4	Long-term Measures for Consumer Products		1
ADV-ARCH	Advance Tech-Architectural Coatings		1
ADV-CLNG	Advance Tech-Solvent Operations		1
ADV-CTS	Advance Tech-CTS		1
ADV-FUG	Advance Tech-FUG		1
ADV-PRC	Advance Tech-PRC		1
ADV-MISC	Advance Tech-Misc		1

TABLE A-1

(Continued)

Measure No. Modified Draft 1997 AQMP	Control Measure Title	Cost Data Available	No Cost Data
	MOBILE SOURCE MEASURES		
ATT-01	Telecommunications	X	
ATT-02	Smart Shuttle Transit	X	
*ATT-03	Zero-Emission Vehicles/Infrastructure		
*ATT-04	Alternative Fuel Vehicles/Infrastructure		
ATT-05	Intelligent Transportation Systems	X	
*FSS-02	Market-Based Transportation Pricing		
M1	Accelerated Retirement of LDVs	X	
M4	Heavy-Duty Diesel Vehicle; 2g/bhp-hr NOx engines	X	
M5	Heavy-Duty Diesel Vehicle; additional NOx reductions in CA	X	
M6	Heavy-Duty Diesel Vehicle; 2g/bhp-hr NOx std - national	X	
M7	Accelerated Retirement of HDVs	X	
ADV-M10	Off-road diesel equipment; 2g/bhp-hr NOx std - national	X	
M11	Industrial Equip., Gas & LPG-CA; 3 way catalyst tech. (ARB)	X	
M12	Industrial Equip., Gas & LPG-Federal; 3 way catalyst tech. (USEPA)		1
M13	Marine Vessels; nationwide stds, new and rebuilt	X	
M14	Locomotives; nationwide stds, new and rebuilt		1
ADV-M15	Aircraft; nationwide emission stds		1
M16	Pleasure Craft; nationwide emission stds	X	
*MOF-07	Credits for the Replacement of Existing Pleasure Craft Engines		
*MON-09	In-use Vehicle Emission Mitigation		
*MON-10	Emission Reduction Credit for Truck Stop Electrification		
TCM-01	Transportation Improvements	X	
ADV-M2	Enhanced LEV	X	
ADV-ON	Market Incentives, Operational Measures		1
ADV-M9	Off-Road 2.5g/bhp NOx std.	X	
ADV-OFF	Market Incentives, Operational Measures		1

* No emission reductions from these measures are claimed.
1 Costs of control technology not quantifiable at this time.
2 Undetermined control method.

the operating and maintenance expenditures within the life of control equipment to 1993 dollars. Control costs for measures which reduce emissions of more than one pollutant are determined for the total emission reductions of all the pollutants except CO. Pursuant to ARB guidelines (CARB, 1990) only one-seventh of the total CO emissions are used in the cost determination calculations.

Short-, intermediate-, and long-term measures are divided into three categories: stationary, on-road, and off-road control. Based on emission reductions and cost-effectiveness for each quantified measure, a weighted average cost-effectiveness can be derived for the quantified stationary, on-road, and off-road measures in each category, respectively. That number is then applied to the unquantified measures for each category, respectively. Finally, annual emission

reductions from the unquantifiable portion of each category are used to project annual costs for unquantifiable measures.

BENEFITS

Better air quality will improve visibility and reduce adverse impacts to human health, building materials, crops, and livestock. Some of these effects can be measured and are quantified relative to the baseline "no control" scenario.

Quantifiable Benefits

The benefits of better air quality in terms of improved human health, reduced damage to building materials and crops, and improved visibility were estimated for the 1989, 1991, and 1994 AQMPs. Those estimates were generally based on previously published studies. The analysis for the draft 1997 AQMP quantifies the benefits of traffic congestion relief, and reduced damage to building materials and crops using the same methodology as past AQMPs, but with updated air quality and economic data. New approaches, discussed below, were used to quantify the benefits of improved human health and visibility.

Health

Based on numerous epidemiology studies published in recent years, concentration-response functions are developed linking ambient PM10 and ozone concentrations with observed health effects (Chestnut and Keefe, 1996b). Epidemiology studies use data on the reported incidence of disease and attempt to discern an association with the concentration of ambient air pollutants measured at the time. The greater breadth of the recent epidemiology literature allows the characterization of more health effects than was possible in the past (see Figure A-1).

The modeling results from the Urban Airshed Model (UAM) and PM10 Model are used for attainment demonstration (see Appendix V of the 1997 AQMP). Projections from the UAM and PM10 model project air quality improvements at each geographic grid cell from implementing the draft 1997 AQMP as compared to the base period. To estimate health benefits, the results from the UAM and PM10 model are fed into the REHEX-II (Regional Human Exposure) model. The REHEX-II model calculates the increased or decreased exposure of the basin's population to PM10 and ozone from the draft 1997 AQMP, compared to baseline levels of these pollutants. These comparisons are made for the years 2000, 2006 and 2010 for PM10 and the years 2000 and 2010 for ozone, using projected population by age cohort and gender from REMI and ethnic distribution from the 1990 census and SCAG. The projected change in exposure to PM10 and ozone brought about by implementing the draft 1997 AQMP are then used in the concentration-response functions for specific health effects and for mortality. Finally, recently revised estimates of the dollar value of improved health and reduced mortality are used to quantify these benefits.

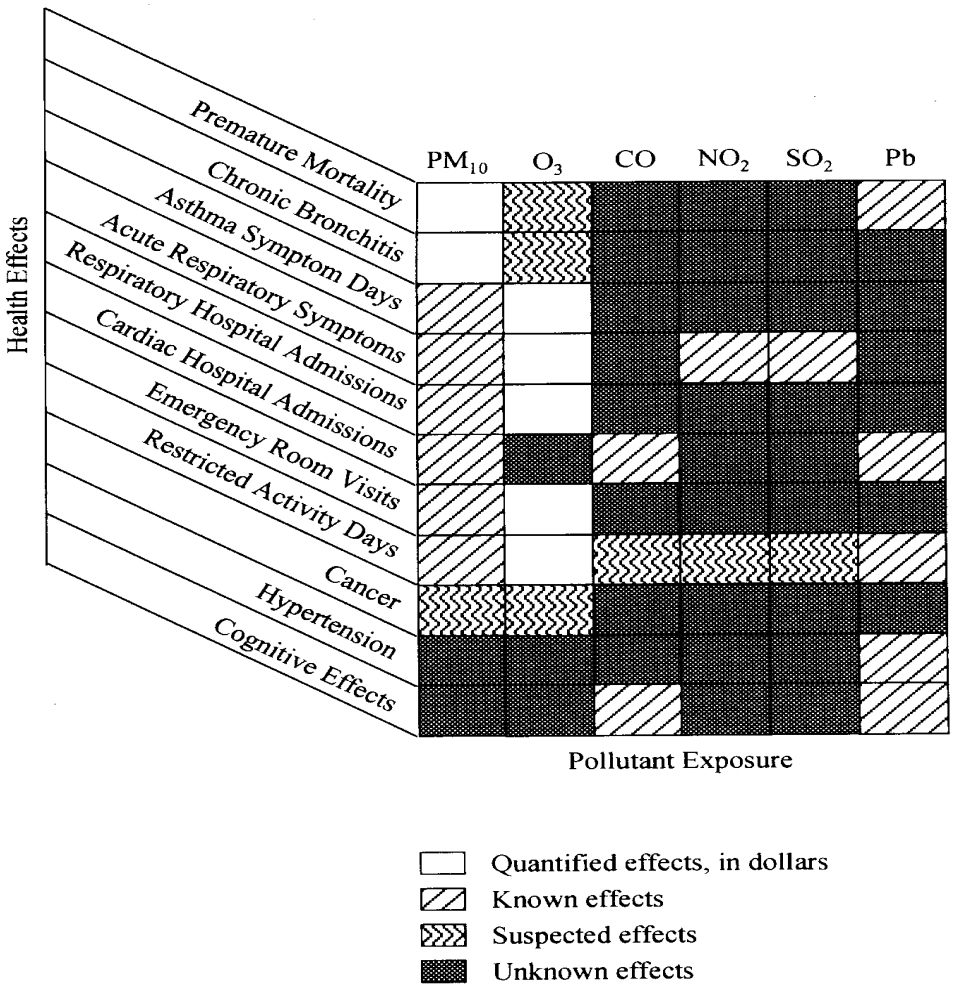

FIGURE A-1

Health Effects Of Criteria Pollutants

Visibility

The benefits associated with improved visibility are estimated by using a percentage of the public's willingness to pay for improved visibility as determined through housing prices (Trijonis, 1985). The willingness to pay reflects the average household income, number of households, and visibility improvements in each county for the years 2000, 2006, and 2010. In the draft 1997 AQMP, visibility data from the PM10 modeling are available only for Rubidoux. Visibility data for Burbank, Long Beach, and Ontario were estimated by using the same ratio of visibility as was found between these three airports and the Rubidoux site in the data used for

the 1994 AQMP. The projection of household income and number of households is taken from the REMI and SCAG forecasts.

The public's willingness to pay as determined through housing prices reflects the value of many benefits including improved health and reduced damage to materials and property as well as improved visibility. In an effort to avoid the double counting of those other benefits and account for the visibility aesthetics only, this analysis attributes only 45 percent of the total willingness to pay factor to visibility. The determination to use a 45 percent factor is based upon a 1994 study prepared by Loehman et al.

Agriculture

Based on the UAM results of peak regional ozone concentration for the draft 1997 AQMP and the 1994 AQMP and the cash value of increased crop yields from implementing the 1994 AQMP, increased crop yields associated with the draft 1997 AQMP are estimated for the years 2000 and 2010. The crops involved are grapes, oranges, lemons, limes, beans, corn, melons, potatoes, spinach, tomatoes, turnips, cotton, grass hay, alfalfa, wheat, avocados, and grapefruits.

Materials

Based on the Urban Air Shed and PM10 modeling results, reduced damages to materials resulting from clean air are estimated (TRC, 1985 and Rowe et al., 1986). Estimates are made for decreased costs of repainting, replacing, and cleaning building materials such as wood, stucco, and indoor surfaces; and reduced costs of replacing rubber products such as tires.

Traffic Congestion Relief

Congestion reduces operating speeds of vehicles resulting in travel delays and increased shipping and storage costs for businesses. Congestion also prevents vehicles from operating under their optimum conditions and thereby increases the operating and maintenance costs of vehicles. Using various studies on congestion costs (SCAG, 1988, 1991 and The Urban Institute, 1991) and potential reductions in vehicle miles traveled (VMT), congestion benefits in the form of reduced vehicle operating and maintenance expenditures and lower shipping and warehousing costs due to the draft 1997 AQMP are assessed. Reductions in VMT were estimated using SCAG's transportation model and input from a 1994 travel survey. Travel-time savings from reduced congestion are not included in the assessment. As such, congestion relief benefits may be underestimated.

Unquantifiable Benefits

Even among the impacted areas noted above there may be additional inputs that are known or suspected but which cannot be easily measured or quantified. Figure A-1 shows the known, unknown, suspected and quantified health effects of exposure to criteria pollutants (66 cubes). Among the known health effects (22 cubes), only 32 percent (7 cubes) can be quantified and the remaining 68 percent cannot be quantified. Moreover, health effects are suspected, but not quantified, for seven additional cubes.

In some cases, quantification of health effects is hindered by the lack of known quantitative relationships between pollutant concentrations and the incidence of health effects. In other cases, these quantitative relationships may be known, but the air quality data needed to perform the calculations may be uncertain The latter is the case for PM10-induced health effects which have been documented based on daily average PM10 concentration readings. The available daily PM10 projections were interpolated from an annual PM10 model. As a result, these projections do not characterize the daily variations in PM10 concentrations well enough to be used for the day-by-day calculations of health effects. Consequently, an estimate is made using annual average PM10 concentration projections. This estimate is for the six PM10-related health effects indicated as "known" in Figure A-1: asthma symptom days, acute respiratory symptoms, respiratory hospital admissions, cardiac hospital admissions, emergency room visits, and restricted activity days.

Further establishment of relationships between poor air quality and its damages, as well as the measurement of these damages, is key to quantifying the benefits from improved air quality in the areas of plant life, livestock, building materials, and human health effects. Inadequate data do not allow full assessments to be made at this time. Benefit assessments which incorporate only quantified benefits significantly underestimate the total benefits which can be expected as a result of implementing the draft 1997 AQMP.

SECONDARY IMPACTS

As control measures in the draft 1997 AQMP are implemented, and as industries spend resources to comply with new requirements and transportation infrastructure is built, the four counties' employment will be affected. Implementation of the draft 1997 AQMP could lead to both increases and decreases in job growth, in the four-county economy, depending upon the industry and year.

REMI Model

To estimate potential employment impacts and other secondary impacts and benefits (e.g., product prices, profits, and income) of quantified measures, District staff relies on the REMI (Regional Economic Models, Inc.) model. The REMI model is widely used by the EPA, state and local agencies, academicians and consultants. The REMI model incorporates state-of-the-art modeling techniques and the most recent economic data. The REMI model has been independently evaluated and found to be "technically sound" by the Massachusetts Institute of Technology (Polenske et al., 1992).

The REMI model is built on published data from 1969 to the present with econometrically estimated parameters and can be used to simulate the impact of public policies on the economy of Los Angeles, Orange, Riverside, and San Bernardino counties. The REMI model allows an assessment of the economic impacts that a policy (such as an AQMP revision or a proposed rule) may cause to the four-county economy for 214 industries which correspond to 3- to 4-digit standard industrial classification (SIC) codes. These impacts include those on jobs, costs of inputs in the production process, personal income, gross regional product, and product prices.

Most of the data in the REMI model are obtained from various departments of the federal government. For example, the REMI model uses employment, wage, and personal income data from the Bureau of Economic Analysis (BEA); employment, wage and salary data collected as part of the unemployment insurance program by the BLS; and employment and wage data from the County Business Patterns. The model also contains population estimates, sectoral fuel usage, capital equipment requirements, and corporate and property tax rates, from the Census Bureau; energy prices from the Department of Energy; and consumption patterns of the public from the BLS. Detailed local data are also used within the model. For example, the model uses birth and death rates from the California Department of Health Services to assist in the calculation of population forecasts for the four-county economy.

The REMI model uses consistent data sources for its forecasts and simulations. For example, most state economic data used by the REMI model, such as those of the California Employment Development Department and the California Department of Finance are also published as part of federal statistics. The use of consistent data bases ensures that the forecast and simulation results from the REMI model are comparable from year to year.

Impact analyses in the REMI model follow a two-step process. First, the national economic projection provided by the Bureau of Labor Statistics (BLS) is used to determine the local baseline economic forecast without any policy change. Second, the direct costs and benefits of a policy are input to the REMI model to generate an alternative forecast for the local economy with the policy. The difference between the baseline and alternative forecasts gives the total effects of the policy. The baseline forecast is recalibrated to ensure consistency with SCAG's population and employment forecasts. The recalibration is performed in three steps. First, the national projection of population and jobs is made the same in both models. Second, SCAG's estimates of birth rates by ethnicity are incorporated into the REMI model. Finally, the growth rates of major industries in each county from 1994 to 2010 are kept the same between the two models. Appendix C provides a detailed description of the recalibration process.

To estimate employment impacts from quantified measures, direct costs associated with each of these measures are utilized as inputs into the model. Implementation costs of measures are distributed in two ways. First, they are distributed to the regulated industries based on the proportion of emission reductions of these industries by geographic location, as proposed in the 1997 AQMP. These costs are the additional cost of doing business. Second, these costs are additional sales to industries which supply necessary equipment and services. These sales are distributed based on the proportion of output of these industries by geographic location. Both distributions are performed for each of the involved industries for each year in the analysis period of 1997 to 2010.

In addition to the categories already described, a number of benefits from clean air are quantified and input into the REMI model. Quantifiable benefits include increased crop yields, improved visibility, reduced damages to materials and health, and relief of traffic congestion. Increased crop yields are divided among cotton, food grains, feed grains, fruits, tree nuts, vegetables, sugar crops, oil-bearing crops, and miscellaneous crops. Visibility improvements and reductions in mortality are translated into additional amenities. Reductions in morbidity are treated as reductions in health expenditures for the public and for employers. Congestion relief benefits are input as a decrease in the cost of doing business for the trucking and warehousing industry and a decrease in sales for auto repair services. Quantifiable benefits are estimated for

those benchmark years when air quality data are available. To provide continuous forecast estimates, estimates for years between benchmark years are interpolated linearly.

Other Secondary Impacts

To assess the impacts on socioeconomic groups, the impacts on product prices identified by the REMI model are overlaid on consumption patterns of various income groups to examine the changes in consumer price indexes of these income groups. The data on consumption patterns are from the Bureau of Labor Statistics' Consumer Expenditure Survey. In addition, the ethnic distribution of the workforce in various industries is adjusted to account for differences in job displacement by ethnic group, based on an extensive literature review and survey data on job displacement and re-employment rates of various ethnic groups.

To assess the impacts of a policy on the competitiveness of the four-county region, the following factors are evaluated: the region's share of national jobs in those industries whose products are also sold in the national market, the impacts on product prices and profits by industry, and the changes in imports and exports. These factors are selected based on a review of effects of past public policies on a region's competitiveness.

Employment Impact of Unquantified Measures

The REMI analysis projects possible impacts on jobs, the distribution of jobs, income, product prices, profits, exports, and imports based upon the input of cost data for each control measure and the benefit data for each effect of clean air. The reliability of such projections is dependent upon the validity of the input. Based on the cost and job impacts of quantified measures, the District makes overall projections of job impacts for unquantified measures. However, the District staff has determined that the limited databases do not lend themselves to use such rough projections for distribution impacts and other types of impacts of unquantified measures. Thus, the impacts of unquantified measures are limited to total job and cost impacts at the region-wide level.