California Environmental Protection Agency
Air Resources Board

The California State Implementation Plan for Ozone
Volume II:
The Air Resources Board's Mobile Source and Consumer Products Elements

Adopted: November 15, 1994

The 1994 California State Implementation Plan

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Executive Summary

California has made significant strides in controlling air pollution both from mobile sources and stationary sources. For example, California's control program has reduced exposure to ozone in Southern California by about 50 percent. However, still far greater reductions in smog precursors, both reactive organic gases (ROG) and oxides of nitrogen (NOx), need to be accomplished to meet the challenge of compliance with the Federal and State Air Quality Standards for ozone. This is particularly true in the South Coast Air Basin (SCAB) where, despite significant reductions in ozone precursors, ambient air quality standards are frequently violated by large margins.

The Clean Air Act, as amended in 1990, requires a comprehensive attainment plan from every ozone nonattainment area classified as serious, severe or extreme. There are six of these areas in California, containing 11 separate air pollution control districts (see Table 1). The ozone plans were submitted to the United States Environmental Protection Agency (U.S. EPA) by November 15, 1994, as a revision to the California State Implementation Plan (SIP).

Table 1. California Ozone Nonattainment Areas with a Federal Classification of Serious or Above

Non-Attainment Area	District(s)	Current Classification
Sacramento Metropolitan	Sacramento, Placer, Yolo-Solano, El Dorado, and Feather River	Serious*
San Diego	San Diego	Severe†
San Joaquin Valley	San Joaquin Valley and Kern County‡	Serious
South Coast	South Coast	Extreme
Southeast Desert	South Coast and Mojave Desert	Severe
Ventura	Ventura	Severe

* Requesting bump-up to severe, based on inability to attain before 1999.
† Reclassification to serious in process, based on rounding error in original air quality data, transport from Los Angeles, and ability to attain by 1999.
‡ Assigned same classification as the San Joaquin Valley, though now located in a different air basin (Southeast Desert) and now governed by a separate air district.

California state law gives the Air Resources Board (ARB) authority to adopt statewide regulations affecting many mobile sources, fuels, and more recently consumer products. The ARB regulations adopted thus far provide a strong foundation for the SIP. The fuels and consumer products regulations were submitted as part of the SIP to the U.S. EPA under separate cover. This volume of the State plan contains the ARB's comprehensive plan for controlling emissions further from mobile sources and consumer products.

The State's element of the SIP is designed to obtain benefits statewide, but the targeted final level of control is based primarily on the emission reductions needed for the SCAB. Because the measures to be adopted will apply statewide, other areas of the state will also realize significant emission reductions from the mobile source and consumer products control program. The measures are essential in those areas to achieve state air quality standards and will help maintain federal standards in the face of growth. To reach attainment in the SCAB

and elsewhere in California, significant additional emission reductions are needed. Air quality modeling shows that the existing emissions of ROG in the six areas that required SIP revisions by November 15,1994, must be reduced between 25 percent and 80 percent to attain the federal ozone standards. For NOx the reductions range from 20 to 60 percent. The needed reductions and the targeted date by when the reductions need to be obtained are listed in Table 2.

Table 2. Emissions Reductions Needed for Attainment.

Area/District	**Percent Reduction from 1990**		**Reduction Needed By**
	ROG	**NOx**	
San Diego	26%	27%	1999[§]
SJ Valley[**]			
Central	30%	22%	1999
South	33%	53%	1999
Sacramento	38%	40%	2005[††]
Ventura	48%	49%	2005
SE Desert[‡‡]			
Mojave	Not Applicable		2007
South Coast			
South Coast	79%	59%	2010

[§] Based on requested reclassification from "severe" to "serious".
[**] Reductions shown for San Joaquin Valley are tentative pending final modeling analysis.
[††] Based on requested bump up in classification from "serious" to "severe".

[##] Attainment based primarily on reduction of transport from upwind areas rather than reductions in the SIP area itself.

This plan provides for the needed reductions in mobile sources and consumer product emissions that, in combination with other measures, will provide for ozone attainment in Southern California and other areas of California. These emission reductions will be obtained in part by developing programs to foster the innovative technologies that will be the foundation of future control measures. We also intend to develop regulations that continue to provide flexibility to the regulated community. While some of the measures rely on traditional control methods, it is anticipated that many of the future emission reductions will be realized through the use of innovative technologies and market incentives.

Mobile Source Element

The mobile source element of the California SIP is the ARB's blueprint of technology- and market-based emission control strategies for achieving attainment of the federal ambient ozone air quality standard. Because on-road and off-road mobile sources together account for more than 70 percent of ozone precursor emissions in the state, further reductions in mobile source emissions are essential if attainment of the federal ozone standard is to be realized. Although reducing emissions from mobile sources is primarily the responsibility of the ARB, the U.S. EPA has sole jurisdiction for a substantial portion of the sources. Therefore, it is imperative that the U.S. EPA enact aggressive measures to reduce ozone precursor emissions from mobile sources.

The ARB's mobile source element will have a dramatic effect on ozone precursor emissions in California. With the joint efforts of the ARB, the U.S. EPA, and the local districts, mobile source emissions of NOx and ROG will drop to the levels needed to achieve attainment of the federal ozone standard in the SCAB by 2010 and in the other areas by 1999 or 2005. The control measures and strategies identified in this element will, for the most part, be implemented statewide, and the entire state will realize emission reductions. These reductions will move the state closer to meeting state air quality standards and help maintain attainment of federal standards in areas which attain before 2010.

ARB's strategy for obtaining further mobile source emission reductions is a combination of advanced technology measures and market-based measures that will affect both sources under state jurisdiction and sources under federal control. The ARB has a proven track record of identifying emerging technologies and developing emission control measures that rely upon the advancement of these technologies. As a result, projected emission levels in California are far below what they would have been, had a more conventional approach been taken. The proposed mobile source control measures in this plan are likewise far-reaching and based on continued technological progress. They are aggressive and they touch virtually every mobile emission source category in the state. This is the only feasible way of obtaining

the emission reductions necessary to comply with federal law. The major components of ARB's mobile source strategy are presented below:

1. Improved Control Technology Measures. The largest new emission reductions will be from on-road and off-road diesel engines, with technology development spearheaded by on-road heavy-duty diesel truck standards.

2. Improved Control Technology Measures-Shared Responsibility with U.S. EPA. The U.S. EPA must adopt stringent national standards for several categories of engines, either because California has been pre-empted from controlling these sources, or because a national standard is essential for California's program to be successful. The pre-empted sources include off-road farm and construction equipment smaller than 175 horsepower, new locomotive engines, and aircraft. National standards are needed for heavy-duty diesel vehicles, heavy-duty industrial equipment, and pleasure craft.

3. New Control Technologies and Techniques. These control measures include incentives to encourage a particular activity or performance standard where the marketplace determines the most cost-effective and efficient method of reducing emissions. Examples of such measures are incentives to purchase or produce "clean" technology vehicles, credit-trading programs, fleet incentives, and fuel conversion incentives.

The ARB is focusing more and more on ways that the efficiency of the marketplace can be harnessed to achieve emission reduction goals. Not only can market principles and flexibility be built into technology-based regulations, but market incentives can be used to encourage people to make environmentally sound choices voluntarily. The ARB is committed to working together with industry, districts, and the public to implement market-based programs that go beyond what the gradual phase-in of new technology can do alone.

In 1990, mobile source emissions in California's six serious, severe or extreme ozone areas were over 2,000 tons per day of NOx and 1,500 tons per day of ROG. These emissions are 73 percent of the total NOx emissions and 55 percent of the total ROG emissions in those areas. Figures 1 and 2 show the emission reductions that will be obtained over the next 15 years from mobile sources in the SCAB, the area with the most severe ozone problem, and the one that drives the emissions reductions sought in the mobile source element. Through implementation of the mobile source element and the mobile source control measures that the ARB has already adopted, these SCAB emissions will be reduced to 450 tons per day of NOx and 115 tons per day of ROG. This is a reduction of 60 percent for NOx and 86 percent for ROG. The significance of this decline cannot be understated -- nowhere in the world has such an aggressive approach to air pollution been taken. The past benefit of the state's program has been a 50 percent reduction in exposure to ozone in little more than a decade. Future progress must be equally dramatic.

Figure 1
Mobile Source Emissions
with State Implementation Plan -- Oxides of Nitrogen

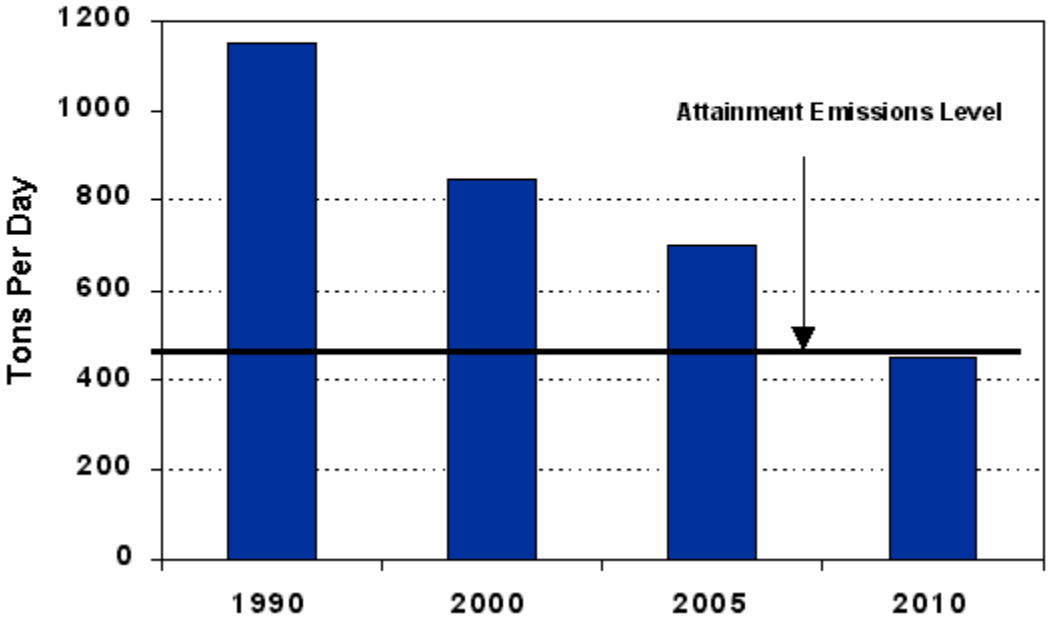
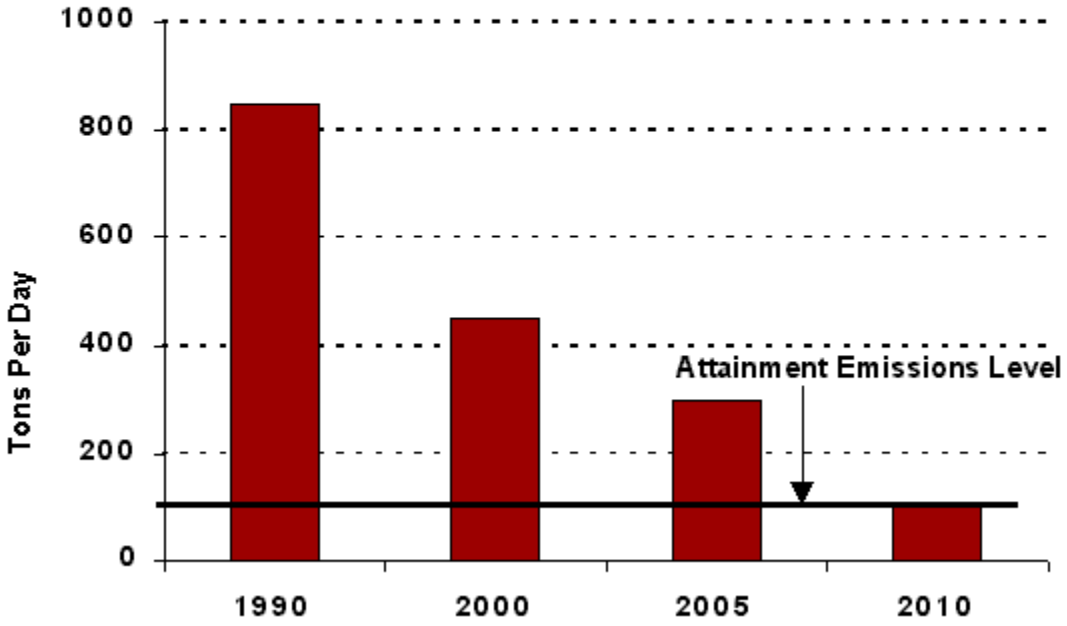


Figure 2
Mobile Source Emissions
with State Implementation Plan -- Reactive Organic Gas

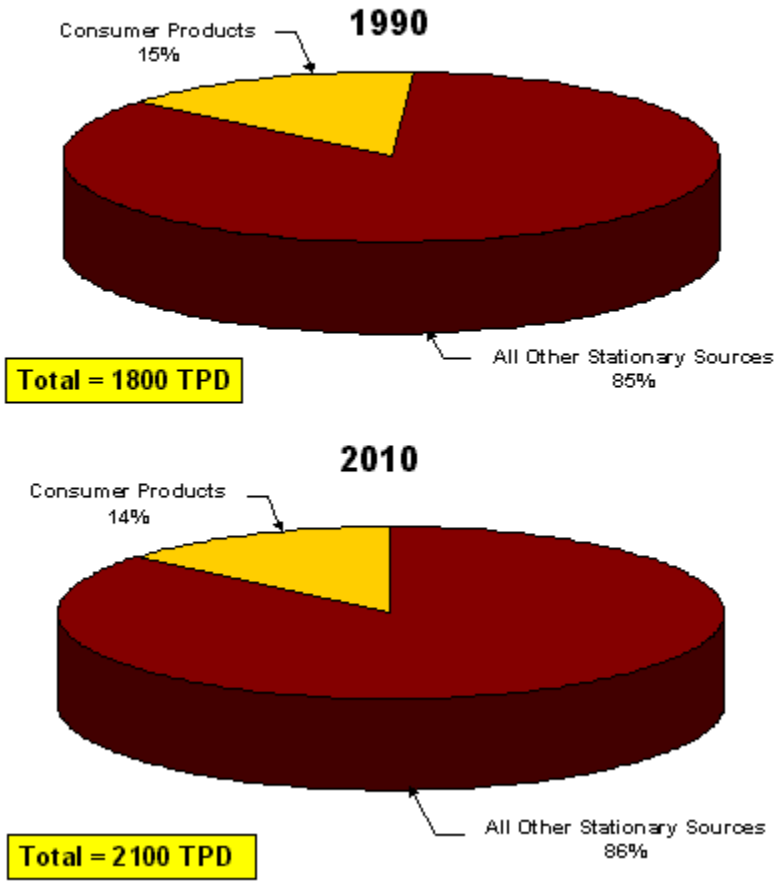


Consumer Products Element

Obtaining emission reductions from consumer products was only recently made a part of the clean air challenge through the enactment of the California Clean Air Act of 1988. This law resulted in regulations adopted by the ARB in the early 1990s that will provide significant statewide emission reductions from consumer products. Achieving additional emission reductions from consumer products is an important component of the 1994 California SIP. These products contain ROG, emitted during product use.

Statewide, the emissions from consumer products (including aerosol paints) are projected to grow, if uncontrolled, from about 265 tons per day in 1990 to about 370 tons per day in 2010. As shown in Figure 3, consumer products comprise 15 percent of the nonvehicular ROG emissions in 1990. For the SCAB, emissions from consumer products and aerosol paint are projected to increase, if uncontrolled, from about 115 tons per day of ROG in 1990 to about 150 tons per day in 2010. While the existing consumer products regulatory program will result in emissions decreasing through the year 2005, this reduction will be overtaken by the increase in emissions due to projected population increases by the year 2010. This same upward trend in consumer product emissions will occur statewide.

Figure 3
Stationary Source ROG Emissions
Statewide -- 1990 and 2010



In the SCAB, an overall 85 percent reduction in consumer product emissions is needed in order to attain the federal ozone standard by 2010. This would reduce emissions from consumer products in the Basin to about 20 tons per day. Consumer products are not alone in this effort to maximize emission reductions from ROG sources. The South Coast Air Quality Management Plan requires several solvent source categories to achieve emission reductions ranging from 75 to 95 percent.

The consumer products control program is a multi-pronged program comprised of near-term, mid-term, and long-term measures. These measures are based on the following five major elements:

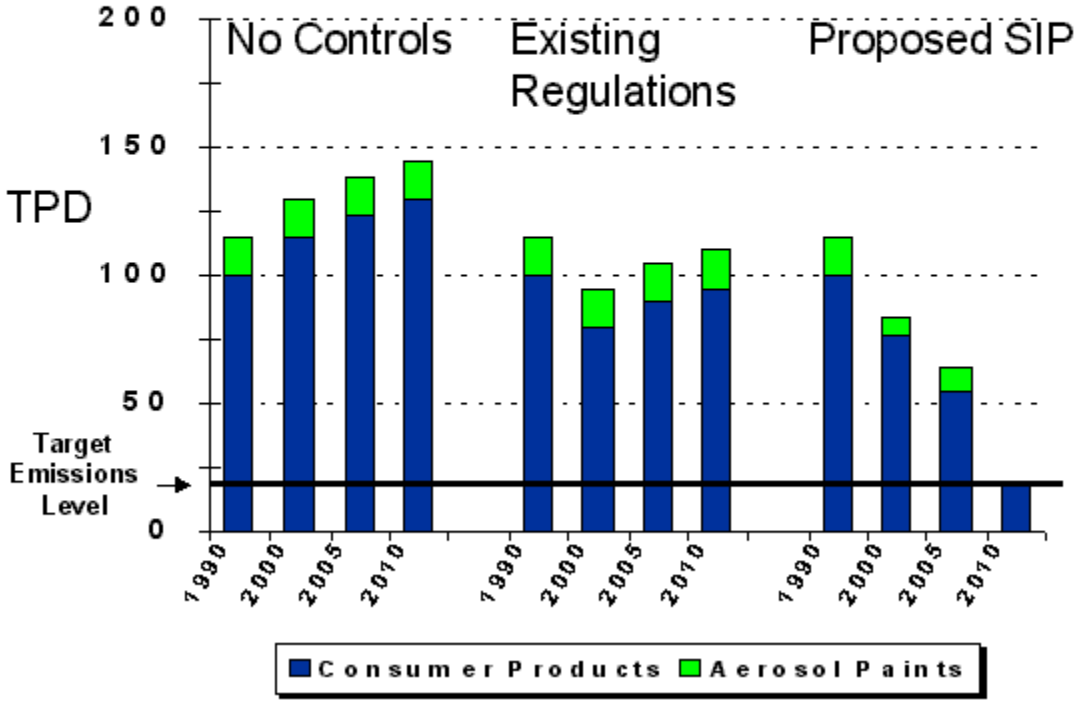
- Existing control measures plus new aerosol paints control measure.
- Traditional control measures applied to currently unregulated consumer products.

- Development of new and innovative technologies and market mechanisms.
- Public education.
- Work with U.S. EPA on its consumer products control program.

The near-term measures are comprised of our existing consumer product regulations, the Alternative Control Plan (ACP), and the aerosol paints regulation currently under development. The mid-term measures consist of regulations to cover additional product categories not currently subject to the existing program. The long-term measures rely on new technologies with components of market incentives and consumer education. Furthermore, because of the need for increased cooperation and coordination with the U.S. EPA, the U.S. EPA will be expected to assist at the national level in regulating consumer products to assist California in its efforts. To facilitate the development and implementation of future measures, a consumer products working group will be established. It will be comprised of representatives from the ARB, U.S. EPA, local districts, affected industry, and environmental groups. This working group will serve as a forum for communication and coordination among interested parties in the development of consumer product regulations.

As shown in Figure 4, without additional measures for consumer products in the SIP, the emissions for consumer products will, after an initial decline due to existing regulations, continue to grow. Without the SIP control measures for consumer products, the projected emissions in 2010 for consumer products are about 35 percent of the attainment ROG emissions in the SCAB. With full implementation of the SIP component for consumer products, the emissions from consumer products will decrease to the attainment level of approximately 20 tons per day.

Figure 4
Projected Emissions - SCAB



(Note: This figure has been revised from the October 7, 1994 draft version of the SIP)

Socio-Economic Analysis

Achievement of the mobile source and consumer products emission reductions necessary to achieve the federal ozone air quality standard will require additional expenditure by those impacted by these control programs. To evaluate the impacts of ARB's mobile source and consumer products plans, a socio-economic impact analysis was performed. While this analysis is not exhaustive, it does provide an approximate estimate of the overall cost of implementing the statewide SIP. Much more detailed analysis will be performed on individual measures as they are further developed and considered for final adoption.

Only the direct cost of the mobile source and consumer products control strategies were evaluated. The assessment does not account for the benefits to the California economy that are expected from development of new technologies and a healthier, more productive work force because these benefits are difficult to quantify.

Based upon estimates made by DRI/McGraw-Hill, in the year 2010 the California economy is expected to employ over 16 million people and produce goods and services valued at about

$1.7 trillion. The direct and indirect costs associated with implementation of this plan is projected to reduce output by about 0.1 percent of the gross state product. Similarly, the plan is expected to reduce job opportunities by about 0.1 percent of the state employment in the year 2010. Putting this into perspective, with the SIP in place, employment is still expected to be over 16 million people in the year 2010 which represents 99.9 percent of the projected employment in 2010 that would be expected in the absence of these elements of the SIP.

California Environmental Quality Act (CEQA) Analysis

The ARB's environmental review program has been certified by the Secretary of Resources pursuant to Public Resources Code section 21080.5, and Title 14, California Code of Regulations, section 15251. Pursuant to the terms of this certified regulatory program, the functional equivalent of an environmental impact report is provided by the ARB in adopting standards, rules, regulations, and plans.

An environmental analysis of the mobile source and consumer products elements for inclusion in the 1994 SIP was conducted. The environmental review concludes that no significant environmental impacts are expected to occur as a result of the adoption of these SIP elements. Consistent with CEQA requirements, the environmental analysis is necessarily general because specific regulatory language is not included in these SIP elements; for those existing regulatory measures that are part of the planned SIP submission, environmental assessments were prepared and provided for comment at the time of the measures' adoption. Additional, more specific environmental analysis will be conducted in the future as part of the regulatory adoption process for each regulation which implements the SIP elements.

Chapter I. Mobile Source Element

I. Introduction

There has been dramatic progress toward cleaner air in California -- the result of California's leadership in developing unique pollution control programs to reduce emissions from both vehicular and non-vehicular sources. Despite continuous increases in population and motor vehicle usage, California's air quality has improved. Nonetheless, meeting health-based air quality standards in many areas of the state remains a long-term challenge, particularly in the South Coast Air Basin (SCAB).

The Mobile Source Element of the State Implementation Plan is the backbone of California's solution to this long-term challenge. On-road and off-road mobile sources together account for more than 70 percent of ozone precursor emissions in the state. Reducing emissions from mobile sources is the primary responsibility of the Air Resources Board (ARB) and the U.S. EPA, which has sole jurisdiction for a substantial portion of these sources. The Mobile Source Element is the ARB's blueprint of technology-based and market-based emission

control strategies that are the major portion of the state's plan to attain the federal ambient ozone air quality standard.

The Mobile Source Element is statewide in scope and will provide needed emission reductions in each non-attainment area. The control strategies, however, are primarily driven by emission reduction requirements for the SCAB. The SCAB is the only area in the state, and in fact the only area in the United States, that is designated a federal extreme ozone non-attainment area, with an attainment deadline of 2010. In addition, the SCAB accounts for almost half of the mobile source ozone-forming emissions in the state. Therefore, the SCAB emissions are used to illustrate the emissions contribution from each source category, and the magnitude of reductions needed to reach attainment.

The foundation of the ARB's mobile source program is technology-based, and generates its full benefit over many years as newer, cleaner vehicles and equipment replace older, higher-polluting sources. These technology-based standards are most effective on a statewide or nationwide basis, and most of the mobile source control strategies discussed herein do apply throughout the state. Thus, the other non-attainment areas in the state, which include San Diego, Ventura, San Joaquin Valley, Mojave, and the greater Sacramento area, would also receive substantial air quality benefits.

Since the other non-attainment areas have a less severe problem than the SCAB, they each have earlier attainment dates than the SCAB's deadline of 2010. Because many of the proposed measures in the Mobile Source Element will not achieve their full effectiveness until the longer-term, special efforts will need to be made in these other areas to adopt near-term measures and incentive programs (such as encouragement to produce/procure cleaner technologies and retire higher-polluting vehicles and equipment faster). Quantification of the emission reductions that will be realized in other non-attainment areas of the state is discussed later in this document.

This document consists of six sections: an introduction, a description of the existing control program, a discussion and schedule of planned control strategies, the estimated emissions impact of the improved technology controls, an explanation of how the additional new control technologies and techniques will be used to obtain additional emission reductions, and an assessment of the benefits of the Mobile Source Element. The section on the existing program describes baseline mobile source emissions (meaning the projected 2010 level of emissions, based on the existing control program). It shows that the existing control program, while very effective, will not reduce emissions sufficiently to achieve attainment of the federal ozone air quality standard in the SCAB. The improved control strategies section describes the mix of improved control technology measures and market-based technology measures that the ARB will pursue to achieve the additional emission reductions needed. Considerable technological challenges are associated with these measures. The section on the impact of planned measures based on expected improvements in technology shows the total emission reductions associated with the planned technology measures in comparison with the targeted attainment emission levels. The additional measures section of this

document describes possible additional measures the ARB will need to employ to provide the additional emission reductions needed for attainment. This document concludes with a summary of the benefits of the Mobile Source Element

II. Existing Program

A. Existing Emissions

Total mobile plus stationary source emissions in the six non-attainment areas for the baseline year 1990 are 2,800 tons per day of oxides of nitrogen (NOx) and 2,800 tons per day of reactive organic gas (ROG). On-road and off-road mobile sources make up the majority of these emissions, as shown in Figures 1 and 2. Mobile sources accounted for 73 percent of total 1990 NOx emissions, and 55 percent of total 1990 ROG emissions. Tables 1 and 2 present this information for each of the six areas.

Figure 1
NOx Emissions
Serious, Severe or Extreme Areas -- 1990

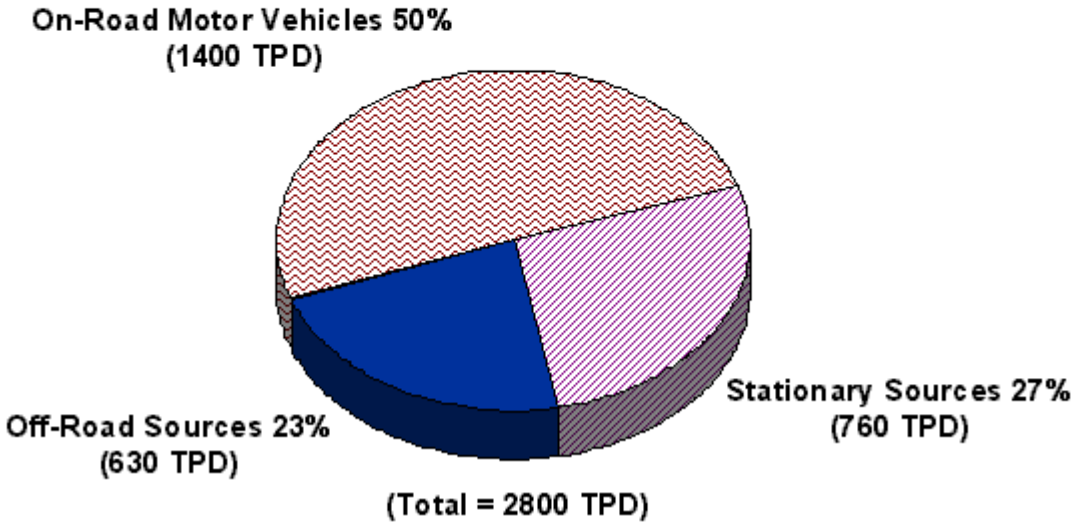
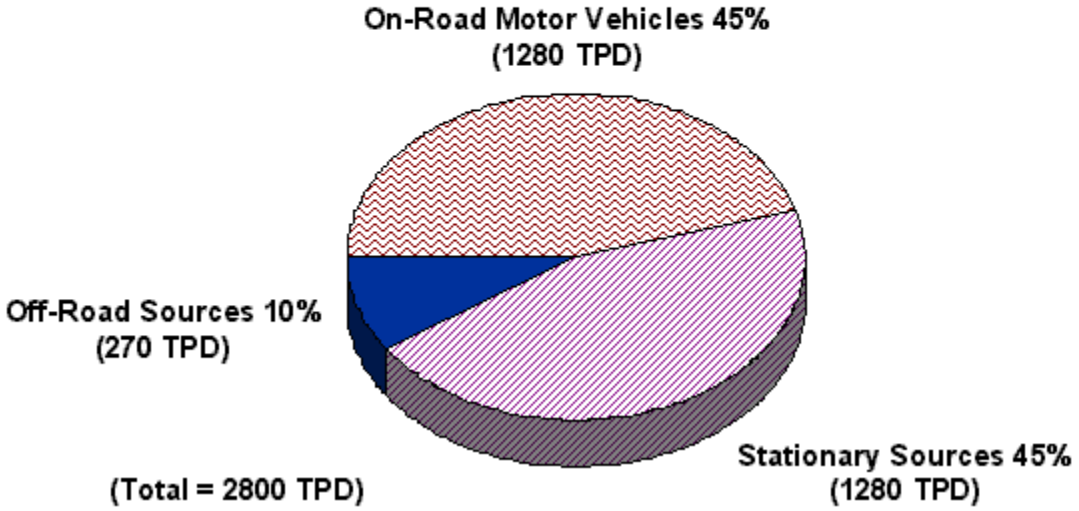


Figure 2
ROG Emissions
Serious, Severe or Extreme Areas -- 1990



B. Attainment Emissions

Significant reductions from current levels of NOx and ROG emissions are necessary to reach attainment in each of the areas, as shown in Table 3. The greatest reductions needed, by far, are in the SCAB. The levels of NOx and ROG emissions that will result in ozone attainment for the SCAB, as determined by air quality modeling, are 553 tons per day of NOx and 321 tons per day of ROG. The locally adopted Air Quality Management Plan contains an attainment demonstration based on reducing both mobile and stationary source emissions. The mobile source shares of the attainment emissions contained in this plan are 453 tons per day of NOx and 116 tons per day of ROG.

Table 1. 1990 NOx Inventory Summary for Affected Nonattainment Areas.

Nonattainment Area	NOx Emissions, tons per day			
	Stationary Source	Mobile Source		
		On-Road	Off-Road	Total Mobile
San Joaquin Valley	406	239	107	346
Ventura County	18	43	21	64
Sacramento Metropolitan Area	12	118	34	152
Southeast Desert	57	82	47	129
San Diego	28	169	41	210
South Coast Air Basin	235	746	370[§§]	1,116
Total	**756**	**1,397**	**620**	**2,017**

[§§] Includes emission inventory adjustment for ships.

Table 2. 1990 ROG Inventory Summary for Affected Nonattainment Areas.

Nonattainment Area	ROG Emissions, tons per day			
	Stationary Source	Mobile Source		
		On-Road	Off-Road	Total Mobile
San Joaquin Valley	355	189	54	243
Ventura County	46	36	6	42
Sacramento Metropolitan Area	88	110	24	134
Southeast Desert	48	76	7	83
San Diego	100	180	32	212
South Coast Air Basin	666	701	150	851
Total	**1,303**	**1,292**	**273**	**1,565**

Table 3. Reductions Needed for Attainment.

Area	Percent Reduction from 1990		Reductions Needed By:
	ROG	NOx	
San Diego	26%	27%	1999***
SJ Valley†††			
Central	30%	22%	1999
South	33%	53%	1999
Sacramento	38%	40%	2005‡‡‡
Ventura	48%	49%	2005
SE Desert§§§	Not Applicable		2007
Mojave			
South Coast			
South Coast	79%	59%	2010

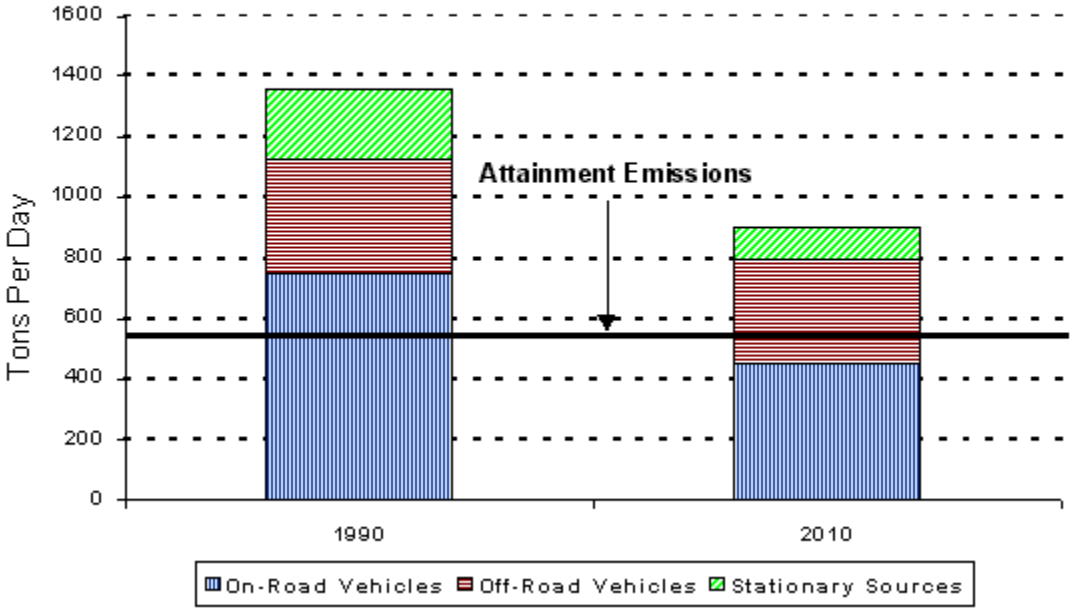
*** Based on requested reclassification from "severe" to "serious."
††† Reductions shown for San Joaquin Valley are tentative pending final modeling analysis.
‡‡‡ Based on requested bump-up from "severe" to "serious.
§§§ Attainment in this area based primarily on reduction of transport from upwind areas rather than reductions in the SIP area itself.

C. Impact of Existing Control Program

The existing control program will achieve significant reductions in total emissions in every non-attainment area mentioned. The specific estimates for the SCAB for 2010 are shown in Figures 3 and 4.

FIGURE 3

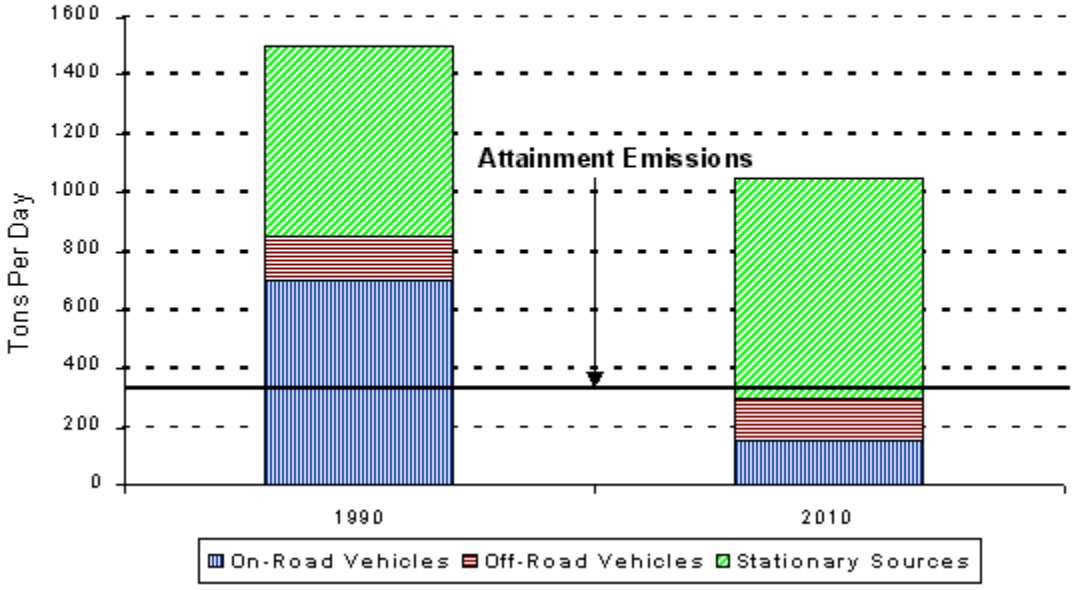
Impacts of Existing Control Programs on NOx Emissions -- SCAB



The emission values in this report are based on modifications to the inventory produced by EMFAC7F, the ARB's model for estimating on-road mobile source emissions, and adjustments to the baseline emission inventory for some off-road sources. A summary of these modifications is shown in Appendix A. As Figures 3 and 4 clearly show, however, the existing control program must be greatly expanded to provide the emission reductions needed for attainment of the federal ambient air quality standard for ozone. Total SCAB baseline emissions in 2010 under the existing program would be 932 tpd NOx and 1054 tpd ROG. These baseline emissions would be in excess of estimated attainment emissions by 379 tons per day NOx and 731 tons per day ROG.

FIGURE 4

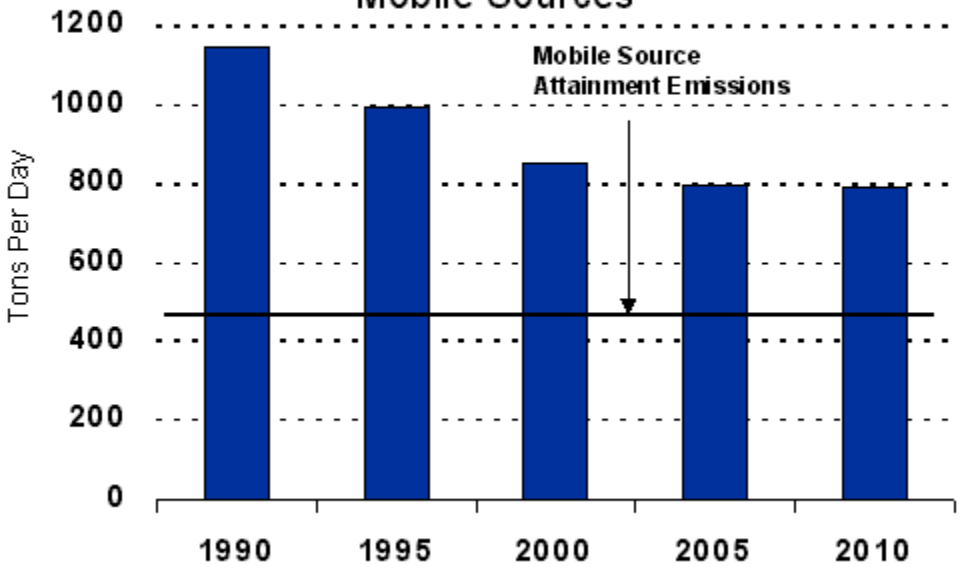
Impacts of Existing Control Programs on ROG Emissions -- SCAB



Focusing specifically on mobile source emissions in the SCAB, Figures 5 and 6 present mobile source emission estimates of NOx and ROG from 1990 to 2010 under the existing control program.

FIGURE 5

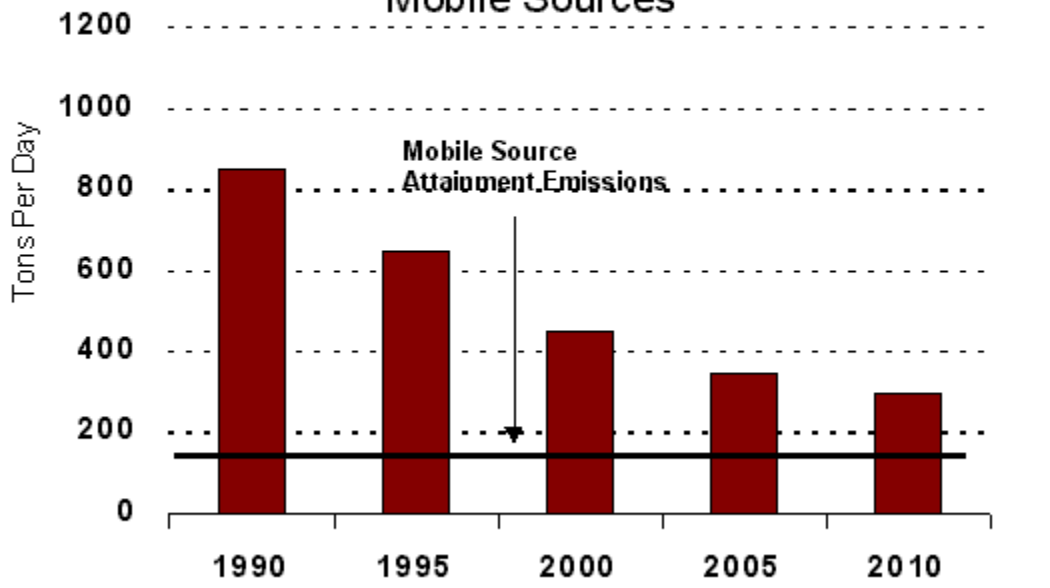
NOx Emission Trends with Adopted Measures -- SCAB Mobile Sources



The existing control program includes all regulations adopted by the ARB and the U.S. EPA. The dramatic reductions in the baseline mobile source ROG emissions over the period, as shown in Figure 6, are almost entirely the result of reductions in emissions from the fleet of light-duty vehicles as the ARB's Low-Emission Vehicle/Clean Fuels (LEV) program is implemented.

FIGURE 6

ROG Emission Trends with Adopted Measures -- SCAB Mobile Sources



The reductions in NOx emissions, shown in Figure 5, while significant, are of a lesser magnitude. Mobile source NOx emissions are dominated by off-road mobile sources and on-road heavy-duty vehicles, and the emission requirements that have been adopted to date for these classes of vehicles are not as effective as the LEV program.

In addition to the LEV program, the measures adopted in 1988 or later that will have the most significant emission reductions include: reformulated gasoline and diesel fuel, emission standards for diesel farm and construction equipment over 175 horsepower, a revised evaporative emission test procedure, a Phase 2 on-board diagnostic system (OBD II) requirement, revised emission standards for medium-duty and light-heavy duty vehicles, and requirements for utility engines and off-highway recreational vehicles/engines.

The LEV program, together with the other measures in ARB's existing control program and Enhanced Inspection and Maintenance, will reduce mobile source emissions in the SCAB to 794 tons per day of NOx and 300 tons per day of ROG by 2010. These reductions are projected to occur despite an increase of nearly 50 percent in vehicle miles travelled (VMT) by light-duty vehicles over the period.

The 2010 baseline emissions in the SCAB can be compared to the mobile source share of the attainment level: 453 tons per day of NOx and 116 tons per day of ROG. As shown in Figures 5 and 6, baseline 2010 mobile source emissions would need to be about half of what they are projected to be under the existing control program.

The further mobile source controls described in this document will be necessary to reduce mobile source emissions to targeted attainment levels.

III. Further Control Strategy

A. Introduction

1. Technology

Traditionally, the mobile source program has emphasized the control of light-duty vehicles due to the large number of vehicles, the substantial vehicles miles traveled, and the significant contribution to total mobile source emissions. With the emissions from light-duty vehicles anticipated to be greatly reduced through implementation of the LEV program, emissions from other mobile sources, especially NOx emissions, become more important to the attainment strategy. Figures 7 and 8 show important mobile sources of NOx and ROG emissions.

FIGURE 7
Important Mobile Sources of NOx Emissions in 2010
(SCAB, With Existing Control Program)

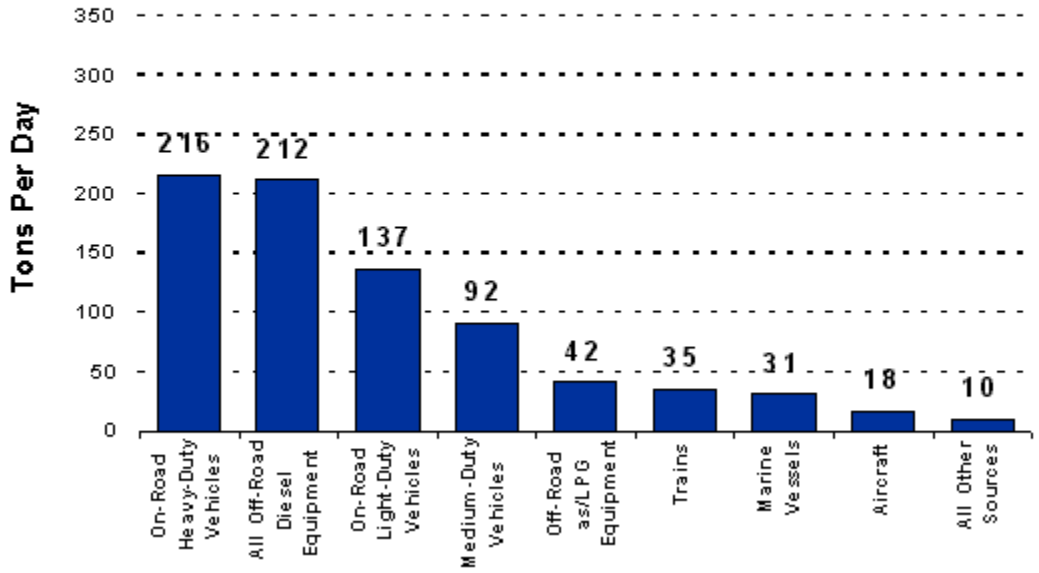
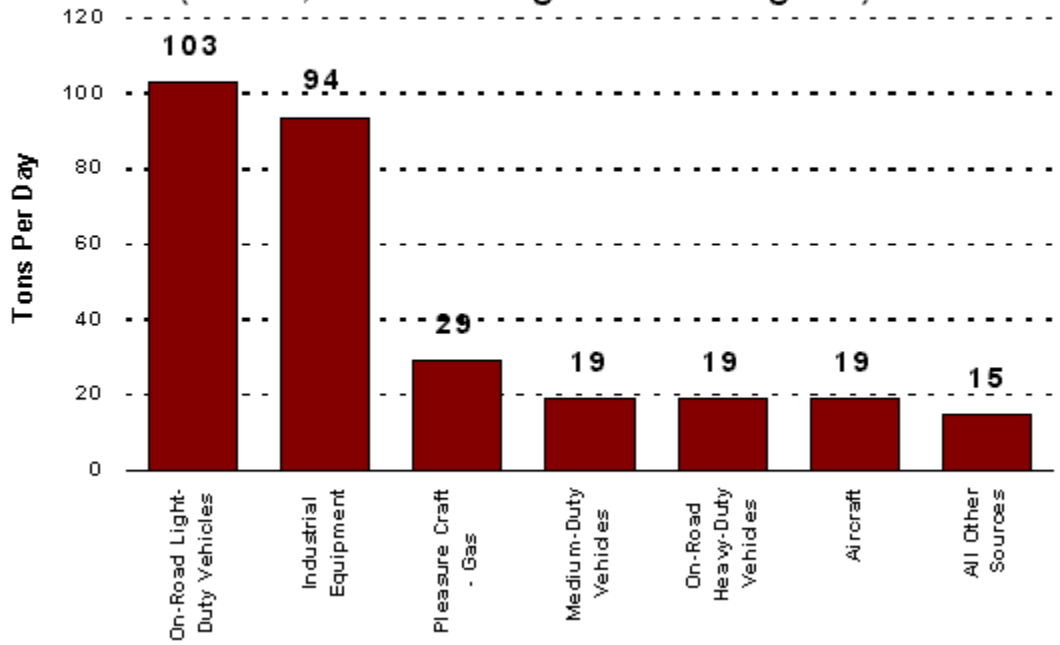


FIGURE 8

Important Mobile Sources of ROG Emissions in 2010
(SCAB, With Existing Control Program)



Emission reductions from all of the mobile source categories shown are necessary to reach attainment emission targets. The greatest NOx emission reductions would be achieved from measures that apply to off-road mobile sources and on-road heavy-duty vehicles, because the emissions from these sources are so large. Further reductions from some mobile source categories that have already been controlled stringently, such as light-duty vehicles, are also needed. Market-based measures are one way to achieve additional reductions in such source categories.

The significant technological advances that have already occurred in some mobile source categories, and the significant advances projected to occur, will move California a long way towards the attainment target. But the significant advances also mean a big disparity between the cleanest equipment in-use and the dirtiest. Given this disparity, the magnitude of reductions required to reach attainment, and the fast-approaching attainment deadlines, it is imperative to consider methods to accelerate the retirement of older, high-emitting vehicles and equipment, or otherwise reduce their impact. For the same reasons, it is beneficial to encourage the early introduction of new technology where feasible and cost-effective.

2. Effect of Older Technology Vehicles and Equipment

Achieving the necessary emission reductions presents a number of challenges. The first challenge in providing the needed reductions on time is the amount of emissions generated from vehicles and engines equipped with "old" technology. The large contribution of old technology emissions is illustrated with examples from two source categories: heavy-duty diesel trucks, and light-duty vehicles. Figure 9 shows that in 2010, about one-third the heavy-duty diesel truck emissions will be from pre-2003 model-year vehicles. Figure 10 shows that in 2010, more than half of passenger vehicle emissions will be from pre-2003 model-year cars.

FIGURE 9

Contribution of Pre-2003 Vehicles to NOx Emissions from Heavy-Duty Diesel Trucks -- SCAB in 2010

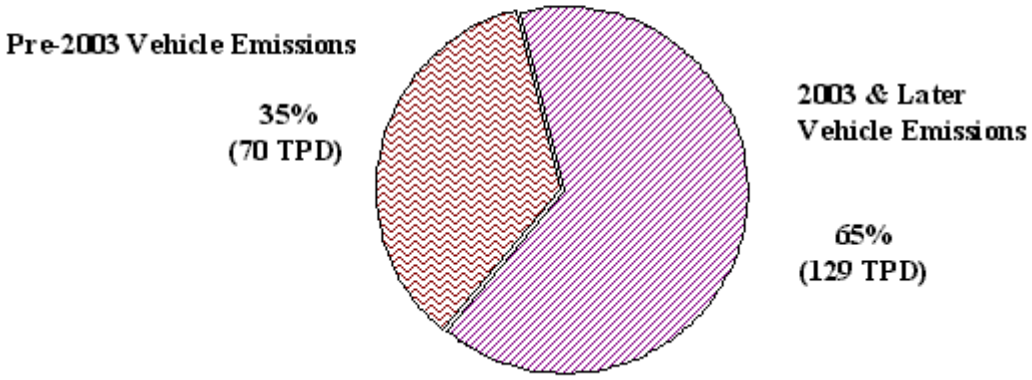
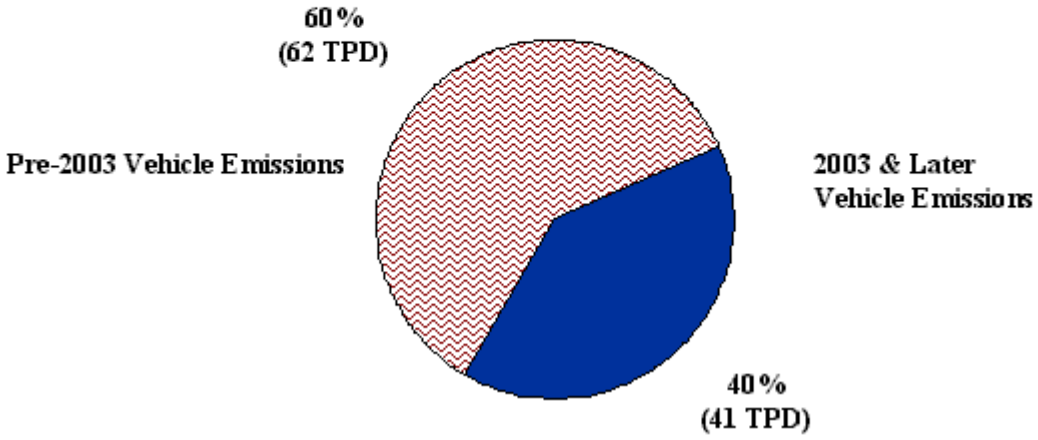


FIGURE 10
Contribution of Pre-2003 Vehicles to ROG Emissions from Light-Duty Vehicles -- SCAB in 2010

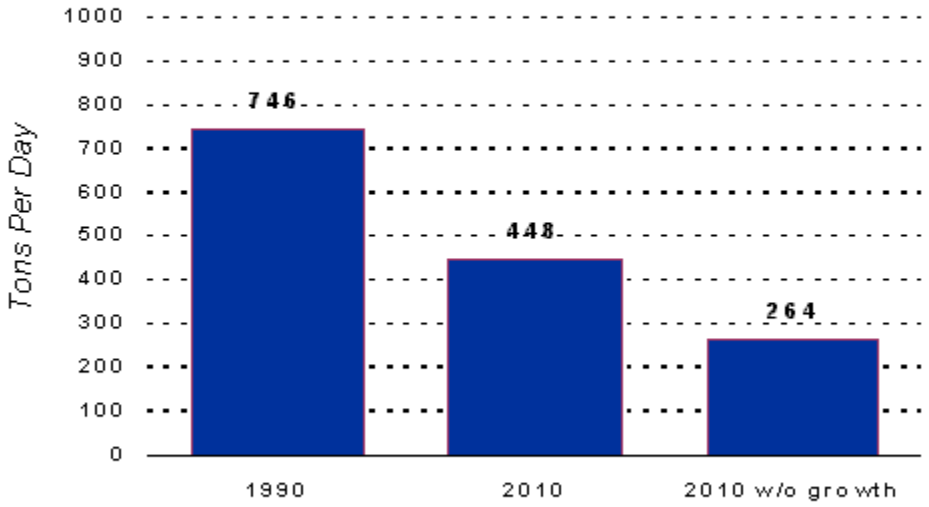


The contribution of older technology to total emissions is also important in other mobile source categories as well, including off-road sources such as locomotives, marine vessels, and industrial equipment. The reduction of emissions from older vehicles must be addressed.

3. Impact of Growth on Emissions

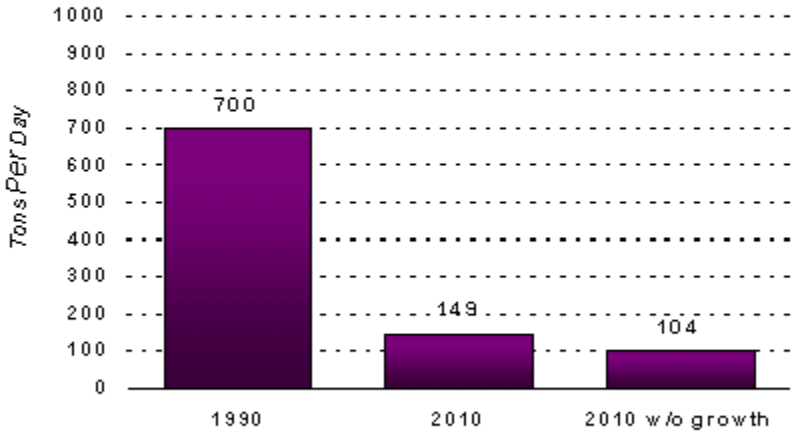
Another challenge is overcoming the effects of growth on mobile source emissions. Both the number of vehicles and the total number of vehicle miles travelled are projected to continue to increase very substantially. The impacts of growth on on-road mobile source emissions for the SCAB are illustrated in Figures 11 and 12.

FIGURE 11
Impacts of Growth on NOx Emissions
On-Road Vehicles -- SCAB



1990 Baseline: Daily Vehicle Miles Travelled = 281,838,000
2010 with Growth: Daily Vehicle Miles Travelled = 413,887,000
2010 w/o Growth: Daily Vehicle Miles Travelled = 281,838,000

FIGURE 12
Impacts of Growth on ROG Emissions
On-Road Vehicles -- SCAB



1990 Baseline: Daily Vehicle Miles Travelled = 281,838,000
2010 with Growth: Daily Vehicle Miles Travelled = 413,887,000
2010 w/o Growth: Daily Vehicle Miles Travelled = 281,838,000

These two figures show on-road NOx and ROG emissions for 1990, projected emissions for 2010 with growth, and projected emissions for 2010 without growth. Of the estimated on-road mobile source emissions, more than 40 percent of NOx and more than 20 percent of ROG emissions are attributable to growth.

B. Control Strategy

The ARB's strategy for obtaining further mobile source emission reductions is a combination of improved control technology measures and market-based control measures. The ARB will pursue and adopt measures for all sources under its legal jurisdiction. The U.S. EPA will be called on to adopt similar controls on preempted sources or for mobile sources, such as interstate trucks, that operate in California but are registered in other states. These control measure types are described below, and the specific control measures are discussed under the category descriptions in the following section.

1. Improved Control Technology Measures

Improved control technology measures have been the cornerstone of the ARB's mobile source control program, and continue to be vital to progress towards attainment. Significant emission reductions will be realized as adopted technology-based measures, such as the low-emission/zero-emission vehicle regulation, are implemented. Further reductions will result from new technology-based requirements for on-road vehicles and off-road mobile sources.

The largest amount of additional emission reductions will be from on-road and off-road diesel engines, with technology development spearheaded by on-road heavy-duty diesel truck standards. In the near-term, the existing 4.0-gram per brake horsepower-hour (g/bhp-hr) federal NOx standard is expected to be met with improved fuel/air management and combustion modifications. By 2002, technology is projected to be able to meet a 2.0 g/bhp-hr NOx standard through further improved fuel/air management, additional combustion modifications, exhaust gas recirculation (EGR), and NOx after treatment. Urban buses and heavy-duty gasoline vehicles are expected to meet equivalent standards.

Technology development in many of the off-road mobile source categories is expected to track on-road technology development, with the need for additional lead times for special applications. For off-road diesel equipment, technology transferred from on-road diesel engines is expected to be able to meet a 2.5 g/bhp-hr standard by 2005 through NOx aftertreatment, engine redesign, and EGR. In addition to these reductions in NOx emissions, technology advances should result in a 50 percent reduction in ROG for new on-road engines. For off-road gasoline and LPG equipment, emission reductions of 75 percent of ROG and 50 percent of NOx are projected by 2000 based on the use of closed-loop three-way catalysts.

Technology improvements similar to those for on-road heavy-duty engines are projected for locomotives and a portion of the marine vessel fleet. Technology improvements would enable the U.S. EPA to implement a national standard for new locomotives and for diesel

marine vessel engines in the captive U.S. fleet. The ARB would establish operational limits on in-use locomotives should the federal rule fail to provide sufficient emission reductions.

Federal standards have been proposed for pleasure craft for implementation starting in 1998. Substantial ROG emission reductions will be achieved primarily by controlling 2-stroke engines used in outboards and personal watercraft, although emissions from 4-stroke engines will also be reduced.

Although the light-duty vehicle category is already well controlled, additional emission reductions would be obtained through enhanced low-emission vehicle requirements.

The ARB has issued guidance on quantifying the emission reductions from programs that scrap, retire or repair older, high emitting vehicles. The enhanced Smog Check program will include a scrap/repair program, and a private sector program financed from marketable emission credits is getting underway in Sacramento. Experience with these programs will help the ARB and districts develop a program to retire and modernize the light-duty vehicle fleet. In a similar vein, the ARB will develop a program to retire older heavy-duty trucks. Legislation will be required to establish funding of these programs.

A list of these proposed new measures, including the estimated percent reduction from baseline 2010 emission levels, is given in Table 4. The measures presented in Table 4 are described in Appendix B.

2. Improved Control Technology Measures - Shared Responsibility with U.S. EPA

As indicated on Table 4, it is essential that the U.S. EPA adopt more stringent national emissions standards for several categories of engines, similar to those proposed by the ARB. National standards are necessary either because California has been preempted from controlling these sources, or because a national standard is essential for the emission control program in California to be fully effective. The federal Clean Air Act preempts the ARB from adopting measures for off-road farm and construction equipment smaller than 175 horsepower (including diesel, gasoline, and LPG), new locomotive engines, and aircraft. Although the ARB can control other source categories such as heavy-duty diesel vehicles, heavy-duty industrial equipment, and pleasure craft, for these categories, nationwide standards are the most effective and practical means of achieving the needed emission reductions. Without the implementation of national standards for these categories, achieving attainment emission levels is not possible, and the adverse competitive impacts on California businesses would be highly detrimental. A discussion of each of the categories for which national standards are proposed as part of this mobile source element follows.

Table 4. Improved Control Technology Measures.

Measure No.	Control Measure	Adoption Date	Implementation Date	Reduction in 2010 (tons/day)		Implementing Agency
				NOx	ROG	
On-Road						
M1	Accelerated retirement of LDVs	1996	1996-2010	11	14	ARB/ Districts
M2	Improved Control Technology for LDVs	2000	2004-2005	15	10	ARB
M3	Accelerated ULEV requirement for MDVs	1997	1998-2002	32	4	ARB
M4	Heavy-Duty Diesel Vehicles; early introduction of 2.0 g/bhp-hr NOx engines in fleets through incentives*	---	1996-2002	1	0	ARB/ Districts
M5	Heavy-Duty Diesel Vehicles; additional NOx reductions in California*	1997	2002	56	4	ARB
M6	Heavy-Duty Diesel Vehicles; 2.0 g/bhp-hr NOx std - national*	1997	2004	15	1	U.S.EPA
M7	Accelerated retirement of HDVs	1996	1996-2010	10	1	ARB/ Districts
M8	Heavy-Duty Gasoline Vehicles;	1997	1998-2002	3	0	ARB

Measure No.	Control Measure	Adoption Date	Implementation Date	Reduction in 2010 (tons/day)		Implementing Agency
				NOx	ROG	
	lower emission stds. in California					
Total Emissions Reductions:				143	34	
Emission Reductions (ARB):				128	33	
Emission Reductions (U.S. EPA):				15	1	
Off-Road						
M9	Off-road diesel equipment; 2.5 g/bhp-hr NOx std. - California†	2001	2005	31	3	ARB
M10	Off-road diesel equipment; 2.5 g/bhp-hr NOx std. - national†	2001	2005	47	5	U.S. EPA
M11	Industrial equipment, Gas & LPG - California; three-way catalyst technology‡	1997	2000-2004	14	29	ARB
M12	Industrial equipment, Gas & LPG - national;	1997	2000-2004	10	19	U.S. EPA

Measure No.	Control Measure	Adoption Date	Implementation Date	Reduction in 2010 (tons/day)		Implementing Agency
				NOx	ROG	
	three-way catalyst technology‡					
M13	Marine Vessels; national and international standards	1996	1998-2001	9	0	U.S.EPA (w/IMO)
M14	Locomotives; nationwide standards, new and rebuilt	1995	2000-2010	23	0	U.S.EPA
M15	Aircraft; nationwide emission standards	1999	2000	4	3	U.S.EPA
M16	Pleasure Craft; nationwide emission standards	1995	1998	0	12	U.S. EPA
Total Emissions Reductions:				138	71	
Emission Reductions (ARB):				45	32	
Emission Reductions (U.S. EPA):				93	39	

* The emission reductions associated with these measures are needed in Sacramento and Ventura to ensure attainment in 2005.

† M9 controls the 40% of off-road diesel equipment emissions that are not pre-empted from California control. M10 controls the 60% of off-road diesel equipment emissions that are pre-empted from California control.
‡ M11 controls the 60% of the industrial equipment emissions that are not pre-empted from California control. M12 controls the 40% of industrial equipment emissions that are pre-empted from California control.

The earliest possible introduction of national standards for lower emissions from on-road heavy-duty diesel vehicles is critical to ensuring the maximum reductions from one of the most significant mobile sources of NOx. A national standard is essential to ensure reductions from all heavy-duty vehicles operating in California, including those base-plated outside the state. A nationwide standard would not only reduce emissions from out-of-state heavy-duty vehicles operating in California, it would prevent a potential increase in the use of vehicles registered out-of-state that could result from a stricter California standard. It is estimated that a California-specific emission standard would effectively control emissions from only about one-half of the on-road heavy-duty diesel vehicles travelling through the state, due to registration shifts resulting from a wide differential in state and national emission standards. In addition, the adoption of a national standard would avoid the competitiveness problems inherent with a state-only standard.

For off-road industrial equipment, national standards for diesel engines and for gasoline and LPG engines would achieve emission reductions from the farm and construction equipment that the ARB is preempted from controlling. National standards of 2.5 g/bhp-hr NOx for diesel engines and standards based on three-way catalyst systems for gasoline and LPG engines would address emissions from these preempted sources. Preempted equipment amounts to roughly one-half of emissions from this source category. In addition, a nationwide standard for industrial equipment would provide a larger market base to manufacturers, which would encourage the development of the new technology.

The U.S. EPA must work with the International Maritime Organization (IMO) to set international controls on trans-oceanic marine vessels to reduce NOx emissions from new engines by 30 percent. Operational controls, including shipping lane changes and vessel speed reduction, are also needed for these marine vessels. Additional national standards for non-ocean going marine vessels are needed to further reduce NOx emissions. These international and national controls would provide needed emission reductions while minimizing localized impacts on the California shipping trade.

The ARB is currently preempted from setting standards for new locomotive engines and for aircraft. A nationwide standard for new and rebuilt locomotive engines is necessary to achieve further reductions from this source category. In addition, national standards for commercial and general aviation aircraft are needed, and standards for military aircraft should also be considered.

The U.S. EPA has proposed nationwide standards for ROG emissions from pleasure craft. The proposal would reduce ROG emissions from two-stroke engines by 75 percent from current

levels, and achieve additional reductions from other engine types. The reductions would be achieved through advances in fuel delivery and air/fuel management systems.

These national standards for on-road diesel vehicles, off-road industrial equipment, marine vessels, locomotives, and pleasure craft are necessary for the attainment of the federal ozone ambient air quality standard. Provided the U.S. EPA completes timely action on these sources, a state level measure is not needed. If, however, there is no national control, the ARB would be compelled to establish California-specific rules for these important categories for which state control authority exists.

3. New Control Technologies and Techniques

New control technologies and techniques include longer-term advanced emissions control technologies, market incentives, operational controls, and other innovative control measures that can complement traditional control measures. A list of these new control technologies and techniques is given in Table 5.

The emergence of new, advanced emission control technologies has been a key factor in reducing emissions from motor vehicles over the past 30 years. The SIP continues to rely on further advances, as evidenced by the control measures listed in Table 4. It is believed that additional advances in emission control technology, beyond those identified in Table 4, will emerge, allowing further reductions in emissions. An example of a new advanced control technology measure (see Table 5) is the post-2003 introduction in fleets of ultra-low emitting heavy-duty trucks.

The new control technologies and techniques also include market-based measures. Market-based measures can take the form of incentives to encourage a particular activity, or performance standards where the marketplace determines the most cost-effective and efficient controls. Some examples of possible market-based measures include incentives to encourage the introduction of new technology, incentives to encourage emission control retrofits or alternative fuel conversions, and emission reduction credits for using equipment that is cleaner than required. The possible market-incentive measures given in Table 5 are general measures; many variations for specific source categories are possible.

The ARB currently has a mobile source emission reduction credits program in place, and will continue to expand the mobile source credit guidelines to include other applications. Although credit programs do not, in general, yield net emission reductions (except to the extent that increased offsets are required), they do encourage the early introduction of new technology and promote the development of infrastructure. Other market-incentive measures would yield more direct emission reduction benefits.

Table 5 also includes some possible operational controls for on-road heavy-duty vehicles, which were suggested during recent symposia and workshops.

This table of new control technologies and techniques is not exhaustive. Other new control technologies and techniques are possible and will certainly be considered as potential sources of emission reductions.

Table 5. New Control Technologies and Techniques

New Control Technologies and Techniques
Possible New Control Technologies
-- Introduction in fleets of ultra-low emitting heavy-duty trucks, post-2003
Possible Market Incentive Measures -- Incentives to purchase or produce "cleaner" technology/vehicles -- Incentives to encourage retrofits of emission control technology
- Incentives for alternative fuel conversions -- Incentives to promote the development of alternative-fuel infrastructure
-- Revise tax rate structure to promote investment in low-emission technology -- Provide -- Provide opportunity for low-interest loans -- Preferred state vendor/contract bid status
-- Company emission averages
-- Air basin emission averages
-- Mobile source emission reduction credit/trading programs
Possible Operational Measures Applicable to Heavy-Duty Vehicles -- Longer combination vehicles on selected routes -- Increased gross vehicle weight -- Better enforcement of the 55 mile-per-hour speed limit -- Reduced vehicle idling time -- Reexamine trailer package concept for local deliveries -- Aerodynamic devices for all power units and trailers -- Others (intermodal transportation, advanced traffic control/tracking technology, alternative fuel for existing fork lifts)

Because of the innovative and developmental nature of these control measures, they do not have the degree of specificity of the measures in Table 4, nor are the reductions for individual measures in Table 5 quantified. The measures will be further defined and quantified, and adopted by 2006 for implementation by 2009. Altogether, the new control

technologies and techniques will achieve emission reductions of 60 tons per day of NOx and 79 tons per day of ROG in the SCAB in 2009 and 2010.

C. Category Descriptions

Each source category that is a major contributor to emissions and each source category for which emissions will be reduced, is discussed in this section. The measures to reduce emissions in each category are described in more detail in Appendix B of this document. Table 6 shows the estimated emission reductions by source category associated with the control measures.

Light-Duty Vehicles: are one of the major contributors to current mobile source emissions. Large reductions are projected for this category through implementation of the already adopted LEV program. An accelerated vehicle retirement program to replace high-emitting vehicles with newer, lower-emitting models will achieve reductions from the light-duty vehicle category. In addition, further reductions in the fleet average emissions would result from increased penetration of ultra-low emission vehicles (ULEVs), electric vehicles including hybrids, and possibly a "super-ULEV" classification of vehicles.

Medium-Duty Vehicles/Heavy-Duty Gasoline Trucks: include large pick-up trucks, vans, and delivery vehicles. Emission reductions for the medium-duty vehicle category will occur as a result of more stringent emission standards adopted for 1990 and newer vehicles, including the low-emission and ultra-low emission vehicle requirements starting in 1998. Further reductions would be realized through acceleration of the required fraction of ULEVs. For heavy-duty gasoline trucks, more stringent standards will be proposed.

Heavy-Duty Diesel Vehicles: include urban buses and other on-road heavy-duty diesel-fueled vehicles, both those registered in California and those base-plated elsewhere. Beginning with the 1995 model year, some of the lightest heavy-duty vehicles will be changed to the medium-duty classification. Emissions from these vehicles will be reduced under the medium-duty vehicle/engine requirements. The ARB plans to adopt the 1998 federal NOx standard of 4.0 g/bhp-hr, which would provide emission reductions from heavy-duty trucks.

Table 6. Emission Reductions from Improved Control Technology Measures.

Emission Reductions from Improved Control Technology Measures (SCAB, from 2010 baseline)		
Source Category	**Emission Reductions (tons per day)**	
	ROG	**NOx**
Light-Duty Vehicles	24	26
Medium-Duty Vehicles	4	32
On-Road Heavy-Duty Diesel Vehicles	6	82
Heavy-Duty Gasoline Trucks	0	3
Industrial Equipment, Diesel	8	78
Industrial Equipment, Gasoline & LPG	48	24
Marine Vessels	0	9
Locomotives	0	23
Aircraft	3	4
Pleasure Craft	12	0
Total*	**105**	**281**

* Total may not add due to rounding.

Market-based measures and local demand-side requirements will be used to increase the use of currently available low-emission engines, primarily those using CNG as fuel. As low-

emission diesel technology becomes available shortly after the turn of the century, emission standards for new engines will be implemented. Diesel engines meeting a 2.0 g/bhp-hr NOx standard will become available by 2002. Emission reductions from these low-emission engines beginning in 2002 are necessary to attainment in the Sacramento and Ventura areas. In addition, nationwide applicability of this low-emission standard is essential to attainment of the ozone standard in California because of the significant impact of out-of-state registered trucks within our borders. However, nationwide implementation of a NOx emission standard below 4.0 g/bhp-hr before the year 2004 is prohibited by the federal Clean Air Act. Therefore, a nationwide standard will be introduced in 2004, and the needed reductions in 2002 and 2003 will either be achieved through implementation of a statewide standard in 2002, or through a combination of operational, retrofit, advanced technology, and local market-based programs. In the long-term, as new, advanced ultra-low emitting engine technologies are developed, they will be evaluated for use in fleet applications.

Off-Road Equipment: includes a variety of off-road mobile sources, including farm and construction equipment, generators, refrigeration units, utility service vehicles, and airport ground support equipment, much of which is diesel-powered. A nationwide 2.5 g/bhp-hr NOx standard for all new diesel engines in this category beginning in 2005 would achieve reductions of about 60 percent over adopted new engine standards. Nationwide ROG standards could also reduce new diesel engine emissions by about 50 percent. A nationwide standard for preempted gasoline and LPG equipment could yield a 50 percent reduction in NOx and a 75 percent reduction in ROG emissions from new engines. The ARB plans more stringent emission standards for some of the non-preempted equipment in this category, including equipment fueled with liquefied petroleum gas, gasoline, and diesel fuel.

Other Off-Road Categories: include pleasure craft, marine vessels, locomotives, and aircraft. For pleasure craft, the U.S. EPA is planning a nationwide program to reduce emissions, and ARB action is not needed if this occurs. For marine vessels, the U.S. EPA must work with the International Maritime Organization to set international emissions standards for new engines. For the captive fleet, emission standards analogous to those for on-road diesel engines should be set. Measures will need to be developed by the U.S. EPA to reduce emissions from new and rebuilt locomotives. The ARB is preempted from setting emission standards for commercial and general aviation equipment, thus U.S. EPA action is required.

Table 7. Impact of Improved Control Technology Measures on SCAB Mobile Source NOx Emissions.

Impact of Improved Control Technology Measures on SCAB Mobile Source NOx Emissions			
Source Category	**Baseline 1990 Emissions (tons per day)**	**Baseline 2010 Emissions (tons per day)**	**Emissions with Improved Control Technology (tons per day)**
	NOx	**NOx**	**NOx**
Light-Duty Vehicles	391	137	111
Medium-Duty Vehicles	124	92	60
On-Road Heavy-Duty Diesel Vehicles	220	208	126
Heavy-Duty Gasoline Trucks	9	9	6
Industrial Equipment, Diesel	263	212	134
Industrial Equipment, Gasoline & LPG	27	42	18
Marine Vessels	30	31	22
Locomotives	32	35	12
Aircraft	13	18	14
Pleasure Craft	3	3	3
Other	5	7	7
Total*	**1116**	**794**	**513**

Mobile Source Share of NOx Attainment Emissions: 453 tons per day.

* Total may not add due to rounding.

Table 8. Impact of Improved Control Technology Measures on SCAB Mobile Source NOx Emissions.

Impact of Improved Control Technology Measures on SCAB Mobile Source NOx Emissions			
Source Category	**Baseline 1990 Emissions (tons per day)**	**Baseline 2010 Emissions (tons per day)**	**Emissions With Improved Control Technology (tons per day)**
	ROG	**ROG**	**ROG**
Light-Duty Vehicles	582	103	79
Medium-Duty Vehicles	75	19	15
On-Road Heavy-Duty Diesel Vehicles	33	19	13
Heavy-Duty Gasoline Trucks	4	1	1
Industrial Equipment, Diesel	27	30	22
Industrial Equipment, Gasoline & LPG	42	63	15
Marine Vessels	2	3	3
Locomotives	2	2	2
Aircraft	16	19	16
Pleasure Craft	25	29	17
Other	43	12	12
Total*	**851**	**300**	**195**

Mobile Source Share of ROG Attainment Emissions: 116 tons per day.

* Total may not add due to rounding.

IV. Impact of Improved Control Technology on Mobile Source Emissions

Tables 7 and 8 show the impact of the proposed improved control technology measures on NOx and ROG emissions, respectively. Tables 7 and 8 show baseline 1990 and 2010 emissions, as well as 2010 emissions with improved control technology measures. Tables 9 and 10 show the impact of the proposed control measures on SCAB mobile source NOx and ROG emissions, respectively, in the intermediate years from 1990 through 2010. Mobile source NOx emissions will be reduced to 513 tons per day, and mobile source ROG emissions will be reduced to 195 tons per day. The effect of the existing control program and the improved control technology measures is illustrated graphically in Figures 13 and 14, which show baseline 1990 and 2010 emissions, as well as 2010 emissions with the improved control technology measures.

FIGURE 13
Impacts of Improved Control Technology Measures
Mobile Source NOx Emissions - SCAB

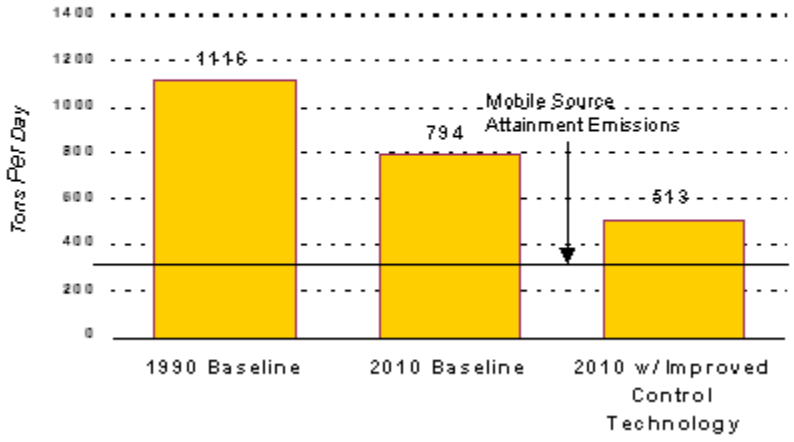
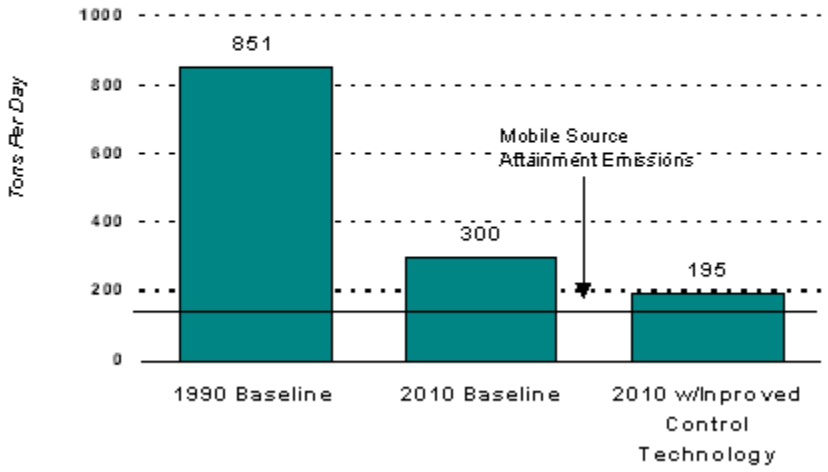


FIGURE 14
Impacts of Improved Control Technology Measures
Mobile Source ROG Emissions - SCAB



Figures 13 and 14 also show the mobile source attainment emissions targets: 453 tons per day of NOx, and 116 tons per day of ROG. The figures show that the proposed improved control technology measures will ensure substantial progress towards attainment of the ambient air quality standards. Overall, the improved control technology measures will reduce NOx and ROG about 35 percent.

Table 9. Mobile Source Emission Inventory for NOx By Source Category for The South Coast Air Basin with Impacts of Improved Control Technology Measures.

Source Category	**Emissions, Tons per Day of NOx**				
Source Category	**1999**	**2002**	**2005**	**2007**	**2010**
On-Road Motor Vehicles					
Light-Duty Vehicles	218	183	151	131	111
Medium-Duty Vehicles	90	81	70	64	60
Heavy-Duty Vehicles					
Gasoline	7	7	6	6	6
Diesel	187	180	158	143	126
Motorcycles	2	2	2	2	2
Off-Road Mobile Sources					
Industrial Equipment					
Diesel	245	229	203	177	134
Gasoline & LPG	34	30	26	22	18
Marine Vessels	30	25	24	23	22
Locomotives	32	28	19	16	12
Aircraft	17	17	17	17	14
Pleasure Craft	3	3	3	3	3
Other	4	5	5	5	5
Total*	**869**	**790**	**684**	**609**	**513**

* Total may not add due to rounding.

Table 10. Mobile Source Emission Inventory for ROG by Source Category for the South Coast Air Basin with Impacts of Improved Control Technology Measures.

Source Category	**Emissions, Tons per Day of ROG**				
Source Category	**1999**	**2002**	**2005**	**2007**	**2010**
On-Road Motor Vehicles					
Light-Duty Vehicles	251	188	140	108	79
Medium-Duty Vehicles	29	25	20	18	15
Heavy-Duty Vehicles					
Gasoline	2	1	1	1	1
Diesel	20	18	16	14	13
Motorcycles	4	5	5	5	5
Off-Road Mobile Sources					
Industrial Equipment					
Diesel	27	28	27	25	22
Gasoline & LPG	51	44	35	25	15
Marine Vessels	2	2	2	3	3
Locomotives	2	2	2	2	2
Aircraft	18	18	18	18	16
Pleasure Craft	25	24	22	20	17

Source Category	Emissions, Tons per Day of ROG				
Source Category	**1999**	**2002**	**2005**	**2007**	**2010**
Other	24	17	13	10	7
Total*	**456**	**370**	**301**	**248**	**195**

* Total may not add due to rounding.

V. Additional New Control Technologies and Techniques

The implementation of the improved control technology measures identified herein does not reduce emissions sufficiently to provide all of the mobile source emission reductions contained in the year 2010 ozone attainment demonstration for the South Coast Air Basin. The additional emission reductions needed will be achieved through the implementation of additional innovative market-based and technology-based measures. Likely measures include market incentive measures to encourage the introduction of even cleaner technologies, and their rapid introduction into the fleet. Also likely are transportation control measures aimed at reducing vehicle miles travelled. These measures would be pursued jointly by the ARB, the local air pollution control districts, and other local agencies. A discussion of some of the measures currently under consideration follows.

The ARB and local governments will continue to pursue the use of pricing to affect the amount of travel and related emissions. Pricing which reduces congestion, and increases free flow travel, is being evaluated. A pilot program to evaluate the use and consumer acceptance of an emission index, based on per mile emissions and VMT, will be carried out in San Diego and Ventura. The practicality of such an accounting scheme will help determine the benefits of shifting vehicle-related fees to an emission basis, which would incentivize use of cleaner vehicles and encourage fewer trips and miles travelled. We will also continue to work to implement other transportation control measures which reduce emissions.

The ARB will also evaluate implementation of retrofit technologies which reduce emissions. Work is beginning to determine if retrofit closure of open bottom evaporative canisters is practical. Increased use of aerodynamic devices on truck trailers, which will reduce NOx emissions, will be pursued.

California has become the leader in demonstration of alternative-fueled vehicles, and thousands of alternative-fueled vehicles are in daily operation. A statewide refueling

infrastructure for CNG and methanol is in place and growing. New federal requirements, such the National Energy Policy Act, provide additional stimulus for the use of alternative-fueled vehicles. The SIP includes one measure M4, to increase the number of new low-emission heavy- duty trucks purchased from 1995 until the broader state and national 2.0 g/bhp-hr or lower standards go into effect. These trucks will likely be alternatively fueled, and reduce NOx emissions in the South Coast Air Basin by 1 ton per day in 2010. The ARB and districts will also work together to further increase the number of cleaner, alternative-fueled heavy-duty and light- duty vehicles in use.

As attainment of standards is approached and the number of days with exceedances of the ozone standard decreases, the ARB and local governments will determine the viability and effectiveness of episodic controls, such as speed reduction and curtailment of other activities such as idling, which provide reduced emissions. There will also be continuous reevaluation of the feasibility of providing additional reductions from stationary and areas sources of emissions.

While the specific benefits associated with each measure cannot be precisely estimated at this time, the ARB will ensure the additional needed emission reductions of 60 and 79 tons per day of NOx and ROG, respectively, are achieved. These reductions amount to an additional 7 percent reduction of NOx and 26 percent reduction of ROG in the South Coast Air Basin in 2010. The ARB will work in cooperation with the South Coast Air Quality Management District, as well as the regulated community, to determine the most appropriate mix of additional measures. These measures will be adopted no later than 2006 to ensure the needed emission reductions are achieved by 2009.

The ARB will also work with other local districts, such as those in the Sacramento area, that need near-term, market-based measures to attain the ozone standard prior to 2010. Because the attainment deadlines for these other areas are sooner than that for the South Coast Air Basin, some areas need additional measures beyond those presented in this Mobile Source Element. The ARB will work hand-in-hand with the districts to implement the near term control measures and incentive programs needed to meet these earlier attainment dates.

Vl. Conclusion: Benefits of The Mobile Source Element

The ARB's Mobile Source Element of the State Implementation Plan will have a dramatic effect on ozone precursor emissions in California. With the joint efforts of the ARB, the U.S. EPA, and the local districts, mobile source emissions of NOx and ROG will drop to the levels needed to achieve attainment of the federal ozone standard in the SCAB and other areas. The control measures and strategies identified in this element will, for the most part, be implemented statewide, and the entire state will achieve comparable reductions.

Many of the control strategies are based on the anticipated development of improved control technologies over the next decade. The ARB has a proven track record of identifying emerging technologies and developing emission control measures that rely upon the

advancement of these technologies. As a result, projected emission levels in California are far below what they would have been, had a more conventional approach been taken. The proposed control measures contained within this Mobile Source Element are likewise far reaching and based on continued technological progress. They are aggressive and they touch virtually every emission source category in the state -- but when public health is at stake, there can be no other way.

The ARB is continuing to develop ways to harness the efficiency of the marketplace to achieve emission reduction goals. Not only can market principles and flexibility be built into technology-based regulations, but market incentives can be used to encourage people to make environmentally sound choices voluntarily. The ARB is committed to working together with the districts to implement market-based programs that go beyond what the gradual phase-in of new technology can do alone.

In 1990, total mobile plus stationary source emissions in the six non-attainment areas were 2,800 tons per day of NOx and 2,800 tons per day of ROG. Through implementation of this Mobile Source Element and the mobile source control measures that the ARB has already adopted, these emissions will be brought down about 60 percent for NOx and more than 80 percent for ROG. The significance of this decline cannot be understated -- nowhere in the world has such an aggressive approach to air pollution been taken. The ARB is obligated to see that the public health is protected to the extent required by the federal Clean Air Act, and this Mobile Source Element is our answer to the Act's requirements. Close cooperation from the U.S. EPA and the local districts is essential in implementing these programs. The ARB is committed to doing its part, in conjunction with the U.S. EPA, the districts, and the regulated industries, to bring about these necessary emission reductions and to thus assure the protection of public health in California.

Chapter II. Consumer Products Element

I. Introduction

California has made significant strides in controlling air pollution both from mobile sources and stationary sources. Still, far greater reductions in smog precursors, both reactive organic gases (ROG) and oxides of nitrogen (NOx), need to be accomplished to meet the challenge of compliance with the federal and state Ambient Air Quality Standards for ozone. This is particularly true in the South Coast Air Basin (SCAB) where, despite significant reductions in ozone precursors, the standards are frequently violated by large margins.

Obtaining emission reductions from consumer products was only recently made a part of this clean air challenge through the enactment of the California Clean Air Act (CCAA). The CCAA added Section 41712 to the Health and Safety Code which stated that the ARB will adopt regulations to achieve the maximum feasible reductions in reactive organic compounds emitted by consumer products provided that adequate data exists for it to adopt the regulations, and that the regulations are technologically and commercially feasible, and

necessary. This law resulted in regulations adopted by the ARB in the early 1 990s that will provide significant statewide emission reductions from consumer products. Achieving additional emission reductions from consumer products is an important component of the 1994 California State Implementation Plan (SIP). These products contain ROGs which are emitted when they are used.

Outlined in this chapter is the consumer products element of California's SIP. This element is designed to obtain benefits statewide, but the targeted level of control is based primarily on the emission reductions needed for the SCAB. Because the measures to be adopted will apply statewide, other areas of the state will also realize significant emission reductions from the consumer products control program. These will help those areas achieve state air quality standards and will help maintain federal standards in the face of growth. There are several goals in preparing this element of the SIP. First, this element of the SIP will provide for the needed reductions in consumer product emissions that, in combination with other measures, will provide for ozone attainment in Southern California and other areas of California. Our second goal is to obtain these emission reductions by developing programs to foster the innovative technologies that will be the foundation of future control measures. Third, we hope to develop regulations that continue to provide flexibility to the regulated community. While some of the measures for consumer products rely on traditional control methods, such as product-specific limits on ROG content, many of the future emission reductions will be realized through the use of innovative technologies and market incentives. In adopting measures to fulfill our SIP goals, the ARB will ensure that any regulations adopted will meet the requirements of Health and Safety Code Section 41712.

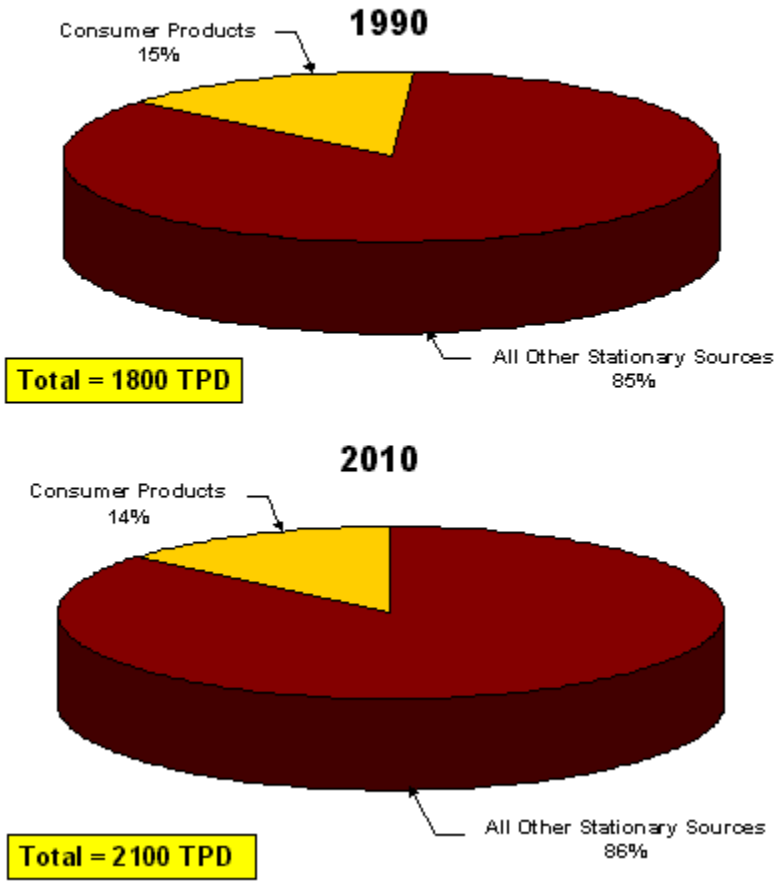
The consumer products control program is a multi-pronged program comprised of near-term, mid-term, and long-term measures. The near-term measures are comprised of our existing consumer product regulations, the Alternative Control Plan (ACP), and the aerosol paints regulation currently under development. The mid-term measures consist of regulations to cover additional product categories not currently subject to the existing program. The long-term measures rely on new technologies with components of market incentives and consumer education. Furthermore, because of the need for increased cooperation and coordination with the U.S. EPA, the U.S. EPA will be expected to assist at the national level in regulating consumer products to assist California in its efforts. To facilitate the development and implementation of future measures, a consumer products working group will be established. It will be comprised of representatives from the ARB, U.S. EPA, local districts, affected industry, and environmental groups. This working group will serve as a forum for communication and coordination among interested parties in the development of consumer product regulations.

II. ROG Emissions from Consumer Products

Statewide, the emissions from consumer products (including aerosol paints) if uncontrolled are projected to grow from about 265 tons per day in 1990 to about 370 tons per day in 2010. As shown in Figure 1, based on the 1990 summer operational inventory, consumer

products comprise 15 percent of the non vehicular emissions in 1990. For the SCAB, emissions from consumer products and aerosol paint are projected to increase from about 115 tons per day of ROG in 1990 to about 150 tons per day in 2010. While the existing consumer products regulatory program will result in emissions decreasing through the year 2005, this reduction will be overtaken by the increase in emissions due to projected population increases by the year 2010. This same upward trend in consumer product emissions will occur statewide.

Figure 1
Stationary Source ROG Emissions
Statewide -- 1990 and 2010



To reach attainment in the SCAB and elsewhere in California, significant additional emission reductions are needed. Air quality modeling shows that the existing emissions of ROGs from ail sources in the six areas that require SIP revisions by November 15, 1994, must be reduced between 25% and 80% to attain the federal ozone standard. In the SCAB, an overall 85% reduction in consumer product emissions is needed by 2010. This would reduce emissions from consumer products in the Basin to about 20 tons per day. Consumer products are not

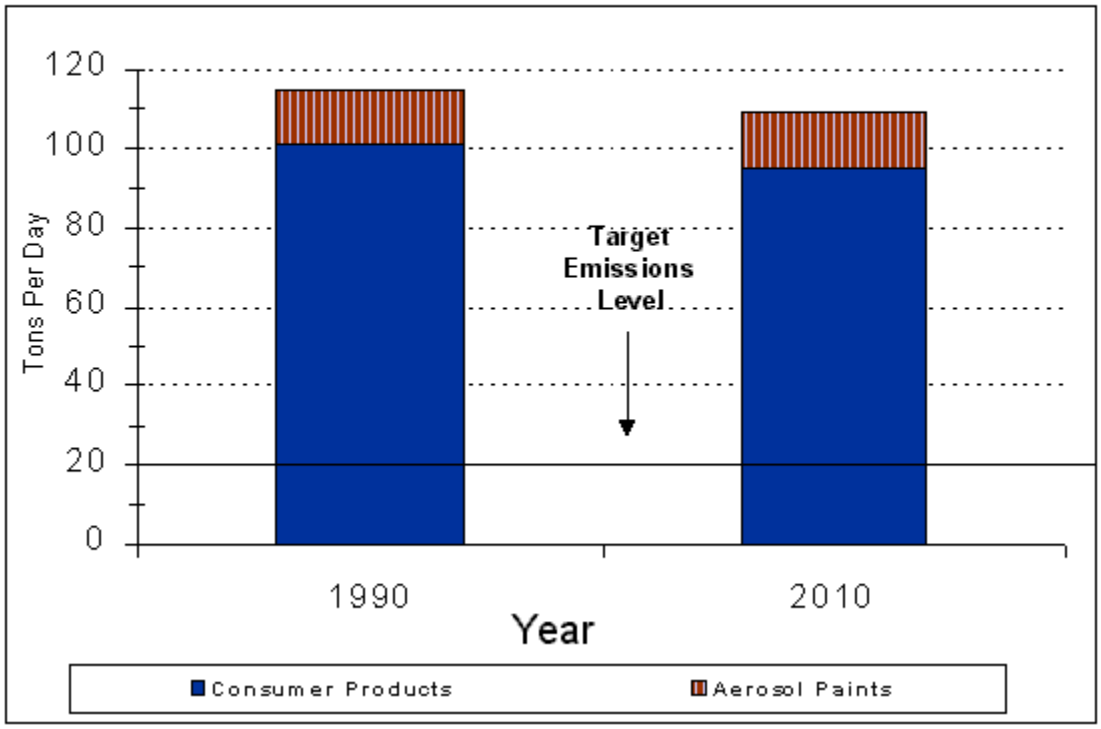
alone in this effort to maximize emission reductions from ROG sources. The SCAB Air Quality Management Plan (AQMP) requires several solvent source categories to achieve emission reductions ranging from 75 to 95 percent, in most cases these emission reductions are in addition to significant emission reductions achieved by rules adopted prior to January 1, 1994.

The near-term, mid-term, and long-term measures in the control program for consumer products are comprised of the following five major elements:

- Existing control measures plus new aerosol paint control measure.
- Traditional control measures applied to currently unregulated consumer products.
- Development of new and innovative technologies and market mechanisms.
- Public education.
- Work with U.S. EPA on its consumer products control program.

As shown in Figure 2, the baseline 2010 consumer product emissions need to be reduced to roughly 15 percent of what they are projected to be under the existing control programs. The near-term, mid-term, and long-term control strategies outlined in this chapter are important and necessary to demonstrate attainment in the SCAB. A more detailed description of these measures is provided in Appendix C.

Figure 2
Impacts of Existing Regulations -- SCAB



There are two major source categories to which the control strategies would apply:

Consumer Products: includes personal care, household care, automobile care, and non-agricultural pesticide products, but excludes household use of architectural coatings. They contain volatile organic compounds, in quantities ranging from a few percent by weight up to 100 percent by weight. Statewide, uncontrolled emissions from consumer products are projected to increase from about 235 tons per day in 1990 to about 330 tons per day in 2010. Uncontrolled emissions from consumer products in the SCAB are projected to increase from about 100 tons per day in 1990 to about 135 tons per day in 2010.

Aerosol Paint: includes paint, varnish, and related products dispensed from disposable aerosol containers. Statewide, uncontrolled emissions from aerosol paint are projected to increase from about 30 tons per day in 1990 to about 38 tons per day in 2010, if no control measures were adopted. Uncontrolled emissions from aerosol paints in the SCAB are projected to increase from 14 tons per day in 1990 to 16 tons per day in 2010.

III. Further Control Strategy

A. Near Term Program (Existing Regulations and Aerosol Paints)

In the near term, the SIP will rely on the existing consumer product regulations and the aerosol paints regulation currently under development to reduce ROG emissions from consumer products and aerosol paints. The ARB's existing consumer products regulations are expected to achieve reductions of approximately 70 tons per day of ROG statewide and about 30 tons per day of ROG in the SCAB. This represents a 30 percent reduction relative to uncontrolled 1990 baseline emissions. These regulations set volatile organic compound (VOC) limits for 27 categories of consumer products, mostly in terms of percent VOC by weight (Note: VOC is equivalent to ROG for consumer products). Some of the products subject to these standards are antiperspirants and deodorants, hairsprays, general purpose cleaners, aerosol cooking sprays, automotive brake cleaners, and charcoal lighter material products (Note: state law specifically excludes architectural coatings from the definition of consumer products, even though the bulk of these products are used by consumers). The regulations are found in Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Articles 1 and 2.

The ARB staff is also currently developing a regulation to reduce ROG emissions from aerosol paints in the near term. This regulation is mandated by California legislation which requires a 60 percent reduction in aerosol paint emissions by December 31, 1999 calculated from the 1989 baseline year (see Health and Safety Code section 4171 2(f). We plan on proposing an aerosol paint regulation to achieve this level of reduction in early 1995 for the Air Resources Board's consideration and approval.

The ARB also recently adopted the Alternative Control Plan (ACP) regulation for consumer products. The ACP is designed to achieve emission reductions which are equivalent to the reductions that will be achieved under the existing consumer product regulations. Currently, the proposed ACP is applicable to 26 products regulated by the consumer products regulation (Title 17, California Code of Regulations, Division, Chapter 1, Subchapter 8.5, Article 2, Consumer Products, Sections 94507-94517). The ARB staff is considering inclusion of aerosol paints into the ACP regulation as part of the development of the aerosol paint regulation.

B. Mid Term Program (Additional Product Categories)

To achieve even further emission reductions in the mid-term, the ARB will adopt additional regulations to reduce ROG emissions from product categories not currently regulated. Based on a recent U.S. EPA survey of consumer products, there are over 200 different types of consumer products. The existing ARB consumer products regulations regulate 27 categories, leaving over 150 product categories as potential candidates for control under the mid-term program. To help guide the development and implementation of the mid-term and long-term programs, a consumer products working group will be established. This working group,

that will include representation from U.S. EPA, ARB, industry, the local districts, and environmental groups, will provide a forum for communication, cooperation, and coordination during the development of consumer products control measures. It is expected that the mid- term regulations will be adopted by July 1, 1997 and will be designed to produce at least an additional 25 percent reduction relative to the uncontrolled consumer product emissions in the year 2005. These mid- term emission reductions are also necessary in the Sacramento Metropolitan Area and Ventura to demonstrate attainment by 2005.

C. Long-Term Program (Advanced Technology, Market Incentives)

The near and mid-term reduction measures rely on available technology and will be adopted within the next 2-1/2 years and fully implemented by 2005. The reductions to be realized from the longer term measures will rely on new and innovative technologies that are not currently available, but that can reasonably be expected provided efforts are made to foster and promote research and development into new technologies. The federal CM recognizes the need that extreme areas may have to rely on these evolving technologies to meet attainment goals and specifically authorized the inclusion of such measures in the SIP under Section 182(e)(5), provided such measures are not needed to achieve emission reductions before 2000.

Even with the near-term and mid-term control measures, significant additional reductions from consumer products will be needed to attain the ozone standard in the SCAB and to reach state standards in other regions of the state. As mentioned earlier, for consumer products, our SCAB ROG attainment target is 20 tons per day with about 15 tons per day for consumer products and 5 tons per day for aerosol paints. Achieving these emission reductions will be a challenging process and will require the introduction of new technologies that are not currently available. We expect however, that with additional time and energies devoted to fostering the development of new low-VOC technologies, when the long-term measures are implemented they will be found to be commercially and technologically feasible.

ARB staff has identified several strategies that will be explored to reach the emissions target for consumer products. Very substantial additional reductions can be anticipated due to a combination of new technological breakthroughs in currently-regulated products, regulating additional product categories, developing market incentive programs to encourage additional emission reductions from the universe of consumer products, developing pollution prevention programs, implementing public education programs, and developing special recognition programs (e.g., environmental labels or awards) for very low VOC- emitting products. Section 182(e)(5) allows such commitments for the bulk of these post-2000 emission reductions. The ARB will develop appropriate technologically and commercially feasible control strategies based on continuing evaluation of new technologies and compliance options.

It is clear that, to meet this ambitious goal, the overall strategy must be based on a cooperative effort undertaken between the Federal Government, ARB, California consumers

and the regulated industry. Each must do their part to help in bringing us closer to our goal. The Federal Government can assist in this endeavor by developing regulations and policies that foster flexibility for states in implementing air quality programs and that encourage the use of innovative programs for addressing air pollution. Efforts on the part of U.S. EPA to expeditiously adopt aggressive national consumer product control measures can also help California attain its air quality goals.

In addition, since the majority of consumer product manufacturers are located outside the state of California, it is imperative the Federal Government develop national market incentives to promote new technologies such as research and development subsidies and other tax incentives to minimize economic burdens and stimulate new technologies.

The ARB must do its part by adopting and implementing the regulations and coordinating the effort to develop and implement new ways to generate emission reductions from consumer products. Furthermore, in cooperation with other regulatory agencies and academic institutions, the ARB will work to further advance low VOC technologies, increase the understanding of consumer product emissions and their impact on the environment, further the understanding of reactivity as it pertains to consumer product VOC emissions, and evaluate the feasibility of incorporating reactivity considerations into the consumer products control strategy. Consumers can further enhance the use of low emission products by being knowledgeable about the impacts of consumer products on air pollution and by encouraging manufacturers to introduce more low-emitting products.

The key to the success of this program, however, lies with the consumer product's manufacturers and associated industries and their ability to develop new and viable technologies and products that meet consumer needs without the concurrent dependence on substantial VOC contents. This industry has successfully met the challenge established by the California Clean Air Act (CCM) and has worked cooperatively with the ARB staff to implement the CCM mandate. It has not been an easy task and to go further will require significant dedication of resources and energies. The challenge to us all will be to design a program that will provide the incentive to do this.

IV. Impact of Consumer Products Control Strategy

As is shown in Figure 3, without additional measures for consumer products in the SIP, the emissions for consumer products will, after an initial decline due to the existing regulations, continue to grow. Without the SIP control measures for consumer products, the projected emissions in 2010 for consumer products are about 35 percent of the attainment ROG emissions in the SCAB. With full implementation of the SIP component for consumer products, the emissions from consumer products will decrease to the attainment level of approximately 20 tons per day.

Figure 3
Projected Emissions - SCAB

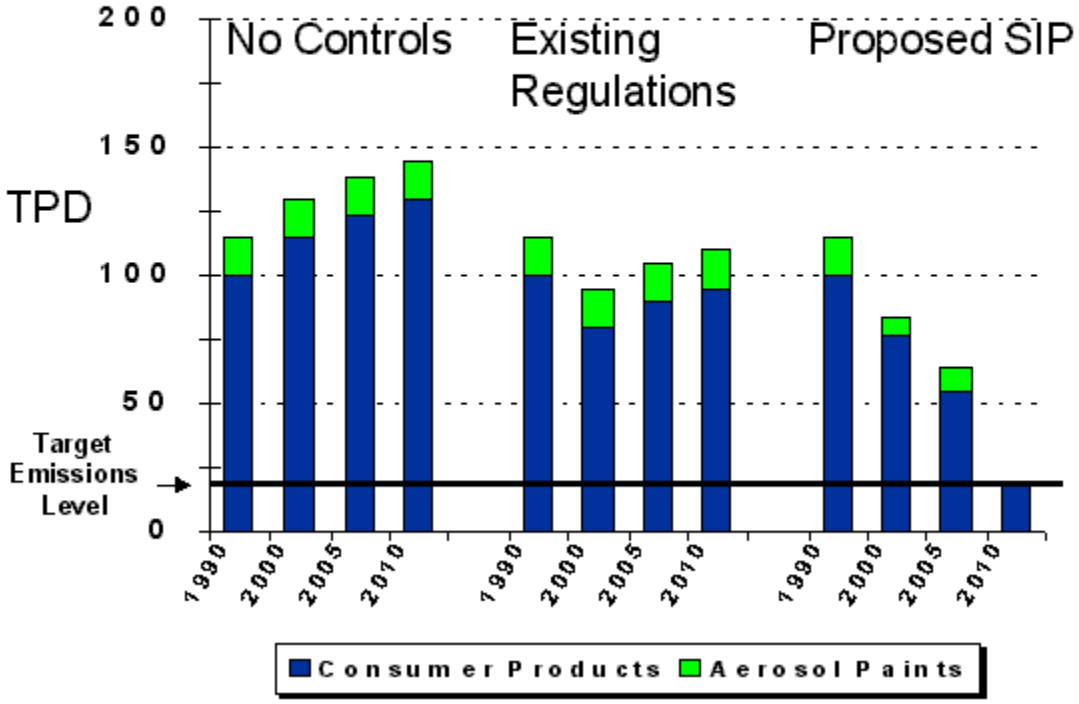


Table 1 presents the emission reductions, relative to uncontrolled 1990 baseline emissions, resulting from the consumer product control strategy on non-attainment air basin ROG emissions. Table 2 shows the expected decrease in the combined emissions from consumer products and aerosol paint products from 1999 through 2010 as the consumer products control strategy is implemented. Table 3 shows the attainment year baseline forecasted emissions for each nonattainment air basin, the combined emission reductions to be achieved by the mid- and long-term measures (i.e., the emission reductions beyond the existing consumer product regulations), and the projected emissions from consumer products remaining after the emission reductions have been achieved from the new control measures. Statewide, upon full implementation of all control measures, the consumer products ROG emissions (including aerosol paints) will be reduced to about 50 tons per day in the year 2010. In the SCAB, the consumer product ROG emissions (including aerosol paints) in the year 2010 will be reduced to 20 tons per day, consistent with the AQMP.

Table 1. Summary of Near, Mid, and Long Term Measures for Consumer Products.

			(Combined 1990 Emissions Baseline) and Emissions Reductions Claimed for Each Control Measure Relative to 1990 Baseline (Tons/Day)						
Control Measure		**% Control of 1990 Baseline**	**Statewide (270)**	**SCAB (115)**	**San Joaquin (25)**	**San Diego (24)**	**Sacramento (15)**	**Ventura (6)**	**Mojave (2.5)**
CP-1	Near Term: Cons. Prod.	30%	70	30	7	6	4	1.5	0.5
CP-2	Mid-Term: Cons. Prod.	25%	60	25	6	5	3	1	0.5
CP-3	Near Term: Aero. Paints	60%	15	7	2	1.5	1	0.5	<0.5
CP-4	Long-Term: Cons. Prod. Aero. Paints	30%	70	30	7	6	4	2	1
Total		85%	220	95	20	20	12	5	2

CP-1 = Existing consumer products regulation only
CP-2 = Mid-Term consumer products measure only
CP-3 = Aerosol paints regulation in development for adoption in 1995 only
CP-4 = Long-Term measures for both consumer products and aerosol paints

Emission Reductions = [Percent Control] X [1990 Baseline Emissions] X [Consumer Products or Aerosol Paints fraction of 2010 Emissions], where consumer products fraction ~ 90%, aerosol paints fraction ~10% of 2010 Uncontrolled Emissions

Emission reductions, shown for each measure, are relative to 1990 Baseline Emissions and are therefore additive. Numbers are rounded.

Table 2. Consumer Product Emissions Remaining After Projected SIP Emission Reductions in Year Given

Year	Combined Emissions (Consumer Products and Aerosol Paints) Remaining after Emission Reductions in Each Year Given, Tons Per Day						
	Statewide	SCAB	San Joaquin	San Diego	Sacramento	Ventura	Mojave
1999	225	96	25	20	13	5	2
2002	220	92	25	20	13	5	2
2005	150	64	15	15	9	3.5	1.5
2007	155	65	18	15	10	3.5	1.5
2008	160	65	18	15	10	3.5	1.5
2010	50	20	5	4	3	1	0.5

Controlled Emissions (Cont.) remaining after emission reductions are calculated as:
[Uncontrolled Emissions in Year Given] X [1 - (Combined Cumulative Percent Emission Reductions in year given)]
Example: For SCAB in 2005,
Remaining Emissions = 135 (Uncontrolled) X [1 - (0.897 x 0.55 + 0.103 x 0.60)] (Combined Cumulative Reductions) = 60 Tons/Day
Numbers are rounded.

Table 3. Baseline Forecast Emissions, Additional Reductions from New Control Measures, and Remaining Emissions (Including Aerosol Paints) in Attainment Year Given

	Statewide	SCAB	San Joaquin	San Diego	Sacramento	Ventura	Mojave
Attainment Year	2010	2010	1999	1999	2005	2005	2007
Baseline Forecast Emissions (includes Near-Term Consumer	270	109	25	20	15	6	3

	Statewide	SCAB	San Joaquin	San Diego	Sacramento	Ventura	Mojave
Product Reductions), Tons/Day							
Additional Emission Reductions From Aerosol Paints (Near/Long-Term) and Consumer Products (Mid/Long-Term), Tons/Day	220	89	< 1	< 1	6	2.5	1.5
Remaining Emissions, Tons/Day	50	20	25	20	9	3.5	1.5

Chapter III. Socio-Economic Analysis

I. Introduction

The United States Clean Air Act Amendments of 1990 require California to submit a comprehensive attainment plan for ozone to the United States Environmental Protection Agency (U.S. EPA) no later than November 15, 1994. The State Implementation Plan (SIP) must cover all nonattainment regions of the state that are classified as serious, severe or extreme for ground-level ozone. These regions include the South Coast, Sacramento, San Diego, Ventura, San Joaquin Valley, and Mojave Desert Air Basins.

The existing state and local control programs will not be adequate to reduce emissions to levels targeted at attainment of the federal ambient air quality standard for ozone. Additional measures are needed to achieve the necessary emission reductions. The SIP provides the blueprint for these emission reductions. These reductions rely on the advancement of technology and the use of market- incentives.

Staff has estimated the direct costs of state level control strategies (See chapters I and II) designed to achieve the federal ambient air quality standard for ozone. The costs associated with emission reductions, as well as the cost-effectiveness for various mobile and stationary source categories were estimated for the year 2010. This analysis does not include the costs of control measures that will be adopted by the air quality management districts.

The increase contract costs will have a contractionary multiplier effect on output and employment in California. An assessment of the economic impacts of the increased control costs on the California economy was also undertaken. These effects were estimated using multipliers from the United States Department of Commerce's Regional Input/Output

Modeling System (RIMS II). These multipliers capture both direct and indirect effects of industry and consumer spending on the regional economy.

Industrial and consumer spending on environmental supplies and services generate a wide range of new economic activity. The ripple effects on the economy of these activities are tied directly to whether supplies and materials are obtained locally or from another area. More spending on locally- produced supplies and materials produce larger localized ripple effects. Thus, the size of a multiplier indicates the importance of an industry to the local economy. In this analysis we used different multipliers for the industries affected most by the SIP measures. The California industries affected most by the SIP control measures are those that are engaged in the production, distribution, and sales of on-road and off-road vehicles and consumer products.

II. Control Costs

The costs of control are estimated for both mobile and stationary sources for the year 2010 by multiplying the necessary emission reductions associated with the planned control strategies for 2010 by the cost-effectiveness estimate for each control measure. The average cost- effectiveness used for all consumer product categories was $2,100 per ton of ROG emission reduced. The cost-effectiveness for on-road mobile source categories ranged from a high of $16,000 to a low of $1,300 per ton of NOx and ROG reduced. For off-road mobile source categories, the cost-effectiveness varied from a low of $2,000 per ton of NOx and $390 per ton NOx and ROG reduced to a high of $4,000 per ton of NOx and $2,000 per ton NOx and ROG reduced. All costs are stated in constant 1994 dollars.

Because the majority of the planned control measures will go into effect between the years 2000 and 2010, most of the control cost will occur after the turn of the century. The costs associated with implementation of the actual control measures are likely to be lower than the costs estimated in this analysis. This is because we expect, based upon decades of experience, that costs for new advanced technologies and market-based emission control strategies will be lower than originally estimated. Much of this plan relies on these strategies to achieve the reductions needed for the year 2010.

We present estimates of annual costs of the planned control measures from both mobile and stationary sources in the South Coast Air Basin (SCAB) and in the state in Table 1. As shown in the table, mobile source control measures account for over 80 percent of the planned control costs while consumer products account for the remaining costs, both statewide and in the SCAB. On-road mobile sources alone account for over 50 percent of the SIP's costs in the state.

Table 1. Estimates of Total Annual Costs for The Year 2010 Of the Planned Control Measures (Millions Of 1994 Dollars)

	SCAB	%Total	Statewide	%Total
Stationary Sources: • Consumer Products	68	15	169	17
Mobile Sources: • On-Road • Off-Road	278 115	60 25	509 301	52 31
Total	**461**	**100**	**979**	**100**

Table 2 provides estimates of the planned control costs for ROG by different categories of consumer products for both the SCAB and the state. The SCAB's share is over 40 percent of total costs of ROG emission reductions in the state. As shown in the table, long-term control measures for consumer products account for over 50 percent of the total costs of stationary source ROG emission reductions that can be achieved under technology- and market-based emission control strategies.

Tables 3 and 4 provide the cost estimates for NOx and ROG for 2010 by different mobile source categories for the SCAB and the state as a whole. Although the SCAB accounts for about 40 percent of the required mobile source emission reductions in the state, it would bear about half of the statewide control costs of the SIP. This is because much of the scrappage program will occur in the SCAB.

Table 3 shows that, of the projected $675 million cost of NOx control for mobile sources, on-road categories account for about 60 percent of the costs and off-road categories for about 40 percent. Similarly, Table 4 shows that on-road mobile source categories account for over 80 percent of the estimated $135 million cost of ROG control, while off-road categories account for the remainder.

Table 2. Estimates of The Costs for ROG Emission Reductions For 2010 by Consumer Products Categories (Millions Of 1994 Dollars)

	SCAB	Statewide	%Total
Near Term: Aerosol Paints	**7**	**17**	**10**
Mid-Term: Consumer Products	25	65	38
Long-Term:	**36**	**87**	**52**
-- Aerosol Paints	3	8	5
-- Consumer Product	33	79	47
Total	**68**	**169**	**100**

Table 3. Estimates of the Costs for NOx Emission Reductions for 2010 by Mobile Source Categories (Millions of 1994 Dollars)

	SCAB	Statewide	%Total
On-Road Sources	**178**	**712**	**53**
-- Light-Duty Vehicles	12	35	3
-- Medium-Duty Vehicles	37	81	6
-- Heavy-Duty Diesel Vehicles	125	544	40
-- Heavy-Duty Gasoline Trucks	4	52	4
Off-Road Sources	**123**	**643**	**47**
-- Industrial Diesel Equipment	66	184	13

	SCAB	Statewide	%Total
-- Industrial Gas & LPG Equipment	5	15	1
-- Pleasure Craft	N/A	N/A	N/A
-- Marine Vessels	15	23	2
-- Locomotives	33	411	30
-- Aircraft	4	10	1
Total	**301**	**1,355**	**100**

Table 4. Estimates of the Costs for ROG Emission Reductions for 2010 by Mobile Source Categories (Millions Of 1994 Dollars).

	SCAB	Statewide	%Total
On-Road Sources	**81**	**113**	**84**
-- Light-Duty Vehicles	70	86	64
-- Medium-Duty Vehicles	2	7	5
-- Heavy-Duty Diesel Vehicles	9	19	14
-- Heavy-Duty Gasoline Trucks	0	1	1
Off-Road Sources	**10**	**22**	**16**
-- Industrial Diesel Equipment	N/A	N/A	0
-- Industrial Gas & LPG Equipment	7	12	9

	SCAB	Statewide	%Total
-- Pleasure Craft	1	3	2
-- Marine Vessels	N/A	N/A	N/A
-- Locomotives	N/A	N/A	N/A
-- Aircraft	2	7	5
Total	**91**	**135**	**100**

III. Economic Impacts

Our impact evaluation assumes that the planned control measures may increase the cost of doing business in California for firms located in the state. This evaluation does not account for the enormous benefits to California businesses that the development of new technologies will bring. We expect that our industries will benefit economically from not only technological advancement, but also new product opportunities and healthier, more productive labor force. These benefits in many instances may more than offset the costs of the planned control measures, however, they are difficult to quantify.

Increased costs of the planned control measures will affect the California economy through many complex interactions. The end results of these complex interactions can be summarized by estimating their effects on state output (gross state product) and employment.

According to DRI/McGraw-Hill, in the year 2010 the California economy is expected to employ approximately 16.2 million people and produce goods and services valued at about $1.7 trillion in constant 1994 dollars. In comparison, the costs associated with implementation of the SIP are expected to reduce the growth of output of goods and services by about $2.0 billion in California, accounting for about 0.1 percent of the gross state product. The SIP is also expected to reduce job opportunities by about 20,000, or about 0.1 percent of employment level in California in the year 2010. Tables 5 and 6 show the impacts of the SIP's measures on the California output and employment in the year 2010.

Table 5. The SIP's Effects on the California Economy in the Year 2010.

	Without SIP	With SIP	Difference	%Total
Output (Billions of 1994 Dollars)	1,667	1,665	2.0	0.1
Employment (Thousands)	16,197	16,177	20	0.1

Table 6. Economic Impacts of the SIP Measures for 2010 (Millions of 1994 Dollars).

	Output Changes		Job Changes	
	SCAB	Statewide	SCAB	Statewide
Stationary Sources	150	372	1,618	4,022
On-Road Mobile Sources	525	962	4,587	8,397
Off-Road Mobile Sources	268	707	2,719	7,163
Total	**943**	**2,041**	**8,924**	**19,582**

IV. Conclusion

Overall, the mobile source and consumer products elements of the SIP are estimated to result in direct costs on the order of $1 billion per year by 2010. Taking into account indirect costs, the measures in the plan are expected to reduce total economic output by approximately $2.0 billion. Not included in this assessment is the fact that the measures proposed in the SIP will also result in many benefits that we were not able to quantify. Nonetheless, the impacts of the increased costs to the California economy is small on a percentage basis. Changes in employment and output will account for a small fraction of one percent of total employment and output in California in the year 2010.

Chapter IV. California Environmental Quality Act Analysis

I. Introduction

In this chapter, we will present for review and comment information about the potential significant adverse impacts of the measures proposed by the Air Resources Board (ARB) in

this portion of California's federally-required state implementation plan (SIP), pertaining to mobile sources and consumer products. The SIP is an evolving, ever-changing, and flexible plan for achieving and maintaining the national ambient air quality standards (NAAQS) for criteria pollutants (oxides of sulfur, particulate matter, carbon monoxide, lead, oxides of nitrogen, and volatile organic compounds [or hydrocarbons], the latter two of which combine in the presence of sunlight to become ozone, or photochemical smog). This portion of the SIP is being submitted to partially satisfy the requirements in the federal Clean Air Act ("the Act;" 42 U.S.C. section 7401 et seq.) for an attainment demonstration and a rate of progress demonstration for the ozone precursors, oxides of nitrogen (NOx) and volatile organic compounds (VOCs). It is essentially a plan which sets forth existing measures and measures for development, adoption, and implementation by the ARB which will contribute towards attainment of the NAAQS for ozone. The ARB plans to submit this plan to the United States Environmental Protection Agency (U.S. EPA) for review and incorporation into California's SIP, along with those portions currently being adopted by those air pollution **control districts** (districts) whose pollution is considered "serious," "severe," or "extreme" on the basis of specified design values set forth in the Act.

In order to provide for meaningful public participation in the assessment of the potential environmental impacts associated with this planning activity, it is important to explain what this environmental discussion is not. It does not set forth the environmental impacts of measures contained in the districts' portions of the SIP, because the districts performed their own environmental analysis of their stationary source control measures. People wishing to participate in assessing and reviewing the impacts associated with the district SIP portions should do so at the district level. The ARB, as the state agency responsible for preparing the SIP, coordinating district efforts to comply with federal SIP requirements, and forwarding the SIP components to the U.S. EPA, will collect and compile the district SIP revisions, along with their environmental documentation, and send the entire SIP revision package to the U.S. EPA.

Further, this chapter does not set forth in detail the beneficial environmental impacts which will result from the adoption and implementation of the measures proposed in this portion of the SIP. The ARB is proposing these measures solely because they are beneficial to air quality and will reduce air pollution, allowing the State to progress towards attainment of the NAAQS (as well as the State's ambient air quality standards adopted by the ARB pursuant to section 39606 of the Health and Safety Code). The rest of this report discusses the measures and their intended benefits. This chapter only discusses the potential adverse impacts which the measures may entail.

Finally, this chapter cannot and does not contain a detailed, quantitative impact analysis. Because the ARB activity which is subject to discussion is a plan for future action which commits the agency to consideration of measures which will yield specified emission reductions but for which specific regulatory language has not been developed, this analysis is necessarily general and qualitative. If the plan is adopted, the measures will be developed over time and proposed in regulatory (rule) format with full public participation. Each

measure will undergo a detailed environmental analysis as required by the California Environmental Quality Act (CEQA), will be aired at public workshops, and will be shepherded through the public hearing process required by law (see the Administrative Procedure Act, Gov. Code section 11340 et seq.). When specific regulatory language is developed, it will be possible to analyze potential environmental impacts in detail and with reference to numerical data. Here, potential negative impacts are explored to the extent currently feasible without engaging in conjecture and speculation. (As noted in the Executive Summary, the ARB portion of the SIP is comprised of both proposed measures and regulatory controls already adopted; the latter have already gone through an environmental analysis at the time they were adopted. Persons wishing to review these analyses may obtain copies of prior ARB staff reports associated with the adopted rules from our Public Information Office.)

The ARB's program involving our adoption or approval of standards, rules, regulations, and plans has been certified by the Secretary of Resources as meeting certain environmental standards set forth in CEQA (see Public Resources Code section 21080.5). Hence, the ARB need only prepare abbreviated, "functionally equivalent," environmental documents instead of negative declarations and ElRs. This environmental document must contain a description of the proposed activity with either alternatives to the activity and mitigation measures to minimize any significant adverse environmental impacts, or a statement supported by documentation that the plan as approved will not produce any such impacts. The ARB encourages public consideration of this plan and its environmental documentation, and will respond in writing to all significant environmental points raised by the public, either in writing during the public review period or at the public hearing. Notice of the ARB proposal to adopt this portion of the SIP, including notice of the availability for review and comment of this evaluation of environmental impacts, has been posted, published, and mailed to interested persons. In addition, the staff report will be circulated by the State Clearinghouse to state agencies for review; although no state agency is "responsible agency" for this activity as defined by CEQA, the ARB is the lead agency for this portion of the SIP, and the plan is of statewide, areawide, and regional significance because the measures therein will ultimately affect the type and composition of certain consumer products, motor vehicles, and other mobile sources available in the State of California.

II. Mobile Source Element

A. Introduction

Some of the proposed mobile source emission reduction programs will have secondary impacts on air, water and solid waste disposal facilities. The potential impacts, alternatives, and possible mitigation measures are discussed below. Because of uncertainty in the scope of some programs, it is not possible to quantify the impact of these programs on air emissions, waste water treatment facilities and waterways, and solid and hazardous waste disposal facilities. As regulations implementing these programs are developed, the ARB will

consider the feasibility of these and other mitigation measures, and a range of alternatives of different stringency and, hence, different impacts will be examined.

B. Accelerated Vehicle Retirement

Accelerated vehicle retirement programs are expected to lead to an increase in the number of vehicles scrapped, which increases solid waste. However, it should be noted that even in the absence of accelerated vehicle retirement programs, these vehicles would eventually have been retired. Accelerated vehicle retirement programs simply expedite the dismantling and disposal of older vehicles.

Normally, after vehicles are retired, the batteries, catalytic converters, tires, and other recoverable components are removed and the rest of the vehicle is shredded. Shredded metal is recovered from the automobile shredder waste and recycled. The remaining shredder waste is usually sent to a landfill. Because Title 22 of the California Code of Regulations requires lead- acid batteries to be recycled, batteries must be removed before shredding. In addition, oxidation- reduction catalysts are normally removed prior to shredding in order to recover the precious metals. Although glass, tires, and automobile fluids can all be recycled, the market for these recyclable is not well-developed. These components are usually sent to landfills or other disposal facilities. Automobile fluids may be hazardous and may require special treatment and disposal. Because the scope of future accelerated vehicle retirement programs is unknown, it is not possible to quantify the impact of these programs on landfills and hazardous waste treatment and disposal facilities. It is believed that shredder waste occupies a minimal amount of existing landfill space. Detailed analysis will be provided to the extent available when regulations implementing this program are proposed for adoption.

The impact of accelerated vehicle retirement programs, as well as normal vehicle retirement, can be minimized by promoting recycling of retired vehicle components. Although the metal in automobiles is recovered at very high rates, other recyclable components are often relegated to landfills or other disposal facilities. The ARB guidelines for accelerated vehicle retirement programs allows the removal of reusable components (e.g., doors, fenders, bumpers, etc.) from vehicles before their dismantling.

In addition, it may be possible to develop new markets for some retired vehicle components. For example, one accelerated vehicle retirement program has discovered a potential market for old tires in Vietnam where the tires will be shredded and used for roadbase. Original equipment manufacturers are also showing increased interest in recycled materials. Ford Motor Company is working with a thermoplastic rubber supplier to facilitate the recycling of old tires into new vehicle parts, such as brake-pedal pads, carpet backing, splash guards and weather seals. Ford is also using material from salvaged plastic Ford bumpers to mold new taillamp housings, and fabricating the plastic splash shields on 1994-model Ford Thunderbirds, Mercury Cougars, and Lincoln Continentals entirely from recycled battery casings. Ford research shows that vehicle parts made from recycled battery casings can be shredded, pelletized, and remolded into new parts up to 12 times.

The ARB will consider the feasibility of these and other mitigation measures during the rule development process.

C. Electric Vehicles

The ARB staff has analyzed emissions associated with electric vehicles (EVs). Because electricity used in California is generated from very clean sources, as illustrated below, the power plant emissions associated with electric vehicles are negligible when compared to emissions from conventional vehicles. In fact, a significant percentage of the electricity used in California is generated from clean, renewable sources such as hydroelectric power, solar, and wind. Electric vehicles also avoid all fuel-related emissions, such as the evaporation of gasoline from storage and marketing operations. As shown in Table 1, in the South Coast Air Basin (SCAB), the power plant emissions of reactive organic gases (ROG), nitrogen oxides (NOx), and carbon monoxide (CO) associated with an electric vehicle are at least 97 percent lower than the ROG, NOx, and CO emissions from a gasoline-powered ultra-low-vehicle (ULEV), the cleanest vehicle of the future. In addition, most electric vehicle charging is expected to take place during off-peak hours when electricity rates are low and utilities have excess capacity. A complete discussion of emissions associated with electric vehicles is contained in the staff report for the 1994 Low-Emission Vehicle and Zero-Emission Vehicle Program Review and the technical support document for the Zero-Emission Vehicle Update, both dated April 1994.

Table 1. Comparison of Emissions Associated with EVs, ULEVs, and Gasoline ULEVs (Grams/Mile).

Scenario	NOx	ROG	CO
Power Plant Emissions in The SCAB Associated with EVs in the SCAB*	0.006-0.009	0.0008-0.001	0.009-0.01
ULEV Tailpipe Emissions in the SCAB† (Including Deterioration)	0.30	0.05	1.2
Gasoline ULEV Emissions in the SCAB‡ (Including Deterioration)	0.30	0.18	1.2

* Assumes EVs are charged during off-peak hours when approximately 33 percent of the electricity used in the SCAB is generated in the SCAB. Most EVs are expected to be charged during off-peak hours. The range in power plant emissions associated with EVs is due to a range in the assumption of EV efficiency from 0.24 kWh/mile to 0.35 kWh/mile.

† Emissions account for conditions unique to the SCAB including ambient temperature, average speed, and average trip length.

‡ This value includes an estimated 0.13 grams/mile of ROG to account for the evaporative, running loss and gasoline marketing emissions associated with gasoline vehicles using Phase II gasoline. Emissions from oil refining are not included.

Because electric vehicles will use more batteries than conventional vehicles, the rate of battery disposal is expected to increase as a result of electric vehicle introduction in California. This means that there will likely be increased impacts on ambient air quality, wastewater treatment facilities, and solid waste disposal facilities. At this time, recycling of lead-acid batteries produces lead ingots and battery casing chips which can be reused. Recycling also results in air emissions, waste water (neutralized electrolyte), and solid waste (furnace slag). Almost all currently-available electric vehicles are equipped with lead-acid batteries that (under Title 22 of the California Code of Regulations) are required to be recycled. The ARB staff has analyzed the criteria pollutant emissions associated with recycling of lead-acid batteries. The staff assumed current recycling technology and that an electric vehicle uses 60 batteries over a 100,000-mile lifetime (30 batteries at a time for a 50,000-mile life). The results of this analysis are shown in Table 2 below:

Table 2. Estimated Lead-Acid Battery Recycling Emissions Associated with EVs* (Grams/Mile).

NOx	ROG	CO
0.001	0.0003	0.0016

* Assumes an electric vehicle uses 60 lead-acid batteries over a 100,000-mile lifetime.

Even when lead-acid battery recycling emissions are included, electric vehicles still reduce emissions of ROG, NOx, and CO by 96 percent on a per-vehicle basis in the SCAB when compared to a ULEV. In addition, the estimates of battery recycling emissions should be considered conservative (on the high side), since any expansion of lead-acid battery recycling facilities to accommodate EV lead-acid batteries will most likely incorporate newer, lower-emitting equipment.

Because the moderate energy storage of lead-acid batteries limits the range of electric vehicles, future vehicles will probably use other battery types which provide greater energy storage and greater vehicle range. Promising candidates for the near-term include nickel-

metal hydride, sodium-nickel chloride, and lithium-based batteries. At this time, advanced batteries such as these are not required to be reclaimed. Depending upon the contents of the battery, some advanced batteries may be considered hazardous by California or the federal government, requiring special transport and disposal procedures.

Ideally, used electric vehicle batteries will be diverted from solid waste facilities and recycled. If not recycled, batteries may simply be drained of electrolyte, and sent to solid waste disposal facilities. The electrolyte would then be neutralized before disposal. Improperly disposed, undrained batteries may leak electrolyte, leading to localized groundwater contamination. Although recycling of advanced batteries will produce air emissions, waste water and solid waste, these tightly-regulated impacts are preferable to the uncontrolled disposal of used batteries.

The ARB is currently funding a contract to assess the recycling technology, recycling infrastructure, market for recycled products, and regulatory restraints associated with electric vehicle battery recycling. In addition, a methodology for estimating the health/hazard impact of each battery based on air, water, and land exposures will be developed. This contract focuses on eight different battery types, including lead-acid, nickel-cadmium, nickel-metal hydride, sodium- nickel chloride, and lithium-based batteries. Once the study is completed, the ARB will work with the Integrated Waste Management Board and the Department of Toxic Substances Control to evaluate the need for financial or regulatory incentives to ensure that all electric vehicle batteries are recycled. If recycling of electric vehicle batteries cannot be justified on solely economic grounds, incentives may be necessary to encourage recycling.

III. Consumer Products Element

A. Summary of Environmental Analysis

As part of our legally-required rulemaking process, we conducted an environmental impacts analysis for each of the existing consumer products regulations (antiperspirant/deodorants, Phase I-II); the recently-approved market-based Alternative Control Plan (ACP) regulation; and the aerosol paints regulation currently under development for the Board's consideration in early 1995. These analyses show that no significant adverse environmental impacts on air quality, water quality, and landfill loading would result from the implementation of these regulations (California Air Resources Board, Stationary Source Division, A Proposed Regulation to Reduce Volatile Organic Compound Emissions from Antiperspirants and Deodorants-Technical Support Document, Sacramento, CA, September, 1989; California Air Resources Board, Stationary Source Division, Proposed Regulation to Reduce Volatile Organic Compound Emissions from Consumer Products - Technical Support Document, Sacramento, CA, August, 1990; California Air Resources Board, Stationary Source Division, Proposed Amendments to the Statewide Regulation to Reduce Volatile Organic Compound Emissions From Consumer Products. Phase II - Technical Support Document, Sacramento, CA, October, 1991; California Air Resources Board, Stationary Source Division, Proposed Alternative Control Plan Regulation for Consumer Products - Staff Report,

Sacramento, CA, August, 1994; California Air Resources Board, Stationary Source Division, Proposed Regulation to Reduce Volatile Organic Compound Emissions from Aerosol Coating Products - Technical Support Document, Sacramento, CA, in preparation). Because future regulatory developments will generally involve additional or expanded applications of the control concepts employed by the existing regulations and the ACP, we do not anticipate any significant adverse impacts from the control measures contained in the SIP. However, as we further develop the SIP proposals, we will continue to analyze potential adverse impacts so as to ensure that negative environmental impacts will not occur due to adoption of the SIP measures. At the time of the rulemaking more specific details will be provided.

B. Discussion

1. Overall Air Quality Impacts

The primary environmental impact, and, indeed, the purpose of the existing regulations and the proposed SIP measures is a decrease in VOC emissions to the atmosphere from consumer products. Since VOCs are precursors to ground-level ozone, a decrease in VOC emissions will result in a net decrease in tropospheric ozone. A decrease in PM10 will also result from the measures contained in the SIP, since VOCs are also precursors to PM10 formation. Therefore, the existing regulations and the proposed SIP measures are projected to result in an 85 percent reduction in VOC emissions by the year 2010, with concomitant reductions in ozone and PM10.

2. Impacts on Stratospheric Ozone Depletion

Stratospheric ozone depletion is included as a possible adverse environmental impact because of the possibility that, in an effort to comply with the proposed VOC regulations for consumer products, manufacturers may resort to use of solvents that are not considered VOCs (also known as "exempt" solvents in the regulations), some of which are ozone-depleting chemicals. We have determined that stratospheric ozone depletion will not occur as a result of adoption of these measures. We reached this conclusion because Title Vl of the federal Clean Air Act amendments of 1990 (CAAA) codifies and expands upon the revised Montreal Protocol to address the depletion of the stratospheric ozone layer. The law requires a complete phaseout of chlorofluorocarbons and haloes, along with interim reductions. Ozone-depleting substances have been grouped into two classes. Class I compounds (chlorofluorocarbons, haloes, carbon tetrachloride, and methyl chloroform) are scheduled to be phased out by the year 2000. All Class II compounds (hydrochlorofluorocarbons) will be phased out by 2030. Regulations have been adopted by the U.S. EPA to limit and phaseout the production of these substances and mandate or induce recycling programs for these substances.

The existing regulations and the proposed SIP measures will prohibit any new or increased uses of ozone-depleting compounds subject to the CAAA. Because of the requirements under the CAAA and market forces, we expect that existing uses of ozone depleting

compounds will be phased out over the next several years. We therefore conclude that the existing regulations and the SIP measures will compliment the goals and intent of the CAAA by identifying such ozone depleting compounds prohibiting new and increased uses of these compounds in consumer products. As a result, we expect a continuing decline in the use of ozone depleting compounds in consumer products.

3. Global Warming

The theory of global warming, although not as yet fully accepted by the scientific community, warrants an evaluation of potential impacts from the use of certain compounds in ACP products. Of primary concern are certain propellants, including chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and carbon dioxide. These compounds absorb infrared energy and can therefore potentially contribute to global warming when emitted in significant quantities.

CFCs are methane or ethane compounds in which all of the hydrogen atoms have been replaced with chlorine and fluorine. Nearly all uses of CFCs in aerosol products in the U.S. have been banned or eliminated since 1978. Because of this, we anticipate no significant global warming to occur due to the use of CFCs in products subject to the existing regulations or to be regulated under the proposed SIP measures.

Similar to CFCs, HCFCs are also methane or ethane derivatives which contain hydrogen in addition to chlorine and fluorine atoms. Initially, these compounds were viewed by some manufacturers as feasible replacements for CFCs in aerosol products. However, recent amendments to the CAAA specify a phaseout schedule for these compounds which will limit their usefulness as replacement propellants. In addition, their high costs (relative to hydrocarbon propellants) and limited availability tend to restrict the use of HCFCs. Because of these reasons, we anticipate no significant global warming to occur due to the use of HCFCs in products subject to the existing regulations or to be regulated under the proposed SIP measures.

HFCs are non-chlorinated methane and ethane derivatives which contain hydrogen and fluorine. It is generally accepted by the scientific community that HFCs, because they lack chlorine, probably do not significantly contribute to ozone depletion. Since they are not considered to be ozone depleters, HFCs are not scheduled for phaseout under the CAAA requirements.

However, this does not necessarily indicate a potential for significant use of HFCs in consumer products. Currently, the primary HFC being used or being considered for use in consumer products is HFC-1 52a (1, 1-difluoroethane). However, because of its cost (e.g., HFC-1 52a currently costs approximately $2.00 per pound, several times the cost of hydrocarbon propellants), we believe that manufacturers will exhaust all other available formulation options before using large quantities of HFC-1 52a or any HFC in consumer products.

Even if HFCs are used as replacement propellants in some ACP products, overall HFC emissions and their impacts on global warming should still be negligible. In this case, only a few tons per day of HFCs would be emitted to the atmosphere. By comparison, nearly 100 million tons of carbon dioxide, the primary anthropogenic greenhouse gas of concern, are emitted into the atmosphere each day from existing processes. Additionally, carbon dioxide has a much higher global warming potential than HFCs. Because of these reasons, we anticipate no significant global warming to occur due to the use of HFCs in products subject to the existing regulations or to be regulated under the proposed SIP measures.

PFCs are hydrocarbon compounds in which all of the hydrogen atoms in the molecule have been replaced by fluorine. These products may find future use in consumer products since they share many properties with CFCs, such as high density, high dielectric strength, high thermal stability, low surface tension, low chemical reactivity, and non-flammability. Additionally, they have zero ozone-depleting potential and are not considered to be VOCs. Perfluorocarbons have been recommended to replace CFCs in special complex, delicate-parts cleaning in the electronics, medical and precision metalworking industries.

It should be noted that some scientists have estimated potentially long atmospheric lifetimes for certain perfluorocarbons. For example, perfluoromethane (CF4) has been estimated to have an atmospheric lifetime of over six million years before being photolyzed in the upper atmosphere.

We believe that, because of their high cost and limited availability, it is extremely unlikely that significant quantities of perfluorocarbon compounds will be used in consumer products. In addition, the performance characteristics and toxicity of perfluorocarbon compounds are relatively unproven in consumer products. Because of these reasons, it is very likely that manufacturers will exhaust all other available technologies before resorting to the use of these chemicals.

Carbon dioxide is currently used in limited applications as a propellant in consumer products. We do not expect the use of carbon dioxide as a propellant in consumer products to add to global warming. This finding is based on the fact that the majority of carbon dioxide propellant used in the United States are recycled by-products from existing industrial/chemical processes.

4. Creation of Localized VOC Hot Spots

It has been suggested that differences in geographical distribution patterns can potentially lead to the formation of localized VOC "hot spots" under market-based programs for consumer products. In other words, a working market-based SIP control measure may show that the VOC emissions statewide are in compliance with the SIP requirements. However, significant quantities of high-VOC products may be distributed disproportionately to one area of California versus other areas, possibly resulting in localized VOC hot spots.

We evaluated this concern during the ACP rulemaking process (California Air Resources Board, Stationary Source Division, Proposed Alternative Control Plan Regulation for

Consumer Products - Staff Report, Sacramento, CA, August, 1994) and determined that no significant adverse impacts would likely result from the implementation of the ACP regulation. For the reasons described in the following discussion, we believe it is highly unlikely for high-VOC products to be distributed to the same location in sufficient quantities and used at the same time to form localized hot spots. More importantly, the regional nature of VOC emissions from consumer products precludes the likelihood of hot spots formation.

Discussions with Nielsen Research Marketing; Information Resources, Incorporated; and industry representatives indicate that manufacturers generally do not have sufficient control of the geographic distribution of products to purposely create hot spots by sending more of a high- VOC product to one area versus another. Moreover, the ARB staff is not aware of any data available at this time which indicate that the per-capita use of consumer products in certain areas of California are significantly greater than per capita consumption in other areas of the state.

Furthermore, products which are sold at one point in a day are not necessarily used at that time or even in the same day. Consumer product usage during the year depends more on established consumer use patterns rather than a manufacturer's sales patterns. For example, a can of hairspray purchased on one day may take up to five months to be used up.

Most importantly, we should emphasize that hot spots are, by definition, localized concentrations of pollutants in the air. However, consumer products are area-wide sources of VOCs, making VOC emissions from consumer products a regional phenomena. In other words, localized hot spots are most likely to form in specific geographic locations, not wide areas or air basins. Thus, we believe that the regional nature of consumer product sales makes it highly unlikely that VOC hot spots will form under the ACP regulation or any other market-based SIP control measure.

Although hot spots formation under the ACP is highly unlikely, we believe that the proposed ACP requirements contain sufficient safeguards to detect such an occurrence. We recognize that current market conditions may change in the future. Such unforeseen changes may result in significant geographical differences in per capita use of an ACP product. In these cases, the Executive Officer can require additional geographical use pattern data from the responsible ACP party. Representatives from Nielsen and IRI have stated that, with additional cost, this level of detail in the reporting of product sales data is possible. With this additional information, we will make appropriate modifications to the approved ACP to ensure that localized hot spots do not form. We will include similar safeguards in the SIP measures to ensure that localized VOC hot spots do not form as a result of these measures.

5. Toxic Air Contaminants

California Health and Safety Code section 39655 defines a toxic air contaminant (TAC) as an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness or which may pose a present or potential hazard to human health. In addition, substances which have been identified as Hazardous Air Pollutants pursuant to section 112 of

the federal Clean Air Act (section 7412 of Title 42 of the United States Code) are identified by the ARB as TACs. Once a substance is identified as a TAC, the ARB staff consult with affected sources and evaluate the need for an appropriate degree of regulation for each TAC. Appropriate control measures are then developed as necessary.

We believe that manufacturers will not reformulate non-complying products to include or increase any TAC in a consumer product. Responsible manufacturers are acutely aware of the process of identifying TACs and of the specific compounds listed or being investigated as TACs. We therefore do not expect significant reformulations using known or potential TACs, because of the potential liabilities involved with formulating a product with a TAC (especially with foreknowledge of a compound's status as a TAC). Additionally, we will monitor the use of TACs through our regular industry surveys and ACP applications and submittals, and if it appears that the use of TACs is increasing we will modify the consumer product measures as necessary to halt this process.

6. Consumer Product Efficacy

Throughout the development of the existing consumer products regulations, there were numerous discussions relating to the impact of the regulations on product efficacy (i.e., the product's ability to perform its intended function). Some industry representatives raised the concern that products reformulated to meet the VOC standards will have reduced efficacy from existing products. They further claimed that, because of this reduced efficacy, consumers would use more of the reformulated products, thereby resulting in reduced or no net emission reductions or even an increase in overall emissions. We evaluated this concern throughout the rulemaking process for the existing consumer product regulations and for the aerosol paints regulation currently under development.

The perceived "efficacy" of consumer products results from many different qualitative and quantitative factors. As documented in the consumer products rulemaking process, the efficacy of a product, as perceived by the consumer, results from both performance characteristics (e.g., "curl droop" test for hairsprays) and subjective qualities (e.g., product marketing, brand loyalty, pricing, store and product image, couponing, etc.). Because of the many factors that can affect the buying public's perception of a product's efficacy, there are no standardized and generally- accepted test methods for most products that will accurately predict how "efficacious" a product will be viewed by the consumers. We therefore evaluated the concern on reduced efficacy based on the products that exist in the market, product market shares, and discussions with industry representatives.

In the past, based on our analyses, we determined that it is highly likely that reformulated products will be as efficacious as existing products. This conclusion was strongly supported by the fact that a significant number of existing products already met the VOC standards at the time of rule adoption. At that time, these products had combined market shares which were sufficient to demonstrate consumer acceptance. If efficacy was not adequate for these products the market forces would have already resulted in product rejection by consumers, and product failure in the marketplace. This is verification that consumers have accepted low-

VOC complying products. We expect that similar findings will be made when the SIP measures are developed and implemented. Additionally, when these SIP measures are executed we will address any efficacy issues that are raised. We also believe that the consumer product education and awareness element within the proposed SIP will be key to the successful use and understanding of the reformulated consumer products that will be developed as a result of this SIP. During implementation of the SIP measures, if efficacy concerns come to our attention through our contact with manufacturers and the public, we will address the needs of each to minimize any potential impact on efficacy.

7. Water Quality

To reduce VOC content, manufacturers are expected to replace some or most of the VOC in many non-complying products with water, organic compounds with low vapor pressure, or non- VOC compounds. The net effect of compliance with regulations is expected to be an overall reduction in the mass of VOCs emitted to the environment. Thus, we believe that the reduced VOC content will result in a decrease in the amount of VOC loading to water treatment systems.

Because of existing regulations, many household and institutional products which are intended for ultimate disposal into the sewage system are designed to be biodegradable in wastewater treatment systems. We expect that many of these products will be reformulated with compounds which are also biodegradable; there is no data available to indicate that reformulated products will be any less biodegradable than their predecessors. Thus, no adverse impacts to water treatment systems or publicly owned treatment works (POTWs) are expected.

8. Landfills

We expect minimal or even a small positive impact on landfill loading from the existing regulations and the proposed SIP measures. Reformulated products are expected to be packaged in containers identical or similar to current non-complying products. For instance, a switch from a VOC to a non-VOC propellant may require only minor modifications to an aerosol can's internals (e.g., lining, valving, actuator, etc.), but the basic aerosol package should remain the same or nearly the same. If an aerosol product is repackaged into a pump, recyclability should not be adversely affected because both aerosol cans and pump sprays can be recycled if properly repackaged and handled. Indeed, the pump spray has the unique advantage over aerosol cans in that it can be reused and refilled many times, as amply demonstrated by existing pump spray glass cleaners, insecticides, and hairsprays.

Aerosol cans, because of their closed-system design, are inherently "one-use" products, which cannot be refilled by the consumer. Furthermore, we expect some non-complying products to be reformulated to be more concentrated, thereby delivering more product per use and using less packaging. Products reformulated in this way should provide a positive impact on landfill loading. Thus, we expect the existing and SIP measures to have minimal or even a positive impact on solid waste management.

Appendix A. Modified Baseline 2010 Emission Inventories for a Number of Mobile Emissions Sources

The following tables show some modifications made to the official baseline emissions inventory for a number of mobile emissions sources. These modifications were made either following recent regulatory action or as a result of re-evaluation of some emission data. The major modifications that were made were 1) accounting for the impact of California's enhanced inspection and maintenance (I/M) program; 2) adjusting for reduced emission rates of reactive organic gases from 1994 and later on-road heavy-duty diesel engines and off-road diesel engines subject to the ARB's 5.8 gram per brake-horsepower oxides of nitrogen standard; 3) accounting for the impact of the upcoming standards for on- and off-road diesel engines of 4.0 and 6.9 grams of nitrogen oxides per brake-horsepower-hour; 4) accounting for reduced emissions from in-port operations from ocean-going marine vessels. The tables present the baseline emissions values and the "modified" emission values of the modified baseline. This modified baseline is used as the baseline value throughout this document.

Table. Modified Baseline for ROG Compared to Official Baseline (South Coast Air Basin).

	Baseline 2010 Inventory	Modified Baseline 2010 Inventory*
On-Road Motor Vehicles		
Light-duty vehicles	126	103
Medium-duty vehicles†	13	19
Heavy-duty vehicles -- diesel†	43	19
Heavy-duty vehicles -- gasoline†	8	1
Off-Road Mobile Sources		
Industrial equipment -- diesel	32	30
Industrial equipment -- gasoline and LPG	63	63
Pleasure craft	28	28
Marine vessels	3	3
Locomotives	2	2

* Includes the effects of the following: a) The ARB's standards for off-road motorcycles and recreational vehicles, which accomplish an 85 percent reduction in ROG emissions, b) Enhanced I/M, c) Modification of 1994 and later on-road heavy-duty diesel vehicle ROG emission rates, and modification of ROG emission rates for off-road diesel engines subject to the ARB's 5.8 gm/bhp-hr NOx standard.

† Emissions of vehicles 8,501 to 14,000 lbs GVW were moved from the heavy-duty category to the medium-duty vehicle category.

Table. Modified Baseline 2010 Inventory for NOx Compared to Official Baseline (South Coast Air Basin).

Source Category	Baseline 2010 Inventory	Modified Baseline 2010 Inventory*
On-Road Motor Vehicles		
Light-duty vehicles	158	137
Medium-duty vehicles†	39	92
Heavy-duty vehicles -- diesel†	282	208
Heavy-duty vehicles -- gasoline†	45	9
Off-Road Mobile Sources		
Industrial equipment -- diesel	304	212
Industrial equipment -- gasoline and LPG	42	42
Pleasure craft	3	3
Marine vessels (ships)	34	24
Locomotives	35	35
Other off-road (utility/rec vehicles)	1	1

* Includes the effects of the following: a) On-road heavy-duty diesel engine 4.0 gm/bhp-hr NOx standard (1998 implementation), b) The ARB's urban bus engine 4.0 gm/bhp-hr NOx standard (1996 implementation), c) The U.S. EPA's off-road diesel engine 6.9 gm/bhp-hr NOx standard (1996 implementation), d) Enhanced I/M.

† Emissions of vehicles 8,501 to 14,000 lbs GVW were moved from the heavy-duty category to the medium-duty vehicle category.

Appendix B. Description of Mobile Source Control Measures by Emissions Category

Light-Duty Vehicles

Accelerated Retirement - Measure M1
Improved Control Technology - Measure M2

Description of the Category and Emissions

The light-duty vehicle category consists of all passenger cars and light-duty trucks (rated at 6,000 pounds gross vehicle weight or less). Emissions from these sources are combustion emissions (ROG, NOx, CO, and PM) and evaporative emissions (ROG). Due to programs that have been adopted by the ARB, emissions from these sources are expected to be reduced significantly by 2010 even though growth in vehicle population and vehicle miles travelled (VMT) is projected to temper the emission reductions expected. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 baseline emissions represent 82 percent and 65 percent reductions of ROG and NOx emissions, respectively, from the 1990 baseline emission inventory.

SCAB Baseline Emission Inventory (TPD)	**1990**	**2010**
ROG	582	103
NOx	391	137

Existing Control Program

The reductions of emissions from light-duty vehicles are largely the result of the implementation of the Low-Emission Vehicle/Clean Fuels program, stricter evaporative emission requirements, and the fleet turnover that takes place as older vehicles drop out of the fleet and new, low-emitting vehicles enter the fleet. Emission requirements for light-duty vehicles are the most stringent of the ARB's emission controls for motor vehicles.

Additional Emission Reduction Measures

M1 - Accelerated Retirement

In the South Coast Air Basin in 2010, light-duty vehicles eight years and older account for 62 tons per day ROG, which is 60 percent of all light-duty vehicle ROG emissions. This occurs because the newer model vehicles are increasingly emitting at LEV levels, but the remaining older vehicles emit at rates many times higher.

This measure involves the annual retirement (scrap or removal) of up to 75, 000 older, high-emitting vehicles in the South Coast Air Basin, beginning in 1999. A smaller number of vehicles will be retired in 1996 to 1998 in order to gain experience with the program, and to gain insight into effects on the used car market.

It is expected that 1,000 dollars per car will be sufficient to secure older cars for retirement, and to pay for administration of the program. To put this into perspective, the cost of this program could be financed by a seven dollars increase in the annual registration fee of each vehicle, or by a 100 dollars fee on the sale of each new vehicle. A broad coalition of business interests, who are supporting the need for a program to retire vehicles, has agreed to pursue legislation, if needed, to finance the program. The financing mechanism will be secured by the end of 1995.

Implementation of light-duty vehicle retirement programs in other non-attainment areas will be considered as a means of further reducing emissions. However, the commitment in this SIP is limited to implementation of a retirement program in the South Coast Air Basin.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	5	8	11	12	14
NOx	4	6	9	10	11

Responsible Agency: ARB

M2 - Improved Control Technology

The emission reductions due to the measure described here may be achievable in a variety of ways - including market measures as well as the traditional technology forcing standards. Development of cost-effective gasoline engine control technology that will allow most models to meet or exceed ultra-low emission vehicle (ULEV) standards in the post-2003 timeframe is expected. In addition, public acceptance of electric vehicles, coupled with anticipated advancements in battery technology and full implementation of supporting infrastructure, may result in zero-emission vehicle (ZEV) sales exceeding mandated levels post-2003. Advanced hybrid electric vehicles, with emission substantially less that ULEVs, also are expected to be available, allowing further penetration of electric vehicle technology with sub-ULEV emission levels into the light-duty market.

With these technologies, a fleet average non-methane organic gases (NMOG) emission level lower than existing requirements is achievable for year 2005 models through market forces and incentives to purchase lower emitting vehicles, through the application of market forces to achieve cleaner motor vehicles, as well as adoption of complementing emission standards.

Emission reductions of 10 tpd ROG and 15 tpd NOx are expected by 2010, with substantially greater reductions occurring post-2010.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	3	7	10
NOx	0	0	5	9	15

Responsible Agency: ARB

Medium-Duty Vehicles

Accelerated ULEV Standards - Measure M3

Description of the Category and Emissions

The medium-duty vehicle designation consists of large pick-up trucks and vans (rated as having a gross vehicle weight rating of 6,001 to 14,000 pounds for 1995 and later model year and 6,001 to 8,500 pounds for pre-1995 model years). Emissions from these sources are combustion emissions (ROG, NOx, CO, and PM) and evaporative emissions (ROG). For simplicity, the emissions from all vehicles, gasoline and diesel, with gross vehicle weight ratings of 8,501 to 14,000 pounds, in addition to those with gross vehicle weight ratings between 6,001 pounds and 8,500 pounds, are included in the medium-duty source category for all years. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 baseline emissions represent 73 percent and 28 percent reductions of ROG and NOx emissions, respectively, from the 1990 baseline emission inventory.

SCAB Baseline Emission Inventory (TPD)	1990	2010
ROG	75	19
NOx	124	92

Existing Control Program

The reductions of emissions from this category of vehicles are the result of the implementation of more stringent new vehicle emission standards, including the low-emission vehicle (LEV) and ultra-low emission vehicle (ULEV) requirements starting in 1998.

Additional Emission Reduction Measure

M3 - Accelerated ULEV Standards

Development of cost-effective gasoline engine control technology that will allow most medium-duty vehicles to meet ULEV standards is expected. This would allow additional reductions beyond what is currently being achieved for this category.

By applying expected advancements in emission control technologies developed for light-duty vehicles, the fraction of ULEVs that become part of the new medium-duty vehicle fleet will be increased beginning in 1998. The measure described here assumes that technological advancement will enable an increase in medium-duty ULEV's from 10 percent in 1998 model year to 100 percent in 2002 and later model years.

The staff expects that gasoline-technology will be able to meet the requirements in the proposed timeframe. The heaviest medium-duty vehicles may have problems meeting the ULEV standard. However, it may be possible to compensate for this situation through flexible standards which allow credits to be generated by the more populous lighter medium-duty vehicles, In addition, other mixes of vehicles and technologies could provide equivalent emission reductions. Emission reductions of 4 tpd ROG and 32 tpd NOx are expected by 2010, with more reductions occurring post-2010.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	1	2	3	4
NOx	1	9	21	28	32

Responsible Agency: ARB

On-Road Heavy-Duty Diesel Vehicles

Early Introduction Of 2.0 G/BHP-HR NOx Engines - Measure M4
Additional NOx Reductions in California in 2002 - Measure M5
2.0 G/BHP-HR NOx Federal Standard in 2004 - Measure M6
Accelerated Retirement - Measure M7

Description of the Category and Emissions

This category of vehicles includes both California and federal larger trucks designed for on-highway operation, inter-city and urban buses, and larger school buses. The heavy-duty emission inventory category includes vehicles with gross vehicle weight ratings of more than 8,500 pounds. Beginning with the 1995 model year, the heavy-duty vehicle category includes only those vehicles with gross vehicle weight ratings greater than 14,000 pounds. For consistency, the emissions from vehicles with gross vehicle weight ratings of 8,501 to 14,000

pounds, which are subject to medium- duty vehicle requirements in 1995, are included in the medium-duty source category for all years.

In spite of the programs that have been adopted by the ARB and the U.S. EPA, growth in vehicle population and VMT is projected to largely offset the per-vehicle NOx emission reductions achieved. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 baseline emissions represent 42 percent and 5 percent reductions of ROG and NOx emissions, respectively, from the 1990 baseline emission inventory.

SCAB Baseline Emission Inventory (TPD)	**1990**	**2010**
ROG	33	19
NOx	220	208

Existing Control Program

Current emission standards apply to the engine rather than the vehicle. The applicable NOx standard for 1991 and later engines is 5.0 grams per brake horsepower hour (g/bhp-hr). The baseline emission inventory for 2010 presented above includes the effects of a 4.0 g/bhp-hr NOx standard to be implemented nationwide in 1998. The reduction in ROG emissions results from the technologies used to meet the lower PM emission standards beginning in 1994.

Additional Emission Reduction Measures

Heavy-duty bus engines that use alternative fuels can achieve an emission level of 2.0 g/bhp-hr NOx now. In the near future, additional alternatively-fueled truck engines that emit at 2.0 g/bhp-hr NOx or less are expected to be put in service although, practically, they may be limited to urban fleets. Diesel engine control technology is expected to be able to meet a 2.0 g/bhp-hr NOx emission standard by 2002 by using improved engine design (especially in fuel/air management and delivery), exhaust gas recirculation, and exhaust gas aftertreatment. This emission level is a 50 percent reduction from the current federal standard applicable to 1998 and later model year engines. Use of this technology will also reduce ROG emissions by 50 percent compared to 1994 model engines. Other technologies (electric, hybrid-electric, fuel cells) are projected to be able to achieve NOx emissions of less than 1.0 g/bhp-hr in a future timeframe that is less certain.

Heavy-duty vehicles that are registered in other states and participate in interstate commerce are substantial contributors to the total emissions from heavy-duty diesel vehicles (emissions from out-of-state vehicles are projected to account for about 25 percent of emissions from this category in 2010 if the existing similar state and federal emission standards remained in place). State regulations cannot effectively achieve emission reductions from these trucks. In

addition, if state requirements become substantially different and more stringent than the U.S. EPA requirements, California-based purchasers of new trucks would have an incentive to buy their vehicles in the other states in which they operate. This would increase the number of federally-certified heavy-duty trucks operating in California. For these reasons, attainment of air quality standards in California is absolutely dependent on the U.S. EPA adopting a more stringent NOx emission standard, applicable nationwide.

The emission control strategy for on-road heavy-duty vehicles includes the following elements designed to provide emission reductions in areas subject to the 2005 and 2010 attainment deadlines.

M4 - Early Introduction of 2.0 g/bhp-hr NOx engines

Increased use of existing low-emission engines, primarily CNG-fueled, would be achieved through locally implemented demand-side programs and market incentives. This would result in a 5 percent sales penetration of 2.0 g/bhp-hr NOx engines throughout the period 1996 to 1999, and a 10 percent sales penetration of 2.0 g/bhp-hr NOx engines over the period 2000 to 2002. Other combinations of penetration and emissions levels that provide equivalent emission reductions, while minimizing any competitive impacts on urban fleets, could be implemented.

M5 - Additional NOx Reductions in California in 2002

Attainment of the federal ozone standard in Sacramento and Ventura depends on achieving additional reductions in NOx prior to the 2005 attainment deadline. This will be achieved by adoption by the ARB of a 2.0 g/bhp-hr NOx emission standard for new engines sold in California beginning in 2002, or by implementation of alternative measures which achieve equivalent or greater reductions. Alternatives that will be considered include expanded introduction of alternative-fueled and low-emission diesel engines through demand-side programs and incentives, retrofit of aerodynamic devices, reduced idling, and speed reduction.

M6 - 2.0 g/bhp-hr NOx Federal Emission Standard in 2004

The U.S. EPA must adopt a 2.0 g/bhp-hr NOx emission standard for new engines applicable nationwide in 2004. Earlier introduction of this standard on a nationwide basis, although feasible, is prohibited by the federal Clean Air Act. This restriction should be reconsidered by Congress.

Total emission reductions from these three measures of 5 tpd ROG and 73 tpd NOx are expected by 2010, with substantially greater reductions occurring post-2010.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	2	3	5
NOx	2	6	29	48	72

Responsible Agency:
M4: Districts, ARB
M5: ARB
M6: U.S. EPA

M7 - Accelerated Retirement

Previously adopted emission standards, and new emissions standards identified elsewhere in this plan, will cause heavy-duty diesel vehicle emissions to continue to decrease. However, in 2010, eight year and older trucks will still contribute 70 tons per day NOx, which is 35 percent of all on- road diesel truck emissions.

This measure involves the annual retirement (scrapping or removal) of about 1,600 of the oldest, high emitting trucks in the South Coast Air Basin, beginning in 1999. A smaller number of trucks would be scrapped in 1996 to 1998 in order to gain experience with the program, and determine the impacts on the used truck market.

Incentives will be provided to operators of older trucks in return for retirement, and purchase of a newer, lower emitting model. The incentives may take the form of guaranteed low interest loans, or subsidies, or both. The lower maintenance and operating costs of newer diesel engines provide savings to help offset the repayment of the loan. A broad coalition of business interests has agreed to pursue legislation, if needed, to finance the retirement program. The financing mechanism will be secured by the end of 1995.

Implementation of truck retirement programs will be considered in Sacramento, and other non- attainment areas of the state. However, the commitment in this SIP is limited to implementation of a retirement program in the South Coast Air Basin.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	1	1	1	1
NOx	3	6	7	8	10

Responsible Agency:
M7: ARB

Heavy-Duty Gasoline Trucks

California Emission Standards - Measure M8

Description of the Category and Emissions

This category of vehicles consists of the smaller classes of heavy-duty trucks that burn gasoline. Emissions from these sources are combustion emissions (ROG, NOx, CO, and PM) and evaporative emissions (ROG). Heavy-duty gasoline trucks include those trucks greater than 8,500 pounds gross vehicle weight rating (GVWR) until 1994. Beginning in 1995, the smaller trucks in this category, those less than 14,000 pounds GVWR, will be subject to the emission requirements for medium- duty vehicles. For consistency, the emissions from these smaller trucks are included in the emission inventory for medium-duty vehicles. The emissions shown below include all gasoline vehicles with gross vehicle weight ratings of 14,001 pounds or more. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 baseline emissions represent a 75 percent reduction in ROG emissions and no change in NOx emissions from the 1990 baseline emission inventory.

SCAB Baseline Emission Inventory (TPD)	1990	2010
ROG	4	1
NOx	9	9

Existing Control Program

The reductions of emissions from this category of vehicles are largely the result of the implementation of the medium-duty low-emission vehicle (LEV) standards applicable to those vehicles with gross vehicle weight ratings of 8,501 to 14,000 pounds.

Additional Emission Reduction Measure

M8 - California Emission Standards

The existing emission standards for NOx from heavy-duty gasoline engines, used in vehicles with GVWR greater than 14,000 pounds, are the same as those for heavy-duty diesel engines. Additional emission reductions will be achieved through adoption of a LEV/ULEV program for this class of vehicles to obtain 50 percent reductions of NOx and ROG emissions through the application of three-way catalyst technology.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	0	0	0
NOx	0	1	2	2	3

Responsible Agency: ARB

Off-Road Industrial Equipment (Diesel)

2.5 G/BHP-HR NOx; California - Measure M9
2.5 G/BHP-HR NOx; Federal - Measure M10

Description of the Category and Emission

This category includes off-road diesel equipment, including farm and construction equipment. The baseline ROG and NOx emissions for the SCAB from these sources are shown below:

SCAB Baseline Emission Inventory (TPD)	1990	2010
ROG	27	30
NOx	263	212

The 2010 levels represent a 19 percent reduction in NOx emissions from 1990 levels, due to existing control programs.

Existing Control Program

The ARB has adopted HC, NOx and PM standards for equipment 175 horsepower and above. By 1996, these sources will have to comply with a NOx standard of 6.9 g/bhp-hr. Effective in 2001, the NOx standard for engines 175 to 750 horsepower will be reduced to 5.8 g/bhp-hr. Engine technology used to meet the NOx standard of 5.8 g/bhp-hr will also reduce ROG emissions from post-2001 new engines by 50 percent. The U.S. EPA has sole

authority to control new farm and construction equipment less than 175 horsepower, which accounts for 68 percent of the 2010 baseline NOx emissions of the under 175 hp subcategory. The U.S. EPA has adopted a nationwide NOx emission standard of 6.9 g/bhp-hr for compression-ignition (diesel) engines 50 horsepower and greater, to be phased-in beginning in 1997. The measure affects all equipment in this category, including the preempted farm and construction equipment.

Additional Emission Reduction Measures

M9 - 2.5 g/bhp-hr NOx; California
M10 - 2.5 g/bhp-hr NOx; Federal

Transfer of cost-effective on-road diesel engine control technology to new off-road engines will allow most engines to meet more stringent standards in the 2005 and later timeframe. That control technology includes improved engine design (especially in fuel/air management and delivery), exhaust gas recirculation, and exhaust gas aftertreatment.

With these technologies, an emission standard for new engines not primarily used in construction or farm equipment of 2.5 g/bhp-hr NOx will be adopted for year 2005 models. This would be a reduction of 64 percent from the new engine emission standard for engines 50 to 175 horsepower, which is being phased-in nationally beginning in 1997. The reduction would be 57 percent from the California 2001 new engine emission standard for engines 175 horsepower or greater. The technology used to meet these standards will also further reduce ROG emissions from post-2005 new engines.

Because over one half of the emissions of engines in this category cannot be regulated by California due to federal preemption, it is necessary that the U.S. EPA also adopt and implement the 2.5 g/bhp-hr NOx standard in the same timeframe. Since much off-road equipment is used regionally, including states other than California, adoption of this standard by the U.S. EPA on a nationwide basis is necessary to achieve the emission reductions upon which the plan is predicated.

Emission reductions of 8 tpd ROG and 78 tpd NOx beyond those due to the existing program are expected by 2010, with substantially greater reductions occurring post-2010, as more of the fleet is replaced through attrition.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	1	4	8
NOx	0	0	9	35	78

Responsible Agency: U.S. EPA, ARB

Gas and LPG Equipment 25 - 175 Horsepower

Three-Way Catalyst Technology; California - Measure M11
Three-Way Catalyst Technology; Federal - Measure M12

Description of the Category and Emissions

The category consists of off-road gasoline and LPG equipment greater than 25 horsepower and less than 175 horsepower, including forklifts, pumps, compressors, farm equipment, and construction equipment. The U.S. EPA has the sole authority to control new farm and construction equipment less than 175 horsepower, whose 2010 baseline emissions account for approximately 43 percent of ROG and NOx from this category. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 levels represent an increase of 50 percent in ROG and 56 percent in NOx from 1990 levels. The increase is due to growth.

SCAB Baseline Emission Inventory (TPD)	1990	2010
ROG	42	63
NOx	27	42

Existing Control Program

The ARB and the U.S. EPA currently have no emission standards for these sources.

Additional Emission Reduction Measures

M11 - Three-Way Catalyst Technology; California
M12 - Three-Way Catalyst Technology; Federal

Many engines in the category are similar to, or derived from, early 1980s automobile engines. Emission standards for new engines not primarily used in construction or farm equipment will be phased-in beginning in 2000, based on use of closed-loop three-way catalyst systems. The catalyst systems are expected to reduce ROG by 75 percent, and NOx by at least 50 percent.

Because over 40 percent of the emissions of engines in this category cannot be regulated by California due to federal preemption, it is necessary that the U.S. EPA also adopt and implement catalyst system technology requirements in the same timeframe. Since much equipment in this category is used regionally, including states other than California, adoption of this standard by the U.S. EPA on a nationwide basis is necessary to achieve the emission reductions upon which the plan is predicated.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	10	22	34	48
NOx	0	6	12	18	24

Responsible Agency: U.S. EPA, ARB

Marine Vessels

National and International Emission Standards - Measure M13

Description of the Category and Emissions

Ocean-going marine vessels, and harbor vessels exclusive of those used in recreational activities, are included in this category. Included are all naval and commercial marine vessels like tugs, crew/supply boats, fishing boats, as well as cruise ships, roll-ons/roll-offs (RO-ROs), container ships, tankers, etc. The marine vessel fleet ranges in power from approximately 500 horsepower to 67,000 horsepower, and is propelled by diesel engines, steam turbines, or gas turbines. The baseline ROG and NOx emissions for the SCAB from these sources are shown below.

Table. SCAB Baseline Emission Inventory (TPD).

ROG/NOx	1990	2010
ROG	2	3
NOx	30	31

The emissions inventory for 1990 represents 24 tons per day of NOx from ocean-going marine vessels and 6 tons per day of NOx from non-ocean going vessels.

Existing Control Program

The ARB and U.S. EPA currently have no emission standards or operational control measures for these sources although some operational controls have been implemented by local districts.

Additional Emission Reduction Measures

M13 - National and International Emission Standards

Many ocean-going vessels are registered in foreign countries, and most use engines produced outside the U.S. Emissions from new engines used in these vessels can be most effectively reduced by establishing international emission standards, and the U.S. EPA and the International Maritime Organization have begun to address appropriate requirements. The proposed control measure would reduce NOx emissions from new diesel engines used in ocean- going vessels by 30 percent. Assuming a 30 year life expectancy for ocean-going ships, the proposed international standards would result in an overall NOx emission reduction of 10 percent for ocean-going ships in 2010.

Commercial ship traffic control measures can be utilized to further reduce ocean-going ship emissions. Relocation of the Southern California shipping channel to outside the Channel Islands would reduce the impact of ship emissions in both the Ventura and South Coast Air Basins. Reduction in ship speeds may also reduce ship emissions.

Emission reductions achieved by the proposed ocean-going ship control measures are dependent upon actual ship operations and associated emissions. Uncertainty remains regarding the actual emissions of this previously unregulated source and the emission inventory is under review. It is, however, estimated that the proposed ocean-going ship international engine standards and ship traffic control measures combined could reduce emissions by approximately 6 tons of NOx per day in the year 2010.

Many non-ocean going vessels (captive fleet vessels) use engines derived from heavy-duty truck or locomotive engines, and NOx emissions can be reduced by at least 65 percent by the U.S. EPA establishing emission limits for new engines used in these vessels.

Technology being developed to meet more stringent standards for on-road diesel trucks and locomotives would be used. Assuming a life expectancy of 16 years for the captive fleet, the proposed measure would result in an overall NOx emission reduction of approximately 50 percent (3 tons per day) in 2010.

Further reductions can be achieved through locally adopted/enforced measures which encourage the use of cleaner/newer engines in nonattainment areas, or provide incentives to reduce emissions at the ports. The degree to which these and other similar approaches can contribute to lower emissions by 2010 has not yet been assessed.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	0	0	0
NOx	0	4	6	7	9

Responsible Agency: U.S. EPA/International Maritime Organization, U.S. Coast Guard

Locomotives

National Emission Standards - Measure M14

Description of the Category and Emissions

This category includes new and in-use locomotives used in line-haul, local, and switch yard service. Federal law preempts California from setting standards for new locomotives and new engines used in locomotives. The baseline ROG and NOx emissions for the SCAB from these sources are shown below.

Table. SCAB Baseline Emission Inventory (TPD).

ROG/NOx	1990	2010
ROG	2	2
NOx	32	35

Existing Control Program

The ARB and the U.S. EPA currently have no emission standards for these sources.

Additional Emission Reduction Measure

M14 - National Emission Standards

Section 213 of the federal Clean Air Act directs the U.S. EPA to adopt emission standards applicable to new locomotives and new engines used in locomotives by 1995, and a proposed rulemaking is expected to be published early next year. The ARB plans to take credit for the locomotive emission reductions that will result due to the promulgation of the Section 213 rules by the U.S. EPA.

The ARB expects that as part of the U.S. EPA's Section 213 authority, the U.S. EPA will adopt national emission standards which are the most stringent, feasible standards possible.

Moreover, the ARB anticipates that locomotive engine emission standards will be met primarily through the use of diesel fuel and the transfer of emission control technologies from clean truck engines. The control technology needed to achieve these reductions has not yet been developed commercially; it might include diesel engine modifications, electronic fuel injection, improved cooling, aftertreatment, and/or use of EGR.

The 1994 SIP assumes that the U.S. EPA will adopt a two-tiered national NOx standard for new locomotives, which will decrease the standard on average by 58 percent effective in 2000, and by 67 percent effective in 2005. In addition, the ARB anticipates that the U.S. EPA will propose a national emission standard for remanufactured engines which reduces emissions on average by 33 percent for this class of engines, beginning in 2000.

Most importantly for the California SIP, the ARB assumes that by 2010 locomotive fleets in the SCAB will be required to emit on average no more than the U.S. EPA-established 2005 emission level for new locomotives. This compliance requirement would be met by the use of only the cleanest engines within the SCAB non-attainment area by an aggressive phase-in of these engines over five years. In essence, this fleet average requirement represents the most aggressive scrappage and replacement program of any transportation source in the SCAB (in effect, 100 percent scrappage/replacement with the latest, low-emitting locomotives over 5 years from 2005-2010). It would lead to an overall emission reduction of 67 percent by 2010.

If the U.S. EPA adopts a different 2005 emission standard than the standard on which the ARB has based its 1994 SIP revisions, the fleet average requirement and reduction assumptions would have to be revisited.

The national Section 213 emission standards for new locomotives and new engines used in locomotives will lead to significant emission reductions throughout the state as newer and lower emitting locomotive engines are purchased and as in-use locomotives are remanufactured. Accordingly, the ARB intends to take credit for a near-term 42 percent NOx reduction by 2005. This reduction level is consistent with the U.S. EPA's published estimates of the emission reduction impact of the phase-in of locomotives meeting the national emission standards to be adopted by the U.S. EPA under its Section 213 standard setting authority. The ARB will also consider operational controls, such as reduced idling and use of California diesel fuel, if, based on the U.S. EPA final rule, additional emission reductions are needed.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	0	0	0
NOx	0	4	14	18	23

Responsible Agency: U.S. EPA, ARB

Aircraft

National Emission Standards - Measure M15

Description of the Category and Emissions

This category includes military, commercial, and general aviation. The ARB is preempted from setting emission standards for aircraft. The U.S. EPA currently has hydrocarbon emission standards for new commercial aircraft engines and the International Civil Aviation Organization has hydrocarbon, NOx, and CO standards for new engines. The federal hydrocarbon emission standards do not apply to military aircraft. Military aircraft are also exempted from any future controls. The baseline ROG and NOx emissions for the SCAB from these sources are shown below. The 2010 baseline emissions represent 19 percent and 38 percent increases of ROG and NOx emissions, respectively, from the 1990 baseline emission inventory.

Table. SCAB Baseline Emission Inventory (TPD).

ROG/NOx	1990	2010
ROG	16	19
NOx	13	18

Existing Control Program

The U.S. EPA implemented a nationwide hydrocarbon emission standard for new commercial aircraft engines in 1984.

Additional Emission Reduction Measure

M15 - National Emission Standards

The U.S. EPA needs to strengthen its existing nationwide hydrocarbon emission standard for aircraft engines as well as adopt a stringent national emission standard for NOx. Specifically, the U.S. EPA needs to adopt standards to effect a 30 percent reduction in ROG and NOx emissions beginning in 2000. Because emissions from military aircraft comprise a significant fraction of emissions from aviation activities, the exempt status of these aircraft should be reconsidered.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	0	1	1	3
NOx	0	0	1	1	4

Responsible Agency: U.S. EPA

Pleasure Craft

Nationwide Emission Standards - Measure M16

Description of the Category and Emissions

Pleasure craft are recreational boats and personal watercraft used in inland waterways and coastal areas. Gasoline engines, including 2-stroke and 4-stroke, are most often used in this application, but diesel engines are also used. The baseline ROG and NOx emissions for the SCAB from these sources are shown below.

Table. SCAB Baseline Emission Inventory (TPD).

ROG/NOx	1990	2010
ROG	25	29
NOx	3	3

Existing Control Program

These sources are currently uncontrolled.

Additional Emission Reduction Measure

M16 - Nationwide Emission Standards

The U.S. EPA has proposed nationwide regulations that would reduce ROG emissions of new outboard and personal watercraft gasoline equipment in this category by 75 percent, with an emission cap for all other watercraft to be phased-in beginning in 1998. In addition, standards of 8.0 g ROG/kw-hr and 6.5 g NOx/kw-hr are being considered by the U.S. EPA with a five year phase-in beginning in 1998 for inboard and stern-drive gasoline engines. Emission reductions will be obtained using carburetor modifications, fuel injection, improved calibration and fueling systems, and possibly aftertreatment. In addition, since 4-stroke

engines are significantly cleaner than 2-stroke engine configurations, a usage shift, which is expected, would result in substantial ROG emission reductions. Additional reductions of ROG emissions from current 4-stroke gasoline equipment are expected as well due to advancement in technology.

Table. Emission Reductions (SCAB), tpd.

ROG/NOx	1999	2002	2005	2007	2010
ROG	0	3	6	8	12
NOx	0	0	0	0	0

Responsible Agency: U.S. EPA

Appendix C. Description of Consumer Products Measures

I. Consumer Products

A. Background

1. Description of the Category and Emissions

Consumer products are chemically formulated products which are used by household, commercial, and industrial consumers. These include personal care, household care, automobile care, and non-agricultural pesticide products. Many of these products contain volatile organic compounds (VOCs, note: VOCs are equivalent to ROGs), in quantities ranging from a few percent by weight up to 100 percent by weight. The VOCs serve as solvents, propellants, carriers, or active ingredients. When the product is used, the VOCs usually evaporate and then contribute to the formation of urban smog. Collectively these emissions are very significant. In 1990, for example, consumer products contributed about 15 percent of the statewide non-vehicular VOC emissions. The ARB has adopted consumer products regulations to control the VOC contents for many of these products.

The 1990 ARB emissions inventory shows about 235 tons per day statewide and 100 tons per day in the SCAB of consumer product VOC emissions, not including approximately 30 tons per day statewide and 14 tons per day in the SCAB from aerosol paints. The SCAB consumer products baseline controlled emissions are projected to be approximately 80 and 95 tons per day in the years 2000 and 2010, respectively, based on an estimated overall control efficiency of 30 percent. Without these regulations, the baseline uncontrolled emissions for consumer products in the SCAB are projected to be about 117 and 135 tons per day in the years 2000 and 2010, respectively.

2. Existing Control Program

The ARB has primary authority over consumer products and has taken several regulatory actions over the past 5 years to reduce the VOC emissions from consumer products. The existing ARB regulations cover 27 product categories which are identified in Table 1. (Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Articles 1 and 2, sections 94500-94517) These regulations were adopted in accordance with the California Clean Air Act requirements for reducing VOC emissions from consumer products and reduce VOC emissions primarily through "command-and-control" methods. Under this approach, the regulations specify maximum allowable VOC content limits (by weight percent) for individual product categories. The existing regulations provide additional flexibility through the Innovative Products provision. This provision allows the sale of a product which exceeds the limits but, through special formulation or packaging, emits less VOCs than a representative product which meets the applicable limit. The existing regulations will result in approximately a 30 percent reduction in the VOC emissions from consumer products relative to the 1990 emissions baseline. While these regulations are not currently part of the SIP, the

ARB staff is currently preparing the regulations for SIP submittal by November 15, 1994, to ensure that these measures which are needed for progress and attainment in the SCAB and other non-attainment districts are recognized by U.S. EPA.

Table 1. Consumer Product Categories Subject to Existing Regulation.

Category	Category	Category
Antiperspirants and Deodorants	Air Fresheners	Aerosol Cooking Sprays
Automotive Brake Cleaners	Automotive Windshield Washer Fluid	Bathroom and Tile Cleaners
Charcoal Lighter Material	Carburetor-Choke Cleaners	Dusting Aids
Engine Degreasers	Fabric Protectants	Floor Polishes/Waxes
Furniture Maintenance Products	General Purpose Cleaners	Glass Cleaners
Hairsprays	Hair Mousses	Hair Styling Gels
Household Adhesives	Insecticides	Insect Repellents
Laundry Prewash	Laundry Starch Products	Nail Polish Removers
Oven Cleaners	Personal Fragrance Products	Shaving Creams

The ARB also recently approved an ACP regulation. The ACP is designed to provide manufacturers of consumer products additional flexibility in meeting the requirements of the consumer products regulation, reduce the overall cost of compliance with the existing consumer products regulation and improve the effectiveness of the consumer products program. The ACP is a voluntary, market-based regulation which employs the concept of an aggregate emissions cap or "bubble." An emissions bubble places an overall limit on the aggregate emissions from a group of products, rather than placing a limit on the VOC content or emissions from each individual product. Manufacturers who voluntarily choose to enter the ACP program would select the products and formulate a detailed ACP bubble program (ACP Plan) for those products. Approval of an ACP plan would be contingent on whether it satisfactorily meets the proposed approval process requirements. An approvable ACP plan must demonstrate that the total VOC emissions under the bubble would not exceed the emissions that would have resulted had the products been formulated to meet

the VOC standards. In addition, the proposed plan must be based on accurate and enforceable records of ACP product sales in California to ensure that all emission reductions will be real and quantifiable. Once approved, the manufacturer must sell its products in accordance with the conditions contained within the ACP plan. Under an approved ACP plan, the manufacturer could sell products that exceed the VOC standards specified in the existing regulations, provided that the emissions from these high-VOC products will be sufficiently offset by the emissions from products reformulated to overcomply with the VOC standards. Overall, compliance with approved ACP plans will ensure that the total VOC emissions from the selected products will be no greater than the aggregate emissions that would have occurred from those products had they been reformulated to meet the existing VOC standards.

The ACP is intended to achieve equivalency with the existing consumer product regulations. As such, the ACP is designed to limit VOC emissions from consumer products under approved emission bubbles to no more than the emissions that would have occurred from the products under the existing VOC standards without the ACP. While additional emission reductions are not mandated by the ACP, the ARB staff expect that emission reductions above that achieved by the consumer products regulation may be realized. This is because the ACP reduces the cost to comply with the consumer products regulation, resulting in additional resources to develop new technologies many of which may be low VOC technologies.

The ARB staff intend to submit the ACP as part of the SIP in 1995. Over the past 2 years during the development of the regulation, ARB staff have worked closely with U.S. EPA staff to ensure consistency with U.S. EPA's Economic Incentive Program guidance. The U.S. EPA supported the ARB adoption of the ACP at its September 1994 hearing.

B. Further Control Measures

Additional Emission Reduction Measures

To help reach attainment in the SCAB, the 2010 emission inventory for consumer products needs to be reduced by about 85 percent or to approximately 15 tons per day. To achieve this goal, a number of strategies will need to be implemented, many of which require significant advances in the development of low-VOC technologies and cooperation between the Federal Government, ARB, California consumers and industry. The control strategies for consumer products are summarized below and categorized under near term, mid term, and long term measures according to the three components of the consumer products control strategy. The near term measures rely on submittal of the existing consumer products regulations as part of the SIP. The mid term measures rely on available control technologies and are proposed to be implemented between 1995 and 2005. These measures are based on the traditional command and control and alternative approaches to achieve emission reductions. The long term measures depend on the advancement of technologies and market incentive methods that can be fostered and developed between now and 2010. Further development and refinement of new low- and zero-VOC emitting technologies in

addition to innovative technological breakthroughs is critical to the successful implementation of these new technology measures. The ARB staff intend to use section 182(e)(5) commitments for these emission reduction strategies. We will not rely on section 182(e)(5) measures to achieve year 2000 needed emission reductions.

1. Near-Term Measures

The near term measures for consumer products will consist of submitting the existing consumer products regulation and the recently adopted alternative control plan regulation to the U.S. EPA as a SIP revision. The existing regulations (Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Articles 1 and 2, Sections 94500-94517), which will achieve a 30% reduction in VOC emissions upon full implementation, will be submitted to U.S. EPA by November 15, 1994. The ACP will be submitted as part of the SIP in 1995. In addition, as part of the Near- Term Measures, the ARB will adopt a statewide regulation to achieve a 60% emission reduction from aerosol paints as required by the CCAA.

2. Mid-Term Measures

a. Establish Consumer Products Working Group

To facilitate the development and implementation of future consumer products control measures, the ARB staff will establish a consumer products working group. This working group will be advisory in nature and will be comprised of representatives from the ARB, industry, environmental groups, the local districts, and U.S. EPA. This working group will provide a forum for on-going communication, cooperation, and coordination in the development of consumer product control measures. We are planning to conduct the first meeting of the workgroup in Spring 1995.

b. Develop and Implement Regulations for Unregulated Product Categories

Many consumer products are not regulated under California's consumer product regulation. According to a recent survey conducted by the U.S. EPA, there are over 200 consumer product categories that would be considered as "consumer products" according to the definition in California Health and Safety Code Section 41712. Currently only 27 consumer product categories are subject to ARB regulations. The ARB staff intend to develop and implement by the year 2005 regulations for additional product categories not currently subject to existing regulations. These regulations, which are referred to as Phase III, would be developed over the next two years with the ARB adoption scheduled for July 1997 with full implementation of all standards by 2005. To determine the appropriate categories for control, the ARB staff will evaluate those product categories identified in the U.S. EPA survey that are not subject to current ARB regulations. These product categories are identified in Table 2. Examples include lubricants, aerosol tire inflators, specialty cleaners, nail polish, and numerous other categories. Since the additional products have never been regulated with respect to the VOC content, and are responsible for about half of the consumer products inventory, we are projecting an additional reduction of 25 percent or about 65 tons per day statewide and about 30 tons per day in the SCAB from the 1990 baseline emissions. This 25%

reduction is slightly less than the emission reductions achieved from the existing regulations, in part due to the fact that the larger consumer product categories, most notably hair sprays and automotive windshield washer fluid, were regulated in the existing regulations and were responsible for a significant portion of the emission reductions achieved by these regulations. During the Phase III development process, we will also work to further our understanding of photochemical reactivity of consumer product VOCs and evaluate the applicability of incorporating reactivity considerations. The proposed implementation schedule for these regulations is presented below. Although it is impossible to fully estimate the cost of such measures at this time, we expect that the overall cost effectiveness (in terms of "dollars per ton of pollutant reduced" will be comparable to that of other VOC measures being adopted in the late 1990's timeframe. The actual cost impacts of the regulations will be quantified and evaluated during the regulatory development process.

Table 2: Examples of Consumer Products Identified in the U.S. EPA Comprehensive Emissions Inventory*

Product	**Product**	**Product**	**Product**
Hair Bleach/Lighteners	Skin Protectants	Plant Leaf Cleaners	Insulating/Seal Foam
Hair Conditioners	Depilatories	Driveway Cleaners	Driveway Patch
Conditioning Sprays	Self-Tanning Products	Misc. HH Products	Cold Process Roof Glue
Curl Activators	Suntan Oils/Lotion	Auto Waxes/Polishes	Other Sealants
Curl Revitalizers	Sunscreens	Vinyl/Leather Cleaners	Wasp/Hornet Sprays
Hair Dyes	Other Facial/Body	Upholstery Cleaners	Other Insecticides
Permanent Wave	Plaque Removal Solns.	Tire Cleaners	Lawn/Garden Fungicid
Setting Lotions	Fluoride Rinses	Wheel Cleaners	Wood Preservatives
Shampoos	Over-the-Counter Drug	Bug and Tar Removers	Other Fung/Nematicide
Spray Shines	Prescription Drugs	Chrome Cleaners	Swim Pool Algicide
Tonics	Other Health Use	Rubber/Vinyl Protect	Herbicides/Defoliants

Product	Product	Product	Product
Other Hair Care	Hand Cleaners/Soaps	Other Auto Detailing	Other Herbicides
Foot Deodorant Spray	Rubbing Alcohol	Brake Anti-Squeal	Sanitizers
Bath Oils/Beads	Misc. Personal Care	Tire Sealants/Inflators	Disinfectants
Baby Powders	Toilet Bowl Cleaners	Belt Dressings	Sterilants
Body Powders	Soap Scouring Pads	Engine Starting Fluids	Other Antimicrobial
Foot Powders	Metal Cleansers	Auto Lubricants	Cat & Dog Repellants
Other Powders	Hard Surface Cleaners	Brake Fluids	Rodent Poisons/Baits
Nail Polishes	Carpet Cleaners	Body Repair	Misc. FIFRA Products
Nail Base/Undercoats	Carpet Deodorizers	Other Auto Repair	Paint Removers
Other Nail Care	Upholstery Cleaners	Arts/Crafts Adhesives	Brush Cleaners
Astringents	Spot Removers	Carpet/Tile Adhesives	Artist Paints/Thinners
Face Creams/Scrubs	Antistatic Sprays	Wallpaper Adhesives	Specialty Cleaning
Rouges and Blushes	Dry Cleaning Fluids	Woodworking Glues	Other Art/Craft Supply
Foundation/Fixatives	Other Fabric Care	Pipe Cements/Primers	Animal Drugs
Lipsticks	Manual Dish Soap	Thread Locking Glues	Animal Grooming
Moisturizers	Machine Dish Soap	Automotive Adhesives	Cat Litter
Skin Lighteners	Leather Treatments	Construction Adhesive	Other Vet Products
Facial Masques	Shoe Polishes	Other Misc. Adhesives	Whipped Dessert
Mascara	Other Leather Care	Window Glazing	Other Food Products

Product	Product	Product	Product
Eyeliner	Household Lubricants	Pipe Thread Sealants	Pens
Eye Shadow	Drain Openers	Plumbers Putties	Markers
Hand/Body Lotion	Wick Lamp Fuels	Wood Fillers	Other Office Products

* The ARB staff has not yet evaluated the categories in the U.S. E.P.A. Survey as to the appropriateness of control. As part of the Phase III Regulation development, ARB staff will evaluate each consumer product category to determine if control is feasible and cost-effective.

Source: Draft Report to Congress, "Volatile Organic Compound Emissions from Consumer and Commercial Products," Volume 2, Comprehensive Emissions Inventory.

Table 3. Proposed Implementation Schedule - Mid-Term Measures

Milestone	Completion Date
First Meeting of Consumer Products Working Group	March 1995
Identify Product Categories for Regulation	November 1995
Develop Regulatory Language for Public Comment	March 1996
Workshops/Preparation of Technical Support Documentation	March - December 1996
Air Resources Board Adoption of Regulation	June 1997
Implementation of Product Specific VOC Limitations	January 2000-2005

3. Long Term Measures

As stated previously, the long term measures include strategies that depend on significant advancement of technologies and market incentive methods that can be fostered and

developed between 1994 and 2010. The consumer products working group that was discussed under the mid-term measures, will play an important role in assisting the ARB staff with prioritizing the long term efforts, coordinating with U.S. EPA and further refining of the control measures. The long term measures encompass three major elements - advanced technology and market incentives, consumer education, and increased cooperation with U.S. EPA. These long term measures will be pursued as a SIP measure under the provisions of CAA section 182(e)(5). These elements, in combination with the near and mid-term measures, will assure the success of the overall effort to achieve further emission reductions from consumer products.

a. New Technology Measures and Market Incentives

To realize significant additional emission reductions from consumer products, new technologically and commercially feasible technologies will need to be encouraged and developed. It is clear that to realize these reductions, many other consumer products will need to be addressed including those that have been regulated under existing regulations and those currently not regulated. Market incentive programs can be developed to encompass the entire universe of consumer products (regulated and non-regulated) to achieve predictable and fixed rates of emission reductions per year. Strategies to be investigated that can foster developments in very low VOC-emitting and other innovative technologies include market incentives and other programs such as:

- Initiation of joint Federal/ARB/academia/private industry research programs to promote significant technological breakthroughs to achieve very low- or zero- VOC products in all regulated categories and to increase the understanding of consumer products emissions and their role in ozone formation;
- Evaluate the feasibility and applicability of incorporating photochemical reactivity considerations into the consumer products control strategy;
- Decreasing ACP emission bubbles combined with marketable permit programs;
- Voluntary Early Reduction Programs;
- Environmental labeling to recognize ultra low-emitting and zero-emitting consumer products;
- Tax incentives such as Federal subsidies for Research and Development, tax rebates for companies that undertake cooperate polices to reduce VOC use in all products;
- Pricing mechanisms to foster very low VOC and very low VOC-emitting technologies through manufacturing, formulation, and consumer usage changes - revenues from such programs can be directed into cooperative research programs or SERP programs (see below);
- Deposit/rebate programs;

- Programs similar to the Super-Efficient Refrigerator Program (SERP), where financial incentives/rewards are provided to manufacturers of the lowest VOC (with high efficacy) products in product categories with significant emissions; and
- Volunteer recognition/certification programs, similar to the U.S. EPA's Energy Star program for computers.

With innovative technological breakthroughs, the new technology control measures along with the market incentive measures can achieve an additional 30 percent reduction or 80 tons per day statewide and 35 tons per day in the SCAB from the 1990 baseline emissions. All combined, the existing consumer products regulations and the mid-term measures, along with the proposed Long Term Measures, are designed to achieve approximately a 85 percent reduction from 1990 baseline emission levels. It is very difficult to project the cost of the new control measures that will rely on technology not yet available. However, we expect the cost effectiveness of these future control strategies to be similar to the cost of other VOC control measures being adopted around the 2010 timeframe.

b. Consumer Education/Awareness

To maximize the emission reductions from consumer products it is important that the end users be engaged in the effort to reduce VOC emissions. This element of our overall program is designed to involve the consumer and to help them make choices that will reduce environmental burdens. These include:

- Environmental labeling/reward programs;
- Intensive public education programs;
- Incentives to purchase and use ultra low VOC products

Although these measures may result in emission reductions, we are not relying on emission reductions from these measures. We believe however, that these measures will be instrumental in the successful implementation of the other elements of our consumer products control program. The cost effectiveness of these educational/labeling measures is also unknown at this time. As these measures are developed, the ARB staff will analyze the potential cost impact associated with implementing these measures and will provide the cost effectiveness information as it becomes available.

c. Increased Cooperation/Coordination with U.S. EPA

U.S. EPA can play an important role in reducing emissions from consumer products. The federal CAA requires U.S. EPA to develop consumer product control measures. As part of this effort, the ARB expects the Federal Government to meet its mandate in a timely fashion. We will coordinate our control efforts with those of the U.S. EPA. In addition, we will invite U.S. EPA to participate on our consumer products working group to help facilitate the exchange of data and information between ARB and the U.S. EPA.

The development and implementation of the long term measures will occur between 1995 and 2010. As a first step, the consumer products working group will assist the ARB staff in further refining the potential measures and prioritizing them for implementation. It is envisioned that the strategies will be prioritized into 3 groups with implementation in 3 phases. In this manner, the implementation of these strategies can proceed in an orderly fashion. Of the 85% overall reduction target, the goal is to achieve a 30 percent reduction from the long term measures by the year 2010. The implementation of the control strategies will occur in 3 phases according to the time table presented in Table 4 below.

Table 4. Proposed Implementation Schedule - Long-Term Measures

Milestone	**Completion Date**
Working Group Discussions	Ongoing
Prioritize Strategies for Development	January 1996
Design and Workshop Strategies	Ongoing
Air Resources Board Adoption - Group I Strategies	December 2001
Implement Strategies - Group I	January 2002-2010
Air Resources Board Adoption - Group II Strategies	December 2003
Implement Strategies - Group II	January 2004-2010
Air Resources Board Adoption - Group III Strategies	December 2005
Implement Strategies - Group III	January 2006-2010

Particulars of Controls

Responsible Agency: ARB

Table. Statewide ROG and SCAB ROG.

Table	**Statewide ROG (tpd)**	**SCAB ROG (tpd)**

1990 Baseline Emissions:	235	100
2005 Emissions:	140	55
2010 Emissions Remaining After All Measures:	43	17

II. Aerosol Paint

A. Background

1. Description of the Category and Emissions

This category consists of paint, varnish, and related products dispensed from disposable aerosol containers. Emissions from aerosol paints come from the solvents and propellants used in these products, which are primarily volatile organic compounds (VOC).

Volatile organic compound emissions from aerosol paint in California are estimated to be about 30 tons per day in 1990. In the SCAB, the 1990 baseline VOC emissions are estimated to be about 14 tons per day. However, VOC emissions from aerosol paints may have decreased since 1990 in California due to aerosol paint "lockup laws" designed to discourage graffiti, the adoption of the Bay Area's aerosol paint regulation, and the state of the economy in California. While the sales of aerosol paint are currently rising nationally, it is difficult to predict whether sales will rise or fall in California in the next decade. Assuming that sales remain flat overall from 1990 to 2000, then grow with population growth in the next decade, the emissions would be about 16 tons per day in 2010 in the SCAB.

2. Existing Control Program

The only existing regulation in California limiting VOC emissions from aerosol paint is the Bay Area AQMD Rule 8-49. The estimated reduction in emissions from this regulation is 1 ton per day (all in the Bay Area). There are no regulations currently in effect in the SCAB. Recently, amendments to the California Clean Air Act designated the ARB as the agency responsible for reducing VOC emissions from aerosol paints and established specific reduction requirements. Under these amendments, the ARB is required to: adopt a statewide regulation by January 1, 1995, which is designed to achieve a 60 percent emission reduction by December 31, 1999; hold a hearing on or before December 31, 1998, to review the technological and commercial feasibility of the 12/31/99 standards; and establish interim standards prior to 12/31/99.

B. Further Control Measures

1. Additional Emission Reduction Measures

Based on the AQMP adopted, to reach attainment, the 2010 emission inventory for this category needs to be reduced to about 5 tons per day of ROG. To reach this target will require the investigation of innovative strategies that promote the development of low VOC technologies and foster these developments through the use of market incentives. The strategies that are envisioned for aerosol paints are summarized below and categorized into "short term measures" and "new technology measures." The short term measures rely on available control technologies and are proposed to be implemented between 1995 and 2005. These measures are based on the traditional command and control approach and also on alternative approaches to achieve emission reductions. The new technology measures depend on the advancement of technologies and market incentive methods that can be fostered and developed between 1994 and 2010. Further development and refinement of new low- and zero- VOC technologies in addition to innovative technological breakthroughs is critical to the successful implementation of these new technology measures. The ARB staff intend to use section 182(e)(5) commitments for these emission reduction strategies.

2. Near Term Measures

a. Adoption and Implementation of the Aerosol Paint Regulation Mandated by the California Clean Air Act

The ARB staff is currently developing a regulation that is scheduled to be considered by the ARB in January 1995. The regulation will fulfill the state law requirement to implement a regulation that is designed to achieve a 60 percent emission reduction by December 31,1999, relative to the 1989 baseline year. The proposed regulation would establish VOC content limits specified for 35 different categories of aerosol paint. There are two tiers of standards proposed. The first tier of standards is proposed for January 1, 1996, and the second for December 31, 1999. Assuming no growth or decline in sales between 1990 and 2000, the currently proposed draft aerosol paint regulation would achieve emissions reductions in the SCAB of approximately 2 tons per day by 1996 and a cumulative total reduction of about 10 tons per day by December 31, 1999. The enabling legislation for this measure, requires the ARB to conduct a hearing on or before December 31, 1998 to determine the commercial and technological feasibility of achieving full compliance with the final limits. If appropriate, the ARB may grant an extension of time, not to exceed 5 years. During any such extension of time, the most stringent interim limits shall be applicable. A special recognition program which would recognize low-VOC aerosol paints is also being explored as a voluntary program that would augment the aerosol paint regulation. Such a program would be used to reward aerosol paints which achieve early compliance or lower their VOC content below the requirements in the aerosol paint regulation. The ARB staff intend to submit the aerosol paint regulation to the SIP in 1995, after approval by the Office of Administrative Law. Based on the current draft of the regulation, the ARB staff estimate

that the cost effectiveness of the proposed regulation is $3 to $5 dollars per pound of VOC reduced. It is expected that when the second tier of standards is finally established, the cost effectiveness will be comparable to other VOC regulations adopted during the late 1990s.

Table 5. Proposed Implementation Schedule - Near-Term Measures for Aerosol Paint

Milestone	Completion Date
Workshop Draft Regulation	October 1994
Air Resources Board Adoption of Regulation	January 1995
Implementation of Product Specific VOC Limitations	January 1996- December 1998
Mandated Interim Hearing	June 1998

3. Long Term Measures

a. New Technology Measures

To realize additional emission reductions from aerosol paints, technologies that are not currently available will need to be developed and deployed. For example, aerosol paints may eventually be able to be formulated with VOC contents at or near zero, if major breakthroughs in resin technology, non-VOC solvent and propellant systems, and valve design occur. Currently, some "brush-on" paints already have reached VOC levels at or near zero VOC. However, formulating zero VOC aerosol spray paints may pose unique challenges different from those encountered in the development of near-zero VOC "brush- on" paints. Market incentive approaches may also be explored as a vehicle to spur the development of low-and zero-VOC aerosol paints. Market incentive approaches may also be explored as a vehicle to spur the development of low-and zero-VOC aerosol paints. Options for market incentive programs were outlined in the section for consumer products. Provided that there are innovative technological breakthroughs and that these measures are implemented, an estimated additional 25 percent reduction or about 3 tons per day relative to uncontrolled 2010 emissions may be realized. Overall, if the short and long term measures are implemented, the emissions from aerosol paints will be reduced by approximately 85 percent relative to 2010 uncontrolled emissions. While the cost effectiveness of these measures is not currently known, it is expected that the cost effectiveness will be similar to other measures adopted around the turn of the century. As the measures are developed, the ARB staff will analyze the potential cost impact and provide the information as it becomes available.

b. Consumer Education/Awareness

Similar to those measures discussed for consumer products, the ARB staff will implement programs to assist the consumer in making choices that benefit clean air. The particulars of the consumer education component was discussed in the previous section for consumer products.

c. Increased Cooperation/Coordination with U.S. EPA

Similar to the consumer products control strategy, improved coordination with U.S. EPA will assist California's efforts to reduce emissions from aerosol paints. The particulars of this element are similar to the increased cooperation/coordination component discussed in the section for consumer products.

Table 6. Proposed Implementation Schedule - Long-Term Measures.

Milestone	**Completion Date**
Prioritize Strategies for Development	January 1996
Design and Workshop Strategies	Ongoing
Air Resources Board Adoption - Group I Strategies	December 2001
Implement Strategies - Group I	January 2002-2010
Air Resources Board Adoption - Group II Strategies	December 2003
Implement Strategies - Group II	January 2004-2010
Air Resources Board Adoption - Group III Strategies	December 2005
Implement Strategies - Group III	January 2006-2010

Particulars of Controls

Responsible Agency: ARB

Table. Statewide ROG and SCAB ROG.

Table	Statewide ROG (tpd)	SCAB ROG (tpd)
1990 Baseline Emissions:	30	15
2005 Emissions:	15	6
2010 Emissions Remaining After All Measures:	5	<5