SUMMARY OF BOARD ITEM

AGENDA ITEM # 03-5-2: Public Hearing to Consider Approval of the Proposed 2003 State Implementation Plan (SIP) for Particulate Matter in the San Joaquin Valley, Including New State Strategies to Reduce Emissions

STAFF RECOMMENDATION: We recommend that the Board approve a State commitment to achieve an additional ten tons per day (tpd) of nitrogen oxides (NOx) and ½ tpd of direct particulate matter 10 microns or less (PM10) by 2010 consistent with the attainment demonstration in the 2003 San Joaquin PM10 Plan (Plan). We also recommend that the Board commit staff to develop and submit to the board the six new statewide measures included in the Plan.

Contingent on adoption of the Plan by the San Joaquin Valley Unified Air Pollution Control District (District), we recommend that the Board approve the Plan as a revision to the California SIP for submittal to the U.S. Environmental Protection Agency (U.S. EPA). This Plan is the next necessary and appropriate step for protecting public health in the San Joaquin Valley.

DISCUSSION: The District prepared the Plan and will consider adoption following a hearing on June 19, 2003. The Plan defines how the San Joaquin Valley will continue progress and attain federal PM10 standards by 2010. The emission reduction strategy includes existing and new control measures to reduce directly emitted PM10 and PM10 precursor emissions (NOx and sulfur oxides) by a combined 245 tpd by 2010.

The bulk of the reductions in the Plan comes from California's existing control program for cleaner vehicles and fuels. The Plan also relies on six new statewide control measures for passenger vehicles, heavy-duty trucks and buses, and off-road equipment.

The Plan includes local commitments to adopt new control measures achieving over 66 tpd of additional direct PM10 reductions, over 16 tpd of NOx reductions, and six tpd of sulfur oxides reductions by 2010. The local strategy affects sources under District jurisdiction, including agriculture

operations, industrial facilities, paved and unpaved roads, and residential woodburning. It also includes a mitigation fee for new developments that generate vehicle trips.

The Plan relies on updated science from field studies to assess the PM10 problem and effectiveness of proposed controls. Since the study results are still being compiled and analyzed, the District proposes to revisit the attainment demonstration when the study model is complete. The District will also reassess the need for ammonia controls with the final modeling in 2005.

SUMMARY AND IMPACTS: The 245 tpd of emission reductions in the Plan, together with the commitment to reassess the attainment demonstration, make the Plan an effective step toward cleaner air. Staff believes that the San Joaquin Valley Plan meets applicable legal requirements and recommends that it be approved for forwarding to U.S. EPA as a SIP revision.

State of California
AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER APPROVAL OF THE PROPOSED 2003 STATE IMPLEMENTATION PLAN FOR PARTICULATE MATTER IN THE SAN JOAQUIN VALLEY, INCLUDING NEW STATE STRATEGIES TO REDUCE EMISSIONS

The Air Resources Board (Board or ARB) will conduct a public hearing at the time and place noted below to consider the approval of the proposed 2003 plan to attain the federal standards for inhalable particulate matter (PM10) prepared by the San Joaquin Valley Unified Air Pollution Control District (District), as well as a State commitment for additional emission reductions to support this plan. If adopted, ARB will submit both of these elements to the U.S. Environmental Protection Agency (U.S. EPA) for approval as a revision to the California State Implementation Plan (SIP).

DATE: **June 26, 2003**

TIME: **9:00 AM**

PLACE: **In-Person**
San Joaquin Valley Unified
Air Pollution Control District
1990 East Gettysburg Avenue
Fresno, California

Via Videoconference

District Northern Region Office
4230 Kiernan Avenue, Suite 130
Modesto, California

District Southern Region Office
2700 M Street, Suite 275
Bakersfield, California

These items will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., June 26, 2003, and may continue at 8:30 a.m., June 27, 2003. These items may not be considered until June 27, 2003. Please consult the agenda for the meeting, which will be available at least 10 days before June 26, 2003, to determine the day on which these items will be considered.

If you have special accommodation or language needs, please contact ARB's Clerk of the Board at (916) 322-5594 or sdorais@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact the Americans with Disabilities Act Coordinator at (916) 323-4916, or TDD (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area.

BACKGROUND

The federal Clean Air Act (Act) sets plan provisions, plan submission schedules, and attainment deadlines for areas that violate the 24-hour and annual average National Ambient Air Quality Standards for PM10. The San Joaquin Valley was classified as a serious PM10 nonattainment area with an attainment deadline of December 31, 2001. On July 23, 2002, U.S. EPA made a final finding that the San Joaquin Valley failed to attain the PM10 standards by that deadline. As a result, the State must submit a SIP revision that provides for attainment by the most expeditious date practical and achieves a five percent annual reduction of PM10 or PM10 precursor emissions until the standards are achieved.

In the San Joaquin Valley, high particulate levels are due to the combination of directly emitted particles (from dust and soot) and aerosol droplets formed in the atmosphere by precursor chemicals (from a variety of sources, such as fuel combustion, livestock operations, and vegetation). The SIP relies on extensive data gathered during field studies done in the Valley in 1995 and the comprehensive California Regional Particulate Air Quality Study conducted in 1999 - 2001. Based on this science, the attainment assessment in the SIP shows that reducing emissions of direct PM10 and the precursor nitrogen oxides (NOx) is the most effective way to attain the standards in the region. The SIP responds with a multi-pollutant control strategy that provides for attainment by 2010, the earliest feasible date.

DESCRIPTION OF THE PROPOSED SIP REVISION

To satisfy the requirements of the Act, the proposed SIP revision consists of the following elements:

State SIP Element

Adopted State and federal regulations for on-road vehicles and off-road equipment will cut San Joaquin Valley NOx emissions by over 140 tons per day (TPD) between 1999 and 2010, and reduce other PM10 contributors as well. To support this SIP, ARB staff is proposing that the Board commit to achieve an additional ten TPD of NOx and 0.5 TPD of direct PM10 reductions in the San Joaquin Valley by 2010. Staff is also proposing a commitment to develop statewide control measures for Board consideration (affecting passenger vehicles, heavy trucks and buses, and off-road equipment) and improvements to the Smog Check program for implementation by the Bureau of Automotive Repair. The emission reduction commitment could be achieved by adoption of these or other State measures. The State measures are a subset of the Proposed 2003 State and Federal Strategy for the California SIP that ARB will consider later this year. The State's proposed commitments for the San Joaquin Valley PM10 SIP are described in Section I, Chapter D of the comprehensive strategy document. Only the emission reduction commitment for the San Joaquin Valley PM10 SIP and the

associated measures identified in this portion of the document will be considered by the Board at its June meeting.

Local SIP Element

The District staff released a draft SIP on March 25, 2003. The District prepared the technical elements of the plan in consultation with ARB, U.S. EPA, and local transportation agencies. The draft SIP reflects 20 TPD of NOx reductions from adopted District rules for stationary and areawide sources, as well as proposed local commitments to achieve over 50 TPD of additional PM10 reductions, over 30 TPD of NOx reductions, and six TPD of sulfur oxides reductions by 2010. The local strategy affects sources under District jurisdiction, including agriculture operations, industrial facilities, fugitive dust, residential woodburning, as well as on-road vehicles through transportation control measures to be implemented by the county Councils of Government.

ARB staff has reviewed the draft SIP and expects that the District will make any necessary revisions for federal approvability in the revised version due out by May 19, 2003. ARB staff will review the District's final proposed plan following its release and will publish an ARB staff report no later than May 23, 2003. The ARB hearing described in this notice will be held only if the District's Governing Board adopts the SIP prior to June 26, 2003.

AVAILABILITY OF DOCUMENTS

The Proposed 2003 State and Federal Strategy for the California State Implementation Plan will be publicly available on May 12, 2003. ARB staff's report to the Board with its evaluation and recommendations on the San Joaquin Valley 2003 PM10 Plan will be publicly available on May 23, 2003. Both documents will be posted on the ARB's website at http://www.arb.ca.gov/planning/sip/sip.htm. In addition, written copies may be obtained from the Board's Public Information Office, 1001 I Street, 1st Floor, Environmental Services Center, Sacramento, California 95814, (916) 322-2990.

PUBLIC PROCESS

The hearing will be conducted in two parts. First, the Board will consider approval of the State commitment for additional emission reductions and measure development to support the San Joaquin Valley 2003 PM10 SIP. Second, the Board will consider approval of the San Joaquin Valley 2003 PM10 Plan as a SIP revision. If adopted by ARB, both of these elements will be submitted to U.S. EPA as a revision to the California SIP.

During each part of the hearing, ARB staff will make an oral presentation and present recommendations to the Board. Interested members of the public may also present comments orally or in writing at the meeting, and in writing or by e-mail before the

meeting. To be considered by the Board, written comments submissions not physically submitted at the meeting must be received **no later than 12:00 noon, June 25, 2003,** and addressed to the following:

Postal mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 "I" Street, 23rd Floor
Sacramento, California 95814

Electronic mail is to be sent to sjvsip@listserv.arb.ca.gov and received at ARB **no later than 12:00 noon, June 25, 2003.**

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at ARB **no later than 12:00 noon June 25, 2003.**

The Board requests, but does not require 30 copies of any written submission. Also, the ARB requests that written and e-mail statements be filed at least ten days prior to the meeting so that ARB staff and Board members have time to fully consider each comment. Further inquiries regarding the San Joaquin Valley PM10 Plan or the proposed State commitment to support the plan should be directed Ms. Sylvia Morrow, Air Resources Engineer, at (916) 324-7163.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: May 6, 2003

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at www.arb.ca.gov.

State of California
AIR RESOURCES BOARD

STAFF REPORT

PROPOSED 2003 STATE IMPLEMENTATION PLAN FOR PARTICULATE MATTER IN THE SAN JOAQUIN VALLEY

Release Date: May 28, 2003
Meeting Date: June 26-27, 2003

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Website: http://www.arb.ca.gov.

California Environmental Protection Agency
AIR RESOURCES BOARD

This report is available for downloading from the Air Resources Board's Internet site at http://www.arb.ca.gov/planning/sip/sip.htm. In addition, written copies may be obtained from the Board's Public Information Office, 1001 I Street, 1st Floor, Environmental Services Center, Sacramento, California 95814, (916) 322-2990.

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State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

STAFF REPORT

PUBLIC HEARING TO CONSIDER APPROVAL OF THE PROPOSED 2003 STATE IMPLEMENTATION PLAN FOR PARTICULATE MATTER IN THE SAN JOAQUIN VALLEY

Air Resources Board Hearing
Begins June 26, 2003
9:00 a.m.
San Joaquin Valley Unified Air Pollution Control District
1990 E. Gettysburg Avenue
Fresno, California
Hearing notice available at http://www.arb.ca.gov/regact/sjvsipnotice.htm

For questions, contact: Ms. Sylvia Morrow, Project Manager
Air Quality and Transportation Planning Branch
Air Resources Board
P.O. Box 2815
Sacramento, California 95812
Phone: (916) 324-7163
Fax: (916) 322-3646
Email: smorrow@arb.ca.gov

This report has been reviewed by the staff of the Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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EXECUTIVE SUMMARY

The San Joaquin Valley Unified Air Pollution Control District (District) released the Proposed Final *San Joaquin Valley Plan to Attain Federal Standards for Particulate Matter 10 Microns and Smaller* (2003 PM10 Plan or Plan) on May 12, 2003. The District will consider adoption of the 2003 PM10 Plan at a hearing scheduled for June 19, 2003. Contingent on adoption by the District, the Air Resources Board (ARB or Board) will consider approval of the 2003 PM10 Plan as a revision to the California State Implementation Plan (SIP) following a public hearing on June 26-27, 2003. This Staff Report is premised on District adoption of the Proposed Plan with the clarifications identified below.

1. <u>What is the San Joaquin Valley's overall air quality status?</u>

The San Joaquin Valley exceeds federal and State air quality standards for particulate matter and ozone. The Valley experiences some of the worst air pollution in the U.S., with both high levels and frequent episodes. According to air quality standards set by ARB, Valley residents breathe unhealthy levels of airborne particles nearly half of each year, (fall and winter) and unhealthy levels of smog or ozone one-third of the year (summer). Like other urban areas of California, the health risk from air toxics in the Valley is too high and particles from diesel-fueled engines are the dominant source of this risk. To meet air quality standards, air agencies must continue to adopt new measures to further reduce emissions from motor vehicles and equipment, fuels, industrial and commercial operations, and other sources.

By law, the 2003 PM10 Plan focuses on meeting federal particulate matter standards– the federal 24-hour and annual standards for particulate matter 10 microns and smaller (PM10). A number of strategies in the 2003 PM10 Plan will also reduce particulate matter 2.5 microns and smaller (PM2.5), one component of PM10. Future air quality plans will need to identify further strategies to attain the PM2.5 standards, as well as the federal and State standards for ozone. Although these other standards are outside the scope of the 2003 San Joaquin Valley PM10 SIP, the control strategies in this Plan will reduce emissions of multiple pollutants that are common precursors to PM10, PM2.5, and ozone.

2. <u>What is particulate matter and how does it impact human health?</u>

In the San Joaquin Valley, inhalable particulate matter or PM10 is a complex mixture of primary or directly emitted particles (from dust and soot), and secondary particles or aerosol droplets formed in the atmosphere by precursor chemicals. In the Valley, nitrogen oxides (NOx) and ammonia react in the winter to form particulate ammonium nitrate. NOx also contributes to ozone formation.

Because these particles are so small, they bypass our body's defenses, deposit in the respiratory tract, and can lodge deep in the lungs. The tiniest particles can also enter the bloodstream. Health studies link particulate pollution to sudden death in infants as well as adults with heart and lung ailments, shortening lives by years. Exposure to airborne particles also aggravates respiratory illnesses like asthma, bronchitis, emphysema, and pneumonia.

A ten-year ARB funded study of 5,000 children in Southern California shows that current levels of particles (and the gases that also contribute to ozone) reduce lung function growth in kids, diminish lung capacity, and increase school absences. In the San Joaquin Valley, ARB is currently sponsoring the Fresno Asthmatic Children's Environment Study to determine the effects of particulate matter (in combination with other ambient air pollutants) on asthma in young children.

3. What is the nature of the PM10 problem in the Valley?

The San Joaquin Valley exceeds both the federal 24-hour PM10 standard of 150 micrograms per cubic meter ($\mu g/m^3$) and the annual average PM10 standard of 50 $\mu g/m^3$ at multiple locations throughout the air basin. Table ES-1 shows the monitoring sites that violated the 24-hour standard or annual average standard between 1999 and 2001, the most recent three year period with complete monitoring results. The sites with the highest 24-hour levels and greatest number of exceedances are in the Bakersfield and Fresno metropolitan areas. Limited monitoring data from 2002 show that the days over the standard and highest values were less severe than in the 1999-2001 period.

Table ES-1
Monitoring Sites Exceeding
the Federal 24-Hour or Annual Average PM10 Standard
San Joaquin Valley, 1999-2001

Monitoring Site Name	High 24-Hour Value Above Standard ($\mu g/m^3$)	Annual Average Above Standard ($\mu g/m^3$)
Bakersfield-California Ave.	190	--
Bakersfield-Golden	205	57
Clovis	155	--
Corcoran-Patterson Ave.	174	--
Fresno-Drummond	186	--
Fresno-First Street	193	--
Hanford-Irwin Street	185	53
Modesto-14th Street	158	--
Oildale-3311 Manor Street	158	--
Turlock-900 Minaret Street	157	--
Visalia-Church Street	--	54

High PM10 episodes in the San Joaquin Valley typically differ by season. Fall episodes occur between October and December during relatively stable atmospheric conditions prior to rainfall. These episodes are dominated by directly emitted PM10, with the highest recent 24-hour violation of 174 $\mu g/m^3$ recorded at Corcoran in 1999.

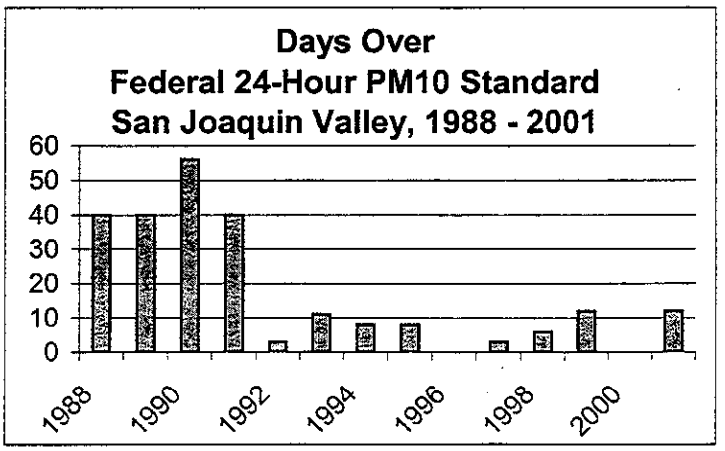
Winter episodes occur between late November and January during extended periods of stagnant weather with cold, damp, foggy conditions conducive to the formation of secondary particulate. Stagnant conditions occur when there are low winds with little movement to the upper atmosphere. These episodes are dominated by ammonium nitrate, which builds up and accumulates over the stagnant weather period. Winter episodes also contain wood smoke and directly emitted particulate. The highest recent winter episode was 205 $\mu g/m^3$ recorded at Bakersfield-Golden in 2001.

4. How have PM10 levels in the Valley changed over time?

The severity and frequency of PM10 episodes have decreased since we began routinely monitoring for this pollutant in 1988. Unlike ozone levels that are measured directly by the monitor each hour, PM10 levels are determined in a multi-step process. The sample is collected at a monitor by drawing air through a filter for 24 hours and then the filter is taken back to a laboratory for analysis.

Because this process is labor intensive and expensive, PM10 samples are routinely collected every sixth day. In Corcoran, sampling is done every three days. The results indicate the level of PM10 detected in the air over the 24-hour period. To estimate the number of days over the applicable standard, we multiply each day with a measured PM10 level exceeding the standard by the monitoring frequency. Figure ES-1 shows the calculated number of days over the PM10 standard from 1988 to 2001. In 1996 and 2000, the San Joaquin Valley did not exceed the federal 24-hour PM10 standard.

Figure ES-1



5. Why has the District developed this Plan?

The 2003 PM10 Plan is designed to fulfill an outstanding requirement of the Clean Air Act (Act) to define how and when the Valley will attain the federal PM10 standards, as well as resolve a number of related legal actions. The San Joaquin Valley is classified as a serious PM10 nonattainment area with a statutory attainment deadline of December 31, 2001. In 1997, the Valley developed and ARB submitted a PM10 SIP to the U.S. Environmental Protection Agency (U.S. EPA) that sought to show attainment by that deadline. The Valley did not attain by that date. At the District's request, the State withdrew the prior PM10 SIP in 2002. The agencies have since focused on developing a new, stronger PM10 plan that relies on improved science and identifies the full scope of control measures needed for attainment.

In 2002, U.S. EPA made formal findings that the Valley failed to submit a PM10 SIP and failed to attain the PM10 standards by the 2001 deadline. U.S. EPA concurrently noted deficiencies in the withdrawn 1997 PM10 Plan. Each of the separate findings starts sanctions clocks that will ultimately result in (1) higher emissions offsets for new and expanding businesses, followed by (2) a cutoff of most federal highway funds, unless the State submits a new PM10 SIP that U.S. EPA finds complete. The first sanction will begin August 28, 2003, the second on February 28, 2004. In response to litigation on PM10-related issues, U.S. EPA must promulgate a Federal Implementation Plan (FIP) for the Valley by February 28, 2004 unless the new California-developed SIP is approved before then.

6. What federal requirements does the Plan address?

Fundamentally, the State must submit a PM10 SIP revision that provides for interim progress in reducing emissions and attainment of both federal standards by the most expeditious date practicable. The Plan must satisfy the requirements of the Clean Air Act for a serious area PM10 plan, and for an area that failed to attain by the deadline. It does. The 2003 PM10 SIP:

- Demonstrates attainment by the earliest practicable date (2010);
- Implements Best Available Control Measures (BACM) for all significant sources of PM10 and NOx;
- Identifies interim emissions targets to show progress based on combined annual reductions in direct PM10 and NOx emissions of at least five percent until attainment;
- Sets emissions budgets for the transportation sector to support progress and attainment; and
- Provides contingency measures.

This Plan also resolves a number of technical deficiencies that U.S. EPA identified in the 1997 PM10 Plan. The 2003 PM10 Plan is based on a substantial improvement in the science and a more extensive control strategy. This Plan relies on a comprehensive emission inventory that includes new data on directly-emitted PM10 and ammonia, as

well as multiple pollutants from motor vehicles and equipment. The current inventory uses county-specific information on activity and growth; it also reflects seasonal changes. This Plan builds on available data from extensive field studies and includes a rigorous analysis of the best relevant controls in place or planned elsewhere in the U.S.

7. How does the Plan use the available science to assess attainment?

The 2003 PM10 Plan uses extensive monitoring data from the California Particulate Matter Air Quality Study (Particulate Study) and the latest technical tools to assess the impact of the proposed control strategy on the region's ability to attain the federal PM10 standards. The Particulate Study is a public-private $27 million effort to develop an improved scientific basis for particulate matter control, including information on emissions, particle composition, and atmospheric processes. The Plan benefits from the Particulate Study data available so far on emission inventory improvements, source profiles specific to the San Joaquin Valley, extensive monitoring data, and a preliminary air quality model (IMS95).

By looking at the chemical compounds that make up the total PM10 captured on filters and at the emissions from pollution sources in the region, the District estimated how much of the measured PM10 came from various sources. Next, by projecting how the emissions from those sources will change in the future with growth and controls, the District determined how the concentration of each chemical compound is expected to change. The Plan shows that the proposed control strategy is sufficient to reduce the combined PM10 mass to attainment levels by 2010.

For directly emitted particles, the Plan uses a 1 to 1 relationship between direct PM10 emission reductions and the resulting change in particulate concentrations. For secondary particles formed in the atmosphere, the Plan relies on photochemical modeling to establish the relationship between precursor emission reductions and the resulting change in ammonium nitrate concentrations. The modeling indicates that to reduce ammonium nitrate, the attainment strategy must include NOx controls. The modeling also supports a relationship between NOx reductions and ammonium nitrate decreases of 1.5 to 1. The potential benefits of ammonia control compared to NOx control remains an open question which will be addressed in the 2006 update to this Plan.

Two different analysis methods were used to try to determine the relative benefits of ammonia and NOx control to reduce ammonium nitrate formation. The goal of these types of analyses is to determine the "limiting" chemical species. Reducing the limiting pollutant from a chemical standpoint is the most efficient way to reduce the end product – which in this case is ammonium nitrate. In the first method, actual measured concentrations (in Bakersfield) of ammonium nitrate and its precursors, nitric acid (formed from NOx) and ammonia, were compared to determine which would be limiting in terms of forming ammonium nitrate. The results indicated that a significant amount of ammonia would remain after all the NOx was consumed. This suggests that NOx is the limiting precursor—ammonia is not and ammonia controls will not be effective at

reducing particulate concentrations at these ambient levels. The second analysis method, atmospheric modeling, suggests that there could be some positive impact from ammonia controls in the Bakersfield area. We expect the final Particulate Study results to reconcile these apparently differing results. Since the data available today do not clearly demonstrate that ammonia reductions would accelerate attainment, there is insufficient evidence to include ammonia controls in the Plan at this time.

The Plan includes a 2010 projection for the highest value at each site that recorded an exceedance between 1999 and 2001, as shown in Table ES-2.

Table ES-2
Projected 24-hour PM10 Values in 2010
With Plan Implementation

Site Name	Highest Measured Value ($\mu g/m^3$)	Projected 2010 Value ($\mu g/m^3$)
Bakersfield-California Ave.	190	139
Bakersfield-Golden	205	153*
Clovis	155	122
Corcoran-Patterson	174	136/134**
Fresno-Drummond	186	145
Fresno-First Street	193	148
Hanford-Irwin Street	185	143
Modesto-14th Street	158	117
Oildale-3111 Manor Street	158	120
Turlock-900 Minaret Street	157	117

* U.S. EPA regulations interpreting the form of the 24-hour PM10 standard prescribe rounding of measured values to the nearest 10 $\mu g/m^3$ and explicitly define attainment as 154 $\mu g/m^3$ or less. Thus, the projected 153 $\mu g/m^3$ rounds to 150 $\mu g/m^3$ and complies with the standard.

** Corcoran had two exceedances at 174 $\mu g/m^3$; the specific conditions of each exceedance day result in different 2010 projections.

The District used the same scientific approach to evaluate the impact of the proposed control strategy on annual average PM10 levels for the three sites that exceeded the standard. The plan strategies would result in attainment of the federal PM10 standard at all three sites.

We believe the modeling conducted for the 2003 PM10 Plan meets U.S. EPA requirements for areas designated as serious nonattainment for PM10. The District and ARB used the best modeling tools available to address the complex PM10 problem in the San Joaquin Valley, and to provide reasonable assurance that the control strategy will attain the standard.

8. How much will the Plan reduce emissions that contribute to PM10 in the Valley?

Table ES-3 below quantifies the net emission reductions in tons per day (tpd) between 1999 and 2010 from the existing State, local, and federal control programs plus new reductions from the commitments quantified in the Plan. The majority of the NOx reductions will come from the State's existing requirements for cleaner new cars, trucks, and equipment.

Table ES-3
Proposed Plan Net Reductions in Direct Particulate and Precursor NOx Emissions
San Joaquin Valley, 1999-2010

	Direct PM10 Emissions		NOx Emissions	
	Reductions (tpd)	% Reduction	Reductions (tpd)	% Reduction
Stationary and Area Sources	39	13	37	21
Mobile Sources	2	13	164	43
Total	41	13	201	36

9. What is the local control strategy?

In the San Joaquin Valley, the District is the primary local agency responsible for regulating air pollution from stationary and areawide sources throughout the region. The District coordinates with the eight county Councils of Government that forecast growth and decide how the transportation system will develop in each county. The miles traveled, the efficiency of the transportation system, and the vehicles used all affect the resulting air emissions. To improve air quality, air agencies must secure enough emission reductions from sources under their control to fully offset the growth in all sectors and achieve a net decrease in emissions.

The new element of the local control strategy will reduce direct PM10 and NOx from District measures, including dust control requirements to be implemented by local governments. The District proposes to adopt a total of 14 new measures between 2003-2005 that achieve 66 tpd direct PM10, 16 tpd NOx, and 6 tpd sulfur oxides (SOx) reductions, compared to 2010 levels with the existing control program. Full implementation would occur between 2004-2006 (except for residential water heaters).

The new proposed District measures address the following types of sources:

- Agricultural irrigation engines (opacity);
- Cotton gins;
- Dryers;
- Wineries;
- Glass-melting furnaces;
- Gas-fired oilfield steam generators;
- Steam enhanced crude oil production well vents;

- Small boilers, steam generators, and process heaters;
- Water heaters (industrial, commercial, and institutional);
- Residential wood combustion;
- Residential space heating; and
- Paved and unpaved roads, parking lots and staging areas, construction activities, and disturbed open areas; plus
- A proposed Conservation Management Practice program to cut dust from on-field agriculture operations, developed in consultation with the agriculture industry; and
- A mitigation fee on new indirect "destination" sources (like shopping malls and distribution centers) that attract vehicle travel; the funds would provide incentives for other sources to reduce emissions, beyond applicable requirements.

10. How does the District propose to address ammonia emissions?

The primary sources of ammonia in the Valley are livestock operations, fertilizer use, and composting. Other sources include fertilizer application, composting, motor vehicles, domestic waste emissions, landfill gases, burning, and combustion devices equipped with selective catalyst reduction technology. Preliminary analyses of the effectiveness of ammonia reduction in decreasing total PM10 levels are inconclusive. As discussed in Question 7, development of ammonia controls will depend on further analysis of the San Joaquin Valley's ammonia chemistry as part of the Particulate Study.

If the final Particulate Study results show that ammonia controls are effective, the District will include ammonia reduction measures in the next PM10 SIP revision. The District will also evaluate the need to reduce livestock waste emissions to achieve the federal ozone standard. Livestock waste is a significant source of ROG emissions as well as ammonia. Ongoing research will provide new information on ammonia, ROG, and direct PM10 emissions from livestock operations. Preliminary data will be used in the Valley ozone SIP in late 2003; final results will be available for the 2006 reassessment of this PM10 attainment demonstration and future ozone SIPs.

11. What is the State control strategy?

The bulk of the State controls with benefits between 1999 and 2010 have already been adopted by ARB; they will provide over 140 tpd of NOx reductions in this period. ARB staff is proposing that the Board commit to achieve an additional 10 tpd of NOx and 0.5 tpd of direct PM10 reductions in the San Joaquin Valley by 2010. Staff is also proposing a commitment to develop statewide control measures for Board consideration (affecting passenger vehicles, heavy trucks and buses, and off-road equipment) and improvements to the Smog Check program for implementation by the Bureau of Automotive Repair. The State measures are a subset of the *Proposed 2003 State and Federal Strategy for the California SIP* that ARB will consider later this year. The State's proposed commitments for the San Joaquin Valley PM10 SIP are described in Section I, Chapter D of the comprehensive strategy document available at http://arb.ca.gov/planning/sip/sip.htm.

The new proposed State measures address the following types of sources:

- Existing passenger vehicles;
- New and existing heavy-duty trucks and buses;
- New and existing off-road industrial equipment, including forklifts; and
- Existing off-road heavy-duty diesel equipment.

12. Why is 2010 the earliest San Joaquin Valley can attain the standards?

The 2003 PM10 Plan provides for attainment as expeditiously as practicable by aggressively reducing directly emitted particles and secondarily formed ammonium nitrate particles through NOx control.

The District has proposed an ambitious rulemaking calendar to implement its 2003 PM10 Plan commitments as soon as possible. New local rules are scheduled for implementation between 2004-2006, including over 70 percent of the reductions in direct PM10.

The NOx reductions phase-in steadily through 2010. Motor vehicles and equipment are the dominant source of NOx emissions. New controls on these sources typically require significant lead time, especially standards for new engines that depend on engine design changes, production line modifications, and natural fleet turnover to the cleaner vehicles and equipment. Regulations already adopted by ARB are scheduled for implementation through 2010. For example, the latest low emission vehicle fleet requirements are increasingly more stringent through 2010, stricter truck standards will be implemented 2007-2010, and the last phase of cleaner pleasure craft engines will be introduced in 2008.

To accelerate the pace of mobile source reductions, the existing fleet can be cleaned up through accelerated replacement, retrofit technology, or repair of excess emissions. ARB staff has proposed commitments for new regulatory strategies to further reduce emissions from existing passenger vehicles, trucks, construction and farm equipment, and industrial equipment. Given the technical work and regulatory development process required to make these strategies successful, we believe the proposed timelines are as expeditious as practicable. The District has also committed to speed the introduction of lower emission engines through incentive programs.

13. When will the District reassess the attainment demonstration?

The final Particulate Study modeling results are currently projected to be completed in 2005. Remaining work includes: improving the emission inventory, creating the meteorological inputs for each day, setting up the initial air quality conditions for each day, evaluating the model performance, and conducting sensitivity testing. If the Particulate Study modeling shows that the assumptions used for the attainment demonstration are no longer valid, the District proposes to revise the 2003 SIP in 2006.

14. What have been the opportunities for public involvement in the Plan?

The District staff held three series of public workshops to solicit input on the 2003 PM10 Plan with a combination of afternoon and evening sessions. Each workshop was held in Fresno, Bakersfield, or Modesto and linked via videoconference to the other locations. ARB staff participated in these local workshops, providing technical support on the joint science and the State's control strategy.

Beginning in June 2002, the first set of workshops focused on the state of the science on PM10, emission inventory development, and the air quality modeling approach. The second workshops in November 2002 provided more background on the PM10 problem and updates on the air quality modeling, emission inventory improvements, and potential control measures. In March 2003, the District released the Draft Plan for initial public review and held the third set of workshops in April to discuss the final inventory, modeling, control measures, and attainment demonstration.

The District released the final PM10 Plan on May 12, 2003 for the formal 30-day review and comment period. On June 19, 2003, the District's Governing Board is scheduled to hear public testimony on the 2003 PM10 Plan, and take action.

Beginning in 2001, ARB also conducted its own outreach across California on the statewide measures from the earliest stages of development. In early 2003, we released draft strategy documents for the South Coast and San Joaquin Valley. Through March and April, we participated in eleven public workshops with the local air districts in the South Coast and San Joaquin Valley, as well as an ARB technical workshop in both those regions plus Sacramento, to discuss the draft State and federal SIP strategy.

15. Is the Plan consistent with State and federal requirements?

Yes. The proposed 2003 PM10 Plan meets the requirements of State and federal law.

The federal Clean Air Act (section 189(b)(1)(A)) requires this PM10 Plan to demonstrate attainment of the PM10 standards by the most expeditious alternative date practicable. Due to timing of controls and vehicle turnover, ARB staff and the District collectively determined that 2010 is the most expeditious date practicable for San Joaquin Valley to attain the 24-hour and annual PM10 standards.

The Act (section 189(b)(1)(B)) requires this PM10 Plan to provide for implementing BACM to reduce PM10. The District hired an outside contractor to conduct a BACM analysis, and determine which controls needed to be upgraded. The District incorporated the contractor suggestions, and we believe the 2003 PM10 Plan provides for BACM on all significant sources of PM10 and PM10 precursors.

The Act (section 189(c)(1)) requires this PM10 Plan to establish PM10 reasonable further progress milestone targets, which are to be achieved every three years until the area attains. The 2003 PM10 Plan establishes progress targets for 2005, 2008, and 2010.

The Act (section 189(d)) requires this PM10 Plan to provide an annual reduction in PM10 or PM10 precursors not less than five percent of such emissions as reported in the most recent inventory prepared for the area. The 2003 PM10 Plan meets this requirement with a combination of direct PM10 and NOx emission reductions. The combined five percent reduction for PM10 plus NOx is calculated using the substitution convention allowed by the Clean Air Act and directed in U.S. EPA guidance for ozone rate-of-progress demonstrations.

16. <u>What clarification to the District's proposal does ARB staff recommend?</u>

We recommend that the District clarify its proposal to revisit the PM10 emission reduction strategy when the final Particulate Study data are available. The District needs to specify a timeline for any needed plan revision.

17. <u>What action does ARB staff recommend to the Board?</u>

With the clarification discussed above, we recommend that the Air Resources Board take the actions necessary to approve both the State and local elements of the 2003 San Joaquin Valley PM10 Plan and to forward it to U.S. EPA as a revision to the California SIP.

(1) After considering public testimony, we recommend that the Board adopt the proposed State commitments to support the 2003 San Joaquin Valley PM10 SIP as identified in Section I, Chapter D of the *Proposed State and Federal Strategy for the California SIP*. These commitments for emission reductions and new measures are integral to the Plan's ability to show both attainment and progress.

(2) After considering public testimony, we recommend that the Board approve the 2003 San Joaquin Valley PM10 Plan as a revision to the California SIP. Board action should also encompass any District revisions that strengthen the Proposed Plan in response to public comments.

ARB staff finds that the 2003 PM10 Plan meets applicable requirements. We believe that Plan implementation would clearly reduce PM10 levels throughout the San Joaquin Valley and benefit public health.

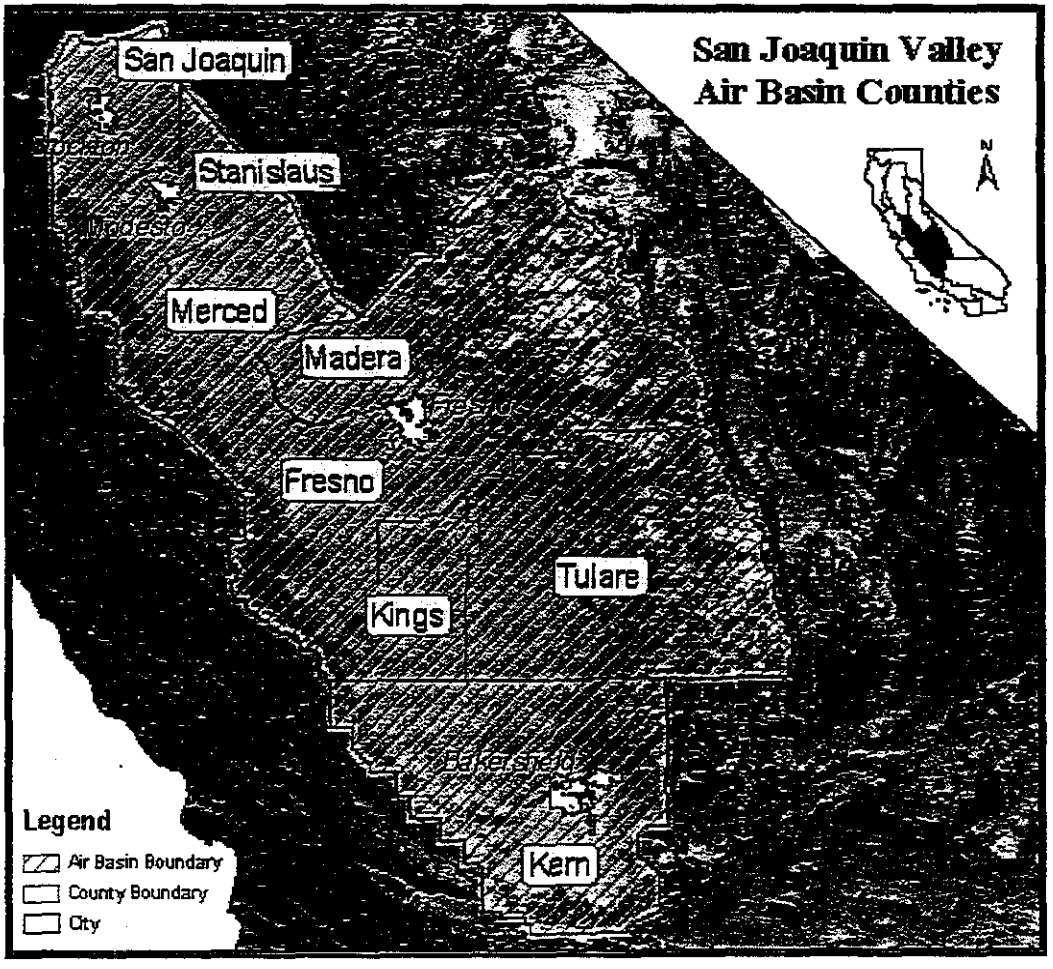
I. BACKGROUND

This chapter provides an overview of the topography, meteorology, and air quality of the San Joaquin Valley and describes some of the air quality research that supports the 2003 PM10 Plan.

A. Profile of the San Joaquin Valley

The San Joaquin Valley Air Basin covers San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Western Kern Counties. The San Joaquin Valley comprises nearly 25,000 square miles and covers approximately 16 percent of the geographic area of California. It is a continuous valley approximately 250 miles long and averaging 80 miles wide. Mountains bound the area on the west (Coastal Mountain range), the east (Sierra Nevada range), and the south (Tehachapi Mountains). The San Joaquin Valley has over 3.3 million residents with major urban centers at Bakersfield, Fresno, Modesto, and Stockton. Figure I-1 shows the San Joaquin Valley Air Basin.

Figure I-1



The San Joaquin Valley Unified Air Pollution Control District is the local air quality agency responsible for the air basin.

B. Historical Air Quality

High PM10 episodes in the San Joaquin Valley typically follow one of two patterns. Fall-type episodes occur between October and December during relatively stable atmospheric conditions before rainfall. Directly emitted PM10 dominates these episodes with the highest recent 24-hour violation of 174 $\mu g/m^3$ recorded at Corcoran in 1999. The federal 24-hour average standard is 150 $\mu g/m^3$, although U.S. EPA regulations interpreting the form of the 24-hour PM10 standard prescribe rounding of measured values to the nearest 10 $\mu g/m^3$ and explicitly define attainment as 154 $\mu g/m^3$ or less.

Winter-type episodes typically occur between late November through January during extended periods of stagnant weather with cold, damp, foggy conditions especially conducive to ammonium nitrate particle formation. These so-called secondary particles are formed in the air by the chemical reaction of gaseous pollutants. While ammonium nitrate particles are the most abundant, these episodes also contain wood smoke and directly emitted particles. The highest recent winter concentration recorded was 205 $\mu g/m^3$ at Bakersfield-Golden in 2001. This multi-day, winter 2001 episode was valley-wide with twelve violations of the federal 24-hour standard recorded at nine separate locations.

The San Joaquin Valley also violates the federal 50 $\mu g/m^3$ annual average standard. While the 24-hour violations occur during stagnant weather conditions with low wind speeds, wind blown dust does contribute to the annual average problem.

Table I-1 shows the highest 24-hour values measured at various monitors between 1999 and 2001, as well as the resulting annual average for that time period. Bold type indicates violations of the standard.

In the late 1980s and early 1990s, fall-type episodes were the most prevalent. Since the implementation of some primary PM10 controls in the early 1990s, the fall episodes are fewer and less severe. Winter-type episodes now predominate. Figure I-2 shows the slight downward trend of the peak 24-hour PM10 concentrations since the late 1980s.

Table I-1
PM10 Design Values (μg/m³)
San Joaquin Valley, 1999-2001

Monitoring Site Name	PM10 Plan 24-hour Design Value	PM10 Plan Annual Average Design Value
Bakersfield-California Ave.	**190**	48
Bakersfield-Golden #2	**205**	**57**
Clovis	**155**	43
Corcoran-Patterson Ave.	**174**	49
Fresno-Drummond	**186**	50
Fresno-First	**193**	42
Hanford-Irwin St.	**185**	**53**
Merced-M Street	134	40
Modesto-14th Street	**158**	37
Oildale-3311 Manor Street	**158**	46
Stockton-Hazelton-HD	150	35
Stockton-Wagner-Holt	119	30
Taft-College	128	36
Turlock-900 Minaret Street	**157**	39
Visalia-Church Street	152	**54**

Figure I-2

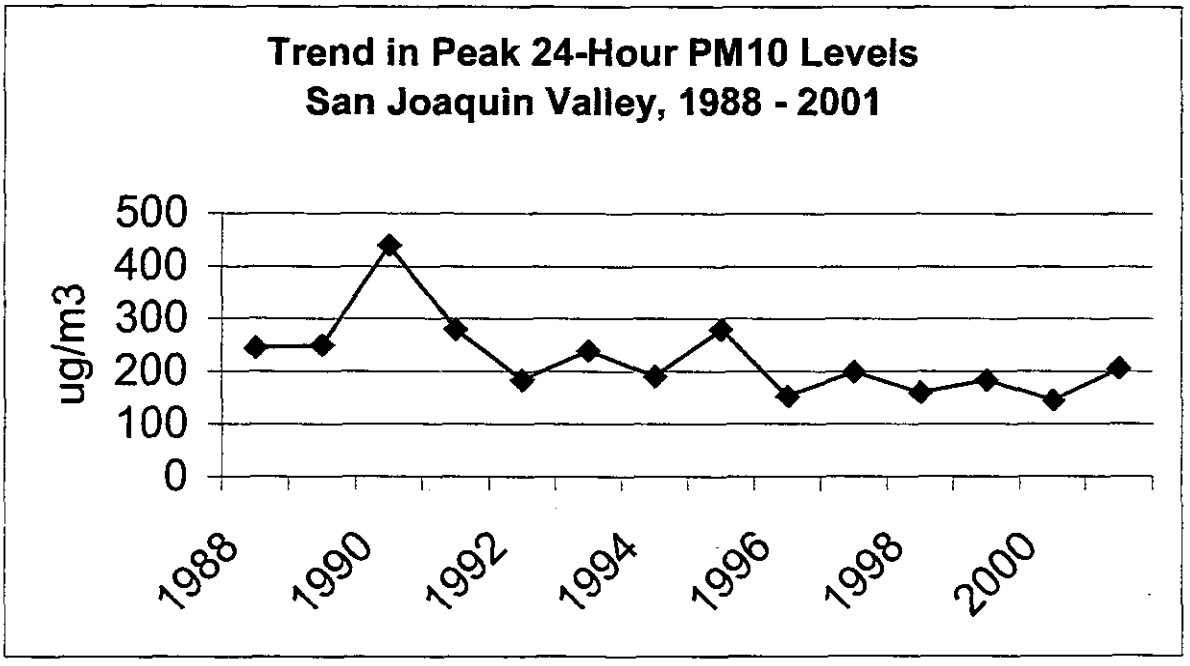
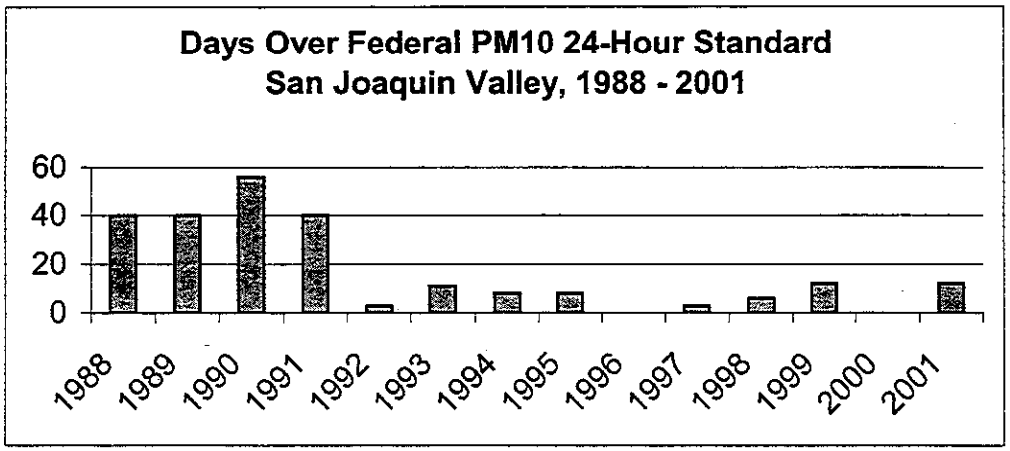


Figure I-3 shows the number of days the San Joaquin Valley has exceeded the 24-hour standard. There were no days over the standard in 1996 and 2000. (Since most of the San Joaquin Valley monitoring occurs once every six days, each recorded exceedance counts as six expected exceedances.) The drop in the number of unhealthy days since the late 1980s reflects the same improvement shown by the decrease in maximum 24-hour values.

Figure I-3



C. Fine Particulate Air Quality

PM10 in the San Joaquin Valley includes a large subset of fine particles, or PM2.5. In 1997, U.S. EPA established a 65 $\mu g/m^3$ 24-hour PM2.5 standard and a 15 $\mu g/m^3$ annual average PM2.5 standard. U.S. EPA is planning to officially designate PM2.5 nonattainment areas in 2004, with SIPs due in 2007 and attainment required by 2014. The San Joaquin Valley exceeds both the 24-hour and annual average PM2.5 standards throughout the basin. The highest recent PM2.5 reading was 160 $\mu g/m^3$ recorded at the Fresno-First Street monitor in 2000.

D. California Regional Particulate Matter Air Quality Study

The California Regional Particulate Matter Air Quality Study (Particulate Study) is a public-private, $27 million effort to develop an improved scientific basis—including emissions, particle composition, and atmospheric processes—for current and future particulate matter control.

The study has four phases:

- Phase 1 involved planning and preparatory research. Projects conducted within this phase included demonstration projects evaluating alternative control strategies, a preliminary field monitoring program known as the 1995 Integrated Monitoring Study (IMS95), analysis and modeling of historical and IMS95 data, and emission inventory development.

- Phase 2 aimed at developing improved techniques for the identification of primary particulate matter sources.

- Phase 3 involved major field studies under both fall and winter-type episode conditions. The field work included four components:

  1. A long-term annual program from December 1, 1999, through January 31, 2001.
  2. A summer program from June 15, 2000, through September 15, 2000.
  3. A fall episodic program between October 8, 2000, and November 14, 2000.
  4. A winter episodic program between December 1, 2000, and February 3, 2001.

  The field measurements were collected over a region extending from the Pacific Ocean on the west to the Mojave Desert on the east, and from the Tehachapi Mountains on the south to the northern end of the Sacramento Valley.

- Phase 4 is underway; it involves analysis and modeling of the data collected during the field program.

II. AIR QUALITY PLANNING

This chapter briefly reviews the relevant planning provisions in the federal Clean Air Act (Act), and describes recent San Joaquin Valley plans.

A. Planning Requirements

In 1987, U.S. EPA replaced its standard for total suspended particulates with standards that focused on PM10. The 1990 Clean Air Act Amendments subsequently established moderate and serious classifications for PM10 nonattainment areas, with planning requirements applicable to each classification.

1. Moderate Area PM10 Attainment Plan

The San Joaquin Valley was originally classified as a moderate PM10 nonattainment area. The Act requires moderate areas to adopt reasonably available control measures (RACM), and sets a December 31, 1994 attainment deadline.

In November 1991, the newly formed San Joaquin Valley Unified Air Pollution Control District adopted the 1991 PM10 Attainment Plan. In the plan, the District committed to adopt rules to limit fugitive dust emissions from paved and unpaved roads, construction sites, and other commercial and industrial activities (collectively Regulation VIII). The District also committed to controls on various burning practices, including fireplace use. The District adopted Regulation VIII and a residential wood combustion rule in 1993.

Because the moderate area plan showed that the San Joaquin Valley would not attain the PM10 standards by December 31, 1994, the San Joaquin Valley was reclassified to serious. Along with the new classification, effective February 8, 1993, came new planning requirements.

2. Serious Area PM10 Attainment Plan

The Act requires serious areas to adopt a plan that contains Best Available Control Measures (BACM) within four years of reclassification. The attainment deadline is December 31, 2001. The Act also allows serious areas an attainment deadline extension to 2006 if the region can demonstrate that it has implemented all the serious area requirements and adopted measures as stringent as done elsewhere in the nation; yet, attainment is still not possible by 2001.

ARB submitted the District's 1994 Serious Area PM10 Plan containing BACM commitments on October 12, 1994. ARB submitted the District's 1997 PM10 Attainment Demonstration Plan on July 17, 1997. In the 1997 PM10 Plan, the District requested an extension until 2006. U.S. EPA had not acted on the 1997 PM10 Plan and the Valley had not attained by the December 31, 2001 deadline. In early 2002, U.S. EPA indicated their intent to disapprove substantial portions of the 1997 PM10 Plan. The basis of its intended disapproval was U.S. EPA's finding that:

- The emissions inventory was incomplete;
- The plan did not provide for attainment by December 31, 2001, nor provide sufficient documentation for a deadline extension;
- The plan did not provide for BACM on all significant sources; and
- The plan did not provide for quantitative milestones nor demonstrate reasonable further progress.

Disapproval would have required the District to correct the identified deficiencies in order to forestall an immediate transportation conformity freeze, and subsequent loss of federal highway funds. Rather than correct a plan that had already failed to provide for attainment by the 2001 deadline, the District requested and ARB withdrew the 1997 PM10 Plan from U.S. EPA consideration.

Effective February 28, 2002, U.S. EPA issued a finding that the San Joaquin Valley failed to submit a serious area PM10 SIP. The finding triggered a number of federal sanctions clocks:

- An 18-month deadline for sanctions on new and modified sources requiring emission offsets at a 2:1 ratio;
- A 24-month deadline to withhold federal highway funds; and
- A 24-month deadline to require that U.S. EPA prepare a Federal Implementation Plan (FIP).

On July 23, 2002, U. S. EPA also issued a finding that the San Joaquin Valley failed to attain the PM10 standards by the December 31, 2001 attainment deadline. This starts additional clocks on the sanctions listed above for this deficiency.

3. 2003 PM10 Plan

The 2003 PM10 Plan addresses both of U.S. EPA's findings: the failure to submit a serious SIP and the failure to attain the standard. The District remains classified as a serious nonattainment area and is still subject to serious area planning requirements. But, having missed the 2001 attainment deadline, additional requirements will apply to the District.

The serious nonattainment requirements are:

- Implement BACM for all significant sources of PM10 or PM10 precursors;
- Provide quantitative milestones for reasonable further progress; and
- Adopt contingency measures to provide further emission reductions in case a milestone is not achieved on schedule.

The additional requirements due to failure to attain by 2001 are:

- Demonstrate attainment at the earliest practicable date; and
- Provide an annual reduction in PM10 or PM10 precursor emissions within the area of not less than five percent of the amount of such emissions as reported in the most recent inventory.

B. Planning Schedule and Impact on Sanctions

1. Sanction Deadlines

For the San Joaquin Valley to avoid federal sanctions, all of the following must happen by August 28, 2003:

- The District must adopt a complying PM10 SIP;
- ARB must adopt and submit the SIP to U.S. EPA; and
- U.S. EPA must issue a finding that the SIP is complete.

The completeness finding is an evaluation by U.S. EPA that the plan includes all the necessary elements. If U.S. EPA does not issue a completeness finding within six months, the SIP is deemed complete by operation of law. However, if sanction deadlines are pending as they are in the San Joaquin Valley, federal regulations require U.S. EPA to make a formal completeness finding.

Unless the Valley PM10 SIP is adopted, submitted, and approved by U.S. EPA by February 28, 2004, U.S. EPA is obligated to issue a Federal Implementation Plan.

2. Moderate Plan Complaint

On October 22, 2002, Earthjustice filed a citizen enforcement action, on behalf of the Sierra Club, Medical Advocates for Healthy Air, and the Latino Issues Forum, to compel U.S. EPA to enforce federal requirements in the San Joaquin Valley. The basis of the Earthjustice complaint was that since U.S. EPA never acted on the District's 1991 Moderate Area PM10 Attainment Plan, U.S. EPA was obligated to impose sanctions and a FIP. U.S. EPA did neither.

On May 14, 2003, the U.S. District Court approved a consent decree requiring U.S. EPA to adopt a FIP for the San Joaquin Valley by July 31, 2004. Under the decree, U.S. EPA is relieved of the FIP obligation if the Administrator signs a final notice approving a San Joaquin Valley PM10 SIP revision on or before that date.

III. PLAN EVALUATION

This chapter reviews the contents of the Proposed 2003 PM10 Plan and provides ARB staff's evaluation of each significant element.

A. Emission Inventory

Emission inventories are fundamental elements of any air quality plan, incorporating the effects of growth and existing regulations to determine the expected emissions in future years. Table III-1 shows the total emissions of each pollutant, and the breakdown by broad source category. In 1999, almost all of the direct PM10, ammonia, and SOx emissions, and one-third of the NOx came from stationary and area sources under the jurisdiction of the District. About two-thirds of the NOx is emitted by sources under State or federal authority.

Table III-1
Plan Base Year Emission Inventory
San Joaquin Valley, Annual Average, 1999

	Direct PM10 (tpd)	SOx (tpd)	NOx (tpd)	VOC (tpd)	Ammonia (tpd)
Stationary and Area Sources	310	27	180	255	351
Mobile Sources - On-Road Motor Vehicles - Off-Road Vehicles/Equipment	 6 9	 2 1	 241 144	 130 159	5
Total	325	30	565	444	356

U.S. EPA cited deficiencies in the emissions inventory in the 1997 PM10 Plan. To ensure that U.S. EPA can approve the 2003 PM10 Plan, District and ARB staffs have worked closely to improve the emission inventory. The major improvements are described below.

1. Ammonia Emissions

The 1997 PM10 Plan did not include an ammonia inventory. ARB and District staff has developed a comprehensive ammonia inventory for San Joaquin Valley. The largest source of ammonia emissions is livestock waste. Work is underway to refine the new estimates. Emission rate estimates per animal remain the greatest uncertainty.

Additional ammonia sources with quantified emissions include fertilizer application, composting, motor vehicles, domestic waste emissions, landfill gases, and burning. In the future, ARB staff will also assess the potential for ammonia contributions from other smaller sources like combustion devices equipped with selective catalyst reduction technology and swimming pools.

2. Unpaved Agricultural Road Emissions

Previously, the vehicle miles traveled (VMT) activity rate on dirt farm roads was based on a single assumption for all crops about the miles traveled per acre per year (4.38 VMT/acre/year). This was replaced with a crop-specific, season-specific estimate developed with input from the agricultural industry. The new crop-specific values range from 0.38 VMT/acres/year for grapes to 2.40 VMT/acre/year for small field cotton. The seasonal-specific emissions are based on land preparation and harvest activities from crop calendars. The crop calendar determines the operations needed to prepare an acre of land for each crop. The inventory now more accurately reflects the fact that there is more unpaved road travel during the times of year when land preparation and harvest activities are at the highest. The change reduced annual agriculture unpaved road dust emission estimates by 80 percent.

3. On-Field Agricultural Emissions

The inventory also includes new UC Davis emission factors for on-field agricultural particulate matter emissions by field operations, including all crop harvesting operations. These agriculture emission factors were developed through the Particulate Study.

Previously, a single emission factor was used for all land preparation activities. Working with agriculture experts, five emission factors were developed for five land preparation activities: root cutting; discing, tilling and chiseling; ripping and subsoiling; land planing and floating; and weeding. The crop calendar and county crop acreage were then used to estimate the monthly fugitive dust emissions from agriculture land preparation.

Due to the limited availability of harvest emission factors, ARB previously estimated harvest emissions for only three crops (cotton, almonds, and wheat). For the 2003 PM10 Plan, ARB used those existing emission factors, and developed a methodology to apply them to all of the harvest activities performed in California. The methodology is to select an existing emission factor, and then scale the factor to reflect the relative dustiness of different harvest activities. The crop calendar along with county-specific crop acreage was then used to determine the monthly fugitive dust emissions from agriculture harvest.

4. Other Improvements

Other inventory improvements include:

- Rainfall factors for paved and unpaved road dust;
- Direct PM10 emissions from dairies (previously zero);
- Direct PM10 emission from private unpaved roads (previously zero);
- Updated agriculture irrigation pump emissions;
- Updated pesticide emissions;
- Revised agriculture burning estimates;

- Revised oil and gas production growth; and
- Updated mobile source emission inventory using ARB's EMFAC 2002 and OFFROAD models.

5. Emission Reduction Credits

According to U.S. EPA and ARB policy, emission reductions credits (ERC) banked before a plan's emission inventory baseyear must be explicitly treated as emissions in the air. In other words, the plan must account for ERC use. The District does this by including projected ERC use in the emission inventory growth factor. This plan's projections for ERC use and total growth between 2002 and 2010 are shown in Table III-2.

Table III-2
Projected ERC Use and Emissions Growth
San Joaquin Valley, Annual Average, 2002-2010

Pollutant	ERC Use (tpd)	Total Growth (tpd)
NOx	9.6	11
ROG	6.4	7.8
PM10	1.6	2.3
SOx	2.4	2.6

Projected ERC use is less than total growth for each pollutant. That is the minimum criteria for the District's approach to work. However, projected ERC use is large and accounts for nearly all growth. Consequently, there is very little margin for nonpermitted stationary sources to grow. The District should provide additional information on both the ERC use projections and growth in nonpermitted sources to demonstrate why the sum of the two will not exceed total growth.

B. Control Strategy

The Proposed 2003 PM10 Plan includes a control strategy to attain the federal 24-hour and annual average PM10 standards based on reductions from existing regulations as well as additional reductions from enforceable commitments to adopt new control measures. The complex nature of PM10 pollution in the San Joaquin Valley requires a multi-pollutant control strategy for a wide variety of sources. The District has lead responsibility for adopting and implementing most stationary and area source controls; the transportation planning agencies for transportation control measures; ARB for most mobile sources, fuels, and consumer products; the Bureau of Automotive Repair for vehicle inspection and maintenance (Smog Check); and U.S. EPA for national transportation sources and certain off-road farm and construction equipment.

1. Existing Stationary and Area Source Commitments

In the 2003 San Joaquin Valley Ozone Rate of Progress Plan, the District committed to adopt two rules by Fall 2003 for implementation in 2007, but did not specify the emission reductions to be achieved. These two rules are listed in Table III-3. In the 2003 PM10 Plan, the District commits to emission reductions for these rules, and uses them in the attainment demonstration.

Table III-3
List of Existing District Commitments and Emission Reductions
San Joaquin Valley, Annual Average, 2010

	Source Category	Adoption Date	Implement Date	PM10 (tpd)	NOx (tpd)	SOx (tpd)
ROP	Boilers, Steam Generators, and Process Heaters	3Q/03	2Q/07	0	0.4	0.15
ROP	Stationary I/C Engines	3Q/03	2Q/07	0	1.7	0
Totals				0	2.1	0.15

2. New Stationary and Area Source Measures

The District is proposing fourteen new or updated control measures for stationary and area sources. These measures are listed in Table III-4.

Table III-4
List of Proposed New District Commitments and Emission Reductions
San Joaquin Valley, Annual Average, 2010

SIP #	Source Category	Adoption Date	Full Implementation Date	Direct PM10 (tpd)	NOx (tpd)	SOx (tpd)
A	Ag CMP	1Q/04	1Q/05	33.8	0	0
B	Cotton Gins	4Q/04	2Q/05	1.7	0	0
C	Dryers	2Q/05	4Q/06	0	0.4	0.15
D	Fugitive PM10	3Q/04	4Q/05	18.8	0	0
E	Glass Melting Furnaces	2Q/05	4Q/06	0	0	1.2
F	Gas-Fired Oilfield Steam Generators	4Q/04	2Q/06	0	0	4.8
G	Indirect Source Mitigation Fee	4Q/04	1Q/05	6.3	4.1	0
H	Residential Wood Combustion	3Q/03	1Q/04	5.4	0.2	0
I	Small Boilers	4Q/04	4Q/06	0	7.7	0
J	Water Heaters	4Q/04	4Q/04	0	1.8	0
K	Wineries	4Q/04	4Q/06	Not Quantified		
L	Steam-Enhanced Crude Oil Production Well Vents	1Q/05	1Q/06	Not Quantified		
M	Residential Space Heating	3Q/04	1Q/05	Not Quantified		
N	Agriculture Irrigation Engines	4Q/04	3Q/05	Not Quantified		
Totals				66.0	14.2	6.15

In Chapter 4 of the 2003 PM10 Plan, the District commits to developing its control measures as follows:

> "For the purpose of implementing the PM10 Plan, the District is committed to adopt and implement control measures that will achieve, in aggregate, emission reductions specified in the following section. Emission reductions achieved in excess of the amount committed to in a given year can be applied to the emission reduction commitments of subsequent years. The District is committed to adopt the control measures listed below unless these measures or a portion thereof are found infeasible and other substitute measures that can achieve equivalent reductions in the same adoption/implementation timeframes are adopted. Findings of infeasibility will be made at a regularly scheduled meeting of the District Governing Board with proper public notification. For purposes of State Implementation Plan (SIP) commitment, infeasibility means that the proposed control technology is [not*] reasonably likely to be available by the implementation date in question, or achievement of the emission reductions by that date is not cost-effective. The District acknowledges that this commitment is enforceable under Section 304(f) of the CAA."

ARB staff's recommendation to approve this approach is with the understanding that the District is committing to adopt control measures between 2003-2005 that achieve in aggregate 66 tpd direct PM10, 16.3 tpd NOx, and 6.3 tpd SOx reductions, for implementation between 2004-2006. The District is also committing to adopt the specific measures in Tables III-3 and III-4, unless the District Board finds a measure

* Note: The District intends to correct this typographical error prior to plan adoption.

infeasible at a noticed public hearing. A summary of each proposed measure is presented below.

A, Agriculture Conservation Management Practice (CMP) Program This is a proposed new measure that would affect on-field agriculture operations, off-field activities, equipment parking and storage areas, inactive open area windblown emissions, and concentrated animal feeding operations. Participation in the CMP program would be mandatory. Small farms would be exempt from the program reporting requirements.

B, Cotton Gins. This is an update to an existing rule to make it BACM. The rule is similar to a Maricopa County, Arizona rule. Under this control measure, cotton gins would be retrofitted with cyclones or equivalent devices with at least 95 percent efficiency, which is considered BACM for seed loading, first seed-cotton cleaning, master trash system, and other high-pressure exhaust emission units. Cyclones or equivalent devices with at least 90 percent efficiency could be installed for low-pressure exhaust units. Other rule requirements would ensure maximum particulate matter collection efficiency for cyclones.

C, Dryers This is a new measure that will affect dryers used to remove water from process material by heating. The District determined that these dryers exceed the de minimus threshold and are subject to BACM. These units are currently subject to District permitting requirements, but there is no specific rule. Emission controls appropriate for dryers include Public Utilities Commission-quality natural gas, low excess air, low NOx burners, and flue gas recirculation.

D, Fugitive PM10 (Regulation VIII) This is an update to make the rule BACM, increasing both the types of operations covered and the effectiveness of the dust reduction requirements. For example, local and State agencies responsible for roads will need to reduce the dust from vehicle travel and construction activities.

E, Glass Melting Furnaces This is an update to an existing rule for NOx, carbon monoxide, and ROG control. The District determined that SOx emissions from glass melting furnaces exceed the de minimus threshold and are subject to BACM. This measure would establish specific SOx limits, and would affect new and existing glass furnaces fired on petroleum-based fuel.

F, Gas-Fired Oilfield Steam Generators This is an update to an existing rule. The District determined that SOx emissions from gas-fired oilfield steam generators exceed the de minimus threshold and are subject to BACM. This measure is intended to assure appropriate control of SOx emissions from steam generators used in petroleum production. Compliance could be achieved through fuel conditioning or caustic scrubbing.

G, Indirect Source Mitigation Fee This proposal would create a program to mitigate emissions from new development projects (like shopping and goods distribution

centers) that generate motor vehicle trips. These types of projects are referred to as indirect sources. New development projects would be required to pay a mitigation fee, and those funds would be used to purchase cost-effective emission reductions. The District is also proposing a focused mitigation program for the Bakersfield Metropolitan Area. The District is committing to additional reductions in the Bakersfield area beyond the Valley-wide source mitigation fee program. The District believes this commitment can be funded through fees or federal grants.

H, Residential Wood Combustion This is an update to an existing rule. Emissions from residential wood combustion exceed the de minimis threshold and are subject to the BACM requirement. The District intends to include mandatory curtailment of burning on high pollution days, limit the number of fireplaces in new homes, and require U.S. EPA-certified fireplaces and woodstoves upon property sale or transfer. The District will provide exemptions where the rule is not practical (for example, homes where wood is the primary source of heat).

I, Small Boilers, Steam Generators and Process Heaters, from 2 MMBtu/hr to 5 MMBtu/hr This is a new measure applicable to small boilers, steam generators, and process heaters, from 2 MMBtu/hr to 5 MMBtu/hr. The District determined that the emissions exceed the de minimus threshold and are subject to BACM requirements.

J, Water Heaters 75,000 Btu/hr to 2 MMBtu/hr This is a new measure applicable to industrial, commercial, and institutional water heaters. The District determined that the emissions exceed the de minimus threshold and are subject to BACM requirements. These sources are currently not regulated by the District. NOx and SOx prohibitory rules may be coupled with a financial incentive program to accelerate the replacement or retrofit of higher-polluting units.

K, Wineries This is a new measure applicable to winery processes that produce significant ROG emissions via wine fermentation and aging. The District determined that the emissions exceed the de minimus threshold and are subject to BACM requirements. The District does not currently regulate wine fermentation and aging. ROG reduction could be achieved with vapor collection and control systems, carbon adsorption, water scrubbers, catalytic incineration, condensation, and additional temperature control.

L, Steam-Enhanced Crude Oil Production Well Vents This is an upgrade to an existing rule. The District determined that ROG emissions from this source exceed the de minimus levels and are subject to BACM requirements. This measure would reduce ROG emissions from steam-enhanced crude oil production wells, and any associated vapor collection and control systems. Emission reductions can be achieved by lowering the rule exemption thresholds.

M, Residential Space Heating This is a new measure applicable to residential fan-type central furnaces fueled with natural gas. The District determined that NOx emissions from this source exceed the de minimus levels and are subject to BACM

requirements. The measure would likely affect new furnaces installed in new residences, and units replaced in existing homes once the useful life of the units have expired. The District is modeling this rule after similar measures in place in other California districts.

N, Agricultural Irrigation Engines This measure is an upgrade to an existing rule establishing opacity standards. Agriculture irrigation engines are currently exempt from the opacity standards; the District plans to remove the exemption.

Resources Needed to Ensure Effectiveness of Dust Strategies The Agriculture CMP and the updates to the fugitive dust rule, Regulation VIII, contribute over three-quarters of the new direct PM10 emission reductions in the Plan. The success of both of these measures, and ultimately the PM10 strategy itself, is critically dependent on the staff resources the District provides for public outreach, education, and enforcement.

3. Mobile Source Measures

State and federal agencies have jurisdiction to regulate mobile source emissions. Adopted State and federal regulations for cleaner engines and fuels are driving Valley NOx emissions down by over 140 tpd, or nearly 40 percent, between 1999 and 2010. To supplement the existing program, ARB staff has identified six new State measures that would be developed over the next several years to provide an additional 10 tpd NOx and 0.5 tpd PM10 reductions by 2010, consistent with the attainment demonstration needs established in this 2003 PM10 Plan. These measures are a subset of a larger strategy ARB staff has proposed to cut emissions of ROG, NOx, and particulate matter statewide.

The proposed ARB SIP commitments and a detailed description of the measures are included in the *Proposed 2003 State and Federal Strategy for the California State Implementation Plan,* released May 12, 2003. Only the six measures that are needed for PM10 attainment in this region are included as part of the San Joaquin Valley's 2003 PM10 Plan.

Table III-5
Proposed New State Measures
San Joaquin Valley, Annual Average, 2010

Strategy (Agency)	Name	Expected Reductions* (tpd)			Action Dates
		ROG	PM10	NOx	
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	0-2.4	--	0-2.7	2005
LT/MED-DUTY-2 (BAR)	Smog Check Improvements	1.5	--	3	2002-2005
ON-RD HVY-DUTY-3 (ARB)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling	1.5	0.1	4	2003-2006
OFF-RD CI-1 (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	1.0	0.4	0	2004-2008
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)	0.1	--	0.1	2004
OFF-RD LSI-3 (ARB)	Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤8,000 Pounds	0.1	--	0.2	2004
Total Emission Reduction Commitment from New State Measures		--	0.5	10	2002-2008

* Expected reductions from individual defined measures are shown for information only. The State is proposing commitments for total new reductions in NOx and PM10 emissions only, consistent with the PM10 attainment demonstration. Commitments for further reductions will be considered in the context of the upcoming Valley Ozone SIP.

The District has also taken action to reduce mobile source emissions in the San Joaquin Valley as shown in Table III-6. In 2001, the District requested the Bureau of Automotive Repair to expand the Enhanced Smog Check program to additional areas. In addition, the District's incentive programs provide funds to reduce emissions from sources not subject to local control.

Table III-6
Benefits of Existing District Mobile Source Strategies
San Joaquin Valley, Annual Average, 2010

Strategy	NOx (tpd)
Request to Add Areas to Enhanced Smog Check	4.9
Clean Engine Incentive Programs	6.5

C. Modeling

The Act requires Serious PM10 nonattainment plans to include a demonstration (including air quality modeling) that the plan provides for attainment of the PM10 standards. The 2003 PM Plan includes chemical mass balance (CMB) receptor modeling, urban airshed modeling, zone of influence analysis, and linear rollback analysis to demonstrate attainment of the 24-hour and annual average PM10 standards.

1. Chemical Mass Balance

CMB is a statistical analysis using information about the chemical composition of air monitoring samples and information about the composition of emission sources to apportion each source's contribution to the measure sample. CMB receptor modeling (CMB version 8) was conducted for all PM10 design value sites in the San Joaquin Valley.

The Particulate Study fieldwork provided extensive data on the types and proportion of the chemical species in San Joaquin Valley PM10. This information goes far beyond the routine data collected by federally required monitors. The receptor modeling used source profiles provided by the Particulate Study specific to dust and tire/brake wear in the San Joaquin Valley, a California-based motor vehicle profile, and a wood smoke profile specific to vegetation in the San Joaquin Valley.

In general, the analysis for all sites met established performance criteria. Two sites, Turlock and Modesto, did not meet all performance criteria. However, monitored concentrations at these sites were close to the standard, and therefore, not limiting in terms of control strategy design.

2. Precursor Analysis

The plan uses an urban airshed model modified to address aerosol chemistry (UAM-Aero) to analyze the response of ammonium nitrate to precursor reductions. Using data from the 1995 Integrated Monitoring Study (IMS95), an early phase of the Particulate Study, the impact on ammonium nitrate concentrations of reductions in NOx, ROG, and ammonia emissions was evaluated. The conclusion was:

- NOx reductions had the greatest impact on ammonium nitrate levels and over the largest geographical area,
- ROG reductions had no impact on ammonium nitrate levels, and
- Ammonia controls appeared to provide some benefits in the Bakersfield area.

From the modeling, a ratio relating NOx emission changes to changes in ambient ammonium nitrate concentrations of 1.5 to 1 was identified. That ratio was then used in the rollback analysis. Without modeling, the nominal assumption is a NOx to ammonium nitrate ratio of 1 to 1. A 1 to 1 ratio was used in the San Joaquin Valley's

previous PM10 plan. The 1.5 to 1 ratio is more health–protective, and therefore, provides increased confidence that the projected NOx reductions will yield the ammonium nitrate reductions relied on in the attainment demonstration.

3. Background Concentrations

Background concentrations are used in the linear rollback analysis to determine the portion of the ambient PM10 that will not respond to controls. The primary sources of natural emissions include organic carbon from vegetation, NOx from soil microbial activities and lightening strikes, fugitive dust from undisturbed surfaces, biogenic sulfur, and sea salt.

The linear rollback analysis for this plan used values ranging from 10 to 14 $\mu g/m^3$. In contrast, the draft South Coast SIP assumed background PM10 concentrations of 5 to 6 $\mu g/m^3$. The rationale for using higher values in the Valley was based on an assumption of elevated concentrations from accumulation of natural emissions during stagnation events, as well as an assumption of significant contributions from biogenic emissions of organic carbon.

Given the level of uncertainty in specifying background concentrations, and the range of values used elsewhere, the background concentrations used appear somewhat high. In addition, a portion of the background carbon was ascribed to the vegetative burning category. This may be appropriate for the annual average when wildfire emissions may cause impacts. However, it is not appropriate to specify a background concentration for this source category for the winter episodic analysis because there are generally no wildfire emissions during this season.

The ultimate effect of higher background concentrations is to require more emission reductions. Assuming background concentrations that are perhaps somewhat high is conservative and does not undermine the attainment demonstration.

4. Attainment Demonstration

To demonstrate attainment, the District used the CMB analysis with linear rollback. Linear rollback assumes that future PM10 levels above background will decrease in proportion to projected emission reductions. In the linear rollback for each design value site, CMB source categories are matched to the appropriate emission inventory categories. Controls are applied to the emission inventory categories and then substituted back into the linear rollback equation to determine what the monitor value would be if the controls had been implemented. For the 2003 PM10 Plan, the District used a 2010 controlled emission inventory. Tables III-7 and III-8 show the projected 2010 values with Plan implementation for both the 24-hour and annual average design values.

Table III-7
Projected 24-Hour PM10 Values at Exceedance Sites with Plan Implementation
San Joaquin Valley

Site Name	1999-2001 Design Value ($\mu g/m^3$)	2010 Projected Value ($\mu g/m^3$)
Bakersfield-California Ave.	190	139
Bakersfield-Golden	205	153
Clovis	155	122
Corcoran-Patterson	174	136/134*
Fresno-Drummond	186	145
Fresno-First Street	193	148
Hanford-Irwin Street	185	143
Modesto-14th Street	158	117
Oildale-3311 Manor Street	158	120
Turlock-900 Minaret Street	157	117

*Corcoran had two exceedances at 174 $\mu g/m^3$

Table III-8
Projected Annual PM10 Values at Exceedance Sites with Plan Implementation
San Joaquin Valley

Site Name	1999-2001 Design Value ($\mu g/m^3$)	2010 Projected Value ($\mu g/m^3$)
Bakersfield-Golden	57	49
Hanford-Irwin Street	53	47
Visalia-Church Street	54	46

The projected 153 $\mu g/m^3$ at Bakersfield-Golden represents attainment of the standard according to U.S. EPA regulation. In the Code of Federal Regulations, Part 50, National Primary and Secondary Ambient Air Quality Standards, Appendix K *Interpretation of the National Ambient Air Quality Standards for Particulate Matter*, U.S. EPA defines a 24-hour exceedance as a "value that is above the level of the 24-hour standard after rounding to the nearest 10 $\mu g/m^3$ (i.e., values ending in 5 or greater are to be rounded up)." The regulation also states that "although the discussion in this appendix focuses on monitoring data, the same principles apply to modeling data." Therefore, according to U.S. EPA regulation, the 153 $\mu g/m^3$ is rounded to 150 $\mu g/m^3$.

As shown above, the Bakersfield-Golden site has the highest design value in the San Joaquin Valley for both standards. The Bakersfield-Golden site was also the site most resistant to controls, especially NOx controls. Attainment at Bakersfield-Golden is critically dependent on the effectiveness of fugitive dust controls.

In general, the attainment demonstration is health-protective with a conservative NOx to ammonium nitrate ratio and conservative background assumptions.

D. Best Available Control Measures

The Act requires all serious nonattainment areas to implement BACM on all significant sources of PM10 or PM10 precursors. U.S. EPA generally presumes the contribution to nonattainment of any source category to be de minimis if the source category causes a PM10 impact in the area of less than 1 $\mu g/m^3$ for the annual mean concentration and 5 $\mu g/m^3$ for a 24-hour average.

The District hired two consultants to do a preliminary BACM analysis for most fugitive dust sources. The consultant calculated the de minimis levels by matching annual average daily emissions with the maximum annual average PM10 measurement for each county, and matching the worst-case 24-hour ambient measurement with seasonal quarter emissions for each corresponding pollutant. The worst-case condition for each component of PM10 was examined separately. This approach determines a de minimis level for each contributing component of PM10 based on a worst-case PM10 day, which is greater than the highest measured 24-hour PM10 concentration. For sources above de minimis, the District's consultants evaluated the relevant District rules and recommended potential upgrades. District staff conducted the BACM analysis for stationary sources and residential wood burning.

Considering the consultants' recommendations and staff analyses, the District is committing to upgrade seven existing rules to BACM levels and to adopt seven new rules. We believe implementation of these commitments would meet BACM requirements. We urge the District to work with ARB and U.S. EPA to ensure that the final rules include control requirements that satisfy BACM.

E. Transportation Conformity Budgets

This Plan establishes on-road motor vehicle emissions budgets for transportation conformity for the years 2005, 2008, and 2010. These emissions budgets reflect the latest planning assumptions and were developed using ARB's latest on-road mobile source emission factor model EMFAC2002 (approved by U.S. EPA on April 1, 2003). Currently, transportation agencies use a build/no-build analysis for PM10 conformity budgets.

The new emissions budgets for NOx and PM10 are shown in Table III-9. The budgets are derived with EMFAC2002 projections and matched to activity data reported by the eight county Councils of Government using ARB's VMT matching methodology. These results are adjusted to account for any baseline emission reductions not included in the model, and any emissions that the model does not project (e.g. PM10 emissions from road construction activities, reentrained paved road dust, and reentrained unpaved road dust.) Finally, the new State and local commitments to reduce on-road vehicle and road construction emissions are subtracted from the adjusted baseline to arrive at the conformity budgets. The new budgets will become applicable when U.S. EPA finds the budgets adequate. The conformity budgets are based on the average annual daily emissions. The District determined that they are applicable for both the annual and

24-hour PM10 standards. Conformity assessments for these budgets will use the emission factors in this SIP with updated activity.

Table III-9
Motor Vehicle Emission Budgets for PM10*
San Joaquin Valley, Annual Average, Tons per Day

County	2005		2008		2010	
	PM10	NOx	PM10	NOx	PM10	NOx
Fresno	14.1	42.6	13.3	36.4	16.2	29.7
Kern	10.6	38.8	10.7	34.2	10.8	28.4
King	5.6	7.5	5.6	6.5	6.7	5.4
Madera	4.3	9.9	4.3	9.1	4.5	7.8
Merced	5.5	15.3	5.2	12.5	5.3	9.9
San Joaquin	9.0	28.9	3.9	23.4	9.2	18.3
Stanislaus	6.5	22.5	6.1	18.7	6.1	14.9
Tulare	8.7	23.6	7.9	20.1	8.9	16.4

* The District released these revised budget numbers on May 19, 2003.

Fugitive dust emissions from roads will continue to grow due to growth in VMT. Section 93.124 of the federal conformity rule, in particular 93.124(c), allows the SIP to establish trading mechanisms between budgets for pollutants or precursors. The basic idea is to allow conformity demonstrations for analysis years after 2010 to use NOx reductions beyond the attainment level to offset PM10 increases from this VMT growth.

We note that since growth in VMT plays a significant role in PM10 emissions in the San Joaquin Valley, the San Joaquin Valley transportation agencies have committed to conduct feasibility analyses as part of each new Regional Transportation Plan, excluding revisions. The analyses will identify and evaluate potential post-2010 control measures to mitigate emissions growth. We believe these are critical for retaining the health benefits of the State's mobile source program. We will work closely with the transportation planning agencies and the District to ensure that post-2010 conformity analyses adequately protect public health.

The emissions budgets established in this Plan fulfill the requirements of the Act and U.S. EPA regulations to ensure that transportation activities support progress and attainment of the PM10 standards. With the upcoming implementation of the more health protective federal eight-hour ozone and PM2.5 standards, we recognize that the motor vehicle budgets associated with those SIPs must reflect additional reductions.

Directly emitted PM10 poses a unique challenge that is not experienced with ozone or PM10 precursors. As currently calculated, directly emitted PM10 from paved roads has a linear relationship with VMT. Thus, as VMT grows, paved road dust also grows. Since the opportunities for controlling paved road dust emissions are limited, ARB will continue to work closely with the District, the Councils of Government, and other transportation agencies to address the emissions growth.

F. Five Percent/Reasonable Further Progress

In addition to the overarching requirement that the Plan demonstrate attainment as soon as practicable, it must also provide for an annual reduction in PM10 or PM10 precursors of not less than five percent of such emissions as reported in the most recent inventory prepared for the area. We believe this is not a separate requirement, but an integral part of the attainment demonstration. It ensures annual progress toward clean air and steady implementation of the attainment strategy. In other words, adoption and implementation of control measures are not put off until late in the attainment period. This is directly analogous to the Act's ozone rate of progress requirements.

For the San Joaquin Valley, CMB and urban airshed modeling results show that to attain the standard, the region must reduce both direct PM10 and NOx emissions. The attainment strategy is designed to do so. Reducing directly emitted PM10 and NOx simultaneously provides for the most expeditious attainment strategy. Therefore, the 2003 PM10 Plan shows a five-percent annual reduction of emissions by reducing a combination of directly emitted PM10 and NOx each year. The percent reductions are added to achieve five percent using the same adding convention used in ozone rate of progress plans.

The Act requires the plan to contain quantitative progress milestones to be achieved every three years. The District has identified emission milestones that satisfy the five-percent annual and reasonable further progress requirements.

G. Contingency Measures

Contingency measures are intended to provide additional reductions in case the control measures identified for attainment and progress do not deliver the expected reductions. The District and ARB have included all measures currently known to be feasible in the 2003 PM10 Plan to obtain the reductions needed to attain the PM10 standards at the earliest practicable date. The District has two contingency measures – additional amendments to the fugitive dust rule and an amendment to the agriculture CMP. For the fugitive dust rule, measures that were not selected for BACM, for reasons such as cost-effectiveness or other reasons, would be implemented. For the agriculture CMP, the District would increase the number of mandatory measures. The District will also be submitting an ozone attainment plan in 2004, which will have additional reductions in both the 2008-2010 and the post-2010 timeframe. The District must continue to implement control measures post-2010 due to nonattainment of the federal eight-hour ozone and the PM2.5 standards.

The State contingency measures in the Plan are the post-2010 benefits of mobile measures ARB and U.S. EPA have adopted, and that will be implemented without the need for further action.

IV. FUTURE ACTIONS AND AIR QUALITY PLANS

A. Further Study Measures

The District includes four further study measures in its plan. These measures appear to have potential for emission reductions, but have uncertain emission inventories or control measure effectiveness at this time.

1. Concentrated Animal Feeding Operations

The District is proposing a further study measure for ammonia emissions from concentrated animal feeding operations (CAFOs). In light of the uncertainty of the impact of ammonia reductions on ammonium nitrate levels and uncertainty in the ammonia inventory itself, ARB staff concurs that a further study measure is appropriate. A decision to move forward with controls should be made as soon as the complete Particulate Study modeling is available. The District is actively engaged in efforts to provide information needed to develop better emission estimates and potential CAFO controls.

The District's Agricultural Technical Advisory Committee includes stakeholders from industry, academia, and environmental regulatory agencies. This group has developed a Dairy Action Plan that defines research to assess ammonia, ROG, and direct PM10 emissions from dairy farms. The goal of the research is to better understand the contribution of livestock related emissions to air pollution.

2. Solid-Fueled Boilers, Steam Generators, and Process Heaters

In the Plan development process, the District received a question about controls on solid-fueled boilers, steam generators, and process heaters. Upon further investigation, the District determined that NOx and SOx emissions from these sources exceed the de minimus threshold levels and are subject to BACM. The District's permitting process establishes NOx and SOx emission limits for these units. The District will evaluate whether the current emission limits are consistent with BACM. In the event they are not BACM, the District commits to adopt a rule in 2005.

3. Soil Decontamination

The District commits to improving the ROG emission inventory for soil decontamination that occurs by open aeration. The District plans to assess the amount of contaminated soils received at these facilities from out-of-district locations. The District's permitting process currently establishes limits for in-situ soil decontamination.

4. Leaf Blowers

The current emissions inventory for leaf blowers includes direct PM10 emissions in the engine exhaust, but does not include the dust that is disturbed during the blowing process. If the dust emissions are determined to be significant, the District will conduct analysis to determine appropriate control measures.

B. Commitment for Air Quality Modeling and Plan Reassessment

Final Particulate Study modeling is scheduled to be completed in 2005. Beyond the data already available from the Particulate Study that was used in the 2003 PM10 Plan, this work will provide greater atmospheric modeling capability. Table IV-1 details some of the critical Particulate Study milestones.

Table IV-1
California Regional Particulate Air Quality Study Modeling Schedule

Spring 2003	Initiate in-house modeling efforts for Study episodes
Spring 2003	Release Request for Proposals for external modeling support
Summer 2003	Initiate UC Davis modeling for Study episodes
Fall 2003	Begin contracts for external modeling support
Winter 2004	Preliminary findings from in house modeling
Summer 2004	Preliminary findings from UC Davis modeling
Fall 2005	Modeling contracts complete

If the Particulate Study modeling shows that the assumptions used for the attainment demonstration are no longer valid, the District proposes to revise the PM10 SIP in 2006.

V. LEGAL AUTHORITY

The Clean Air Act Amendments of 1990 (42 U.S.C. section 7401 et seq.) require states such as California to submit to the U.S. EPA revisions to the SIP for ozone and PM10 for certain areas. The primary tool to be used in the effort to attain national ambient air quality standards is a plan to be developed by any state with one or more nonattainment areas which provides for implementation, maintenance and enforcement of the standards—the SIP (section 110(a)(1)). Section 110(a)(2)(A) broadly authorizes and directs states to include in their SIPs:

> "...enforceable emission limitations and other control measures, means, or techniques (including economic incentives such as fees, marketable permits, and auctions of emissions rights), as well as schedules and timetables for compliance, as may be necessary or appropriate to meet the applicable requirements of the Act."

Pursuant to these statutory provisions, ARB is charged with coordinating State, regional, and local efforts to attain and maintain both State and national ambient air quality standards. The direct statutory link between ARB and the mandates of the Clean Air Act is found in section 39602 of the Health and Safety Code. This provision states:

> "The state board is designated the air pollution control agency for all purposes set forth in federal law.
>
> The state board is designated as the state agency responsible for the preparation of the state implementation plan required by the Clean Air Act (42 U.S.C., Sec. 7401, et seq.) and, to this end, shall coordinate the activities of all districts necessary to comply with that act.
>
> Notwithstanding any other provision of this division, the state implementation plan shall only include those provisions necessary to meet the requirements of the Clean Air Act."

VI. STAFF RECOMMENDATIONS

A. For District Action Prior to Plan Adoption

We recommend that the District clarify its proposal to revisit the PM10 emission reduction strategy when the final Particulate Study data are available. The District needs to specify a timeline for any needed plan revision.

B. For Air Resources Board Action

With the clarification discussed above, we recommend that the Board take the actions necessary to approve both the State and local elements of the 2003 San Joaquin Valley PM10 Plan and to forward it to U.S. EPA as a revision to the California SIP.

(1) After considering public testimony, we recommend that the Board adopt the proposed State commitments to support the 2003 San Joaquin Valley PM10 SIP as identified in Section I, Chapter D of the *Proposed State and Federal Strategy for the California SIP*. These commitments for emission reductions and new measures are integral to the Plan's ability to show both attainment and progress.

(2) After considering public testimony, we recommend that the Board approve the 2003 San Joaquin Valley PM10 Plan as a revision to the California SIP. Board action should also encompass any District revisions that strengthen the Proposed Plan in response to public comments.

ARB staff finds that the 2003 PM10 Plan meets applicable requirements. We believe that Plan implementation would clearly reduce PM10 levels throughout the San Joaquin Valley and benefit public health.

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

May 2003

California Environmental Protection Agency
Air Resources Board

DOCUMENT AVAILABILITY

Electronic copies of this document and related materials (including notices of public workshops and Board consideration) can be found at the ARB's web site at http://www.arb.ca.gov/planning/sip/sip.htm. Alternatively, paper copies may be obtained from the Board's Public Information Office, 1001 I Street, 1st Floor, Environmental Services Center, Sacramento, California 95814, (916) 322-2990.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact our Americans with Disabilities Act Coordinator at (916) 323-4916, or TDD (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area.

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This report has been reviewed by the staff of the Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

EXECUTIVE SUMMARY

QUESTIONS AND ANSWERS

1. What are the harmful effects of air pollution on our health?
2. Who regulates sources of air pollution in California?
3. What major urban areas currently violate the federal one-hour ozone and PM10 standards?
4. What is the State Implementation Plan (SIP)?
5. How does the Proposed Strategy relate to the 1994 SIP?
6. Why is ARB proposing to update the State and federal SIP strategy now?
7. How is the SIP connected to federal transportation funding?
8. What air pollutants are targeted in the Proposed Strategy?
9. How did we develop the Proposed Strategy and seek public input?
10. How does the Proposed Strategy differ from the January 2003 draft?
11. How is the Proposed Strategy document structured?
12. What is the legal framework for the proposed State commitments?
13. What about State commitments for other SIPs?
14. What kinds of defined measures are proposed in the Proposed Strategy?
15. How would a defined SIP measure become a regulation?
16. What is the federal government's responsibility to reduce emissions from sources under its control?
17. What is the Black Box and how big is it?
18. How would the Proposed Strategy affect generation of emission reduction credits?
19. How would the Proposed Strategy support environmental justice and reduce community exposure to air pollution?
20. How would the Proposed Strategy impact the State's environment?
21. How would the Proposed Strategy impact the State's economy?
22. What are the opportunities for public comment on the Proposed Strategy?
23. What is the staff recommendation for Board action?

EXECUTIVE SUMMARY

1. What are the harmful effects of air pollution on our health?

Current levels of air pollution exact a toll on our lives. Recent studies link particulate air pollution to sudden death in infants as well as adults, shortening lives by years. Research in Southern California also shows that children exposed to unhealthful levels of ozone suffer decreased lung function growth and increased asthma. And air toxics, like particles from diesel engines and benzene from gasoline, significantly increase our cancer risk.

Monitored air quality data and a health model allow us to quantify the potential scope of harm to Californians from air pollution each year – from premature death to asthma attacks, as well as the impacts on health care and productivity. For example, attaining the State's own health-based air quality standards for particulate matter and ozone would annually prevent:

- 6,500 premature deaths,
- 10,000 hospital admissions,
- 350,000 asthma attacks, and
- 2.8 million lost work days.

2. Who regulates sources of air pollution in California?

In California, primary responsibility for controlling air pollution is shared by the State Air Resources Board (ARB), 35 local air pollution control and air quality management districts (districts), and the U.S. Environmental Protection Agency (U.S. EPA).

State. ARB is responsible for improving outdoor air quality by controlling emissions from mobile sources (except where federal law preempts ARB's authority) and consumer products, developing fuel specifications, adopting statewide control measures for air toxics, establishing gasoline vapor recovery standards and certifying vapor recovery systems, providing technical support to the districts, and overseeing local district compliance with State and federal law. The State Department of Pesticide Regulation (DPR) is responsible for control of agricultural, commercial and structural pesticides, while the Bureau of Automotive Repair (BAR) runs the State's Smog Check programs to identify and repair polluting cars.

Local. Local air districts are primarily responsible for controlling emissions from stationary and areawide sources (with the exception of consumer products) through rules and permitting programs. Examples of stationary and areawide sources include industrial sources like factories, refineries, power plants, and smelters; commercial sources like gas stations, dry cleaners, and paint spray booth operations; and

residential sources like fireplaces, water heaters, and house paints. Districts also inspect and test fuel vapor recovery systems to check that such systems are operating as certified. In addition, local transportation agencies are responsible for developing and implementing transportation control measures aimed at reducing vehicle activity and emissions.

Federal. U.S. EPA has the authority to control emissions from mobile sources, including sources under exclusive federal jurisdiction (like interstate trucks, some farm and construction equipment, aircraft, marine vessels, and locomotives based in this country). International organizations develop standards for aircraft and marine vessels that operate outside the United States. Federal agencies have the lead role in representing the U.S. in the process of developing international standards. U.S. EPA sets national ambient air quality standards for specific pollutants like ozone, inhalable particulate matter (PM10), and the subset of fine particles (PM2.5). The agency also has oversight authority for state air programs as they relate to the federal Clean Air Act.

3. What major urban areas currently violate the federal one-hour ozone and PM10 standards?

Air quality in the South Coast, San Joaquin Valley, and Imperial County continues to violate the federal one-hour ozone and PM10 standards; the Sacramento Region also experiences ozone levels above the existing federal standard. Coastal regions including San Diego, Ventura, Santa Barbara, and the San Francisco Bay Area have attained the one-hour ozone standard in the last few years. However, most of California does not attain the more health-protective new federal and State standards for ozone and fine particles.

4. What is the State Implementation Plan (SIP)?

The SIP is our blueprint for meeting federal air quality standards by the applicable deadlines set in the federal Clean Air Act. California's SIP is a compilation of region-specific plans that detail how each area will meet the air quality standards. The plan includes an estimate of the emission reductions needed to meet each air quality standard based on air monitoring results, data on emission sources, and complex air quality modeling. It reflects the benefits of the pollution control program adopted by air agencies at all levels, and may also include commitments to implement new strategies. Together, these elements must reduce emissions by an amount sufficient to meet the air quality standard in each region. Once the local element of the plan is adopted by the air district(s) and other responsible local agencies, it is sent to ARB for adoption and then formally submitted to the U.S. EPA for approval as a revision to the California SIP.

5. How does the Proposed Strategy relate to the 1994 SIP?

In 1994, ARB and local districts covering six regions of the State developed a comprehensive control strategy to attain the federal one-hour ozone standard. U.S. EPA approved that plan in 1997, and agreed to pursue appropriate measures for

sources under federal control as well. Most of the measures anticipated in the 1994 SIP, and many others, have since been adopted. We are proposing this Strategy to update the existing State and federal SIP element. Upon approval by ARB, the Strategy would identify a series of new State commitments to achieve the next increment of progress toward the federal one-hour ozone and PM10 standards in the most polluted urban areas. It also describes feasible approaches to reduce emissions from sources under the jurisdiction of the federal government.

This Proposed 2003 State and Federal Strategy for the California SIP (Strategy) would update and entirely replace the comprehensive statewide control strategy contained in the existing 1994 ozone SIP (as modified in 1999 for South Coast). For areas of the State that have not yet achieved the full amount of emission reductions committed to in the existing SIP, this proposed strategy would retain the existing statewide commitments to achieve all of these emission reductions. However, the specific statewide measures identified in the existing SIP would be entirely replaced by the new proposed measures and control strategy to achieve these emission reductions. For those areas, we will reflect the new Strategy in the region's next SIP revision.

6. Why is ARB proposing to update the State and federal SIP strategy now?

First, recent technical work in the South Coast and San Joaquin Valley – including improved emission inventories and air quality modeling – show that both regions need further emission reductions to meet all of the existing federal air quality standards by 2010. With virtually all of the State's 1994 SIP measures already adopted and being implemented, we must develop new measures to continue progress.

Second, the U.S. EPA has directed the San Joaquin Valley to revise its ozone and particulate matter SIPs to define the controls needed for attainment or face federal sanctions beginning next year.

Third, changes in federal policy require that most SIPs be updated to reflect new emissions estimates and controls for motor vehicles to preserve California's ability to secure federal transportation funding.

7. How is the SIP connected to federal transportation funding?

The Clean Air Act says that the emissions from the transportation system must "conform" or fit within the motor vehicle emissions budget established in the SIP to support attainment of the air quality standards in each region. A transportation agency must use the latest data to analyze the emissions projected to result from new transportation projects and plans to determine "conformity." A positive conformity finding is required to obtain federal approval and funding to expand the transportation system.

ARB has greatly improved the accuracy of its vehicle emissions inventory. More extensive real-world testing of vehicles and greater numbers of older vehicles on the

road result in higher emissions than estimated in prior SIPs. Thus, transportation agencies using the current vehicle data cannot make new conformity findings until the SIPs and their vehicle budgets are updated with the same data. The higher vehicle emissions also create a need for more control measures in the SIP to reduce them.

8. What air pollutants are targeted in the Proposed Strategy?

The Proposed Strategy seeks to explicitly reduce the reactive organic gases (ROG) and nitrogen oxides (NOx) that contribute to both ozone and PM10 formation; as well as direct PM10 emissions, primarily from diesel soot. Some of the measures also provide ancillary benefits – reducing emissions of toxic air pollutants and carbon monoxide.

9. How did we develop the Proposed Strategy and seek public input?

As the Board neared adoption of all the defined measures in the 1994 SIP, ARB staff began to outline the next generation of State and federal control measures. In 2001, we initiated a public process to identify new emission reduction strategies for California. We solicited public input on options for reducing ozone, particulate, toxics, and greenhouse gas pollution across California. We held two sets of workshops throughout the State to hear ideas from the public and share our concepts. From those efforts, the staff compiled an extensive list of potential control measures for sources under State, federal, and local control.

In January 2003, ARB staff released a draft of this Proposed Strategy focused on the potential measures for sources under State and federal authority that would help reduce ozone and PM10 in the South Coast by 2010. In March, we provided a subset of those measures for publication in the draft PM10 SIP for the San Joaquin Valley. Through March and April, we participated in eleven public workshops with the local air districts in the South Coast and San Joaquin Valley, as well as an ARB technical workshop in both those regions plus Sacramento, to discuss the draft State and federal SIP strategy. ARB staff has considered the public concerns and suggestions voiced at these workshops and additional stakeholder meetings, as well as over 300 comment letters on the draft Strategy.

10. How does the Proposed Strategy differ from the January 2003 draft?

The measures and strategies in the Proposed Strategy are largely unchanged from the January 2003 draft. However, based on public input and our own updated assessment of emissions and control potential for some measures, the Proposed Strategy does reflect some refinements. For example, the Proposed Strategy lays out our expectations of the federal government as part of the long-term strategy, and measure OFF-RD LSI-3 (regarding zero-emission forklifts) has been renamed and modified to acknowledge that electric forklifts may not be feasible in all applications.

Table ES-1 summarizes the significant changes made to the defined State and federal measures since January 2003 when we released the draft SIP element for South Coast.

11. How is the Proposed Strategy document structured?

- *Executive Summary* includes general questions and answers about the plan.
- *Section I: Overview of Commitments* presents the legal framework for the proposed State commitments, summarizes the measures and emission reductions, and includes the legal authority.
- *Section II: Mobile Sources* presents existing and proposed measures for all types of vehicles (cars, trucks, buses), off-road equipment, marine vessels and ports, aircraft and airports, locomotives and railyards, plus conventional and alternative fuels.
- *Section III: Consumer Products, Vapor Recovery, and Pesticides* describes the existing and proposed measures for these sources.
- *Section IV: Long-Term Strategy* identifies our initial thoughts on additional approaches to further reduce emissions beyond the benefits of the defined measures. This section also outlines concepts that the federal government could use to reduce emissions from the sources it is responsible for controlling.
- *Section V: Potential Impacts* describes the possible effects of the defined measures on California's environment and economy, as well as the environmental justice impacts. *(Note: the statewide economic analysis will be available by early June at* http://www.arb.ca.gov/planning/sip/sip.htm*)*

12. What is the legal framework for the proposed State commitments?

We are proposing a three-tiered commitment, described in Section I of this document. The foundation is a commitment to develop and propose for Board consideration 20 defined new statewide control measures. The Board could take any action within its discretion in response to these proposals.

For the South Coast SIP and San Joaquin PM10 SIP, the next element is a commitment to adopt these or other measures sufficient to achieve the specified new State emission reductions for that region in 2010. In the South Coast commitment, we include a proposed schedule for adoption of measures in 2003, 2004, 2005, and 2006 to achieve specified emission reductions in 2010.

Because of the magnitude of reductions needed to attain the federal one-hour ozone standard in both the South Coast and San Joaquin Valley, we are proposing to lead a public process to identify and develop further strategies, beyond those outlined in

the defined measures. Finally, we are proposing a long-term commitment to achieve the remaining emission reductions that ARB determines to be appropriate to reach the ozone attainment target in the South Coast.

13. What about State commitments for other SIPs?

We anticipate that the San Joaquin Valley will require new emission reduction measures to achieve further ROG and NOx reductions from State and federal sources to attain the federal one-hour ozone standard. Commitments beyond those proposed for the San Joaquin Valley's PM10 SIP will be considered as part of the San Joaquin Valley's Ozone SIP.

If the commitment to develop the State defined measures is approved by the Board, we will provide the appropriate language and benefit estimates to other regions developing attainment SIPs that demonstrate a need for these measures in the proposed implementation timeframe. As part of this process, ARB will also work with each region to identify any additional strategies that are needed based on the nature of the problems in a particular region.

14. What kinds of defined measures are proposed in the Proposed Strategy?

The Strategy proposes 20 defined measures that ARB staff would develop, plus BAR's planned improvements to the Smog Check program and continuation of DPR's existing SIP commitment to reduce volatile emissions from pesticides. The ARB measures cover on-road vehicles, off-road equipment, marine vessels/ports, fuels and refueling, and consumer products. Lower emission standards for new engines and consumer products are complemented by measures to clean up the existing fleet of mobile sources. Other measures would reduce gasoline vapor emissions from storage tanks, service stations, and fuel tanker trucks. Tighter limits on fuel properties are also proposed. Sections II and III of this document discuss each measure in detail.

15. How would a defined SIP measure become a regulation?

Each defined measure would go through the full public, regulatory development process. ARB staff's steps in this process typically include:

- Meetings with the affected industry to better understand the source, its uses, and its emissions;
- A rigorous technical evaluation to determine the potential technologies and techniques to reduce emissions, including the feasibility, effectiveness, cost and impacts;
- Public workshops to discuss the technical evaluation and staff's ideas for regulatory concepts, as well as participants' suggestions;

- Release of a staff report with the formal regulatory proposal, including an assessment of the potential environmental and economic impacts for a 45-day public comment period; and

- Consideration by the Board at a public hearing.

16. What is the federal government's responsibility to reduce emissions from sources under its control?

Statewide, the emission sources under the exclusive legal or practical control of the federal government account for over one-quarter of all NOx emissions and almost two-thirds of all diesel particulate matter. Like State and local agencies, the federal government has a responsibility to further control emissions in response to the contribution from sources under its jurisdiction. Federal government action is essential to reach the attainment targets which will require reducing emissions across all sources contributing to the problem.

17. What is the Black Box and how big is it?

The federal Clean Air Act (CAA) recognizes that extreme ozone nonattainment areas, such as the South Coast, must rely on evolving technologies to meet attainment goals. As such, CAA Section 182(e)(5) specifically authorizes the inclusion of long-term measures that anticipate the development of new control techniques or improvement of existing control technologies. In prior SIPs for South Coast, we have included both: (1) long-term defined measures and (2) a more general long-term commitment to achieve the further emission reductions needed for attainment from unspecified sources. This second element is commonly known as the "black box."

We don't know the size of the black box yet. As this document goes to publication, the modeling and resulting carrying capacity for ozone attainment in the South Coast are not yet finalized. A variety of modeling analyses have shown there will be a gap between the emissions after accounting for the potential benefits of defined measures (State and local) and the carrying capacity, but the precise size is still uncertain. However, we can use the information from the Draft 2003 South Coast SIP as a general indicator.

Total Long-Term Strategy Emission Reductions
Based on Draft South Coast SIP
(Emission reductions in tons per day, 2010)

	ROG	NOx
Total Reductions Needed from 2010 Baseline	320	210
Maximum Reductions from Defined State/Local Measures	90	50
Total Remaining Reductions for Long-Term Strategy	230	160

In this document, ARB staff is proposing a process and a general commitment for the long-term State strategy, but deferring the total emission reductions to be achieved pending final modeling. We will identify this total in our staff report on the 2003 South Coast SIP, which will be released at least 30 days prior to the Board hearing on that SIP, now tentatively scheduled for September 2003.

18. How would the Proposed Strategy affect generation of emission reduction credits?

Emission reduction credits are generated when sources clean up their pollution to a greater extent than required. They can then bank, sell, or use these credits to fund new emissions growth, or as a means to comply with certain control requirements. State and federal law require emission reduction credits to be surplus to regulations and air quality plans. Credits may not be used to comply with technology-based requirements for new and modified sources of air pollution.

Board approval of the Proposed Strategy would provide advance notice of the source categories ARB intends to regulate in the future, helping to define opportunities to generate emission reduction credits and the potential life of those credits. Until the time new, more stringent regulations become effective, emissions from these sources can be voluntarily reduced beyond current requirements for credits. Once reductions are required for clean air purposes, further credits can't be generated.

For any measures that show a range of possible implementation dates, voluntary reductions from those sources will be reliably surplus only until the beginning of that range. If ARB establishes a later implementation date when the Board adopts the regulation, voluntary reductions may be considered surplus until the actual effective date of new requirements.

19. How would the Proposed Strategy support environmental justice and reduce community exposure to air pollution?

The Proposed Strategy would reduce emissions of ozone and PM10 precursors in communities across California. The Proposed Strategy includes measures that use cleaner technologies to reduce multiple air pollutants -- ROG, NOx, and direct PM10 -- as well as the toxic constituents of those pollutants.

The Proposed Strategy incorporates environmental justice policies in order to help prioritize our activities to reduce public exposure to air toxics as well as regional pollutants whose sources are concentrated in some communities. For example, the series of measures to clean up the existing truck fleet would require the earliest controls on vehicles that travel through neighborhoods – solid waste collection vehicles and fuel tanker trucks. While the Proposed Strategy would be implemented statewide to achieve regional emission reductions, several strategies are especially beneficial to low-income and minority communities. These include measures to reduce vapor emissions from the

hoses on gasoline tanker trucks and to increase the number of heavy-duty truck inspections in communities with high truck traffic.

20. How would the Proposed Strategy impact the State's environment?

We expect that implementation of the State defined measures would significantly decrease ambient ozone and particulate matter levels, with ancillary benefits that cut carbon monoxide and air toxics. Some of the proposed measures may have an impact on water quality, water demand, energy demand, hazardous waste, solid waste, and/or noise. However, in most cases, regulations are in place to prevent environmental degradation. As specific strategies are developed, we will evaluate the environmental impacts of each strategy in detail, and work with the appropriate agencies to recommend any necessary mitigation.

21. How would the Proposed Strategy impact the State's economy?

ARB staff is working with the University of California, Berkeley to answer this question. By early June, we will release Section V, Chapter B of this document, entitled "Economic Impact Analysis." This chapter will assess the economic impacts that would result from implementation of the defined State measures, and will include estimates of direct cost, impact on economic output, personal income, and employment statewide. The chapter will be available on our website at http://www.arb.ca.gov/planning/sip/sip.htm.

22. What are the opportunities for public comment on the Proposed Strategy?

We invite public comment on the Proposed Strategy at meetings with staff, in writing prior to Board consideration, and at the Board meeting. In addition, as ARB develops each SIP measure, it will go through the full regulatory development process with extensive opportunities for public comment before the Board considers adoption at a public hearing.

23. What is the staff recommendation for Board action?

We are recommending Board action in two phases.

June 26-27, 2003:	Concurrent with Board consideration of the San Joaquin Valley PM10 Plan, we recommend that the Board approve the subset of six measures and the associated emission reductions needed to demonstrate attainment in the San Joaquin Valley. We anticipate that the District's Governing Board will act on the PM10 Plan prior to June 26, 2003.
Sept 25-26, 2003: *(Tentative)*	Concurrent with consideration of the South Coast SIP, we recommend that the Board approve the entire Strategy for use in the South Coast SIP, anticipated use in upcoming San Joaquin Valley Ozone SIP, and reflection in future attainment SIPs for other regions.

For information on SIP development across the State, please see our new website http://arb.ca.gov/planning/sip/sip.htm or contact our Air Quality and Transportation Planning Branch main line at (916) 322-0285.

Table ES-1

Significant Changes to Defined State and Federal Measures Since ARB Released Draft Strategy for South Coast in January 2003

Strategy (Agency)	Name	Significant Changes
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	---
LT/MED-DUTY-2 (BAR)	Smog Check Improvements	---
ON-RD HVY-DUTY-1 (ARB)	Augment Truck and Bus Highway Inspections with Community-Based Inspections	---
ON-RD HVY-DUTY-2 (ARB)	Capture and Control Vapors from Gasoline Cargo Tankers	Revised adoption date
ON-RD HVY-DUTY-3 (ARB/~~U.S. EPA~~)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling	Federal element moved to long-term strategy
~~OFF-RD CI-1 (ARB)~~	~~Set Lower Emission Standards for New Off-Road Compression Ignition Engines~~	New federal proposal to implement post-2010
~~OFF-RD CI-1 (U.S. EPA)~~	~~Set Lower Emission Standards for New Off-Road Compression Ignition Engines~~	
OFF-RD CI-1 ~~OFF-RD CI-2~~ (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	Renumbered
OFF-RD CI-2 ~~OFF-RD CI-3~~ (ARB)	Implement Registration and Inspection Program for Existing Off-Road Equipment to Detect Excess Emissions (Compression Ignition Engines)	Renumbered and revised to clarify implementation strategy
OFF-RD LSI-1 (ARB)	Set Lower Emission Standards for New Off-Road Gas Engines (Spark Ignited Engines 25 hp and Greater)	---
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)	---
OFF-RD LSI-3 (ARB)	**Require Zero-Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 Pounds** ~~Require new Forklift Purchases and Forklift Rentals to be Electric – Lift Capacity <8,000 pounds~~	Retitled and revised to discuss feasibility considerations and reflect updated control potential
SMALL OFF-RD-1 (ARB)	Set Lower Emission Standards for New Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Weed Trimmers, Leaf Blowers, and Chainsaws)	Updated emissions inventory and control potential

Strategy (Agency)	Name	Significant Changes
SMALL OFF-RD-2 (ARB)	Set Lower Emission Standards for New Non-Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Lawnmowers)	Updated emissions inventory and control potential
~~MARINE-1 (U.S. EPA)~~	~~Set More Stringent Emission Standards for New Harbor Craft and Ocean-Going Ships~~	Federal measure; moved to long-term strategy
MARINE-1 ~~MARINE-2~~ (ARB)	Pursue Approaches to Clean Up the Existing Harbor Craft Fleet –Cleaner Engines and Fuels	Renumbered
~~MARINE-3 (U.S. EPA)~~	~~Pursue Approaches to Clean Up the Existing Ocean-Going Ship Fleet – Cleaner Fuels, Incentives for Cleaner Ships, Smoke (Opacity) Limits~~	Federal measure; moved to long-term strategy
MARINE-2 ~~MARINE-4~~ (ARB)	Pursue Approaches to Reduce Land-Based Port Emissions – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls	Renumbered
~~AIRPORT-1 (U.S. EPA)~~	~~Pursue Approaches to Reduce Emissions from Jet Aircraft – Cleaner Engines/Retrofit Controls, Aerodynamic Design, Fleet Purchase Strategy, Emission-Based Landing Fees, Cleaner Fuel, Operational Measures~~	Federal measure; moved to long-term strategy
FUEL-1 (ARB)	Set Additives Standards for Diesel Fuel to Control Engine Deposits	---
FUEL-2 (ARB~~/U.S. EPA~~)	Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines	Federal element moved to long-term strategy
CONS-1 (ARB)	Set New Consumer Products Limits for 2006	---
CONS-2 (ARB)	Set New Consumer Products Limits for **2008-2010** ~~2006-2010~~	Corrected typographical error on summary table
FVR-1 (ARB)	Increase Recovery of Fuel Vapors from Aboveground Storage Tanks	---
FVR-2 (ARB)	Recover Fuel Vapors from Gasoline Dispensing at Marinas	---
FVR-3 (ARB)	Reduce Fuel Permeation Through Gasoline Dispenser Hoses	---
PEST-1 (DPR)	Implement Existing Pesticide Measure	---

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

SECTION I

OVERVIEW OF COMMITMENTS

May 2003

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CHAPTER A. INTRODUCTION

The proposed 2003 State and Federal Strategy for the California State Implementation Plan (SIP) described in this document is intended to protect all Californians from the harmful effects of air pollution. To improve air quality and meet our legal obligations under state and federal law, the Air Resources Board (ARB or Board) will need to continue developing, adopting, and implementing programs to reduce emissions from all sources under its control – and to encourage other State, local and federal agencies to do the same. This document describes the next installment of new strategies for ARB, the State Bureau of Automotive Repair (BAR), the State Department of Pesticide Regulation (DPR), U.S. Environmental Protection Agency (U.S. EPA), and other federal agencies to reduce emissions that contribute to unhealthful ozone and particulate matter less than 10 microns in diameter (PM10) in California by 2010. The strategy targets the precursors reactive organic gases (ROG) and nitrogen oxides (NOx), as well as direct PM10 emissions.

1. State, Local, and Federal Responsibilities

In California, the primary responsibility for controlling air pollution is shared between the State ARB, 35 local air pollution control and air quality management districts (air districts), and U.S. EPA.

a. State Responsibility

ARB is responsible for improving outdoor air quality by controlling emissions from mobile sources (except where federal law preempts ARB's authority) and consumer products, developing fuel specifications, adopting statewide control measures for air toxics, establishing gasoline vapor recovery standards and certifying vapor recovery systems, providing technical support to the districts, and overseeing local district compliance with State and federal law.

BAR is responsible for the administration of California's vehicle inspection and maintenance program, known as "Smog Check." These programs are meant to help ensure that in-use vehicles stay clean as they age. Under federal law, certain nonattainment areas are required to implement Smog Check programs. In addition, areas with more severe air quality problems must implement "Enhanced" Smog Check programs which use a treadmill-like device to allow the measurement of NOx emissions, in addition to the hydrocarbon and carbon monoxide emissions measured in the "Basic" Smog Check program.

DPR is the California agency responsible for regulating pesticides for commercial/structural and agricultural uses. DPR can establish regulations to reduce both toxic and criteria pollutant emissions from pesticides using the best practicable control techniques available. Control measures may be implemented by several

methods including regulator actions, local permit conditions, and product substitution or cancellation.

Between 1990 and 2010, actions already taken by the State to require cleaner passenger vehicles, trucks and buses will cut emissions of ROG by over 70 percent and NOx by over 60 percent in California. Adopted regulations for off-road equipment, including boats and personal watercraft, will result in a nearly 40 percent reduction in both ROG and NOx over the same time period. ARB's consumer products program is cutting volatile emissions by over 20 percent from 1990 to 2005, with emissions growth projected after 2005 unless further controls are established.

b. Local Responsibility

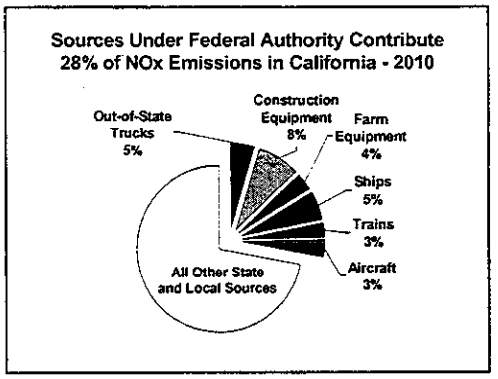
Local air districts are primarily responsible for controlling emissions from stationary and areawide sources (with the exception of consumer products) through rules and permitting programs. Examples of stationary and areawide sources include industrial sources like factories, refineries, power plants, and smelters; commercial sources like gas stations, dry cleaners, and paint spray booth operations; and residential sources like fireplaces, water heaters, and house paints. Districts also inspect and test fuel vapor recovery systems to check that such systems are operating as certified. In addition, local transportation agencies are responsible for developing and implementing transportation control measures aimed at reducing vehicle activity and emissions.

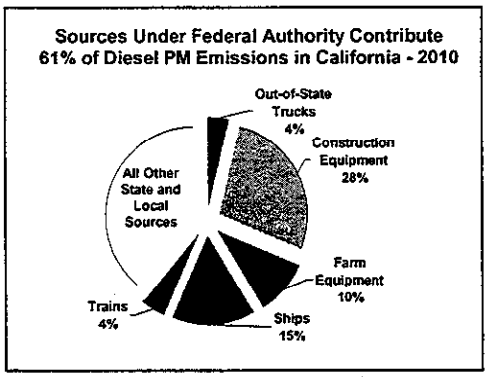
On a statewide basis, adopted air district regulations will reduce stationary sources emissions of both ROG and NOx by over 30 percent between 1990 and 2010, but areawide source emissions (excluding consumer products under State control) are projected to increase by over five percent due to growth. On a regional basis, the emission trends may vary considerably from the statewide numbers depending on the stringency of the local program.

c. Federal Responsibility

Mobile sources under the legal or practical control of the federal government are an important contributor to California's air quality problems. These sources include vehicles registered outside California that travel within the State, new pre-empted farm equipment and construction equipment, locomotives, marine vessels and aircraft, as well as the fuels sold outside California for these engines. The federal Clean Air Act directs U.S. EPA to continue reducing mobile source emissions that cause or contribute to air pollution that endangers public health. International organizations develop standards for aircraft and marine vessels that operate outside the United States. Federal agencies have the lead role in representing the United States (U.S.) in the process of developing international standards. U.S. EPA also has oversight authority for state air programs as they relate to the federal Clean Air Act.

The emissions sources that only the federal government can effectively regulate are significant contributors to California's air pollution problems, which continue to include ozone and particulate levels above the national air quality standards. Statewide, in 2010, these federal sources will account for over one-quarter of all NOx emissions and almost two-thirds of diesel particulate matter, a toxic air contaminant. These sources will also contribute about 6 percent of statewide ROG emissions in 2010.





On a regional basis, the relative contribution of each source type differs. For NOx, in the San Joaquin Valley, farm equipment is the most significant federal contributor at nine percent, while aircraft contribute the least at one percent. In the South Coast, construction equipment is the top category at 11 percent, while farm equipment is the lowest at one percent. For diesel particulate matter, farm equipment is the largest category in the San Joaquin Valley at 25 percent, and construction equipment dominates in South Coast at 34 percent.

U.S. EPA and ARB have partnered effectively, sharing technical resources to develop new emission standards and other approaches to reduce emissions from source categories under shared authority. For example, parallel regulations will reduce emissions from new 2007 heavy-duty trucks by 95 percent compared to 1998 levels, when fully implemented. The national emission standards for these vehicles are vital to reducing NOx and particulate emissions to meet health-based air quality standards and reduce the cancer risk from exposure to diesel PM. These benefits are reflected in the baseline inventory.

Despite continued population and travel growth, ozone-forming emissions from most sources are declining over time due to the effectiveness of adopted controls. But, net emissions from marine and aircraft categories are rising. Between 2000 and 2010 in the South Coast, the total NOx emissions from marine vessels are projected to increase 25 percent because the effects of activity growth are greater than the benefits of current controls. In contrast, total NOx emissions will drop by 60 percent for passenger vehicles and 30 percent for trucks over the same period in that region. Marine and aircraft emissions continue to grow dramatically by 2020 without new strategies. As State and local agencies continue to make commitments and adopt new measures, the relative contribution of emissions (especially NOx and direct PM10) from sources under federal control will increase even faster.

Agencies at all levels need to deliver new reductions for sources under their respective jurisdictions. The magnitude of the additional reductions required to attain air quality standards necessitates that federal government agencies with authority to control air pollution share responsibility for reaching attainment targets.

2. 1994 State Implementation Plan

Under the federal Clean Air Act, all nonattainment areas must submit SIPs that detail how they plan to improve air quality to meet federal ambient air quality standards. The 1994 Ozone SIP described an ambitious 16-year strategy to dramatically reduce emissions to attain the one-hour ozone standard in six regions of the State by the applicable federal deadline. The State and federal portion of the SIP contained 16 measures directed at mobile sources under State and federal control, 3 measures focused on consumer products and aerosol paints, an enhanced vehicle Smog Check program and a measure to cut volatile emissions from agricultural and structural pesticides.

1994 Ozone SIP Regions
(with current attainment deadline)

South Coast (2010)
Southeast Desert (2007)
Ventura County (2005)
Sacramento Region (2005)
San Joaquin Valley (2005*)
San Diego (1999)

* District has stated its intent to move to 2010 via voluntary reclassification

For the South Coast ozone nonattainment area, the 1994 SIP also described a long-term strategy – allowed under Section 182(e)(5) of the federal Clean Air Act – to identify and develop additional control measures needed to attain the federal one-hour ozone standard by the 2010 deadline.

Since 1994, most of the existing near-term SIP measures have been adopted by the responsible agency, along with additional controls (that had not been identified in 1994) to reduce emissions. The legal commitments described in the 1994 Ozone SIP applied only to the six regions explicitly covered by that SIP. But, the regulations adopted to fulfill the commitments in the 1994 SIP are being implemented throughout California, leading to statewide reductions and improvements in air quality.

Table I-1 shows our progress implementing the defined State and federal measures described in the 1994 SIP. The table also lists additional measures adopted, but not envisioned in the 1994 SIP.

Table I-1
State and Federal Measures Adopted Since 1994 SIP

	Responsible Agency	Adopted
Defined Measures in 1994 Ozone SIP		
M1: Light-duty vehicle scrappage	ARB	1998
M2: Low Emission Vehicle II program	ARB	1998
M3: Medium-duty vehicles	ARB	1995
M4: Incentives for clean engines (Moyer Program)	ARB	1999
M5: California heavy-duty diesel vehicle standards	ARB	1998
M6: National heavy-duty diesel vehicle standards	U.S. EPA	1998
M7: Heavy-duty vehicle scrappage	ARB	Replaced with M-17
M17: In-use reductions from heavy-duty vehicles	ARB	No
M8: Heavy-duty gasoline vehicle standards	ARB	1995
M9: CA heavy-duty off-road diesel engine standards	ARB	2000
M10: National heavy-duty off-road diesel engine stds	U.S. EPA	1998
M11: CA large off-road gas/LPG engine standards	ARB	1998
M12: National large off-road gas/LPG engine stds	U.S. EPA	2002
M13: Marine vessel standards	U.S. EPA	1999
M14: Locomotive engine standards	U.S. EPA	1997
M15: Aircraft standards	U.S. EPA	No
M16: Marine pleasurecraft standards	U.S. EPA	1996
CP2: Consumer products mid-term measures	ARB	1997/1999
CP3: Aerosol paint standards	ARB	1995/1998
Enhanced I/M (Smog Check II)	BAR	1995
DPR-1: Emission reductions from pesticides	DPR	Voluntary
Adopted measures not originally included in 1994 Ozone SIP		
Clean fuels measures	ARB	Multiple
Marine pleasurecraft (reductions beyond M16)	ARB	1998/2001
Motorcycle Standards	ARB	1998
Urban transit buses	ARB	2000
Enhanced vapor recovery program	ARB	2000
Medium/heavy-duty gasoline standards (beyond M8)	ARB	2000
2007 heavy-duty diesel truck standards (beyond M5 and M6)	ARB/U.S. EPA	2001
Small off-road engine standard revisions	ARB	1998

CHAPTER B. NEW STATE DEFINED MEASURES

This chapter describes ARB staff's revised proposal to update the State commitments from the 1994 SIP and develop measures to support upcoming SIP revisions for the South Coast, San Joaquin Valley, and other regions. After briefly discussing ARB staff's development process and how these proposals would apply to multiple regions of the State, we summarize the specific defined measures. Section I.C. identifies general concepts for a long-term strategy, including federal actions. Specific commitments for the South Coast and San Joaquin Valley SIPs are described in Section I.D.

1. Process for Development

As the Board neared adoption of all the defined measures in the 1994 SIP, ARB staff began to outline the next generation of State and federal control measures. In 2001, we initiated a public process to identify new emission reduction strategies for California. We solicited public input on options for reducing ozone, particulate, toxics, and greenhouse gas pollution across California. We held two sets of workshops throughout the State to hear ideas from the public and share our concepts. From those efforts, the staff compiled an extensive list of potential control measures for sources under State, federal, and local control. Based on our experience developing and adopting regulatory controls, we assessed the list for technical feasibility, cost, cost-effectiveness, feasibility of implementation, and other factors. We passed the concepts for further reduction from sources under local authority to the air districts for their use in plans to meet both federal and State air quality standards.

In January 2003, ARB staff released a draft of this document focused on the subset of potential measures for sources under State and federal authority that would help reduce ozone and PM10 by 2010 (the latest existing SIP deadline). In March and April, we participated in eleven public workshops with the local air districts in the South Coast and San Joaquin Valley, as well as an ARB technical workshop in both those regions plus Sacramento, to discuss the draft State and federal SIP strategy.

2. Applicability to Multiple Regions

This year, the Board will consider adopting the proposed commitments to develop the defined measures on a statewide basis, with specified emission reductions to support the South Coast SIP and San Joaquin Valley PM10 SIP that are already scheduled for local and State consideration. Because we will be asking the Board to commit to statewide measures, the regional benefits could be reflected in other SIPs without further action or hearing by the ARB. If the Board approves the proposals, ARB staff will provide the appropriate commitment language and benefit estimates for other attainment SIPs that need these defined measures in the 2010 timeframe. We will also work with each region to identify any additional strategies that are needed based on the unique nature of the problems in each particular region.

The ARB measures are intended to apply statewide, although ARB could choose to develop a strategy for particular regions. BAR may distinguish application of its Smog Check improvements based on the Basic and Enhanced area designations allowed by State law. Further DPR action may be focused on the region(s) with the greatest need. Federal rulemaking has traditionally been nationwide, but U.S. EPA might choose to develop a regional strategy (for example, federal incentives for agricultural equipment in the San Joaquin Valley or a program to cut emissions from marine vessels and ports along the entire West Coast of the U.S.).

3. State Defined Measures

Table I-2 summarizes the proposal for the State's defined measures to be reflected in upcoming SIPs upon approval by the Board. The table includes 20 defined measures that ARB would develop, which are described in detail in Sections II and III of this document. Since the Proposed 2003 State and Federal Strategy would replace the approved SIP measures in its entirety, Table I-2 also reflects the revised version of existing SIP measures that other agencies are still in the process of implementing.

BAR is improving the Enhanced Smog Check program, including bringing in heavier vehicles and requiring evaporative emission testing. The Enhanced Smog Check program in place today, combined with the remaining improvements in Measure LT/MED-DUTY-2 below, would alter and replace the prior SIP commitment for the program. For pesticides, we show the emission reduction target in DPR's existing SIP measure carried over intact to the new strategy. In the 1994 SIP, DPR committed to reduce volatile emissions from pesticides in certain areas of the State to 20 percent below 1990 levels by 2005. The benefits were expected to be achieved through a shift in the application practices and types of pesticides used. The reductions achieved so far are incorporated in the baseline inventory for each regional SIP.

Table I-2
Proposed State Defined Measures

Strategy (Agency)	Name
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program
LT/MED-DUTY-2 (BAR)	Improve Smog Check to Reduce Emissions from Existing Passenger & Cargo Vehicles
ON-RD HVY DUTY-1 (ARB)	Augment Truck and Bus Highway Inspections with Community-Based Inspections
ON-RD HVY DUTY-2 (ARB)	Capture and Control Vapors from Gasoline Cargo Tankers
ON-RD HVY DUTY-3 (ARB)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling

Strategy (Agency)	Name
OFF-RD CI-1* (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls
OFF-RD CI-2* (ARB)	Implement Registration and Inspection Program for Existing Off-Road Equipment to Detect Excess Emissions (Compression Ignition Engines)
OFF-RD LSI-1 (ARB)	Set Lower Emission Standards for New Off-Road Gas Engines (Spark Ignited Engines 25 hp and Greater)
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)
OFF-RD LSI-3 (ARB)	Require Zero Emission Forklifts Where Feasible– Lift Capacity ≤8,000 pounds
SMALL OFF-RD-1 (ARB)	Set Lower Emission Standards for New Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Weed Trimmers, Leaf Blowers, and Chainsaws)
SMALL OFF-RD-2 (ARB)	Set Lower Emission Standards for New Non-Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Lawnmowers)
MARINE-1* (ARB)	Pursue Approaches to Clean Up the Existing Harbor Craft Fleet – Cleaner Engines and Fuels
MARINE-2* (ARB)	Pursue Approaches to Reduce Land-Based Port Emissions – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls
FUEL-1 (ARB)	Set Additives Standards for Diesel Fuel to Control Engine Deposits
FUEL-2 (ARB)	Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines
CONS-1 (ARB)	Set New Consumer Products Limits for 2006
CONS-2 (ARB)	Set New Consumer Products Limits for 2008-2010
FVR-1 (ARB)	Increase Recovery of Fuel Vapors from Aboveground Storage Tanks
FVR-2 (ARB)	Recover Fuel Vapors from Gasoline Dispensing at Marinas
FVR-3 (ARB)	Reduce Fuel Permeation Through Gasoline Dispenser Hoses
PEST-1 (DPR)	Implement Existing Pesticide Strategy

*Renumbered since January draft. See Table ES-1 (in Executive Summary) or measure discussion (in Section II) for additional information.

3. Post-2010 Benefits of State Defined Measures

Some of the defined State measures have relatively modest emission reductions projected for 2010 -- the one-hour federal ozone attainment deadline for the South Coast and the anticipated ozone and PM10 attainment dates for the San Joaquin Valley. In many cases, particularly for mobile source strategies, the benefits of the anticipated control measures increase substantially after 2010 as older engines are replaced with cleaner models.

It is critical that local, State, and federal agencies continue to pursue every available emission reduction, even if some of those benefits will not be fully realized until post-2010. Urban areas in California will need additional reductions to attain the next health goals each region is striving to achieve.

In 1997, U.S. EPA promulgated tighter new federal air quality standards for eight-hour ozone and PM2.5. Almost half of the counties in California are anticipated to be nonattainment for the eight-hour ozone standard. Based on preliminary air quality monitoring data, the South Coast, San Joaquin Valley, and some other urban areas are also likely to be nonattainment for the federal PM2.5 standards. In addition, virtually all areas of California do not meet ARB's health-based ambient air quality standards. Because a large proportion of the emissions contributing to California's ozone and fine particulate problems are from sources under State and federal authority, additional measures to reduce the impact of cars, trucks and equipment will be critical to meeting the new federal standards in the post-2010 timeframe. Achieving the more protective standards will require substantial emission reductions beyond those needed to meet the one-hour federal ozone standard.

As the population of California continues to grow, more people will increase the number of cars, trucks, lawnmowers, heavy equipment, consumer products and other emission sources being used in the State. Even after areas attain all health-based standards, ARB and the local districts must continue to push for new emission reductions simply to maintain healthful air.

For informational purposes only, Sections II and III include the projected benefits from some defined State measures for 2015 and 2020.

CHAPTER C. APPROACHES FOR LONG-TERM STRATEGY

The defined State measures will provide sizeable benefits, but not enough to meet existing SIP attainment needs in the South Coast and San Joaquin Valley. Both of these areas, and perhaps others, will need significant additional emission reductions beyond those we will realize through even the maximum potential benefits of the defined State measures. To meet our legal obligations under current federal law, we must secure significant emission reductions from long-term measures by 2010.

As part of the public process to develop new emission reduction strategies, ARB staff also identified approaches that, although promising, face barriers to successful implementation. Examples include strategies that could not be successful without significant technological advances, improvements to reduce cost or increase cost-effectiveness, or the securing of a dependable stream of financial incentives.

ARB has a long-standing history of successfully adopting and implementing both technology-advancing strategies and innovative emission control techniques. By working closely with the regulated industry and research scientists, ARB staff have been able to craft regulations that are stringent enough to compel technology development, yet flexible enough to encourage industry innovations. Since 1998, the State has also provided over $200 million in funding for innovative incentive programs to speed the conversion to cleaner trucks, off-road equipment, agricultural irrigation pumps, and harborcraft; another $50 million (from Proposition 40 funds) is earmarked for the next two years. These types of programs can reduce NOx and PM10 emissions.

We have included these more speculative long-term approaches because we know that California will need additional emission reductions to meet our public health goals. In addition, the federal Clean Air Act allows extreme ozone nonattainment areas, such as the South Coast, to take credit for long-term technology measures. When the San Joaquin Valley acts on its intended request for reclassification as an extreme ozone area, it will also be eligible for these long-term technology provisions.

Specific information about the SIP commitment for long-term measures in the South Coast can be found in Section I.D.

1. Possible State Approaches

Table I-3 contains an initial list of possible approaches that ARB staff will pursue to identify suitable long-term measures. ARB intends to provide opportunities for the public to offer additional input on this list -- and also as we develop the measures. Further discussion about the long-term strategy for each source category can be found in Sections II and III and is summarized in Section IV.

Table I-3
Possible State Approaches for Long-Term Measures

Light/Medium Duty Vehicles	▪ Provide incentives for voluntary passenger vehicle retirement
Smog Check	Explore program expansion to increase benefits, including: ▪ Expanded enhanced smog check ▪ Opt-in to test-only program ▪ Replace rolling 30-year exemption with exemption of pre-1974 vehicles
On-Road Heavy Duty Vehicles	▪ Provide incentives for cleaner trucks and buses, including school buses
Off-Road Vehicles	▪ Provide incentives for cleaner off-road equipment
Airports	▪ Pursue approaches to reduce emissions from vehicles traveling to and from airports
Locomotives	▪ Pursue approaches to reduce emissions from in-use locomotives
Diesel Engines	▪ Set toxics standard for existing stationary diesel fueled engines – over 50 hp ▪ Set toxics standard for existing portable diesel engines ▪ Set toxics standard for new and existing small stationary diesel engines – under 50 hp ▪ Set toxics standard for diesel-fueled refrigeration units on trucks
Fuels	▪ Set sulfur/ash content limits for diesel engine lubricating oils ▪ Support infrastructure for zero emission vehicles – electric, fuel cell, hydrogen
Consumer Products	▪ Consider future consumer products regulations
Incentives	▪ Establish clean air labeling program ▪ Continue Statewide energy conservation program ▪ Consider Statewide public education campaign for air quality
Pesticides	▪ Explore approaches to further reduce volatile emissions from pesticides based on regional need

2. Possible Federal Approaches

Like State and local agencies, the federal government has a responsibility to further control emissions in response to the contribution from sources under its jurisdiction. Federal government action is essential to reach the attainment targets which will require reducing emissions across all sources contributing to the problem.

U.S. EPA and ARB are continuing to coordinate on future rulemaking, including three on-going efforts described below. First, U.S. EPA is developing more stringent

emission standards for new off-road diesel equipment based on the transfer of emission control technology for on-road engines. These benefits will be critical in the post-2010 timeframe to both offset growth and make progress toward the new, more stringent federal air quality standards. Second, U.S. EPA has proposed to phase in the use of lower sulfur diesel fuel in off-road applications nationwide. Diesel fuel with a 15 parts per million sulfur level would support the use of more sophisticated control technology for off-road diesel engines. Third, U.S. EPA is working in parallel with California to develop on-board diagnostics and to strengthen manufacturers' in-use testing to ensure that new heavy trucks and buses maintain expected emission levels throughout their useful lives.

We expect that U.S. EPA and other federal agencies will secure further reductions, and that the federal government may consider a mix of regulatory programs, incentives, or other agreements to achieve reductions.

As part of the evaluation of long-term strategies under our authority, we also identified possible federal emission reduction approaches. Accordingly, ARB staff is including concepts in this document that the federal government could consider. Long-term strategies for new engines in locomotives, ocean-going ships, harborcraft, and commercial and non-tactical military aircraft are feasible and effective means to cut emissions and will be critical in order to make progress toward all of the national air quality standards. Because of the extended life of these engines, we believe the long-term strategy will need to rely heavily on programs to replace existing engines with cleaner models or to add emission control equipment. Given the volume of equipment in operation and the public health impact of the emissions, it is important that U.S. EPA and its federal partners take early action in this regard.

Table I-4 lists some possible concepts the federal government could pursue. This list reflects ARB staff's assessment of current technology. As technology advances, this list could be expanded. In addition, the federal government could provide economic incentives to accelerate clean up of diesel engines, specifically those used in schoolbuses and farm operations.

Table I-4
Concepts for Federal Action

On-Board Diagnostics For New Truck/Bus Fleet And In-Use Testing For Existing Truck/Bus Fleet
Lower Emission Standards for New Off-Road Compression Ignition Engines
Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines
More Stringent Emission Standards for New Harbor Craft and Ocean-Going Ships
Clean Up The Existing Ocean-Going Ship Fleet Through Approaches Such As Cleaner Fuels, Incentives For Cleaner Ships, Smoke (Opacity) Limits
Reduce Emissions from Jet Aircraft Through Approaches Such As More Stringent Engine Standards, Retrofit Controls, Cleaner Fuel, and Applying Standards to Non-Tactical Military Aircraft
More Stringent Emission Standards for New and Remanufactured Locomotive Engines
Incentives to Accelerate Clean Up of Existing Diesel Engines

CHAPTER D. STATE IMPLEMENTATION PLAN COMMITMENTS

Under the federal Clean Air Act, regions with air quality that does not meet the national ambient air quality standards must submit plans describing how they intend to reduce emissions to improve air quality and meet the health-based standards. Based on forecasted inventories of emissions and air quality modeling, local districts and ARB develop estimates of the maximum amount of emissions a region can hold without violating ambient air quality standards (referred to as the "carrying capacity"). Local and State air quality planners compare the carrying capacity with the expected emission levels in the attainment year with the existing control program (the baseline inventory) to determine whether additional reductions are necessary to meet the attainment target. If more reductions are needed, ARB and the air districts must work with their regulatory partners to identify ways to achieve them. The commitments to reduce emissions from new measures become part of the SIP, which must be approved at the local and State level before submittal to U.S. EPA. Once U.S. EPA approves a SIP, the commitments in that SIP become federally-enforceable.

This Proposed Strategy would update and entirely replace the comprehensive statewide control strategy contained in the existing 1994 ozone SIP (as modified in 1999 for South Coast). For areas of the State that have not yet achieved the full amount of emission reductions committed to in the existing SIP, this Proposed Strategy would retain the existing statewide commitments to achieve all of these emission reductions. However, the specific statewide measures identified in the existing SIP would be entirely replaced by the new proposed measures and control strategy to achieve these emission reductions. For those areas, we will reflect the new Strategy in the region's next SIP revision.

This remainder of this section describes specific SIP commitments for two areas which currently have revisions to attainment SIPs in the final stages of development – the South Coast and the San Joaquin Valley. This section also discusses how we intend to handle future SIPs that need new reductions from emission sources under State and federal control.

1. 2003 South Coast State Implementation Plan

For the South Coast, ARB proposes to entirely replace the existing State control measures in the approved South Coast SIP with the updated and expanded strategy described here for mobile sources, fuels and fueling infrastructure, consumer products, and pesticides. We have also updated the description of our expectations of federal strategies that should be pursued.

a. Existing South Coast SIP

Most of the existing near-term SIP measures have been adopted by the responsible agency, along with additional controls to reduce emissions. The baseline

emission inventory in this document reflects the benefits of State and federal measures adopted since the 1994 ozone SIP. We track progress on SIP commitments in the inventory currency of the approved SIP that contained them to provide a consistent benchmark. Table I-5 shows the rulemaking and emission reduction progress in the currency of the existing ozone SIP for the South Coast. Since we have also made many inventory improvements in the intervening years, our current estimates of the benefits of the adopted measures may differ substantially from those shown in the table because of changes to the baseline emissions.

Table I-5
State and Federal Measures Adopted Since 1994 SIP
(tons per day in 2010 based on South Coast inventory from 1997/1999 SIP)

			ROG Reductions		NOx Reductions	
Near-Term Measures	**Agency**	**Adopted**	**Commit-ment**	**Achieved in 2010**	**Commit-ment**	**Achieved in 2010**
M1: Light-duty vehicle scrappage	ARB	1998	19	0	17	0
M2: Low Emission Vehicle II program	ARB	1998		4		43
M3: Medium-duty vehicles	ARB	1995	Baseline[1]	-	Baseline[1]	-
M4: Incentives for clean engines (Moyer Program)	ARB	1999	9	0	62	3
M5: California heavy-duty diesel vehicle standards	ARB	1998		5		44
M6: National heavy-duty diesel vehicle standards	USEPA	1998		1		11
M7: Heavy-duty vehicle scrappage	ARB	Replaced with M17		NA		NA
M17: In-use reductions from heavy-duty vehicles	ARB	No		0		0
M8: Heavy-duty gasoline vehicle standards	ARB	1995	Baseline[1]	-	Baseline[1]	-
M9: CA heavy-duty off-road diesel engine standards	ARB	2000	4	4	47	18
M10: National heavy-duty off-road diesel engine stds	USEPA	1998		6		25
M11: CA large off-road gas/LPG engine standards	ARB	1998	32	16	17	5
M12: National large off-road gas/LPG engine stds	USEPA	2002		14		5
M13: Marine vessel standards	USEPA	1999	0	0	15	2
M14: Locomotive engine standards	USEPA	1997	0	0	17	17
M15: Aircraft standards	USEPA	No	3	0	6	0
M16: Marine pleasurecraft standards	USEPA	1996	21	17	0	0
CP2: Consumer products mid-term measures	ARB	1997/1999	34	15	0	0
CP3: Aerosol paint standards	ARB	1995/1998	Baseline[1]	-	-	-
Enhanced I/M (Smog Check II)	BAR	1995	Baseline[1]	(6)	Baseline[1]	-
DPR-1: Emission reductions from pesticides	DPR	Voluntary	1	1	0	0
Adopted measures not originally included in SIP						
Clean fuels measures	ARB	Multiple		13		12
Marine pleasurecraft (reductions beyond M16)	ARB	1998/2001		7		0
Motorcycle Standards	ARB	1998		1		0
Urban transit buses	ARB	2000		0		1
Enhanced vapor recovery program	ARB	2000		6		0
Medium/heavy-duty gasoline standards (beyond M8)	ARB	2000		0		1
2007 heavy-duty diesel truck standards (beyond M5 and M6)	ARB/ USEPA	2001		1		16
Small off-road engine standard revisions	ARB	1998		(1)		0
NEAR-TERM TOTAL			**125**	**105**	**181**	**203**

Long-Term Measures (Section 182(e)(5))						
Advanced technology on-road mobile "Black Box"	ARB	No	37	0	6	-[2]
Advanced technology off-road mobile "Black Box"	ARB	No	18	0	3	-[2]
CP4: Long-term measure for consumer products	ARB	No	43	0	0	0
LONG-TERM TOTAL			**98**	**0**	**9**	-[2]
GRAND TOTAL (near-term + long-term)			**223**	**105**	**190**	**203**

Emission reductions from individual measures may not add to total due to rounding.
( ) = Emission increase relative to baseline.
[1] Measures M3, M8, CP3, and the Smog Check II program from the 1994 SIP had already been adopted when the SIP was revised in 1997. The reductions from these measures are included in the 1997 SIP baseline. Although the Smog Check II program is achieving significant benefits, the emission reductions are less than anticipated in the 1997 SIP as indicated by the negative number under reductions achieved.
[2] The NOx reductions anticipated from the long-term mobile source "Black Box" commitment have already been achieved from adopted measures.

b. New State Strategy

The proposed State element of the South Coast 2003 SIP has three components: an adoption schedule for emission reductions, defined control measures, and a long-term strategy commitment.

The total emission reductions in Table I-6 and the obligation to propose specific measures in Table I-7 for Board consideration would become enforceable upon approval by U.S. EPA of the comprehensive control strategy and revised attainment demonstration in the 2003 South Coast SIP. The commitments for emission reductions are calculated using ARB's summer planning inventory for the 2003 South Coast SIP; progress will be tracked in the same inventory currency to assess compliance.

i. Commitment to Reduce Emissions via Adoption Schedule

ARB will commit to adopt and implement measures to achieve, at a minimum, the ROG and NOx emission reductions in tons per day in the South Coast Air Basin in 2010 shown in Table I-6. These totals represent the mid-range of emission reductions expected for the defined State measures in Table I-7. Reductions in excess of the minimum commitment for a given period may be applied to the commitment for subsequent years. ARB may meet this commitment by adopting one or more of the control measures in Table I-7, by adopting one or more alternative control measures, or by implementing incentive program(s), so long as the aggregate emission reductions therefrom comply with the schedule for adoption.

Table I-6
Proposed State Annual Adoption Commitments for Near-Term Measures
2003 South Coast SIP
(emission reductions in tons per day in 2010)

	2003	2004	2005	2006	Long-Term 2007-2009
ROG	10	4	21*	14	to be determined pending final modeling
NOx	11	5	21*	0	

* Includes BAR's commitment to implement improvements to the Enhanced Smog Check Program.

ii. Commitment to Propose Defined Control Measures

In addition to the commitment to reduce emissions via an annual adoption schedule through 2006, the ARB staff also commits to submit to the Board and propose for adoption the ARB control measures set forth in Table I-7. The staff proposal for each control measure shall, at a minimum, achieve the estimated emission reductions set forth in Table I-7. Where a range of estimated emission reductions is set forth for a measure in Table I-7, the staff proposal shall, at a minimum, achieve the bottom end of the range of reductions. The Board shall take action thereon on or before the action dates set forth in Table I-7. Such action by the Board may include any action within its discretion.

Since the control strategy in this element would replace the approved SIP strategy in its entirety, we must reflect any existing SIP measures that other State agencies are still in the process of implementing. Further improvements to the enhanced vehicle inspection and maintenance program, or Smog Check, will provide emission reductions as shown in Table I-7. (Appendix I-1 includes evidence of BAR's commitment to finish implementing the Enhanced Smog Check improvements described in LT/MED-DUTY-2.) This implementation may require additional regulatory action. Anticipated ROG reductions from pesticide emissions in the South Coast have been achieved and incorporated into the baseline inventory.

For more information about individual measures, please refer to the descriptions in Sections II and III.

iii. Commitment to Reduce Emissions via Long-Term Strategy

The federal Clean Air Act (CAA) recognizes that extreme ozone nonattainment areas, such as the South Coast, must rely on evolving technologies to meet attainment goals. As such, CAA Section 182(e)(5) specifically authorizes the inclusion of long-term measures that anticipate the development of new control techniques or improvement of existing control technologies. In prior SIPs for South Coast, currently the only extreme nonattainment area in the U.S., we have included both: (1) long-term defined measures and (2) a more general long-term commitment to achieve the further emission

reductions needed for attainment from unspecified sources. This second element is commonly known as the "black box."

The updated emission inventories and air quality modeling in the new SIP revision demonstrate a need for more reductions in both ROG and NOx than the existing SIP. As this document goes to publication, the modeling and resulting carrying capacity for ozone are not yet finalized. A variety of modeling analyses have shown there will be a gap between the emissions after accounting for the potential benefits of defined measures (State and local) and the carrying capacity, but the precise size is still uncertain. In this document, ARB staff is proposing a process and a general commitment for the long-term State strategy, but deferring the total emission reductions to be achieved pending final modeling. We will identify the proposed ARB emission reduction commitment for the long-term strategy in our report to the Board evaluating the South Coast SIP once it is adopted by the local district. This staff report will be available 30 days prior to the Board hearing at which the South Coast SIP will be considered, tentatively scheduled for September 2003.

Between now and 2006, ARB would commit to take responsibility, with the participation of the South Coast Air Quality Management District and U.S. EPA, to assess potential emission reduction concepts to meet the long-term commitments. All agencies need to actively seek to identify additional cost-effective control strategies to achieve the maximum feasible reductions from all source categories. Special attention will be given to achieving reductions from in-use on-road and off-road mobile sources because of the extended life of these sources and their slow turnover rate. The public's participation will be important both in identifying potential emission reduction concepts and developing approaches to achieve those emission reductions in practice. The participation of stakeholders in crafting ways to overcome implementation barriers and providing assistance to ultimately obtain the emission reductions will be a key component to meeting the long-term commitment. As new control strategies are identified, agencies would adopt regulations to implement these measures in the earliest practicable timeframe.

Every type of emission source – mobile, stationary, and area – as well as new and existing sources needs to be evaluated to determine the remaining emissions in the attainment year, and the possibility for further emission reductions. ARB will consider the possible approaches listed in Table I-3 as well as others suggested by our regulatory partners and the public. ARB will also push the federal government to pursue the possible approaches in Table I-4.

Together with the interested public, the agencies will evaluate the opportunities to achieve all feasible emission reductions from regulatory programs as well as innovative approaches such as incentives, voluntary programs, episodic controls, and other actions. Part of this evaluation will include a discussion of which agency or agencies can most effectively obtain the emission reductions in practice. For sources such as airports, ports, and railyards, the agencies will consider facility-based approaches to reduce overall emissions. For these types of sources, a comprehensive

approach may be the most effective way to reduce emissions of ozone and fine particulate precursors, as well as address community health concerns. The agencies will also work with the Southern California Association of Governments (SCAG) to identify how transportation agencies can support further emission reductions. As strategies are defined throughout this process, the responsible agency will begin development as soon as practicable.

To ensure a focus on development of potential new measures, ARB staff will request periodic public input. Beginning in 2004, we will solicit written proposals for innovative control concepts from the public and conduct technical workshops to further explore promising ideas to implement the long-term strategy. By 2007, the District and ARB will prepare a revision to the Ozone SIP that (1) reflects any modifications to the carrying capacity based on updated science; and (2) identifies the additional strategies needed to provide the remaining emissions reductions, including the specific measures, benefits, timing, and responsible agencies. This schedule would harmonize with development of SIPs to attain the federal eight-hour ozone standard and the fine particulate matter standards in the post-2010 timeframe.

ARB and the South Coast District expect that U.S. EPA and other federal agencies will secure further reductions. Like State and local agencies, we anticipate the federal government may consider a mix of regulatory programs, incentives, or other agreements to achieve reductions.

c. Summary of New State and Federal SIP Element

The emission reduction strategies affecting State sources are summarized in Table I-7.

Table I-7
Proposed State Strategy
2003 South Coast SIP
(tons per day in 2010)

Strategy (Agency)	Name	Final Action Date	Expected Reductions (South Coast 2010)	
			ROG	NOx
DEFINED STATE MEASURES TO BE DEVELOPED AND PROPOSED				
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	2005	0-19	0-18
LT/MED-DUTY-2 (BAR)	Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles	2002-2005	5.6-5.8	8.0-8.4
ON-RD HVY-DUTY-1 (ARB)	Augment Truck and Bus Highway Inspections with Community-Based Inspections	2003	0-0.1	0
ON-RD HVY-DUTY-2 (ARB)	Capture and Control Vapors from Gasoline Cargo Tankers	2005	4-5	0
ON-RD HVY-DUTY-3 (ARB)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet	2003-2006	1.4-4.5	8-11
OFF-RD CI-1 (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	2004-2008	2.3-7.8	NQ
OFF-RD CI-2 (ARB)	Implement Registration and Inspection Program for Existing Heavy-Duty Off-Road Equipment to Detect Excess Emissions (Compression Ignition Engines)	2006-2009	Not Quantified	Not Quantified
OFF-RD LSI-1 (ARB)	Set Lower Emission Standards for New Off-Road Gas Engines (Spark Ignited Engines 25 hp and Greater)	2004-2005	0	0.8
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)	2004	0.5-1.4	1.5-3.5
OFF-RD LSI-3 (ARB)	Require Zero-Emission Forklifts Where Feasible – Lift Capacity ≤8,000 pounds	2004	0.3-0.6	1.4-2.8
SMALL OFF-RD-1 (ARB)	Set Lower Emission Standards for New Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Weed Trimmers, Leaf Blowers, and Chainsaws)	2003	1.9	0.2
SMALL OFF-RD-2 (ARB)	Set Lower Emission Standards for New Non-Handheld Small Engines and Equipment (Spark Ignited Engines Under 25 hp such as Lawnmowers)	2003	6.6-7.7	0.6-1.9
MARINE-1 (ARB)	Pursue Approaches to Clean Up the Existing Harbor Craft Fleet – Cleaner Engines and Fuels	2003-2005	0.1	2.7

Strategy (Agency)	Name	Final Action Date	Expected Reductions (South Coast 2010)	
			ROG	NOx
MARINE-2 (ARB)	Pursue Approaches to Reduce Land-Based Port Emissions – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls	2003-2005	0.1	0.1
FUEL-1 (ARB)	Set Additives Standards for Diesel Fuel to Control Engine Deposits	2006-2009	Not Quantified	Not Quantified
FUEL-2 (ARB)	Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines	2003-2005	Enabling	Enabling
CONS-1 (ARB)	Set New Consumer Products Limits for 2006	2003-2004	2.3	0
CONS-2 (ARB)	Set New Consumer Products Limits for 2008-2010	2006-2008	8.5-15	0
FVR-1 (ARB)	Increase Recovery of Fuel Vapors from Aboveground Storage Tanks	2003	0-0.1	0
FVR-2 (ARB)	Recover Fuel Vapors from Gasoline Dispensing at Marinas	2006-2009	0-0.1	0
FVR-3 (ARB)	Reduce Fuel Permeation Through Gasoline Dispenser Hoses	2004	0-0.7	0
PEST-1 (DPR)	Implement Existing Pesticide Strategy	—	Baseline	Not Applicable
Subtotal of Potential Range for Defined State Measures			**33.6-72.2**	**23.3-49.4**
Minimum Commitment via Adoption 2003 - 2006			**49**	**37**
PROCESS FOR LONG-TERM STRATEGY				
LONG-TERM STRATEGY	**Multi-Agency Effort (State, federal and local) and Public Process Beginning in 2004 to Identify and Adopt Long-Term Measures**	2007-2009	To be determined pending final ozone modeling and identified in staff report to Board on 2003 South Coast SIP	

d. Process for State Action

The Air Resources Board will hold a public hearing in Fall 2003 to consider adoption of ARB staff's proposal for new State commitments, as well as the local elements of the South Coast SIP, if approved by the Governing Board of the South Coast Air Quality Management District. We will identify the proposed ARB emission reduction commitment for the long-term strategy, and the resulting total State reductions in our report to the Board evaluating the South Coast SIP adopted by the District. This staff report will be released at least 30 days prior to the ARB hearing, tentatively scheduled for September 2003. If adopted by the District and ARB, ARB will submit both of these elements to the U.S. EPA for approval as a revision to the California SIP.

2. 2003 San Joaquin Valley Particulate Matter State Implementation Plan

This section describes the proposed State commitments to achieve further emission reductions in PM10 and its precursors to help attain the federal PM10 standards in the San Joaquin Valley ("Valley") by 2010. The motor vehicles and equipment under State and federal jurisdiction are responsible for the majority of Valley air pollution, but are also contributing the majority of the emission reductions needed for attainment. Adopted State and federal regulations for cleaner engines and fuels are driving Valley NOx emissions down by over 140 tpd, or nearly 40 percent between 1999 and 2010. Emissions of direct particulate matter from these sources will drop by over 10 percent and ROG by well over 40 percent in the same timeframe.

To supplement the existing program, ARB staff has identified a series of new measures that would be developed over the next several years to provide additional NOx and PM10 reductions, consistent with the attainment demonstration needs established in this SIP. These measures are a subset of the larger strategy ARB staff has proposed to cut emissions of ROG, NOx, and particulate matter statewide. ARB began developing the strategy in 2001 with workshops around the State, including the Valley, to solicit ideas from the public and to share initial concepts for emission reduction measures.

The proposed State commitment for this plan has two parts – achieving specific emission reductions and developing the defined measures for Air Resources Board consideration.

a. State Commitment for Further Emission Reductions

Table I-8 shows the proposed State commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley in 2010. ARB may meet this commitment by adopting one or more of the control measures in Table I-9, by adopting one or more alternative measures, or by implementing incentive program(s), so long as the total new emission reductions are achieved. While the legal commitment is to adopt and implement strategies that achieve the emission reductions by the attainment date, ARB staff is already working on several of the measures for near-term consideration.

The new reductions also include the benefits of planned improvements to the enhanced vehicle inspection and maintenance program, or Smog Check. This implementation may require additional regulatory action by BAR.

Table I-8
Proposed State Commitment for New Emission Reductions
2003 San Joaquin Valley PM10 SIP
(tons per day in 2010)

	State Commitment
NOx	10
PM10	0.5

b. State Commitment to Propose Defined Control Measures

In addition to the enforceable commitment to reduce emissions, the ARB staff also commits to submit to the Board and propose for adoption the ARB control measures set forth in Table I-9. For LT/MED-DUTY-1, ARB commits to complete the pilot program and propose a control measure if the approach described proves to be feasible and effective.

The specific regulatory proposal for each potential measure will be developed in an extensive public process that considers the technical feasibility, effectiveness, cost, and other impacts of the strategy. The Board shall take action on or before the dates set forth in Table I-9. Such action by the Board may include any action within its discretion. For informational purposes, Table I-9 shows the benefits that would be expected from implementation of each defined measure, although the enforceable commitment is for the total new reductions.

The defined State measures are described in detail in Section II of this document. Appendix I-1 includes evidence of BAR's commitment to finish implementing the Enhanced Smog Check improvements described in LT/MED-DUTY-2.

Table 1-9
Proposed New State Measures
2003 San Joaquin Valley PM10 SIP
(tons per day in 2010)

Strategy (Agency)	Name	Expected Reductions*, tpd			Action Dates
		ROG	PM10	NOx	
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	0-2.4	--	0-2.7	2005
LT/MED-DUTY-2 (BAR)	Smog Check Improvements	1.5	--	3	2002-2005
ON-RD HVY-DUTY-3 (ARB)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling	1.5	0.1	4	2003-2006
OFF-RD CI-1 (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	1.0	0.4	0	2004-2008
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)	0.1	--	0.1	2004
OFF-RD LSI-3 (ARB)	Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤8,000 Pounds	0.1	--	0.2	2004
Total Emission Reduction Commitment from New State Measures		**0**	**0.5**	**10**	**2002-2008**

* Expected reductions from individual defined measures are shown for information only. The State is proposing commitments for total new reductions in NOx and PM10 emissions only, consistent with the PM10 attainment demonstration. Commitments for further reductions will be considered in the context of the upcoming Valley Ozone SIP.

c. Process for State Action

The Air Resources Board will hold a public hearing on June 26-27, 2003 in Fresno to consider adoption of a portion of the proposed new State commitments, as well as the local elements of the San Joaquin Valley PM10 SIP, if approved by the District's Governing Board. Only the emission reduction commitment for the San Joaquin Valley PM10 SIP in Table I-8 and the associated measures in Table I-9 will be considered for adoption at the June meeting. If the SIP is adopted by the District, and the SIP and the State commitment are approved by ARB, ARB will submit both of these elements to the U.S. EPA for approval as a revision to the California SIP.

3. Future State Implementation Plans

As other regions of California develop attainment SIPs that demonstrate a need for these measures in the proposed implementation timeframe, ARB will provide the appropriate commitment language and benefit estimates. Because this Proposed Strategy would update and entirely replace the comprehensive statewide control strategy contained in the existing 1994 ozone SIP, for areas of the State that have not yet achieved the full amount of emission reductions committed to in the existing SIP, we will reflect the new Strategy in the region's next SIP revision.

For those areas, this Proposed Strategy would retain the existing statewide commitments to achieve all of these emission reductions. However, the specific statewide measures identified in the existing SIP would be entirely replaced by the new proposed measures and control strategy to achieve these emission reductions.

As part of this process, ARB will also work with each region to identify any additional strategies that are needed based on the nature of the problems in a particular region.

We anticipate that the San Joaquin Valley will require new emission reduction measures to achieve further ROG and NOx reductions from State and federal sources to attain the federal one-hour ozone standard. Commitments beyond those proposed for the San Joaquin Valley's PM10 SIP will be considered as part of the San Joaquin Valley's Ozone SIP.

CHAPTER E. LEGAL AUTHORITY TO ADOPT SIP MEASURES

1. Overview of Legal Authority

This chapter discusses the legal authority to adopt the regulations and other measures that comprise the Proposed 2003 State and Federal Strategy for the California SIP. This chapter also discusses the appropriate reliance on commitments in the SIP to pursue measures based on advanced technology.

Legal authority to regulate sources of air pollution in California is found in both federal and state law. At the federal level, the Clean Air Act ("the Act" or "CAA") calls for a two or three partner endeavor involving federal, state and, where permitted by state law, local authorities. The Act directs the U.S. EPA to undertake a national effort to improve air quality. To carry out this directive, U.S. EPA is directed to establish national ambient air quality standards to protect the public health and welfare (CAA §109).

The primary tool to be used in the effort to attain national standards is a SIP to be developed by each state with one or more nonattainment areas. The SIP must provide for implementation, maintenance, and enforcement of the national standards (CAA §110(a)(1)). CAA § 110(a)(2)(A) broadly authorizes and directs states to include in their SIPs:

> "...enforceable emission limitations and other control measures, means, or techniques (including economic incentives such as fees, marketable permits, and auctions of emissions rights), as well as schedules and timetables for compliance, as may be necessary or appropriate to meet the applicable requirements of the Act."

While the Act requires states to develop SIPs, and clearly intends that they bear primary responsibility for attaining the national standards (CAA §101(a)(3)), it also provides U.S. EPA with two significant roles in this process. As a partner in the effort to attain and maintain the standards, U.S. EPA is authorized and directed to adopt measures to control emissions from various sources, such as consumer products, motor vehicles, nonroad engines and vehicles, and aircraft (CAA §§183(e)(3), 202, 213 and 231). Additionally, U.S. EPA has ultimate authority and responsibility to intervene with direct federal action if the SIP is inadequate, incomplete or not properly implemented by the state (CAA §§ 110(c)(1) and 113).

Similarly, California law generally divides responsibility for meeting the requirements of the Clean Air Act (as well as separate, comprehensive state requirements related to air quality) between ARB and local air pollution control or air quality management districts (districts). However, other state or local agencies also have the authority under state law to regulate certain pollutant-emitting sources or activities. For example, the State's motor vehicle inspection and maintenance program is primarily the

responsibility of BAR in the Department of Consumer Affairs, and DPR has primary authority to regulate the pesticidal use of pesticides. Legal authority for state, district, and local efforts to improve air quality is contained primarily in Division 26 of the California Health and Safety Code, although authority for some programs is located elsewhere in the state codes.[1]

Pursuant to these codes, the ARB is charged with coordinating state, regional and local efforts to attain and maintain both state and national ambient air quality standards. The direct statutory link between the ARB and the mandates of the CAA is found in §39602 of the Health and Safety Code, which states:

> "The state board is designated the air pollution control agency for all purposes set forth in federal law.
>
> The state board is designated as the state agency responsible for the preparation of the state implementation plan required by the Clean Air Act (42 U.S.C., Sec. 7401, et seq.) and, to this end, shall coordinate the activities of all districts necessary to comply with that act.
>
> Notwithstanding any other provision of this division, the state implementation plan shall only include those provisions necessary to meet the requirements of the Clean Air Act."

In directing the California approach to improving air quality, state law divides control activities into vehicular and nonvehicular sectors (§§39002 and 40000). The control of vehicular sources is the responsibility of the ARB, while primary responsibility for nonvehicular controls falls to the local air districts (§§ 39002, 40000-40002, 40702, 40717; see also §§ 40400-40540 for provisions specific to the SCAQMD). These authorities have been used by the local districts to adopt and enforce numerous rules to control air pollution. In addition,
the ARB has comprehensive oversight authority over the districts to undertake nonvehicular source control activities if any districts fails to perform satisfactorily (§§39002, 41500, 41502, 41503, 41504, 41505 and 41652).

The Clean Air Act requires that SIP provisions be legally enforceable. A tiered system of authority for enforcement exists which parallels the authority to develop and implement the SIP. The ARB has authority to enforce vehicular controls. (See, e.g., §§41510, 41511 and 41513, 43012, 43016 and 43017, 43100, 43105, 43106, 43204-43212 and Vehicle Code §§27156, 38390 and 38391.) Primary responsibility for nonvehicular enforcement is vested in the local air districts. (See, e.g., §§41510, 41511 and 41513, and 42300 et seq.) However, if the ARB finds that a district is not taking reasonable action to enforce applicable air pollution control statutes, rules and regulations, the ARB may, after a public hearing, assume the district's enforcement powers and enforce these laws (§41505). U.S. EPA has similar authority to assume enforcement jurisdiction if a state fails to enforce SIP provisions (CAA §113).

[1] All section references in this chapter are to the Health and Safety Code unless otherwise specified.

Within the framework of state and local shared responsibility for air pollution control, with ultimate air district accountability to the ARB, the ARB has the necessary statutory authority to assure compliance with the requirements of the Clean Air Act relating to the attainment of national standards and the rate-of-progress demonstrations.

2. Legal Authority to Adopt State and Federal SIP Measures

State components of this comprehensive SIP revision target mobile sources, fuels, consumer products, vapor recovery, and pesticides. The legal authority for implementing the measures in each of these components is described below.

a. Mobile Sources

Motor vehicles and other mobile sources comprise the most significant source of ozone precursor emissions in the State. The ARB's mobile source section of California's SIP includes numerous measures to reduce mobile source emissions at the state level and is a central component of this SIP revision. The measures include reductions to be realized from actions taken or to be taken at both the federal and state level.

i. Federal Responsibility for National Mobile Source Measures

If all areas of the State are to demonstrate attainment by the specified deadlines, a critical part of the overall strategy to reduce mobile source emissions in California must be U.S. EPA's fulfillment of the Act's promise for regulation of national sources pursuant to §§202(a)(2)(B), 213 and 231. While U.S. EPA has not yet provided complete information regarding what regulatory actions will be undertaken pursuant to these authorities, the ARB anticipates adoption by U.S. EPA of national standards for sources states are preempted from regulating (i.e., new locomotives and aircraft, and nonroad engines used in farm and construction equipment under 175 horsepower); and sources the ARB cannot regulate as effectively as a practical matter (i.e., new heavy-duty diesel trucks registered in other states, marine vessels, and fuels sold outside of California). As discussed in Section I.A.1.c of this SIP revision, the projected 2010 emissions from sources under federal jurisdiction are very significant, and these emissions are expected to grow dramatically by 2020 without new strategies. Under these circumstances, U.S. EPA has an obligation under the Clean Air Act to promulgate standards for these unregulated or underregulated national sources. Such measures should be fully creditable in the SIP.

Certainly, U.S. EPA has the authority to adopt standards for national sources in order to assist states in achieving the national ambient air quality standards (NAAQS). U.S. EPA's authority derives from a number of provisions of the Clean Air Act which authorize or require the promulgation of various types of control measures. The scope of U.S. EPA's authority under many of these provisions is broadly defined. For example, §202 directs the Administrator of the U.S. EPA to establish emission standards for new motor vehicles and §231 directs the Administrator to establish aircraft emission standards. Both of these sections direct the Administrator to promulgate regulations in order to control emissions:

> "which, in [her] judgement, cause or contribute to air pollution which may reasonably be anticipated to endanger public health and welfare ..." (CAA §§202(a) and 231(a)(2)).

Under §213, the Administrator is required to determine whether ozone precursor or carbon monoxide emissions from nonroad engines or vehicles (other than locomotives) "cause, or significantly contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare" and to regulate the sources that in her judgment "cause, or contribute to, such air pollution." That section also directs the Administrator, by 1995, to adopt emission standards for new locomotives that

> "achieve the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the locomotives or engines to which such standards apply, giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers and to noise, energy and safety factors associated with the application of such technology." (CAA §213(a)(5).)

Federal law preempts individual states from adopting emission standards for most of these sources (§§209 and 233). California has concurrent authority to regulate some nonroad engines or vehicles including marine vessels, and California can obtain a waiver of federal preemption to adopt emission standards for other national source categories (e.g. heavy-duty trucks). However, as a practical matter adoption of separate, California-only standards for national transportation sources (e.g., heavy-duty trucks or marine vessels) is not a fully effective means of controlling emissions from these sources.

If California is to adequately protect public health, the essential emission reductions necessary from these sources must be fully realized through timely promulgation of all feasible standards for national sources by U.S. EPA under the authorities provided in the Act. Without such federal control of preempted and national transportation sources, California simply cannot adequately protect public health because it is not possible to obtain sufficient emission reductions solely from sources under local and state jurisdiction to offset uncontrolled or undercontrolled emissions contributed by national sources subject to federal control.

National standards for these sources are feasible. These measures are described in Section I.C.2 and under each source category in Section II of this submittal. Furthermore, while California may present the worst case and, therefore, have the greatest need for such standards, there are many other long-term ozone, PM10, and PM2.5 nonattainment areas in other states that will benefit from the adoption of such standards. It is not even subject to debate that Congress intended U.S. EPA to participate in states' efforts to attain national air quality standards by regulating these sources.

The very broad language of the Clean Air Act authorizes and directs the Administrator to establish appropriate standards for national sources in order to effectively address emissions from these sources in California and other states. Such standards are necessary and technologically feasible; therefore, U.S. EPA has an obligation to promulgate these standards without delay. The agency's failure to fully exercise its national standard-setting authority fully places burdens on California never envisioned by Congress, and the lack of these emission reductions cannot be made up by additional state measures because the state and local air districts already must extract the maximum emission reductions possible from all source categories under their control.

ii. State Authority for Mobile Source Measures

The ARB has broad authority under State law to regulate motor vehicles and other mobile sources. These authorities empower the Board to adopt the mobile source regulations and other control measures identified in Section II of this SIP revision. Health and Safety Code §43013(a) provides that:

> "The state board may adopt and implement motor vehicle emission standards, in-use performance standards, and motor vehicle fuel specifications for the control of air [pollutants] and sources of air pollution which the state board has found to be necessary, cost-effective, and technologically feasible to carry out the purposes of this division, unless preempted by federal law."

In addition, Health and Safety Code §43018 provides:

> "The state board shall endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practical date."

To carry out these directives, the Board is directed to:

> "... adopt and implement emission standards for new motor vehicles [or new motor vehicle engines] for the control of emissions therefrom, which standards the state board has found to be necessary and technologically feasible to carry out the purposes of this division. Prior to adopting such standards, the state board shall consider the impact of such standards on the economy of the state, including, but not limited to, their effect on motor vehicle fuel efficiency." (§43101.)

The Board is also directed by §43013(b) to regulate other categories of mobile sources:

"The state board shall ... adopt standards and regulations for ... off-road or nonvehicle engine categories, including, but not limited to, off-highway motorcycles, off-highway vehicles, construction equipment, farm equipment, utility engines, locomotives, and, to the extent permitted by federal law, marine vessels."

Each of these sections must be read in the context of Health and Safety Code 39600, which provides that: "The state board shall do such acts as may be necessary for the proper execution of the powers and duties granted to, and imposed upon, the state board by this division and by any other provision of law."

Pursuant to these authorities the ARB has adopted the world's most stringent standards for passenger cars, light-duty trucks and medium-duty vehicles, including the Low Emission Vehicle/Clean Fuels. (13 Cal. Code Regs. §1960.1.) The ARB has also adopted regulations establishing standards for heavy-duty vehicles that are at least as protective as the comparable federal standards applicable elsewhere in the nation. (13 Cal. Code Regs. §1956.8.) In addition, the ARB has adopted regulations establishing standards for off-road vehicles and engines, including small off-road engines and equipment (e.g., lawn and garden, small utility engines), off-road recreational vehicles (e.g., dirt bikes, all-terrain vehicles, golf carts), off-road diesel engines and equipment (e.g., certain farm and construction equipment, portable generators), off-road gasoline and LPG engines and equipment (e.g., forklifts, airport ground support equipment), and marine pleasure craft (e.g., jet skies, recreational boats).

In addition to the emission reductions to be achieved from implementation of existing ARB mobile source measures, Section II of this SIP revision contains a detailed description of the new mobile source measures proposed for adoption. This SIP revision also includes advance technology measures that rely on new or evolving technology. These measures will be adopted pursuant to CAA 182(e)(5).

b. Smog Check Program

California's vehicle inspection and maintenance program (commonly referred to as the "smog check program") is administered by BAR, which has the sole and exclusive authority within the State for developing and implementing the program. (Health and Safety Code § 44002) The overall structure of California's current smog check program was established by legislation enacted in 1994 in response to the requirements of the federal Clean Air Act and U.S. EPA regulations. The laws governing the implementation and enforcement of the program are found in Health and Safety Code §44000 et seq. A description of the smog check program and the proposed improvements to the program can be found in Section II.A of this SIP revision.

c. Fuels

The ARB has the authority to regulate the content of motor vehicle fuels. This was recognized by the California Supreme Court in a 1975 decision, *Western Oil & Gas Assn. v. Orange County Air Pollution Control District* (1975), 14 Cal. 3d 411, 418-420, which held

that the authority of the ARB to adopt and implement motor vehicle emission standards includes the authority to set standards for motor vehicle fuels.

The ARB's authority over fuels was reaffirmed and clarified in the California Clean Air Act of 1988, which added §43018 to the Health and Safety Code and substantially amended §43013. These sections provide that the ARB has the authority to establish motor vehicle fuel regulations, and that before adopting and amending such regulations the ARB must make take certain specified actions and make specified determinations. Pursuant to §§43013 and 43018, the ARB has adopted a number of fuels regulations. A description of the existing fuels regulations and the two proposed SIP measures for diesel fuel are set forth in Section II, Chapter I of this SIP revision.

One of the two proposed measures for diesel fuel, FUEL-2, would set low-sulfur standards for diesel fuel used in trucks, buses, off-road equipment, and stationary engines. Health and Safety Codes §§43013 and 43018 provide the legal authority for the ARB to regulate motor vehicle fuels, but they do not address the regulation of nonvehicular fuels. While these sections can therefore be relied upon as legal authority for the FUEL-2 provisions that apply to motor vehicle fuels, they cannot be relied upon for the FUEL-2 provisions that apply to fuel produced for nonvehicular sources. The legal authority to adopt the nonvehicular provisions of FUEL-2 is instead provided by the California's toxic air contaminant control law, the Tanner Act (Health and Safety Code §39650 et seq.). For substances that have been identified as toxic air contaminants (TACs), the Tanner Act directs the ARB to adopt air toxic control measures to control TAC emissions from nonvehicular sources (§§36658 and 39666). "Particulate emissions from diesel-fueled engines" has been identified by the ARB as a TAC (17 Cal. Code Regs. § 93000). The Tanner Act thus provides the ARB with the authority to adopt the nonvehicular provisions of FUEL-2 as an air toxic control measure.

d. Consumer Products

The ARB has broad authority under California law to regulate consumer products. Specifically, Health and Safety Code §41712(b) provides that:

> "The state board shall adopt regulations to achieve the maximum feasible reduction in volatile organic compounds [VOC] emitted by consumer products, if the state board determines that adequate data exists to establish both of the following:
>
> (1) The regulations are necessary to attain state and federal ambient air quality standards.
>
> (2) The regulations are commercially and technologically feasible and necessary."
>
> (See also Health & Safety Code §39600.)

Pursuant to this authority the ARB has already adopted standards for numerous categories of consumer products and has achieved significant emission reductions from these products. The ARB will continue to develop and adopt measures that limit the VOC

emissions from consumer products. A description of the existing regulations and the proposed consumer products measures are set forth in Section III, Chapter A of this SIP revision.

e. Vapor Recovery

Health and Safety Code §41954 requires the ARB to adopt procedures and performance standards for controlling gasoline vapor emissions from gasoline marketing operations, including transfer and storage operations, to achieve and maintain ambient air quality standards. This section also authorizes the ARB, in cooperation with districts, to certify vapor recovery systems that meet the performance standards. Health and Safety Code 39607(d) requires the ARB to adopt test procedures to determine compliance with ARB and districts non-vehicular standards. State law (§41954) further requires districts to use ARB test procedures for determining compliance with performance standards and specifications established by ARB.

To comply with these provisions of State law, the ARB has adopted the gasoline vapor recovery certification and test procedures found in 17 Cal. Code Regs., §§94010 to 94015 and 94101 to 94165. These regulations reference procedures for certifying vapor recovery systems and test procedures for verifying compliance with performance standards and specifications.

f. Pesticides

DPR has broad authorities under state law to control the use of pesticides for the purposes of protecting human health and the environment, including improving air quality. (Food & Agriculture Code §§14102, also §§12781, 12824-12828, 12976-12977, 12991-12995, 12996-12999, 13101 and 13102.) Pursuant to these authorities, in 1994 the DPR approved a plan to institute and monitor a voluntary VOC reduction program, together with a commitment to adopt regulations to require reductions in VOC emissions from pesticide use if the voluntary program does not produce specified reductions in accordance with a schedule approved as part of the pesticide element of the plan. This plan was submitted as a SIP revision in 1994 and approved by the U.S. EPA on January 8, 1997. (62 FR 1150, 1169-1170; January 8, 1997). DPR's approved SIP commitment to control pesticide emissions is described in Section III.C, of this SIP revision.

g. New Technology Measures for ARB's Long-Term Strategy

Like the 1994 and 1999 SIPs for the South Coast Air Basin, this SIP revision contains a special class of new technology measures necessary to contribute to attainment in the South Coast. CAA §182 sets out requirements for marginal, moderate, serious, severe and extreme ozone nonattainment areas, with the requirements for each level building on the preceding. As the only extreme area in the nation at this time, the South Coast must meet the most strenuous requirements applicable to areas with less intense ozone problems, plus all of the requirements of §182(e)(1) through (3). Under 181(a) of the Act, extreme areas have until 2010 to attain the national ozone standard.

Other regions may choose to voluntarily request reclassification to extreme. The San Joaquin Valley has stated its intention to do so in parallel with a SIP revision to show attainment of the federal one-hour ozone standard by 2010. The following discussion applies to any California nonattainment area classified as extreme.

To address attainment planning for extreme ozone nonattainment areas, Congress enacted §182(e)(5) as part of the 1990 CAA amendments. Specifically, §182(e)(5) provides:

> "The Administrator may, in accordance with section 110, approve provisions of an implementation plan for an Extreme Area which anticipate development of new control techniques or improvement of existing control technologies, and an attainment demonstration based on such provisions, if the State demonstrates to the satisfaction of the Administrator that--
>
> (A) such provisions are not necessary to achieve the incremental emission reductions required during the first 10 years after the date of the enactment of the Clean Air Act Amendments of 1990; and
>
> (B) the State has submitted enforceable commitments to develop and adopt contingency measures to be implemented as set forth herein if the anticipated technologies do not achieve planned reductions.
>
> Such contingency measures shall be submitted to the Administrator no later than 3 years before proposed implementation of the plan provisions and approved or disapproved by the Administrator in accordance with section 110. The contingency measures shall be adequate to produce emission reductions sufficient, in conjunction with other approved plan provisions, to achieve the periodic emission reductions required by subsection (b)(1) and (c)(2) and attainment by the applicable dates. If the Administrator determines that an Extreme Area has failed to achieve an emission reduction requirement set forth in subsection (b)(1) or (c)(2), and that failure is due in whole or part to an inability to fully implement provisions approved pursuant to this subsection, the Administrator shall require the State to implement the contingency measures to the extent necessary to assure compliance with subsections (b)(1) and (c)(2)."

U.S. EPA approved the new technology measures set forth in the 1994 and 1999 Ozone SIPS (60 FR 43379, 4381 (August 21, 1995); 65 FR 6091, 6093 (February 8, 2000), and further explained its interpretation of §182(e)(5):

> " The 1990 Amendments to the Act added section 182(e)(5), which applies exclusively to "Extreme ozone areas. This provision authorizes the State to use conceptual, as yet unadopted measures for its ozone attainment demonstration and rate-of-progress after the year 2000, if these measures anticipate new or improved technology or control techniques and are not need to meet the progress requirements of the first 10 years . . . These measures necessarily are preliminary, and as such lack both regulations and technical support or even decisions regarding specific directions and approaches. Complete SIP rule elements are dependent upon future years of research projects, analyses of technologies and

associated commercial feasibility, public workshops, and public decisionmaking." (60 FR 43381)

California's SIP revisions for extreme areas are expected to rely on §182(e)(5) measures for substantial emission reductions beyond the year 2009. This reliance was intended by the Act and affects both the completeness review and the approval process for this SIP revision.

Long-term measures that rely on new or evolving technology (including measures requiring complex analyses and decision-making and coordination among numerous government agencies) fall within the coverage of §182(e)(5) (57 Fed.Reg. 13498, 13524) and are approvable as SIP revisions although not in final rule form. Because §182(e)(5) contemplates the use of yet-to-be-developed technologies or yet-to-be-completed analyses and decision-making, the rules implementing these measures have not yet been developed or adopted. For purposes of U.S. EPA's review under §110(k), these measures should be treated in the same way as fully adopted rules because they are fully developed in the manner contemplated by the Act at this point in time.

APPENDIX I-1

LETTER FROM THE BUREAU OF AUTOMOTIVE REPAIR ON IMPROVING THE ENHANCED SMOG CHECK PROGRAM

State of California Department of Consumer Affairs

BUREAU OF AUTOMOTIVE REPAIR
10240 SYSTEMS PARKWAY, SACRAMENTO, CA 95827
PHONE: (916) 255-4300

May 12, 2003

Ms. Catherine Witherspoon
Executive Officer
California Air Resources Board
1001 I Street
Sacramento, California 95814

Catherine

Dear Ms. ~~Witherspoon~~:

The Bureau of Automotive Repair (BAR) wishes to apprise you of the status of the Smog Check Program (Program) improvements that were committed to in an earlier letter to the United States Environmental Protection Agency. The following is a list of the improvements and their status.

1. *Expanded Loaded-Mode Testing of Heavy Duty Vehicles.* BAR successfully promulgated regulations requiring loaded-mode testing of vehicles registered in enhanced areas with a gross weight rating between 8,501 and 9,999 pounds. The expanded testing began on May 1, 2003. Previously, these higher weight vehicles were given a static two-speed idle test.

2. *More Stringent Oxides of Nitrogen (NOx) Exhaust Emission Standards.* The NOx pass/fail standards (cutpoints) were tightened to the levels identified in the State Implementation Plan in three phases. The first phase began on October 30, 2002, the second was December 4, 2002 and the final phase cutpoints were implemented on January 8, 2003.

3. *Remote Sensing and the Identification of High Emitting Vehicles.* In March 2003, a Request for Proposal was released for a joint ARB/BAR pilot study to determine the best uses for remote sensing technology in California. The contract for the pilot study is expected to be executed no later than September 2003.

4. *More Comprehensive Fuel Evaporative Control System Testing.* A liquid leak functional test was incorporated into the official Smog Check inspection protocol on September 28, 2001. In addition, in December 2002, BAR released draft performance specifications for a tester that would meet the Program's needs. A revised set of specifications will be released within the next ten days. The regulations needed to formally adopt the low-pressure evaporative test are undergoing final executive review and will be formally noticed within the next sixty days and adopted later this year. BAR anticipates a mid-2004 implementation date for the low-pressure evaporative test.

5. *Directing More Vehicles to Test-Only Stations.* As of August 2002, BAR increased the percentage of vehicles directed to Test-Only stations for their biennial Smog Check inspections to 36% of the enhanced fleet.

BAR reaffirms its commitment to all parties to implement the remaining improvements as expeditiously as possible. I hope this information proves helpful. If you have any questions, please do not hesitate to call me.

Yours truly,

Patrick Dorais

PATRICK DORAIS
Chief

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

SECTION II

MOBILE SOURCES

May 2003

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Significant Changes to Defined State and Federal Measures Since ARB Released Draft Strategy for South Coast in January 2003 Section II Measures

Strategy (Agency)	Name	Significant Changes
LT/MED-DUTY-1 (ARB)	Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	---
LT/MED-DUTY-2 (BAR)	Smog Check Improvements	---
ON-RD HVY-DUTY-1 (ARB)	Augment Truck and Bus Highway Inspections with Community-Based Inspections	---
ON-RD HVY-DUTY-2 (ARB)	Capture and Control Vapors from Gasoline Cargo Tankers	Revised adoption date
ON-RD HVY-DUTY-3 (ARB/~~U.S. EPA~~)	Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling	Federal element moved to long-term strategy
~~OFF-RD CI-1 (ARB)~~	~~Set Lower Emission Standards for New Off-Road Compression Ignition Engines~~	New federal proposal to implement post-2010; concept moved to long-term strategy
~~OFF-RD CI-1 (U.S. EPA)~~	~~Set Lower Emission Standards for New Off-Road Compression Ignition Engines~~	
OFF-RD CI-1 ~~OFF-RD CI-2~~ (ARB)	Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	Renumbered
OFF-RD CI-2 ~~OFF-RD CI-3~~ (ARB)	Implement Registration and Inspection Program for Existing Off-Road Equipment to Detect Excess Emissions (Compression Ignition Engines)	Renumbered and revised to clarify implementation strategy
OFF-RD LSI-1 (ARB)	Set Lower Emission Standards for New Off-Road Gas Engines (Spark Ignited Engines 25 hp and Greater)	---
OFF-RD LSI-2 (ARB)	Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls (Spark-Ignition Engines 25 hp and Greater)	---
OFF-RD LSI-3 (ARB)	**Require Zero-Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 Pounds** ~~Require new Forklift Purchases and Forklift Rentals to be Electric – Lift Capacity <8,000 pounds~~	Retitled and revised to discuss feasibility considerations and reflect updated control potential

Strategy (Agency)	Name	Significant Changes
SMALL OFF-RD-1 (ARB)	Set Lower Emission Standards for New Handheld Small Engine and Equipment (Spark Ignited Engines Under 25 hp such as Weed Trimmers, Leaf Blowers, and Chainsaws)	Updated emissions inventory and control potential
SMALL OFF-RD-2 (ARB)	Set Lower Emission Standards for New Non-Handheld Small Engine and Equipment (Spark Ignited Engines Under 25 hp such as Lawnmowers)	Updated emissions inventory and control potential
~~MARINE-1 (U.S. EPA)~~	~~Set More Stringent Emission Standards for New Harbor Craft and Ocean-Going Ships~~	Federal measure; moved to long-term strategy
MARINE-1 ~~MARINE-2~~ (ARB)	Pursue Approaches to Clean Up the Existing Harbor Craft Fleet –Cleaner Engines and Fuels	Renumbered
~~MARINE-3 (U.S. EPA)~~	~~Pursue Approaches to Clean Up the Existing Ocean-Going Ship Fleet – Cleaner Fuels, Incentives for Cleaner Ships, Smoke (Opacity) Limits~~	Federal measure; moved to long-term strategy
MARINE-2 ~~MARINE-4~~ (ARB)	Pursue Approaches to Reduce Land-Based Port Emissions – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls	Renumbered
~~AIRPORT-1 (U.S. EPA)~~	~~Pursue Approaches to Reduce Emissions from Jet Aircraft – Cleaner Engines/Retrofit Controls, Aerodynamic Design, Fleet Purchase Strategy, Emission-Based Landing Fees, Cleaner Fuel, Operational Measures~~	Federal measure; moved to long-term strategy
FUEL-1 (ARB)	Set Additives Standards for Diesel Fuel to Control Engine Deposits	---
FUEL-2 (ARB/~~U.S. EPA~~)	Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines	Federal element moved to long-term strategy

INTRODUCTION

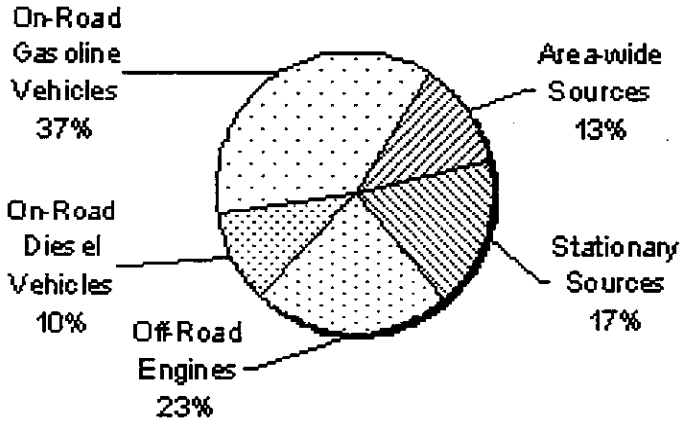
INTRODUCTION

1. Category Description

Mobile sources encompass a broad variety of vehicles and equipment – everything from gasoline-fueled leaf blowers to large diesel-fueled ocean liners. Mobile source categories include: light- and medium-duty vehicles; heavy-duty vehicles; diesel equipment; gasoline equipment; and ships, planes, and trains. In addition, the gasoline or diesel fuel used in these vehicles, engines and equipment can have an impact on emissions.

On-road and off-road mobile sources account for about 70 percent of ozone precursor emissions in the State (Figure II-1). Reducing reactive organic gases (ROG) and oxides of nitrogen (NOx) emissions from on- and off-road mobile sources is a top ARB priority because motor vehicles are the dominant source of air pollution and toxics health risk in California.

Figure II-1
2000 ROG + NOx Sources



To address California's acute air quality problems, the federal Clean Air Act granted California the unique authority to adopt and enforce rules to control mobile source emissions within California. ARB is required to adopt State requirements that are as stringent or more stringent than federal requirements. The California Clean Air Act requires ARB to achieve the maximum degree of emission reductions possible from vehicular and other mobile sources in order to attain the State ambient air quality standards by the earliest practicable date.

2. Existing Programs

California's mobile source and fuels programs exemplify the State's long-standing commitment to clean air. As far back as 1961, the State mandated the first

automotive emissions control technology in the nation – the positive crankcase ventilation valve, or PCV valve, to control hydrocarbon crankcase emissions. Progressively tighter emission standards, coupled with fuel specifications, have put California in the forefront of mobile source emissions control.

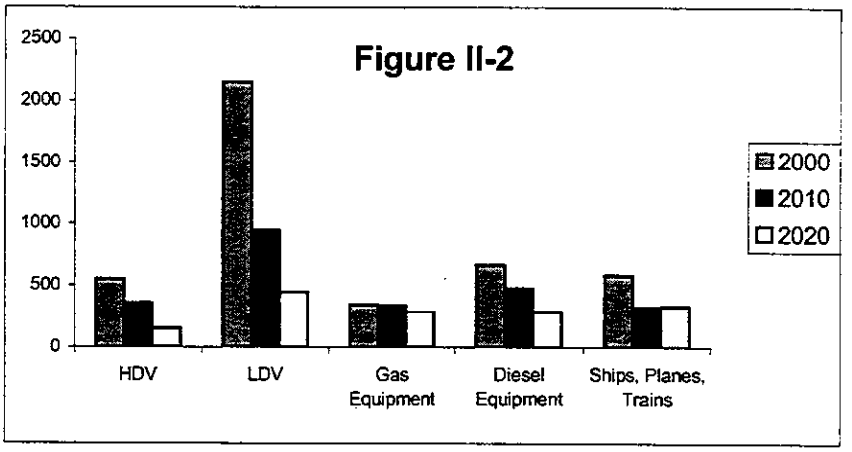
California has led the way in adopting stringent regulations for passenger vehicles. A new 1965 car produced about 2,000 pounds of smog-forming hydrocarbon emissions during 100,000 miles of driving. California's low-emission standards, coupled with reformulated gasoline, have cut that to less than 50 pounds for the average new car today. By 2010, California's standards will further reduce hydrocarbon emissions from the average new 2010 car to approximately 10 pounds.

Today, there are 24 million gasoline-powered vehicles registered in California, and over one million diesel-fueled vehicles and engines. To power these vehicles, over 14 billion gallons of gasoline and approximately 3 billion gallons of diesel fuel are consumed annually. To reduce the harmful effects of the emissions from all these vehicles, ARB has adopted fuel specifications that reduce exhaust and evaporative emissions from motor vehicles. These fuel initiatives complement mobile source controls.

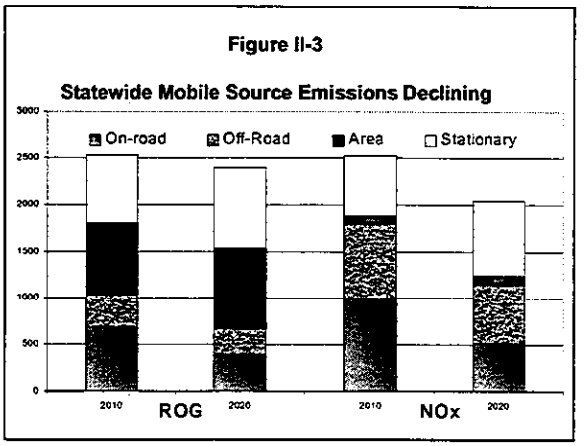
In the last decade, California has dramatically tightened standards for heavy-duty vehicles and off-road equipment as well. Some mobile sources are pre-empted from State authority to control, and some – due to interstate or international commerce issues – are not practical to control at the State level. These mobile sources are referred to as "federal sources." California must rely on the federal government to control them. Federal sources include: interstate trucks registered outside California, farm and construction equipment (like bulldozers and tractors), trains, ships, and planes. ARB staff has worked closely and successfully with United States Environmental Protection Agency (U.S. EPA) staff to develop, adopt, and implement harmonized regulations for interstate diesel trucks, off-road diesel equipment, and off-road equipment. The new federal emission standards requiring low-sulfur diesel fuel in 2006 and cleaner trucks in 2007 are critical to help reduce harmful exposure to ozone and particles in California.

Mobile source regulations have reduced motor vehicle exhaust emissions by approximately 99 percent over uncontrolled levels for all on-road sources in California. More than any other pollution control effort, ARB's mobile source control program has moved the State's nonattainment areas closer to meeting federal and State air quality standards.

Figure II-2 shows mobile source emissions, in tons per day, by category in 2000, 2010 and 2020. These categories include: heavy-duty vehicles; light-duty vehicles; gasoline equipment; diesel equipment; and ships, planes, and trains. Figure II-2 also clearly illustrates the benefits of ARB's mobile source and fuels programs. It shows reductions in ozone precursor emissions (i.e., ROG plus NOx emissions) from nearly every mobile source category as a result of ARB's existing control program (i.e., not including the measures in this draft SIP). As the California regulated fleet of mobile sources gets cleaner, the relative share of emissions from federally regulated sources such as ships, planes, and trains, increases. Nevertheless, with the ongoing joint efforts of ARB, U.S. EPA, and the local districts, mobile source emissions of ROG and NOx will continue to drop.



Mobile sources, both on- and off-road, are currently responsible for more than 70 percent of California's ROG and NOx emissions. The total statewide summer emissions in 2010 from all sources, under the existing control program, are estimated to be approximately 2,500 tpd each of ROG and NOx. By 2010, mobile sources will account for about 55 percent of the ozone precursor emissions, and by 2020, mobile source emissions are expected to account for less than 40 percent of ozone precursor emissions. See Figure II-3.



New engines are ever cleaner, but the number of vehicles and miles traveled are outpacing population growth. Plus, the lifetime of heavy diesel trucks and equipment can extend over several decades, slowing air quality benefits that depend on fleet turnover.

Because on-road and off-road mobile sources together account for so much of the State's inventory of smog-forming emissions, further reductions in mobile source emissions are essential if clean air standards are to be realized. The mobile source

element of the State Implementation Plan (SIP) is ARB's blueprint of technology- and market-based emission control strategies for achieving this outcome.

3. Proposed Strategies

Technological breakthroughs over the past 30 years made significant emission reductions possible. Over the next decade, ARB expects to see even greater advances through the development, commercialization, and use of zero and near-zero emission technologies, as well as further development of clean and alternative fuels. These emerging technologies hold promise for several reasons: tailpipe, evaporative and fuel marketing emissions will be eliminated, emission control equipment deterioration or failure will be a thing of the past, toxic and greenhouse gas emissions will be substantially reduced, and emissions associated with the traditional fuels infrastructure will be significantly reduced.

ARB's strategy for achieving additional emissions reductions from the mobile source emissions inventory can be grouped into five approaches: (a) set technology-forcing new engine standards; (b) reduce emissions from the in-use fleet; (c) require clean fuels, support alternative fuels, and reduce petroleum dependency; (d) work with U.S. EPA to reduce emissions from federal and State sources; and (e) pursue long-term advanced technologies measures. These five strategies would be implemented via the mobile source and fuels measures cited in this Section.

a. Set Technology-Forcing New Engine Standards

Technology-forcing emission standards for new vehicles and engines have been at the heart of ARB's mobile source control program. Progressively more stringent emission standards have helped spur improvements in combustion efficiency and advanced engine and aftertreatment technology. For many mobile source categories, more stringent standards were adopted under the existing program, and will be phased-in between now and 2010. Because the emission benefits of new emission standards are achieved as older engines are retired and new engines are purchased, the 2010 emission benefits of new emission standards adopted in the next several years are relatively slight. However, to achieve and maintain healthful air quality for California residents in the face of increased population, increased vehicle miles traveled, and increased equipment usage, the push toward zero emission technology is absolutely essential. Thus, ARB is proposing the next round of emission standards, which will be adopted during this decade and realize substantial emission benefits by 2020.

ARB staff is planning to propose new standards for large spark-ignited engines, such as forklifts, and for small off-road equipment (lawnmowers, leaf blowers, etc.). In addition, included in concepts the federal government should consider are new

emission standards for locomotives, ocean-going ships, harborcraft, and commercial and non-tactical military aircraft.

b. Reduce Emissions from the In-Use Fleet

Incentive-based programs using public funds have been successful in reducing emissions of ROG and NOx. Some incentive programs, for example ARB's Lower-Emission School Bus Program and the Carl Moyer Program, are also achieving particulate matter (PM) reductions. However, the implementation of incentive-based programs was never intended to relieve the private sector of its ultimate responsibility to reduce emissions from the existing vehicle fleet. Therefore, ARB must now consider other options that require the aging vehicle and equipment fleet within California to reduce emissions and the associated impacts on our State's air quality over the next ten years.

Light- and Medium-Duty Vehicles: Inspection and Maintenance (or Smog Check) programs help ensure that in-use vehicles stay clean as they age. ARB and the Bureau of Automotive Repair (BAR) have implemented a number of near-term improvements to the Smog Check program. Three improvements that remain to be implemented include: 1) loaded-mode testing for gasoline trucks between 8,500 and 14,000 pounds gross vehicle weight, 2) an evaporative emission control test to identify excess ROG emissions from leaks in the fuel system, and 3) increasing the percent of vehicles sent to Test-Only stations.

In addition, ARB is currently conducting a Pilot Program to test both light- and medium-duty vehicles to determine the most effective means of reducing in-use emissions. Vehicle testing under the Pilot Program, which targets model year 1995 and older vehicles, will be completed by the end of 2003. The results of the pilot program will be used to determine the emission benefits and estimated costs of implementing light- and medium-duty vehicle part replacement/repair programs.

Heavy-Duty Vehicles and Equipment: ARB must also focus its efforts on reducing emissions from in-use on- and off-road heavy-duty diesel vehicle and equipment fleets. While stringent new emission standards will result in significant reductions – this will only occur over time. The durability and performance reliability of the heavy-duty diesel engine means that each one remains in service for an extended period of time, typically 500,000 miles to a million or more miles, diluting the near-term emissions impact of standards targeting only new engines. For both on-road and off-road diesel engines, ARB will be considering several strategies to reduce in-use emissions. Some examples of these strategies are fleet rules to reduce PM emissions, idling restrictions, and vapor recovery for cargo tanker fueling hoses. ARB also intends to implement a software upgrade program that specifically targets 1993 through 1998 model year on-road heavy-duty diesel engines. These software upgrades, developed

by the engine manufacturers and available now, will significantly reduce excess NOx emissions during typical on-highway driving conditions.

c. Require Clean Fuels, Support Alternative Fuels, and Reduce Petroleum Dependency

Cleaner conventional and alternative fuels will reduce emissions and enable the new technology envisioned in this draft SIP.

One proposed fuels measure would lower the maximum sulfur content allowed in diesel fuel to 15 ppm by 2006, and significantly reduce diesel PM levels for on-road and off-road vehicles statewide. Low sulfur diesel fuel would enable technologies, such as catalyzed diesel particulate filters and NOx adsorbers that could significantly reduce emissions from on- and off-road engines. Additional measures would control the sulfur in lubricating oil and set additive standards for diesel fuel to control engine deposits.

While tighter fuel specifications can enable the next generation of vehicle and equipment technology, alternative fuels and alternative diesel fuels can reduce emissions in the near-term. There are several mobile source and fuels measures that provide for the use of alternative fuels or alternative diesel fuels to yield near-term emissions benefits.

One sure way to reduce emissions from fuels is to use less of it. ARB will pursue approaches to reduce petroleum dependency, including looking at advanced technologies, alternative fuels and alternative diesel fuels, lowering travel demand, and reducing upstream emissions.

d. Work with U.S. EPA to Reduce Emissions from Federal and State Sources

Adopted U.S. EPA regulations for interstate diesel trucks and off-road equipment and the federal requirement for low-sulfur diesel fuel in 2006 for on-road trucks are critical parts of the strategy to attain federal ambient air quality standards. But significant additional reductions are needed, and the federal government needs to do more to control federal sources.

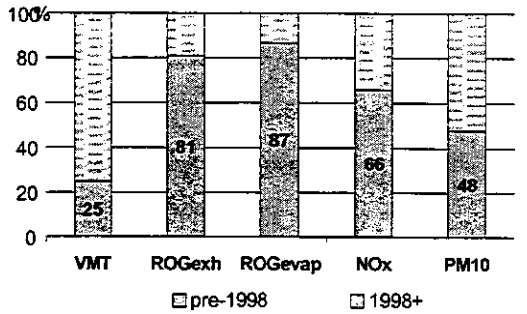
Suggested federal measures include: more stringent standards for off-road compression ignition engines; a federal requirement for low-sulfur diesel fuel for off-road engines, marine, and locomotive engines beginning in 2006; more stringent standards for harborcraft and ocean-going ships; and more stringent standards for aircraft engines, as well as reformulated jet fuel for aircraft engines.

e. Pursue Long-Term Advanced Technologies Measures

Light- and Medium-Duty Vehicles: There is a wide disparity in emissions between pre- and post-1998 light-duty vehicles. This variation is primarily due to the technological advancements in motor vehicle controls and vehicle design that occurred beginning in 1998, and the results of overall deterioration in the aging motor vehicle fleet. Figure II-4 illustrates how older engines in the light-duty fleet will contribute a disproportionate share of emissions relative to their population and usage in 2010.

Figure II-4

Older Gasoline Powered Vehicle Contribution Statewide Summer 2010



Other long-term advanced technology measures for light- and medium-duty vehicles include: 1) Voluntary Accelerated Vehicle Retirement (VAVR) – which requires funding, and 2) improvements to the Smog Check program – which would require legislative authority, including replacing the rolling 30-year model year exemption with exemption of pre-1974 vehicles, and expanding Enhanced Smog Check.

Heavy-Duty Vehicles and Equipment: For both on-road and off-road diesel engines, ongoing funding for incentive programs such as the Carl Moyer Program and the Lower-Emission School Bus Program would introduce cleaner technology and reduce in-use emissions. Other long-term advanced technology measures include lower U.S. EPA emission standards for new and remanufactured locomotive engines, additional marine reductions, including alternatives to dockside power and propulsion in/out of port and operational controls, and reduced emissions from vehicles traveling to and from airports.

Post-2010 Measures: In virtually every mobile source category, ARB has adopted more stringent emission standards that are being phased-in between now and 2010. There are a number of categories ARB plans to revisit, to adopt the next round of more stringent emission standards which will yield emission benefits after 2010. These post-2010 measures will help counter growth in population and activity, and continue to ensure healthy air in California. Post 2010 measures already planned include Tier IV emission standards for diesel off-road engines and for diesel recreational marine engines, low-emission vehicle (LEV III) standards for light-duty vehicles, exhaust and evaporative standards for off-road motorcycles, and more stringent standards for personal watercraft and outboard engines.

There is no doubt that ARB must move beyond traditional technologies, such as the internal combustion engine, to achieve our long-term clean air goals. Consequently, our future efforts will involve fundamental shifts to new technologies and fuels. One of our continuing goals is to encourage the development, commercialization, and use of zero and near-zero emission technologies in the post-2010 timeframe. ARB's Zero Emission Vehicle (ZEV) Program has been a major catalyst in the research and development of a variety of technologies for the mobile sector. Fuel cell technology is the most likely candidate to replace today's technology in the post-2010 timeframe. Other technologies, including hybrid-electrics and micro-turbines are being developed.

These advanced technologies, coupled with the fueling infrastructure to support them, will move California into a cleaner, healthier future.

CHAPTER A

Light and Medium-Duty Vehicles

CHAPTER A. LIGHT AND MEDIUM-DUTY VEHICLES

1. Category Description

Mobile sources are responsible for about 70 percent of the ozone-forming emissions in California. Light- and medium-duty vehicles, as a segment of mobile sources, consist of passenger cars, small and large trucks, vans, sport-utility vehicles, and mid-sized delivery vehicles. The relative contribution of light- and medium-duty vehicles is expected to decline over time as new standards phase in. Even so, in 2010 such vehicles will still be responsible for over half of total ROG emissions, approximately 30 percent of the NOx emissions and approximately 20 percent of the PM10 emissions from all mobile sources. About 40 percent of the ROG emissions from light- and medium-duty vehicles are attributable to evaporative emissions.

In addition to ROG, NOx and PM10, light- and medium-duty vehicles are a significant source of emissions of toxic air contaminants in California, and a major contributor to greenhouse gas emissions. The facilities needed to refuel the current light- and medium-duty vehicle fleet (service stations, bulk terminals, refineries) present another source of smog precursors, air toxics, water pollution, and hazardous waste. Emissions of criteria pollutants from light- and medium-duty vehicles (up to 14,000 pounds gross vehicle weight) are shown in Tables II-A-1, II-A-2 and II-A-3 for the South Coast and the San Joaquin Valley.

Table II-A-1
Baseline Emissions for Light and Medium-Duty Vehicles up to 14,000 Pounds Gross Vehicle Weight (South Coast, Summer Planning, tpd)

Pollutant	2000	2005	2006 (annual average)	2008	2010	2020
ROG	364	233	220	189	165	96
NOx	374	236	236	189	163	80
PM10	117	13	13	13	14	16
CO	3758	2352	2211	1885	1627	824

Note: Brake and tire wear are included in PM10 inventory.

Table II-A-2
Baseline Emissions for Passenger Cars and Light-Duty Trucks
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	43
NOx	44
PM10	3.5

Note: Brake and tire wear are included in PM10 inventory.

Table II-A-3
Baseline Emissions for Gasoline Vehicles up to
14,000 Pounds Gross Vehicle Weight
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	50
NOx	54
PM10	3.9

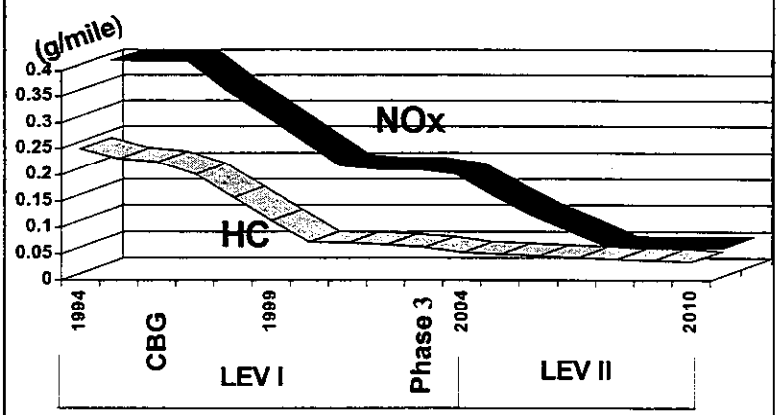
Note: Brake and tire wear are included in PM10 inventory.

2. Existing Control Program

The Low-Emission Vehicle (LEV) regulations are the cornerstone of ARB's efforts to reduce emissions from light- and medium-duty vehicles. The original LEV I program was adopted in 1990. ARB adopted the second phase of its Low-Emission Vehicle program (LEV II) in November 1998. Both the LEV I and LEV II regulations include four primary elements: (1) increasingly stringent exhaust emission standards for specific categories of low-emission vehicles, (2) an increasingly stringent annual fleet average standard for non-methane organic gas (NMOG) which requires each manufacturer to phase-in a progressively cleaner mix of vehicles from year to year, (3) banking and

Figure A-1

Emission Standards for LEV Program



trading provisions, and (4) a requirement that a specified percentage of passenger cars and lighter light-duty trucks be zero emission vehicles (ZEVs), vehicles with no emissions. Figure II-A-1 illustrates the emission standards set forth by the LEV program by model year.

a. Low-Emission Vehicle Program (LEV I)

The LEV I program established four low-emission vehicle categories to which a car or light-duty truck could be certified: Transitional Low-Emission Vehicle (TLEV), Low-Emission Vehicle (LEV), Ultra Low-Emission Vehicle (ULEV), and Zero Emission Vehicles (ZEV). The medium-duty vehicle categories are LEV, ULEV, Super Ultra Low-Emission Vehicle (SULEV), and ZEV. Each low-emission vehicle category has a progressively more stringent standard for exhaust emissions of NMOG. For example, passenger car LEVs and ULEVs have to meet standards for NMOG that are respectively about one-third and one-sixth of the corresponding federal 1994 Tier 1 non-methane hydrocarbon (NMHC) standard. The identical LEV and ULEV standard for oxides of nitrogen (NOx) represents a 50 percent reduction from the federal 1994 Tier 1 NOx standard.

All passenger cars have been subject to the same low-emission vehicle standards, regardless of weight. However, heavier light-duty trucks and medium-duty vehicles were allowed to have greater emissions for given low-emission vehicle categories. There were two weight categories for light-duty trucks (LDT1 and LDT2) and four weight categories for medium-duty vehicles (MDV2, MDV3, MDV4, and MDV5).

Under LEV I, each year a manufacturer may produce cars and LDT1s certified to any combination of emission categories – TLEV, LEV, etc. – as long as its full model line meets the annual NMOG fleet average requirement. The required fleet average NMOG emissions level starts at the Tier 1 level for the 1994 model year. It then becomes incrementally more stringent through the 2003 model year, when the level for cars and LDT1s was derived from a potential mix of 75 percent LEVs, 15 percent ULEVs and 10 percent ZEVs. The heavier light-duty trucks in the LDT2 category are subject to numerically higher fleet average NMOG emissions requirements reflecting the numerically higher TLEV, LEV and ULEV standards and the absence of a ZEV requirement for these vehicles. Medium-duty vehicles have separate requirements based on a percent phase-in schedule.

An integral part of LEV I is the requirement for specific percentages of ZEVs. This requirement, often referred to as the "ZEV program," is an essential part of California's mobile source control efforts and is intended to encourage the development of advanced technologies that will secure increasing air quality benefits for California

now and into the future. A more detailed discussion of the ZEV program is included below.

b. Low-Emission Vehicle Program II (LEV II)

While the LEV I program established the ZEV program and set forth increasingly stringent vehicle tailpipe emission standards from 1994 through 2003, LEV II continued that trend by setting even more stringent emission requirements beginning in 2004 and continuing through 2010. The LEV II program was adopted in 1998 with the intent of satisfying the requirements of the Improved Control Technologies (M2) measure of the 1994 State Implementation Plan (SIP) obligations and a significant portion of the SIP's so-called "black box." LEV II meets its SIP goals by reducing ozone precursors in the South Coast Air Basin by 57 tons per day by 2010.

One of the principal goals of the LEV II program is to ensure that the increasingly popular sport utility vehicles (SUV) and pickup trucks that are being used primarily as passenger cars be required to meet the same emission requirements as passenger cars. Thus, all light-duty trucks and all medium-duty vehicles having a gross vehicle weight (GVW) of less than 8,500 pounds will be subject to the LEV II passenger car exhaust emission standards. Only vehicles having a GVW of 8,500-14,000 pounds – the MDV4 and MDV5 categories – will remain as medium-duty vehicles. Another goal of the program is to dramatically reduce NOx emissions for all vehicles below 8,500 pounds to a level 75 percent below that allowed for passenger cars in the LEV I program. The LEV II standards for the various vehicle emissions categories are phased in during the 2004-2007 model years.

In 1995, the U.S. Environmental Protection Agency (U.S. EPA), ARB and the automobile manufacturers signed a Statement of Principles that states:

> "... the Signatories commit to working together to achieve regulatory streamlining of light-duty vehicle compliance programs, including reduction of process time and test complexity, with the goal of more optimal resources spent by both government and industry to better focus on in-use compliance with emission standards."

ARB staff worked with U.S. EPA and the automobile industry to develop a streamlined motor vehicle certification process coupled with an enhanced in-use compliance program, the Compliance Assurance Program. The goal of U.S. EPA and ARB in this compliance program is to redirect manufacturer and government efforts toward in-use compliance, which would provide greater assurance that vehicles are actually complying with the standards while in-use. The LEV II regulations divert the significant resources presently devoted to motor vehicle certification and reallocate a portion of them towards in-use compliance. Reducing the regulatory burden during

certification would provide manufacturers with more control over their production timing, which would provide significant savings, while the enhanced in-use test programs would provide more air quality protection. This proposal became effective with the 2001 model year although manufacturers could certify their 2000 model year vehicles using the compliance program framework as adopted by the Board.

Subsequent to adoption of the LEV II program, ARB staff assisted the U.S. EPA in developing a similar program for federal vehicles that would achieve maximum emission reductions for vehicles in other states. ARB staff met with U.S. EPA staff to review the engineering approach taken in ARB's test program, provide them with emission test data, loan them experimental catalysts, and provide other assistance. U.S. EPA staff demonstrated that emission levels adopted in LEV II could also be achieved cost-effectively on vehicles nationwide. The program that was subsequently adopted by U.S. EPA in January 1999 is referred to as the Tier 2 standards.

While Tier 2 was patterned after the LEV II program, there is a significant difference in that California has a NMOG fleet average requirements, whereas Tier 2 vehicles must meet a NOx fleet average requirements. This difference could potentially result in manufacturers certifying certain vehicles models to a more stringent federal standard than is required in California. This would most likely occur when vehicles previously classified as medium-duty vehicles are transitioning to the light-duty truck classification during the 2004 through 2006 model years. Thus, to ensure that only the cleanest vehicles are available in California, the Board approved modifications to the LEV II regulations in December 2000 that require a manufacturer to certify California vehicle models to the most stringent emission standards categories available whether that be the Tier 2 or California standards.

c. Zero Emission Vehicle Program

As discussed above, under the LEV I regulations, the seven largest auto manufacturers were required to produce ZEVs beginning with model year 1998. In model years 1998 through 2000, two percent of the vehicles offered for sale in California by large volume manufacturers were to be ZEVs, and this percentage was to increase to five percent in model years 2001 and 2002, and ten percent in model years 2003 and beyond.

In 1996, ARB modified the regulations to allow additional time for the technology to develop. The requirement for ten percent ZEVs in model years 2003 and beyond was maintained, but the sales requirement for model years 1998 through 2002 was eliminated. At that same time, ARB entered into Memoranda of Agreement (MOAs) with the seven largest vehicle manufacturers. Under the MOAs, the manufacturers agreed to place more than 1,800 advanced-battery electric vehicles in California in 1998 through 2000, and ARB agreed to work with State and local governments to help develop ZEV infrastructure and remove barriers to ZEV introduction.

In 1998, ARB adopted changes to the ZEV program that allowed extremely clean conventional vehicles to meet a portion of the pure ZEV requirements. Under the changes, manufacturers were able to certify to a new standard, the partial credit zero emission vehicle (PZEV). Intermediate-sized automakers could meet their entire ZEV obligation with PZEVs, whereas large manufacturers were still required to meet, at a minimum, four percent of their sales with vehicles classified as "pure" ZEVs.

In January 2001, the ZEV program was modified to reflect the state of battery technology and to respond to new advances in vehicle technology. These modifications included:

- Allowing manufacturers to generate "credit" towards their ZEV requirement with vehicles that have advanced componentry.
- Increasing ZEV credit for hybrid vehicles with specific amounts of all-electric range.
- Allowing additional ZEV credit for ZEVs placed in transportation systems such as station car programs.
- Phasing in a ZEV requirement for larger trucks and sport utility vehicles.
- Some technical modifications to the ZEV credit calculation mechanism.

In April 2003, ARB adopted changes to the program to address issues raised in ongoing litigation of the program in State and federal court, and to further refine the program to reflect the state of vehicle technology. In addition to removing all references to fuel economy and efficiency, the modified program established an alternative compliance path for automobile manufacturers.

Auto manufacturers can fulfill their ZEV obligations by meeting standards that are similar to the 2001 ZEV program. This means using a formula allowing a vehicle mix of two percent pure ZEVs, two percent AT PZEVs (vehicles earning "advanced technology" partial ZEV credits) and six percent PZEVs.

Conversely, a manufacturer may choose an alternative ZEV compliance strategy, meeting part of their ZEV requirement by producing their sales-weighted market share of 250 fuel cell vehicles by 2008. The remainder of their ZEV requirements can be achieved by producing four percent AT PZEVs and six percent PZEVs. The required total number of fuel cell vehicles will increase to 2,500 from 2009 to 2011, 25,000 from 2012 to 2014 and 50,000 from 2015 through 2017. Automakers can substitute battery electric vehicles for up to 50 percent of their fuel cell vehicle requirements.

The Board made further modifications to the regulation to encourage the continued research and development of battery electric vehicles including an increase in the credit awarded for vehicles in-use beyond three years and removal of the battery warranty requirement. The Board also increased the credit for grid-connected hybrid electric vehicles and a manufacturer to receive credit for fuel cell vehicles placed in other states that have adopted California's ZEV program.

To report on ZEV technology progress, costs and consumer acceptance, ARB will establish an independent review panel of technology/industry experts. In addition, ARB staff will report annually on the progress of the ZEV program. As a result of the 2003 modifications brought on by the automaker lawsuits, the program requirements will not go into effect until 2005. However, automakers can receive credit for any ZEV, PZEV or AT PZEV vehicles they choose to sell until then.

There are two recently approved programs undertaken to strengthen the success of the ZEV program: the ZEV Incentive Program (ZIP) and the regulatory standardization of electric vehicle infrastructure.

The ZIP Program: The ZIP program was established by the passage of Assembly Bill (AB) 2061 (Lowenthal) in 2000. AB 2061 appropriated an $18,000,000 fund to grant incentives to the purchasers or lessors of zero emission vehicles between October 2000 and December 2002. The program grants up to $3,000 each year for three years (totaling $9,000) for the purchase or lease of a freeway capable zero emission vehicle. As a result of this program, as many as 2,000 electric vehicles could be subsidized. This program is important to the early success of the ZEV program as the cost of electric vehicles is currently quite high. By providing grants to consumers and fleets, the price of these ZEVs can be brought down to levels comparable to conventionally fueled vehicles.

In addition to the already established ZIP program, the 2001/2002 fiscal year budget included $20,000,000 towards incentives for ZEVs. This new infusion of incentive money provides up to $5,000 per ZEV for as many as 2,000 additional ZEVs and also creates incentives of up to $11,000 for fleet vehicles operated in disproportionately impacted low income and minority communities. This funding will cover vehicle placements through 2004.

Charger Standardization: The standardization of electric vehicle charging infrastructure is essential to the success of the ZEV program. In June 2001, the Air Resources Board approved a regulatory addition to the ZEV regulations, which establishes the requirement that all vehicles that earn ZEV credit must be compliant with a standard charging technology. One of the barriers identified to commercial success of electric vehicles was the lack of a single charging standard. The market was faced with multiple charging technologies. This regulatory action ensures that all electric vehicles will be able to make use of all public charging facilities and will reduce cost and confusion in the electric vehicle market.

Standardization may result in increased public acceptance of electric vehicles because of clarification over charging technology, which may result in increased sales. Additionally, a single charging technology may result in increased penetration of public charging sites because of reduced costs. This could increase the effective range and usefulness of electric vehicles which results in increased zero emission miles traveled.

d. Smog Check Program

Inspection and maintenance (or Smog Check) programs are meant to help ensure that in-use vehicles stay clean as they age. The Smog Check programs are important strategies to improve air quality and protect public health by reducing vehicle emissions. California has three types of Smog Check programs, all administered by the Bureau of Automotive Repair (BAR):

- Enhanced Smog Check in the State's smoggiest urbanized regions;
- Basic Smog Check in the remaining urbanized areas of the State; and
- Change-of-ownership Smog Check in most rural parts of the State.

Basic and change-of-ownership Smog Check use an idle test to measure hydrocarbon (HC) and carbon monoxide (CO) emissions from vehicles. The distinguishing features of Enhanced Smog Check include:

- Loaded-mode testing, i.e., testing on a treadmill-like device that allows measurement of NOx emissions, in addition to HC and CO; and
- Inspection of vehicles most likely to have high emissions at test-only stations, i.e., stations that perform only tests and are prohibited from performing repairs.

In the 1994 California State Implementation Plan (1994 SIP), California committed to achieve emission reductions with Enhanced Smog Check. After a comprehensive evaluation in 2000, ARB determined that although Enhanced Smog Check was reducing emissions, it was not achieving the full emission reductions required by the 1994 SIP. Therefore, in August 2000, ARB and BAR jointly committed to U.S. EPA to implement the following near-term improvements to Enhanced Smog Check to address the emission reduction shortfall:

- More stringent inspection standards for oxides of nitrogen;
- Loaded-mode testing for heavy-duty gas trucks;
- Improved evaporative emission testing, including a test for liquid fuel leaks;
- Directing more vehicles to Test-Only stations; and
- Use of remote sensing.

No emission reductions were claimed for remote sensing.

In addition to the near-term improvements, ARB and BAR committed to work together to pursue additional mid-term program improvements to provide the remainder of the needed reductions. Potential legislative options identified included:

- Removing the rolling 30-year model year exemption, i.e., the exemption that will exclude all vehicles older than 30 years from the Smog Check program; and
- Extending Enhanced Smog Check beyond the current definition of urbanized area to include all eligible vehicles registered in a nonattainment region subject to Smog Check.

A significant number of the near-term improvements have been implemented. Since August 2000, BAR has tightened inspection standards for both NOx and HC and has directed more vehicles to test-only stations. The HC inspection standards were tightened beyond what was anticipated in the Enhanced Smog Check improvement commitments. BAR also added a test for liquid fuel leaks to Smog Check inspections in September 2001. Finally, the Enhanced Smog Check program area has been expanded. Many districts including San Joaquin Valley, Sacramento, Yolo-Solano, South Coast, and Ventura County have voluntarily chosen to work with BAR to begin to expand the Enhanced Smog Check program within their districts. ARB and BAR are working together to implement the remaining near-term and mid-term improvements, as well as to expand the most rigorous form of Smog Check, Enhanced Smog Check, to as many areas of the State as possible.

3. Proposed Strategies

Two additional emission reduction measures are proposed for light and medium-duty vehicles. The implementation schedule for these measures is listed in Table II-A-4.

Table II-A-4
Proposed Strategy for Light and Medium-Duty Vehicles

Strategies	Timeframe	
	Action	Implementation
LT/MED-DUTY-1: Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program	2005	2007 - 2008
LT/MED-DUTY-2: Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles	2002 - 2005	2002 - 2006

a. LT/MED-DUTY-1: Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program

Time Frame: Adopt 2005; Implement 2007-2008

Responsible Agency: ARB

Proposed Strategy:

ARB is currently performing a test program to evaluate the potential benefits of mandatory replacement of catalysts, oxygen sensors and evaporative emission carbon canisters on older passenger cars. These components are the heart of a modern emission control system, and deteriorate during the life of a vehicle through thermal stress, and chemical contamination. While it is known that these components deteriorate, the benefits associated with their replacement are less certain because of interactions between the "new" parts and the other "old" parts of a vehicle. It is also possible that such a program could specify lower cost "new" parts, because the remainder of the vehicle's life is expected to be much shorter than its age at the time of retrofit. The performance of the low cost parts needs to be evaluated compared to the old parts on the cars and to new factory (higher cost) parts.

The data being produced by this program needs to include enough cars to provide reasonable confidence in its conclusions; testing one car takes a couple of weeks. So the decision on whether to proceed with a mandatory program is expected to be in 2004, with regulations to follow in 2005, if the pilot program shows the potential for significant benefits at reasonable cost and funding can be identified. The program would be implemented in 2007 or 2008, with benefits between zero (decision not to proceed) to 19 tpd of ROG and 18 tpd of NOx in the South Coast Air Basin in 2010. The benefits for the South Coast and the San Joaquin Valley are summarized in Tables II-A-5 and II-A-6.

Table II-A-5
LT/MED-DUTY-1: Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program (South Coast, tpd)

Pollutant	2010	2020
ROG	0-19	Not Quantified
NOx	0-18	Not Quantified
CO	0-140	Not Quantified

Table II-A-6
LT/MED-DUTY-1: Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program (San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	0-2.4
NOx	0-2.7
PM10	0

SIP Commitment for Measure LT/MED-DUTY-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board by 2005. The measure as proposed to the Board will, at a minimum, achieve between 0 and 19 tpd of ROG reductions and between 0 and 18 tpd of NOx reductions in the South Coast Air Basin in 2010.

San Joaquin Valley 2003 PM10 SIP Commitment:

ARB staff proposes to commit to complete the Pilot Program and propose a control measure if the approach described above proves to be feasible and effective. If the approach is found be to feasible and effective, the Board will consider this measure by 2005. Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. LT/MED-DUTY-2: Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles

Time Frame: Action 2002-2005; Implement 2002-2006

Responsible Agency: Bureau of Automotive Repair and ARB

Proposed Strategy:

The following three improvements to Enhanced Smog Check, which ARB and BAR committed to in August 2000, will provide additional emission reductions -- the first has been implemented, the second was adopted but not yet implemented, and the third is still in development:

(1) Test-Only Direction Increase: As of a year ago, about 20 percent of vehicles subject to Enhanced Smog Check were being inspected at Test-Only stations. BAR studies have shown that greater emission reductions are achieved when vehicles are directed to Test-Only stations rather than Test and Repair stations. BAR steadily increased the percent of vehicles sent to Test-Only stations and reached 36 percent by December 2002.

(2) Gasoline Trucks Loaded-Mode Testing: Currently, gas trucks between 8,500 and 14,000 pounds gross vehicle weight rating (GVWR) in the Enhanced Smog Check program are subject to the two-speed idle test, but excluded from the loaded-mode test. ARB and BAR have developed loaded-mode test protocols and inspection standards for these vehicles. BAR adopted the regulations and the Office of Administrative Law has now approved them as well. BAR plans to implement the program as soon as possible. The requirement for loaded-mode testing will apply to heavy-duty gas trucks between 8,500 and 9,999 GVWR in the Enhanced Smog Check inspection program areas.

(3) Evaporative Emission Control Test: With tailpipe emissions becoming a smaller portion of the mobile source inventory, maintaining in-use evaporative emission controls becomes more important. Evaporative emission reductions could be achieved by requiring a low-pressure evaporative test. The low-pressure evaporative test would identify excess ROG emissions from leaks in the fuel system and help facilitate necessary repairs. BAR has developed a low-pressure evaporative test prototype and is working to develop a reasonably priced low-pressure test device. BAR is working on developing regulations for a low-pressure evaporative test and implementing it as soon as possible.

Since BAR has the regulatory authority in California for the Smog Check program, we have included evidence of BAR's commitment to implement these improvements as Appendix I-1 in Section I of this document. Upon SIP approval by ARB and U.S. EPA, the combination of the improvements described in this measure and BAR's existing Enhanced Smog Check program would revise and entirely replace the prior State commitments (originally established in the 1994 SIP) for California's Enhanced Vehicle Inspection and Maintenance Program.

Emission benefits associated with the Smog Check improvements are shown in Tables II-A-7 and II-A-8 for the South Coast and the San Joaquin Valley, respectively.

Table II-A-7
LT/MED-DUTY-2: Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles Estimated Emission Reductions (South Coast, tpd)

Pollutant	2010
ROG	5.6-5.8
NOx	8.0-8.4
CO	58

Table II-A-8
LT/MED-DUTY-2: Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles Estimated Emission Reductions (San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	1.5
NOx	3
PM10	0

SIP Commitment for Measure LT/MED-DUTY-2

South Coast 2003 SIP Commitment:

ARB expects that BAR will act on these Smog Check improvements between 2002 and 2005 to achieve between 5.6 and 5.8 tpd of ROG reductions and between 8.0 and 8.4 tpd of NOx reductions in the South Coast Air Basin in 2010.

San Joaquin Valley 2003 PM10 SIP Commitment:

ARB expects that BAR will act on these Smog Check improvements between 2002 and 2005. Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

4. Long-Term Advanced Technologies Measures

Additional emission reductions from light and medium-duty vehicles could be achieved through development and implementation of technological advances, availability of financial incentives, or legislative action. A number of these approaches are presented in this section.

Provide Incentives for Voluntary Passenger Vehicle Retirement: Currently, there are several types of vehicle retirement programs operating throughout California. One of these programs is run by the Bureau of Automotive Repair (BAR) and accepts only vehicles that fail the Smog Check inspection. The emission benefits of BAR's program are used to meet air quality goals; no tradeable emission credits are generated. Other retirement programs are operated by private enterprises under local air district control and only accept vehicles that pass the Smog Check inspection. Emission benefits from the programs funded with air district incentive funds are used to meet air quality goals. Emission benefits from other programs can generate emission reduction credits that can be used by air districts or by industry to offset excess emissions.

An additional vehicle retirement proposal would accept vehicles that have passed their most recent Smog Check inspection. By accepting only vehicles that pass their Smog Check inspection into the program, the measure would avoid double-counting emission benefits from the BAR retirement and repair programs. The measure would not allow for credit trading; all emission benefits would be counted toward air quality attainment goals. The emission benefits and cost-effectiveness of a vehicle retirement program would be entirely dependent on the amount of funding available.

Set Tighter Emission Standards for New Passenger Vehicles [Low Emission Vehicle III]: In 1998, ARB adopted the second generation Low-Emission Vehicle Program (LEV II) which significantly lowered emissions for light- and medium-duty vehicles. The program allows significant compliance flexibility in implementing the standards by use of an increasingly more stringent fleet average requirement. Vehicles in the lower weight classes of the light- and medium-duty categories have lower fleet average requirements because the zero emission vehicle requirement lowers the fleet average for those vehicles. Manufacturers can use credits from one fleet average to offset any debits that may occur in the other fleet average.

LEV III would incorporate two changes to the emission standards in the LEV II program: 1) lowering the fleet average emission standards for all weight classes; and 2) lowering the LEV II, LEV and ULEV exhaust emission standards.

In addition to these two changes to the emission standards, a third generation on-board diagnostic (OBD) system, OBD III could be implemented. Under OBD III, all OBD II-equipped light- and medium-duty vehicles would be capable of electronically communicating with an off-board computer when a malfunction is detected by the OBD system. When a malfunction is identified, the owner would be notified of the malfunction and would be required to repair the vehicle within a specified time interval. Additional emission benefits could be achieved by utilizing the diagnostic capability of OBD II systems to provide timely repair of malfunctioning emission control components, thereby improving the effectiveness of the current Smog Check program. This enhanced on-board diagnostics system could also improve consumer convenience, further increasing the effectiveness of the current programs.

The anticipated emission benefits associated with this proposal would be realized in the post-2010 timeframe.

Additional Improvements to Smog Check: A number of additional improvements to the current Smog Check program could be achieved through legislative action:

Allow Districts to Opt in to Test-Only Program: Currently, for attainment areas, unclassified areas, moderate nonattainment areas, and non-urbanized serious, severe, and extreme nonattainment areas, State law allows air districts to request BAR to implement the Enhanced Smog Check program, excluding the test-only requirement. Recently, several air districts chose to implement the Enhanced Smog Check program in their areas. However, current law prohibits air districts from opting into the test-only portion of the Enhanced Smog Check program. If legislation authorizing air districts to also opt in to the test-only portion of the Enhanced Smog Check program were passed, this Smog Check improvement option could provide the air districts about 30 percent more in benefits than the Enhanced Smog Check program without the test-only element.

Replace Rolling 30-year Exemption with Exemption of pre-1974 Vehicles: Originally, the Smog Check inspection program applied to all 1966 and newer gasoline vehicles. In 1997, the State Legislature modified the Smog Check program to exempt pre-1974 vehicles, and beginning in January 2003, to exempt motor vehicles 30 or more model-years old. Because older vehicles contribute a disproportionate amount of emissions (despite their relatively low numbers and use), excluding these older vehicles from the program reduced the effectiveness of the Smog Check program. Replacing the 30-year rolling exemption with exemption of pre-1974 vehicles would achieve additional emission reductions in future years. In addition, these vehicles would also be eligible for other BAR assistance programs such as vehicle retirement and repair assistance.

Expand Enhanced Smog Check: Currently, California has two types of smog check inspection tests, two-speed idle and loaded-mode. The two-speed idle test measures HC and CO under idle conditions. The loaded-mode test uses a treadmill-like device to measure NOx in addition to HC and CO. The loaded-mode test closely simulates real world driving conditions and is more adept at identifying failures in new vehicles. If loaded-mode testing were fully implemented, additional emission reductions could be achieved.

CHAPTER B

On-Road Heavy-Duty Diesel Engines and Vehicles

CHAPTER B. ON-ROAD HEAVY-DUTY DIESEL ENGINES AND VEHICLES

1. Category Description

Under ARB's current program to control emissions from mobile sources, heavy-duty vehicles, regardless of fuel type, are defined as vehicles with gross vehicle weight ratings (GVWRs) greater than 14,000 pounds. The heavy-duty vehicle category, which is dominated by diesel-fueled vehicles, includes vehicles such as dump trucks, solid waste collection vehicles, fuel cargo tankers, larger delivery trucks, urban buses and school buses, motor homes, and line haul trucks.

Heavy-duty diesel vehicles are major contributors to California's continuing air quality challenges. Per vehicle, they emit relatively high levels of oxides of nitrogen (NOx) and particulate matter (PM). Based on emission modeling estimates for the South Coast Air Basin (SCAB), heavy-duty diesel vehicles will emit about 50 percent of the NOx emissions and about 37 percent of the exhaust PM emissions from all on-road mobile sources in 2010. These are significant contributions – particularly since these vehicles represent about two percent of the total on-road fleet. While stringent standards have already been adopted by ARB and U.S. EPA to curb these emissions, growth in the vehicle population and in vehicle miles traveled (VMT) have largely offset the per-vehicle reductions resulting from existing regulations.

In contrast to their high NOx and PM emissions, heavy-duty diesel vehicles have relatively low emissions of carbon monoxide (CO), carbon dioxide (CO2), and reactive organic gases (ROG). Nonetheless, these emission impacts are important due to the potential of CO to create "hot spots" that affect public health (although nearly all areas of California are in CO attainment), the role of CO2 in global warming, and the reaction of ROG in the atmosphere to form ozone and PM.

The baseline emission inventories for the South Coast Air Basin and the San Joaquin Valley for all on-road heavy-duty diesel vehicles with GVWRs greater than 14,000 pounds are shown in Tables II-B-1 and II-B-2 below. These estimates, based on ARB's emission inventory modeling program, EMFAC2002 version 2.2, represent the emissions contribution of heavy-duty diesel vehicles before implementation of any of the proposed measures discussed in this chapter.

Table II-B-1
Baseline Emissions for
On-Road Heavy-Duty Diesel Vehicles > 14,000 lbs GVWR
(South Coast, Summer Planning, tpd)

Pollutant	2000	2005	2006 (Annual Average)	2008	2010	2020
ROG	10	10	10	9	9	6
NOx	299	287	290	255	221	96
PM10 (exhaust)	6	5	5	5	4	3
CO	50	48	47	45	42	35

Table II-B-2
Baseline Emissions for On-Road Heavy-Duty Diesel Vehicles
>14,000 pounds gross vehicle weight
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	4.4
NOx	85
PM10 (exhaust)	2.2

The baseline emissions in Tables II-B-1 and II-B-2 also include the emissions impact in California from heavy-duty diesel trucks that are registered in other states. Emission estimates from EMFAC2002 incorporate the assumption that about 25 percent of the VMT in California, and thus the associated emissions, are from vehicles in the heavy heavy-duty diesel vehicle category (diesel vehicles with GVWRs greater than 33,000 pounds) that are registered out of state, but that travel a portion of time within California.

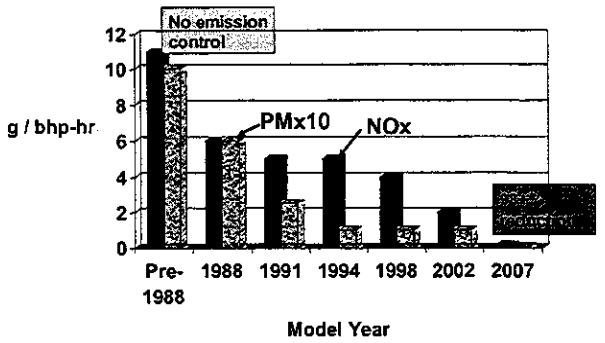
2. Existing Control Program

The federal Clean Air Act grants California the authority to adopt and enforce rules to control mobile source emissions within California – California is the only state in the nation with the authority to establish its own unique motor vehicle control program. In doing so, however, ARB is required to adopt State requirements that are as stringent, or more stringent, than the federal requirements.

In 1969, when ARB first began regulating new heavy-duty vehicles, exhaust standards targeted only ROG and CO emissions. Since then, ARB has expanded its approach and has gradually reduced NOx and PM emissions by over 95 percent from the mid-1980s to the near-zero levels of the 2007 standards, as shown in Figure II-B-1. ARB staff has worked closely with U.S. EPA to develop a harmonized federal and California program to more effectively control emissions from new heavy-duty trucks. When it has been feasible to do so, the Board has adopted a more stringent program than the federal program. An example of such action is ARB's urban bus regulation adopted by the Board in February 2000. ARB's efforts have also focused on ensuring maximum emission reductions through the adoption of engine test procedures that more accurately measure emissions that occur during typical in-use driving conditions. These components, all described in this chapter, are the backbone of ARB's program and will support additional future measures to ensure new engines maintain low emissions, to ensure existing engines emit at the lowest feasible levels, and to push heavy-duty technology to achieve zero emissions, where possible.

Figure II-B-1

Reducing Diesel Emissions
California New Truck Standards



a. 2004 and Later Model Year Emission Standards

Since 1998, heavy-duty diesel engines, exclusive of urban bus engines, have been required to certify to a 4.0 grams per brake horsepower-hour (g/bhp-hr) NOx standard and a 0.10 g/bhp-hr PM standard. Urban bus engines produced for sale in California have generally been subject to more stringent emission standards sooner than other classes of heavy-duty diesel engines; hence, they have been required to certify to a 4.0 g/bhp-hr NOx standard and a 0.05 g/bhp-hr PM standard since 1996. While ARB regulates other pollutants, NOx and PM are the criteria pollutants of primary concern from diesel engines.

In 1997 and 1998 respectively, U.S. EPA and ARB adopted more stringent requirements for 2004 and later model year heavy-duty diesel engines and vehicles. These requirements harmonized the California and federal programs, while maintaining unique aspects of California's program to ensure maximum emission benefits throughout the State. Both programs include a NOx plus non-methane hydrocarbons (NMHC) emission standard of 2.4 g/bhp-hr, or 2.5 g/bhp-hr with a 0.05 g/bhp-hr NMHC cap.

The 2004 requirements did not affect PM emissions, thus the 0.10 g/bhp-hr PM standard for heavy-duty diesel engines, exclusive of urban bus engines, remains in place until 2007 when new heavy-duty diesel engines are required to cut PM exhaust emissions by 90 percent. ARB's urban bus regulation requires urban bus engines to reduce PM emissions even sooner – starting October 1, 2002, diesel-fueled urban bus engines must comply with a 0.01 g/bhp-hr PM standard (this regulation is discussed in more detail later in this chapter).

b. 2004 Standards "Pull-Ahead"

Heavy-duty engines are currently certified on engine dynamometers using a driving cycle known as the Federal Test Procedure (FTP). The FTP mimics the light loads and low speeds typical of urban driving. The high speed, high load operating conditions typical of on-highway heavy-duty trucks are not well represented on the FTP.

Subsequent to the adoption of the 2004 standards, U.S. EPA, ARB, and the Department of Justice discovered that seven large manufacturers of heavy-duty diesel engines had, throughout the late 1980s and 1990s, violated emissions regulations by designing engines with advanced computer controls that maximized fuel economy during steady-state operation, significantly increasing NOx emissions from heavy-duty diesel trucks during typical on-highway driving. Thus, over a million heavy-duty diesel engines manufactured over a period of nearly ten years produced NOx emissions in excess of what would be expected from the FTP. These excess NOx emissions are commonly referred to as "off-cycle" emissions.

To address these emissions violations, U.S. EPA, ARB, and the Department of Justice signed Consent Decrees, legally-binding agreements, with seven engine manufacturers requiring them to partially mitigate their violations and to take corrective action to ensure that future new engines did not produce off-cycle emissions. The key provision of the Consent Decree is the requirement for the majority of affected engine manufacturers to begin producing engines meeting the NOx plus NMHC standards for 2004 and later model year engines starting on October 1, 2002 – over one year ahead of when originally required by U.S. EPA and ARB.

Another key provision of the Consent Decrees is the requirement for affected engine manufacturers to produce engines that meet supplemental test procedures known as the Not-To-Exceed (NTE) test and the EURO III European Stationary Cycle (ESC) test. These supplemental test procedures are more representative than the FTP of the real world driving conditions of on-highway heavy-duty trucks. Together with the FTP, the NTE and ESC tests will help ensure that off-cycle emissions are eliminated in new engines.

c. Not-To-Exceed and EURO III European Stationary Cycle Test Procedures

Recognizing the need for including the supplemental tests in the existing federal engine certification process, U.S. EPA adopted a rule in October 2000 reaffirming the 2004 standards, and also including the use of the supplemental test procedures[1]. However, because of federal timing constraints, the NTE and ESC test procedures will not be required until 2007 for federally certified heavy-duty diesel engines. Therefore, when Consent Decree requirements expire in 2004, heavy-duty diesel engines produced for sale throughout the nation will not be obligated to comply with the requirements of the supplemental test procedures in 2005 and 2006.

To ensure that there is no disruption in the implementation of the supplemental test procedures on heavy-duty diesel engines produced for sale in California, however, ARB adopted amendments in December 2000 requiring manufacturers of engines produced for sale in California to comply with the NTE and ESC test procedures for 2005 and later model year engines. Urban bus engines are not required to submit to testing under the supplemental procedures until the 2007 model year. Other states have already exercised their authority under the Clean Air Act to adopt California's more rigorous emission requirements and thus have adopted ARB's NTE limits for on-road heavy-duty diesel engines and vehicles starting with the 2005 model year.

d. New Emission Standards for Urban Bus Engines and the Public Transit Bus Fleet Rule

Heavy-duty diesel engines used in urban buses with GVWRs greater than 33,000 pounds have historically been regulated separately from other heavy-duty diesel engines. In February 2000, the Board adopted a comprehensive urban bus regulation that includes more stringent emission standards for urban bus engines produced for sale in California, and a fleet rule affecting California's public transit bus operators. The regulation requires new diesel urban bus engines to meet a 0.01 g/bhp-hr PM standard in October 2002; an intermediary 0.5 g/bhp-hr NOx standard in 2004, and a near-zero 0.2 g/bhp-hr NOx standard in 2007, equivalent to the NOx standard adopted by U.S. EPA and by ARB for other heavy-duty diesel engines beginning with the 2007 model year. The regulation also requires both diesel and alternative-fuel urban bus engines to comply with more stringent ROG, CO, and formaldehyde emission standards beginning in 2007.

The fleet rule component of the regulation is designed to encourage the use of alternative-fuel buses and contains multiple strategies to reduce emissions from the

[1] U.S. EPA's 2004 Final Rule on the Control of Emissions of Air Pollution from 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles; Revision of Light-Duty On-Board Diagnostics Requirements (65 FR 59896, October 6, 2000). Referred to as U.S. EPA's 2004 Final Rule or 2004 Final Rule.

existing diesel bus fleet. Incorporating regulatory amendments adopted by our Board in October 2002, the fleet rule strategies include: 1) a phased-in diesel PM reduction requirement beginning in 2004; 2) a requirement to use low-sulfur diesel fuel (diesel fuel with a sulfur content no greater than 15 parts per million by weight [ppmw]), or any other fuel verified by our Executive Officer for use as a diesel emission control strategy, beginning July 2002; and 3) a requirement for public transit fleets to achieve and maintain a 4.8 g/bhp-hr NOx average by October 2002. The most innovative and technology-advancing elements of the fleet rule are its requirements for zero emission bus demonstration projects in 2003 and zero emission bus purchases starting in 2008.

An outgrowth of the urban bus regulation is the Board's recognition of heavy-duty vehicle hybrid-electric technology as a viable option for providing emission benefits now – not just as a future technology for reducing emissions. Recent analyses indicate that hybrid-electric heavy-duty vehicles offer improved fuel economy and emit less criteria pollutants than their conventional heavy-duty vehicle counterparts. Urban transit buses, as well as delivery trucks, are particularly good candidates for hybridization, as the diesel engine is not necessary for power in many stop-and-go drive cycles, and regenerative braking during frequent stops will charge the battery system. Through months of coordination between ARB staff and stakeholders, the staff developed the "Interim Certification Procedures for 2004 and Subsequent Model Year Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes." The Board approved the certification procedures on October 24, 2002.

e. Heavy-Duty Vehicle Inspection and Periodic Smoke Inspection Programs

Because trucks and buses may last 500,000 miles to over one million miles before their engines are rebuilt or replaced, in-use emissions and their potential to increase over time are a critical issue. California currently has two programs designed to control smoke emissions from existing heavy-duty vehicles and to detect malmaintenance and tampering that can increase emissions of any regulated pollutant.

Under the first program, the Heavy-Duty Vehicle Inspection Program (HDVIP), heavy-duty diesel trucks and buses are tested for excessive smoke emissions with a hand-held electronic smoke meter. The smoke opacity test procedure was developed by the Society of Automotive Engineers and adopted by the Board in 1997 for use in the HDVIP and the Periodic Smoke Inspection Program. The smoke opacity cannot exceed 55 percent for pre-1991 model year engines, and cannot exceed 40 percent for 1991 and later model year engines. Vehicles with engines that exceed these smoke standards must be repaired; those with especially high smoke must also pay a monetary penalty. Under the HDVIP, both diesel and gasoline heavy-duty vehicles are inspected for tampering by ARB inspectors at California Highway Patrol facilities, weigh stations, and at random roadside locations.

The second program, the Periodic Smoke Inspection Program (PSIP), complements the HDVIP by requiring California-based truck and bus fleets with two or more heavy-duty diesel vehicles to annually test their own vehicles to measure smoke opacity and to check for tampering. The smoke opacity test procedure and standards are identical to those in the HDVIP.

f. 2007 and Later Model Year Emission Standards

In January 2001, U.S. EPA finalized its rule for new emission standards for 2007 and later model year on-road heavy-duty diesel engines and vehicles.[2] U.S. EPA also adopted minor changes to its requirements for the supplemental test procedures, including the Not-to-Exceed and EURO III European Stationary Cycle tests. In October 2001, ARB approved regulatory amendments to align California's emission standards and supplemental test procedure requirements with the 2007 federal requirements.

The 2007 standards break new ground by setting emission standards that require aftertreatment-based technologies for all classes of heavy-duty diesel engines and vehicles. The adopted standards will reduce exhaust emissions from new diesel-cycle engines meeting the 2004 standards by 90 percent for NOx, 72 percent for NMHC, and 90 percent for PM. These emission standards, which are also applicable to both natural gas-fueled engines and liquefied petroleum gas-fueled engines derived from the diesel-cycle engine, are shown in Table II-B-2 below. ARB staff is scheduled to propose to the Board similar requirements for heavy-duty gasoline-fueled engines in late 2002. U.S. EPA adopted the requirements for heavy-duty gasoline-fueled engines (with implementation starting in 2008) at the same time it adopted emission standards for 2007 and later model year heavy-duty diesel engines.

The Board approved the same phase-in schedules for the NOx and NMHC emission standards as adopted by U.S. EPA. The phase-in schedules, shown in Table II-B-3, represent the percentage of new engines produced for sale in California that are required to meet the more stringent emission standards beginning in 2007. Full implementation is required starting with the 2010 model year.

[2] U.S. EPA's 2007 Final Rule on the Control of Emissions of Air Pollution from 2007 and Later Model Year Heavy-Duty Highway Engines and Vehicles; Revision of Light-Duty On-Board Diagnostics Requirements (66 FR 5002, January 18, 2001). Referred to as U.S. EPA's 2007 Final Rule or 2007 Final Rule.

Table II-B-3
Exhaust Emission Standards for 2007 and Later Model Year Heavy-Duty Diesel Engines/Vehicles

Pollutant	Standard (g/bhp-hr)	Phase-In by Model Year**			
		2007	2008	2009	2010
NOx	0.20	50%	50%	50%	100%
NMHC	0.14	50%	50%	50%	100%
PM10	0.01	100%	100%	100%	100%

** Represents percent of sales

Other components of U.S. EPA's regulation for the 2007 standards are a requirement for the control of crankcase emissions from turbocharged heavy-duty diesel engines, and a requirement to cap the sulfur content of diesel fuel for on-road vehicles at 15 ppmw. ARB regulation includes the requirement for the control of crankcase emissions. Amendments to California's diesel fuel specifications to cap the sulfur content at 15 ppmw will be proposed in a separate rulemaking, which is scheduled to be presented to the Board in 2003-2005, with implementation beginning in 2006. Low-sulfur diesel fuel is necessary to ensure that the advanced emission control devices expected to be used to meet the 2007 standards achieve and maintain maximum efficiency and durability levels.

Of note is that U.S. EPA's rule is applicable to heavy-duty vehicles with GVWRs from 8,501 pounds to 14,000 pounds. However, ARB's adopted regulation is mandatory only for those heavy-duty vehicles with GVWRs greater than 14,000 pounds. In California, vehicles with GVWRs of 8,501 pounds to 14,000 pounds, and engines used in those vehicles, have been regulated through ARB's medium-duty vehicle requirements starting with the 1995 model year. Under these requirements, vehicles with GVWRs of 8,501 pounds to 14,000 pounds are required to chassis certify to applicable emission standards for medium-duty vehicles, or, as an option, engine manufacturers may choose to certify the engines in these vehicles to California's heavy-duty engine emission standards. Engine manufacturers are opting to certify virtually all of their diesel engines used in vehicles with GVWRs of 8,501 pounds to 14,000 pounds to the heavy-duty diesel engine standards; hence, these engines will be subject to the 2007 standards and will benefit from the improved emission control.

3. Proposed Measures

Table II-B-4 provides a summary of measures ARB staff will be proposing over the coming years to enhance California's current control program for on-road heavy-duty diesel engines and vehicles. These measures, when implemented, will achieve

further emission reductions from the heavy-duty diesel vehicle fleet. Each measure is described in more detail below.

Table II-B-4
Proposed Measures for On-Road Heavy-Duty Diesel Vehicles

Measures	Timeframe	
	Action	Implementation
ON-RD HVY-DUTY-1: Augment Truck and Bus Highway Inspections with Community-Based Inspections	2003	2005
ON-RD HVY-DUTY-2: Capture and Control Vapors from Gasoline Cargo Tankers	2005	2006-2007
ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet	2003-2006	2004-2010

a. ON-RD HVY-DUTY-1: Augment Truck and Bus Highway Inspections with Community-Based Inspections

Time Frame: Action 2003; Implement 2005

Responsible Agency: ARB

Proposed Strategy:

Proper engine maintenance, including maintaining manufacturers' original engine specifications, is critical to ensuring that in-use heavy-duty diesel engines do not exceed established engine standards. As already discussed, the current roadside Heavy-Duty Vehicle Inspection Program is designed to detect malmaintenance and tampering that affect in-use emissions, and to specifically measure smoke emissions to ensure compliance with Board-approved smoke opacity limits.

To complement the traditional Heavy-Duty Vehicle Inspection Program, in March 2001, ARB staff began participating in a new program of focused environmental inspections in existing mixed-use communities (residential/commercial/industrial areas). Under this program, heavy-duty vehicles are inspected to detect malmaintenance and tampering, and to measure smoke emissions, all in concert with fuel inspections and hazardous waste transport inspections. These environmental inspections are implemented in coordination with the California Highway Patrol and local law enforcement agencies.

Diesel emissions are a significant component of the health risk in mixed-use communities. Because of the juxtaposition of residential, commercial and industrial areas, minimizing and further reducing emissions from heavy-duty diesel trucks is necessary to protect the health and safety of the residents and workers in these areas.

The ARB staff has participated in about two environmental inspections per month. Based on ARB's analysis, failure rates are higher for environmental inspections than the traditional inspections. Therefore, ARB intends to reallocate existing resources in order to double the number of environmental inspections performed each month.

Table II-B-5 presents a preliminary estimate of the additional emission reductions that could be achieved.

Table II-B-5
ON-RD HVY-DUTY-1: Augment Truck and Bus Highway Inspections with Community-Based Inspections
Estimated Additional Emission Reductions
(South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0.0 – 0.1	0.0 – 0.1	0.0 – 0.1	0.0 – 0.1	Not Applicable
NOx	0	0	0	0	
PM10	0.0 – 0.1	0.0 – 0.1	0.0 – 0.1	0.0 – 0.1	

SIP Commitment for Measure ON-RD HVY-DUTY-1

South Coast 2003 SIP Commitment:

ARB staff proposes to implement this measure beginning in 2003. The measure will, at a minimum, achieve between 0 and 0.1 tpd ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. ON-RD HVY-DUTY-2: Capture and Control Vapors from Gasoline Cargo Tankers

Time Frame: Adopt 2005; Implement 2006-2007

Responsible Agency: ARB

Proposed Strategy:

Gasoline cargo tanks are sealed containers coupled with heavy-duty diesel fueled trucks. These vessels are equipped with a vapor recovery system that returns and collects gasoline vapor during the loading at terminals or bulk plants and unloading at service stations respectively. The tanks also include valves and fittings to prevent the loss of vapor during transport.

In 1998, about 4,500 fuel cargo tankers transported over 14 billion gallons of gasoline on California's roadways. These trucks utilize hoses and fittings during the transfer process of delivering gasoline and collecting gasoline vapor. Currently, they do not employ control technologies to reduce ROG emissions that occur through the evaporation of gasoline from the transfer hoses and connections on the tanks after the delivery is completed. ARB staff is now considering a proposal for enhanced vapor recovery systems for gasoline cargo tankers to reduce these ROG losses. The staff plans to present the proposal to the Board in 2005 for implementation beginning in 2006 or 2007.

The control technology necessary to implement this measure is currently available. This measure would require the vapor connections on fuel cargo tankers to be fitted with closure devices such as poppeted adapters or manually operated valves, and product and vapor recovery hoses to have poppeted caps or adapters. The measure would also require a monthly inspection and maintenance program to check the vapor connections and hoses on the fuel cargo tankers.

A separate but related measure is the requirement for purging (degassing) the tankers prior to maintenance or repair. Gasoline cargo tanks must undergo annual testing for pressure integrity as a requirement for certification (CP-204). Before this testing can be performed, the cargo tank must first be purged of any residual gasoline vapors, which may skew the results of the pressure testing. The requirement for purging does not however extend to maintenance and repair of gasoline cargo tanks. These events can be a significant source of ROG emissions. This measure would require that cargo tanks be purged using an approved method prior to any maintenance or repair being performed. Currently, there are three methods available by which the tanks can be purged. These current purging (degassing) methods need to be reviewed.

A third element of this measure is the certification of gasoline cargo tank components. Gasoline cargo tanks are required annually to demonstrate compliance with a leak rate standard. The current procedure tests the pressure integrity of the cargo tank vapor recovery system as a whole but does not contain performance specifications or standards for the individual components of the system. This measure would include developing performance specifications and standards for individual components and methodology for testing and certifying these components.

Potential Emission Reductions:

ARB staff's preliminary estimate of the potential ROG emission reductions from these control measures are based on testing fuel cargo tankers with leaking vapor recovery hoses and connections. Initial testing indicates that statewide ROG emissions of about 14 tpd could be reduced by about 80 percent, or by about 11 tpd in 2010 through the implementation of an enhanced vapor recovery strategy for fuel cargo tankers. For the South Coast, staff estimates an emission inventory of about 5 tpd and potential reductions of about 4 tpd in 2010. As these measures are further developed through ARB's public rulemaking process, the emission estimates will be refined.

SIP Commitment for Measure ON-RD HVY-DUTY-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2005. The measure as proposed to the Board will, at a minimum, achieve between 4 and 5 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

c. ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling

Time Frame: Adopt 2003-2006; Implement 2004-2010

Responsible Agency: ARB

Proposed Strategy:

New engine standards, together with compliance and enforcement programs designed to ensure that new engines maintain their low emission levels, will provide significant reductions over time. In addition to implementing programs that target new engines and vehicles, ARB must also focus its efforts on reducing emissions from the existing heavy-duty diesel vehicle fleet in order to improve air quality and benefit public health in the near-term. The measures discussed here form a comprehensive strategy to reduce harmful emissions from both the new and in-use heavy-duty vehicle fleet and to ensure that ARB's heavy-duty vehicle program achieves maximum emission benefits.

PM In-Use Emission Control Fleet Rules: In February 2000, ARB adopted a fleet rule that requires public transit operators to aggressively reduce emissions from their bus fleets. The use of verified diesel emission control strategies to reduce PM emissions is an important part of the transit bus rule. As called for in the Diesel Risk Reduction Plan, which was adopted by the Board in September 2000, ARB intends to expand its opportunities to achieve PM reductions, and in most cases, ROG reductions, through the implementation of additional rules targeting specific heavy-duty diesel fleets.

Like other ARB regulations, the fleet rules will not prescribe the emission control strategies that fleet operators must use. The strategies that operators select, however, must have ARB-verified emission reductions or involve the use of ARB-certified engines, and must meet the emission reduction targets specified by the fleet rules. There are a variety of strategies that fleet operators could potentially use to reduce PM emissions, such as the installation of a hardware-based retrofit system (e.g., a diesel particulate filter) or the use of an alternative diesel fuel. Such retrofit-based strategies would have to be verified by ARB staff using ARB's Diesel Emission Control Strategy Verification Procedure. Fleet operators may also elect to replace older, dirtier engines with new, certified ones (engine repower), retire old vehicles, or replace vehicles with new, lower-emission models. Depending on the strategy chosen by fleet operators, the use of low-sulfur diesel fuel may be an integral strategy component. For example, most

catalyst-based diesel particulate filters provide the greatest emission reductions when used with low-sulfur diesel fuel (sulfur content of 15 ppmw or less).

As part of ARB's Diesel Emission Control Strategy Verification Procedure, ARB adopted a multi-level approach for categorizing strategies based on their verified PM emission reductions. For example, "Level 1" verification applies to strategies that achieve at least a 25 percent PM reduction; "Level 2" verification applies to strategies that achieve at least a 50 percent PM reduction; and "Level 3" verification applies to strategies that achieve at least an 85 percent PM reduction, or reduce exhaust PM levels to no more than 0.01 g/bhp-hr. Together with regulations that will require the use of retrofits or other strategies verified to the highest level possible, this multi-level approach ensures the development of high-efficiency control strategies. At the same time, it allows for lower level reductions in applications where higher level options are not yet available, thus ensuring that diesel PM emissions are reduced in a timely manner when and where they can be realized.

The PM fleet rules are intended to provide a flexible and progressive-in-use emission control program that achieves the highest level of PM emission control possible. Although PM reductions are the focus of the rules, staff expects ROG reductions to be realized as well. The currently verified diesel particulate filters, for instance, achieve ROG reductions commensurate with the level of PM reductions achieved.

Table II-B-6 below shows the on-road heavy-duty diesel fleets for which ARB staff plans to propose PM in-use emission control rules and the proposed phase-in schedules for each fleet category. ARB staff is scheduled to present a proposal for a PM in-use emission control rule for solid waste collection vehicles and a proposal for fuel cargo tankers in 2003. Proposals for rules for publicly-owned and publicly-contracted fleets and for other on-road heavy-duty vehicles would follow in 2003 and 2005, respectively. Table II-B-7 presents staff's estimate of the range of emission benefits for the South Coast Air Basin that would be achieved through implementation of the fleet rules.

Table II-B-6
ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing And New Truck/Bus Fleet: PM In-Use Emission Control Schedule (Cumulative Percentage of Fleet to be Retrofitted)

Vehicle Category	Calendar Year						
	2004	2005	2006	2007	2008	2009	2010
Solid Waste Collection Vehicles	3%	8%	15%	30%	60%	100%	
Fuel Cargo Tanker Trucks		10%	40%	60%	80%	100%	
Publicly-Owned and Publicly-Contracted Vehicles		10%	50%	60%	80%	100%	
Other On-Road Vehicles				20%	50%	75%	100%

Note: Percentages shown are based on 90 percent of the regulated population assumed suitable for retrofitting.

Table II-B-7
ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet: PM In-Use Emission Control Estimated Emission Reductions (South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0.04 – 0.09	0.09-0.3	0.8 – 2.6	1.4 – 4.5	0.5 – 1.7
NOx	Not Quantified				
PM10	0.02 – 0.04	0.03 – 0.2	0.2 – 1	0.4 – 1.6	0.2 – 0.5
CO	Not Quantified			6-18	NQ

Engine Software Upgrade: ARB staff is proposing to require the installation of low NOx software in heavy-duty diesel vehicles with 1993 through 1998 model year engines for which low NOx software was developed under the Consent Decrees. The installation of low NOx software is also known as engine recalibration, chip reflash or engine software upgrade. In this procedure, the engine's electronic control module (ECM) is reprogrammed to reduce NOx emissions from levels achieved during typical in-use driving conditions.

Prior to installing low NOx software, the 1993 through 1998 model year engines emit "off-cycle" NOx. Off cycle NOx are emissions greater than the emissions allowed in the engine certification process; these off-cycle emissions emission occur when the

ECM recognizes that the engine is not being driven in accordance with the federal test procedure used for engine certification.

Upgrading the software on a heavy-duty diesel engine's ECM provides opportunities to reduce NOx emissions. To comply with the Low NOx Rebuild Program contained in the federal Consent Decrees and similar state Settlement Agreements, engine manufacturers were required to provide engine dealers and distributors with low NOx rebuild kits to reduce the off-cycle emissions from specified engines. Under the provisions of the Consent Decrees, these kits implement certain software and/or minor hardware changes to achieve the necessary NOx reductions. To date, the available low NOx rebuild kits have relied only on engine software upgrades; the kits have not included hardware changes. In general, the engine software upgrade reduces NOx emissions by eliminating advanced computer controls – "defeat devices" – that produce excess off-cycle NOx emissions during steady-state vehicle operation, such as on-highway driving.

The Low NOx Rebuild Program contained in the Consent Decrees is applicable to approximately 100,000 1993 through 1998 model year electronically-controlled engines. When the Consent Decrees were signed, it was assumed that the low NOx rebuild kits would be installed at the time of normal engine rebuild, typically around 200,000 to 300,000 miles of service. The engine manufacturers have complied with the provisions of the Low NOx Rebuild Program requiring them to provide dealers and distributors with low NOx rebuild kits (i.e., engine software upgrade kits). ARB staff, however, estimates that only four percent of the low NOx rebuild kits have been installed in applicable engines. As diesel engines have become increasingly durable, fewer rebuilds are being performed or are performed at higher mileage intervals. As such, the Low NOx Rebuild Program has not yet achieved its expected emission benefits.

To ensure that emission benefits are achieved, ARB staff will propose to the Board in October 2003 a mandatory heavy-duty diesel engine software upgrade measure to reduce NOx emissions. Implementation of this measure would begin in the 2004 to 2005 timeframe. This measure would expand upon the original requirements of the Low NOx Rebuild Program by requiring the installation of software upgrades on applicable engines. The proposed mandatory measure would not require any engine hardware changes. The reductions associated with this proposed measure are necessary to mitigate a portion of the off-cycle emissions that occurred due to the use of "defeat devices."

Table II-B-8 below shows the estimated NOx reductions that could be achieved through the implementation of a mandatory engine software upgrade measure. These reduction estimates are based on the assumption that software upgrades are installed on all applicable 1993 through 1998 model year heavy heavy-duty diesel and medium

heavy-duty diesel engines in vehicles registered in California. The estimates presented below were calculated using confidential emissions data obtained during the Consent Decree negotiations, and VMT estimates provided by the Southern California Association of Governments. ARB staff intends to propose that engines in heavy-duty diesel vehicles registered out of state also be subject to this regulatory measure; the staff is now in the process of estimating any additional emission benefits that may be achieved.

Table II-B-8
ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet: Mandatory Engine Software Upgrade Estimated Emission Reductions for MHDDE and HHDDE (South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
NOx	13 - 17	12 - 16	11 -14	8 - 11	0 - 1

On-Board Diagnostics (OBD): As ARB implements more stringent emission standards, engine manufacturers are incorporating into their engine designs more sophisticated emission control devices such as exhaust gas recirculation systems, fuel injection rate shaping techniques, particulate filters, NOx adsorbers, and other electronic controls. To maintain low emission levels over time, these emission control devices must continue to perform properly throughout each vehicle's life.

One strategy to ensure that sophisticated emission controls perform adequately over time is to require a more comprehensive OBD system on all heavy-duty vehicles. Current OBD systems are designed primarily to detect gross failures of components (e.g., disconnections and other circuit failures, rather than deterioration or reduced performance) without regard to the emission level associated with the malfunction. The measure proposed here would require OBD systems to detect malfunctions of virtually every component that can cause an emission increase before the emissions exceed a specified level. While discussed here as a heavy-duty diesel engine strategy, it would also apply to heavy-duty gasoline engines used in vehicles with a GVWR greater than 14,000 pounds.

The comprehensive OBD system would alert the vehicle operator of the malfunction through a dashboard light; valuable information about the malfunction would be stored in the on-board computer to assist technicians in diagnosing and repairing the malfunction. As with light-duty vehicles, an OBD system for heavy-duty vehicles would likely not require the addition of many new sensors or components. Instead, the OBD

system would consist primarily of software in the existing on-board computer and would use many of the existing engine and emission control sensors.

ARB staff is working closely with U.S. EPA on developing an OBD program for heavy-duty engines and vehicles. ARB staff expects to present a proposal to the Board in the 2003-2004 timeframe with implementation beginning in 2007. Because many trucks in interstate commerce are registered outside of California, it is also necessary for U.S. EPA to adopt the same regulatory requirements. We expect U.S. EPA adoption in 2005 with federal implementation also beginning in 2007.

Manufacturer-Required In-Use Vehicle Testing: This proposed measure would require manufacturers of heavy-duty diesel engines to test a specific number of engines per engine family by procuring and testing in-use vehicles at various mileage intervals. The responsibility for procuring and testing vehicles would be on the engine manufacturers, not on ARB. If the vehicles tested do not meet applicable emission standards, the engine manufacturer may be required to test additional vehicles to determine if an engine recall is required. This program component may also include mechanisms to streamline the engine certification process in order to ease engine manufacturers' testing burden. ARB is working closely with U.S. EPA to develop this measure. ARB staff expects to propose this measure to the Board in the 2003-2004 timeframe with implementation as a pilot program in California beginning in 2005. The pilot program will be used to generate data and gain experience in testing heavy-duty diesel engines on-road with on-board measurement systems. U.S. EPA adoption of an in-use compliance program is also expected in the 2003-2004 timeframe. A fully implemented and enforceable manufacturer-run in-use compliance program for both ARB and U.S EPA will begin in 2007.

Reduced Truck and Bus Idling: To date, ARB's heavy-duty emission control program has focused on engine emission standards without specifically targeting idling emissions. Nonetheless, ARB staff recognizes that idling emissions pose a serious air quality and health threat, particularly at warehouse/distribution centers located in areas that may already be disproportionately impacted by pollution, or at school bus stops populated by young children who are particularly sensitive to the impacts of pollution.

During idle operations, heavy-duty vehicles consume large amounts of diesel fuel, increase emissions, and produce noise. While idling practices vary among truck drivers by season and geographic location, a study by the Argonne National Laboratory indicates that long-haul trucks in the United States idle between five hours and ten hours per day, depending on the season. This same study also estimates that the average heavy-duty long-haul truck idles about six hours per day for 303 days annually[3]. When resting or sleeping, truck drivers may keep the engine running at idle

[3] Stodolsky, F.; Gaines, L.; Vyas, A. *Analysis of Technology Options to Reduce the Fuel Consumption of Idling Trucks*; Argonne National Laboratory; ANL/ESD-43. June 2000.

to heat or cool the sleeper and/or cab, and to provide power to operate on-board appliances such as refrigerators, microwaves, television sets, and laptop computers. Heavy-duty trucks are also typically operated at idle to keep the engine block and diesel fuel warm for easy start-up during the winter months.

Some proactive trucking firms implement their own voluntary restricted-idling programs, and certain cities and municipalities already enforce ordinances that prohibit extended idling. ARB staff is now developing measures expanding upon these local efforts to reduce idling emissions from both new and in-use heavy-duty diesel vehicles.

New Vehicles: For new vehicles, ARB staff plans to present to the Board a proposal in the 2003-2004 timeframe that would require idle-limiting devices on California-registered new heavy heavy-duty vehicles (diesel vehicles with GVWRs greater than 33,000 pounds) starting with the 2007 model year. These vehicles are typically used in line haul service and provide the greatest opportunities for reductions in idling emissions. The idle-limiting devices could range from systems that automatically shut down an engine after a specific time, to stop/start systems that automatically stop and start the engine as necessary to maintain engine and cab temperature and battery voltage within pre-set limits. Different idle-limiting technologies would be fully evaluated during ARB's public process for regulatory development. This regulatory strategy could also incorporate the use of alternative power systems, such as auxiliary power units, thermal storage systems, and truck stop electrification, to supply power for cab and on-board appliance functions as necessary.

Based on staff estimates, NOx emissions would be reduced by less than one ton per day in the SCAB in 2010. This estimate is based on the assumption that the average idling time for a heavy heavy-duty diesel truck would be reduced by 25 percent to 50 percent through the use of an idle-limiting device.

In-Use Vehicles: ARB in December 2002 adopted an Airborne Toxic Control Measure (ATCM) to reduce idling emissions from school buses, thereby reducing toxic diesel PM and other associated toxic air contaminants. The ATCM also includes provisions to limit idling from other heavy-duty vehicles operating near and on school grounds. While the ATCM provides some modest emission benefits that would reduce region-wide exposure to unhealthful exhaust emissions, the main purpose of the measure is to reduce localized exposure to diesel PM and other toxic air contaminants in the vicinity of schools.

To address heavy-duty vehicles operating at locations other than schools, ARB staff also plans to conduct an assessment to identify possible approaches for reducing diesel PM emitted from heavy-duty trucks and transit buses during idling operations. ARB staff plans to complete this assessment by the end of 2003. This assessment would examine the magnitude of current and future idling emissions, the level of human

exposure, and possible approaches for reducing idling emissions. Staff would examine a wide range of approaches. Approaches to be examined would include operator education programs, public information, and fleet operator training programs. Additional approaches to be examined would include local ordinances restricting idling, no-idle zones, and requiring idle-limiting devices for certain fleets. Development of an airborne toxic control measure would be pursued to implement the regulatory aspects of this effort.

Alternatively, ARB staff may consider the feasibility of a legislative approach to restrict heavy-duty vehicles throughout the State from idling for extended time periods at loading docks, bus stops, and other areas where idling emissions occur. Similar to the regulatory approach, this strategy would restrict idling at various sources, thus reducing toxic diesel PM emissions and other associated toxic air contaminants.

Table II-B-9 shows the estimated emission benefits from all the approaches in this measure in the San Joaquin Valley.

Table II-B-9
ON-RD HVY-DUTY-3: Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, Reduced Idling
Estimated Emission Reductions
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	1.5
NOx	4
PM10	0.1

SIP Commitment for Measure ON-RD HVY-DUTY-3

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2006. The measure as proposed to the Board will, at a minimum, achieve between 1.4 and 4.5 tpd of ROG reductions and between 8 and 11 tpd of NOx reductions in the South Coast Air Basin in 2010.

San Joaquin Valley 2003 PM10 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2006 Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

4. Long-Term Advanced Technologies Measures

In addition to the specific proposed measures discussed in this chapter, there are other strategies that may yield further emission reductions from the on-road heavy-duty diesel vehicle fleet. For example, continued funding for ARB's Carl Moyer Program and Lower-Emission School Bus Program would provide for the introduction of cleaner heavy-duty vehicle technologies and reduce in-use emissions. These are examples of successful incentive programs, but their future success depends directly on the availability of State funding. Additional NOx reductions could be achieved with the installation of NOx retrofit technologies such as selective catalytic reduction systems or NOx adsorbers – once these or other NOx retrofit technologies are verified through ARB's Diesel Emission Control Strategy Verification Procedure. Other long-term advanced technology measures include the use of alternative diesel fuels such as emulsified diesel fuels or biodiesel, and the introduction of extremely low-emitting alternative-fuel engines and fuel cells for heavy-duty vehicles.

a. Federal Responsibility

On-Board Diagnostics: ARB staff is working closely with U.S. EPA on developing an OBD program for heavy-duty engines and vehicles. ARB staff expects to present a proposal to the Board in the 2003-2004 timeframe with implementation beginning in 2007. Because many trucks in interstate commerce are registered outside of California, it is also necessary for U.S. EPA to adopt the same regulatory requirements. We expect U.S. EPA adoption in 2005 with federal implementation also beginning in 2007.

Manufacturer-Required In-Use Vehicle Testing: ARB is working closely with U.S. EPA to develop this measure. ARB staff expects to propose this measure to the Board in the 2003-2004 timeframe with implementation as a pilot program in California beginning in 2005. The pilot program will be used to generate data and gain experience in testing heavy-duty diesel engines on-road with on-board measurement systems. U.S. EPA adoption of an in-use compliance program is also expected in the 2003-2004 timeframe. A fully implemented and enforceable manufacturer-run in-use compliance program for both ARB and U.S EPA will begin in 2007

CHAPTER C

Off-Road Compression-Ignition (Diesel) Engines

CHAPTER C. OFF-ROAD COMPRESSION-IGNITION (DIESEL) ENGINES

1. Category Description

Off-road compression-ignition (CI) engines are diesel engines primarily used in farm, construction, and industrial equipment. In 2000, the California off-road CI engine category included over 450,000 engines, contributing 4 percent of total mobile source baseline ROG emissions, 21 percent of NOx emissions, and 31 percent of PM emissions. By 2020, emissions will be reduced by over 50 percent due to existing control programs. The baseline ROG, NOx and PM emissions from all off-road CI engines, including both preempt and non-preempt, are listed in Table II-C-1.

Table II-C-1
Statewide Off-Road CI Engines
Baseline Emission Inventory
(Annual Average, tpd)

Pollutant	2000	2005	2010	2015	2020
ROG	75	64	48	34	26
NOx	585	511	404	301	244
PM10	39	36	29	23	18

The federal Clean Air Act prohibits California (and other states) from regulating emissions from new engines used in construction and farming equipment less than 175 horsepower. These equipment types are termed "preempted" and represent about 80 percent of the total number of CI engines operating in California. ARB works closely with U.S. EPA and relies heavily on federal action to regulate these engines to obtain needed emission reductions. The remaining equipment is commonly referred to as non-preempt off-road CI engines. Some types of equipment in this category include generators and pleasure craft. Table II-C-2 lists the South Coast baseline emission inventory grouped by non-preempt (ARB regulated) and preempt (U.S. EPA regulated) engines based on summer planning daily emissions. Table II-C-3 shows baseline emissions for the San Joaquin Valley.

Table II-C-2
Baseline Emissions for Off-Road Compression-Ignition (Diesel) Engines
(South Coast, Summer Planning, tpd)

Pollutant	2000		2005		2010		2015		2020	
	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA
ROG	7	15	5	13	4	10	3	7	3	5
NOx	65	100	56	90	44	72	32	53	27	43
PM10	3	8	3	8	2	7	2	5	2	4
CO	27	45	19	45	15	44	13	42	13	42

Table II-C-3
Baseline Emissions for Off-Road
Compression Ignition Engines
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	7.1
NOx	66
PM10	4.5

2. Existing Control Program

a. Engine Standards

In September 1996, ARB, U.S. EPA, and the diesel engine manufacturers signed a statement of principles (SOP) calling for harmonization of ARB and U.S. EPA off-road CI engine regulations. The SOP is a cooperative agreement between ARB, U.S. EPA, and the engine manufacturers that recognizes the technological feasibility of significant emission reductions from off-road CI engines. The SOP called for new NOx, HC, and PM emission standards that would reduce NOx and PM emissions by more than 60 percent.

In August 1998, U.S. EPA adopted new emission standards, along with changes to the existing federal averaging, banking, and trading program, and changes to useful life and maintenance requirements for off-road diesel engines. In January 2000, ARB adopted amendments to existing California emission standards and test procedures to harmonize as closely as possible with the federal program while still maintaining the emission reduction benefits of the existing California program. These standards consist of a tiered structure of emission limits based on engine power. The federal Tier 1

standards were implemented in 1996 and the Tier 2 standards are being phased-in, beginning in 2001, over the next few years based on each power category. Tier 3 HC+NOx and CO standards were adopted for 50 to 750 horsepower (hp) engines with a phase-in beginning in 2006. Table II-C-4 below summarizes the existing standards applicable to new off-road CI engines sold in the United States.

Table II-C-4
Off-Road Compression-Ignition (Diesel) Engine Standards for New Engines

Rated Power (hp)	Model Year	g/bhp-hr				
		NOx	HC	NMHC +NOx	CO	PM10
<11	2000+	--	--	7.8	6.0	0.75
<11	2005+	--	--	5.6	6.0	0.60
11 to <25	2000+	--	--	7.1	4.9	0.60
11 to <25	2005+	--	--	5.6	4.9	0.60
25 to <50	1999+	--	--	7.1	4.1	0.60
25 to <50	2004+	--	--	5.6	4.1	0.45
50 to <100	2000-2003	6.9	--	--	--	--
50 to <100	2004+	--	--	5.6	3.7	0.30
50 to <100	2008+	--	--	3.5	3.7	--
100 to <175	2000-2002	6.9	--	--	--	--
100 to <175	2003+	--	--	4.9	3.7	0.22
100 to <175	2007+	--	--	3.0	3.7	--
175 to <300	1996-2002	6.9	1.0	--	8.5	0.40
175 to <300	2003+	--	--	4.9	2.6	0.15
175 to <300	2006+	--	--	3.0	2.6	--
300 to <600	1996-2000	6.9	1.0	--	8.5	0.40
300 to <600	2001+	--	--	4.8	2.6	0.15
300 to <600	2006+	--	--	3.0	2.6	--
600 to 750	1996-2001	6.9	1.0	--	8.5	0.40
600 to 750	2002+	--	--	4.8	2.6	0.15
600 to 750	2006+	--	--	3.0	2.6	--
>750	2000-2005	6.9	1.0	--	8.5	0.40
750+	2006+	--	--	4.8	2.6	0.15

b. Carl Moyer Program

The Carl Moyer Program is a heavy-duty diesel engine incentive program designed to obtain early emission reductions of NOx and particulate matter from heavy-duty vehicles and equipment, including those used in off-road applications. Under the program, ARB has the responsibility to establish program guidelines, oversee the program, and report program benefits. Local air districts implement the program and work with the public and private participants. The program provides grants to pay for the extra cost of replacing existing diesel engines with lower-emission engines, including new cleaner diesels, or engines powered by alternative fuels or electricity. The program is successful in providing near-term emission reductions from off-road engines such as those in farm and construction equipment. For the first two years of funding, off-road projects constituted about 60 percent (4 tons per day NOx) of the overall emission reductions from the Carl Moyer Program. An annual funding source is needed in order to rely on incentive programs, similar to the Carl Moyer Program, to provide emission reductions.

3. Proposed Strategies

The measures ARB staff is proposing are listed in Table II-C-5. All listed measures would reduce emissions from ROG, NOx, and diesel PM.

Table II-C-5
Proposed Strategies for Off-Road Compression-Ignition (Diesel) Engines

Strategy	Timeframe	
	Action	Implementation
*OFF-RD CI-1: Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet – Retrofit Controls	2004 - 2008	2006 - 2010
*OFF-RD CI-2: Implement Registration and Inspection Program for Existing Heavy-Duty Off-Road Equipment to Detect Excess Emissions	2006 - 2009	2010

*Renumbered from January 2003 draft.

a. OFF-RD CI-1: Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet – Retrofit Controls [Compression-Ignition Engines]*

Time Frame: Adopt 2004-2008; Implement 2006-2010

Responsible Agencies: ARB

New heavy-duty diesel engine standards provide significant, long-term reductions in emissions as the fleet turns over. Compliance and enforcement programs are designed to ensure that new engines maintain their low emission levels. However, to improve air quality and benefit public health in the near-term, emissions from the existing heavy-duty diesel equipment fleet must be reduced.

The strategies discussed here specifically target in-use emissions from the existing fleet. These strategies can provide near-term reductions, depending on when implemented, but can also provide longer-term reductions lasting until each affected vehicle is replaced with a newer vehicle meeting more stringent emission standards.

PM In-Use Emission Control Rules: Verified diesel emission control strategies to reduce PM emissions first appeared in California regulations with the adoption of the transit bus rule by ARB in February 2000. As called for in the Diesel Risk Reduction Plan, which was adopted by the Board in September 2000, ARB intends to expand its opportunities to achieve PM reductions, and in most cases, ROG reductions. These reductions will be accomplished through the implementation of additional rules targeting not only other on-road fleets, but heavy-duty diesel off-road vehicles and equipment as well.

Like other ARB regulations, the in-use emission control rules will not prescribe the emission control strategies that operators of off-road engines must use. The strategies that operators select, however, must have ARB-verified emission reductions or involve the use of ARB-certified engines, and must meet the emission reduction targets specified by the rules. There are a variety of strategies that operators could potentially use to reduce PM emissions, such as installation of a hardware-based retrofit system (e.g., a diesel particulate filter). Such retrofit-based strategies would first have to be verified by ARB staff using ARB's Diesel Emission Control Strategy Verification Procedure. Fleet operators may also elect to replace older, dirtier engines with new, certified ones (engine repower), retire old vehicles/equipment, or replace vehicles/equipment with new, lower-emission models. Depending on the strategy chosen by operators, the use of low-sulfur diesel fuel may be an integral strategy

* Renumbered from January 2003 draft. This measure was numbered OFF-RD-CI-2 in the January 2003 draft.

component. For example, most catalyst-based diesel particulate filters provide the greatest emission reductions when used with low-sulfur diesel fuel (sulfur content of 15 ppmw or less).

As part of the Diesel Emission Control Strategy Verification Procedure, ARB adopted a multi-level approach for categorizing strategies based on their verified PM emission reductions. For example, "Level 1" verification applies to strategies that achieve at least a 25 percent PM reduction; "Level 2" verification applies to strategies that achieve at least a 50 percent PM reduction; and "Level 3" verification applies to strategies that achieve at least an 85 percent PM reduction, or reduce exhaust PM levels to no more than 0.01 g/bhp-hr. Together with regulations that will require the use of retrofits or other strategies verified to the highest level possible, this multi-level approach ensures the development of high-efficiency control strategies. At the same time, it allows for lower level reductions in applications where higher level options are not yet available, thus ensuring that diesel PM emissions are reduced in a timely manner when and where they can be realized.

The PM rules are intended to provide a flexible and progressive in-use emission control program that achieves the highest level of PM emission control possible. Although PM reductions are the focus of the rules, the staff expects ROG reductions to be realized as well. The currently verified diesel particulate filters, for instance, achieve ROG reductions proportional to the PM reductions achieved.

In-use emission control programs for off-road vehicles/equipment could be implemented through a variety of approaches. One such approach could require large State construction contracts to include a demonstration of reductions as a contract condition. In addition, an in-use emission control rule for off-road equipment could apply specifically to publicly-owned and contracted fleets. While an off-road in-use emission control program is certainly feasible, its effectiveness may be less than optimum without a statewide registration program. This is because it would be difficult to track certain types of retrofitted off-road equipment, thereby hampering the ability to directly enforce the retrofit installation. Therefore, ARB staff is also considering a proposal for a registration requirement in California for off-road equipment (see measure OFF-RD CI-2).

A likely timeframe for implementing a PM in-use emission control rule for privately-owned off-road vehicles/equipment would be in 2007. By that time, there should already be widespread availability of low-sulfur diesel fuel (sulfur content of 15 ppmw or less), which is necessary for many retrofit technologies to perform effectively and reliably. For publicly-owned or publicly-contracted fleets, however, a phased-in implementation schedule beginning earlier may be considered since California refiners are capable of producing very low sulfur diesel fuel in sufficient quantities for fleet use.

Table II-C-6 below shows the estimated emission benefits in the South Coast Air Basin from implementation of the PM in-use emission control rules. Table II-C-7 shows the estimated benefits in the San Joaquin Valley.

Table II-C-6
OFF-RD CI-1: Pursue Approaches to Clean Up the Existing Off-Road Equipment Fleet – Retrofit Controls
[Compression-Ignition Engines]
Estimated Emission Reductions
(South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	n/a	0.03-0.10	0.8-2.8	2.3-7.8	1.3-4.3
NOx	Not Quantified				
PM10	n/a	0.02-0.06	0.6-1.9	1.6-5.4	0.9-3.2
CO	Not Quantified			9-29	NQ

Table II-C-7
OFF-RD CI-1: Pursue Approaches to Clean Up the Existing Off-Road Equipment Fleet – Retrofit Controls
[Compression-Ignition Engines]
Estimated Emission Reductions
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	1.0
NOx	0
PM10	0.4

SIP Commitment for Measure OFF-RD CI-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2004 and 2008. The measure as proposed to the Board will, at a minimum, achieve between 2.3 and 7.8 tpd of ROG reductions in the South Coast Air Basin in 2010.

San Joaquin Valley 2003 PM10 SIP Commitment:

ARB staff proposes to commit to bring this measure to Board between 2004 and 2008. Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

c. OFF-RD CI-2: Implement Registration and Inspection Program for Existing Heavy-Duty Off-Road Equipment to Detect Excess Emissions [Compression-Ignition Engines]*

Time Frame: Action 2006-2009; Implement 2010

Responsible Agency: ARB

Proposed Strategy:

As ARB staff develops off-road control measures to reduce in-use emissions (including PM and NOx), registration and inspection programs will be incorporated as a component of each regulation. The most-effective registration and inspection programs would be tailored to the type of equipment, the application, and the type of control proposed. Thus, this strategy would not be an all-encompassing registration and inspection program, but rather would be developed on a measure-by-measure basis, with input from engine and aftertreatment manufacturers, industry, environmental groups, and the public. For PM in-use emission controls like those described in OFF-RD CI-1, the registration and inspection program would help ensure that control equipment is properly installed and functioning as designed by the manufacturer, and that the equipment owner is complying with any equipment or fleet requirements.

Registration and inspection programs are a means of ensuring that the chosen control strategies remain effective over the lifetime of the engine or equipment. Thus, the benefits of registration and inspection programs can be divided into (1) reductions due to detection of failing systems and corrective action, and (2) indirect reductions due to the deterrent effect of the program. The inspection component could include a simplified compliance test that could be performed on-site and correlated to the certification test. The inspection component could also include in-use testing to detect excess emissions. ARB staff has not estimated emission benefits from off-road registration and inspection programs. The benefits are assumed to be included in the estimated benefits from the in-use control strategies.

SIP Commitment for Measure OFF-RD CI-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2006 and 2009. We have not quantified benefits for this measure.

* Renumbered from January 2003 draft. This measure was numbered OFF-RD-CI-3 in the January 2003 document.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

4. Long-Term Advanced Technologies Measures

Additional emission reductions from off-road CI engines can be achieved through the development and implementation of technological advances, availability of financial incentives, or federal action. A number of these approaches are presented in this section.

Emulsified diesel or alternative diesel fuels: The use of emulsified or alternative diesel fuel can provide emission reductions for earlier model year off-road engines, where retrofit controls options are very expensive or can be difficult to implement. Emulsified or alternative diesel fuels used in early model off-road diesel engines can provide NOx emission reductions of about 10 percent and PM emission reductions of about 60 percent. Emission reductions could be realized almost immediately.

Reduced idling from construction equipment: Off-road diesel engines with electronically controlled engines could be programmed to shut down the engine after a set period of free idle. In addition to reducing emissions that occur during extended idling an idle limit device also would provide protection to aftertreatment devices such as diesel particulate filters. Add-on devices such as the Cummins ICON™ Idle Control Systems are currently available to consumers for existing electronically controlled engines and have been used successfully in on-road applications resulting in 0.5 miles per gallon fuel economy improvements, according to the manufacturer.

Blue Skies Series engines: Additional emission reductions from off-road CI engines could be obtained by extending the current voluntary "Blue Sky Series" engine program. The optional emission standards for HC+NOx and PM would be 40 percent lower than the current model year standards.

NOx emission control retrofit technology: Selective catalytic reduction (SCR) technology has been used in stationary sources for over 15 years and is also used in some mobile sources throughout Europe. SCR as a retrofit system has demonstrated a NOx reduction of about 70 percent, PM emissions by about 25 percent and ROG emissions by about 50 to 90 percent. NOx adsorbers operate within the oxygen rich ("lean burn") conditions of diesel engines. The adsorber stores NOx under oxygen rich conditions; an engine management system then determines when NOx adsorption is near saturation and changes engine operation to the fuel rich conditions necessary to release and catalyically reduce to stored NOx. NOx adsorbers require the use of low-sulfur diesel fuel.

Off-Road CI engine fleet upgrade: Replace or upgrade engines in the existing fleet with lower-emitting engines. Upgrade as many pre-Tier 2 engines as possible to

bring them into compliance with federal Tier 2 HC+NOx emission standards. For engines where a Tier 2 upgrade is unfeasible, compliance with Tier 1 emission standards could instead be funded. It is estimated that approximately 85 percent of existing Tier 1 engines and 50 percent of uncontrolled engines could be upgraded to Tier 2 HC+NOx standards. It is also estimated that 80 percent of the remaining uncontrolled engines could be upgraded to meet the Tier 1 HC+NOx standards.

a. Federal Responsibility

ARB intends to work closely with U.S. EPA to establish nationwide lower-emission standards for HC, NOx, and PM emissions from new off-road compression ignition engines. A nationwide standard would produce much needed reductions from preempt off-road CI engines that also operate within California.

CHAPTER D

Off-Road Large Spark-Ignition Engines

CHAPTER D. OFF-ROAD LARGE SPARK-IGNITION ENGINES

1. Category Description

The large spark-ignition engine (LSI) category consists of off-road spark-ignition engines greater than 25 horsepower and typically fueled by gasoline or liquefied petroleum gas (LPG). A small number are fueled by compressed natural gas (CNG), and some have dual fuel capability. Emissions from these sources include combustion emissions, such as hydrocarbons (HC), oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM), as well as evaporative hydrocarbon (HC) emissions. LSI engines are most commonly found in forklifts, specialty vehicles, portable generators, pumps, compressors, farm equipment, and construction equipment. This category excludes marine propulsion engines, engines used in equipment that operate on rails, recreational vehicles, snowmobiles, and gas turbines. U.S. EPA has the sole authority to control new farm and construction equipment engines less than 175 horsepower.

The estimated South Coast 2010 non-preempt LSI engine population is about 33,400. The estimated South Coast 2010 population of federally preempted LSI engines is about 6,400. South Coast summer average emissions from these two LSI populations are listed in Table II-D-1. The decrease in exhaust emissions for non-preempt engines is the result of California standards implemented in 2001. The federally preempted portion of this category accounts for about 20 percent of the estimated 2010 uncontrolled emissions of ozone precursors from LSI engines. Forklifts are a major subcategory – almost 50 percent of the LSI engine population. The forklift population in South Coast Air Basin is estimated to be about 22,600 in 2010. Baseline emissions for the San Joaquin Valley are shown in Table II-D-2.

Table II-D-1
Baseline Emissions for Large Spark-Ignition Engines
ARB (Non-Preempt) vs. U.S. EPA (Preempt)
(South Coast, Summer Planning, tpd)

Pollutant	2005		2006 (Annual Average)		2008		2010		2020	
	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA	ARB	U.S. EPA
ROG	6	1	6	1	5	1	3	1	2	1
NOx	22	3	19	3	15	3	12	3	9	3
PM10	0	0	0	0	0	0	0	0	0	0
CO	106	13	105	12	102	13	94	13	89	14

Table II-D-2
Baseline Emissions for Large Spark-Ignition Engines
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	5.4
NOx	3.4
PM10	0.2

2. Existing Control Program

a. Engine Standards

To implement 1994 SIP Measure M11, Three-Way Catalyst Technology, ARB adopted the current HC+NOx and CO exhaust emission standards for the non-preempt portion of LSI engines and equipment in October 1998. Staff relied on the expected exhaust emission reductions associated with closed loop, three-way catalyst technology to develop the HC+NOx and CO exhaust emission standards shown in Table II-D-3 below. The adopted 3.0 g/bhp-hr HC+NOx exhaust standard was based primarily on what is achievable with automotive-derived technologies. Staff based the 37 g/bhp-hr CO standard on the CO standard for on-road heavy-duty trucks powered by gasoline. Catalysts have long been used to reduce emissions from off-road spark-ignition equipment in special operating environments such as mines and indoor warehousing applications.

These standards, which are being phased in over four years, institute new engine emission standards beginning with the 2001 model year and are summarized in Table II-D-3. For 2001, 25 percent of LSI engines were required to certify as compliant with the standard and 75 percent could be certified non-compliant engines. Beginning with 2004 models, the same numerical exhaust emission standards for HC+NOx and CO will apply, but manufacturers will be required to certify their engines to a durability period. Beginning with the 2007 model year, this durability period will be 5000 hours, representative of the useful life of the engine.

Table II-D-3
Current ARB Exhaust Emission Standards for Large Spark-Ignition Engines

Model Year	Engine Displacement	Durability Period	HC + NOx	CO
			Grams per brake horsepower-hour [grams per kilowatt-hour]	
2002 and subsequent	≤ 1.0 liter	1,000 hours or 2 years	9.0 [12.0]	410 [549]
2001 – 2003	> 1.0 liter	N/A	3.0 [4.0]	37.0 [49.6]
2004 – 2006**	> 1.0 liter	3,500 hours or 5 years	3.0 [4.0]	37.0 [49.6]
2007 and subsequent	> 1.0 liter	5,000 hours or 7 years	3.0 [4.0]	37.0 [49.6]

**Alternate emission standards are allowed for in-use compliance testing during this period

In 2000, U.S. EPA, ARB, and the South Coast Air Quality Management District co-sponsored catalyst durability testing for LSI engines at the Southwest Research Institute (SwRI). Test results showed that LSI engines are able to meet exhaust emission levels well below the current ARB standards using three-way catalysts and closed-loop fuel control, and that there is little to no degradation in the emission control system over the useful life of the engine.

Measure M12 in the 1994 SIP called for U.S. EPA to adopt an LSI engine program for preempt engines akin to California's current program. California cannot regulate a significant percentage of the emissions from LSI engines due to federal preemption. In 2002, utilizing the data generated from the SwRI test program, U.S. EPA finalized nationwide emission standards for these engines. The federal program aligns with California's exhaust emission standards for LSI engines with implementation beginning in 2004. In addition, U.S. EPA promulgated more stringent, Tier 2 requirements for LSI engines beginning in 2007. Starting with the 2007 model year engines, the federal Tier 2 exhaust emission standards for HC+NOx and CO are 2.7 g/kW-hr (2.0 g/bhp-hr) and 4.4 g/kW-hr (3.3 g/bhp-hr), respectively. Manufacturers must certify to these levels utilizing both a steady-state and transient test cycles. In addition, manufacturers may optionally certify engines according to a formula based on a HC+NOx/CO tradeoff. However, an engine cannot be certified to an HC+NOx standard above 2.0 g/bhp-hr or a CO standard above 15.4 g/bhp-hr. The emissions benefits from the federal standards are shown in Table II-D-4.

Table II-D-4
Lower Emission Standards for New Off-Road Preempt Engines
U.S. EPA 2002 Final Rulemaking
[Spark-Ignition Engines 25 hp and Greater]
Estimated Emission Reductions
(South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0.2	0.2	0.3	0.4	0.6
NOx	0.9	0.9	1.4	1.7	2.7
PM10	0	0	0	0	0
CO	1.0	1.5	3.2	4.2	8.6

Note: These are emission reductions resulting from federal regulations. These emission reductions are not reflected in the baseline emissions shown in Table II-D-1.

3. Proposed Strategies

There are three additional emission reduction measures identified for this category of equipment that are summarized in Table II-D-5 below and further described in this section. These measures primarily affect ROG and NOx emissions.

Table II-D-5
Proposed Strategies for Off-Road Large Spark-Ignition Engines

Strategies	Timeframe	
	Action	Implementation
OFF-RD LSI-1: Set Lower Emission Standards for New Off-Road Gas Engines [Spark-Ignition Engines 25 hp and Greater]	2004 - 2005	2007
OFF-RD LSI-2: Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls [Spark-Ignition Engines 25 hp and Greater]	2004	2006 - 2012
OFF-RD LSI-3: Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 lbs	2004	2005 – 2010

a. OFF-RD LSI-1: Set Lower Emission Standards for New Gas Engines (Off-Road Spark-Ignition Engines 25 hp and Greater)

Time Frame: Adopt 2004-2005; Implement 2007

Responsible Agency: ARB

Proposed Strategy:

Background: To implement Measure M11 in the 1994 SIP, ARB adopted California's current HC+NOx and CO exhaust emission standards for the non-preempt portion of LSI engines and equipment. Staff relied on the expected exhaust emission reductions associated with closed-loop, three-way catalyst technology to develop the exhaust emission standards. Catalysts had long been used to reduce emissions from off-road spark-ignition equipment in special operating environments such as mines and indoor warehousing applications.

In 2002, U.S. EPA adopted more stringent emission standards based on catalyst durability testing co-sponsored by U.S. EPA, ARB, and the South Coast Air Quality Management District.

Additional Emission Reductions: ARB staff would propose the adoption of exhaust emission standards for new non-preempt engines, in alignment with the federal Tier 2 standards beginning with the 2007 model year. This would represent at least a 33 percent reduction from California's current HC+NOx exhaust emission standard.

Table II-D-6 summarizes the emission reductions expected from aligning with the federal emission standards. The benefits of electric forklift measure, OFF-RD LSI-3 are excluded from these reduction estimates.

Table II-D-6
OFF-RD LSI-1: Lower Emission Standards for New Off-Road Non-Preempt Gas Engines [Spark-Ignition Engines 25 hp and Greater] Estimated Emission Reductions (South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0	0	0	0	0
NOx	0	0	0.3	0.8	1.6
PM10	0	0	0	0	0
CO	0	0	2.9	7.3	16.3

SIP Commitment for Measure OFF-RD LSI-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board by between 2004 and 2005. The measure as proposed to the Board will, at a minimum, achieve 0.8 tpd of NOx reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. OFF-RD LSI-2: Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls [Spark-Ignition Engines 25 hp and Greater]

Time Frame: Adopt 2004; Implement 2006-2012

Responsible Agency: ARB

Proposed Strategy:

The general approach of this measure is to retrofit existing equipment utilizing LSI engines to achieve an 80 percent reduction in exhaust emissions or meet emission levels equivalent to 3.0 g/bhp-hr HC+NOx. Recent data have shown that existing LSI engines retrofitted with catalyst-based emission systems could achieve emission reductions similar to those achieved from new engines designed with catalysts. ARB currently has no regulations limiting emissions from pre-2001 model year spark-ignition engines over 25 horsepower, and some uncontrolled engines can be sold in California through the 2003 model year. Implementation of a retrofit program for LSI engines would therefore be considered, utilizing a phase-in approach over a period of six years.

In 2004, staff would propose the adoption of retrofit requirements for LSI engines that are not certified as compliant with ARB's post-2000 model year standards. Projected benefits are based on implementation beginning in 2006 and phased in over six years. Tables II-D-7 and II-D-8 summarize the expected emission benefits for this measure for South Coast and the San Joaquin Valley.

Table II-D-7
OFF-RD LSI-2: Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls [Spark-Ignition Engines 25 hp and Greater] Estimated Emission Reductions (South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	Not Applicable	1	0.4-1.0	0.5-1.4	0-0.1
NOx	Not Applicable	2.5	1.5-3.0	1.5-3.5	0.2-0.4
PM10	Not Applicable	Not Quantified	Not Quantified	Not Quantified	Not Quantified

Table II-D-8
OFF-RD LSI-2: Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls
[Spark-Ignition Engines 25 hp and Greater]
Estimated Emission Reductions
(San Joaquin Valley, Winter Planning, tpd)

Pollutant	2010
ROG	0.1
NOx	0.1
PM10	0

A conservative analysis of the necessary control technology for this measure would call for the addition of a three-way catalyst and closed-loop fuel system, including the addition of a throttle-body injector. However, a significant amount of the equipment would be able to achieve the required emission reductions by utilizing a three-way catalyst system, without significantly modifying the engine or fuel system.

SIP Commitment for Measure OFF-RD LSI-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2004. The measure as proposed to the Board will, at a minimum, achieve between 0.5 and 1.4 tpd of ROG reductions and between 1.5 and 3.5 tpd of NOx reductions in the South Coast Air Basin in 2010.

San Joaquin 2003 PM10 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2004. Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

c. OFF-RD LSI-3: Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 lbs

Time Frame: Adopt 2004; Implement 2005-2010

Responsible Agency: ARB

Proposed Strategy:

This measure would require companies purchasing or leasing forklifts to select a zero-emission forklift. The requirement would be limited to forklifts used in applications where zero-emission forklifts have been deemed to be suitable alternatives to internal combustion engine (ICE) forklifts. The rule would also be limited to forklifts with a lift capacity of 8,000 pounds or less and purchased after the implementation date, beginning in 2005. The estimated emission reductions expected from this measure are shown in Table II-D-9 for the South Coast and in Table II-D-10 for the San Joaquin Valley.

Currently, the only commercially available zero-emission forklifts are electric. Electric forklifts are a technically feasible alternative to ICE forklifts, constituting about 25 percent of the total 8000 pound and under lift capacity counterbalanced forklift market (classes 1, 4, and 5) in the United States. This percentage is significantly higher in some categories and weight classes. The advent of more powerful, more energy efficient, alternating current motors, 48 volt batteries, and fast-charging technology will only broaden the range of electric forklift applications and hasten the growth of the electric forklift market. However, electric forklifts may not be suitable for 100 percent of applications due to operation requirements such as specific terrain challenges or extreme hours of use. Consideration of operational feasibility and economic impact to operations will enter into regulatory development. The regulatory development process will also include careful consideration of diesel forklift purchases and forklift rentals to ensure these categories are not utilized to circumvent the regulation.

Forklift owners may be able to recoup the incremental cost of some zero-emission forklifts during their useful life due to lower life cycle costs. Additionally, Carl Moyer Program funding is currently available to offset the incremental cost increase of electric forklifts. In the last three years, the Carl Moyer Program has provided over $2,000,000 in funding to incentivize the introduction of over 200 electric forklifts into applications where ICE forklifts had previously been used, demonstrating the potential of electric forklifts in these applications. Once this regulatory measure becomes effective, electric forklifts would no longer be eligible for Carl Moyer funding.

Table II-D-9
OFF-RD LSI-3: Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 lbs
Estimated Emission Reductions
(South Coast, Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0	0.1	0.15-0.3	0.3-0.6	0.5-1
NOx	0.1	0.6	0.8-1.6	1.4-2.8	1.2-4.3
PM10	0	0	0	0	0-0.1
CO	0.4	2.1	4.4-8.8	10.8-21.6	27-55

Table II-D-10
OFF-RD LSI-3: Require Zero Emission Forklifts Where Feasible – Lift Capacity ≤ 8,000 lbs
Estimated Emission Reductions
(San Joaquin Valley Winter Planning, tpd)

Pollutant	2010
ROG	0.1
NOx	0.2
PM10	0

SIP Commitment for Measure OFF-RD LSI-3

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2004. The measure as proposed to the Board will, at a minimum, achieve between 0.3 and 0.6 tpd of ROG reductions and between 1.4 and 2.8 tpd of NOx reductions in the South Coast Air Basin in 2010.

San Joaquin Valley 2003 PM10 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2004. Emission reductions from this measure would be used toward meeting ARB staff's proposed commitment to adopt new measures between 2002 and 2008 that reduce emissions by an additional 10 tpd NOx and 0.5 tpd direct PM10 in the San Joaquin Valley by 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

4. Long-Term Advanced Technologies Measures

Implementation of measure OFF-RD LSI-2, which includes retrofits, would be most effective if a tracking mechanism is established. For optimum effectiveness of the retrofit measure, ARB is considering enforcement of a statewide registration program analogous to the registration of a new vehicle purchase with the DMV. This program would enable authorities to track retrofitted off-road equipment by adopting a registration requirement in California in the same time frame as this retrofit strategy.

In addition, new technologies are always in the offing. Prototype cars, trucks, and buses powered by fuel cells are currently tested in the U.S. and Europe for performance and durability. Fuel cells are also being used in small vehicles and equipment, such as golf cars, neighborhood electric, airport ramp, forklifts, other material and people movers. In the future fuel cells may offer a zero emission, noiseless, odorless power source while retaining the vitality and functionality of conventional fuel-powered vehicles and equipment.

CHAPTER E

Small Off-Road Engines

CHAPTER E. SMALL OFF-ROAD ENGINES

1. Category Description

The small off-road engine (SORE or "small engine") category consists of off-road spark-ignition engines below fueled typically by gasoline, liquid petroleum gas (LPG) or other alternative fuels and below 25 horsepower. The SORE category includes lawn, garden and other maintenance utility equipment. Within this category, engines are typically grouped by engine displacement measured in cubic centimeters (cc). Engines under 65 cc displacement are traditionally associated with handheld equipment such as weed trimmers, leaf blowers and chain saws. Engines greater than 65 cc displacement are collectively referred to as non-handheld small off-road engines. Non-handheld equipment is primarily lawn mowers, but also includes other equipment such as riding mowers and generator sets. U.S. EPA preempts new small engines used in farm and construction equipment from California emission regulation. The total South Coast small engine population is estimated to be over 6.5 million by 2010. Tables II-E-1 and II-E-2 summarize the handheld and nonhandheld emission inventory of small off-road engines in the South Coast for nonpreempt and preempt engines, respectively.

Table II-E-1
Baseline Emissions for Small Off-Road Engines (<25 hp)
(South Coast, Summer Planning, tpd) Nonpreempt

Pollutant	2005		2006 Annual Average		2008		2010		2020	
	Hand	Non	Hand	Non	Hand	Non	Hand	Non	Hand	Non
ROG										
exhaust	14.89	13.55	13.14	11.37	14.58	11.37	14.79	10.50	16.97	9.44
evap	2.17	16.17	2.10	16.16	2.25	16.77	2.31	17.14	2.61	19.14
NOx	0.46	4.01	0.43	3.77	0.49	4.48	0.51	4.74	0.58	5.62
PM10	0.14	0.18	0.09	0.16	0.07	0.18	0.07	0.19	0.08	0.21
CO	42.68	382.61	37.65	332.98	41.63	351.70	42.21	340.28	48.54	343.94

Table II-E-2
Baseline Emissions for Small Off-Road Engines (<25 hp)
(South Coast, Summer Planning, tpd) Preempt

Pollutant	2005		2006 Annual Average		2008		2010		2020	
	Hand	Non	Hand	Non	Hand	Non	Hand	Non	Hand	Non
ROG										
exhaust	7.74	5.06	5.94	4.08	5.36	3.77	5.00	3.49	5.58	3.46
evap	0.24	2.47	0.24	2.52	0.25	2.53	0.25	2.58	0.28	2.70
NOx	0.09	1.57	0.09	1.55	0.11	1.83	0.12	1.92	0.14	2.13
PM10	0.02	1.25	0.02	1.12	0.02	1.18	0.02	1.19	0.03	1.25
CO	23.78	132.08	19.59	114.56	18.20	116.59	15.68	114.03	16.92	118.30

Small engines have been subject to exhaust emission controls since 1995. Since then, emissions from this category have been cut by 30 to 70 percent.

Evaporative emissions are a significant source of hydrocarbons from this category as shown in the above tables. The sources of evaporative emissions from this category arise from gasoline vapors vented from the carburetor and fuel cap. These emissions arise from diurnal (emissions due to daily temperature changes), hot soak (occur after shutdown of equipment), and running loss (occur during equipment operation) processes. Permeation (liquid gasoline migrating through the walls of plastic fuel tanks) is also another source of emissions.

The emissions contribution from walk-behind mowers is a major portion of the total small engine category. The walk-behind mower population in 2010 is estimated to be over 60 percent of the total nonpreempt, nonhandheld engine population. The contribution of the nonhandheld engines to the emissions inventory is most evident during spring and summer months when vegetation growth rates and equipment activity are at their highest levels.

2. Existing Control Program

a. Emission Standards

ARB has adopted HC+NOx and CO emission standards for SORE, along with PM emission standards for 0-65 cc two-stroke engines. The standards differ by engine sizes. In 1990, the Board approved regulations for two tiers of engine emission standards for small off-road engine regulations and requested ARB staff to return with a status report twice before the 1999 implementation of the Tier 2 standards. The Tier 1

standards took effect in 1995 and required manufacturers to produce clean engine versions of their handheld and non-handheld equipment. In 1998, ARB modified the regulation to require small engines to demonstrate durability in their emission control systems. The Board also delayed the Tier 2 standards until January 2000 to provide sufficient time for manufacturers and distributors to comply with the revised regulations.

The Tier 2 standards encourage the use of advanced engine designs and emission controls. Handheld equipment engine standards are currently less stringent than non-handheld standards to maintain the use of two-stroke engine technology in applications where maneuverability is needed.

In July 1995, U.S. EPA finalized the first federal regulations affecting small engines. Phase 1 regulations took effect for most new handheld and non-handheld engines beginning in model year 1997 and were harmonized with the California Tier I standards that had been implemented two years earlier. The initial U.S. EPA and California engine standards resulted in a 32 percent reduction in HC emissions. U.S. EPA's Phase 2 small off-road engine standards were adopted separately for handheld equipment and non-handheld equipment. Standards were phased in beginning with the 2002 model year for handheld equipment and the 2001 model year for non-handheld equipment. U.S. EPA standards are less stringent than the California standards, except in one case. The federal HC+NOx emission standard for engines with less than 50 cc displacement beginning in 2005 is more stringent than the current ARB HC+NOx emission standard.

The 2000 and later California exhaust emission standards for small off-road engines are summarized in Table II-E-3.

Table II-E-3
California 2000 and Later Exhaust Emission Standards (Tier 2)
for Small Off-Road Engines (Less Than 25 HP)

Calendar Year	Engine Displacement	Durability Periods (hours)	HC+NOx	CO	Particulate**
			grams per brake horsepower-hour [grams per kilowatt-hour]		
2000 and subsequent	0-65 cc, inclusive	50/125/300	54 [72]	400 [536]	1.5 [2.0]
2000 – 2001	>65 cc - <225 cc	N/A	12.0 [16.1]	350 [467]	N/A
	≥225 cc	N/A	10.0 [13.4]	350 [467]	N/A
2002 – 2005	>65 cc - <225 cc Horizontal	125/250/500	12.0 [16.1]	410 [549]	N/A
	>65 cc - <225 cc Vertical	N/A	12.0 [16.1]	350 [467]	N/A
2002 and subsequent	≥225 cc	125/250/500	9.0 [12.0]	410 [549]	N/A
2006 and subsequent	>65 cc - <225 cc	125/250/500	12.0 [16.1]	410 [549]	N/A

** The PM standard is applicable to all two-stroke engines.

3. Proposed Strategies

There are two additional emission reduction measures proposed for the small off-road engine sector listed in Table II-E-4. These measures affect ROG and NOx and are further described in the following section.

Table II-E-4
Proposed Strategies for Small Off-Road Engines

Strategies	Timeframe	
	Action	Implementation
SMALL OFF-RD-1: Set Lower Emission Standards for New Handheld Small Engines and Equipment [Spark-Ignition Engines Under 25 hp]	2003	2005
SMALL OFF-RD-2: Set Lower Emission Standards for New Nonhandheld Small Engines and Equipment [Spark-Ignition Engines Under 25 hp]	2003	2006

a. SMALL OFF-RD-1: Set Lower Emission Standards for New Handheld Small Engines and Equipment – Like Weed Trimmers, Leaf Blowers, and Chain Saws [Spark-Ignition Engines Under 25 hp]

Time Frame: Adopt 2003; Implement 2005

Responsible Agency: ARB

Proposed Strategy:

This measure will focus on reducing emissions from engines up to 65 cc displacement, and also extend the standards to include engines with displacements at or below 80 cc. These engines include handheld equipment such as weed trimmers and leaf blowers.

Staff proposes adoption in 2003 of a 50 g/kW-hr (37 g/bhp-hr) HC+NOx emission standard for less than 50 cc engines beginning in 2005 to align with federal standards. The current HC+NOx emission standard of 72 g/kW-hr (54 g/bhp-hr) will remain the same for engines between 50 to 65 cc, and will also apply to engines up to and including 80 cc. (This standard is more stringent than the current federal standard.) In conjunction with the exhaust proposal, staff proposes the adoption of a 1.0 gram HC/m^2/day permeation performance standard. The proposed standard will control permeation emissions from the fuel tanks on handheld equipment less than or equal to 80 cc.

Staff is also proposing the addition of an optional HC+NOx exhaust emission standard. Additional emission reductions from handheld engines could be obtained by the introduction of voluntary optional lower-emission standards and an environmental or "green" labeling program. The optional emission standard for HC+NOx would be 50 percent lower than the proposed 2005 standards. Engines certifying to optional standards would need to meet all other requirements that would otherwise be applicable to the model year engine, including warranty, useful life, and applicable testing. Incentive programs would be developed and utilized to promote the production of lower emission engines. This program is similar to U.S. EPA's "Blue Sky Series" engine program. Implementation of this program would benefit air quality by promoting the early development, introduction, and quicker widespread use of advanced low-emission technology.

Table II-E-5 lists the estimated emission benefits of this measure.

Table II-E-5
SMALL OFF-RD-1: Set Lower Emission Standards for New Handheld Small Engines and Equipment [Spark-Ignition Engines Under 25 hp]
Estimated Emission Reductions
(South Coast, Summer Planning, tpd) Nonpreempt

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG					
exhaust	0	0	1.1	1.5	1.9
evap	0	0	0.2	0.4	0.9
NOx	0	0	0.1	0.2	0.2
PM10	0	0	0	0	0
CO	0	0	0	0	0

SIP Commitment for Measure SMALL OFF-RD-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2003. The measure as proposed to the Board will, at a minimum, achieve 1.9 tpd of ROG reductions and 0.2 tpd NOx reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. SMALL OFF-RD-2: Set Lower Emission Standards for New Nonhandheld Small Engines and Equipment – Like Lawnmowers [Spark-Ignition Engines Under 25 hp]

Time Frame: Adopt 2003; Implement 2006

Responsible Agency: ARB

Proposed Strategy:

ARB staff proposes adoption in 2003 of a control measure that would require nonhandheld small off-road engine manufacturers to reduce combined HC+NOx emissions from new engines. This measure would begin with the 2006 model year and would require lower emission standards (25 percent to 50 percent lower than current levels) for engines with 80 cc – 225 cc displacement (Class I) and greater than 225 cc displacement (Class II). The measure would also include a durability demonstration to show emission levels remain under the applicable standard. In addition, similar to the SMALL OFF-RD-1 measure, staff proposes to adopt optional HC+NOx exhaust emission standards that are 50% below the proposed standards. This measure is expected to reduce the HC+NOx summer average emissions inventory attributed to these engines statewide by over 20 percent in the 2020 calendar year.

In conjunction with the exhaust proposal, staff proposes the adoption of diurnal evaporative emission standards for Class I and Class II engines to substantially reduce evaporative emissions from gasoline powered off-road equipment. Staff proposes setting a 1.0 gram/day diurnal evaporative emission standard for Class I engines and a 2.0 gram/day diurnal evaporative emission standard for Class II engines. The measure is expected to reduce the HC summer average evaporative emissions attributed to these engines statewide by over 65 percent in the 2020 calendar year.

Table II-E-6 details the estimated exhaust emission reductions from the implementation of the above measure for Class I and Class II engines. Table E-II-6 also details the estimated ROG reductions based on the new evaporative and permeation standards.

Table II-E-6
SMALL OFF-RD-2: Set Lower Emission Standards for New Nonhandheld Small Engines and Equipment
[Spark-Ignition Engines Under 25 hp]
Estimated Emission Reductions
(South Coast, Summer Planning, tpd) Nonpreempt

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG					
exhaust	0	0.1-0.3	0.7-1.3	1.1-2.2	1.8-3.6
evap	0	1.1	3.4	5.5	13.1
NOx	0	0.1-0.2	0.4-1.1	0.6-1.9	1.1-3.2
PM10	0	0	0	0	0
CO	0	0	0	0	0

SIP Commitment for Measure SMALL OFF-RD-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2003. The measure as proposed to the Board will, at a minimum, achieve between 6.6 and 7.7 tpd of ROG reductions and between 0.6 and 1.9 tpd of NOx reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

CHAPTER F

Commercial Marine Vessels and Ports

CHAPTER F. COMMERCIAL MARINE VESSELS AND PORTS

1. Category Description

Commercial marine vessels and land-based maritime or port-related activities are addressed in this chapter. Brief descriptions of these categories and their emissions are provided below.

a. Commercial Marine Vessels

Commercial marine vessels include ocean-going ships and harbor craft, but excludes recreational vessels. Ocean-going ships include international trade vessels such as container ships, bulk carriers, general cargo ships, tankers, and auto carriers. Passenger cruise ships, and some military and Coast Guard vessels, are also included in this category.

Most ocean-going vessels are propelled by large diesel piston engines (motor ships), although some are powered by steam turbines (steam ships), or diesel-fueled gas turbines. In addition, diesel piston or turbine engines may be used to drive generators to produce electricity for an electric propulsion motor (i.e., diesel-electric). The diesel-electric configuration is commonly used in passenger cruise ships.

The diesel piston engines powering the majority of oceangoing ships are referred to by U.S. EPA as "category 3" engines, meaning they have a displacement greater than 30 liters per cylinder. These engines are available in configurations with 4 to 14 cylinders, and power outputs ranging from roughly 5 to 100 megawatts. The larger diesel engines produce more power than many land-based electric generating power plants, and in some cases similar engines have been used as power plants.

In addition to the propulsion engines, ocean-going ships generally run diesel generators and boilers, particularly while "hotelling" in port. Diesel generators provide electrical power for lights and equipment, and boilers provide steam for hot water and fuel heating. Hotelling emissions are a significant component of marine vessel emissions in the South Coast Air Basin (SCAB). For example, in 2000 they are responsible for nearly 30 percent of the nitrogen oxide emissions from commercial marine vessels within the district.

Although the power systems described above are described as "diesel-fueled," the types of fuel vary. Most ocean-going ships run their main propulsion engines (and many newer ships also run their auxiliary engines) on intermediate fuel oil (IFO 180 or IFO 380). This fuel is also referred to as "bunker fuel," and requires heating to reduce its viscosity to a point where it can be properly atomized and combusted. Bunker fuel

typically contains much higher levels of sulfur, nitrogen, ash, and other compounds which increase exhaust emissions. For example, typical bunker fuel used by ships visiting the Ports of Los Angeles and Long Beach averages about 2.8 percent sulfur (28,000 ppm), compared to about 120 ppm sulfur for California on-road diesel. Diesel-powered gas turbine engines and auxiliary engines on many ocean-going ships use lighter "distillate" diesel fuel (also referred to as marine gas oil), which is much lower in sulfur and other contaminants.

Harbor craft (or the "captive fleet") include tugboats, commercial fishing vessels, commercial passenger fishing vessels ("party boats"), work boats, crew boats, ferries, and some Coast Guard and military vessels. These vessels generally stay within California coastal waters and often leave and return to the same port. Most harbor craft use diesel-powered propulsion and auxiliary engines. Harbor craft propulsion and auxiliary engines in California generally run on distillate diesel fuel, such as U.S. EPA on-road diesel.

The baseline and projected emissions of reactive organic gases (ROG), nitrogen oxides (NOx), particulate matter (PM), sulfur oxides (SOx), and carbon monoxide (CO) from marine vessels are shown in Table II-F-1. The emissions inventories are shown for the South Coast Air Basin (SCAB) in both summer planning and annual average format. As noted in the footnote to the tables, the inventory figures include the effect of the International Maritime Organization's (IMO) regulation of nitrogen oxides, but not the impact of U.S. EPA's harbor craft regulation, and local California programs such as the Carl Moyer program. ARB staff is currently working to develop an improved statewide emissions inventory for marine vessels that will include the effect of national and California-specific programs.

As shown in Table II-F-1, marine vessels are a significant source of emissions in the SCAB. For perspective, marine vessels currently contribute about 12 percent of the SCAB's particulate matter, and about 4 percent of the NOx emissions. In addition, the port facilities where these marine vessel emissions are concentrated are often located near population centers, which may be exposed to elevated levels of toxic diesel PM. In the SCAB, this is of particular concern for the communities surrounding the Los Angeles/Long Beach Port Complex.

Table II-F-1
Baseline Emissions for Marine Vessels
(South Coast Air Basin, Summer Planning, tpd)

Pollutant by Vessel Type	2000	2005	2006 (Annual Average)	2008	2010	2020
ROG						
Ocean-going ships	3.5	3.9	4.0	4.2	4.3	5.8
Harbor craft	0.4	0.4	0.4	0.4	0.4	0.4
Total	3.9	4.3	4.4	4.6	4.7	6.2
NOx						
Ocean-going ships	35.4	41.2	42.4	44.7	47.1	67.5
Harbor craft	10.5	10.6	10.7	10.7	10.7	11.4
Total	45.9	51.8	53.1	55.4	57.8	78.9
PM10						
Ocean-going ships	3.0	3.4	3.4	3.6	3.7	5.1
Harbor craft	0.2	0.2	0.2	0.2	0.2	0.2
Total	3.2	3.6	3.6	3.8	3.9	5.3
SOx						
Ocean-going ships	25.8	29.7	30.5	32.0	33.5	48.1
Harbor craft	0.2	0.2	0.2	0.2	0.2	0.2
Total	26.0	29.9	30.7	32.2	33.7	48.3
CO						
Ocean-going ships	4.1	4.8	4.9	5.1	5.4	7.8
Harbor craft	1.4	1.4	1.4	1.5	1.5	1.6
Total	5.5	6.2	6.3	6.6	6.9	9.4

Source: 2000 ARB Emissions Inventory. These emission inventory figures include the effect of the IMO regulation of nitrogen oxides, but do not reflect emission reductions expected from U.S. EPA's harbor craft regulation, or the California-based programs summarized in this chapter.

b. Land-Based Port Activities

California's ports support a tremendous amount of commerce, as well as tourism and military operations. California's coastline and inland waterways support a number of ports, including the Ports of Hueneme, Long Beach, Los Angeles, Oakland, Redwood City, Richmond, Sacramento, San Diego, San Francisco, and Stockton. The ports of Los Angeles and Long Beach in the SCAB are among the largest in the country, and the combined Los Angeles/Long Beach Port complex is one of the world's largest ports.

Ports in California are established by State government, and are operated by entities such as port authorities and departments of municipal governments. For example, the Port of Los Angeles is an independent department of the City of Los Angeles and is under the control of a five-member Board of Harbor Commissioners appointed by the Mayor and approved by the City Council.

A primary focus of California's larger ports, including the Ports of Los Angeles and Long Beach, is the inter-modal transfer of "containerized" cargo between ships, and railroads and heavy-duty trucks. Other ports mainly support the commercial fishing industry or military operations. It is also common to find a variety of different commercial enterprises operating on port land, such as airports, power plants, refineries, office complexes, retail development, and recycling operations. Ports may either directly operate terminals and other port facilities, or lease property to other entities.

A number of land-based port activities contribute to port emissions. Among these sources, the emissions from on-road heavy-duty diesel trucks are probably of greatest concern. Trucks enter and leave the ports to pick up or deliver containerized cargo. During these trips, trucks often form bottlenecks at key checkpoints, where they can idle for long periods as they slowly move forward. In addition, the trucks that service the ports tend to be disproportionately older vehicles with higher emissions.

Other major sources of emissions at the ports include diesel-powered locomotives and port-handling equipment. Locomotives, like heavy-duty trucks, transport cargo containers, while cargo-handling equipment is used to move containers around at the port terminals. Cargo-handling equipment includes yard trucks, rubber-tired gantry cranes, top-picks, side-picks, and forklifts.

Other emissions sources at the ports include light- and medium-duty vehicles, recreational marine vessels, diesel-powered transport refrigeration units, emergency/standby generators, petroleum handling and storage, maintenance and repair operations, and the variety of commercial enterprises located on port property. Descriptions of many of these sources, including heavy-duty diesel trucks, locomotives, and off-road diesel engines (which includes cargo-handling equipment), have been provided in other chapters in this document.

Currently, ARB does not have port-specific emission inventories that take into account all of the emissions that are attributable to port activities. However, the emissions from these activities are included in the regional emissions inventories for both on-road and off-road vehicles and in the stationary point source inventory. As mentioned later in this chapter, ARB staff plans to develop port-specific emission inventories to help ascertain the need for additional emission reductions to reduce the impacts on neighborhoods located near port operations.

2. Existing Control Programs for Commercial Marine Vessels

In contrast to other mobile sources, marine vessels are relatively recent newcomers to the air quality regulatory arena. However, within the last several years, action has been taken at both the international and national level to regulate emissions from commercial marine vessels. As explained below, these regulations are expected to achieve relatively modest emission reductions in California. Other programs established within California will result in reduced emissions. These, along with the national and international regulations, are described below.

a. International Maritime Organization Regulation

The International Maritime Organization established NOx standards in Annex VI to the International Convention for the Prevention of Pollution from Ships in 1997. The standards apply to diesel engines over 130 kW (174 hp) installed on new vessels. Standards for PM and hydrocarbons (HC) were not included in the regulation. As shown in Table II-F-2 below, the NOx standards range from 9.8 to 17 g/kW-hr, depending on the rated engine speed.

Table II-F-2
IMO NOx Standards

Engine Speed (rpm)	NOx (g/kW-hr)
$n < 130$	17.0
$130 \leq n < 2000$	$45n^{(-0.2)}$
$n \geq 2000$	9.8

Unfortunately, the IMO standards do not become enforceable until ratified by 15 countries that represent at least 50 percent of the gross tonnage of the world's merchant shipping. To date, this has not happened, and the United States is among the countries that have not ratified these standards. However, the standards are retroactive to January 1, 2000, if ratified, and engine manufacturers have generally produced IMO compliant engines since that date. The NOx emission reductions in California resulting from the IMO regulation are estimated to be modest. For example, the emission reductions resulting from the IMO regulation in the SCAB are estimated to be about 1.7 tons of NOx per day in 2010 for ocean-going ships (Arcadis, 1999).

b. U.S. EPA Standards

U.S. EPA promulgated final exhaust emission standards for new diesel engines over 37 kW (50 hp) on December 29, 1999 (64 FR 73301). The standards apply primarily to commercial harbor craft because the rule exempts recreational craft and the

large "category 3" engines (over 30 liters per cylinder) used by ocean-going vessels. The standards apply to combined NOx+ROG, PM, and CO. As shown in Table II-F-3 below, the specific standard and implementation date depends on the engine cylinder displacement. The NOx+ROG standards range from 7.2 to 11 g/kW-hr, the particulate matter standards range from 0.20 to 0.50 g/kW-hr, and the carbon monoxide standard is 5.0 g/kW-hr. The implementation dates range from 2004 to 2007, depending on engine size. The emission reductions from the federal rule are expected to be modest. The NOx standards will not achieve significant emission reductions until after 2010, since the standards only apply to new engines introduced beginning 2004-2007. In addition, the PM and CO standards are effectively caps in many cases, designed primarily to prevent increases.

Table II-F-3
U.S. EPA "Tier II" Marine Diesel Emission Standards

Engine Category	Displacement (liter/cyl)	Starting Date	NOx+THC (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)
1	$D < 0.9$	2005	7.5	0.40	5.0
	$0.9 \leq D < 1.2$	2004	7.2	0.30	5.0
	$1.2 \leq D < 2.5$	2004	7.2	0.20	5.0
	$2.5 \leq D < 5.0$	2007	7.2	0.20	5.0
2	$5 \leq D < 15$	2007	7.8	0.27	5.0
	$15 \leq D < 20$ ($P < 3300$ kW)	2007	8.7	0.50	5.0
	$15 \leq D < 20$ ($P \geq 3300$ kW)	2007	9.8	0.50	5.0
	$20 \leq D < 25$	2007	9.8	0.50	5.0
	$25 \leq D < 30$	2007	11.0	0.50	5.0

With regard to ocean-going ships, U.S. EPA issued a Notice of Proposed Rulemaking (NPRM) for new marine compression-ignition engines at or above 30 liters per cylinder (Category 3 engines) on May 29, 2002 (67 FR 37548). The proposed rule was developed as part of a settlement agreement with the Bluewater Network. Under the proposed rule, new category 3 engines built in 2004 or later on U.S.-flagged vessels would be subject to the IMO NOx standards established in 1997. In addition, the NPRM invites comments on whether foreign-flagged vessels should be subject to regulation. Under the settlement agreement, U.S. EPA was required to take final action by January 31, 2003. As currently drafted, the proposed rule is not expected to achieve significant emission reductions because manufacturers are already making IMO compliant engines. In addition, the vast majority of ocean-going ships calling on California's ports are foreign-flagged vessels.

c. South Coast District Credit Generation Rules

On May 11, 2001, the South Coast District adopted four rules designed to generate NOx emission reduction credits for its Regional Clean Air Incentives Market (RECLAIM) program. Two of these rules (Rules 1631 and 1632) apply to marine vessels. Rule 1631, Pilot Credit Generation Program for Marine Vessels, allows the generation of NOx credits through the voluntary replacement of diesel engines in harbor craft with new, cleaner engines. Several vessel owners have entered into the program to date, and the Rule was recently amended to also allow for the inclusion of remanufactured, as well as new engines.

Under Rule 1632, Pilot Credit Generation Program for Hotelling Operations, NOx credits can be generated when vessels near ports use electrical power supplied by fuel cells (normally, hotelling power is generated from onboard diesel generators). The Rule envisions that fuel cells would be located on a mobile barge that could move to individual vessels. To date, credits have not been generated under Rule 1632.

Minimal emission reductions will be generated from Rules 1631 and 1632 because any emission reductions achieved by these programs will be used to generate credits, allowing inland sources such as power plants to increase their emissions (less a 10 percent "discount" retired for the benefit of the environment).

d. Carl Moyer Program

The Carl Moyer Program is a heavy-duty diesel engine incentive program designed to obtain early emission reductions of NOx and particulate matter from heavy-duty vehicles and equipment, including marine vessels. Under the program, ARB has the responsibility to establish program guidelines, oversee the program, and report program benefits. Local air districts implement the program and work with the public and private participants. The program provides grants to pay for the extra cost of replacing existing diesel engines with lower-emission engines, including new cleaner diesels, or engines powered by alternative fuels or electricity. The marine vessel projects funded under the Carl Moyer Program are primarily repower projects where older diesel engines are replaced with cleaner diesel engines on fishing vessels and tugboats

From 1998-2000, marine vessel projects constituted about five percent of the overall emission reductions from the Carl Moyer Program. Specifically, during the 1998-1999 fiscal year, the Carl Moyer Program funded marine vessel projects that resulted in NOx emission reductions of 357 tons per year (tpy), and will continue to generate emission reductions over the estimated 20-year life of the projects. During the 1999-2000 fiscal year, additional marine vessel projects generated an additional 29 tpy NOx emission reductions.

3. Existing Control Programs for Port Dockside Activities

The land-side sources of emissions at the ports are virtually all subject to regulations at the federal, State, or local level. A brief summary of the existing control programs for some of the larger emissions sources is provided below. More detailed descriptions of most of these programs are found in other chapters in this document, as cited below. In addition, many ports have implemented additional emission reduction programs of their own, partly to mitigate emission increases due to port expansions. For example, ports have worked with their customers to introduce cleaner-burning fuels and add-on controls on cargo handling equipment and on-road trucks. Some ports have also provided opportunities to utilize electrical power as an alternative to diesel engines, where feasible.

a. On-Road Vehicles

ARB has regulated on-road vehicles since the 1960s, and continues to require progressively cleaner engines in new vehicles. ARB's standards for light- and medium-duty vehicles and standards for heavy-duty gasoline and diesel engines are described in Chapters A and B of this document.

b. Off-Road Equipment

Diesel-powered cargo handling equipment at the ports is generally subject to both U.S. EPA and ARB off-road compression-ignition (diesel) standards. Under a 1996 agreement, these regulations are harmonized to prevent two sets of standards. The U.S. EPA/ARB off-road equipment standards apply to new engines, and the emission standards vary with the size of the engine. A special situation applies to new engines used in construction and farming equipment less than 175 horsepower. California is preempted by federal law from regulating these engines, and they are only subject to U.S. EPA standards. However, most port handling equipment is above 175 horsepower. Chapter C describes the programs for off-road diesel equipment in more detail.

c. Locomotives

Like marine vessels, locomotives are relatively new to air quality regulatory requirements. The existing programs for locomotives are described in detail in Chapter H of this document.

d. Stationary Sources

The local air pollution control agencies have the primary authority to regulate emission sources from stationary sources. A variety of stationary sources are found on port property, including power plants, refineries, diesel generators, boilers, repair and maintenance facilities, and fuel storage and handling equipment. These sources are subject to local regulation, standards, permits, and new source review requirements.

4. Proposed Strategies

ARB is proposing the two measures listed in Table II-F-4 for the "commercial marine vessels and ports" component of the South Coast SIP. One of these measures controls emissions from marine vessels, while the other applies to land-side port sources.

The proposed measures include different regulatory options that would be pursued or evaluated for implementation. The measures provide flexibility, in part, due to the many uncertainties and challenges that are expected in developing programs for marine vessels. The marine industry is complex and has only recently been subject to air quality regulation. Information regarding duty cycles, emission factors, and the effectiveness of controls on marine engines is less definitive than for other mobile sources that have been subject to air quality regulations for many years. In addition, the proposed measures will require the cooperation and collaboration of multiple agencies on the local, State, national, and international level.

To provide a central point in California for the coordination and discussion of air quality strategies for the maritime community, ARB established the Maritime Air Quality Technical Working Group (Maritime Working Group). The Maritime Working Group is open to all interested parties and includes representatives from a variety of stakeholders, including the ports, commercial shipping companies, U.S. EPA, the local districts, maritime industry associations, and community and environmental groups. A key task of the Maritime Working Group will be to participate in the development of emission reduction strategies for commercial marine vessels and dockside equipment. The measures described below will impact maritime activities, and ARB envisions the Maritime Working Group providing critical input to the development of those measures. However, the Maritime Working Group is not intended to replace the public process necessary for development of regulatory proposals. The Maritime Working Group will instead enhance that process and provide a place where frank and open discussions can be conducted on maritime air quality impacts and emission reduction strategies.

Table II-F-4
Proposed Strategies for Commercial Marine Vessels and Ports

Strategies	Timeframe	
	Action	Implementation
*MARINE-1: Pursue Approaches to Clean Up the Existing Harbor Craft Fleet - Cleaner Engines and Fuels	2003 – 2005	2005
*MARINE-2: Pursue Approaches to Reduce Land-Based Port Emissions - Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls	2003 – 2005	2003 - 2010

*Renumbered from January 2003 draft

a. MARINE-1: Pursue Approaches to Clean Up the Existing Harbor Craft Fleet – Cleaner Engines and Fuels*

Time Frame: Adopt 2003-2005; Implement 2005

Responsible Agency: ARB

Proposed Strategy:

Under this measure, ARB is proposing to reduce NOx, ROG, and PM emissions from existing "in-use" harbor craft engines. The proposed measure includes a number of options, including: (1) the use of add-on control equipment; (2) repowering of existing vessels or early introduction of new vessels; and (3) cleaner fuels such as California on-road low sulfur diesel, emulsified diesel fuels, biodiesel, compressed natural gas (CNG), or liquefied natural gas (LNG). Due to the diversity within the harbor craft category, specific emission reduction proposals may vary with the type of vessels, industry, or other factors. Several strategies would be evaluated to determine the most effective means to reduce emissions from in-use engines. These are described below.

Add-On Control Equipment: Dramatic reductions in both NOx and PM emissions can be achieved with exhaust treatment devices. ARB's Diesel Risk Reduction Plan (RRP) anticipates PM emission reductions from harbor craft. The reductions in the RRP are expected to result from the use of diesel particulate filters (DPFs). DPFs trap and oxidize PM using the heat of the engine's exhaust, along with a catalyst (passive systems) or supplemental heat source (active systems). DPFs are currently used in a variety of on-road and off-road mobile source applications. While their use in marine engines is currently limited, ARB believes that they can be used in many marine applications. To evaluate the effectiveness of installing traps on marine engines, ARB is providing funding to the U.S. Navy to include an evaluation of DPFs in a study they are initiating to evaluate different in-use emissions control technologies on marine military craft. DPFs can achieve PM emission reductions of 90 percent or more, along with similar reductions in HC and CO. DPFs require the use of low sulfur fuel and, in the case of passive systems, engine duty cycles that generate exhaust temperatures high enough to effectively oxidize trapped PM.

Another option for PM control is diesel oxidation catalysts (DOCs). DOCs reduce the soluble organic fraction of diesel PM, which includes many of diesel PM's toxic components. DOCs typically result in overall PM control efficiencies of about 25 percent, along with significant reductions in HC and CO.

* Renumbered from January 2003 draft. This measure was numbered MARINE-2 in the January 2003 document.

NOx emissions can be controlled from existing engines by the use of SCR. SCR is currently used in over 50 marine vessels of various types, primarily in Europe. SCR reduces NOx to nitrogen and water through the use of a catalyst and a reducing agent (e.g., urea solution). SCR can be used in many marine applications to achieve NOx emission reductions of 65-90 percent.

Other NOx exhaust treatment control options include lean-NOx catalysts and rapidly developing technologies such as NOx adsorbers and plasma-catalyst systems. In addition, while not exhaust treatment devices, controls such as water injection, injection timing retard, exhaust gas recirculation, and humid air motor (HAM) technology can achieve significant NOx reductions from existing engines. NOx reductions can also be achieved by more significant mechanical changes to the engine, particularly during rebuilding.

In addition, there is an emerging trend in the development of add-on control systems that can control both PM and NOx. For example, combination systems incorporating both DPFs and SCR, or DPFs and NOx adsorbers. Another option to control both NOx and PM is the combination of add-on controls with cleaner fuel options (as described below). Examples of this strategy include the use of emulsified fuels and oxidation catalysts, and biodiesel in combination with NOx control strategies.

Cleaner New Engines: Replacement of older engines is another option to reduce emissions from the existing fleet. We will investigate additional programs to encourage replacement of older engines with cleaner new models. In addition, we will investigate incentives to accelerate the introduction of new cleaner vessels in the district, which will be subject to U.S. EPA's harbor craft standards beginning 2004 to 2007.

Cleaner Burning Fuels: Harbor craft can use off-road diesel fuel with much higher sulfur and aromatics levels compared to California on-road lower sulfur fuel. In practice, harbor craft use federal off-road diesel, federal on-road diesel, and California on-road diesel. The extent to which each of these fuels are used is not known. However, ARB estimates that the industry is primarily using the federal off-road and federal on-road diesel. Both of these fuels have higher levels of aromatics compared to California on-road diesel and result in higher NOx and PM emissions. Sulfur oxides (SOx) emissions are a function of the sulfur content of the fuel, and federal off-road fuel may be as high as 5,000 ppm sulfur, compared to the 500 ppm requirement for federal on-road and California on-road diesel.

The easiest cleaner fuel option may be to switch to California on-road diesel fuel which ARB anticipates will be reduced to 15 ppm (low sulfur diesel fuel) by 2007. Under AB 2135 (passed into law in August 2000), diesel ferries with a capacity to hold 75 or more passengers will be required to use California on-road diesel fuel beginning

January 1, 2003. Some ferry operations are already beginning to use California on-road diesel. The use of California on-road diesel will result in reductions in NOx, SOx, and PM, compared to federal on-road and off-road diesel. Specifically, reductions in PM and NOx compared to federal on-road diesel would be about 25 percent and 7 percent, respectively. Reductions compared to off-road diesel would be even higher and would result in significant SOx reductions. In addition, the California 15 ppm sulfur diesel fuel has the advantage of enabling more efficient use of exhaust treatment devices such as DPFs.

More significant reductions in PM and NOx could be achieved with the use of water/diesel emulsions. Test data for one product (PuriNox) demonstrate NOx reductions of up to 14 percent and PM reductions of up to 63 percent, compared to standard California on-road diesel, depending on the engine and application.

Biodiesel is another option. Biodiesel is derived from vegetable oils or recycled restaurant grease, and can be mixed with diesel fuel or used straight. Pure biodiesel can reduce PM emissions by over 50 percent. However, it generally also results in an increase in NOx emissions. For this reason, it is best used along with NOx control strategies. Biodiesel manufacturers are also working on additives that can be used to prevent the increase in NOx emissions.

Use of compressed or liquefied natural gas or diesel/CNG dual fuel applications can result in significant reductions in NOx and particulate emissions. The resulting emission reductions vary widely with the specific application and the ratio of diesel to CNG for dual fuel applications. In addition, the use of these fuels will require more extensive vessel and engine modifications compared to other clean fuel options.

Table II-F-5 summarizes the estimated emission reductions from this measure, based on a 25 percent reduction in NOx, PM, and ROG phased in over three years, beginning in 2006. The reductions also reflect the anticipated implementation of measure MARINE-1. The emission reduction strategies necessary to achieve these reductions will vary with the vessel type or industry affected, and any emission reduction program would likely not require the use of any given technology, leaving it up to the vessel owner to chose the technology that best fits the particular vessel.

Table II-F-5
MARINE-1: Pursue Approaches to Clean Up the Existing Harbor Craft Fleet – Cleaner Engines and Fuels
Estimated Emission Reductions in the South Coast Air Basin
(Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	Not Applicable	0.03	0.1	0.1	0.05
NOx	Not Applicable	0.09	2.7	2.7	2.2
PM10	Not Applicable	0.02	0.05	0.05	0.02

SIP Commitment for Measure MARINE-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2005. The measure as proposed to the Board will, at a minimum, achieve 0.1 tpd of ROG reductions and 2.7 tpd of NOx reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. MARINE-2: Pursue Approaches to Reduce Land-Based Port Emissions– Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls*

Time Frame: Adopt 2003-2005; Implement 2003-2010

Responsible Agency: ARB

Proposed Strategy:

As mentioned previously, a number of land-based on- and off-road sources contribute to port emissions. These sources include: (1) stationary sources such as refineries and repair and maintenance facilities; (2) portable equipment such as dredges; (3) off-road mobile sources such as cargo handling equipment and locomotives; and (4) on-road mobile sources such as heavy-duty trucks.

On-road heavy-duty trucks are a particular concern due to the heavy volume visiting California's larger commercial ports, such as the Ports of Los Angeles and Long Beach. It is not unusual to have numerous trucks idling simultaneously as they wait for their cargo to be loaded or unloaded. The trucks then inch forward at very slow speeds as the line moves. The diesel exhaust emissions from these trucks pose a serious air quality and health threat, particularly to those individuals that work at the port or live in nearby residences.

While the emissions from land-side port sources are included in the regional emission inventories, port-specific inventories are not currently available. This makes it difficult to assess the impacts of control programs on port emissions and the communities surrounding the ports.

ARB staff is proposing a broad-based measure focusing specifically on California's ports because of the heavy concentration of emission sources at the ports, the dramatic growth in trade expected at some ports, and their proximity to residential areas. In addition, ports have a unique ability to assist in environmental programs within their jurisdiction, and many have been actively involved in evaluating and implementing emission reduction strategies to reduce their emissions.

This measure outlines a three-step process for addressing port land-side emissions. First, port-specific inventories would be created for California ports. ARB would work closely with the ports, the local districts, the regional transportation agencies and U.S. EPA to develop an inventory model that would encompass the broad range of

* Renumbered from January 2003 draft. This measure was numbered MARINE-4 in the January 2003 document.

emissions that occur in the ports. This work has already begun for the Ports of Los Angeles and Long Beach, and results are expected in 2003. Second, once the inventories are prepared, ARB staff would assess the impacts of existing and planned control measures on port emissions, and determine the additional port-specific emission reduction strategies needed to help attain regional air quality goals and to protect the health of communities near the ports. Strategies to be evaluated may include early introduction of cleaner new vehicles and equipment, expanded use of alternative fuels, repowering with cleaner new engines, add-on control equipment, electrification of diesel equipment, public education programs, and operational changes such as idling limits.

The implementation timeline for this measure is outlined in Table II-F-6.

Table II-F-6
MARINE-2: Pursue Approaches to Reduce Land-Based Emissions at Ports
Specific Strategies

Strategies	Timeframe	
	Action	Implementation
Create port-specific emission inventories	2003	2003
Assess impacts of existing and planned measures to determine additional emission reductions that are necessary	2003 – 2005	2003 – 2005
Identify and implement port-specific measures	2003 – 2005	2005 – 2010

The emission reductions from this measure are difficult to estimate since port-specific emissions inventories are not yet available. For this reason, we are simply estimating that proposals developed under this measure will achieve a small but measurable (0.1 tpd) reduction in NOx, PM, and ROG emissions beyond existing and proposed SIP measures beginning in 2005. It is expected that further reductions will be achieved as the proposals in this measure are more fully developed over time.

SIP Commitment for Measure MARINE-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2005. The measure as proposed to the Board will, at a minimum, achieve 0.1 tpd of ROG reductions and 0.1 tpd of NOx reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

5. Long-Term Advanced Technologies Measures

a. Federal Responsibility

i. Set More Stringent Emission Standards for New Harbor Craft and Ocean-Going Ships

Time Frame: Adopt 2003-2004; Implement 2008-2010

Responsible Agency: U.S. EPA

Proposed Strategy:

As discussed previously, the IMO and U.S. EPA have adopted exhaust emission standards for new marine diesel engines. However, the current standards in these regulations will not achieve the emission reductions possible with currently available emission control technology. In addition, the emission reductions achieved by these standards are expected to be largely negated in California due to growth in the marine shipping industry.

ARB has identified three regulatory avenues that U.S. EPA could pursue to achieve additional emission reductions: 1) pursue more stringent IMO standards for all commercial marine vessels over 130 kW (174 hp), 2) adopt more stringent U.S. EPA standards for harbor craft over 37 kW (50 hp), and 3) adopt new U.S. EPA standards for U.S. and foreign-flagged ocean-going ships. In all cases, ARB is proposing new engine standards for NOx based on the federal Tier 2 and Tier 3 off-road standards, and PM standards based on state-of-the-art technology.

Given the importance of regulating emissions from ocean-going ships, both in California and other U.S. states, ARB also encourages U.S. EPA to work to identify innovative strategies in addition to traditional approaches to achieving emission reduction targets. For example, ARB encourages U.S. EPA to work with shipping companies to develop MOUs that would encourage faster turnover of older ships or provide an incentive for shipping companies to send their cleaner ships to ports with greater air pollution problems. ARB also suggests that U.S. EPA work with manufacturers of category 3 engines (i.e., large engines used on ocean-going ships). They could discuss agreements that would help accelerate the turnover of older ships, encourage the development of retrofit kits that could be installed (especially during rebuilding operations) to lower emissions from existing engines, and the manufacture of new engines exceeding IMO requirements.

IMO Standards: This concept calls on U.S. EPA to work with the IMO to seek future effective standards for NOx+HC and PM. The current IMO standards only apply to NOx, and range from 9.8 to 17 g/kW-hr, based on engine speed. These standards would achieve minimal emission reductions in California, especially from large cargo ships with slow speed two-stroke engines subject to the maximum 17 g/kW-hr standard.

ARB suggests future effective NOx+HC standards similar to the federal Tier 2 and Tier 3 off-road future-effective standards, which range from 4 to 6.4 g/kW-hr. Depending on the engine design, these standards can be met using a variety of technologies (alone or in combination), including: advanced fuel injection controls (common rail injection systems), combustion chamber design changes, injection timing retard, turbocharging and aftercooling, exhaust gas recirculation, selective catalytic reduction (SCR), direct water injection, and humid air motor (HAM) technology.

For PM, ARB recommends considering a standard of 0.03 g/kw-hr for four-stroke engines (harbor craft), and 0.10 g/kW-hr for two-stroke, slow speed engines (ocean-going ships). For four-stroke harbor craft engines with access to low sulfur (15 ppm) diesel, this standard could be met by many engines with the use of catalyzed diesel particulate filters (DPFs). For other harbor craft and ocean-going ships with large two-stroke, slow speed engines, other technologies could be utilized (in some cases in combination or along with alternative fuels). These technologies include: active/noncatalyzed DPFs, fuel-borne catalysts, diesel oxidation catalysts, and advanced fuel injection controls (common rail injection systems). Manufacturers of large slow-speed two-stroke engines are also investigating additional PM techniques, such as specialized scrubber designs.

Although the proposed limits would be challenging to manufacturers, they are still higher than the 2007 standards for on-road heavy-duty diesel trucks at about 0.2 g/hp-hr NOx and 0.01 g/hp-hr PM. ARB expects implementation could begin in 2010.

National Harbor Craft Standards: This concept would rely upon U.S. EPA to develop another tier of more stringent standards for new harbor craft engines. As suggested for the IMO standards, ARB recommends future effective NOx+HC standards similar to the federal Tier 2 and Tier 3 off-road future-effective standards, which range from 4 to 6 g/kW-hr, based on engine size. For PM, ARB recommends a standard of 0.03 g/kW-hr. Implementation could begin three years after implementation of the current 2004-2007 standards (from 2007-2010).

U.S. EPA Standards for Ocean-Going Vessels: As mentioned previously, on May 29, 2002, U.S. EPA issued a Notice of Proposed Rulemaking (NPRM) for new marine compression-ignition engines at or above 30 liters per cylinder (67 FR 37548). Under the proposed rule, new category 3 engines built in 2004 or later on U.S.-flagged

vessels would be subject to the IMO NOx standards adopted in 1997. In addition, the NPRM invites comments on whether foreign-flagged vessels should be subject to regulation. Under the settlement agreement, U.S. EPA was required to take final action by January 31, 2003.

Unfortunately, the proposed rule is not expected to achieve significant emission reductions because manufacturers are already making IMO compliant engines. In addition, the vast majority of ocean-going ships calling on California's ports are foreign-flagged vessels. Therefore, consistent with the first two proposals, this measure relies upon U.S. EPA to adopt NOx+HC standards based on the federal Tier 2 and Tier 3 off-road diesel standards for NOx HC (4 to 6.4 g NOx/kW-hr), and a 0.10 g/kW-hr standard for PM. Under the proposed measure, both foreign and U.S.-flagged vessels would be subject to the proposed standards beginning in 2008.

The estimated emission reductions from this strategy are shown in Table II-F-7. The estimate reflects adoption of U.S. EPA standards for both harbor craft and ocean-going vessels. The estimated reductions for ROG assume that the PM and NOx control strategies utilized to meet the proposed standards will also result in 90 percent control of ROG emissions. Significant further reductions beyond 2020 would also occur as new engines continue to replace existing vessels.

Table II-F-7
Set More Stringent Emission Standards for
New Harbor Craft and Ocean-Going Ships
Estimated Emission Reductions in the South Coast Air Basin
(Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	Not Applicable	Not Applicable	Not Applicable	0.4	3.3
NOx	Not Applicable	Not Applicable	Not Applicable	3.1	29.1
PM10	Not Applicable	Not Applicable	Not Applicable	0.3	2.8

ii. Pursue Approaches to Clean Up the Existing Ocean-Going Ship Fleet – Cleaner Fuels, Incentives for Cleaner Ships, Smoke [Opacity] Limits

Time Frame: Adopt 2003-2005; Implement 2005-2010

Responsible Agency: U.S. EPA

Proposed Strategy:

Under this concept, U.S. EPA would reduce in-use emissions from ocean-going vessels. We expect that U.S. EPA would work closely with the maritime industry, ARB, the local districts, and other stakeholders on this measure. This collaboration is particularly critical for this measure since the majority of ocean-going ships frequenting California coastal waters are foreign-flagged vessels. Implementation of measures for ocean-going vessels may even require the formation of a national or international coalition, particularly for some of the proposed federal incentive programs (which would be more effective if implemented on a national or West Coast basis). ARB staff believes the options under this measure could be implemented in the 2005-2010 timeframe.

As a starting point, ARB staff has identified five emission reduction strategies that U.S. EPA should evaluate for applicability to ocean-going ships, including foreign-flagged vessels. The five proposals ARB has identified are:

- Operational controls
- Cleaner fuels in California coastal waters
- Incentive programs to encourage cleaner vessels
- Opacity limits within California coastal waters
- Cold Ironing (Electrical power for hotelling)

Operational Controls: Operational controls can provide emission reductions through a broad array of potential measures, including speed controls, idling time limits, and other changes to vessel activities. For example, U.S. EPA assisted in the development of a voluntary speed reduction demonstration project that was initiated in May 2001 at the ports of Los Angeles and Long Beach. The Memorandum of Understanding (MOU) that initiated the project calls for ocean-going vessels entering or leaving the ports to slow to 12 knots within 20 nautical miles of the ports. The speed reduction results in lower engine speeds, power, and associated NOx emissions. Upon full implementation, the MOU is expected to result in an emission reduction of two to four tons of NOx per day in the South Coast Air Basin.

Cleaner Fuels: Under this option, ocean-going vessels would use cleaner burning fuels in California coastal waters. Currently, most ocean-going ships visiting the ports of Los Angeles and Long Beach use bunker fuels (such as intermediate fuel oil (IFO) 180, or IFO 380) with an average sulfur content of about 2.8 percent (28,000 ppm). On-board generators use marine diesel fuel (also called marine gas oil or MGO) or bunker fuel, depending on the vessel. Under this option, several opportunities exist to use cleaner fuels, such as requiring generators to run on California on-road diesel fuel in California coastal waters. It may also be possible for propulsion engines to switch to California on-road diesel fuel (or standard MGO, or lower viscosity and/or lower sulfur bunker fuel). Currently, many ocean-going ships switch to MGO for maneuvering at or near the ports, so it may be possible to extend the use of MGO to California coastal waters. The PM and NOx emission reductions achieved by switching from bunker fuel to MGO would be expected to be 44 percent and 10 percent, respectively. Even further reductions would be expected with the use of California on-road diesel fuel. For example, the PM and NOx emission reductions achieved by switching from MGO to California on-road diesel would be expected to be at least 25 percent and 7 percent, respectively (the reductions expected by switching from U.S. EPA on-road to California on-road diesel). There would also be a dramatic reduction in the sulfur content of the fuel and associated reductions in SOx emissions. For example, California on-road diesel currently averages about 140 ppm sulfur, compared to 28,000 ppm for bunker fuels. The introduction of cleaner, lower sulfur fuels would also enable the use of a wider range of control technologies to be used on either the propulsion or auxiliary engines.

International availability of the cleaner fuels mentioned above and separate fuel storage options will be issues that will need to be addressed in considering these options. However, other countries have successfully taken steps to encourage the use of lower sulfur fuels. At a minimum, U.S. EPA could work with the International Maritime Administration to create a sulfur emission control area (SECA) under the existing provisions of MARPOL Annex VI. An existing SECA covering the Baltic Sea limits sulfur content to 1.5 percent.

***Economic Incentive Programs that Reward Cleaner Ships*:** Economic incentive programs could be implemented to encourage ocean-going vessel owners to reduce the emissions from their ships. Under this option, a full evaluation of potential incentive programs would be explored – both existing programs and new programs that would be identified and evaluated with help from the maritime industry. Efforts would be directed to identifying the ships that will produce the greatest reductions for the dollars spent. Federal incentive programs could include programs which help finance the incremental cost of purchasing cleaner engines (compared to standard replacement engines) or installing pollution control equipment.

Another option would be a differential port fee structure under which cleaner vessels are charged lower fees. For example, in Sweden, several ports have implemented a port fee system that offers discounts for ships emitting lower NOx emissions and using lower sulfur bunker fuels. The loss in revenue from the discounted fees is compensated for by slight increases charged to higher emitting ships. Finnish and Norwegian ports have proposed or implemented similar programs which reduce port fees or taxes for cleaner vessels.

Federal incentive programs would have a greater degree of success if implemented throughout the West Coast or nationally since most of the emissions from ocean-going ships will be emitted beyond California's boundaries, and the cost of emissions control is high for these very large diesel engines. Therefore, participation by a national coalition may be necessary in implementing an incentive program for ocean-going ships.

Currently, ARB staff is working with U.S. EPA, the Maritime Administration, and several other regulatory agencies, shipping operators and port representatives to provide funding for demonstration projects that will test emission control technologies on ocean-going ships. It is expected that successful demonstration projects will support federal economic incentive programs by providing information on the feasibility of currently available technologies.

Opacity Requirement for Vessels in California Coastal Waters: Under this option, U.S. EPA would evaluate restrictions on opacity for vessels in California coastal waters. As an example, Alaska has established a requirement that cruise ships operating within 3 miles of the coastline cannot release emissions that reduce visibility by more than 20 percent (18 Alaska Administrative Code 50.070). To meet this requirement, cruise lines have employed a variety of techniques, including the use of fuel additives, lower viscosity bunker fuel (IFO 180), operational changes, and increased maintenance schedules. Cruise lines have also installed cleaner engines on some ships. For example, some cruise lines have installed combinations of both diesel electric and gas turbine-electric engines in their ships. With this arrangement, the ship owners can operate without visible emissions by using the gas turbine alone, or operating the diesel piston engines at constant high load and letting the gas turbine handle the variations. Engine manufacturers have also responded to the challenge by manufacturing new "smokeless" diesel engines using common-rail fuel injection.1

Depending on the type of opacity limits ultimately proposed, vessel operators may be able to use some of the same techniques used by the cruise lines to meet Alaska's opacity limit. In addition, clean fuel options such as those discussed previously in this chapter may be feasible.

1 Marine News, Wartsila Corporation, October 2001

Cold Ironing: Marine vessels typically run diesel generators when at rest in port (hotelling) to generate electrical power for lights and equipment on board. These diesel generators are a significant contributor to diesel PM and NOx emissions at major ports in California. Under this proposed option, ships would use dockside electrical power (cold ironing) during hotelling. For dockside electrical power, the power plant emissions associated with providing dockside power would be a fraction of the emissions from a marine auxiliary engine. For example, the NOx emissions per megawatt-hour from a diesel generator would be roughly 100 times greater than the emissions from power plants supplying electricity to California's utilities.

Although there are technical challenges associated with providing cold ironing for ships, this process is currently being used by Princess Cruise ships that dock in Juneau, Alaska. The Alaska Electric Light and Power Company (AEL&P) and Princess Cruises joined forces to construct a shore-side power station that provides up to 13 megawatts of hydroelectric power produced by AEL&P. The Port of Los Angeles is also investigating this option with several Asian cargo ship operators and the Los Angeles Department of Water and Power.

The estimated emission reductions from this concept are shown in Table II-F-8. The emission reductions reflect a 10 percent reduction in NOx, PM10, and ROG beginning in 2005 and a 25-40 percent reduction in these pollutants beginning in 2010. It is expected that these emission reductions would be achieved by implementing several of the options discussed above. The reductions also reflect the anticipated implementation of the new emission standard strategy described above.

Table II-F-8
Pursue Approaches to Clean Up the Existing Ocean-Going Ship Fleet
Estimated Emission Reductions in the South Coast Air Basin
(Summer Planning, tpd)

Pollutant	2005	2006 (Annual Average)	2008	2010	2020
ROG	0.4	0.4	0.4	1.0-1.6	0.7-1.1
NOx	4.1	4.2	4.5	11-17.6	10.2-16.4
PM10	0.3	0.3	0.4	0.8-1.3	0.6-0.9

CHAPTER G

Aircraft and Airports

CHAPTER G. AIRCRAFT AND AIRPORTS

This chapter discusses aircraft as well as other sources that are located at or access the airport—ground service equipment (GSE) and ground access vehicles. Turboprops, smaller business jet aircraft, and piston engine aircraft, which include all propeller driven aircraft, make up only a small percentage of aircraft emissions and are not addressed in this chapter.

The primary pollutants emitted by jet aircraft engines are ROG, NOx, CO, PM10, and CO2. Jet aircraft also emit a host of toxic compounds, including 1,3-butadiene and formaldehyde.

1. Category Description

The emission sources of concern at the airport are divided into three categories: jet aircraft, ground service equipment, and ground access vehicles.

a. Jet Aircraft

Jet aircraft are a growing source of emissions at California's commercial airports due to the large increase in air travel. Jet aircraft are long-lived, with the average economic life of a passenger aircraft on the order of 28 years and up to 40 years for all-cargo aircraft. (Cargo aircraft last longer because they undergo fewer landing and takeoff cycles and accumulate less annual operational hours than passenger jets.) The long lives of these emission sources underscore the need for more stringent emission standards for jet aircraft.

Like any motorized vehicle, aircraft produce emissions as long as the engine is running or idling. However, the aircraft operations of most concern for a nonattainment area are those that occur during takeoff, landing, approach, climb-out, and taxiing.

Fuel is a major operating expense for airlines; therefore, airlines have and continue to put a high priority on fuel-efficient engines. Since 1975, on a per passenger mile basis, the airline industry has experienced 75 and 20 percent reductions in ROG and CO2 emissions, respectively, due to increased fuel efficiency. However, NOx emissions from new engines introduced into service have been declining by only about one percent per year. This is due to the tradeoff that results when temperature and pressure in the engine's combustion chamber are increased to enhance fuel efficiency at the expense of NOx emissions.

The National Aeronautics and Space Administration (NASA) conducts most of the original research and development work on new turbine engine technology and has

a multi-year program to develop lower emitting jet engines. One target is to introduce an engine that can emit 70 percent less NOx than the current International Civil Aviation Organization (ICAO) standard. Aircraft engine manufacturers have also been working to develop engines with lower NOx emissions while improving fuel efficiency. At issue is whether lower NOx engines will be available and introduced into the fleet in sufficient quantities to offset the emissions associated with the projected increase in air travel.

New noise standards that have been approved by ICAO but not yet promulgated by the Federal Aviation Administration (FAA) could also increase NOx emissions; however, advanced engine combustor technologies could reduce noise and future NOx emissions.

As with automobiles and trucks, most aircraft can be ordered with different models of aircraft engines, each potentially having different emission levels. When ordering an aircraft, an air carrier's first consideration is to ensure the engine matches the operational requirements intended for the aircraft. In addition, previous contractual agreements or desire for fleet consistency can influence selection of a particular engine model. A national aircraft emissions reduction stakeholders group has discussed various potential aircraft emission reduction measures; one would be to have air carriers commit to order new aircraft with engines having the lowest emissions certified for that aircraft consistent with its intended mission. Further evaluation could help determine the full extent of opportunities for achieving lower NOx emissions through such purchases and identify potential pollutant tradeoffs that could occur.

Some airports have also been exploring means for reducing aircraft emissions. Airports in Zurich, Switzerland and Boston, Massachusetts are pursing revenue-neutral emission based landing fees that provide lower emission fees for lower emitting aircraft and, conversely, higher fees for higher emitting aircraft. Such fee systems are intended to provide air carriers an incentive to purchase and operate aircraft with lower emission engines.

As noted above, the aircraft emissions of most concern to State Implementation Plans are those that occur when aircraft are operating at an airport or during takeoff and approach. Thus, ground-based operational practices provide potential opportunities for emission reductions. These include having aircraft reduce multi-engine taxiing on the runway, having aircraft use the electricity at the gates instead of the auxiliary power unit on the aircraft to provide power while parked at the terminal, and having the airport provide efficient taxiway configurations to reduce aircraft congestion. There are a number of operational measures in the "tool box," but many are totally dependent on aircraft pilot judgment as to what is safe and feasible in each particular situation. Nevertheless, these strategies have resulted in meaningful and cost-effective emission reductions in the past and could potentially provide more.

Aircraft engine exhaust also contains PM; however there are limited data on the specific components of the PM in the exhaust at this time. Although jet fuel is chemically similar to diesel fuel, ARB has not been able to determine whether aircraft exhaust PM has similar toxicity as diesel exhaust PM. The highest PM emission rates occur during high power operations of takeoff and climb-out when there is high fuel consumption. Because these operations occur at or near airports, communities located adjacent to airports have raised concerns about the potential risk from exposure to toxic compounds.

b. Ground Service Equipment

Ground service equipment (GSE) are specialized off-road equipment that perform a variety of functions in support of aircraft operations including aircraft towing, maintenance, fueling, baggage handling, cargo loading, and food service. They are largely uncontrolled with typically long vehicle and equipment life. To reduce costs, airlines frequently rebuild GSE engines, thereby extending the life of the older, higher polluting units, rather than purchase new, lower polluting equipment. Engine deterioration, along with aging equipment and parts, increases ROG, NOx, and PM emissions. Another contributor to high GSE ROG and diesel PM emissions is extended engine idling. GSE use is primarily a function of the number of aircraft takeoffs and landing. To the extent that airline traffic and total annual passengers increase, GSE equipment and usage will also increase – as will emissions.

c. Ground Access Vehicles

Ground access vehicles move airport passengers, employees, and goods to, from, and around the airport. These vehicles include private passenger vehicles, airport shuttles, taxis, hotel shuttles, parking shuttles, cargo vehicles, and tenant and employee vehicles.

Ground access emissions at airports are not accounted for separately in ARB emission inventory. Rather, these emissions are included within other motor vehicle emission source categories. Ground access emissions vary by airport and surrounding land uses. However, traffic-related NOx emissions can be as high as 50 percent of total airport-related NOx emissions and ROG as much as 80 percent of the total.

Strategies to reduce emissions from ground access vehicles take several different forms because of the variety and ownership of the vehicles involved. Following are examples of strategies to reduce ground access vehicle emissions that are (or could be) implemented by California airport operators.

<u>Reduce Emissions from Airport Vehicles</u>: Some airport operators are reducing emissions from their own vehicle fleets, through the acquisition of either ZEVs or

alternate fuel vehicles. A number of airports are already moving in this direction with CNG and LNG shuttle buses. Another option is purchase of ULEV or SULEV models where available when replacing fleet vehicles. The airport could also reduce diesel PM emissions by retrofitting diesel vehicles with PM filters or to purchase new diesel vehicles equipped with a PM filter.

Provide Alternative Fuel/Electric Infrastructure: By providing fueling and charging infrastructure, airports can facilitate use of ZEVs and alternative-fuel vehicles. Some examples include alternate fuel dispensers for airport owned vehicles, availability of alternate fueling facilities for non-airport vehicle operators at consolidated facilities or at downtown airport shuttle terminals, or people movers to reduce vehicle trips. The magnitude of associated emission reductions would be dependent on the exact nature of the infrastructure.

Transportation Options: Consolidating and streamlining on-airport vehicle travel can reduce emissions and decrease public exposure to toxics at terminals. For vehicles not owned by the airport, there is a mix of fee adjustment, incentive, and public education programs. Because airports vary in the way they operate and their specific operating authority, programs would need to be tailored to each airport's specific situation.

Cleanest Vehicles: Airports could require shuttle and taxi fleet operators to operate fleets with progressively higher percentages of new vehicles or those meeting optional low emission standards, such as ULEV or SULEV vehicles. Another program would have airports that have the authority charge variable access fees consistent with the emissions level of the vehicle. The overall objective would be to require or provide incentives to fleet operators to reduce emissions at a faster rate than would occur with "normal" fleet turnover or company purchase policies.

Viable Alternative Ground Transportation Choices: In order to reduce off-airport vehicle emissions, airports could provide travelers with more viable ground transportation options, and also provide commute programs for airport employees.

The airports could promote airport and airport tenant employee commute programs, including lower parking rates and priority parking for carpoolers, an airport-sponsored integrated employee clean fuel shuttle system, an employees' carpool and vanpool matching system, and subsidized or free employee transit and shuttle fares.

Offsite park and ride or "fly away" lots also can reduce vehicle trips to the airport and relieve airport congestion and localized CO emissions. The Van Nuys FlyAway terminal checks people in and then express buses them to the main terminal at Los Angeles International Airport. The magnitude of the emission reductions from these facilities would depend on their location, number of trips offset, and the emission

characteristics of airport shuttles. The success of such measures would also be highly dependent on a close collaboration with local and regional transportation planning agencies and transit authorities. Long range transit service plans for the region would need to consider providing adequate service to the airport.

Public Education: Finally, public education is a critical component to any airport transportation program. The public needs to be fully aware of the various modes of travel available to the airport and the economic and environmental benefits of one mode versus another.

2. Emission Trends[1]

The baseline and projected emissions from aircraft and ground support equipment are shown in Table II-G-1. Between 1980 and 1999, commercial air passengers increased by about 125 percent nationally and more than doubled in California. Air cargo tonnage is growing more rapidly than air passengers, at nearly six percent per year, a rate that is expected to continue through 2012.

Table II-G-1
Baseline Emissions for Aircraft/Airports
(South Coast, Summer Planning, tpd)

Pollutant Source Category	2000	2010	2020
ROG			
Aircraft	**6.1**	**5.4**	**7.1**
-Commercial	1.9	2.8	4.4
-Military	3.5	1.9	1.9
-General Aviation	0.7	0.7	0.8
Ground Service Equipment	**1.0**	**0.5**	**NA**
NOx			
Aircraft	**23.1**	**32.1**	**40.1**
-Commercial	21.7	29.2	37.3
-Military	1.3	2.8	2.8
-General Aviation	0.1	0.1	0.1
Ground Service Equipment	**6.9**	**3.2**	**NA**

1 The emissions estimates provided do not reflect the impact of events on September 11, 2001. Air travel dropped dramatically in the short term and nearly all air carriers experienced severe financial setbacks. Air carriers have responded by reducing the number of flights, retiring older, less efficient aircraft, and generally scaling back operations in an effort to cut expenses. Air travel in the long term is expected to increase, although whether air travel returns to pre-September 11 growth rates or lower-than-earlier-projected rates remains to be seen.

Over the past 25 years, national commercial aircraft emissions increased 25 percent for ROG and 66 percent for NOx. In California, aircraft emissions of ROG plus NOx in 2000 were about two percent of all mobile source ROG plus NOx emissions. However, by 2020, this percentage is expected to more than double. Newer (and cleaner) aircraft engines continue to be introduced into the fleet. Nevertheless, without additional measures, emission "benefits" will be more than offset by the increase in the number of aircraft and flights needed to accommodate an estimated 75 percent increase in air passengers and more than a doubling of air cargo tonnage by 2020.

Military aircraft also represent a significant source of emissions, although trends show that these emissions are expected to remain relatively constant in the foreseeable future.

ARB does not currently have detailed emission inventory data by source type at individual airports. Data from airport master plans and expansion project environmental documents indicate that on-airport stationary and area source emissions are typically one to three percent of total on-airport emissions, excluding aircraft maintenance emissions. If aircraft maintenance operations are conducted at an airport, then stationary and area source emissions can be up to five to six percent of total on-airport emissions.

One of the future mechanisms to reduce the growth in aircraft emissions is to establish alternative travel options that use cleaner technology. The planned California high-speed train system offers the potential to significantly reduce emissions across the State, including San Francisco, Sacramento, San Joaquin Valley, South Coast, and San Diego. A high-speed train system would provide air passengers with an alternative to interstate or local air flights in California as well as connecting links to major airports and rail systems.

The California High-Speed Rail Authority, a nine-member appointed board, is the State entity responsible for planning, constructing, and operating a 700 mile high-speed train system serving all of the State's metropolitan areas by 2020. Recently, the Legislature eliminated the Authority's December 31, 2003 sunset date; included in the 2002-2003 State budget is $7 million dollars in funding for the first step of the system – completion of a program-level State and federal environmental review. The final environmental document will be completed by December 2003.

Governor Davis signed legislation on September 19, 2002 that places a $10 billion general obligation bond measure on the November 2004 ballot. This bond would fund the planning and construction of the first phase of the system—connecting Los Angeles with the Bay Area. The second phase of the program, taking about four years, will include a project-specific environmental analysis and preliminary engineering design that would be completed around the end of 2007. Final design and construction

of the starter system could be completed within seven years, with the entire system completed within about ten years.

When fully operational in 2020, the system could have an estimated 32 million passengers annually for the base case and up to 55 million annual passengers if air and automobile travel growth rates, air and automobile travel times, and air fares increase. About 45 percent of high-speed train passengers could be diverted from air transportation; thus, substantial emission reductions could occur in the South Coast, as well as Bay Area, San Diego, and Sacramento airports. Approximately half of these benefits could occur in the South Coast Air Basin, since it will be the origin or destination of the majority of trips diverted from air transportation.

3. Existing Control Program

The ICAO, U.S. EPA, ARB, and local air districts have programs to control emissions from airport-related sources.

a. Aircraft Engines

ARB is pre-empted from adopting jet aircraft engine emission standards. Under federal law, that right is reserved for U.S. EPA. In practice, U.S. EPA works its standard-setting process through ICAO because aircraft engines are international commodities and jet aircraft frequently operate internationally. ICAO was created in 1944 by the Convention on International Civil Aviation (the "Chicago Convention"). ICAO's responsibilities include developing aircraft technical and operating standards, recommending practices, and generally fostering the growth of international civil aviation. Over 180 nations participate in the organization, including the United States. ICAO develops aircraft engine standards through its Committee on Aviation Environmental Protection (CAEP).

Since 1998, U.S. EPA and FAA have jointly sponsored a national stakeholder group whose goal is to define emission reduction targets for air carriers that include a longer term (post-2010) goal for reductions in jet aircraft emissions. One objective of this process is for ICAO to develop more stringent aircraft emission standards.

U.S. EPA historically has not required military aircraft engines to meet its aircraft emission standards, although the Clean Air Act does not prohibit U.S. EPA from doing so. In areas that have military aviation facilities, emissions from military aircraft can be significant and pose opportunities for reductions if they would be required to comply with U.S. EPA aircraft emission standards.

Current jet aircraft engine standards are listed in Table II-G-2. The net effect of the form of the NOx standard is to allow larger engines with higher pressure ratios to

emit more NOx per unit of rated thrust. In addition to the complex form of the NOx standard, aircraft engine emission standards differ from motor vehicle emission standards in that aircraft standards sometimes apply only to newly designed engines, not to all engines manufactured after a specified year.

Table II-G-2
Current U.S. EPA Emission Standards for Jet Aircraft Engines (grams per kilonewton of thrust*)

Pollutant	Standard
CO	118
HC	19.6
NOx	32 + 1.6 x engine pressure ratio

*Thrust is rated output or maximum thrust required for takeoff

ICAO has recently approved a new standard that will apply starting in 2004 and is being proposed for promulgation by U.S. EPA. Again, the standard is written to allow higher-pressure ratio engines to have higher NOx emissions. The new standard will require NOx to be reduced by 16 percent for the smaller, lower pressure ratio engines. However, for the larger, higher-pressure ratio engines, the new standard requires less reductions as the engines get larger with no reductions for the largest ones. Because most new aircraft engines are being designed with higher-pressure ratios, the net effect of the new standard would be minimal change in per aircraft-related NOx emissions. The U.S. and a number of European countries have expressed strongly the need for aircraft NOx emissions reductions, which has prompted ICAO to begin work on a new, more stringent NOx standard.

b. Ground Service Equipment

Both U.S. EPA and ARB's on-road and off-road motor vehicle emission standards apply to GSE used in airport operations. Additional information on these standards can be found in the chapters dealing with off-road compression-ignition engines and off-road large spark-ignition engines.

A joint effort by U.S. EPA and ARB resulted in lower emission standards for new off-road equipment, however, additional measures are needed to reduce GSE-related emissions from existing units. Air carriers have historically elected to rebuild GSE engines rather than to replace the units with new, lower emitting equipment. The greatest emission reduction would come from accelerated fleet turnover.

In addition, an enforceable agreement has been negotiated with air carriers to replace older GSE with lower or zero emitting units. The agreement, referred to as the

GSE Memorandum of Understanding (MOU), is a joint effort among ARB, U.S. EPA, South Coast District, and the 17 Air Transport Association-member airlines that operate at the five commercial airports in the South Coast Air Basin. The MOU will require the air carriers to reduce their 1997 GSE fleet-average (ROG+NOx) emissions by approximately 80 percent by 2010. The MOU does not specify how the airlines are to achieve these reductions, however, the calculation of the 80 percent reduction was predicated on the accelerated turnover and replacement of between 30 to 40 percent of existing equipment with ZEVs. Another 40 percent of the GSE fleet would need to be repowered, retrofitted, or replaced with new equipment that meet lower emission standards.

The MOU also requires air carriers to reduce diesel particulate emissions by installing filters or oxidation catalysts on phase-in schedules that depend on the type and age of the equipment. The MOU requires the use of 15 ppm sulfur diesel fuel after December 31, 2003.

The MOU deals separately with the "growth fleet" (units added to the fleet after 1997 to accommodate growth). Forty-five percent of growth units must be ZEVs, excluding four categories of GSE. The MOU also requires that all non-ZEV units added to the GSE growth fleet must have certified engines that comply with emission standards in place on the date the equipment begins service at the five airports. The requirement will ensure that older, higher-emitting units are not transferred from outside the region.

The requirements in the GSE MOU apply only to those GSE owned and operated by the 17 air carriers that are member of the Air Transport Association that operate at airports in the South Coast Air Basin. International air carriers and regional air carriers that contract with private GSE companies to provide required services at airports are not covered by the GSE MOU. These contractors own and operate approximately 17 percent of all the GSE. Los Angeles World Airports (LAWA) staff has recently begun to renegotiate access leases with businesses operating at the airport. LAWA staff intends to condition the leases to require all entities owning and operating GSE to meet the requirements in the GSE MOU. There may be opportunities for further reductions from GSE at other airports in the region if these airports are able to utilize access leases or similar means for extending the requirements in the GSE MOU to all GSE operating in the South Coast Air Basin.

Major elements of the MOU are described in more detail below. Table II-G-3 presents expected emission benefits of the MOU.

Reduction in ROG + NOx Fleet Average Emissions: The first element requires the carriers to reduce the fleet average emissions of ROG + NOx from their 1997 GSE fleet to 2.65 grams/brake-horsepower/hour between 1997 baseline levels

and 2010. This represents an 80 percent reduction. It is based on a high penetration of existing ZEV technologies into the existing GSE fleet as well as the accelerated purchase of new fossil-fueled engines that meet ARB and U.S EPA's most stringent standards for off-road equipment.

Zero Emission GSE Vehicles: The second element requires that a minimum of 30 percent of the 1997 fleet GSE be ZEVs in 2010. Because ZEV technology is already a commercial success for baggage tractors and belt loaders, the MOU anticipates that a very high percentage (85-90 percent) of these GSE will be ZEV in 2010. Other GSE categories, such as aircraft pushback tractors, are less advanced, have some ZEV models, and show promise for commercial development of improved electric battery-powered drives. The MOU also requires that 45 percent of the GSE added to fleet for growth purposes be ZEV, with the exception of four categories of GSE that are not amenable to electrification.

Electric Infrastructure: To support the MOU requirement that the air carriers have ZEV GSE by 2010, the airports will need to ensure there is adequate infrastructure for electric GSE where such infrastructure does not exist. Gate electrification to support GSE recharging and that provides electricity and preconditioned air for parked aircraft is becoming more common with new gates and terminals. However, full-scale gate electrification is needed to ensure zero-emitting GSE can be used, and to preclude the need for using the aircraft's turbine auxiliary power unit.

Table II-G-3
Emission Benefits of Ground Service Equipment MOU
Estimated Emission Reductions in 2010
(South Coast, Summer Planning, tpd)

Pollutant	Reduction
ROG	0.3
NOx	1.5

c. Ground Access Vehicles

ARB's motor vehicle emission program will cut ROG plus NOx emission rates per vehicle mile by about 85 percent over the next twenty years. Growth in air travel, however, could lead to increases in motor vehicle emissions through the increase in the number of airport-related trips, unless there is a shift to higher occupancy vehicles, e.g., taxicabs, passenger shuttle buses, and local transit.

Trip reduction strategies are primarily the domain of local jurisdictions. ARB has been able to require modest ground access-related emission reduction measures through the air quality certification process. This process conditions federal funding of

certain airport projects (new airports, new runways, or major runway extensions) on ARB's certification that the project will not interfere with the attainment or maintenance of air quality standards. Under this process, an airport applying for certification must commit to implement all feasible measures to reduce emissions, including emissions from ground access and GSE. An example of ARB certification conditions is requiring an airport to purchase or lease low-emission on-airport shuttle buses that meet or exceed ARB's emission standards for new buses.

4. Long-Term Advanced Technologies Strategies

One approach to reduce emissions from airports is to reduce emissions from vehicles traveling to and from airports. Ground access vehicles move airport passengers, employees, and goods to, from, and around the airport. These vehicles include private passenger vehicles, airport shuttles, taxis, hotel shuttles, parking shuttles, cargo vehicles, and tenant and employee vehicles.

Strategies to reduce emissions from ground access vehicles could take several different forms because of the variety and ownership of the vehicles involved. Specific ideas include reducing emissions from airport fleet vehicles using alternative fuels, or particulate diesel filters; providing an infrastructure for alternative fuel/electric vehicles between airports and shuttle terminals; consolidating on-airport vehicle travel; emissions-based airport entry fees for cabs and other shuttle vehicles; and increased ground transportation options for both passenger-bound and employee commuting to and from the airport.

a. Federal Responsibility

i. Pursue Approaches to Reduce Emissions from Jet Aircraft – More Stringent Engine Standards, Retrofit Controls, Cleaner Fuel, Apply Standards to Non-Tactical Military Aircraft

Time Frame: Adopt 2004-2009; Implement 2008-2015

Responsible Agency: U.S. EPA

Proposed Strategy:

The proposed approaches for U.S. EPA to cut emissions from new and existing jet aircraft would provide some benefit by 2010, growing over time to help mitigate the net increase in aircraft emissions. Some concepts require new technology, new standards, and considerable investments in research and development funding by NASA, airframe manufacturers, and jet aircraft engine manufacturers. U.S. EPA has the responsibility to reduce emissions from jet aircraft.

Lower-Emission Aircraft Engines: This concept calls for more stringent aircraft emission standards and the development of lower-emission aircraft engines. U.S. EPA could work with FAA and ICAO to adopt lower emission standards for: VOC, to reduce both ozone and toxic compounds; PM, to reduce fine particles and potentially toxic compounds; and NOx. The NOx emission standards should reflect at least a 50 percent reduction in per-engine NOx emissions from current standards (known as "CAEP/2 standards") for all engines for which the date of manufacture of the first individual production model is after 2007. In addition, a longer-range standard of a 70 percent reduction in per-engine NOx emissions from current standards should be adopted for implementation in the 2010-2015 timeframe. These concepts depend on substantial funding commitments by both governmental and industry partners to develop integrated component technology demonstrations leading to clean engine certification by 2007 to 2010.

Install Engine Emission Retrofit Kits: This concept calls for the purchase and installation of jet engine NOx emission retrofit kits where available and feasible. For example, a retrofit kit developed for Rolls Royce engines that power Boeing 757 aircraft reduces NOx emissions by about 30 percent over existing engines.

Reformulate Jet Fuel: U.S.EPA, with concurrence of FAA, has the authority to require the reformulation of jet fuel to lower the sulfur content. Sulfur contributes to PM emissions. Reformulation of diesel fuel and gasoline have resulted in significant emission reductions for on- and off-road motor vehicles. Because of potential benefits for reduced PM emissions, reformulating jet fuel should be evaluated.

Apply Commercial Aircraft Engine Standards to Non-Tactical Military Aircraft: U.S. EPA could exercise its authority under the Clean Air Act to require non-tactical military aircraft to meet the same emission standards as the commercial aircraft engines. This concept could result in significant reductions, but cannot be quantified at this time.

Table II-G-5
Pursue Approaches to Reduce Emissions from Jet Aircraft
Estimated Emission Reductions in 2010
(South Coast, Summer Planning, tpd)

Pollutant	Reduction
ROG	0 - 0.5
NOx	0 - 1.8

CHAPTER H

Locomotives and Railyards

CHAPTER H. LOCOMOTIVES AND RAILYARDS

1. Category Description

Railroads operate national locomotive fleets that travel between states daily, currently moving more than 40 percent of the total intercity revenue ton-miles of freight in the United States. Rail networks are geographically spread across the country, serving every major city in the United States. Efficient train transportation is an important factor in the regional and national economy.

Locomotives are an environmentally efficient way to move goods. Railroads continue to improve their efficiency and reduce emissions per ton-mile by utilizing more efficient locomotives, improving freight movement operations, and other means. Currently, emissions per ton-mile of freight moved are lower for locomotives than for heavy-duty trucks. However, new on-road trucks will become significantly cleaner with the introduction of the 2007 emission standards. As heavy-duty truck standards become more stringent, railroads need to do more to improve locomotive emissions and remain an environmentally efficient choice to move goods.

Most of the emissions that occur in California from locomotives are from line haul locomotives that travel in and out of the State. About 67 percent of the locomotive exhaust emissions that occur in California are from interstate line haul operations; 20 percent are from local (short-line locomotive) operations that occur only in California; 10 percent are from switch yard operations; and the remaining 3 percent are from passenger trains. Although not quantified, locomotives used in industrial settings would also contribute a very minor amount of additional emissions. Baseline ROG, NOx, PM, and CO emissions from locomotive engines are listed in Table II-H-1 below.

The type of diesel fuel that is used by the railroads also affects in-use emissions but is not regulated. While railroads are allowed to use high-sulfur fuel (5,000 ppm max), most of the diesel fuel purchased by the railroads in California is either U.S. EPA on-highway grade diesel fuel – with an average sulfur content of 330 ppm (500 ppm max) – or California grade diesel with an average sulfur content of about 140 ppm (500 ppm max). High sulfur diesel fuel is not generally available for locomotive refueling in California. The major pipeline distribution system in California excludes high sulfur diesel fuel shipments in order to reduce sulfur cross contamination with other petroleum products. The widespread use of the lower sulfur diesel fuels would result in lower PM emissions, and the use of California grade diesel fuel would also reduce NOx emissions.

Table II-H-1
Baseline Emissions for Locomotive Engines
(South Coast, Summer Planning, tpd)

Pollutant	2005	2006	2008	2010	2020
ROG	1.8	1.8	1.7	1.7	1.6
NOx	32.5	30.5	28.2	18.3	19.9
PM10	1.0	1.0	1.0	0.9	0.9
CO	6.6	6.7	6.8	7.0	8.0

Note: Reflects the benefits of the South Coast Memorandum of Understanding.

2. Existing Control Program

Section 209(e) of the federal Clean Air Act prohibits any state or local government from adopting or enforcing any standard or other requirement relating to the control of emissions from new locomotives and new engines used in locomotives. Locomotives last a very long time. It is typical for the railroads to remanufacture locomotives every seven years. During remanufacture, the engine can be rebuilt or replaced. To minimize future emissions from post-1972 model-year locomotives, U.S. EPA regulates new engines and the remanufacture of post-1972 units. California also has developed and implemented voluntary programs that are expected to reduce emissions from locomotives. The following subsections provide a brief description of existing programs for locomotives in California.

a. U.S. EPA Standards for Locomotives

In 1998, U.S. EPA adopted exhaust emission standards for NOx, HC, CO, PM, and smoke for newly manufactured and remanufactured locomotives and locomotive engines beginning in 2001 (Table II-H-2). The standards are being phased in and are based on the date of original manufacture. The federal Tier 0 standards set specifications for locomotive engines originally manufactured from 1973 to 2001. The Tier 1 standards apply to locomotive engines originally manufactured from 2002 through 2004, and the Tier 2 standards apply to locomotive engines originally manufactured in 2005 and later.

Table II-H-2
Federal Locomotive Exhaust and Smoke Emission Standards

Tier	NOx (g/bhp-hr)		PM (g/bhp-hr)		Smoke (Percent Opacity – Normalized)			HC (g/bhp-hr)	
	Line-haul duty-cycle	Switch duty-cycle	Line-haul duty-cycle	Switch duty-cycle	Steady-state	30 sec Peak	3-sec Peak	Line-haul duty-cycle	Switch duty-cycle
Tier 0 1973-2001	9.5	14	0.6	0.72	30	40	50	1.00	2.10
Tier 1 2002-2004	7.4	11	0.45	0.54	25	40	50	0.55	1.20
Tier 2 2005 and later	5.5	8.1	0.2	0.24	20	40	50	0.30	0.60

By comparison, U.S. EPA estimates uncontrolled locomotive emission rates for NOx are 13.0 and 17.4 g/bhp-hr for line-haul and switcher locomotive engines, respectively.

b. Memorandum of Understanding for Locomotives in the South Coast Air Basin

Although federal law preempts California from setting standards for new locomotives and new engines used in locomotives, ARB and the two Class 1 freight railroads operating in California have taken steps to further reduce emissions from locomotives within the South Coast. The federal Surface Transportation Board classifies those railroads with annual revenues of $261.9 million or more for year 2000 as Class 1 railroads. In 1993, these railroads proposed to U.S. EPA, ARB and others the establishment of a locomotive fleet average emissions program in the South Coast Nonattainment Area tied to the promulgation of the U.S. EPA National Locomotive Rule. The intent was to accelerate introduction of newer, lower-emitting locomotives in the South Coast. A Memorandum of Understanding (MOU) between ARB and the railroads was signed in July 1998. The MOU includes provisions for early introduction of cleaner locomotives, with requirements for a fleet average in the South Coast equivalent to U.S. EPA's 2005 locomotive standard by 2010. The agreement fulfills the objective of the 1994 SIP measure, M14: National Emission Standards, that assumes that cleaner federally-complying locomotives will be operated in California and the South Coast.

Implementation of the MOU will reduce emissions in the South Coast by 67 percent by 2010.

c. Emission Reduction Research Program

The railroads (with technical guidance and review by ARB) are investing a minimum of five million dollars over three years to test the feasibility of implementing emission reduction technologies on locomotives. The current focus is to develop and test the feasibility of operating a switchyard locomotive using a diesel particulate filter (DPF). ARB expects that this program will lead to significant advancement in the design of DPF technology for all locomotives and thus could enhance the ability of industry to reduce PM emissions. ARB will also work closely with the railroads to conduct research in demonstrating NOx control technology in locomotives.

d. Carl Moyer Program

The Carl Moyer Program is a heavy-duty diesel engine incentive program designed to obtain early emission reductions of NOx and particulate matter from heavy-duty vehicles and equipment, including locomotives. Under the program, ARB has the responsibility to establish program guidelines, oversee the program, and report program benefits. Local air districts implement the program and work with the public and private participants. The program provides grants to pay for the extra cost of replacing existing diesel engines with lower-emission engines, including new cleaner diesels, or engines powered by alternative fuels or electricity. Currently, the Carl Moyer program has funded one locomotive. Substantial emission reductions would be achieved with the funding of additional locomotive projects. An annual funding commitment would be needed in order to rely on incentive programs, like the Carl Moyer Program, to provide emission reductions.

3. Control Strategies for Locomotives

Locomotive emissions in the near- and mid-term in the South Coast have been addressed through the locomotive MOU signed in 1998. Under that MOU, additional approaches used by the railroads to reduce NOx emissions may be used by the railroads to comply with the MOU's fleet average emission requirement Because of this, ARB staff is not proposing additional locomotive measures for the South Coast at this time.

However, locomotive activity (and thereby emissions) occurs throughout the State. We will assess the need for additional reductions from locomotives and railyards in other areas of the State in regional SIPs over the next year.

4. Long-Term Advanced Technologies Measures

A number of viable control technologies for locomotives are listed below. They can be implemented through incentive programs, regulations, voluntary actions, research projects, use of advanced technology, fuel changes, and other methods. In addition, in its proposal for tighter emission standards for new land-based off-road equipment, U.S. EPA indicates that it will consider development of lower standards for new and remanufactured locomotive engines, for implementation in the post-2010 timeframe. Such standards would help address the projected growth in goods movement via rail.

Fleet Turnover: In the near term, a significant reduction in NOx emissions will occur when existing locomotives operating in the U.S. are remanufactured to meet the Tier 0 standards. This should result in a 30 percent reduction in NOx emissions. When fully phased-in, the new standards will reduce NOx emission by nearly two-thirds, and HC and PM emissions by half. New locomotive engines manufactured to Tier 1 standards (2002-2004) and Tier 2 standards (2005+) will have even lower emissions than the uncontrolled or Tier 0 locomotives in use today. Any mechanism for accelerating fleet turnover could significantly reduce emissions.

Reduced Idling: The railroads are already taking a number of steps to reduce idling. For example, all major railroads currently have a policy to shut down locomotives when they would idle for greater than a specified time (generally 30 minutes to an hour), providing that ambient temperatures are moderate (generally above 40-50 degrees Fahrenheit). ARB will meet with the railroads to investigate how idling emissions can be further reduced at railyards and on sidings, and to enforce existing idling policies.

Retrofits:

Diesel Particulate Filters: The recently adopted U.S. EPA locomotive rule will result in significant reductions in diesel PM emissions from locomotives beginning with model year 2005. The national rule only affects PM emissions from model year 1973 and later locomotives at the time of purchase or remanufacture and does not reduce PM emissions from older locomotives. Control of PM is expected to occur through improvement in air cooling, fuel management, combustion chamber configuration, and electronic controls.

At the time of its rulemaking, U.S. EPA did not consider diesel particulate filters a technology that manufacturers would use to meet Tier 2 standards. However, because of recent developments in diesel particulate filter technology, it appears retrofitting locomotive engines with particulate filters would result in significant reductions in diesel PM emissions, especially when coupled with requirements for low sulfur fuel. As mentioned above, ARB is currently working with the railroads to demonstrate the use of

a PM filter on a locomotive. The demonstration program is scheduled to be complete in 2003. Some associated HC emission reductions would also be achieved. If particulate filters prove feasible, installation could occur as early as 2007, when the federal diesel regulations for on-highway diesel fuel is fully implemented.

NOx Control Technologies: New methods for reducing NOx emissions may prove feasible as technology advances over time. ARB will review the feasibility of selective catalytic reduction (SCR) as a method to control NOx emissions in the future, as appropriate. Also, NOx adsorber technology is expected to improve in the near term and to be used in on-road vehicles. Depending on durability, space constraints, operational constraints, and cost, this technology may be transferable from on-road vehicles to locomotive applications.

Fuel Changes: Currently available alternative fuels and alternative diesel fuel formulations could also be used to reduce NOx, PM and HC from in-use locomotives. Emulsified fuels or other alternative diesel fuels may be a more immediate emission reduction option for earlier model year locomotives, where control retrofit options are very expensive or difficult to implement. These fuels have been formulated for use in existing diesel-powered vehicles and equipment, new and old, without hardware add-ons, engine modifications or replacements. Emulsified or alternative diesel fuels have been shown to reduce NOx and PM emissions by 14 percent and 63 percent, respectively (in on-road heavy-duty diesel vehicles), when compared to ARB diesel. Transferring the use of these fuels to switch-yard and local locomotives could result in emission reductions. The use of emulsified or other alternative diesel fuels may necessitate injector replacement if peak power is to be maintained. However, power limitation in switch-yard locomotives is seldom an issue.

Converting diesel-powered locomotive engines to alternative fuels, such as compressed natural gas (CNG), liquefied natural gas (LNG) and dual fuel, has become a viable technology for reducing NOx and PM emissions from locomotive engines. Alternative fuel technology has been incorporated into several locomotives nationwide. In fact, through the Carl Moyer Program, the Napa Valley Wine Train in California was converted from diesel to CNG. ARB estimates that NOx emissions were reduced about 50 percent from converting this locomotive engine powered by diesel to an engine powered by natural gas.

CHAPTER I

Conventional and Alternative Fuels

CHAPTER I. CONVENTIONAL AND ALTERNATIVE FUELS

1. Category Description

Today, there are 24 million gasoline-powered vehicles registered in California and over a million diesel-fueled vehicles and engines. To power these vehicles, over 14 billion gallons of gasoline and approximately 3 billion gallons of diesel fuel are consumed annually.

Gasoline and diesel motor vehicle fuels emit a variety of pollutants that impact human health. To address these impacts, the California Clean Air Act (CCAA) requires ARB to adopt fuel specifications to reduce exhaust and evaporative emissions from motor vehicles. California Health and Safety Code Section 43018 (a) states, "[t]he state board shall endeavor to achieve the maximum degree of emission reductions possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date."

a. Fuel Characteristics

For most motor vehicle owners in the United States, the most practical fueling options are gasoline for light-duty vehicles and diesel fuel for heavy-duty vehicles. These two fuels are relatively inexpensive, and mature marketing and distribution infrastructure already exists. Diesel fuel is also commonly used in light-duty vehicles in Europe and other parts of the world.

The discussion below summarizes fuel characteristics of the mainstream fuels (gasoline and diesel fuel), as well as alternative fuels (compressed natural gas, liquified natural gas, liquified petroleum gas, methanol, ethanol, hydrogen, and electricity).[1]

Gasoline: Nearly all light-duty vehicles run on gasoline, which is relatively inexpensive and has a mature infrastructure with more than 11,000 fueling stations in California. Over the past century, automotive engineering has developed gasoline engines that perform well. Reformulated gasoline has enabled engines to reduce emissions. However, collectively, automobiles are still a major source of ROG (evaporative emissions from the fuel system, cold starts, running exhaust emissions), NOx, and carbon dioxide (CO2).

Diesel Fuel: Diesel engines are more fuel-efficient than gasoline-powered engines, but due to the higher compression ratios, the engines have to be sturdier. Thus, diesel engines are practical for trucks, buses, other heavy-duty vehicles, locomotives, and ships. Current diesel engines create more PM and NOx, but less CO2

[1] California Energy Commission, "ABCs of AFVs: A Guide to Alternative Fuel Vehicles – Fifth Edition," November 1999.

than gasoline engines. ARB has identified particulate matter from diesel-fueled engines as a toxic air contaminant. Raising the ignition temperature suppresses PM formation, but results in more NOx. Likewise, lowering the ignition temperature suppresses NOx but yields more PM. Evaporative emissions are not a problem for diesel fuel, due to its low vapor pressure. Very low-sulfur fuel, required statewide in 2006, is necessary in order to use diesel particulate filters and NOx converters to reduce emissions.

Compressed/Liquefied Natural Gas: Compressed natural gas (CNG) and liquefied natural gas (LNG) are substitutes for diesel fuel in heavy-duty applications such as transit buses and school buses. Light-duty vehicles can also be powered by CNG in place of gasoline. CNG-powered and LNG-powered engines produce less PM, but about the same amount of NOx as diesel engines. CO2 exhaust emissions are also lower because natural gas gets more of its energy from hydrogen and less from carbon compared to diesel fuel. However, natural gas consists mainly of methane, which is a greenhouse gas. CNG is available at over 100 retail outlets in California, but there are currently few public access LNG stations. LNG has advantages over CNG in heavy-duty vehicles for which range and payload are critical, such as locomotives and trucks over 33,000 pounds.

Liquefied Petroleum Gas: Liquefied petroleum gas (LPG) is a combination of hydrocarbons like propane, ethane and butane. It has less carbon than gasoline, but more carbon than natural gas, so its CO2 emissions are between that of gasoline and natural gas. LPG combustion produces some PM and sulfur emissions, but yields less ROG and NOx emissions than gasoline combustion. However, LPG evaporative emissions can release more ROG than gasoline does. California has over 500 retail outlets that sell LPG.

Methanol: Most methanol is made from natural gas, but biomass can be a renewable source as well. Methanol serves as a substitute for gasoline. Indeed, methanol is the fuel of choice for Indianapolis 500 racing cars. This fuel provides a high octane number and high performance while burning at a cooler temperature, producing fewer CO2 emissions and half as much NOx as gasoline does. Light-duty flexible fuel vehicles use M85 (85 percent methanol, 15 percent gasoline), which is sold at a few locations in California. Methanol costs more than gasoline on an energy-equivalent basis. Heavy-duty vehicles use M100 (methanol without gasoline) and produce less NOx and PM than diesel fuel vehicles. Methanol heavy-duty engines are significantly more expensive than their diesel counterparts. Methanol is a promising fuel for reforming into hydrogen for fuel cells. Work is underway to develop a direct injected methanol fuel cell that requires no reformer.

Ethanol: Corn, grains, and agricultural waste (including rice) products and residues are the sources of ethanol, a renewable fuel. Depending on how it is produced, the use of ethanol can reduce greenhouse gas emissions, compared to the

use of gasoline. Ethanol flexible-fuel vehicles use E85 (85 percent ethanol, 15 percent gasoline), which is not available to the public in California. Ethanol has a lower energy content than gasoline and relies on tax incentives to make the fuel cost per mile similar to gasoline. In California, ethanol has more potential as an additive to gasoline (to replace the oxidant methyl tertiary butyl ether (MTBE)) than as a fuel in its own right.

Hydrogen: Water is the only by-product of fuel cells powered by hydrogen. This clean fuel produces no greenhouse gas emissions nor pollutants. The challenges involve producing and distributing hydrogen. Currently, most hydrogen comes from natural gas (thus, emitting some greenhouse gases), but electrolysis powered by wind power or solar energy is a future possibility. Hydrogen gas is awkward to handle -- its volumetric energy density is low, and it costs more than diesel fuel on a per mile basis. In the foreseeable future, hydrogen will be practical for centrally-fueled fleets of large vehicles with space for hydrogen storage, such as transit buses.

Electricity: Battery-powered cars are the original zero emission vehicles. The power plant releases lower CO2 and lower pollutant emissions in recharging the battery, compared to burning gasoline in the car. Drawbacks include limited range, long recharging time and bulky or expensive battery packs. Drivers in California can recharge at home or at hundreds of public charging stations through the State. Auto manufacturers are focusing on neighborhood electric vehicles as suitable niches for battery-powered electric vehicles.

California's zero emission vehicle program is essential to attaining State ambient air quality standards as well as achieving significant improvements in total environmental impact of transportation in the light-duty vehicle sector. Beyond the benefits of reduced criteria pollutants, zero emission vehicles have reduced total fuel cycle and reduced emissions of toxic air contaminants and impacts on other environmental media.

The success of the zero emission vehicle program depends on the State's support of innovative technology changes in the automotive industry as well as in the infrastructure used to support it. Electric vehicles have been successfully demonstrated as practical, reliable zero emission vehicles. Fuel cells, using stored hydrogen, provide a longer-term option for widespread implementation of zero emission vehicles. Research and development in fuel cell vehicle technology is moving quickly toward commercialization. Deployment of electric recharging and hydrogen refueling infrastructure will greatly improve the commercial market potential, acceptance, and fleet penetration of zero emission vehicles.

The ultimate goal will not only be widespread implementation of zero emission vehicles and infrastructure, but also zero emission upstream fueling emissions. Air quality impacts of transportation range from the extraction of fuel/energy through

refining, delivery and refueling, to finally the direct vehicle emissions. In addition to benefits of no direct vehicle emissions, electric and fuel cell vehicles using electricity or stored hydrogen have the potential to be nearly emission free from "well to wheel." By using electricity or hydrogen generated from renewable energy such as solar or wind, an electric or fuel cell vehicle could have zero impact on the environment. Given growing demand for petroleum and the impacts of using carbon-based fuels on the environment in the conversion of that energy to motive power, pursuit of electricity and hydrogen, derived from renewable sources is a great opportunity to move into a truly zero emission future.

b. Pollutants/Toxic Compounds

The use of fuels such as gasoline, diesel, and alternative fuels in motor vehicles results in the emissions of many different pollutants. Exhaust emissions occur due to both the incomplete combustion of fuel as well as the formation of other compounds due to the heat of combustion. Pollutants in motor vehicle exhaust include CO, NOx, sulfur oxides (SOx), and toxic compounds such as benzene, 1,3-butadiene, aldehydes (such as formaldehyde), polycyclic aromatic hydrocarbons (PAHs), and diesel PM.

Evaporative emissions, which are mostly ROG, result from fuel escaping from the fuel system. Sources of evaporative emissions from motor vehicles include fuel tanks and fuel lines. As temperatures increase within the fuel system, increased evaporation occurs, resulting in greater emissions. Many of the ROGs that evaporate are also toxic air contaminants, including benzene, toluene, and PAHs.

2. Existing Control Program

As shown in Table II-I-1, ARB has implemented a number of fuels programs that have provided significant reductions in vehicular emissions. These programs have contributed significantly to the air quality gains that have been achieved over the past 20 years and are a major component in ARB's efforts to achieve both the federal and State air quality standards statewide.

Table II-I-1
Summary of Fuels Program Benefits
(Statewide, tpd)

Program	Emissions Reductions (tpd)					
	ROG	NOx	PM	SOx	CO	Toxics
Diesel (1993)	17	70	20	80	--	25%
Phase I Reformulated Gasoline (1992)	210	--	--	--	--	--
Winter Oxygenate	20	--	--	--	1200	--
Phase II Reformulated Gasoline (1996)	190	110	--	30	1300	30%
Phase III Reformulated Gasoline (2003)	0.5	19	--	4	--	7%

Note: Emission benefits shown on this table are not additive as they are based on different calendar years and baseline inventories.

A brief summary of the steps ARB has taken to reduce fuel-related emissions is provided below.

Reformulated Gasoline

Reformulated gasoline remains one of the cornerstones of California's effort to achieve healthful air quality. Reformulated gasoline reduces emissions from older vehicles while enabling emission-control systems in late model vehicles to work at high efficiencies. New vehicles are as much as 85 percent cleaner than automobiles produced in the early 1990s. Without reformulated gasoline, these vehicles cannot operate at the emissions levels for which they were designed. Highlights from ARB's Cleaner Burning Gasoline Program are listed below.

a. Phase I Cleaner Burning Gasoline

In 1990, ARB adopted the California Phase I reformulated gasoline regulations that included a new Reid vapor pressure (RVP) limit, requirements for deposit control additives, and the elimination of lead from gasoline starting in 1992. These regulations resulted in ROG emission reductions of 210 tpd.

b. Wintertime Oxygenate Program

As required under the federal Clean Air Act, ARB adopted a regulation in 1991 requiring gasoline sold in California to contain an oxygen content of 1.8-2.2 percent during winter months to help areas with poor CO air quality meet the standards. The

program reduced wintertime motor vehicle CO emissions by 10 percent (about 1200 tpd) and ROG emissions by about 20 tpd in 1992-93, when the oxygenate requirement went into effect. Most of California now meets the federal CO air quality standards with the exception of Calexico in Imperial County. ARB rescinded the wintertime oxygen requirement in 1998 for areas where the requirement is no longer needed to achieve and maintain the CO air quality standard. Rescinding the wintertime oxygen requirement provides refiners additional flexibility and assists in the phase-out of MTBE.

c. Phase II Cleaner Burning Gasoline

In 1991, ARB adopted the California Phase II reformulated gasoline (CaRFG2) regulations which contained a comprehensive set of specifications for eight fuel properties designed to achieve the maximum reductions in ROG, NOx, SOx, PM, CO, and toxic air emissions starting in 1996. The regulations sought to provide flexibility to refiners to produce the cleanest possible gasoline at the lowest cost to the consumer by providing compliance options to gasoline producers. CaRFG2 reduced smog-forming emissions from motor vehicles by 15 percent (equivalent to removing 3.5 million vehicles from California roads) and reduced toxic air emissions from gasoline use by 40 percent.

d. Phase III Cleaner Burning Gasoline

In 1999, ARB adopted the Phase III cleaner burning gasoline regulations to enable refiners to produce MTBE-free gasoline while preserving the air quality benefits of existing gasoline. The regulations prohibit the addition of MTBE to California gasoline after 2002 and reduce the sulfur and benzene content of gasoline. The action implements the provisions of Governor Gray Davis' Executive Order calling for the phase out of MTBE from gasoline. The Governor issued the Executive Order after determining there is significant risk to the environment from using MTBE in gasoline in California, because MTBE from leaking underground fuel tanks threatens groundwater and drinking water quality.

Diesel Fuel

In 1988, ARB approved the current specifications for California diesel fuel. These regulations, implemented in 1993, established limits on both the sulfur (500 parts per million by weight) and aromatic hydrocarbon content (10 percent by volume, and 20 percent for small refiners). The regulations reduced SOx emissions by 80 tpd (with concurrent sulfate particulate reductions), NOx emissions by 70 tpd, PM emissions by 20 tpd, and ROG emissions by 17 tpd in 1993. The regulation reduced toxic emissions as well.

Recently, U.S. EPA adopted national diesel fuel standards that will lower sulfur content to 15 ppm starting in 2006. This change enables tighter emission standards for new diesel engines and retrofits that require the use of NOx adsorbers and particulate filters. ARB staff will propose incorporating the new sulfur limits into the California diesel fuel regulations to the Board.

Alternative Fuels

While not used in the same quantities as gasoline and diesel fuel, alternative fuels play an important part in California's transportation and clean air strategies. In 1990, ARB established specifications, effective in 1993, for the following seven alternative fuels to ensure the availability of consistent fuel-quality alternatives while providing the expected benefits from the low-emission vehicle/clean fuels program:

- M-100 fuel which contains 100 percent methanol
- M-85 fuel which contains 85 percent methanol and 15 percent gasoline
- E-100 fuel which contains 100 percent ethanol
- E-85 fuel which contains 85 percent ethanol and 15 percent gasoline
- Compressed natural gas (CNG) which contains 88 percent methane
- Liquefied petroleum gas (LPG) which contains 85 percent propane,
- Hydrogen.

Also in 1990, ARB adopted a regulation designed to ensure that clean alternative fuels are available to meet public demand. The regulations require certain retail gasoline station owners to equip an appropriate number of their stations to dispense a designated alternative fuel if at least 20,000 vehicles are certified in California to a low-emission vehicle (LEV) standard on the fuel. To date, the 20,000 vehicle trigger has not been met for any fuel.

In order to reduce emissions from motor vehicles, ARB has launched several programs and regulations that are summarized in the subsequent paragraphs. These ongoing programs augment the introduction of vehicles powered by alternative fuels, such as CNG, LNG, LPG, by offering funds for the incremental cost of the lower emission equipment.

The Carl Moyer Program: A heavy-duty diesel engine incentive program designed to obtain early emission benefits from a wide variety of heavy-duty vehicles and equipment such as trucks, buses, locomotives, boats, and agriculture and construction equipment. The Carl Moyer program funds the incremental cost of cleaner alternative-fueled vehicles. Since its inception in 1998, the program has funded $44.5 million in alternative fuel and electric projects. A portion of these funds went to the California Energy Commission to expedite the research and development of additional technologies to achieve emission reductions.

Public Transit Bus Fleet Rule: The Public Transit Bus Fleet Rule was established to promote the use of alternative-fueled buses for transit agencies. The fleet rule also requires the larger transit agencies to demonstrate the highly advanced zero emission buses in 2003 followed by its successful implementation starting in 2008.

Lower Emission School Bus Program: Another incentive program to reduce school children's exposure to particulate and smog-forming pollutants is the Lower-Emission School Bus Program. In the 2000-2001 fiscal year, $50 million has been apportioned for the purchase of 350 new school buses powered by diesel and alternative fuels besides retrofitting the existing school buses with catalyzed diesel particulate filters. For the fiscal year 2001-2002, $16 million will go towards the purchase of 110 new school buses and for the retrofit of about 640 older school buses.

Zero Emission Vehicle Support

The zero emission vehicle program was first adopted in 1990 as part of the low-emission vehicle regulations. Zero emission vehicle (ZEV) regulations have been modified over the last 10 years; however, the core requirement remains and contains the flexibility necessary to encourage the development of a variety of near-zero and zero emission technologies.

In 2001, ARB adopted modifications to the ZEV regulation to establish standards for electric vehicle charging. The Board decided this standardization regulation was necessary to support electric vehicle deployment as the market was on a divergent path. There were at least three commonly used charger types. Standardization provides market certainty, reduces cost to public infrastructure providers and encourages focused technology and cost improvements in a single technology. The Board has not taken any regulatory action to support or standardize hydrogen-fueling infrastructure. At this early stage in development, significant divergence in vehicle to fueling equipment technology has not surfaced. Research and development activities into the best method for hydrogen storage and fueling is ongoing. ARB staff is encouraged by the early willingness of vehicle manufacturers to work together with fuel providers to explore standards for hydrogen use.

ARB is working with the State and local governments to develop ZEV infrastructure and remove barriers to ZEV introduction. For example, an increasing percentage of light-duty vehicles manufactured must be ZEVs. The ZEV Incentive Program (ZIP) grants up to $5,000 per ZEV so that consumers could buy the electric vehicle at a price comparable to the conventional vehicles. Additionally, ARB participates in the Fuel Cell Partnership; a partnership of industry and government designed to facilitate the development and commercialization of fuel cell-powered vehicles.

3. Proposed Strategies

a. FUEL-1: Set Additives Standards for Diesel Fuel to Control Engine Deposits

Time Frame: Adopt 2006-2009; Implement 2006-2010

Responsible Agency: ARB

Proposed Strategy:

Diesel-fueled vehicles account for a disproportionate amount of certain pollutants emitted by motor vehicles. While they account for about 4 percent of the California motor vehicle population, they produce about 40 percent of NOx and 60 percent of PM from California vehicles. Diesel PM was identified as a toxic air contaminant in 1998 and the cancer risk from diesel PM has been estimated at 70 percent of the toxic air contaminant risk statewide. Consequently, all avenues of possible emission reductions for diesel engines must be pursued, including diesel deposit control additives.

Diesel engines, like spark-ignited engines, develop engine deposits over time. Deposits are formed on the injectors and in the combustion chamber. Deposits on the injectors develop from the formation of gums and resins that act as binders for minute particles in the combustion gas. These deposits interfere with the injector spray pattern, which in turn may affect proper combustion. Engine deposits that form in the combustion chamber may also adversely affect combustion. Both injector deposits and combustion chamber deposits could result in increased emissions, decreased power, and decreased fuel economy.

ARB staff will investigate the significance of diesel fuel system and engine deposits and the effect on emissions. Staff will also investigate the effectiveness of deposit control additives to prevent or reduce deposits and their cost. When regulatory action is deemed appropriate, a certification test procedure and an additive performance standard will be developed.

Currently, diesel fuels are regulated for sulfur and aromatics content. There are no regulations requiring the use of deposit control additives for diesel fuel. In 1990, regulations were adopted requiring the use of deposit control additives in California gasoline where they have been shown to clean and maintain port fuel injectors and intake valves. Like gasoline deposit control additives, diesel deposit control additives could be effective in reducing diesel engine deposits and emissions. The proposed method of control is to require the use of deposit control additives in diesel fuel. The fuel would be certified upon passing engine tests that demonstrate that the fuel keeps injectors, cylinders, valves, and other engine parts free of combustion deposits.

Projected emission reductions are not quantifiable at this time. The cleanup and maintenance of diesel fuel systems and engine deposits return engines closer to factory tolerances, which may minimize the deterioration rate of engine-out emissions. This may have an emissions benefit.

SIP Commitment for Measure FUEL-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2006 and 2009. We have not quantified benefits for this measure.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. FUEL-2: Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines

Time Frame: Adopt 2003-2005; Implement 2006

Responsible Agency: ARB

Regulatory History:

ARB's current diesel fuel regulations specify a 500 ppm by weight limit for sulfur and an aromatic hydrocarbon content limit of 10 percent for large refiners and 20 percent for small refiners. Use of diesel fuel meeting California regulations is not required for stationary engines, locomotives, and marine vessels; they are exempt from these regulations. About 90 percent of the diesel fuel sold or supplied in California meets the requirements of the California diesel fuel regulations.

In December 2000, U.S. EPA signed a national diesel fuel rule that will lower sulfur content nationwide to 15 ppm starting in 2006. These standards apply to fuel for on-road vehicles only.

The South Coast Air Quality Management District has adopted Rule 431.2 that limits the sulfur content of diesel fuel for stationary and mobile sources in the South Coast Air Basin to 500 ppm, but this limit will be lowered to 15 ppm in 2005.

Proposed Strategy:

Diesel fuel is used in three major source categories in California: motor vehicle sources (on-road and off-road vehicles and other mobile sources), stationary area sources (such as oil and gas production facilities, shipyards, repair yards), and stationary point sources (such as chemical manufacturing and electric utilities). However, motor vehicle sources account for most of the population of diesel engines and emissions from all source categories.

Diesel-fueled vehicles account for a disproportionate amount of certain pollutants emitted by motor vehicles. Of the 1.3 million diesel-fueled engines operating in the State in 2000, about 1.2 million or 95 percent were on-road and off-road motor vehicle diesel-fueled engines. The majority of the approximately 700,000 on-road diesel-fueled vehicles in use in California in 2000 are heavy-duty vehicles with a gross vehicle weight rating greater than 14,000 pounds. While they account for about 4 percent of the California motor vehicle population, they produce about 40 percent of the NOx and 60 percent of PM from California vehicles.

Diesel exhaust is a complex mixture of inorganic and organic compounds that exist in gaseous, liquid, and solid phases. The emissions from diesel-fueled engines include over 40 substances that are listed by U.S. EPA as hazardous air pollutants (HAPs) and by ARB as toxic air contaminants (TACs). ARB identified diesel particulate matter as a toxic air contaminant in 1998.

In 2000, ARB approved the Diesel Risk Reduction Plan. This plan is anticipated to result in several measures that will substantially reduce emissions from new and existing on-road vehicles, off-road equipment, portable equipment, and stationary engines.

ARB Strategy

In 2003-2005, ARB staff would propose low-sulfur diesel fuel regulations that reduce statewide the maximum sulfur content allowed in diesel fuel from the current limit of 500 ppm to 15 ppm by 2006. The proposed regulation would apply to diesel fuel produced for on-road and off-road vehicles. The proposal would also be adopted as an air toxics control measure that would apply to diesel fuel produced for non-vehicular sources.

Low-sulfur diesel fuel would enable technologies such as catalyzed diesel particulate filters and NOx adsorbers to be used. Heavy-duty diesel vehicles would be able to meet the very low 2007 emission standards with low-sulfur diesel fuel. Low-sulfur diesel fuel is also required to enable the diesel PM emissions control systems proposed in ARB's Diesel Risk Reduction Plan.

As noted earlier, U.S. EPA has adopted national on-road diesel fuel standards that will lower sulfur content nationwide to 15 ppm starting in 2006. ARB staff is continuing to evaluate what differences would exist between California and federal diesel fuel once the low-sulfur standard is in effect. The goal is harmonization of U.S. EPA's and California's diesel fuel standards while maintaining emission benefits that are comparable to those provided by California diesel requirements. ARB staff is working with U.S. EPA staff to evaluate mathematical models that can be used to predict the effects of diesel fuel properties on emissions. If successful, this should be a valuable tool for increasing the flexibility for refiners inside and outside of California to certify and produce low-sulfur fuel for sale in California.

Emission Reductions:

Use of low-sulfur diesel fuel reduces PM and SOx emissions and enables the use of aftertreatment technologies which can reduce NOx, PM, and ROG. Because a national on-road diesel fuel rule is already set to go into effect in 2006, the emission benefits for on-road vehicles are already reflected in the baseline SIP emission

inventory. The SOx emission benefits from low-sulfur diesel for off-road engines have also been incorporated into the baseline SIP emission inventory because the South Coast Air District has adopted a rule that would apply in lieu of a statewide rule. The PM benefits for off-road engines have not been quantified at this time.

SIP Commitment for Measure FUEL-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2005.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

4. Long-Term Advanced Technologies Strategies

Set Sulfur/Ash Content Limits for Diesel Engine Lubricating Oils: This idea would look at the effect on diesel after-treatment technology from limits on sulfur concentration and/or ash content in diesel engine lubricating oil.

In addition to diesel fuel, engine lubricating oil is a source of sulfur and other constituents potentially harmful to after-treatment control technologies essential to achieving emission reductions. Diesel engines are designed to consume some amounts of engine lubricating oils that are burned along with the fuel. Depending on the amount of oil consumed and the level of sulfur and other constituents, the oil consumed can adversely affect the after-treatment controls. Also, lubricating oils can contribute to increased engine-out emissions of sulfur. The significance of engine lubricating oils' contribution to engine-out emissions is not known, but current research efforts are investigating this concern.

If the current research efforts indicate that regulatory action is appropriate, then the concentration of sulfur and/or ash content of diesel engine lubricating oils could be limited for both on-road and off-road vehicles. This would minimize emissions increases by curtailing deterioration rates of the control technology.

Support Infrastructure for Zero-Emission Vehicles – Electric and Hydrogen: The main focus of this concept would be to facilitate development of the infrastructure needed to support the current zero emission vehicle regulations and the resulting vehicles that will be introduced to the market. Such efforts would include an examination of the suitability of regulatory standards, research funding priorities, public education efforts and resource allocations. These efforts could also provide support for future mobile and stationary regulatory efforts utilizing zero emission technology.

One potential mechanism would be to build on ARB's existing Clean Fuels Regulation that requires alternative fuels to be made available for sale to the public at high volume service stations once the number of vehicles certified on that fuel exceeds a specified threshold. This provision was originally established in 1990 to ensure fuel infrastructure and supply for the alternative fuel vehicles that were anticipated under the Low-Emission Vehicle program.

Near-Term Electric Vehicle Infrastructure Support:

- Continue installations of electric vehicle public charging stations.
- Pilot programs to establish a self-sustaining network of public charging stations that addresses maintenance, repair, and the cost of electricity, possibly through an electric vehicle driver subscription service.

- Transition to conductive electric vehicle infrastructure by working with infrastructure providers, vehicle manufacturers and electric vehicle drivers to ensure a smooth transition to the standard technology.

Near and Mid-Term Hydrogen Vehicle Infrastructure Support:

- Demonstration projects (fuel cell and hydrogen internal combustion engines) using hydrogen by funding technology development for low cost, semi-permanent, transportable hydrogen stations.

- Encourage hydrogen-fueled technology in regulatory development through setting of standards and demonstration or pilot components.

- Studies to determine the necessary backbone and network of hydrogen stations needed to support early commercialization of hydrogen fueled vehicles.

- Development of appropriate building codes and permitting policies for hydrogen vehicle storage and refueling as well as dissemination of information to building code officials and permitting authorities regarding hydrogen infrastructure.

- National efforts to develop and disseminate a hydrogen education program.

- Standards-setting efforts by the Society of Automotive Engineers and international standards-setting organizations for the fueling of hydrogen vehicles and hydrogen vehicle storage.

Long-Term Hydrogen Vehicle Infrastructure Support:

To carry out any measures as described above would require financial support of the State. Such support would be in the form of research funding, staffing and demonstration/pilot project funding. The implementation period for the activities described above should take place over the next five to ten years.

a. Federal Responsibility

Although U.S. EPA has a rule requiring low sulfur diesel fuel in on-road vehicles nationwide starting in 2006, it has not yet set low-sulfur diesel fuel requirements for off-road engines. ARB expects that, in the 2003-2005 timeframe, US. EPA will promulgate a rule requiring 15 ppm sulfur diesel in off-road engines nationally by 2010.

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

SECTION III

CONSUMER PRODUCTS, VAPOR RECOVERY, AND PESTICIDES

May 2003

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Significant Changes to Defined State and Federal Measures Since ARB Released Draft Strategy for South Coast in January 2003 Section III Measures

Strategy (Agency)	Name	Significant Changes
CONS-1 (ARB)	Set New Consumer Products Limits for 2006	---
CONS-2 (ARB)	Set New Consumer Products Limits for **2008-2010** ~~2006-2010~~	Corrected typographical error on summary table
FVR-1 (ARB)	Increase Recovery of Fuel Vapors from Aboveground Storage Tanks	---
FVR-2 (ARB)	Recover Fuel Vapors from Gasoline Dispensing at Marinas	---
FVR-3 (ARB)	Reduce Fuel Permeation Through Gasoline Dispenser Hoses	---
PEST-1 (DPR)	Implement Existing Pesticide Measure	---

CHAPTER A

Consumer Products

CHAPTER A. CONSUMER PRODUCTS

1. Category Description

As part of the 1988 California Clean Air Act, the California State Legislature gave the Air Resources Board (ARB) the authority and responsibility to achieve the maximum technologically and commercially feasible reactive organic gas (ROG) emission reductions from consumer products.

A consumer product is defined as a chemically formulated product used by household and institutional consumers. Consumer products include, but are not limited to: detergents, cleaning compounds, polishes, floor finishes, cosmetics, personal care products such as antiperspirants and hairsprays, home, lawn and garden products, disinfectants, sanitizers, automotive specialty products, and aerosol paints. Other paint products, such as furniture or architectural coatings, are not part of ARB's consumer products program because local air districts regulate them. Consumer products can come in different product forms including aerosol, liquid, solid, or gel. California law includes a provision that states that the ARB's regulations cannot eliminate any product form.

Consumer products are a significant source of ROG emissions in California and contribute to the formation of both ozone and particulate matter pollution. Although each consumer product may seem to be a small source of emissions, the cumulative use of these products by nearly 35 million Californians results in significant emissions. Consumer products accounted for approximately 267 tons per day (tpd) of ROG emissions in the year 2000, which comprised about eight percent of the total man-made ROG emissions statewide. ARB staff (staff) acknowledges that the ROG emissions from consumer products are relatively less reactive when compared to some other ROG emission sources. For example, on a pound for pound basis, the ROG emissions from vehicle exhaust are estimated to lead to the formation of more than twice as much ozone than the ROG emissions from consumer products. However, this does not mean that consumer products should not be controlled. ROG emissions from consumer products do lead to the formation of ozone and are a significant source of air pollution in California. Further reductions in ROG emissions from consumer products and other ROG sources are needed if ozone standards are to be achieved.

As a result of several regulations adopted by the ARB over the last ten plus years, emissions from consumer products and aerosol coatings have decreased, and continued reductions are projected through 2005. Table III-A-1 lists the various regulations adopted by the ARB with respect to consumer products. Each regulation has been amended at least once since it was originally adopted. Table III-A-2 presents current and projected emissions from consumer products reflecting the benefits of all adopted regulations. Due to population growth and without additional controls, staff

expects the trend of emissions reductions to reverse once the last of the already adopted standards takes effect in 2005. With a projected 1.4 percent population increase per year in California, consumer product emissions are expected to increase by more than 3.5 tpd annually after 2005.

Table III-A-1

California Consumer Products Regulations

Regulation	Adoption Year
Antiperspirants and Deodorants	1989
Consumer Products	1990
Phase I Amendments	1993
Phase II Amendments	1996
Midterm Measures Amendments I	1997
Midterm Measures Amendments II	2000
Alternative Control Plan	1994
Aerosol Coatings	1995
Hairspray Credit Program	1997

Table III-A-2
Baseline Emissions for Consumer Products
(Statewide Emissions, Summer, tpd)

	1990	2000	2005	2010	2015	2020
ROG	320	267	244	260	277	295

(South Coast Air Basin Emissions, Summer, tpd)

	1990	2000	2005	2010	2015	2020
ROG	142	117	105	110	116	121

2. Existing Control Program

ARB has adopted five regulations affecting consumer products. The first regulation reduced ROG emissions from antiperspirants and deodorants in 1989. This was followed in 1990 by the first phase of regulations for 16 other consumer product categories. The regulations have been amended several times including, Phase I in 1993, Phase II in 1996, Midterm Measures I in 1997, and Midterm Measures II in 2000,

and contain a total of nearly 200 emission limits affecting 82 categories of consumer products. In 1995, ARB adopted a separate regulation that included mass emission limits for 35 categories of aerosol coatings. The aerosol coatings regulation was recently amended to replace the mass limits with photochemical reactivity limits for 36 aerosol coating categories. Photochemical reactivity limits are designed to restrict the amount of ozone likely to be formed from reactions of the reactive organic compounds used in each aerosol coating product. On the other hand, mass emission standards limit the quantity of ROG emissions from a given product. Both methods are effective control strategies. As a result of these measures, emissions from regulated categories have been reduced 50 percent, and in total, statewide consumer product emissions will have been reduced by over 130 tpd ROG (37 percent reduction) in 2005, compared to uncontrolled levels with growth.

This 130 tpd reduction from consumer products comes despite the fact that a significant portion of consumer product emissions is not easily available for reduction. Categories of consumer products comprising approximately 100 tpd ROG have not yet been regulated. Of these emissions, approximately 22 tpd are represented by very small categories, each emitting less than 0.1 tpd, which makes setting cost-effective limits difficult. Multi-purpose solvents comprise 20 tpd of the 100 tpd total. Consumers purchase these products for the solvent effect; therefore, replacing a hydrocarbon solvent with water or exempt solvents may not always be a viable option. Nevertheless, we are currently conducting a survey for this category to determine if reductions in either mass or reactivity are feasible. Further, the remaining 58 tpd are comprised of other categories, such as rubbing alcohol, which are difficult to regulate due to health or efficacy concerns. Another complicating factor is that emissions from all categories of consumer products, both regulated and unregulated, are growing yearly because of California's burgeoning population.

ARB has attempted to provide manufacturers with compliance flexibility in the regulations by incorporating market-based components such as the Innovative Products Exemption (IPE) provision (1990), Alternative Control Plan (ACP) (1994) and Hairspray Credit Program (1997). The IPE allows manufacturers to market products with a higher percentage of ROG than the regulation limit as long as they can demonstrate that, due to some characteristic of the product formulation, design, delivery system or other factor, the use of the product will result in less ROG emissions than a representative, complying product. The ACP employs the concept of emissions averaging to provide additional flexibility when formulating consumer products. The Hairspray Credit Program allows manufacturers to generate emission reduction credits by introducing low-ROG based hairspray prior to the effective date of a regulatory limit or by formulating products with a ROG content lower than the regulatory limit. Manufacturers could then use credits to defer compliance with other consumer products emission limits, so long as emission reduction obligations are met in the aggregate.

3. Proposed Strategies

As part of the revised SIP for the South Coast, ARB would evaluate two measures to reduce the emissions associated with consumer products. The strategies ARB staff proposes to pursue are listed in Table III-A-3.

Table III-A-3
Proposed Strategies for Consumer Products

Strategies		Timeframe	
		Action	Implementation
CONS-1	Set New Consumer Products Limits for 2006	2003-2004	2006
CONS-2	Set New Consumer Products Limits for 2008 – 2010	2006 - 2008	2008 - 2010

a. CONS-1: Set New Consumer Products Limits for 2006

Time Frame: Adopt 2003-2004; Implement 2006

Responsible Agency: ARB

Proposed Strategy:

Adopt new consumer product category limits in 2003-2004 and implement these new limits in 2006.

To adopt new limits for addressing emissions growth from consumer products, staff plans to target previously unregulated categories or regulated categories that staff has not evaluated for further emissions reductions during the last five years. Additional reductions may be achieved through both mass-based and reactivity-based limits. Using survey data from the 2001 calendar year, staff will consider proposal of new mass-based or reactivity-based limits in the 2003 to 2004 timeframe for implementation in 2006.

In order to ensure ARB reaches a consumer product emission reduction goal of at least five tpd ROG statewide by 2006 (about two tpd in the South Coast) to mitigate the projected emissions increase due to growth, staff proposes to evaluate solvents and many other regulated or unregulated categories. However, staff would pursue additional reductions beyond the target if they prove to be technologically and commercially feasible.

As part of this effort, staff is proposing to evaluate the various unregulated solvent categories that may contain up to 100 percent ROG. These product categories include multi-purpose removers, graffiti removers, electronic cleaners, adhesive removers, and other packaged solvents. Within the solvent categories, we intend to investigate the feasibility of using reactivity-based strategies to reduce the ozone forming potential of the products. However, we also propose to evaluate mass-based strategies, which may include reducing the ROG content of the products by reformulating with water or exempt solvents, using low vapor pressure ROG, or by replacing propellants with exempted hydrocarbons or compressed gases. Staff is conducting a detailed survey to obtain 2001 sales and formulation data to better understand the variety of products available, the basic functions of these products, and potential reformulation alternatives.

ARB may also seek reductions from many of the smaller regulated or currently unregulated categories of consumer products. For example, toilet/urinal care products, several categories of personal care products, such as nail polishes, certain hair styling aids, and other cleaning products that are not currently regulated will be evaluated to

determine if it is feasible to establish ROG limits. Some other categories we may consider are special purpose adhesives, footwear care products, and other products that were not included in the 1997 Consumer and Commercial Products Survey.

Potential Emission Reductions:

The potential emission reductions for this measure are 5 tpd ROG statewide by 2006, growing to 5.3 tpd ROG by 2010 and 6.1 tpd ROG by 2020. For the South Coast, the potential emission reductions are 2.2 tpd ROG by 2006, growing to 2.3 tpd ROG by 2010 and 2.5 tpd ROG by 2020.

SIP Commitment for Measure CONS-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2003 and 2004. The measure as proposed to the Board will, at a minimum, achieve 2.3 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. CONS-2: Set New Consumer Products Limits For 2008 – 2010

Time Frame: Adopt 2006-2008; Implement 2008-2010

Responsible Agency: ARB

Proposed Strategy:

Adopt new consumer product category limits in 2006 and 2008. Implement these new limits in 2008 and 2010.

To adopt new limits for consumer products in 2006, ARB staff will need to update inventories detailing product ingredients and product sales. Staff plans to conduct a survey in 2004 for the 2003 calendar year. Survey categories would include those with limits effective by January 1, 2003, as well as previously unregulated categories. From data collected in the 2003 calendar year survey, staff would consider adoption of new mass-based or reactivity-based limits in 2006, for implementation in 2008.

To adopt new and/or lower limits for consumer products in 2008, staff will need to further update inventories detailing product ingredients and product sales. We plan another survey in 2006 for the 2005 calendar year. Categories would include products with limits effective between 2003 and 2005 and all aerosol coatings. Based on the survey results, ARB staff will evaluate both mass-based and reactivity-based control options for adoption of new limits in 2008, with implementation by 2010.

There are several possible approaches that will be evaluated for reducing ROG from consumer products in the 2006-2010 timeframe. One possible regulatory approach would be to adopt mass-based limits based on reformulation. In addition, mass or reactivity-based limits may be set for new categories and for small categories that have grown significantly (in terms of product sales) over the last five to ten years. Reactivity limits would be set for those categories where mass-based limits may not be a feasible option. Some solvent categories, for example, are purchased by consumers for their solvent effect. A reactivity-based limit in these categories would allow manufacturers to reformulate using less reactive compounds that would maintain the product's efficacy and result in a reduction of the formation of ozone. The feasibility of adopting a single limit for a product category could also be evaluated. For example, if technologically and commercially feasible, all products within a category, irrespective of product form, could meet the same limit whether the products were dispensed from a pump spray, squeeze bottle, or aerosol can. Staff will also evaluate the technical and commercial feasibility of adopting general emission limits to cover broad ranges of consumer products to keep up with industry changes to product lines. Another approach that could be evaluated is to limit the use of hydrocarbon propellants. Lower limits may be set while still allowing the use of hydrocarbon propellants, such as in post-

foaming products or by blending with exempt propellants. Specific exemptions contained in the regulation may be re-evaluated to see if they are still warranted.

Potential Emission Reductions:

The potential emission reductions for this measure are 20 to 35 tpd ROG statewide by 2010, growing to 23 to 40 tpd by 2020. For the South Coast, the potential emissions reductions are 8.5 to 15 tpd ROG by 2010, growing to 9.7 to 17 tpd ROG by 2020.

SIP Commitment for Measure CONS-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring measures to the Board between 2006 and 2008. The measures as proposed to the Board will, at a minimum, achieve between 8.5 tpd and 15 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

CHAPTER B

Fueling and Vapor Recovery

CHAPTER B. FUELING AND VAPOR RECOVERY

1. Category Description

ARB and districts share responsibility for controlling emissions from the storage and transfer of gasoline. ARB certifies prototype vapor recovery systems. District rules and State law require that only ARB-certified systems be used for gasoline storage, transfer, and refueling operations. Districts inspect and test the vapor recovery systems upon installation during the permit process and conduct regular inspections to check that systems are operating as certified. ARB provides districts with these inspection procedures and test methods.

ARB is also responsible for controlling air toxics that pose harm to public health. For this reason, air toxics from gasoline storage and transfer also fall under the State's authority to control air toxic emissions.

The storage and transfer of gasoline for vehicle refueling is a significant source of ROG emissions in California. Vapor recovery systems are used to capture vapors during the transfer of gasoline between storage tanks and tanker trucks and during the refueling of vehicles at gasoline pumps. Storage tanks can either be sited above ground or underground.

Transfers of gasoline for pleasure craft refueling can be a significant source of emissions, particularly during the summer months when the potential for ozone formation is highest. Emissions can be released when the operator transfers the nozzle from the vessel to the dispenser, tries to overfill or "top off" the vessel, or when the vessel "spits back" fuel from overfill.

When working properly, the emission reduction benefits of these systems are significant. Unfortunately, in many cases, systems have not worked in the field to control emissions at the certified level, and consequently, significant emission reductions have been forgone. In recent years, ARB and the districts have taken many steps to improve the performance and reliability of vapor recovery systems, including ARB's adoption of the Enhanced Vapor Recovery (EVR) program in 2000. ARB staff believes there are additional opportunities to reduce emissions from gasoline storage, transfer, and vehicle refueling.

Emissions from petroleum marketing have dropped significantly since 1980 as a result of the installation of vapor recovery systems. In 2000, petroleum marketing operations still accounted for about 40 tpd of ROG emissions in the South Coast, but emissions are projected to drop as the enhanced vapor recovery program is implemented. Table III-B-1 presents baseline emissions projected for fueling and vapor recovery operations.

Table III-B-1
Baseline Emissions for Fueling and Vapor Recovery Operations
(South Coast, Summer, tpd)

	2000	2005	2010	2015	2020
ROG	42	22	22	23	23

2. Existing Control Program

Vapor recovery systems have been used in California to control ROG for over 20 years. State law enacted in 1975 required ARB to "adopt procedures for determining the compliance of any system designed for the control of gasoline vapor emissions during gasoline marketing operations, including storage and transfer operations, with performance standards, which are reasonable and necessary to achieve or maintain any applicable ambient air quality standard." Since then, ARB has adopted the certification and test procedures to ensure vapor recovery systems meet minimum standards.

Phase I Vapor Recovery

As each gasoline transfer will lead to displaced vapors, vapor recovery is used throughout the gasoline marketing chain. Phase I vapor recovery is applied to gasoline transfer operations involving cargo tank trucks. The first transfer occurs when the cargo tank is filled with product at the loading rack of a refinery terminal or a bulk plant. While the cargo tank is filled, gasoline vapor from the cargo tank is recovered and normally condensed back to liquid fuel. The vapor recovery units at the terminal or bulk plant are certified under ARB procedures. There is also an ARB certification procedure for cargo tanker trucks. ARB assists districts by conducting certification tests at terminals and bulk plants. Phase I vapor recovery also includes the transfer from the cargo tank to the gasoline dispensing facility, or service station. Phase I vapor recovery is required throughout California and in most other states.

Phase II Vapor Recovery

Phase II vapor recovery controls emissions resulting from gasoline transfer from the gasoline dispensing facility to vehicles. This is the vapor recovery equipment that many of us operate routinely when filling up our cars. The two main types of Phase II vapor recovery systems are balance and assist. The balance systems can be identified by the long bellows or boot on the nozzle. The end of the bellows must make a good seal when the nozzle is dispensing fuel into the vehicle. This is important to ensure the vapor pushed out while filling the vehicle tank is routed back through the nozzle to the

underground vapor space. Assist system nozzles, in contrast, are often "bootless." The vapors are collected through a series of holes in the spout which vacuum up the vapors during a refueling. This requires use of an active vapor pump. Some assist systems also have processors to manage the underground vapor space pressure. Two currently certified systems operate with vapor incinerators on or near the vent pipe in order to reduce emissions.

Benzene Airborne Toxic Control Measure

In 1987, ARB adopted an airborne toxic control measure (ATCM) for benzene. This measure requires use of Phase II vapor recovery at all gasoline dispensing facilities in California, except those with very low throughput. Previous to implementation of the ATCM, Phase II vapor recovery was required only if specified in a district rule as an ROG control measure. Usually, those districts were in nonattainment of the ambient ozone standard. Thus, the ATCM resulted in the expansion of Phase II vapor recovery in all districts within California and reduced exposure to benzene while fueling vehicles.

On-Board Refueling Vapor Recovery

In 1994, U.S. EPA set vehicle-based or onboard refueling vapor recovery (ORVR) standards to control refueling emissions as required under the federal Clean Air Act. In 1995, ARB adopted the federal ORVR regulations, with minor modifications, to promote a consistent vehicle design for all 50 states and reduce the testing burden for vehicle manufacturers. ORVR works by routing refueling vapors to a carbon canister on the vehicle. The routing of the vapor to the canister requires a few hardware changes to the vehicle. The fuel tank vent line must be rerouted from the vehicle fill-pipe to the canister, and a seal must be established at the fill-pipe to ensure the vapor is not emitted at the fill-pipe outlet. Vehicle manufacturers use different designs to meet these requirements, but there are two basic types of fill-pipe seals. The most common is a "liquid" seal, which is formed by the gasoline itself as it enters the fill-pipe, which has been reduced in diameter to ensure a good seal. The other type is a "mechanical" seal, which is similar to a gasket that seals closely to the nozzle.

After U.S. EPA adopted the ORVR requirements, concerns were raised regarding compatibility of Phase II vapor recovery and ORVR. The main concern was that since vapor was not returned to the underground storage tank when fueling an ORVR vehicle, air would be drawn into the underground vapor space as liquid was dispensed. Gasoline evaporation would lead to vapor growth and possible excess emissions.

Enhanced Vapor Recovery

In 2000, ARB adopted enhanced vapor recovery (EVR) requirements to improve equipment reliability and achieve additional emission reductions. New requirements include more stringent standards and new equipment specifications for both Phase I and Phase II vapor recovery systems. The new standards will reduce spillage and gasoline evaporation from gasoline nozzles, make vapor recovery systems compatible with the ORVR systems on motor vehicles, and require computerized monitoring equipment for vapor recovery systems to self-diagnose and alert operators when repairs are needed. These requirements are being phased-in over the next several years. In addition to these regulatory changes, ARB is working with districts to improve inspection and compliance test procedures to aid in the enforcement of vapor recovery regulations.

3. Proposed Strategies

ARB would evaluate a number of measures to reduce the evaporative emissions associated with fuel storage, transport, and vehicle refueling. The strategies ARB staff proposes to pursue are listed in Table III-B-2. ARB is also proposing a measure to control evaporative emissions from cargo tanker trucks, as described in Chapter B of Section II.

Table III-B-2
Proposed Strategies for Fueling and Vapor Recovery

Strategies		Timeframe	
		Action	Implementation
FVR-1	Increase Recovery of Fuel Vapors from Aboveground Storage Tanks	2003	2007
FVR-2	Recover Fuel Vapors from Gasoline Dispensing at Marinas	2006 - 2009	2006 - 2010
FVR-3	Reduce Fuel Permeation Through Gasoline Dispenser Hoses	2004	2007

a. FVR-1: Increase Recovery of Fuel Vapors from Aboveground Storage Tanks

Time Frame: Adopt 2003; Implement 2007

Responsible Agency: ARB

Table III-B-3
Baseline Emissions for Aboveground Storage Tanks[1]
(South Coast, Summer, tpd)

	2000	2005	2010	2015	2020
ROG	0.1	0.1	0.1	0.2	0.2

Proposed Strategy:

Regulations controlling the transfer and marketing of fuel in California were initiated in the 1970s in two phases. Phase I regulates gasoline transfer from cargo tank to dispensing facility storage tank, and Phase II regulates gasoline transfer from the dispensing facility to the motor vehicle.

EVR for facilities with underground storage tanks was approved by the Board in March 2000 and is being implemented. The purpose of EVR is to seek additional emission reductions by increasing the stringency of performance standards and specifications and to improve the performance and reliability of vapor recovery equipment. The approved EVR regulations do not apply to vapor recovery systems used on aboveground storage tanks (ASTs). Therefore, the Board is developing a new EVR rulemaking package specific to vapor recovery systems for this category. Vapor recovery systems for aboveground tanks are currently certified by ARB with an allowed 90 percent control efficiency versus 95 percent proposed for EVR.

This regulation would address the increasing number of aboveground storage tank dispensing systems used at private and public facilities and some retail sites. There has been an increasing demand for ASTs for fleet operators in both the public and private non-retail sectors, such as emergency response operations, public works, school districts, marinas, car rental agencies, and car dealerships. This demand has been due to increased compliance costs associated with underground storage tank

1 The current inventory does not differentiate between UST and AST dispensing facility emissions. Therefore, the baseline inventory is estimated. Data on AST emissions would be collected over the next year.

operations. ARB staff is therefore proposing to apply as many of the current EVR standards as feasible to ASTs, including an increase in overall system efficiency from 90 to 95 percent vapor recovery. If ARB's data collection and testing determine that this measure is technically feasible, staff would schedule this for ARB consideration as a rule in 2003.

Potential Emission Reductions:

Until more inventory data are collected, the potential emission reductions associated with this proposal are difficult to estimate. Assuming that one percent of the statewide gasoline throughput is dispensed via ASTs and that these tanks are equipped with vapor recovery systems operating at 90 percent efficiency, then the current emissions are about 0.3 tpd statewide (about 0.1 tpd in the South Coast). By reducing Phase I and Phase II transfer and vent emissions, this strategy would reduce emissions by about 0.2 tpd statewide (0-0.1 tpd in the South Coast). However, diurnal and fugitive emissions (not yet quantified) are expected to be higher than for underground storage tanks and amenable to control. Therefore, reductions are expected to be even greater.

SIP Commitment for Measure FVR-1

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2003. The measure as proposed to the Board will, at a minimum, achieve between 0 and 0.1 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

b. FVR-2: Recover Fuel Vapors from Gasoline Dispensing at Marinas

Time Frame: Adopt 2006-2009; Implement 2006-2010

Responsible Agency: ARB

Table III-B-4
Baseline Emissions for Marinas: Vapor Recovery[2]
(South Coast, Summer, tpd)

	2000	2005	2010	2015	2020
ROG	0.1	0.1	0.1	0.1	0.1

Proposed Strategy:

Unlike vehicle fueling emissions controlled by vapor recovery systems, vapors released during marina fueling are uncontrolled. As marina gasoline is dispensed primarily during the summer months, these ROG emissions are contributing to smog levels during the ozone season.

The South Coast District considered vapor recovery controls at marinas in the 1980s, but did not pursue the rule due to technical difficulties and cost. Existing certified vapor recovery systems cannot be easily applied at marinas as the storage tank is usually located uphill and quite a distance away from the gasoline dispenser.

Under this strategy, ARB staff proposes to determine if new technology may be feasible and cost-effective in reducing ROG emissions from gasoline dispensing operations at marinas. The State Water Resources Control Board (SWRCB) is also considering new requirements for marinas and has already distributed a marina survey that includes requests for information pertinent to estimating air emissions. Survey data has been collected for 80 percent of the marinas statewide as of July 2002. The data indicate that approximately 0.10 percent of the total statewide throughput, or about 14 million gallons of gasoline annually, are dispensed at marina fueling facilities.

2 ARB's current official inventory assumes that gasoline dispensed for off-road purposes is uncontrolled and represents two percent of statewide throughput, but does not identify the emissions associated with marinas specifically. This table contains preliminary estimates of emissions at marinas, assuming negligible growth in gas consumption at marinas in the next 20 years.

Potential Emission Reductions:

The potential emission reductions associated with this proposal are expected to be between 0.1 to 0.2 tpd statewide (0-0.1 tpd in the South Coast) based on the following assumptions: 0.10 percent of the total statewide throughput is dispensed at marinas. If 80 percent control of these emissions were achieved, the emission reduction would be about 0.13 tpd.

SIP Commitment for Measure FVR-2

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board between 2006 and 2009. The measures as proposed to the Board will, at a minimum, achieve between 0 and 0.1 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

c. FVR-3: Reduce Fuel Permeation Through Gasoline Dispenser Hoses

Time Frame: Adopt 2004; Implement 2007

Responsible Agency: ARB

Table III-B-5
Baseline Emissions for Gasoline Dispenser Hose Permeation
(Statewide, Annual Average, tpd)

	2000	2005	2010	2015	2020
ROG	3	NQ	NQ	NQ	NQ

Note: Emissions have only been estimated for 2000. Future year emissions will be estimated during measure development.

Proposed Strategy:

Emission controls for vapors generated from motor vehicle fueling were initiated in the 1970s. ARB's EVR program, adopted in March 2000, constitutes a major overhaul of the vapor recovery program with numerous new standards and specifications aimed at increasing durability and reliability of vapor recovery equipment. However, permeation emissions from dispenser hoses were not targeted in the EVR program.

Gasoline dispensing hoses used at marinas have stricter standards for hose permeability due to water quality concerns. The goal of FVR-3 is to determine the applicability of applying the stricter permeability standard for marine gasoline hoses to dispenser hoses at service stations. Specifically, this measure would review current permeation requirements for gasoline dispenser hoses and, if feasible, establish lower permeation requirements.

Potential Emission Reductions:

Emission reductions of up to 1.7 tpd ROG statewide (0-0.7 tpd ROG in the South Coast) may be achievable if the lower permeation limit associated with marine hoses can be applied to gasoline dispenser hoses at service stations.

SIP Commitment for Measure FVR-3

South Coast 2003 SIP Commitment:

ARB staff proposes to commit to bring this measure to the Board in 2004. The measure as proposed to the Board will, at a minimum, achieve between 0 and 0.7 tpd of ROG reductions in the South Coast Air Basin in 2010.

Commitments for Future SIPs:

As other areas of the State develop attainment SIPs that require additional emission reductions to show progress and/or attainment, we will work with the appropriate local air districts to determine which State and/or federal measures are appropriate to include for federal approval.

CHAPTER C

Pesticides

CHAPTER C. PESTICIDES

1. Category Description

Pesticides are industrial chemicals produced specifically for their toxicity to a target pest. Any living organism that causes damage or economic loss or transmits or produces disease may be a target pest. Pests can be animals (e.g., insects or mice), unwanted plants (e.g., weeds), or microorganisms (e.g., plant diseases and viruses).

Many pesticide products contain volatile organic compounds (VOC), either as an active ingredient or other ingredient. The chemical formulation and application method for pesticides affect the amount of VOC emitted. In the South Coast, pesticides are used primarily to treat structures, as well as agricultural products. Integrated pest management practices, other voluntary actions, and regulatory action on methyl bromide in response to health and environmental concerns have all contributed to a significant reduction in reactive emissions from pesticides in the South Coast since 1990, as shown in Table III-C-1. Emissions from pesticides in other regions of California may vary significantly from the trend shown below.

Table III-C-1
Baseline Emissions for Pesticides
(South Coast, Annual Average, tpd)

	1990	1995	2000	2005	2010	2015	2020
ROG	8.2	3.0	2.8	2.0	1.7	1.7	1.7

2. Existing Control Program

The Department of Pesticide Regulation (DPR) is the California agency responsible for regulating pesticides for commercial/structural and agricultural uses. DPR can establish regulations to reduce both toxic and criteria pollutant emissions from pesticides using the best practicable control techniques available. Control measures may be implemented by several methods, including regulatory actions, local permit conditions, and product substitution or cancellation.

Pesticides are also regulated under federal law. Congress, under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), gave the U.S. EPA authority to provide federal control of pesticide distribution, sale, and use. All pesticides used in the United States must be registered (licensed) by the U.S. EPA. Registration helps to ensure that pesticides will be properly labeled and will not cause unreasonable harm to the environment.

Pesticides available for sale to household and institutional consumers have been regulated under ARB's consumer product authority since 1995. Currently, ARB has adopted VOC limits for insecticide products targeted for crawling insects, flying insects, fleas and ticks, and wasps and hornets. ARB also regulates other pesticide products, such as non-selective herbicides and insect repellants. By 2005, when the final tier of adopted VOC limits for consumer pesticides becomes effective, ARB will have obtained VOC reductions of approximately 60 to 70 percent from the regulated household pesticide categories.

As part of the 1994 SIP, DPR committed to reduce VOC emissions from pesticides in certain federal ozone nonattainment areas of the State. The reductions were to be gradually achieved through a shift in the application practices and types of pesticides used. In the South Coast, VOC emissions from pesticide use have declined dramatically; as a result, we propose to retain the existing SIP commitment. As part of the SIP development process for other areas, ARB and DPR will work with each region to identify any additional strategies that are needed based on the nature of the problems in that particular region.

3. Proposed Strategy

a. PEST-1: Implement Existing Pesticide Strategy

Time Frame: Implement 1996-2010

Responsible Agency: DPR

Proposed Strategy:

DPR has broad authorities under state law to control the use of pesticides for the purposes of protecting human health and the environment, including improving air quality (Food & Agriculture Code §§14102, also §§12781, 12824-12828, 12976-12977, 12991-12995, 12996-12999, 13101 and 13102.)

As described in the 1994 SIP and U.S. EPA's notice approving that plan, DPR committed to reduce VOC emissions from pesticides through voluntary measures, with a regulatory backstop. Specifically, DPR committed to adopt and submit to U.S. EPA by June 15, 1997, any regulations necessary to reduce VOC emissions from agricultural and commercial structural pesticides by specific percentages of the 1990 base year emissions, by specific years, and in specific nonattainment areas. For the South Coast, the commitment is to reduce VOC emissions from pesticides to a level 20 percent below 1990 base year emissions by the attainment year.

Potential Emission Reductions for 2003 South Coast SIP:

Based on today's estimate of 1990 South Coast Air Basin emissions at 8.2 tpd VOC, the target level is 6.6 tpd VOC emissions remaining in 2010. Current emissions are already below the target level and 2010 emissions are projected at 1.7 tpd. These projections are reflected in the baseline inventory for the 2003 South Coast SIP.

4. Long-Term Advanced Technologies Strategies

ARB will seek to achieve additional ROG reductions from pesticides, beyond those identified in the existing SIP commitment, for areas with a demonstrated regional need for such benefits. During development of the San Joaquin Valley Ozone SIP, DPR will take the lead in working with interested stakeholders to determine how pesticide emissions can be further reduced by the attainment deadline.

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

SECTION IV

LONG-TERM STRATEGY

May 2003

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CHAPTER A. INTRODUCTION

The federal Clean Air Act (CAA) recognizes that extreme ozone nonattainment areas, such as the South Coast, must rely on evolving technologies to meet attainment goals. As such, CAA Section 182(e)(5) specifically authorizes the inclusion of long-term measures that anticipate the development of new control techniques or improvement of existing control technologies. When the San Joaquin Valley acts on its intended request for reclassification as an extreme ozone area, it will also be eligible for these long-term technology provisions.

This Section describes the concepts that the State will explore to reduce emissions beyond the levels achievable with the proposed State defined measures, and presents approaches the federal government could use to reduce the contribution from sources under its control. It also includes a commitment to identify additional strategies in a public process.

As part of the public process to develop new emission reduction strategies, ARB staff also identified approaches that, although promising, face barriers to successful implementation. Examples include strategies that could not be successful without significant technological advances, improvements to reduce cost or increase cost-effectiveness, or the securing of a dependable stream of financial incentives.

ARB has a long-standing history of successfully adopting and implementing both technology-advancing strategies and innovative emission control techniques. By working closely with the regulated industry and research scientists, ARB staff have been able to craft regulations that are stringent enough to compel technology development, yet flexible enough to encourage industry innovations. Since 1998, the State has also provided over $200 million in funding for innovative incentive programs to speed the conversion to cleaner trucks, off-road equipment, agricultural irrigation pumps, and harborcraft; another $50 million (from Proposition 40 funds) is earmarked for the next two years. Although this funding is not permanent, it is helping to reduce NOx and PM10 emissions, as well as demonstrate the feasibility of retrofit technologies.

1. Need for Long-Term Strategy

The defined State measures will provide sizeable benefits, but not enough to meet existing SIP attainment needs in South Coast and San Joaquin Valley. Both of these areas, and perhaps others, will need significant additional emission reductions beyond those we will realize with defined State measures. To meet our legal obligations under current federal law, we must secure significant emission reductions from long-term measures by 2010.

Other regions in California would also benefit from statewide long-term strategies. In 1997, U.S. EPA promulgated tighter new federal air quality standards for eight-hour ozone and PM2.5. Almost half of the counties in California are anticipated to

be nonattainment for the eight-hour ozone standard. Based on preliminary air quality monitoring data, the South Coast, San Joaquin Valley and some other urban areas are also likely to be nonattainment for the federal PM2.5 standards. In addition, virtually all areas of California do not meet ARB's health-based ambient air quality standards. Because a large proportion of the emissions contributing to California's ozone and fine particulate problems are from sources under State and federal authority, additional measures to reduce the impact of cars, trucks and equipment will be critical to meeting the new federal standards in the post-2010 timeframe. Achieving the more protective standards will require substantial emission reductions beyond those needed to meet the one-hour federal ozone standard.

2. Sources Of Remaining Emissions In 2010

As a starting point for discussion of the long-term strategy, Figures IV-1 and IV-2 below illustrate where the remaining emissions will be in the South Coast in 2010 if all of the defined State and local measures are implemented. The figures assume that each defined control measure in this document obtains the maximum estimated emission reductions.

In the South Coast, and we anticipate the San Joaquin Valley as well, agencies at all levels must deliver new reductions to help meet the federal one-hour ozone standard by 2010. Mobile sources under the legal or practical control of the federal government are an important contributor to California's air quality problems. The federal Clean Air Act directs U.S. EPA to continue reducing mobile source emissions that cause or contribute to air pollution that endangers public health. The magnitude of the additional reductions required to attain air quality standards necessitates that federal government agencies with authority to control air pollution share responsibility for reaching attainment targets.

Figure IV-1: Remaining NOx Emissions
After Defined State and Local Measures
South Coast 2010

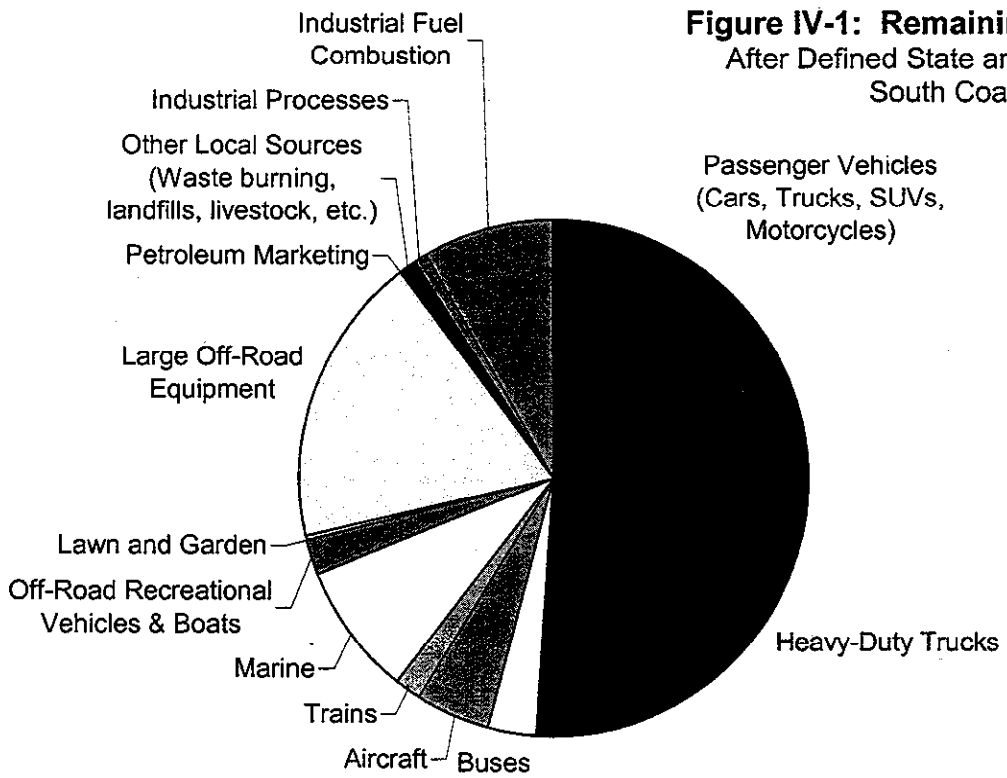
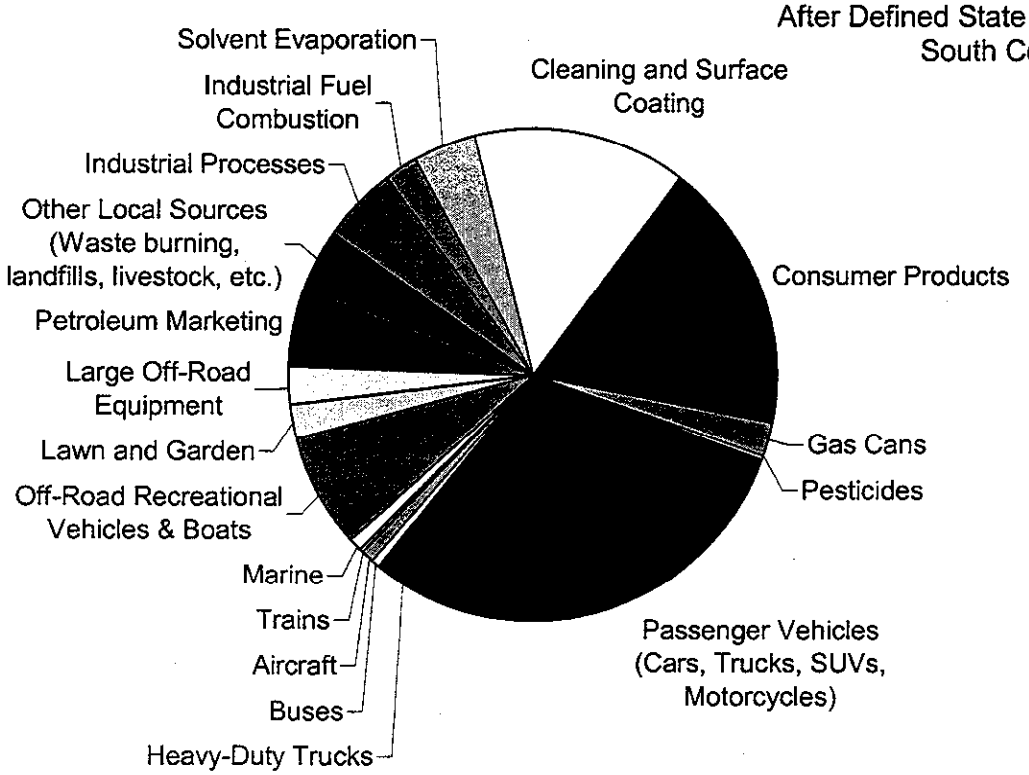


Figure IV-2: Remaining ROG Emissions
After Defined State and Local Measures
South Coast 2010



CHAPTER B. CONCEPTS FOR LONG-TERM MEASURES

1. Possible State Approaches

Table IV-1 lists possible approaches as a starting point for development of the long-term measures. ARB staff appreciates the fact that the possible measures discussed in this section may be highly speculative in today's terms. Success may depend on making significant technological advances, surmounting major implementation barriers (including cost-effectiveness), obtaining financial incentives. And while some technologies may not be feasible until 2010 or later, a continued focus on the state-of-the-art for different source categories can bring attention and support to the need for increasingly lower-emitting activities. One of our goals is to lay the groundwork now that will result in the development, commercialization, and use of zero and near-zero emission technologies by 2010 and beyond.

ARB intends to provide opportunities for the public to offer additional input on this list -- and as we develop the measures. The process will include an investigation of the technical feasibility and timeframe for emission reduction techniques that may not be currently available. The assessment will cover efforts to develop and commercialize advanced and emerging technologies for new and in-use engines, as well as to reformulate consumer products. The assessment will also determine the extent to which emission reduction strategies such as market incentive programs, pollution prevention, public education, and voluntary efforts can complement and enhance the effectiveness of traditional control approaches.

In addition to meeting the federal one-hour ozone standard, ARB staff believes that the process we are proposing for this long term strategy will also aid California's efforts to meet more health protective ozone and particulate matter standards, as well as reduce regional haze and the State's contribution to global climate change.

Table IV-1
Possible State Approaches for Long-Term Measures

Light/Medium-Duty Vehicles	▪ Provide incentives for voluntary passenger vehicle retirement
Smog Check	Explore program expansion to increase benefits, including: ▪ Expanded enhanced smog check ▪ Opt-in to test-only program ▪ Replace rolling 30-year exemption with exemption of pre-1974 vehicles
On-Road Heavy Duty Vehicles	▪ Provide incentives for cleaner trucks and buses, including schoolbuses
Off-Road Vehicles	▪ Provide incentives for cleaner off-road equipment
Airports	▪ Pursue approaches to reduce emissions from vehicles traveling to and from airports
Locomotives	▪ Pursue approaches to reduce emissions from in-use locomotives
Diesel Engines	▪ Set toxics standard for existing stationary diesel fueled engines – over 50 hp ▪ Set toxics standard for existing portable diesel engines ▪ Set toxics standard for new and existing small stationary diesel engines – under 50 hp ▪ Set toxics standard for diesel-fueled refrigeration units on trucks
Fuels	▪ Set sulfur/ash content limits for diesel engine lubricating oils ▪ Support infrastructure for zero emission vehicles – electric, fuel cell, hydrogen
Consumer Products	▪ Consider future consumer products regulations
Incentives	▪ Establish clean air labeling program ▪ Continue Statewide energy conservation program ▪ Consider Statewide public education campaign for air quality
Pesticides	▪ Explore approaches to further reduce volatile emissions from pesticides based on regional need

We briefly describe each of these possible approaches in the following sections.

Light- and Medium-Duty Vehicles

a. Incentives for Voluntary Accelerated Vehicle Retirement

This proposal would expand the current Bureau of Automotive Repair (BAR) vehicle retirement program for older vehicles that have failed Smog Check. The idea would be to include vehicles that have passed their most recent Smog Check

inspection. By accepting only "passed" vehicles, this concept would avoid double-counting emission reduction benefits from the BAR retirement and repair programs. Emissions would be permanently retired from the air.

Smog Check Program

The benefits of the Smog Check program could be increased by expanding the most effective elements of the program.

b. Expanded Enhanced Smog Check

Currently, California has two types of Smog Check inspection tests, two-speed idle and loaded-mode. The two-speed idle test measures hydrocarbon (HC) and carbon monoxide (CO) emissions under idle conditions. The loaded-mode test uses a treadmill-like device to measure nitrogen oxides (NOx) in addition to HC and CO. The loaded-mode test better simulates real world driving conditions and is more adept at identifying failures in new vehicles. With the on-going transition of the Bay Area into loaded-mode testing and test-only stations under the Enhanced Program, more vehicles will be subject to the most stringent requirements. If loaded mode testing were fully implemented, additional emission reductions could be achieved.

c. Allow Air Districts to Opt-In to Test-Only Program

Currently, for attainment areas, unclassified areas, moderate nonattainment areas, and non-urbanized serious, severe, and extreme nonattainment areas, State law allows air districts to request BAR to implement the Enhanced Smog Check program, excluding the test-only requirement. Recently, several air districts chose to implement the Enhanced Smog Check program in their areas. However, current law prohibits air districts from opting into the test-only portion of the Enhanced Smog Check program. If legislation authorizing air districts to also opt in to the test-only portion of the Enhanced Smog Check program were passed, this Smog Check improvement option could provide the air districts about 30 percent more in benefits than the Enhanced Smog Check program without the test-only element.

d. Replace Rolling 30-Year Exemption With Exemption of Pre-1974 Vehicles

Originally, the Smog Check inspection program applied to all 1966 and newer gasoline vehicles. In 1997, the State Legislature modified the Smog Check program to exempt pre-1974 vehicles, and beginning in January 2003, to exempt motor vehicles 30 or more model-years old. Because older vehicles contribute a disproportionate amount of emissions (despite their relatively low numbers and use), excluding these older vehicles from the program reduced the effectiveness of the Smog Check program. Replacing the 30-year rolling exemption with exemption of pre-1974 vehicles would achieve additional emission reductions in future years. In addition, these vehicles would

also be eligible for other BAR assistance programs such as vehicle retirement and repair assistance.

In-Use Fleet of Heavy-Duty Vehicles and Equipment

e. Incentives for Cleaner Trucks and Buses, Including School Buses

For both on-road and off-road diesel engines, ongoing funding for incentive programs such as the Carl Moyer Program and the Lower-Emission School Bus Program would introduce cleaner technology and reduce in-use emissions.

Additional reductions could be achieved with the installation of NOx retrofit technologies such as selective catalytic reductions systems or NOx adsorbers – once these or other NOx retrofit technologies are verified through the ARB's Diesel Emission Control Strategy Verification Procedure. Other long-term advanced technologies could include the use of alternative diesel fuels, and the introduction of extremely low-emitting alternative-fuel engines and fuel cells for heavy-duty vehicles.

f. Incentives for Cleaner Off-Road Equipment

The fleet of off-road combustion ignition engines is dominated by diesel engines that are usually rebuilt two or three times over their long service lifetime. Providing incentives to re-power older engines with cleaner, lower-emitting engines is one method of providing near-term emission reductions from existing engines. Incentive programs encourage equipment operators/owners to purchase equipment that meets emission levels beyond any State, federal, or local requirements. Incentive programs also encourage reduced emission technology and encourage introduction of new technology into niche markets. Continual funding is critical for incentive programs to succeed.

The concept behind this idea would be to replace, or otherwise upgrade, engines in the existing fleet with lower-emitting engines. Specifically, the order of precedence for the upgrade would be to bring as many pre-Tier 2 engines as possible into compliance with the federal Tier 2 HC+NOx emission standards. For engines where such an upgrade is demonstrated to be infeasible, compliance with Tier 1 emission standards would instead be funded. It is estimated that approximately 85 percent of existing Tier 1 engines and 50 percent of uncontrolled engines could be upgraded to comply with the Tier 2 HC+NOx standards. It is also estimated that 80 percent of the remaining uncontrolled engines could be made to meet the Tier 1 HC+NOx standards. Replacement engines and/or upgrade kits would have to show compliance with durability requirements. Options for reducing fleet emissions could include the use of alternative-fuel engines.

Airports

g. Pursue Approaches to Reduce Emissions from Vehicles Traveling To and From Airports

Ground access vehicles move airport passengers, employees, and goods to, from, and around the airport. These vehicles include private passenger vehicles, airport shuttles, taxis, hotel shuttles, parking shuttles, cargo vehicles, and tenant and employee vehicles.

Strategies to reduce emissions from ground access vehicles could take several different forms because of the variety and ownership of the vehicles involved. Specific ideas include reducing emissions from airport fleet vehicles using alternative fuels or particulate diesel filters; providing an infrastructure for alternative fuel/electric vehicles between airports and shuttle terminals; consolidating on-airport vehicle travel; emissions-based airport entry fees for cabs and other shuttle vehicles; and increased ground transportation options for both passenger-bound and employee commuting to and from the airport.

Locomotives

h. In-Use Strategies for Locomotives

Because of the long life of locomotives, strategies to reduce emissions from the in-use fleet are particularly important. There are a number of potentially viable control techniques for locomotives including accelerating fleet turnover, reduced idling, retrofits, and fuel changes. These types of strategies can be implemented through incentive programs, regulations, voluntary actions, research projects, use of advanced technology, fuel changes, and other methods.

Stationary and Portable Diesel Engines

In addition to ideas for reducing emissions from ROG sources, ROG emission reductions can accrue from implementation of the ARB Diesel Risk Reduction Plan. Some diesel particulate control strategies under consideration would also reduce ROG emissions and aid the ozone control strategy. Because the diesel plan reductions have not as yet been defined, it is not possible to project the expected ancillary ROG reductions at this time. Consequently, these strategies are not included as specific commitments in the ozone SIP. However, once the airborne toxic control measures (ATCMs) for diesel PM have been adopted and the emission reductions are enforceable, ARB would claim any associated ROG benefits against its SIP commitments.

i. Set Toxics Standard for Existing Stationary Diesel-Fueled Engines – over 50 hp

The experience gained from controls for highway diesel engines would be reviewed to determine the cost-effectiveness and suitability of new PM and NOx emission control technologies for new stationary diesel engines of less than 50 hp. ARB staff would also assess which existing engines should be retrofitted, paying particular attention to higher usage equipment and those engines with many years of remaining life. These efforts could include voluntary programs and economic incentives to assist and support regulatory efforts.

j. Set Toxics Standard for Existing Portable Diesel Engines

ARB staff would assess retrofit technologies for portable diesel engines whose application does not allow for electrification. This could include requiring these engines to be retrofitted to meet emission standards equivalent to Tier IV standards for off-road diesel engines.

k. Set Toxics Standard for New and Existing Small Stationary Diesel Engines – Under 50 hp

The experience gained from controls for highway diesel engines would be reviewed to determine the cost-effectiveness and suitability of new PM and NOx emission control technologies for new stationary diesel engines of less than 50 hp. ARB staff would also assess which existing engines could be retrofitted, paying particular attention to higher usage equipment and those engines with many years of remaining life. These efforts could include voluntary programs and economic incentives to assist and support regulatory efforts.

l. Set Toxics Standard for Diesel-Fueled Refrigeration Units on Trucks

A transport refrigeration unit is a portable refrigeration unit that is fitted on the front of a truck trailer so that the vehicle can deliver meat, produce, or other perishables requiring refrigeration during transport. A diesel engine is used to power the unit's compressor. The engine is exhausted through a small stack at the top of the unit and is the source of diesel PM and other emissions.

Under this concept, ARB staff would evaluate the control efficiency and cost effectiveness of possible technologies including electrification, engine performance standards, the use of alternate fuels, and catalyzed diesel particulate filters. Staff would also evaluate the phase-in of new manufacturer certification standards.

Fuels

m. Set Sulfur/Ash Content Limits for Diesel Engine Lubricating Oils

This idea would look at the effect on diesel after-treatment technology from limits on sulfur concentration and/or ash content in diesel engine lubricating oil.

In addition to diesel fuel, engine lubricating oil is a source of sulfur and other constituents potentially harmful to after-treatment control technologies essential to achieving emission reductions. Diesel engines are designed to consume some amounts of engine lubricating oils that are burned along with the fuel. Depending on the amount of oil consumed and the level of sulfur and other constituents, the oil consumed can adversely affect the after-treatment controls. Also, lubricating oils can contribute to increased engine-out emissions of sulfur. The significance of engine lubricating oils' contribution to engine-out emissions is not known, but current research efforts are investigating this concern.

If the current research efforts indicate that regulatory action is appropriate, then the concentration of sulfur and/or ash content of diesel engine lubricating oils could be limited for both on-road and off-road vehicles. This would minimize emissions increases by curtailing deterioration rates of the control technology.

Consumer Products

n. Future Consumer Products Regulations

This idea would focus on additional zero and near-zero technologies that could replace volatile compounds. Additional ideas could include the substitution of reactivity-based strategies for products to reduce ozone-forming emissions.

o. Explore Approaches to Further Reduce Volatile Emissions from Pesticides Based on Regional Need

This concept would seek to achieve additional ROG reductions from pesticides, beyond those identified in the existing SIP commitment, for areas with a demonstrated regional need for such benefits. During development of the San Joaquin Valley Ozone SIP, DPR will take the lead in working with interested stakeholders to determine how pesticide emissions can be further reduced by the attainment deadline.

Public Education Programs and Outreach

p. Establish Clean Air Labeling Program

This idea focuses on encouraging consumer purchases of clean products is through a "clean air labeling" program. Such a program would focus and publicize products that emit substantially below any applicable emission standards, or products that have zero or near-zero emissions.

q. Continue Statewide Energy Conservation Program

The focus of this concept would be to pursue ideas that would result in continued and expanded public and private energy conservation and efficiency programs. In 2001, the State conducted an electricity conservation campaign to avoid rolling blackouts. The campaign achieved a 6.7 percent reduction in electricity consumption and a 10 percent decrease in the number of peak hours, compared to the summer of 2000. Several State agencies made special efforts to promote energy conservation. In the summer of 2001, the Public Utilities Commission programs cost $209 million and conserved 238 MW. The California Energy Commission spent $362 million on its peak load reduction programs and saved 454 MW.

r. Consider Statewide Public Education Campaign for Air Quality

This concept would involve the establishment of a statewide public education campaign to reduce air pollution. The concept could include ideas to engage the public through (1) public education that more clearly connects voluntary clean air actions with public health benefits, and (2) increasing awareness of available low-emitting consumer products, paints, vehicles, lawn equipment, and recreational vehicles licensed to use clean air "green" labels.

2. Possible Federal Approaches

Like State and local agencies, the federal government has a responsibility to further control emissions in response to the contribution from sources under its jurisdiction.

U.S. EPA and ARB are continuing to coordinate on future rulemaking, including three on-going efforts described below. First, U.S. EPA is developing more stringent emission standards for new off-road diesel equipment based on the transfer of emission control technology for on-road engines. These benefits will be critical in the post-2010 timeframe to both offset growth and make progress toward the new, more stringent federal standards. Second, U.S. EPA has proposed to phase in the use of lower sulfur diesel fuel in off-road applications nationwide. Diesel fuel with a 15 parts per million sulfur level would support the use of more sophisticated control technology for off-road diesel engines. Third, U.S. EPA is working in parallel with California to develop on-

board diagnostics and to strengthen manufacturers' in-use testing to ensure that new heavy trucks and buses maintain expected emission levels throughout their useful lives.

We expect that U.S. EPA and other federal agencies will secure further reductions, and that the federal government may consider a mix of regulatory programs, incentives or other agreements to achieve reductions.

As part of the evaluation of long-term strategies under our authority, we also identified possible federal emission reduction approaches. Accordingly, ARB staff is including concepts in this document that the federal government could consider. Long-term strategies for new engines in locomotives, ocean-going ships, harborcraft, and commercial and non-tactical military aircraft are feasible and effective means to cut emissions and will be critical to make progress toward all of the national air quality standards. Because of the extended life of these engines, we believe the long-term strategy will need to rely heavily on programs to replace existing engines with cleaner models or to add emission control equipment. Given the volume of equipment in operation and the public health impact of the emissions, it is important that U.S. EPA and its federal partners take early action in this regard.

Table IV-2 lists some possible concepts the federal government could pursue. This list reflects ARB staff's assessment of current technology. As technology advances, this list could be expanded. In addition, the federal government could provide economic incentives to accelerate clean up of diesel engines, specifically those used in schoolbuses and farm operations.

Table IV-2
Concepts for Federal Action

On-Board Diagnostics for New Truck/Bus Fleet and In-Use Testing for Existing Truck/Bus Fleet
Lower Emission Standards for New Off-Road Compression Ignition Engines
Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines
More Stringent Emission Standards for New Harbor Craft and Ocean-Going Ships
Clean Up the Existing Ocean-Going Ship Fleet through Approaches such as Cleaner Fuels, Incentives for Cleaner Ships, Smoke (Opacity) Limits
Reduce Emissions from Jet Aircraft through Approaches such as More Stringent Engine Standards, Retrofit Controls, Cleaner Fuel, and Applying Standards to Non-Tactical Military Aircraft
More Stringent Emission Standards for New and Remanufactured Locomotive Engines
Incentives to Accelerate Clean Up of Existing Diesel Engines

A short description of each concept is provided on the following pages. Many of these concepts are described in detail under the applicable source category in Section II.

a. On-Board Diagnostics for New Trucks and Buses

On-board diagnostic (OBD) systems ensure that the sophisticated emission control devices needed to meet emission standards are working. The OBD systems currently installed on heavy-duty diesel vehicles are designed primarily to detect gross failures. ARB staff is working closely with U.S. EPA on an OBD program for heavy-duty engines and vehicles. The comprehensive OBD system would alert the vehicle operator of the malfunction through a dashboard light. As with light-duty vehicles, an OBD system for heavy-duty vehicles would likely not require the addition of many new sensors or components. Instead, the OBD system would consist primarily of software in the existing on-board computer and will use many of the existing engine and emission control sensors.

b. In-Use Testing for Existing Trucks and Buses

This concept would require manufacturers of heavy-duty diesel engines to test a specific number of engines per engine family by procuring and testing in-use vehicles at various mileage intervals. This is similar to the in-use testing requirements already in place for light-duty vehicle manufacturers. The responsibility for procuring and testing the vehicles would be on the engine manufacturers, not on the U.S. EPA. ARB is working closely with U.S. EPA to develop this measure.

c. Lower Emission Standards for New Off-Road Diesel Engines

Most diesel (compression-ignition) engines are currently regulated, but can meet more stringent emission standards with the incorporation of advanced technology into the engines. ARB is working closely with U.S. EPA to establish nationwide lower emission standards for off-road diesel engines. U.S. EPA's current proposal calls for tighter PM10 standards beginning in 2011 and tighter NOx standards beginning in 2012.

d. Low-Sulfur Diesel Fuel

Although U.S. EPA has a rule requiring low-sulfur diesel fuel in on-road vehicles nationwide starting in 2006, it has not yet set low-sulfur diesel fuel requirements for off-road engines. U.S. EPA has proposed to require 15 ppm sulfur diesel fuel for land-based off-road engines nationally by 2010. Low-sulfur diesel fuel is needed to achieve the emissions standards for off-road diesel engines described above and would facilitate retrofit programs as well.

e. Emission Standards for New Harbor Craft and Ocean-Going Ships

The International Maritime Organization (IMO) and the U.S. EPA have adopted exhaust emission standards for new marine diesel engines. However, the current standards do not achieve the maximum possible emission reductions with available emission control technology. U.S. EPA could achieve additional emission reductions by

1) pursuing more stringent IMO standards for all commercial marine vessels over 130 kW, 2) adopting more stringent U.S. EPA standards for harbor craft over 37 kW and 3) adopting new U.S. EPA standards for U.S. and foreign-flagged ocean-going ships.

f. Clean Up the Existing Ocean-Going Ship Fleet

Because of the long-life of marine engines, it is reducing emissions from the in-use fleet can have significant emission benefits. U.S. EPA could reduce emissions from in-use marine vessels by implementing strategies such as operational controls, requiring the use of cleaner fuels, implementing incentive programs to encourage cleaner vessels, setting opacity limits, and providing for the use of electrical power for hotelling.

g. Lower Emission Standards for New and Remanufactured Locomotives

Requiring even more stringent locomotive emission standards would encourage improvements in locomotive engine technology, further reducing emissions and health risks nationwide. In its proposal for tighter land-based off-road engine standards, U.S. EPA indicated that it is considering lower emission standards for new and remanufactured locomotive engines in the post-2010 timeframe.

h. Reduce Emissions from Jet Aircraft

The options for reducing emissions from jet aircraft include lower emission standards for aircraft engines, installing engine emission retrofit kits, reformulating jet fuel, and applying commercial aircraft engine standards to non-tactical military aircraft. Some of these approaches would require new technology and considerable investments in research and development funding by the National Aeronautics and Space Administration, airframe manufacturers and jet aircraft engine manufacturers.

i. Incentives to Accelerate Clean Up of Existing Diesel Engines

The federal government could provide economic incentives to accelerate clean up of diesel engines, specifically those used in schoolbuses and farm operations. This approach could reduce the risk from toxic diesel particulate emissions, as well as emissions that contribute to ozone formation.

CHAPTER C. STATE IMPLEMENTATION PLAN COMMITMENTS

1. 2003 South Coast State Implementation Plan

In prior SIPs for South Coast, we have included both: (1) long-term defined measures and (2) a more general long-term commitment to achieve the further emission reductions needed for attainment from unspecified sources. This second element is commonly known as the "black box."

The approved 1999 South Coast SIP included commitments for long-term State and federal measures approved under Section 182(e)(5). ARB adopted its defined long-term measures, including the Low Emission Vehicles II and Heavy-Duty Diesel Off-Road standards earlier than anticipated in the SIP. While ARB has satisfied its existing long-term commitment to reduce NOx, the State must adopt additional measures to fulfill its existing long-term commitment to cut ROG. The State defined measures could provide about half of the remaining ROG reductions from the prior "black box," as well as additional NOx reductions.

The updated emission inventories and air quality modeling in the new SIP revision demonstrate a need for more reductions in both ROG and NOx than the existing SIP. As this document goes to publication, the modeling and resulting carrying capacity for ozone are not yet finalized. A variety of modeling analyses have shown that there will be a gap between the emissions after accounting for the potential benefits of defined measures (State and local) and the carrying capacity, but the precise size is still uncertain.

In this document, ARB staff is proposing a process and a general commitment for the long-term State strategy, but deferring the total emission reductions to be achieved pending final modeling. As shown in Table IV-3, we will identify the proposed ARB emission reduction commitment for the long-term strategy in our report to the Board evaluating the South Coast SIP once it is adopted by the local district. This staff report will be available 30 days prior to the Board hearing, tentatively scheduled for September 2003.

Table IV-3
Proposed State Long-Term Strategy
South Coast 2003 SIP

Strategy (Agency)	Name	Final Action Date	Expected Reductions (South Coast 2010)	
			ROG	NOx
LONG-TERM	**Multi-Agency Effort (State, federal, and local) and Public Process Beginning in 2004 to Identify and Adopt Long-Term Measures**	2007-2009	To be determined pending final ozone modeling and identified in Staff Report to Board on 2003 South Coast SIP	

Between now and 2006, ARB would commit to take responsibility, with the participation of the South Coast Air Quality Management District (District) and U.S. EPA, to assess potential emission reduction concepts to meet the long-term commitments. All agencies need to actively seek to identify additional cost-effective control strategies to achieve the maximum feasible reductions from all source categories. Special attention will be given to achieving reductions from in-use on-road and off-road mobile sources because of the extended life of these sources and their slow turnover rate. The public's participation will be important both in identifying potential emission reduction concepts and developing approaches to achieve those emission reductions in practice. The participation of stakeholders in crafting ways to overcome implementation barriers and providing assistance to ultimately obtain the emission reductions will be a key component to meeting the long-term commitment. As new control strategies are identified, agencies would adopt regulations to implement these measures in the earliest practicable timeframe.

Every type of emission source – mobile, stationary, and area – as well as new and existing sources needs to be evaluated to determine the remaining emissions in the attainment year, and the possibility for further emission reductions. ARB will consider the possible approaches listed in Table IV-1 as well as others suggested by our regulatory partners and the public. ARB will also push the federal government to pursue the possible approaches in Table IV-2.

Together with the interested public, the agencies will evaluate the opportunities to achieve all feasible emission reductions from regulatory programs as well as innovative approaches such as incentives, voluntary programs, episodic controls, and other actions. Part of this evaluation will include a discussion of which agency or agencies can most effectively obtain the emission reductions in practice. For sources such as airports, ports, and railyards, the agencies will consider facility-based approaches to reduce overall emissions. For these types of sources, a comprehensive approach may be the most effective way to reduce emissions of ozone and fine particulate precursors, as well as address community health concerns. The agencies will also work with the Southern California Association of Governments to identify how transportation agencies can support further emission reductions. As strategies are

defined throughout this process, the responsible agency will begin development as soon as practicable.

To ensure a focus on development of potential new measures, ARB staff will request periodic public input. Beginning in 2004, we will solicit written proposals for innovative control concepts from the public and then conduct technical workshops to further explore promising ideas to implement the long-term strategy. By 2007, the District and ARB will prepare a revision to the Ozone SIP that (1) reflects any modifications to the carrying capacity based on updated science, and (2) identifies the additional strategies needed to provide the remaining emissions reductions for adoption by 2009 and implementation prior to the beginning of the ozone season in 2010. This schedule would harmonize with development of SIPs to attain the federal eight-hour ozone standard and the fine particulate matter standards in the post-2010 timeframe.

ARB and the District expect that U.S. EPA and other federal agencies will secure further reductions. Like State and local agencies, we anticipate the federal government may consider a mix of regulatory programs, incentives, or other agreements to achieve reductions.

2. Future State Implementation Plans

If other regions of California are reclassified to extreme and develop attainment SIPs that require long-term strategies, ARB will work with each region to identify any additional measures that are needed based on the nature of the problems in a particular region.

PROPOSED
2003 STATE AND FEDERAL STRATEGY FOR THE CALIFORNIA STATE IMPLEMENTATION PLAN

SECTION V

POTENTIAL IMPACTS

May 2003

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CHAPTER B. ECONOMIC IMPACT ANALYSIS V-B-1

CHAPTER A. ENVIRONMENTAL IMPACT ANALYSIS

1. The California Environmental Quality Act

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed projects. This chapter presents ARB's analysis of the potential adverse environmental impacts of the Proposed State and Federal Strategy (Strategy). This chapter also summarizes and discusses ARB's environmental justice policies and identifies the specific strategies in the Proposed Strategy that, if adopted, will reduce air pollution at the community level.

ARB's program involving 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, ARB need only prepare "functionally equivalent" environmental documents instead of Initial Studies, Negative Declarations, and Environmental Impact Reports. In addition, ARB will respond in writing to all significant environmental concerns raised by the public during the public review period or at the Board hearing.

In order to provide for meaningful public review and comment on this environmental analysis, it is important to first explain what this analysis is not. This chapter does not set forth in detail the beneficial environmental impacts that will result from the Proposed Strategy. ARB is proposing the measures contained in the Proposed Strategy because they will benefit air quality. The rest of this report discusses the measures and their intended benefits. This chapter focuses primarily on the potential adverse environmental impacts that may result from the State defined measures identified in the Strategy.

Furthermore, this chapter cannot and does not contain a detailed, quantitative impact analysis of the control strategies contained in the Proposed Strategy. Because the Proposed Strategy is a plan for future action to adopt measures and strategies for which specific regulatory language has not yet been developed, this analysis is necessarily general and qualitative. Each strategy will be developed over time. Some may be developed as incentive or voluntary programs. Most will be proposed in regulatory format with full public participation. The regulatory measures will undergo a detailed environmental analysis as required by CEQA, will be discussed at public workshops, and will go through the public hearing process as 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. In this chapter of the Proposed Strategy, potential environmental impacts are estimated to the extent currently feasible.

2. Project Alternatives

CEQA requires an Environmental Impact Report (EIR) to describe and evaluate the comparative merits of a range of reasonable alternatives to a proposed project [CEQA Guidelines Section 15126 (d)]. Alternatives chosen for analysis should feasibly attain the basic objectives of the proposed project. The range of alternatives required in an EIR is governed by the "rule of reason" that the EIR set forth only those alternatives necessary to permit a reasoned choice. An EIR need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative [CEQA Guidelines Section 15126 (d)(5)(c)].

a. Alternative 1 - 'No Project'

CEQA requires a specific alternative of 'no project' to be evaluated. CEQA documents typically assume that the adoption of a 'no project' alternative would result in no further action on the part of the project proponent or lead agency. For example, in the case of a proposed housing development project, adopting the 'no project' alternative terminates further consideration of that housing development or any housing development alternative identified in the associated CEQA document. In that case, the existing setting would remain unchanged.

One interpretation of the 'no project' alternative is that if the 'no project' alternative was selected, all the measures in the Proposed Strategy are rejected. Since the Proposed Strategy contains all currently known feasible State strategies or measures that ARB could potentially take to reduce ozone, this would mean that no additional measures on existing sources or measures on uncontrolled sources would be developed. The result would be the continual deterioration of California air quality as population increases. In addition, California would fail to meet SIP commitments and would be subject to federal sanctions. Water quality would suffer as acidic rain increases and toxic air contaminants are deposited on the ground. Public exposure to toxic materials would increase. Higher levels of air pollutants would deteriorate aesthetics by increasing haze and would damage crops. On the positive side, there might not be the small increases in solid and hazardous waste that could result from the measures.

b. Additional Alternatives – Adopting Fewer Strategies or Measures, or Adopting Strategies or Measures with Different Emission Standards

As mentioned previously, the Proposed Strategy contains all feasible State strategies or measures to reduce ozone that ARB staff is currently aware of. Instead of adopting all of these measures, ARB could adopt only some of them. Numerous alternatives therefore exist to adopt various subsets of the measures identified in the Plan. In addition, for each individual measure there exists many alternatives for different possible emission standards or levels of control for the sources that are being regulated.

It is not possible to examine these many alternatives in detail without engaging in speculation, because the measures ultimately adopted by ARB will depend on the information that is learned in the future during the regulatory development process. In general, however, ARB staff believes that it will be necessary to adopt all Strategy measures and emission standards that are determined to be feasible, rather than a subset of feasible measures and standards. This is because to attain the federal ozone standard in the South Coast and San Joaquin Valley, significant additional emission reductions will be needed beyond the defined measures specifically identified in the Strategy. Therefore, failing to adopt all feasible measures and emission standards would result in failure to meet California's SIP commitments, and would subject the State to sanctions under the federal Clean Air Act.

3. Potential Adverse Environmental Impacts

The following environmental impact areas were considered for each proposed control measure.

- Water Resources
- Air Quality
- Energy Demand
- Hazards and Hazardous Materials
- Solid / Hazardous Waste
- Noise
- Transportation and Traffic
- Aesthetics
- Agricultural Resources
- Biological Resources
- Cultural Resources
- Geology and Soils
- Land Use and Planning
- Mineral Resources
- Population and Housing
- Public Services
- Recreation

Each environmental impact area is described below. Impacts considered potentially significant are noted in parenthesis at the end of each description. A detailed reference table identifying each measure in the Proposed Strategy, any potential adverse environmental impacts, and some potential mitigation measures is at the end of this section.

At this time, some measures have been developed more fully than others and more impacts have been identified. However, for those less developed strategies, we have attempted to include any potential impact that reasonably could occur, given our present knowledge.

a. Water Resources

This environmental analysis of water resources is divided into two major categories – water quality and water demand. Several potentially significant adverse water quality impacts are identified, including impacts from alternative transportation fuels, and reformulated low-VOC consumer products. However, the cumulative effect of the Proposed Strategy is expected to be beneficial to water quality. No significant water demand impacts have been identified.

Measures in the Proposed Strategy with potential water quality impacts are described further below.

i. Water Quality

Although rain can effectively scrub the air clean, air pollutants absorbed by rainwater can have an adverse impact when deposited into surface waters. NOx and SOx emissions can form acids that can lower the pH of sensitive mountain lakes and streams and adversely affect the flora and fauna. NOx emissions can oxidize to nitrate, a powerful fertilizer, and can spur algae growth contributing to lake water turbidity and algae blooms. Organic molecules can be deposited in surface waters and affect the aquatic plants and animals. Toxic air contaminants (TACs) can dissolve in rain and eventually stress or kill organisms.

Cumulative Impact: The Proposed Strategy would significantly reduce a number of air pollutants and the reductions in deposition will improve overall water quality in California, especially in sensitive lakes in the Sierra Nevada and other eastern mountains. Also, accelerated retirement of older equipment with potentially leaky gasoline or diesel engines will reduce fluid (oil and grease) drips, resulting in cleaner storm water runoff.

The use of alternative fuels is not expected to result in greater adverse water quality impacts than the use of regular petroleum-based fuels. A number of regulations are currently in place to minimize the potential impacts from leaks and spills. The reformulation of consumer products to reduce VOC emissions can be monitored to minimize any potential adverse impacts on water quality. The few measures with a potential for adverse water quality impacts would include mitigation strategies to minimize their limited impact. Cumulative impacts are expected to be less than significant.

ii. State and Regional Water Boards

California has an extensive regulatory program to control water pollution. The most important statute governing water quality is the Porter-Cologne Act, which gives the State Water Resources Control Board (SWRCB) and the nine regional water quality control boards (RWQCB) broad powers to protect surface and groundwater supplies in

California, regulate waste disposal, and require cleanup of hazardous conditions (California Water Code §§3000-13999.16). In particular, the SWRCB establishes water-related policies and approves water quality control plans, which are implemented and enforced by the RWQCBs. The nine regional boards include: North Coast, San Francisco Bay, Central Coast, Los Angeles, Central Valley, Lahontan, Colorado River Basin, Santa Ana, and San Diego.

It is the responsibility of each regional board to prepare water quality control plans to protect surface and groundwater supplies within its region. These plans must identify important regional water resources and their beneficial uses, such as domestic, navigational, agricultural, industrial, and recreational; establish water quality objectives, limits, or levels of water constituents or characteristics established for beneficial uses and to prevent nuisances; and present an implementation program necessary to achieve those water quality objectives. These plans also contain technical information for determining waste water discharge requirements and taking enforcement actions. The plans are typically reviewed and updated every three years (California Water Code §13241).

California dischargers of waste that "could affect the quality of the waters of the State" are required to file a report of waste discharge with the appropriate regional water board (California Water Code §13260). The report is essentially a permit application and must contain information required by the regional board. After receipt of a discharge report, the regional board will issue "waste discharge requirements" analogous to a permit with conditions prescribing the allowable nature of the proposed discharge (California Water Code §§3263, 13377, and 13378).

iii. National Pollutant Discharge Elimination System Requirements

Most discharges into California's waters are regulated by the National Pollutant Discharge Elimination System (NPDES), a regulatory program under the federal Clean Water Act. The NPDES is supervised by U.S. EPA, but administered by the SWRCB. NPDES requirements apply to discharges of pollutants into navigable waters from a point source, discharges of dredged or fill material into navigable waters, and the disposal of sewage sludge that could result in pollutants entering navigable waters. California has received U.S. EPA approval of its NPDES program. Pursuant to California's NPDES program, any waste discharger subject to the NPDES program must obtain an NPDES permit from the appropriate RWQCB. The permits typically include criteria and water quality objectives for a wide range of constituents. The NPDES program is self-monitoring, requiring periodic effluent sampling. Permit compliance is assessed monthly by the local RWQCB and any NPDES violations are then categorized and reported to U.S. EPA on a quarterly basis.

U.S. EPA has also published regulations that require certain industries, cities and counties to obtain NPDES permits for stormwater discharges [55 CFR (1990)]. The new regulations set forth permit application requirements for classes of stormwater

discharges specifically identified in the federal Clean Water Act. The regulated stormwater discharges include those associated with industrial activity and from municipal storm sewer systems serving a population of 100,000 or more.

iv. Discharges to Publicly-Owned Treatment Works (POTWs)

Water discharges to a public sewage system (referred to generically as a POTW), rather than directly to the environment, are not subject to the NPDES discharge requirements. Instead, such discharges are subject to federal pretreatment requirements under §§307(b) and (c) of the Clean Water Act [33 USC §1317(b)-(c)]. Although these pretreatment standards are enforced directly by U.S. EPA, they are implemented by local sanitation districts (Monahan *et al.*, 1993). The discharger, however, has the responsibility to ensure that the waste stream complies with the pretreatment requirements of the local system. Any facility using air pollution control equipment affecting water quality must receive a permit to operate from the local sanitation district. In cases where facilities modify their equipment or install air pollution controls that generate or alter existing wastewater streams, owner/operators must notify the local sanitation district and request that their existing permit be reviewed and modified.

To ensure compliance with wastewater pretreatment regulations, local sanitation districts sample and analyze the wastewater streams from facilities approximately two to four times per year. Persons who violate California's water quality laws are subject to a wide array of enforcement provisions. In 1990, U.S. EPA revised and extended existing regulations to further regulate hazardous waste dischargers and require effluent testing by POTWs. To comply with revised permit limits, POTWs may alter their operations or impose more stringent local limits on industrial user discharges of hazardous wastes (Monahan *et al.*, 1993). POTWs in California are operated by sanitation districts that adopt ordinances establishing permit systems and fee structures. There are 630 POTWs in California.

Alternative Diesel Fuels and Emulsified Diesel – The Proposed Strategies to reduce emissions from on-road, off-road, and stationary diesel-fueled engines could require or encourage the use of alternatively fueled engines and alternative fuel formulations. Because some alternative diesel fuel formulations and additives could more readily dissolve in water, these control measures have the potential to adversely impact local ground and surface waters.

Emulsified diesel fuel is diesel with a small amount of water mixed in and emulsified until stable. By lowering combustion temperatures, the water reduces NOx formation. Use of emulsified diesel may have some negative water quality impacts because spilled emulsified diesel is more soluble in water than spilled diesel. The chemicals in the alternative diesel fuels will be evaluated for toxic effects during the health effects evaluation that is required before the fuel receives federal registration prior to approval.

The use of these alternative fuels is not expected to result in significantly greater adverse water quality impacts than the use of regular diesel fuels. A number of rules and regulations are currently in place to minimize the potential impacts from underground leaking storage tanks, and spills from fueling activities, including requirements for the construction of the storage tanks, requirements for double containment, and installation of leak detection systems. These regulations minimize the potential for additional leaks from the use of diesel fuels or alternative fuels.
(Not Significant)

Consumer Products – Two TACs used in some consumer products, methylene chloride (MeCl) and perchloroethylene (Perc), are specifically exempted from the VOC definition in recognition of their very low ozone-forming capabilities. Some manufacturers could use MeCl or Perc in their formulations to reduce the VOC content to meet future limits, creating potential adverse environmental impacts for air, soil and water.

ARB staff has recognized the potential for increased use of MeCl and Perc in consumer products and has taken steps to mitigate and limit the use of these compounds in recent Board actions. These actions include: the toxics control measure for automotive maintenance and repair activities; aerosol adhesives limits in the consumer products regulation; and reactivity limits in the aerosol coating regulations. ARB also currently tracks the use of MeCl and Perc in regulated consumer products through yearly manufacturer reporting requirements. Further, ARB staff has proposed VOC limits in the past that were achievable without the increased use of TACs. Furthermore, Proposition 65 labeling requirements discourage manufacturers from reformulating consumer products with TACs.

In the future, if new products contain Perc and MeCl, ARB staff will monitor their use and, if necessary, limit or prohibit their use in additional consumer products. Mitigation measures will be implemented if a significant presence of consumer product-related Perc is detected in wastewater.

Under these control measures, petroleum-based products are expected to be reformulated to aqueous-based products to comply with specified VOC emission reduction requirements. Like petroleum-based materials, aqueous materials may lead to adverse impacts to water resources if contaminated products are not handled properly. However, the use of water to reformulate would generally lead to products that would be less toxic than petroleum based materials and generate fewer impacts to water quality.
(Not Significant)

v. Water Demand

No significant negative impacts on water demand were identified.

Cumulative Impact: None.

b. Air Quality

Cumulative Impacts: ARB staff believes the cumulative impact of the Proposed Strategy is to substantially improve air quality. However, some strategies may involve trade-offs, where emissions of one pollutant may increase slightly in order to more effectively reduce overall emissions and protect public health. The initial environmental analysis has examined each measure for potential adverse air quality impacts. The impacts are divided into four major categories – criteria pollutants, air toxics, global warming, and stratospheric ozone depletion.

Potentially significant impacts on criteria pollutant emissions may occur due to: selective catalytic reduction processes; use of diesel particulate filters; and production of low-sulfur diesel fuel. However, the cumulative impact of the Proposed Strategy is to reduce emissions of every major criteria pollutant (ROG, NOx, SOx, PM10, PM2.5, and CO).

Potentially significant air toxics impacts could occur due to reformulation of consumer products and the use of new fuel or alternative fuel additives. However, any new formulations of these products and additives would be closely scrutinized to prevent the addition of toxic compounds. These potential impacts will be more than offset by the substantial reductions in toxics from diesel engines required by the Plan. The cumulative impact of the Proposed Strategy is to greatly reduce emissions of toxic compounds.

Potentially significant global warming impacts could result from measures that may reduce fuel efficiency or increase energy use, strategies that increase natural gas consumption, and consumer product rules. To offset these greenhouse gas increases, local transportation agencies are proposing transportation control measures and districts (like the South Coast Air Quality Management District) are proposing strategies that promote fuel efficiency and pollution prevention. In general, strategies that conserve energy and promote clean technologies usually also reduce greenhouse gas emissions. Other local agencies may also promote transportation measures, fuel efficient technologies and pollution prevention methods. With some of these mitigating strategies in effect, this Strategy is not expected to have a significant adverse impact on global warming.

No potentially significant stratospheric ozone depletion impacts were identified.

i. Criteria Pollutants

The Proposed Strategy will achieve significant reductions of criteria pollutant emissions. Some individual strategies, however, may result in slight increases in one pollutant in order to more effectively reduce emissions of another.

Cumulative Impact: Potential adverse impacts on criteria pollutant emissions may occur due to: selective catalytic reduction processes; use of diesel particulate filters; and production of low-sulfur diesel fuel. However, the cumulative impact of the Proposed Strategy is to reduce emissions of every major criteria pollutant (ROG, NOx, SOx, PM10, PM2.5, and CO) and to benefit overall air quality.

Diesel-Fueled Engines – Measures in the Proposed Strategy to reduce NOx from diesel-fueled engines may necessitate use of Selective Catalytic Reduction (SCR). SCR reduces NOx into molecular nitrogen and water by injecting ammonia into the exhaust upstream of a catalyst. If too much ammonia is used, the ammonia can slip past the catalyst unreacted (called "ammonia slip") and be emitted to the atmosphere. Ammonia slip can worsen as the catalyst ages and becomes less effective. In many SCR installations, ammonia slip must be continuously monitored and controlled. A limit on ammonia emissions is normally included in the Permit to Operate for the SCR. (Potentially Significant)

Diesel Particulate Filters – A number of measures in the Proposed Strategy would require the use of diesel particulate filters, add-on devices that are mounted on the exhaust pipe. Certain types of these diesel particulate filters, referred to as passive filters, accelerate the conversion of nitrous oxide (NO) to nitrogen dioxide (NO2). As such, there is a potential for an adverse effect on the concentration and location of peak ozone levels in the State, especially near centers of diesel activity, as well as increases in levels of NO2, nitric acid, and secondary particulate matter formation.

Catalyst manufacturers are aware of the issue and preliminary analysis suggests that the impacts may be adequately mitigated by designing the system to limit the NO to NO2 conversion rates. In the near term, the advantages of getting diesel particulate filters into operation to reduce risk from diesel PM and allowing the technology to develop and mature should offset any limited adverse impacts.
(Potentially Significant)

Low Sulfur Diesel Fuel – Low sulfur diesel fuel requirements may necessitate increased hydrotreating of fuel to remove sulfur, which would require increased hydrogen production. Hydrogen production, in turn, would require energy, which could increase criteria pollutant (particularly NOx), as well as produce an increase in CO2 emissions. The most acute impact of this process change and emissions increase could be in the communities near refineries. Air district permitting programs will evaluate and mitigate the air quality and environmental impacts to the extent feasible. (Potentially Significant)

Electrification of Equipment – Electric forklifts, dockside electrical hookups for larger marine vessels, the addition of vapor recovery at marinas and other strategies may increase electricity demand from power plants. The increase in power production will increase emissions (primarily NOx) from power plants somewhat. Air district permitting programs are in place to limit these emission increases. Overall, emissions should decrease significantly as fuels such as diesel and propane are replaced by the

much cleaner natural gas burned at power plants.
(Not Significant)

Forklift Purchases – Requirements for zero-emission forklifts (currently electric technology) may cause users to buy and rent larger capacity forklifts fueled by propane or diesel or to delay purchases of new electric forklifts and use older and dirtier forklifts longer. Use of these larger or older forklifts would increase emissions. This regulation will be developed with full consideration of the limits of electric forklifts and the needs of forklift operators. Exemptions for specific applications may be included. This issue will be thoroughly studied to minimize unintended emissions increases.
(Potentially Significant)

ii. Air Toxics

Cumulative Impact: ARB staff believes that the Proposed Strategy as a whole will substantially reduce emissions of TACs. However, some strategies may involve a slight increase in emissions of one pollutant in order to more effectively reduce overall emissions or health risk. Potentially significant air toxics impacts could occur due to reformulation of consumer products and the use of new fuel or alternative fuel additives. However, any new formulations of these products and additives would be closely scrutinized to prevent the addition of toxic compounds. The cumulative impact of the Proposed Strategy is to reduce emissions of toxic compounds.

A brief description of potential impacts of the strategies is provided below.

Consumer Products – The consumer products measures would reduce organic gas emissions by requiring reformulation to reduce VOC content. A number of VOCs currently used in consumer product formulations, such as ethylene-based glycol ethers, trichloroethylene (TCE), and toluene, have also been identified as toxic air contaminants. When a product is reformulated to meet new VOC limits, however, a manufacturer could use small amounts of a chemical, not used before, that may be a toxic air contaminant. This potential impact will need to be evaluated and mitigated as reformulation options are reviewed during the development of new VOC limits.

Two particular TACs used in some consumer products, methylene chloride (MeCl) and perchloroethylene (Perc), are specifically exempted from the VOC definition because of their very low ozone-forming capabilities. As a result, some manufacturers may choose to use MeCl or Perc in their reformulations to reduce the VOC content in meeting future limits. In the future, if new products contain Perc and MeCl, ARB staff will monitor their use and, if necessary, limit or prohibit their use in additional consumer products.

Under these control measures, petroleum-based products are expected to be reformulated to aqueous-based products to comply with specified VOC emission reduction requirements. The use of water to reformulate would generally lead to

products that would be less toxic than petroleum based materials and generate fewer impacts to air quality.
(Not Significant)

Fuel Additives – Before proposing rules requiring fuel additives, staff will evaluate the chemicals in the additives for their toxic effects. Since additives are federally regulated, they will undergo a health effects evaluation prior to approval.
(Not Significant)

iii. Global Warming

In general, strategies that promote clean technologies usually also reduce greenhouse gas emissions. However, some of the individual measures in the Proposed Strategy may result in an increase in the release of greenhouse gases.

Cumulative Impact: Potentially significant global warming impacts may occur due to measures that may slightly reduce fuel efficiency or increase energy use. In addition, strategies that promote natural gas (methane) may increase the potential for methane leaks to the atmosphere. Finally, greenhouse gas emissions resulting from consumer product measures could be potentially significant. These potential impacts could be mitigated by local traffic control measures and by fuel conservation education. With these or other mitigating strategies in effect, this Strategy is not expected to have a significant adverse impact on global warming.

Diesel-Fueled Engines – Proposed Strategy measures to reduce emissions from diesel-fueled engines could require the use of new diesel engines, engine modifications, alternatively fueled engines, add-on control devices such as particulate filters and catalysts, low-sulfur diesel fuel, alternative fuel formulations, or other strategies. These strategies have the potential to slightly reduce fuel economy and increase greenhouse gas emissions. These impacts may be mitigated as other engine features become more efficient to meet air pollution emission standards.
(Potentially Significant)

Mandatory Chip Reflash – During the 1990s, some engine manufacturers programmed the computer chips in diesel engines to maximize power and fuel efficiency with result that NOx emissions were higher. This was in violation of federal and State air pollution regulations. A Proposed Strategy measure would accelerate correction of this problem by requiring computer chips to be reprogrammed to reduce NOx emissions before they are brought in for rebuild. Greenhouse gas emissions could increase slightly due to a decrease in fuel efficiency.
(Potentially Significant)

Natural Gas – Natural gas (methane) is a clean burning fuel but is also a potent greenhouse gas. Strategies that promote natural gas use (in place of diesel fuel, for example) may increase the risk of methane leaks to the atmosphere.
(Potentially Significant)

Diesel Particulate Filters – A number of measures in the Proposed Strategy would require the use of diesel particulate filters. These particulate filters must be periodically regenerated by burning off excess hydrocarbons trapped on the filter. Active regeneration methods use external fuel or energy to heat the filter and regenerate it.
(Not Significant)

Off-Road Spark Ignition Engines – Retrofit emission controls for off-road spark ignition vehicles and equipment could decrease fuel efficiency slightly and increase carbon dioxide emissions.
(Potentially Significant)

Consumer Products – Alternative compounds used to meet lower VOC limits in the Proposed Strategy's consumer products measures could be greenhouse gases. For aerosol products to meet the VOC limits in the proposed regulations, manufacturers may choose to replace some or all of the typical hydrocarbon propellants with HFC-152a or CO2, both of which are greenhouse gasses. HFC-152a has no ozone depletion potential, does not contribute to the formation of ground-level ozone, is low in toxicity, and is only mildly flammable. In addition, HFC-152a has the lowest global warming potential of all the HFCs and an atmospheric lifetime of only 1.5 years. Due to the high cost of HFC-152a (as much as five to seven times greater than other hydrocarbon propellants), it is anticipated that manufacturers will use as little HFC-152a as possible when reformulating their aerosol products. Consequently, the impact on global warming from increased use of HFC-152a should be negligible. However, further analysis of the properties and effects of HFC-152a is needed. Should the analysis reveal significant impacts, ARB staff would reassess the control strategy. CO2 used as a replacement for hydrocarbon propellants would be a recycled byproduct from existing processes and would therefore not contribute to global warming.
(Not Significant)

iv. Stratospheric Ozone Depletion

Cumulative Impact: One strategy had a potential impact on the stratospheric ozone layer, but the impact is not considered significant.

Consumer Products – Some HCFCs are still used in consumer products as propellants and are exempt VOCs under the existing and proposed regulations. It is unknown if there will be an increased use of these compounds in meeting lower VOC limits. However, all HCFCs are classified as group II ozone-depleting compounds by U.S. EPA and are scheduled for phase out between 2004 and 2030. Because of the phase out, manufacturers may prefer to use propellants other than HCFCs. We therefore anticipate that the impact on ozone depletion due to HCFCs will be negligible, or there may be an environmental benefit as manufacturers switch to more benign alternative propellants.
(Not Significant)

c. Energy Demand

Cumulative Impact: ARB staff has identified some potentially significant adverse energy impacts for some individual measures. Potentially significant impacts include: reduced fuel economy due to some diesel engine strategies and increased electricity demand due to electrification of equipment and vehicles. Fuel economy impacts may be mitigated as other engine features become more efficient to meet air pollution emission standards. Electricity demands can be offset somewhat if equipment is charged at night when electricity demand is low. Alternative methods of generating electricity, such as solar panels or fuel cells, might also be incorporated. The cumulative impact of all of the State SIP measures could be a small but measurable increase in energy demand.

Mobile, Stationary, and Portable Diesel-Fueled Engines – Proposed Strategy measures to reduce emissions from diesel-fueled engines could require the use of new diesel engines; engine modifications; alternatively fueled engines; add-on control devices such as particulate filters and catalysts; low-sulfur diesel fuel; alternative fuel formulations; or other strategies. These strategies have the potential to cause a small decrease in fuel economy. Fuel economy impacts may be mitigated as other engine features become more efficient to meet air pollution emission standards.
(Potentially Significant)

Alternative Fuels: Emulsified Diesel – Emulsified diesel fuel is diesel with a small amount of water mixed in and emulsified until stable. By lowering combustion temperatures and affecting combustion chemistry, the water reduces NOx formation. Negative effects include a small fuel efficiency penalty and a decrease in available power.
(Potentially Significant)

Low Sulfur Diesel Fuel – Low sulfur diesel fuel requirements may necessitate increased hydrotreating of fuel to remove sulfur, which would require additional energy consumption.
(Potentially Significant)

Mandatory Chip Reflash – During the 1990s, some diesel engine manufacturers programmed the computer chips in diesel engines to maximize power and fuel efficiency with the result that NOx emissions were higher. A Proposed Strategy measure would accelerate correction of this problem by requiring computer chips to be reprogrammed to reduce NOx emissions before they are brought in for rebuild. Diesel fuel usage could increase due to a slight decrease in fuel efficiency.
(Potentially Significant)

Electrification – Measures in the Proposed Strategy for electrification of forklifts and other equipment can provide significant reductions of air pollutant emissions. However, these projects can create a greater demand for electricity to charge or

operate the equipment. These demands can be offset somewhat if equipment is charged at night when electricity demand is low. Alternative methods of generating electricity, such as solar panels or fuel cells, might also be incorporated.
(Potentially Significant)

Diesel Particulate Filters – A number of measures in the Proposed Strategy would require the use of diesel particulate filters, add-on devices that are mounted on the exhaust pipe. These particulate filters must be periodically regenerated by burning off excess hydrocarbons trapped on the filter. Active regeneration methods use external fuel or energy to heat the filter and regenerate it. However, the additional energy required should not be significant.
(Not Significant)

Fuel Vapor Recovery – The addition of vapor recovery at marinas and improvements for aboveground tanks may increase electrical use slightly.
(Not Significant)

d. Hazards/Human Health

The purpose of the Proposed Strategy is to help California attain the federal one-hour ozone and PM10 standards. ARB's goal is to ensure that all individuals in California, especially children and the elderly, can live, work, and play in a healthy environment. Each of the measures in the Proposed Strategy is intended to reduce the health risks from air pollution. The measures would reduce the pollutants that contribute to adverse health impacts, including: ozone, inhalable particles (including soot and dust), carbon monoxide, and toxic emissions (like particles emitted from diesel engines and benzene).

Cumulative Impact on Human Health: The cumulative impact of the Proposed Strategy will be to reduce human health risk. However, measures in the Proposed Strategy to reduce emissions from consumer products could have local human health impacts.

Cumulative Impact on Human Hazards: Vapor recovery for marina fueling stations and use of selective catalytic reduction have known hazard impacts which can and will be mitigated. Reformulation of consumer products could increase the use of exempt but more flammable VOC solvents such as acetone and methyl acetate. With mitigation measures in effect, the cumulative impact of the Proposed Strategy on hazard risk is not projected be significant.

i. Hazardous Materials

Hazards are related to the risks of fire, explosions, or releases of hazardous substances in the event of accident or upset conditions. Hazards are thus related to the production, use, storage, and transport of hazardous materials. Industrial production and processing facilities are potential sites for hazardous materials. Some facilities

produce hazardous materials as their end product, while others use such materials as an input to their production processes. Examples of hazardous materials used by consumers include fuels, paints, paint thinner, nail polish, and solvents. Hazardous materials may be stored at facilities producing such materials and at facilities where hazardous materials are part of the production processes. Storage refers to the bulk handling of hazardous materials before and after they are transported to the general geographical area of use. Currently, hazardous materials are transported throughout California in great quantities via all modes of transportation including rail, highway, water, air, and pipeline.

State law requires detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of to prevent or mitigate injury to health or the environment in the event that such materials are accidentally released. The Office of Emergency Services (OES) enforces these requirements. Federal laws, such as the Emergency Planning and Community-Right-to-Know Act of 1986 (also known as Title III of the Superfund Amendments and Reauthorization Act or SARA) impose similar requirements.

The U.S. Department of Transportation (U.S. DOT) has regulatory responsibility for the safe transport of hazardous materials between states and to foreign countries. U.S. DOT regulations govern all means of transportation, except for those packages shipped by mail. Hazardous materials sent by U.S. mail are covered by U.S. Postal Service (USPS) regulations. U.S. DOT regulations are contained in 49 CFR; USPS regulations are in 39 CFR. Common carriers are licensed by the California Highway Patrol (CHP), pursuant to the California Vehicle Code, §32000. This section requires licensing of every motor (common) carrier who transports, for a fee, in excess of 500 pounds of hazardous materials at one time and every carrier, if not for hire, who carries more than 1,000 pounds of hazardous material of the type requiring placards. Common carriers conduct a large portion of their business in the delivery of hazardous materials.

The CHP and Caltrans have primary responsibility for enforcing federal and State regulations and responding to hazardous materials transportation emergencies. The CHP enforces hazardous materials and hazardous waste labeling and packaging regulations that prevent leakage and spills of material in transit and provide detailed information to cleanup crews in the event of an accident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of the CHP. The CHP also conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at 72 locations throughout California.

Pursuant to the Emergency Services Act, California has developed an Emergency Response Plan to coordinate emergency services provided by federal, State, and local government agencies and private persons. Response to hazardous materials incidents is one part of this plan. The plan is administered by OES, which coordinates the responses of other agencies including U.S. EPA, CHP, Department of

Fish and Game, the applicable RWQCB, and local fire departments (see California Government Code, §8550).

In addition, pursuant to the Hazardous Materials Release Response Plans and Inventory Law of 1985 (the Business Plan Law), local agencies are required to develop "area plans" for response to releases of hazardous materials and wastes. These emergency response plans depend to a large extent on the business plans submitted by persons who handle hazardous materials. An area plan must include pre-emergency planning of procedures for emergency response, notification and coordination of affected government agencies and responsible parties, training, and follow-up. Hazardous materials incidents are reported to OES, which compiles and archives the information.

ii. Public Health

The Toxic Air Contaminant Identification and Control Act (Health and Safety Code §§ 39650 *et seq.*, Food and Agriculture Code Sections 14021 *et seq.*) established California's two-phased program to identify and control air toxics. In the first phase (risk assessment), ARB selects substances for review, considering criteria relating to "the risk of harm to public health, amount or potential amount of emissions, manner of, and exposure to, usage of the substance in California, persistence in the atmosphere, and ambient concentrations in the community" (Health and Safety Code § 39666(f)). One example of an identified TAC is particulate matter from diesel-fueled engines.

In the risk management phase of the program, ARB reviews the emission sources of an identified TAC to determine if any regulatory action is necessary to reduce the risk. The analysis includes a review of controls already in place, the available technologies and associated costs for reducing emissions, and the associated risk.

Also in the risk management phase, ARB, working closely with the air districts, is responsible for developing control measures for all identified toxic air contaminants except those used as pesticides. Pesticides are evaluated in a similar process by the Department of Pesticide Regulation. Following ARB adoption of measures to control a specific toxic compound, the districts must adopt equal or more stringent regulations for the stationary sources in their jurisdiction. Regulations to control airborne toxic emissions from mobile sources are the responsibility of ARB.

The Air Toxics Hot Spots Program (Health and Safety Code §§ 44300-44384) requires facilities to report their air toxics emissions, ascertain health risks, and to notify nearby residents of significant risks. Facilities that pose a significant health risk to the community are required to reduce their risk through a risk management plan.

iii. Worker Safety Requirements

The California Occupational Safety and Health Administration (Cal/OSHA) and the Federal Occupational Safety and Health Administration (OSHA) are the agencies responsible for assuring worker safety in the handling and use of chemicals in the workplace. In California, Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations. Under the authority of the Occupational Safety and Health Act of 1970, OSHA has adopted numerous regulations pertaining to worker safety (contained in 29 CFR). These regulations set standards for safe workplaces and work practices, including the reporting of accidents and occupational injuries. Some OSHA regulations contain standards relating to hazardous materials handling, including workplace conditions, employee protection requirements, first aid, and fire protection, as well as material handling and storage. Because California has a federally approved OSHA program, it is required to adopt regulations that are at least as stringent as those found in 29 CFR.

Cal/OSHA regulations concerning the use of hazardous materials in the workplace (detailed in CCR, title 8) include requirements for employee safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal/OSHA enforces hazard communication program regulations containing training and information requirements, including procedures for identifying and labeling hazardous substances. The hazard communication program also requires that Material Safety Data Sheets (MSDSs) be available to employees and that employee information and training programs be documented. These regulations also require preparation of emergency action plans (escape and evacuation procedures, rescue and medical duties, alarm systems, and emergency evacuation training).

Both federal and State laws include special provisions for hazard communication to employees in research laboratories, including training in chemical work practices. The training must include instruction in methods for the safe handling of hazardous materials, an explanation of MSDSs, use of emergency response equipment and supplies, and an explanation of the building emergency response plan and procedures. Chemical safety information must also be available at the workplace. More detailed training and monitoring is required for the use of carcinogens, ethylene oxide, lead, asbestos, and certain other chemicals listed in 29 CFR. Emergency equipment and supplies, such as fire extinguishers, safety showers, and eye washes, must also be kept in accessible places. Compliance with these regulations reduces the risk of accidents and worker health effects.

The National Fire Code (NFC), Standard 45 (published by the National Fire Protection Association) contains standards for laboratories using chemicals that are not requirements, but are generally employed by organizations in order to protect workers. These standards provide basic protection of life and property in laboratory work areas through prevention and control of fires and explosions, and also serve to protect personnel from exposure to non-fire health hazards. While NFC Standard 45 is

regarded as a nationally recognized standard, the California Fire Code (24 CCR) contains State standards for the use and storage of hazardous materials and special standards for buildings where hazardous materials are found. Some of these regulations consist of amendments to NFC Standard 45. California Fire Code regulations require emergency pre-fire plans to include training programs in first aid, the use of fire equipment, and methods of evacuation.

Consumer Products – In meeting lower VOC limits, there is a slight potential that products may become more flammable if reformulation increases the use of highly flammable exempt VOC solvents such as acetone and methyl acetate. This could be of concern in the manufacture, storage, shipping and end use of the reformulated products. In many instances, however, manufacturers can use other, less flammable, exempt solvents and/or water borne formulations.
(Potentially Significant)

Marina Vapor Recovery – Unlike vehicle service station fueling, gasoline vapors recovered during marina fueling operations are not easily transferred back to the marina gasoline storage tank. At vehicle service stations, the storage tank is in close proximity to the dispenser, while at marinas, the storage tank may be several hundred feet away at a higher elevation.

The marina vapor recovery measure may involve collection of vapors at the dispenser into a carbon canister system. These systems have been used in refinery operations to collect organic vapors. As with all gasoline vapor recovery systems, there is a potential to form an explosive gas mixture when the vapors mix with air. This is an especially critical concern with boats since the boat hull can collect leaking heavy gasoline vapors. The State Fire Marshall reviews all vapor recovery equipment designs and procedures to assure that they will not cause any undue risk. The U.S. Coast Guard would probably also have to approve the system. A more detailed analysis will be provided when regulations implementing this measure are proposed for adoption.
(Potentially Significant)

Selective Catalytic Reduction (SCR) – Selective catalytic reduction may be used on large diesel engines to reduce NOx in the exhaust. Ammonia or urea is used to react with the NOx, in the presence of a catalyst, to form nitrogen gas and water. In some SCR installations, anhydrous ammonia is used. There are known safety hazards related to the storage and handling of this volatile and poisonous liquid. These hazards must be addressed in the initial system design and periodically in hazard assessments.
(Potentially Significant)

Fuel Additives – Before proposing rules requiring fuel additives, staff will evaluate the chemicals in the additives for their toxic effects. Since additives are federally regulated, they will undergo a health effects evaluation prior to approval.
(Not Significant)

Cargo Tank Vapor Recovery – Cargo tank vapor recovery measures in the Proposed Strategy will prevent the escape of gasoline vapors contained in cargo tanks and delivery hoses. Gasoline vapors can be explosive or flammable if not handled properly. Thus, vapor recovery systems must be designed to eliminate the risk of explosion or fire. The State Fire Marshal reviews all vapor recovery equipment designs and procedures to assure that they will not cause any undue risk.
(Not Significant)

Diesel Particulate Filters – A number of measures in the Proposed Strategy would require the use of diesel particulate filters. Some safety concerns include reduced visibility from the driver's seat due to new equipment mounted near eye level, particularly on off-road equipment such as bulldozers, backhoes, and tractors. ARB staff believes that proper engineering design can mitigate or eliminate these potential problems.
(Not Significant)

Another property of diesel particulate filters is that they must be regenerated by burning off excess hydrocarbons trapped on the filter. Active regeneration methods use external fuel or energy to heat the filter and regenerate it. Some small potential exists for a runaway regeneration that could pose a fire hazard. Proper engineering design should mitigate or eliminate these potential risks. Diesel particulate filter measures will be written to assure that the design is proven effective.
(Not Significant)

Alternative Fuels: Compressed Natural Gas (CNG) – Proposed Strategy incentive programs and in-use strategies may require or promote the use of alternative fuels, particularly compressed natural gas (CNG). This presents a potential safety issue due to the increased use and handling of gaseous fuels. While CNG is flammable, it has been demonstrated in recent years that the fire risks from CNG use are known, manageable, and reasonable. CNG is an increasingly common fuel which is developing a proven safety record.
(Not Significant)

e. Solid / Hazardous Waste

Cumulative Impact: The cumulative impact of all strategies in the Proposed Strategy would be to create a small but potentially significant increase of both solid and hazardous wastes. To mitigate these impacts, ARB will work with the California Department of Toxic Substances Control (DTSC) and the California Integrated Waste Management Board (CIWMB) to reduce waste production in these and other areas.

Several Proposed Strategy measures may produce small amounts of solid or hazardous wastes. The strategies with potential impacts are: controls for diesel-fueled engines and vehicles, use of particulate filters, a pilot program to replace emission controls on older light duty vehicles, electrification of forklifts and other equipment, and

gasoline vapor recovery for marinas. The potential impacts of these and other measures on solid or hazardous waste are described below.

i. Solid Waste

Solid waste consists of residential wastes (trash and garbage produced by households), construction wastes, commercial and industrial wastes, home appliances and abandoned vehicles, and sludge residues (waste remaining at the end of the sewage treatment process). CCR title 14, Division 7, provides the State standards for the management of facilities that handle and/or dispose of solid waste. CCR title 14, Division 7, is administered by the CIWMB and the designated Local Enforcement Agency (LEA). The designated LEA for each county is the County Department of Environmental Health.

CCR title 14, Division 7, establishes general standards to provide required levels of performance for facilities that handle and/or dispose of solid waste. Other title 14 requirements include operational plans, closure plans, and post-closure monitoring and maintenance plans. Title 14 covers various solid waste facilities including but not limited to landfills, material recovery facilities (MRFs), transfer stations, and composting facilities.

ii. Hazardous Waste

Hazardous materials are substances with certain physical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed, or otherwise managed. As defined in CCR title 22, Division 4.5, Chapter 11, Article 3, hazardous materials are grouped into the following four categories based on their properties: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials) and reactive (causes explosions or generates toxic gases). A hazardous waste is any hazardous material that is discarded, abandoned, or to be recycled. The criteria that render a material hazardous also make a waste hazardous (Health and Safety Code, § 25151). If improperly handled, hazardous materials and wastes can result in public health hazards if released to the soil or groundwater or through airborne releases in vapors, fumes, or dust.

Under the Resource Conservation and Recovery Act (RCRA), U.S. EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA was amended in 1984 by the Hazardous and Solid Waste Act (HSWA), which affirmed and extended the concept of regulating hazardous wastes from generation through disposal. HSWA specifically prohibits the use of certain techniques for the disposal of some types of hazardous wastes. Under RCRA, individual states may implement their own hazardous waste programs in lieu of RCRA as long as the state program is at least as stringent as the federal RCRA requirements. U.S. EPA approved California's program to implement federal regulations as of August 1, 1992.

DTSC administers the Hazardous Waste Control Law (HWCL). Under HWCL, DTSC has adopted extensive regulations governing the generation, transportation, and disposal of hazardous wastes. HWCL differs little from RCRA; both laws impose "cradle to grave" regulatory systems for handling hazardous wastes in a manner that protects human health and the environment. Regulations implementing HWCL are generally more stringent than regulations implementing RCRA. HWCL regulations list over 780 hazardous chemicals, as well as nearly 30 more common materials that may be hazardous, and establish criteria for identifying, packaging, and labeling hazardous wastes. They prescribe management practices for hazardous wastes; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills.

Under both RCRA and HWCL, hazardous waste manifests must be retained by the generator for a minimum of three years. Hazardous waste manifests list a description of the waste, its intended destination, and regulatory information about the waste. A copy of each manifest must be filed with DTSC. The generator must match copies of hazardous waste manifests with certification notices from the treatment, disposal, or recycling facility. Hazardous waste as defined in the Code of Federal Regulations title 40 (40 CFR) 261.20 and CCR title 22, Article 9 (including listed substances, 40 CFR 261.30) is disposed of in Class I landfills. California has enacted strict legislation for regulating Class I landfills (Health and Safety Code, §§25209 - 25209.7). For example, the treatment zone of a Class I landfill must not extend more than five feet below the initial surface and the base of the zone must be a minimum of five feet above the highest anticipated elevation of underlying groundwater (Health and Safety Code, §25209.1(h)). The Health and Safety Code also requires Class I landfills to be equipped with liners, a leachate collection and removal system, and a groundwater monitoring system (Health and Safety Code, §25209.2(a)). Such systems must meet the requirements of DTSC and the SWRCB (Health and Safety Code, §25209.5).

Hazardous waste can also be transported to permitted facilities outside of California. The nearest out-of-state landfills are U.S. Ecology, Inc., located in Beatty, Nevada; USPCI, Inc., in Murray, Utah; and Envirosafe Services of Idaho, Inc., in Mountain Home, Idaho. Incineration is provided at the following out-of-state facilities: Aptus, in Aragonite, Utah and Coffeyville, Kansas; Rollins Environmental Services, Inc., in Deer Park, Texas and Baton Rouge, Louisiana; Chemical Waste Management, Inc., in Port Arthur, Texas; and Waste Research & Reclamation Co. in Eau Claire, Wisconsin (SCAQMD, 1996).

Diesel-Fueled Engines and Vehicles – The recommended measures to reduce emissions from diesel-fueled engines and vehicles could require the use of new diesel engines or add-on control devices such as particulate filters and catalysts. Potential adverse impacts include increased scrapping of diesel engines and vehicles, and impacts due to handling and disposal of collected particulate matter. The impact of accelerated vehicle scrapping can be largely mitigated by recycling.
(Potentially Significant)

Diesel Particulate Filters – A number of measures in the Proposed Strategy would require use of diesel particulate filters. Diesel particulate filters will probably produce a small amount of waste ash for disposal. This waste is estimated at about 10 to 150 grams of ash per vehicle per year and is projected to be considered a hazardous material due to zinc content. While most larger maintenance facilities can be expected to handle, collect, and dispose of the material properly, as a hazardous waste, it is less certain how smaller facilities will handle waste ash. The filters themselves will eventually also be retired. Some filters contain a precious metal catalyst that is valuable for recycling and reclaiming. Other spent filters may not be worth recycling and may be disposed of at a proper landfill. We do not expect that the spent filters themselves will be considered a hazardous material.
(Potentially Significant)

Motor Vehicles – Replacement of Old Emission Control Parts – Several strategies will evaluate the benefits of replacing key emission control parts with new parts on older vehicles which exceed their original certification standards. Parts to be replaced include catalysts, carbon canisters, fuel lines and oxygen sensors. Catalysts normally contain precious metals and are recycled. The other replaced components would probably be disposed of in landfills.
(Potentially Significant)

Electrification – Electrification of forklifts and other equipment can provide significant reductions of air pollutant emissions. However, electrification strategies may result in the production and use of a significant number of batteries. These batteries are normally recycled and the recycle rate for lead-acid batteries is currently over 95%. However, the increase in the number of spent batteries to be processed would potentially have significant impacts on the recycling industry and on the disposal system for non-recyclable materials. Leasing, deposit, or rebate programs for electric batteries could be required to increase recycling. A spent battery exchange for battery replacement could also reduce waste impacts. With these mitigation measures in place, battery disposal impacts should not be significant.
(Not Significant)

Forklift Scrapping – The recommended measure to reduce emissions from forklifts could require the replacement of older forklifts with new electrical equipment. Potential adverse impacts include increased scrapping of forklifts and engines. The impact of accelerated vehicle scrapping can be largely mitigated by recycling.
(Not Significant)

Marina Vapor Recovery – A marina vapor recovery measure may involve collection of vapors at the dispenser into a carbon collection device (carbon bed). As marinas have fairly low gasoline throughputs, vapors may be collected over a period of several days before the carbon is recycled. At this time, ARB believes that the carbon would be recycled rather than discarded as waste. A more detailed analysis will be

provided when regulations implementing this program are proposed for adoption. (Potentially Significant)

Small Off-Road Engines – Lower emission standards for new non-handheld lawn and garden equipment may require emission control parts, such as catalysts, that may ultimately be discarded into landfills. Recycling of catalysts could mitigate much of the impact.
(Not Significant)

f. Noise

Cumulative Impact: The cumulative effect of the Proposed Strategy will not have a potentially significant impact on noise. Some air pollution strategies described in the Proposed Strategy, such as measures that promote the electrification of vehicles and forklifts, may reduce noise.

Mobile, Stationary, and Portable Diesel-Fueled Engines – The recommended measures to reduce emissions from diesel-fueled engines could require the use of add-on control devices such as particulate filters and catalysts and engine modifications. This could result in a potential increase in noise levels due to exhaust system changes to accommodate add-on controls. However, testing of current add-on controls has shown no increase in noise and ARB staff does not expect future adverse noise impacts (Not Significant).

g. Transportation and Traffic

No element of the Proposed Strategy is expected to have negative impacts on transportation or traffic. Although many control measures in the Proposed Strategy call for emission reductions from motor vehicles, these control measures rely on technological changes, which will not impact transportation or traffic.

h. Aesthetics

No element of the Proposed Strategy is expected to degrade the natural beauty of California. Instead, the Proposed Strategy will have significant positive impacts on aesthetics. Regional haze will be reduced by Proposed Strategy elements that reduce hydrocarbon, nitrogen oxide, and particulate matter emissions. Acid rain (which damages trees, lakes, historic buildings and rock formations, etc.) will be reduced by measures that reduce NOx emissions.

i. Agricultural Resources

The Proposed Strategy is not expected to cause any adverse impacts on the agricultural resources of California. Ozone pollution causes significant crop yield loss in California. The Proposed Strategy will help reduce ozone levels and consequently reduce crop loss resulting from ozone damage.

j. Biological Resources

The Proposed Strategy is not expected to cause any adverse impacts on the biological resources of California. We believe that the proposed measures will improve air quality and consequently, will improve the habitat of our biological resources.

k. Cultural Resources

The Proposed Strategy is not expected to cause any adverse impacts on the cultural resources of California. We believe that the proposed measures will reduce ozone and acidic compounds in the air. Ozone, which causes oxidation, and airborne acids are both known to cause deterioration of archaeological, paleontological, and geological features.

l. Geology and Soils

The Proposed Strategy is not expected to cause any adverse impacts on geology or soils.

m. Land Use and Planning

The Proposed Strategy is not expected to cause any adverse impacts on land use and planning.

n. Mineral Resources

The Proposed Strategy is not expected to cause any adverse impacts on mineral resources.

o. Population and Housing

The Proposed Strategy is not expected to cause any adverse impacts on population and housing.

p. Public Services

The Proposed Strategy is not expected to cause any adverse impacts on public services.

q. Recreation

The Proposed Strategy is not expected to cause any adverse impacts on recreation. By reducing the number of days with unhealthy air quality, ARB expects that our parks and outdoor recreational facilities could see increased usage by children, the elderly, asthmatics, and others with sensitive airways or chronic breathing problems.

4. Cumulative Impacts of State Measures and Local District Measures

For each environmental impact area, the cumulative environmental impacts of the State Strategy are discussed above. This section addresses the cumulative environmental impacts of the State Strategy combined with the impacts of the plans of the local air districts. To address these combined impacts, the cumulative impacts discussion contained in the South Coast Air Quality Management District's Draft Environmental Impact Report (EIR) for the 2003 Air Quality Management Plan (SCAQMD Plan), released in April 2003, is hereby incorporated by reference.

Because of the serious air quality problem in the South Coast Air Basin, the SCAQMD has defined the greatest present need for new emission reductions, and the SCAQMD Plan has outlined the most comprehensive set of measures to achieve these reductions. The measures set forth in the SCAQMD Plan therefore constitute a "worst case" scenario for cumulative impacts. While it is possible that future SIP revisions for other districts may contain measures that are not discussed in the SCAQMD Plan, at this time we do not know what such hypothetical future measures may be and it would be speculative to attempt to evaluate them. For the purposes of this analysis, therefore, the most reasonable approach is to utilize the SCAQMD Plan as a "worst case" scenario.

ARB staff has reviewed and considered the cumulative impacts analysis contained in the SCAQMD EIR and concurs with its approach and conclusions. This analysis considers the cumulative impacts of the measures contained in the State Strategy combined with the measures in the SCAQMD Plan. The SCAQMD analysis can be found in Chapter 4 of the SCAQMD EIR, entitled "Environmental Impacts and Mitigation Measures." To avoid redundancy, it is appropriate to incorporate this analysis by reference rather than repeat it here. The SCAQMD EIR can be found on the SCAQMD internet site at:
http://www.aqmd.gov/ceqa/documents/2003/aqmd/draftEA/AQMP/AQMP_DEIR.html.

5. Impacts of the Individual Defined Measures

The State and federal measures in the Proposed Strategy will help make progress toward our goal of healthy air for all Californians. Each of the defined State measures was evaluated to identify adverse environmental impacts. The following table lists each of the measures, any potentially significant environmental impacts, and possible mitigation methods.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
MOBILE SOURCES			
Light and Medium-Duty Vehicles			
LT/MED-DUTY-1	**Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles -- Pilot Program.**	Waste: Some increased disposal of faulty emission control parts.	Recycle parts and/or catalyst when feasible.
LT/MED-DUTY-2	**Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles.**	Waste: Some increased disposal of faulty emission control parts.	Recycle parts and/or catalyst when feasible.
On-Road Heavy-Duty Diesel Engines and Vehicles			
ON-RD HVY-DUTY-1	**Augment Truck and Bus Highway Inspections with Community-Based Inspections.**	None Identified	None Required
ON-RD HVY-DUTY-2	**Capture and Control Vapors from Gasoline Cargo Tankers.**	None Identified	None Required

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
ON-RD HVY-DUTY-3	**Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet – PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance.**	Air: Potential for passive particulate filters to emit higher levels of NO2 affecting ozone, NO2, nitric acid, and secondary particulate.	Limits on NO to NO2 conversion rates.
		Energy: Potential fuel efficiency loss due to controls.	Design system to reduce back pressure and require back pressure monitoring.
		Waste: Filter ash and spent filter may be a hazardous waste.	Promote safe handling, collection, and recycling.
		Waste: Potential increase in engine and vehicle scrapping.	Promote recycling of engines and vehicles.
		Waste: Some increased disposal of faulty emission control parts.	Recycle parts and/or catalysts when feasible.
		Hazards/Human Health: Potential fuel additives could be hazardous.	Additives must be proven safe.
		Water: Emulsified diesel may disperse into surface water easily.	Require spill prevention plan.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	Off-Road Compression-Ignition Engines		
OFF-RD CI-1	**Pursue Approaches to Clean Up the Existing Off-Road Equipment Fleet (Compression-Ignition Engines) -- Retrofit Controls.**	Air: Potential for passive particulate filters to emit higher levels of NO2 affecting ozone, NO2, nitric acid, and secondary particulate.	Limits on NO to NO2 conversion rates.
		Energy: Potential fuel efficiency loss due to controls.	Design system to reduce back pressure and require back pressure monitoring.
		Waste: Filter ash and spent filter may be a hazardous waste.	Promote safe handling, collection, and recycling.
		Hazards/Human Health: Potential fuel additives could be hazardous.	Additives must be proven safe.
		Water: Emulsified diesel may disperse into surface water easily.	Require spill prevention plan.
OFF-RD CI-2	**Implement Registration and Inspection Program for Existing Off-Road Equipment to Detect Excess Emissions [Compression-Ignition Engines].**	Waste: Some increased disposal of faulty emission control parts.	Recycle parts and/or catalyst when feasible.
	Off-Road Large Spark-Ignition Engines		
OFF-RD LSI-1	**Set Lower Emission Standards for New Off-Road Gas Engines [Spark-Ignition Engines 25 hp and Greater].**	None Identified	None Required

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
OFF-RD LSI-2	**Clean Up Existing Off-Road Gas Equipment Through Retrofit Controls [Spark-Ignition Engines 25 hp and Greater].**	Waste: Some increased disposal of faulty emission control parts. Air: Potential decrease in fuel economy could increase carbon dioxide emissions. Energy: Potential decrease in fuel economy.	Recycle parts and/or catalyst when feasible. Design retrofit controls to minimize impact on fuel economy. Design systems to minimize adverse impacts on fuel economy.
OFF-RD LSI-3	**Require Zero Emission Forklifts Where Feasible -- Lift Capacity ≤8,000lbs.**	Air: Potential increase in purchases of larger and/or diesel forklifts to avoid electric could increase emissions. Air: Increase in emissions from electrical power plants. Air: Potential for older and dirtier forklifts to be kept longer. Energy: Increase in demand for electrical power. Waste: Potential increase in forklift scrapping. Waste: Potential increase in battery waste.	Regulation will be written to consider and minimize unintended emission increases. Air district permitting programs to limit emissions increases. Regulation will be written to consider and minimize unintended emission increases. Charge batteries at night. Use solar panels or fuel cells. Promote recycling of engines and vehicles. Promote battery recycling.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Small Off-Road Engines			
SMALL OFF-RD-1	**Set Lower Emission Standards for New Handheld Small Engines and Equipment -- Like Weed Trimmers, Leaf Blowers, and Chain Saws [Spark-Ignition Engines Under 25 hp].**	None Identified	None Required
SMALL OFF-RD-2	**Set Lower Emission Standards for New Non-Handheld Small Engines and Equipment -- Like Lawnmowers [Spark-Ignition Engines Under 25 hp].**	Waste: Potential for catalyst systems to be sent to landfill.	Promote recycling of catalysts.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Commercial Marine Vessels and Ports			
MARINE-1	**Pursue Approaches to Clean Up the Existing Harbor Craft Fleet -- Cleaner Engines and Fuels.**	Air: Potential for passive particulate filters to emit higher levels of NO2 affecting ozone, NO2, nitric acid, and secondary particulate.	Ensure systems are properly designed to minimize conversion of NO to NO2. Establish cap on NO2 emissions.
		Air: Potential for ammonia emissions from NOx controls.	Monitor and control ammonia.
		Air: Potential decrease in fuel economy (add on control devices, alternative fuels) could increase carbon dioxide emissions.	Promote increases in fuel efficiency.
		Air: Expanded use of alternative fuels could increase emissions at refineries.	Air district permitting programs to limit emissions increases.
		Energy: Potential fuel efficiency loss due to controls.	Design to reduce back pressure and require back pressure monitoring.
		Waste: Filter ash and spent filter may be a hazardous waste.	Promote safe handling, collection, and recycling.
		Waste: Potential increase in engine scrapping.	Promote recycling of engines.
		Hazards/Human Health: Potential fuel additives could be hazardous.	Additives must be proven safe.
		Water: Emulsified diesel fuel or additives may disperse into surface water easily.	Require spill prevention plan and safe storage practices.
		Hazards/Human Health: Potential for ammonia storage hazards.	Require proper facility design with hazard assessment.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
MARINE-2	**Pursue Approaches to Reduce Land-Based Port Emissions – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Idling Restrictions.**	Air: Potential for passive particulate filters to emit higher levels of NO2 affecting ozone, NO2, nitric acid, and secondary particulate.	Ensure systems are properly designed to minimize conversion of NO to NO2. Establish cap on NO2 emissions.
		Air: Potential decrease in fuel economy (add on control devices, alternative fuels) may increase emissions of carbon dioxide.	Promote increases in fuel efficiency.
		Air: Expanded use of alternative fuels could increase emissions at refineries.	Air district permitting programs to limit emissions increases.
		Energy: Potential decrease in fuel economy due to controls.	Design to reduce back pressure and require back pressure monitoring.
		Energy: Potential increase in electricity use due to electrification.	Promote energy conservation.
		Waste: Filter ash and spent filters may be a hazardous waste.	Promote safe handling, collection, and recycling.
		Waste: Potential increase in engine scrapping.	Promote recycling of engines.
		Hazards/Human Health: Potential fuel additives could be hazardous.	Additives must be proven safe.
		Water: Emulsified diesel fuel or additives may disperse into surface water easily.	Require spill prevention plan and safe storage practices.
Conventional and Alternative Fuels			
FUEL-1	**Set Additives Standards for Diesel Fuel to Control Engine Deposits.**	Hazards/Human Health: Potential fuel additives could be hazardous.	Additives must be proven safe.

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
FUEL-2	**Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines.**	Energy: Increase in energy use for refining to remove sulfur. Air: Production of cleaner fuels could increase emissions at refineries.	Promote energy conservation. District to require NSR and BACT on all modifications.
CONSUMER PRODUCTS, VAPOR RECOVERY, AND PESTICIDES			
Consumer Products			
CONS-1	**Set New Consumer Products Limits for 2006.**	Air: Potential use of TACs Water: Potential use of TACs Hazards: Potential flammability Other: Potential global warming, ozone depletion	Air, Water, Hazards: Monitor usage and prohibit manufacturers from reformulating using paradichlorobenzene, MeCl and Perc or other TACs. Global Warming: not yet identified Ozone depletion: not yet identified
CONS-2	**Set New Consumer Products Limits for 2008 – 2010.**	Air: Potential use of TACs Water: Potential use of TACs Hazards: Potential flammability Other: Potential global warming, ozone depletion	Air, Water, Hazards: Monitor usage and prohibit manufacturers from reformulating using MeCl and Perc or other TACs. Global Warming: not yet identified Ozone depletion: not yet identified

Table V-A-1: Potential Adverse Environmental Impacts of the Proposed 2003 State and Federal Strategy for the California SIP

Number	Description	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Fueling and Vapor Recovery			
FVR-1	**Increase Recovery of Fuel Vapors from Aboveground Storage Tanks.**	Energy: Increase in electrical use.	Promote energy conservation.
FVR-2	**Recover Fuel Vapors from Gasoline Dispensing at Marinas.**	Waste: generates gasoline vapor collection devices (carbon beds). Energy: Increase in electrical use.	Develop recycling program to regenerate gasoline vapor collection devices. Promote energy conservation.
FVR-3	**Reduce Fuel Permeation Through Gasoline Dispenser Hoses.**	None Identified	None Required
Pesticides			
PEST-1	**Implement Existing Pesticide Strategy**	None Identified	None Required

6. Environmental Justice

In December 2001, ARB adopted a set of policies and associated actions that provide the framework for incorporating environmental justice into ARB's programs consistent with the directives of State law. The proposed policies and actions are based on State law, which describes "environmental justice" as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies." ARB's environmental justice policies will help ensure that we take into account neighborhood impacts as we prioritize and develop controls and pollution-prevention strategies.

The environmental justice policies touch virtually every ARB program, including motor vehicles, air-quality planning, toxics, research, enforcement, and air monitoring. They apply to all communities in California but recognize that extra efforts may be needed in some communities due to historical land-use patterns, limited participation in public processes in the past, and a greater concentration of air pollution sources in these communities.

The Proposed Strategy incorporates environmental justice policies in order to help prioritize our activities to reduce public exposure to air toxics as well as regional pollutants whose sources are concentrated in some communities. While all of the proposed State measures would result in better air quality for residents throughout California, we are making measures that cut exposure and risk in communities with high air pollution burdens a high priority for development. These include strategies to capture emissions from gas cargo tankers, retrofit trash trucks, restrict idling for trucks and buses, augment the truck inspection program in communities with high truck traffic, clean up port-related sources, and reduce fuel vapors from gasoline storage and refueling.

ARB has placed a high priority on controlling particulate emissions from diesel engines, the dominant source in California of known risk from air toxics. Several measures outlined in the Proposed Strategy have their origin in the Diesel Risk Reduction Plan, which lays out a three pronged approach to reduce emissions and the associated risk from diesel PM: (1) new regulatory standards for all diesel-fueled engines to reduce diesel PM emissions 90 percent from current levels; (2) retrofit of in-use engines; and (3) the use of low sulfur fuel to provide the quality of diesel fuel needed by the advanced diesel PM emission controls.

ARB staff is committed to working with districts, local governments and affected communities to improve statewide compliance for all air pollution sources, whether under ARB or district jurisdiction. ARB staff has already begun to incorporate environmental justice perspectives into our program activities. ARB staff is working with districts to assure that all air pollution complaints are promptly investigated and that feedback is provided to the public on the actions taken in response to those complaints. ARB staff is also working with the local air districts to improve accessibility of

information regarding enforcement activities, including notices of violations, monetary penalties, and other settlement of violations. ARB is also reviewing its own enforcement activities and redirecting efforts where we can achieve a more direct community benefit.

Another matter of concern in communities stems from historic land use patterns and practices that have led to siting of air pollution sources in close proximity to homes and schools. In addition to working to reduce air toxics, ARB staff is developing a handbook intended to provide more information to decision-makers at the local level.

In addition to the specific measures in the Proposed Strategy, ARB staff has identified ideas in the long-term strategy that will move the State toward zero and near-zero technologies. ARB will work with local governments to look for new opportunities to apply these far reaching technologies in communities -- for example, using converted electric or fuel-cell postal-delivery vehicles and public transit buses in affected neighborhoods.

CHAPTER B. ECONOMIC IMPACT ANALYSIS

ARB staff is working with the University of California, Berkeley to assess the potential statewide economic impacts that would result from implementation of the defined State measures. This chapter will include estimates of the direct cost, as well as the impact on economic output, personal income, and employment statewide from those measures.

This analysis will be available in early June 2003 on our website, at http://www.arb.ca.gov/planning/sip/sip.htm.