TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE ZERO-EMISSION VEHICLE REQUIREMENTS FOR PASSENGER CARS AND LIGHT-DUTY TRUCKS

The Air Resources Board (ARB or "Board") will conduct a public hearing at the time and place noted below to consider adoption of amendments to California regulations that require zero-emission vehicles.

DATE: March 28, 1996

TIME: 9:30 a.m.

PLACE: California Air Resources Board
Board Hearing Room, Lower Level
2020 L Street
Sacramento, California

This item will be considered at a two-day meeting of the Board, which will commence at 9:30 a.m., March 28, 1996, and may continue at 8:30 a.m., March 29, 1996. This item may not be considered until March 29, 1996. Please consult the agenda for the meeting, which will be available at least 10 days before March 28, 1996, to determine the day on which this item will be considered.

INFORMATIVE DIGEST OF PROPOSED ACTION/PLAIN ENGLISH POLICY STATEMENT OVERVIEW

Sections Affected: Amend title 13, California Code of Regulations (CCR), section 1960.1.

I. Summary of Proposed Changes

The Board adopted the Low-Emission Vehicle regulations in September 1990. These regulations established four new categories of emission standards for passenger cars (PCs) and light-duty trucks (LDTs): Transitional Low-Emission Vehicle (TLEV), Low-Emission Vehicle (LEV), Ultra-Low-Emission Vehicle (ULEV) and Zero-Emission Vehicle (ZEV). The regulations established a progressively more stringent fleet average emission requirement for non-methane organic gases (NMOG), which manufacturers can meet by producing any combination of TLEVs, LEVs, ULEVs and ZEVs. In addition to meeting the fleet average emission requirement, the seven largest manufacturers are required to produce and offer for sale in California ZEVs in amounts equal to two percent of their total sales of PCs and LDTs weighing less than 3750 pounds loaded vehicle weight beginning with the 1998 model year, rising to five percent in the 2001 model year and ten percent in the 2003 model year.

The staff conducted a series of public forums during 1995 to discuss all aspects of the ZEV program, including hybrid-electric vehicles, consumer marketability, infrastructure, fleet issues, technology, benefits and costs. The staff also established a Battery Technology Advisory Panel ("Battery Panel") to evaluate the status of batteries for the 1998 implementation of ZEVs.

Based on information gathered through the public forums and the Battery Panel, the staff is proposing to amend the LEV regulations to eliminate the percentage ZEV requirements for model years 1998 through 2002. The ten percent requirement for the 2003 model year would remain unchanged. This modification would allow auto manufacturers more time to develop and demonstrate ZEVs powered by advanced batteries and flexibility to determine the best time to introduce this new technology to the market. To encourage the early production of advanced ZEVs, the staff is also proposing to add a provision to allow multiple credits for longer-range ZEVs produced prior to the 2003 model year. These ZEV credits could be applied to a manufacturer's 2003 and subsequent model year requirements.

To ensure that no emission reductions are lost by suspending the ZEV requirements, the staff is recommending that the Board enter into memoranda of agreement (MOAs) with each of the seven auto manufacturers that are subject to the 1998 through 2002 model year percentage ZEV requirements. These MOAs would formalize commitments by the auto manufacturers to achieve the air quality benefits of the percentage ZEV requirements, continue investing in advanced batteries, produce ZEVs powered by advanced batteries for demonstration purposes and ramp up to large-volume ZEV production in the 2003 model year.

II. Comparison with Similar Federal Requirements

Under Title II of the Federal Clean Air Act (FCAA), the U.S. Environmental Protection Agency has promulgated comprehensive regulations to control emissions from new motor vehicles (see 40 CFR Part 86). However, both state law and section 209 of the FCAA allow California to establish its own standards that are different from the federal standards. While both the federal and California automotive emission standards are similar in purpose and scope, California has adopted standards that are generally more stringent and effective in order to address the severity of California's air pollution problem. California's Low-Emission Vehicle regulations, which establish emission standards for light- and medium-duty vehicles, are more stringent than the federal requirements. The Low-Emission Vehicle regulations are essential to attain the national and state ozone standards, and to fulfill the requirements of state and federal law.

There is no federal requirement for ZEVs. The amendments proposed in this rulemaking would eliminate the California requirement for ZEVs for the 1998 through 2002 model years.

AVAILABILITY OF DOCUMENTS AND CONTACT PERSON

The staff has prepared a Staff Report which includes the initial statement of reasons for the proposed action and a summary of the environmental and economic impacts of the proposal. Copies of the Staff Report and the full text of the proposed regulatory language may be

obtained from the Board's Public Information Office, 2020 L Street, Sacramento, California 95814, (916) 322-2990. These documents are also available on the Air Resources Board Information System (ARBIS) electronic bulletin board. The documents may be accessed via modem by calling (916) 322-2826 and choosing "Mobile Source Programs" and "Zero-Emission Vehicle Program" from the "System Features" menu. The documents are also available on the Internet at http://www.arb.ca.gov/ (choose "CARB Programs" from the main menu and then "ZEV Program"). If you have any questions regarding access to the ARBIS, please contact the Business Assistance Hot Line at 1-800-ARB-HLP2 (in California) or (916) 323-3336.

The Board staff has compiled a record which includes all information upon which the proposal is based. This material is available for inspection upon request to the contact person identified immediately below.

The ARB has determined that it is not feasible to draft the regulations in plain English due to the technical nature of the regulations; however, a plain English summary of the regulations is available from the agency contact person named in this notice, and is also contained in the Staff Report.

Inquiries regarding this matter should be directed to Sue de Witt, Mobile Source Division, P.O. Box 2815, Sacramento, California 95812, (916) 322-6975. Inquiries regarding Appendix B of the Staff Report should be directed to Mark Carlock, Mobile Source Division, 9420 Telstar Avenue, El Monte, California 91731, (818) 575-6608.

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred in reasonable compliance with the proposed regulations are presented below.

The Executive Officer has determined that the proposed regulatory action will not create costs or savings, as defined in Government Code section 11346.5(a)(6), to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to part 7 (commencing with section 17500), division 4, title 2 of the Government Code, or other nondiscretionary savings to the local agencies.

In developing this regulatory proposal, the ARB staff evaluated the potential economic impacts on private persons and businesses. The proposed regulatory action would eliminate an existing requirement for large auto manufacturers to produce ZEVs beginning in 1998. This action is expected to result in savings for auto manufacturers, which in turn could translate into savings for consumers.

Because the proposed regulatory action does not place any requirements on individuals or California businesses, in accordance with Government Code section 11346.3 the Executive Officer has determined that adoption of the proposed regulatory action will not have a

significant adverse economic impact on businesses, including the ability of California businesses to compete with businesses in other states, or on directly affected private persons.

The Board's Executive Officer has also determined, pursuant to Government Code section 11346.5(a)(3)(B), that the regulation will affect small businesses. Some small businesses in California's advanced transportation industry may be adversely affected by this action because it may result in fewer ZEVs being produced from 1998 through 2002. This may reduce investments and lower the demand for goods and services from California's advanced transportation businesses in the near-term. However, the proposed regulatory action is expected to increase the success of ZEVs over the long-term, which would be beneficial to these California businesses.

The Executive Officer has also determined that this regulatory action will not have a significant or any long-term affect on the creation or elimination of jobs within California, the creation of new businesses and the elimination of existing businesses within California, or the expansion of businesses currently doing business within the State of California. A more detailed assessment of the economic impacts of the proposed regulatory action can be found in the Staff Report.

Before taking final action on the proposed regulatory action, the Board must determine that no alternative considered by the agency would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing. To be considered by the Board, written submissions must be addressed to and received by the Board Secretary, Air Resources Board, P.O. Box 2815, Sacramento, California 95812, no later than 12:00 noon, March 27, 1996, or received by the Board Secretary at the hearing.

The Board requests, but does not require, that 20 copies of any written statement be submitted and that all written statements be filed at least 10 days prior to the hearing. The Board encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

STATUTORY AUTHORITY AND HEARING PROCEDURES

This regulatory action is proposed under the authority granted in Health and Safety Code sections 39600, 39601, 43013, 43018, 43101 and 43104. This action is proposed to implement, interpret and make specific Health and Safety Code sections 39002, 39003, 43000, 43013, 43018, 43100, 43101, 43102 and 43104.

The public hearing will be conducted in accordance with the California Administrative Procedure Act, title 2, division 3, part 1, chapter 3.5 (commencing with section 11340) of the Government Code.

Following the public hearing the Board may adopt the regulatory language as originally proposed, or with nonsubstantial or grammatical modifications. The Board may also adopt the proposed regulatory language with other modifications if the text as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice that the regulatory language as modified could result from the proposed regulatory action; in such event the full regulatory text, with the modifications clearly indicated, will be made available to the public, for written comment, at least 15 days before it is adopted. The public may request a copy of the modified regulatory text from the Board's Public Information Office, 2020 L Street, Sacramento, CA 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

Original signed by Tom Cackette for

James D. Boyd
Executive Officer

Date: January 30, 1996

State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF RULEMAKING

PROPOSED AMENDMENTS TO THE ZERO-EMISSION VEHICLE REQUIREMENTS FOR PASSENGER CARS AND LIGHT-DUTY TRUCKS

Date of Release: February 9, 1996

Mobile Source Division
9528 Telstar Avenue
El Monte, California 91781

EXECUTIVE SUMMARY

The Low-Emission Vehicle (LEV) regulations, adopted by the California Air Resources Board ("ARB" or "Board") in 1990, are a critical element of California's plan to meet federal and state health-based ambient air quality standards. The zero-emission vehicle (ZEV) requirement is an integral part of the LEV program and is intended to secure increasing air quality benefits for California over the long-term. Under the ZEV regulation, beginning in 1998 two percent of the vehicles produced and delivered for sale in California by the seven largest auto manufacturers must be ZEVs. That percentage increases to five percent in 2001 and ten percent in 2003.

When the ZEV requirement was adopted the Board acknowledged that many ZEV-related issues, including questions regarding the cost of developing the technology necessary to produce ZEVs and the marketability of these new vehicles, would have to be addressed prior to the 1998 implementation date. The Board committed to biennial reviews of the LEV program, including the ZEV requirement, to provide a forum for answering these questions. Thus as the Board took this bold step forward, there was a clear recognition that it might be necessary to make interim course adjustments to find the best and surest track to the ultimate destination -- cleaner air for California.

The proposal in this report is the result of the third biennial review of the LEV program. In preparation for this review, the ARB held a series of public forums during 1995 to solicit comments on virtually all aspects of the ZEV requirement, and retained an independent panel of experts to report on the readiness of electric vehicle battery technology for the 1998 model year implementation.

Based on the results of the review process, the staff proposes amendments to the LEV regulations to eliminate the percentage ZEV requirements through the 2002 model year. This proposal is intended to preserve, not abandon the ZEV program. In fact several manufacturers have indicated that they will introduce ZEVs for sale in California by 1998. By suspending the percentage requirements for five years, staff seeks to capitalize on these efforts and ensure the successful launch of a sustainable ZEV market that will provide air quality benefits in California through 2010 and beyond. The current ten percent ZEV production requirement in the 2003 model year would remain unchanged. Staff has concluded that this action will not have a long-term adverse economic impact on California.

The staff further recommends the ARB enter into memoranda of agreement, or MOAs, with each of the seven major automakers subject to pre-2003 ZEV requirements. The MOAs formalize the automakers' enforceable commitments to introduce low-emission vehicles nationwide in 2001, three years earlier than could be required under federal law. The emission reductions associated with this commitment will offset the emission reductions associated with the 1998-2002 ZEV requirements

plus a premium, ensuring California's commitments under the state implementation plan.

The MOAs also formalize the manufacturers commitment to participate in a Technology Development Partnership. Under the MOAs the automakers will carry out demonstration projects designed to validate advanced technology batteries consistent with the recommendations of the battery panel and will continue funding of ZEV-related technology research and development.

CONTENTS

LIST OF TABLES

APPENDICES

1.0 INTRODUCTION

1.1 Air Quality -- The Big Picture

Air quality in California has improved dramatically over the past 25 years, largely due to state and federal initiatives to control pollution from motor vehicles. However, in several areas of the state, air quality still does not meet health-based ambient air quality standards. Mobile sources are responsible for well over half the ozone-forming emissions in California. Passenger cars and small trucks, or light-duty vehicles, are responsible for a significant portion of mobile source emissions.

State and federal law require the implementation of emission control strategies to attain the ambient air quality standards as expeditiously as practicable. The 1990 amendments to the Federal Clean Air Act (FCAA) require attainment of the ozone standard in all areas of the state no later than 2010. Under the FCAA, states are required to produce a state implementation plan to ensure attainment of the federal standards by specified deadlines.

In November 1994, the California Air Resources Board (ARB or "Board") adopted a comprehensive set of amendments to the California State Implementation Plan for Ozone (SIP) that demonstrate early and continuing progress toward attainment of the ozone standard as required by the 1990 FCAA amendments. The SIP rate-of-progress and attainment plans for various local air quality management districts take into account emission reductions from existing regulatory programs for stationary and mobile sources. The SIP includes new measures focused on light-duty vehicles, such as accelerated vehicle scrappage and implementation of advanced technologies, as well as measures targeting heavy-duty vehicles and off-road equipment. Even with these new measures, however, the SIP includes a shortfall that will require the ARB to obtain additional emission reductions from as yet unspecified measures, or so called "black box" measures.

1.2 Low-Emission Vehicle Program

The Low-Emission Vehicle (LEV) program adopted by the Board in 1990 is a cornerstone of the SIP, and is essential for California to achieve attainment status. California's LEV program has been the impetus for a number of technological advances, including the rapid acceleration of developments in zero-emission vehicle (ZEV) technology.

The LEV program establishes an increasingly stringent fleet-average emission requirement for non-methane organic gases (NMOG) beginning with the 1994 model year. To meet the fleet average emission requirement, manufacturers can choose to produce any mix of vehicles from four vehicle classes: transitional low-emission

vehicles (TLEVs), low-emission vehicles (LEVs), ultra-low-emission vehicles (ULEVs) and ZEVs. The seven largest auto manufacturers must also produce and deliver for sale two percent of their 1998 model year light-duty fleet as ZEVs. This percentage increases to five percent in the 2001 model year and ten percent in the 2003 model year. Manufacturers are provided the flexibility of purchasing ZEV credits from other manufacturers or producing extra ZEVs and banking the credits for future use. The only technology currently capable of meeting the ZEV standard is the battery-powered electric vehicle (EV), although other technologies are being rapidly developed.

1.3 The History of the ARB's Zero-Emission Vehicle Program

From its inception, the ZEV requirement has been highly controversial, not only because it is technology forcing, but also because the requirement for ZEVs was perceived to be qualitatively different from other mobile source regulations, such as the standards that were set in the 1970's which essentially required catalytic converters on all new vehicles. It was clear to the Board, however, that with increasing numbers of cars on the road, each driving more and more miles every year, ZEVs would be essential to obtaining the long-term emission reductions needed from the mobile source sector.

When the Board adopted the ZEV requirement in 1990 it was not certain when or to what extent the technology necessary to meet the requirement would be available. There were questions about the cost of developing the technology and the readiness of the consumer market. With these concerns in mind, the ARB included the ZEV requirement in the LEV program with the understanding that it could be modified at a later date if necessary. In order to remain fully aware of the technological and implementation status of new vehicle technologies, the ARB directed staff to present biennial progress reviews to the Board. Thus, at the time the Board adopted the ZEV regulation, there was a clear recognition that it might be necessary to revisit this requirement as more was learned about its implementation and to make alterations if necessary to ensure that the requirement would in fact result in the emission reductions necessary to benefit air quality in California.

1.4 Benefits of the ZEV Program

The benefits to be realized from the introduction and long-term use of ZEVs in California are substantial, particularly when considered within the context of all the SIP measures needed to approach attainment in California's most severe air quality regions. The full ZEV program would provide direct exhaust, evaporative and marketing emission reductions of 14 tons per day oxides of nitrogen (NOx) and nonmethane organic gases (NMOG) in the South Coast Air Basin (SCAB) in 2010. An unique emissions benefit that EVs provide above and beyond strategies to make

gasoline cars cleaner is their guarantee of no future emission increases because, unlike gasoline-fueled vehicles, EVs do not have emission control systems that can deteriorate over time. Furthermore, EVs do not emit cancer-causing toxic air contaminants such as benzene and formaldehyde. Consequently, EVs provide the best safeguard against increased air pollution as California continues to strive to attain and maintain acceptable air quality, even as the number of vehicles and the miles they travel continues to grow. Finally, unlike most other emission reduction strategies, incremental costs of EVs are expected to eventually fall to zero as the product becomes fully commercialized. To realize these benefits, however, the successful launch of a sustainable and growing EV market is critical.

1.5 Setting the Course for the Future

The ZEV program has been effective to date; it has successfully driven substantial progress in the development of EV technologies as well as the development of the infrastructure necessary to support widespread EV use in California. Certainly the requirements can be credited with fostering significant business investment and development, creating "high-tech" jobs in California and placing the state in a position of leadership in an emerging global technology.

Now that the ZEV requirement has succeeded in pushing technology to near-commercialization, however, the ARB faces a growing body of information that indicates program modifications are needed. At this juncture the ARB must address difficult questions regarding the program's future: Has the current requirement served its salutary purposes? Is now the right time to step back and let the market more fully shape the outcome? The ARB recognizes that this is a critical moment to act on the above questions because vehicle manufacturers will be making commitments regarding production of 1998 model year ZEVs within the next few months.

In considering potential changes to the existing ZEV program, the ARB staff has been guided by the following principles:

- Alterations to the ZEV requirement should ensure the successful introduction and proliferation of EVs in California through 2010 and beyond by allowing industry flexibility as to the timing and numbers in which ZEVs are introduced.

- Any modifications of the existing requirements must be tailored to ensure ongoing improvement in the quality of EVs and promote consumer acceptance of ZEVs.

- The modifications must not jeopardize approval of the SIP. To this end, all emission reductions attributable to the ZEV program plus a "clean air premium" must be achieved.

- The modifications should make maximum use of competitive forces and other market-based strategies to promote the development and application of advanced technologies through the least costly and most practicable strategy.

- Any change to the ZEV requirement must send clear signals to technology developers regarding the ARB's strong commitment to ZEVs. A sure and steady course is critical to retaining investment in ZEV technologies.

The staff proposal meets these objectives. It provides automakers with an additional five years in which to continue battery related research and development and to refine market development and launch strategies while retaining the ten percent ZEV requirement for 2003 and subsequent model years. By establishing a credit system to reward the early introduction of ZEVs and formalizing automaker commitments to a voluntary early market launch of EVs, the proposal recognizes and respects the commitment of businesses that have made investments which rely on the current regulation. Finally the staff proposal will ensure that elimination of the ZEV requirement in 1998 through 2002 will not cause California to fail to meet its obligations under the 1994 SIP because it provides for emission reductions from the production of cleaner cars nationwide that will offset the reductions to be realized from implementation of the ZEV requirement during that period.

2.0 PROCESS

2.1 Public Meetings

At the time the LEV program was adopted, the Board resolved to conduct periodic reviews of the progress in implementing the regulations, including the requirement for introducing ZEVs in California in 1998. Given the far-reaching nature of the ZEV program, these reviews were intended to monitor progress made and to ensure that any necessary mid-course changes were made in a timely manner. Since 1990, the Board has held two biennial reviews (June 1992 and May 1994) to discuss the status of technology development. At the end of the Board's May 1994 review, the Board directed the staff to pursue a number of implementation issues raised during the hearing and bring any significant matters to the Board for its consideration. To address these issues, the ARB staff held a number of public forums during 1995 to solicit information on essentially all aspects of the ZEV program. Table 1 provides a list of the forum topics and the dates the forums were held.

Table 1. Zero-Emission Vehicle Public Forum Schedule

Topic	Date
Hybrid-Electric Vehicles	May 9, 1995
Consumer Marketability	June 28, 1995
Infrastructure	July 12, 1995
Hybrid-Electric Vehicles	August 9, 1995
Fleet Issues	September 13, 1995
Technology Review	October 11, 1995
Benefits and Costs	November 8, 1995

Through the public forum process the ARB staff heard over 200 statements from representatives of industry, government and the public. The testimony presented arguments on both sides of the ZEV issue.

- At the Hybrid-Electric Vehicle (HEV) forums, hybrid technology developers argued that HEVs could achieve benefits beyond those possible from pure EVs. Auto manufacturers were pessimistic about the chances for near-term commercialization of HEVs and concerned that changes to the existing HEV provisions may discourage investment in promising long-term technologies.

- At the Consumer Marketability forum, auto manufacturers presented market research that indicated the market for EVs, given 1998 technology, is less than one percent of total light-duty vehicle sales. A study conducted by the University of California at Davis indicates a market large enough to meet both the two percent and five percent requirements using today's technology.

- At the Infrastructure forum, utilities and government agencies described the progress made to date in developing EV infrastructure. Auto manufacturers expressed concern that the infrastructure would not be ready for 1998. Emergency response providers expressed concern that more EV-specific training is needed.

- At the Fleet Issues forum, several private fleet operators stated that EVs would not be practical or cost-effective for fleets due to limited range and

high vehicle prices. Several government and utility fleets stated that they have used EVs successfully, citing very low operating and maintenance expenses.

- At the Technology Review forum, auto manufacturers argued that advanced batteries are not ready for 1998, and will be necessary to ensure a successful market launch of ZEVs. Lead-acid battery manufacturers stated that they have made significant advancements in recent years, and that currently available lead-acid batteries could provide the vehicle range needed by many consumers.

- At the Benefits and Costs forum, Sierra Research presented results of their study which calculated the ZEV requirement will cost California $20 billion through 2010. Representatives of taxpayer groups said the ZEV program would result in insignificant emission reductions and the costs would be too high. Bevilacqua-Knight found the cost-effectiveness of the program could range from a savings of $2000 per ton to a cost of around $10,000 per ton, which is well within the range of other air quality measures.

Clearly, the forums provided the ARB staff with a full range of data and opinion regarding the key aspects of the ZEV program.

2.2 Battery Technology Advisory Panel

In August 1995, the ARB provided funding to establish a Battery Technology Advisory Panel ("Battery Panel"). The purpose of this four person panel, which was comprised of individuals with extensive experience in science and battery technology development, was to evaluate the readiness of battery technology for the 1998 implementation of the ZEV program. To fulfill its mission, the Battery Panel visited nine battery manufacturers and solicited written information from eleven others involved in the development of advanced batteries. The Battery Panel focused on the development and commercialization of advanced batteries (those that can provide a range over 100 miles and a battery life of around five years, such as nickel-metal hydride and lithium-ion) because vehicles using these batteries have the potential for greater consumer acceptance than vehicles using currently available lead-acid batteries. The Battery Panel also held discussions with automobile manufacturers subject to the ZEV requirement in 1998 to better understand the issues related to vehicle production and timing. Based on the information received, the Battery Panel first presented its draft findings at the October 11, 1995 forum to review battery and vehicle technology. The Battery Panel subsequently presented their draft conclusions to the Board at the October 26, 1995 public meeting, and produced a final report dated December 11, 1995. The main conclusions are:

- The ZEV regulation has substantially accelerated investment and progress in developing advanced EV batteries.

- Lead-acid batteries will be available for use in EVs in 1998, however, automakers believe that limited range will restrict these vehicles to a market share less than the objectives of the current regulations.

- Advanced batteries are on the immediate horizon --- in-vehicle prototypes have been evaluated with promising results. Pilot quantities are expected by 1998 and, barring unexpected development problems, production quantities could be available in the 2000 to 2001 time frame.

The Battery Panel noted that two key steps are needed before commercialization of advanced batteries. First is pilot-scale production of advanced batteries in numbers sufficient to prove out and refine production processes in terms of economics and product quality. Second is the evaluation of performance, reliability, safety and life of these batteries as mechanically and electrically integral components of EVs under representative driving conditions.

The Battery Panel concluded that in the most optimistic scenario (i.e. no technical or decision delays in any of the testing, production planning and production implementation phases by either battery or car manufacturers), EVs with commercial-production, advanced batteries could become available in the 2000 to 2001 time frame. The Battery Panel also noted that with ten or more strong efforts currently in progress, chances appear reasonable that at least a few of them will reach commercialization in the 2000 to 2001 time period.

2.3 Consideration of ZEV Program Modifications

As a result of the Battery Panel's draft findings and the testimony heard throughout the series of forums, the ARB staff held a meeting with the primary stakeholders on October 24, 1995. The purpose of the meeting was to discuss, within the context of the Battery Panel's findings, how the ZEV program could best be implemented and to determine what changes might be needed to ensure that the long-term benefits of ZEVs in California are realized. At the conclusion of the meeting, all stakeholders were asked to submit proposals on how to modify the program.

The staff provided an informational update to the Board on October 26, 1995 summarizing the major findings of the public forums held to that date. At the November 16, 1995 public meeting, the staff reported back to the Board on the results of the Benefits and Cost forum held on November 8, 1995.

After evaluating the information received from the public forums, the Battery Panel and the meetings with interested parties, the ARB staff concluded that modifications to the ZEV portion of the LEV program could increase the long-term success of the program. This conclusion is based in large part on the uncertainties surrounding the near-term market for ZEVs, which can be attributed to many factors including, but not limited to, the state of battery technology development. While currently available lead-acid batteries, when used in a well-designed efficient vehicle, can appeal to many consumers with range needs of less than 100 miles, advanced batteries providing longer range will substantially increase the market for this new technology. Results from the Battery Panel indicate that small quantities of advanced technology batteries will be available for use in demonstration programs beginning in 1998, and that production quantities could be available shortly after the turn of the century. Although advanced battery technology will not address or solve all marketability issues, the staff believes that regulatory modifications which would delay the large-scale introduction of ZEVs until advanced batteries are available provide a window of opportunity in which consumer awareness can be heightened, while ensuring more battery choices for consumers when ZEVs are ultimately introduced in large volumes. It is important for early consumer experiences with all types of ZEVs to be positive in order to gain long-term success with the ZEV program.

At the November 16, 1995 public meeting, the Board directed the staff to conduct a forum to discuss the proposals received for modifying the ZEV requirement and to solicit additional proposals.

2.4 Evaluation of Three Concepts

The staff held a public forum on December 6, 1995 to discuss three main concepts representing different perspectives on the direction the ZEV program could assume in the future (Concepts A, B, and C). Forty witnesses provided comments. At the subsequent December 14, 1995 Board meeting, the staff presented these three concepts to the Board and received comments from thirty-nine witnesses.

Concept A suggested that the existing requirements be eliminated and the program rely solely on performance standards and market forces to bring ZEVs to California. Concept B relied on a combination of market forces and regulatory requirements, with a suspension of the percentage ZEV requirements through the 2003 model year coupled with commitments by the affected automakers to continued ZEV research and development, introduction of increasing numbers of ZEVs powered by advanced batteries in the near-term, and a ramp-up to volume production in the 2004 model year. Concept C suggested maintaining the percentage ZEV requirements, with a slower phase-in of ZEVs than required by the current program, combined with advanced technology incentives for pre-1998 model year ZEV sales.

Through a continuation of the December 14, 1995 Board meeting, on December 21 the staff proposed a concept to the Board recommending ZEV program modifications largely based on Concept B. The staff's rationale for pursuing a program resembling Concept B is described below. Upon approval by the Board to pursue the staff's recommended approach, the concept put forth evolved into the detailed regulatory package described in this report.

2.5 Rationale for Pursuing Concept B

Concept A's sole reliance on market forces is attractive in theory, but staff does not believe that performance-based standards alone can achieve ARB's long-term air quality goals for the ZEV program. Achieving these goals requires a substantial number of vehicles to have zero or near-zero emissions. Long-term equivalent emission reductions would be difficult to achieve due to the fact that the ARB is already counting on virtually all available alternative emission reduction measures to attain the SIP goals. Stakeholders almost unanimously agree that absent the ZEV program EV technology would not have advanced as rapidly as it has to date, and that elimination of the ZEV requirements could greatly decrease industry investment in the technology. Finally, Concept A does not provide any certainty that ZEVs will be produced, which would make it difficult to prepare the needed infrastructure.

Concept C does not fully address the need for implementation flexibility. Automakers believe producing large numbers of EVs with current technology would be too costly. Automakers are also concerned that a 1998 EV launch relying solely on lead-acid battery technology could "poison the well" for future sales if consumer perceptions of low-range EVs and battery replacement needs are negative. While Concept C encourages incentives for advanced battery EVs prior to 1998, it does not allow additional time for manufacturers to ensure this technology is ready. The ARB staff places a high priority on engaging automakers in a partnership to ensure a successful introduction and proliferation of ZEV technology. Concept C would not facilitate such a partnership.

Concept B became the working concept of choice primarily because it promotes the positive effects of a market-based launch while maintaining a regulatory push for technology development by retaining a percentage ZEV requirement. Both of these factors are needed for a successful outcome to the ZEV program. Concept B allows the flexibility offered in Concept A for manufacturers to choose near-term alternatives to meet ZEV-equivalent emission reductions without compromising the long-term technology push provided through Concept C's retention of a percentage ZEV requirement. Concept B would promote partnership and commitment between the ARB and automakers to move EV technology forward, make EVs available for near-term demonstration in California, and provide a ramp-up to volume production.

The potential success of this approach is reinforced by the commitment of several manufacturers to introduce ZEVs in California by 1998.

3.0 PROPOSED CHANGES

The staff proposes to amend the LEV regulations to eliminate the percentage ZEV requirements contained in the California Code of Regulations (CCR), title 13, section 1960.1 (g)(2) note (9), for the 1998 through 2002 model years. The 10 percent ZEV requirement would be retained for the 2003 and subsequent model years. The requirements for intermediate-volume manufacturers would remain unchanged. The staff proposes to add a provision that allows manufacturers to earn multiple ZEV credits for producing longer range vehicles or vehicles that use advanced batteries prior to the 2003 model year. The staff also proposes to make a number of nonsubstantive changes to the regulations establishing the ZEV requirements to improve clarity.

The staff further recommends the ARB enter into memoranda of agreement (MOAs) with each of the seven auto manufacturers subject to the 1998 through 2002 model year ZEV requirements. The MOAs formalize commitments by the automakers (1) to enter into a Technology Development Partnership with the ARB to ensure continuation of advances in battery technology and (2) to provide emission reductions for California from the production and sale of cleaner cars to ensure that approval of the SIP and attainment of the federal ozone ambient air quality standard is not jeopardized. A master MOA, which provides an example of the MOAs specific to each manufacturer, is included in Appendix C.

Specifically, the MOAs include an enforceable commitment by the automakers to certify, produce and sell cleaner cars nationwide beginning with the 2001 model year, three years before the U.S. Environmental Protection Agency (U.S. EPA) could require introduction of these cleaner vehicles under federal law. This commitment will provide emission reductions equivalent to those attributable to the ZEV requirements for 1998 through 2002, plus a premium.

The technology partnership provisions of the MOAs will: 1) promote the development and demonstration of EVs powered by advanced batteries; 2) provide for continued automaker funding of advanced battery technology research and development; and 3) ensure manufacturers plan for an appropriate ramp-up in production to meet the ten percent ZEV requirement in 2003 and subsequent model years. The MOAs promote the development of advanced batteries because the staff believes these batteries will need to be available before ZEVs can be successfully introduced in numbers that equal or exceed the 2003 requirement. The staff believes lead-acid batteries do not need this added development and demonstration push,

except perhaps in the near-term, because they are already at or very near the commercialization stage, as evidenced by the publicly stated plans of several manufacturers to introduce ZEVs by 1998. In order to encourage the commercialization of advanced batteries, the Battery Panel concluded it is important to have an orderly, stable program to "encourage the next phase of investments required for pilot plant battery production and fleet testing...." The staff believes the MOAs would provide the order and stability needed for this purpose.

3.1 Proposed Changes to Existing Regulations

The staff proposes to make two changes to the existing ZEV requirements contained in 13 CCR §1960.1(g)(2) note (9). The staff proposes to delete the language containing the percentage ZEV requirements in note (9) for the 1998 through 2002 model years. Beginning with the 2003 model year, manufacturers would be required to certify, produce and deliver for sale in California ZEVs in amounts equal to at least 10 percent of their new passenger cars (PCs) and light-duty trucks (LDTs) less than 3750 pounds loaded vehicle weight (LVW) produced for California, as required by the current regulation.

The staff also proposes to add a provision to note (9)a that would grant multiple ZEV credits for vehicles produced prior to the 2003 model year, to encourage the development of vehicles with greater range. Credits would be based directly on range capabilities or on the specific energy of the battery. These multiple ZEV credits would be available for vehicles produced *in excess of the ZEVs placed in demonstration projects under the Technology Development Partnership provisions of the MOAs*. They could be used to meet the percentage ZEV requirements in the 2003 and subsequent model years. Multiple credits would not be applicable to the NMOG fleet average emission requirements. Credits would be granted as indicated in Table 2 or Table 3, but not both.

Table 2. Proposed Multiple ZEV Credits -- Range

Number of ZEV Credits	Vehicle Range (miles)		
	Model Years 1996 and 1997	Model Years 1998, 1999 and 2000	Model Years 2001 and 2002
2	any	≥ 100	≥ 120
3	≥70	≥ 120	≥ 150

Vehicle range would be determined using the Federal Urban Dynamometer Driving Schedule contained in Part 86, Appendix I of the Code of Federal Regulations.

Table 3. Proposed Multiple ZEV Credits -- Specific Energy

Number of ZEV Credits	Specific Energy of Battery (w-hr/kg)		
	Model Years 1996, 1997 and 1998	Model Years 1999 and 2000	Model Years 2001 and 2002
2	any	≥ 50	≥ 60
3	≥ 40	≥ 60	≥ 90

The specific energy of the battery would be determined in accordance with the "Constant Current Discharge Test Series," developed by the U.S. Advanced Battery Consortium, using the C/3 rate, with the weight calculation reflecting a completely functional battery system.

Credits would be treated as if they were earned in the 2003 model year, that is, they would not be discounted during the 1998 through 2003 time frame. Consistent with the provisions in the existing regulations that describe credit discounting (which would remain unchanged), these multiple ZEV credits would actually retain their full value through the 2004 model year. If not used by the end of the 2004 model year, they would be discounted by 50 percent. If not used by the end of the 2005 model year, they would be discounted to 25 percent of their original value. After the 2006 model year, any remaining credits from 2003 or earlier years would have no value.

The purpose of providing multiple ZEV credits is to encourage the early production of high-quality ZEVs. Providing multiple credits for either long vehicle range or high specific energy batteries is consistent with the staff's belief that, while advanced batteries need to be available to fully develop the consumer ZEV market, well-designed vehicles powered by lead-acid batteries can provide longer ranges and therefore could meet the needs of many consumers. Larger vehicles (e.g. trucks and vans) that provide greater utility in certain applications would be fairly rewarded if they use an advanced battery but have a shorter range due to their inherently higher vehicle weight.

By producing ZEVs prior to the 2003 model year, manufacturers could earn extra credits that would retain their full value and could be applied toward the ten percent ZEV requirement in 2003 and subsequent model years. It is important to note that even if a manufacturer markets vehicles that do not qualify for multiple credits, it is to their advantage to produce and sell ZEVs as early as the market will accept them, as ZEV credits earned in earlier years are worth more than credits earned in later years. For example, a 1998 model year ZEV earns 0.157 g/mi NMOG credit, while a 2003

model year ZEV earns 0.062 g/mi NMOG credit (due to the decreasing fleet average NMOG requirement over time).

It should be noted also that manufacturers have expressed concerns that assessments of the viability of the market for ZEVs in 2003 could be artificially influenced by credits generated under the proposal described above. Staff is also sensitive to this concern and, therefore, would not, in making any evaluation of the feasibility of the ZEV program, rely on a market assessment that is biased by the effects of multiple credits. To do otherwise would undercut ARB's goal of assuring that the ZEV program results in a successful launch of a sustainable market for ZEVs in California to provide long-term air quality benefits for the state.

Finally, staff proposes to incorporate the numerical component of the ZEV standard from section 1900(a)(15), title 13, CCR, into the standards table in section 1960.1 as a formatting change to clarify the regulation.

3.2 Memoranda of Agreement (MOAs)

The staff proposes that ARB enter into MOAs with each of the seven large-volume auto manufacturers. The MOAs will ensure that California will meet its commitments under the California SIP by providing emission reductions equivalent to the reductions attributable to the 1998 through 2002 ZEV requirements plus a premium. The MOAs will also ensure the successful launch of a sustainable market for ZEVs through technology improvements to be realized under a Technology Development Partnership between the ARB and automakers. The MOAs would be in effect through the 2002 model year.

The principle elements of the MOAs are described below:

3.2.1 Cleaner Cars Nationwide: This section commits the manufacturers to certify, produce and sell nationwide cleaner light-duty vehicles beginning with the 2001 model year, a full three years before such vehicles could be required by the U.S. Environmental Protection Agency (U.S. EPA) under federal law. Under this "49-state" program manufacturers would opt-in to the voluntary National LEV (NLEV) program proposed by the U. S. EPA in their October 10, 1995 Notice of Proposed Rulemaking, or alternatively produce "50-state" vehicles (i.e., vehicles certified by ARB as meeting California LEV standards and certified by U.S. EPA as meeting the applicable federal standards) for sale in any state that has not adopted the California LEV program. Under the NLEV program proposed by the U.S. EPA, manufacturers would voluntarily agree to be subject to an alternative set of federal exhaust emission standards in lieu of the federal Tier 1 exhaust emission standards. This alternative set of standards would be equivalent to the California Tier 1, TLEV, LEV, ULEV and ZEV exhaust emission standards. Manufacturers would be required to produce and

deliver for sale a combination of vehicles that complies with a nationwide annual fleet average NMOG value, which would be equal to 0.075 g/mi NMOG for PCs and LDTs 0-3750 lbs. LVW, and 0.1 g/mi NMOG for LDTs 3751-5750 lbs. LVW beginning with the 2001 model year. Manufacturers would also be required to install on-board diagnostic systems (OBD II) consistent with California regulations on all NLEVs. This section would allow manufacturers to use an alternative means to providing the same level of emission reductions to be realized from the 49-state program subject to approval of the Executive Officer.

The purpose of this element is to ensure that the emission reductions lost by eliminating the ZEV requirements for the 1998 through 2002 model years will not jeopardize approval of the California SIP by providing substitute emission reductions from control strategies not already included in or encumbered by the SIP. (See discussion under 3.2.6 below.)

3.2.2 Market-Based ZEV Launch and ZEV Product Plans: To provide an early market-based ZEV launch, these sections provide that manufacturers will offer ZEVs for sale according to their estimate of market readiness. Confidential and proprietary business information regarding each manufacturer's annual capacity to produce ZEVs for the 1996 through 2002 model years has previously been received by the ARB. Manufacturers will also submit to the ARB ZEV product plans for model years through 2004. These plans are to be held in confidence by the ARB in accordance with state law. The purpose of the plans is to show how the manufacturer will transition between producing the numbers of ZEVs being sold in years prior to 2003, including those ZEVs required to be placed in demonstration projects under the Technology Development Partnership and the 2003 model year requirement for 10 percent ZEVs.

The purpose of these elements is to demonstrate that the manufacturer is committed to developing the market for ZEVs during the 1996 through 2002 time frame, and to provide information for business and regulatory planning purposes and for infrastructure development and funding. ZEV market development is necessary to ensure that the requirement for ten percent ZEVs can be met beginning with the 2003 model year.

3.2.3 Technology Development Partnership: This element commits the manufacturer to continued ZEV research and development, and to production of the manufacturer's pro rata share of 750 advanced battery-powered ZEVs in 1998, and 1500 advanced battery-powered ZEVs in each of the years 1999 and 2000. The Technology Development Partnership is intended to promote the development and demonstration of advanced battery technologies in real-world applications. The ARB staff believes this element would address the need outlined by the Battery Panel for "...pilot-scale production of advanced batteries in numbers sufficient to prove out

production processes in terms of product quality and process economics, and to permit the evaluation of the performance, reliability, safety, and life of these batteries as mechanically and electrically integral components of EVs under representative driving conditions." This element is important also because ongoing EV-related research and development together with provisions for a market-based launch of EVs by 1998 and EV ramp-up planning will provide assurance to technology developers in the emerging EV industry that ARB looks to the ZEV program as a critical component of the state's long-term strategy to attain and maintain air quality standards.

For the purposes of the MOA, "advanced battery" means a battery with a specific energy of at least 40 watt-hours per kilogram (w-hr/kg) for the 1998 calendar year and at least 50 w-hr/kg for 1999 and subsequent calendar years, as determined by the United States Advanced Battery Consortium (USABC) "Constant Current Discharge Test Series" (which takes into account battery packaging, including thermal management systems). This definition was chosen because batteries with a specific energy less than 40 w-hr/kg are already commercialized and do not need the added development and demonstration push that would be provided by the partnership. Batteries with a specific energy between 40 and 50 w-hr/kg are very close to being commercialized and would be given a boost by qualifying for the partnership in the 1998 calendar year.

The ZEVs produced under the partnership would be placed in California by means of either selling, leasing or otherwise transferring the vehicles to consumers who will use the vehicle on a frequent, regular basis for the duration of the MOA and provide feedback to the manufacturer. Each manufacturer's share of the total ZEVs to be placed under this element is presented in Table 4.

Table 4. Manufacturer Commitments for Placing Vehicles

Calendar Year	Number of Vehicles (Based on Average Market Share)						
	General Motors	Ford	Toyota	Honda	Nissan	Chrysler	Mazda
1998	182	181	135	101	70	51	28
1999	365	363	271	202	141	103	55
2000	366	363	271	203	141	103	55

Manufacturers may reduce the total number of ZEVs required to be placed in demonstration projects if the batteries used in the vehicles have a specific energy over 50 w-hr/kg. This "extra credit" is only available for ZEVs produced to meet the

requirements of the partnership. Such vehicles would receive credit based on a linear interpolation between the values shown in Table 5.

Table 5. Placement Credits for Advanced Battery Vehicles

Vehicles powered by a battery with a specific energy of:	Shall be credited as:
40 w-hr/kg (1998 only)* 50 w-hr/kg (1999 and 2000)	One ZEV
60 w-hr/kg	Two ZEVs
90 w-hr/kg	Three ZEVs

* no interpolation allowed between 40 and 50 w-hr/kg

It is important to note the vehicles produced to meet the requirements of the partnership would not earn ZEV credits under 13 CCR §1960.1(g)(2), note (9)a. This is because the vehicles required under the partnership are for demonstration purposes, and may not be fully commercialized vehicles. Any vehicles placed by a manufacturer in excess of the number required to be placed under the partnership could be transferred to another manufacturer to satisfy their partnership obligations, or could be used toward the 2003 and subsequent model year ZEV requirements.

3.2.4 Annual Report: This element requires the manufacturers to file reports with the ARB Executive Officer within 90 days after the close of each calendar year. The annual reports would provide information regarding ZEVs placed in California and the United States during the previous calendar year, information regarding the purchase of advanced battery prototypes prior to 1998, and information regarding the placement of ZEVs under the partnership.

3.2.5 ARB's Obligations: The ARB would commit to working with state and local governments and others to help ensure the development of ZEV infrastructure and the removal of barriers to ZEV introduction. The purpose of this element is to specify the ARB's role in developing the market for ZEVs. Specifically, the ARB would commit to:

- Facilitate the purchase of ZEVs in state fleets
- Address insurance issues with the California Department of Insurance
- Address financing issues with the California Department of State Banking
- Ensure the availability of battery recycling by working with the Department of Toxic Substance Control, the Integrated Waste Management Board and the Office of Environmental Health Hazard Assessment

- Work with local governments, as needed, on planning and permitting charging stations
- Ensure adequate training for installation and maintenance of EV charging systems by working with utilities and electrical contractor trade groups
- Continue to support the efforts of the Infrastructure Working Council
- Continue to work with the State Fire Marshal and other emergency response officials and towing companies to create a comprehensive ZEV emergency response training program
- Maintain the commitment to observe the activities of the USABC regarding the development of advanced technology batteries
- Support the development and implementation of reasonable incentive programs that enhance the near-term marketability of ZEVs

3.2.6 SIP Credits: The purpose of this element is to provide the basis for ARB's determination that the emission reductions lost by eliminating the 1998 through 2002 model year percentage ZEV requirements will be made up by manufacturers through the production of cleaner light-duty vehicles to ensure approvability of the California SIP under federal law.

The ARB staff has determined that by the year 2010, implementing a NLEV program for the 2001 to 2003 model years would provide emission reductions in the SCAB in excess of those provided by the 1998 through 2002 model year percentage ZEV requirements. (For 2004 model years and beyond, it is assumed the U.S. EPA will adopt Tier II national emission standards on a mandatory basis, as allowed by the federal Clean Air Act. Thus, emission reductions from the production of these vehicles will no longer be available as manufacturer-generated offsets.) These 2001 to 2003 model year NLEVs would create emission benefits in California when out-of-state residents move and register their vehicles in California because they would be much cleaner than the current federal fleet. The SCAB emission benefits of a NLEV program are compared to the emission benefits of the 1998 through 2002 model year percentage ZEV requirements in Table 6. These emission benefits were determined using ARB's emission inventory model EMFAC 7F, updated to account for OBD II and enhanced inspection and maintenance programs. A detailed description of the methodology and assumptions used is provided in Appendix B.

Table 6. Comparison of SCAB Emission Benefits (1998 through 2002 Model Year ZEVs versus NLEV)

Year	SCAB NOx plus NMOG Emission Benefits (tons per day)	
	1998-2002 MY ZEVs	2001-2003 NLEV
2004	2.0	0.5
2010	1.6	3.2

The emission benefits of the NLEV program are lower than the emission benefits of the 1998 through 2002 model year ZEVs in 2004 because the migration of newer federal cars into California is initially small. However, by 2010, the emission benefits of the NLEV program exceed the benefits of ZEVs by a factor of two, as greater numbers of NLEVs register in California. An analysis of the cumulative emission benefits of each program through 2010 is presented in Table 7. The results show that in 2010, the NLEV program achieves the cumulative emission benefits of the ZEV program.

Table 7. Cumulative SCAB Emission Benefits Through 2010

Program	Cumulative NOx plus NMOG Benefits (tons per day)
1998 through 2002 MY ZEVs	13
2001 through 2003 NLEV	13

3.2.7 Review: This element commits the ARB to continue conducting biennial reviews of the ZEV program, including the status of battery technology development.

3.2.8 Enforcement: The benefits of the MOAs will only be achieved if all signatory manufacturers strictly adhere to the provisions of the agreements. Any failure to comply with these requirements will compromise the overall effectiveness of the MOAs and significantly impair the purposes for which the agreements were created. In light of these facts, the MOAs establish significant consequences for noncompliance as an enforcement mechanism. The primary consequence of a failure to comply is a monetary payment in the form of liquidated damages. The amounts

specified in the agreements for failure to implement a 49-state LEV program, failure to place vehicles in demonstration projects, failure to continue ZEV-related research and development, or failure to submit reports as required under the agreements are set at levels commensurate with the full range of the harm done by the manufacturer's noncompliance. The amounts established are sufficient to ensure that manufacturers will meet these requirements. Any amounts paid under these provisions would go to a third-party escrow holder approved by ARB and be used to fund projects to develop a sustainable market for ZEVs. Although we anticipate full compliance by each of the manufacturers, the MOAs include a further provision acknowledging that if a manufacturer fails to meet its commitments, the ARB may both pursue liquidated damages as provided in the MOA and exercise its regulatory authority to reinstate a percentage ZEV requirement as to the noncomplying manufacturer.

4.0 ISSUES

4.1 Marketability

The ultimate success of the ZEV program depends upon consumer acceptance of a new technology. The modifications proposed by staff will promote the development of a strong market for ZEVs by providing the flexibility manufacturers believe is necessary to ensure that initial consumer experience with ZEVs is positive.

During the course of the public forums, the staff reached two main conclusions regarding marketability. First, EVs have market potential because they offer distinct characteristics not available with gasoline vehicles. Second, negative consumer perceptions of EVs are primarily based on comparisons between currently available non-optimized, short-range EVs; and the long-range gasoline vehicles with which consumers are most familiar.

Staff believes that the differences between EVs and gasoline vehicles are likely to become their strongest attraction. For example, the laptop computer offered significantly less storage memory than desktop computers when first marketed, yet it also offered something new -- the convenience of flexible use. Likewise, while early market EVs may not offer ranges comparable to gasoline vehicles, they will offer the new convenience of home recharging (no trips to the gas station), along with other differences that make them unique, such as a quiet motor, long life, less maintenance (e.g. no oil changes or tune-ups), reliable and durable electronic components, and peppy in-city acceleration, as well as the clean air benefits of zero tailpipe and in-use emissions. These benefits will be especially attractive to today's new car buyers, who typically own at least one other vehicle, and therefore may be interested in a vehicle with these advantages even if it does not offer the range of a gasoline car.

By modifying the existing ZEV program to allow a voluntary market launch of ZEVs over the next seven years, the staff believes consumers will have an opportunity to gain the real-world experience necessary to overcome doubts about this new technology. Current market research shows many consumers, even after they have participated in a demonstration program or have closely examined their driving patterns, are still concerned about the limited ranges offered by currently available lead-acid batteries. Auto manufacturers suggest, and the staff agrees, that it is extremely important for the experiences of early EV purchasers to be positive. Lead-acid batteries typically provide EVs with less than 100 miles of driving range and are expected to require more replacements over the vehicle life, as compared to advanced batteries. Even though consumers' perception of EV performance may not accurately reflect the performance of well-designed lead-acid battery-powered EVs, the ARB staff does not believe it prudent to rely upon a large scale introduction of lead-acid battery EVs to launch the consumer ZEV market. As consumers become familiar with how EVs can meet their travel needs, lower-range lead-acid battery vehicles may in fact become a popular choice among EV purchasers if they offer a cost advantage. Also during this period continued development of advanced technology batteries including pilot project placements of vehicles with these batteries will result in ZEVs that come closer to matching the benefits of gasoline-fueled vehicles while retaining the additional benefits of EVs.

4.2 Costs

The proposed modifications will address issues regarding the costs of ZEVs by strengthening the marketability of ZEVs. The two primary issues regarding EV costs presented to the ARB staff at the public forums include: 1) the concern that early market EVs will have high initial purchase prices compared to gasoline cars, requiring manufacturers to recover their costs by raising prices on other California cars, and 2) the concern that EV manufacturing costs will remain higher than gasoline car costs indefinitely.

New, innovative products require significant investment and are more costly than existing products when first introduced to the market in small volumes. This is a business reality. No matter how the program is modified, early market EVs will cost more than gasoline cars which have already achieved economies of scale. But manufacturers are not likely to risk substantial losses of market share by raising prices significantly on <u>all</u> of their major California product lines. They will probably recover costs in such a way that minimizes company losses and maximizes the future market potential of the product. It is likely that successful battery and component manufacturers will realize economies of scale through exports to other states and foreign countries. Manufacturers may also realize indirect benefits, such as a corporate "environmental", or "technology leadership" image, and carry-over of EV technology into other product lines. Furthermore, similar to other innovative products

introduced to the market in small volumes, EVs may merit a longer time frame for cost recovery. Manufacturers are more apt to allow this when the technology has a better chance for market success.

Staff believes that in time EV costs will match or even be lower than the costs of gasoline vehicles. Based on precedents set by other electronic and battery products, it is likely that EV technology will undergo cost decreases through economies of scale and optimization of technology. The crucial question is whether EVs are inherently more expensive to produce and operate than gasoline vehicles, and whether the market for EVs will eventually be large enough for manufacturing economies of scale to be realized. While there is always a degree of uncertainty surrounding cost estimates, the staff believes the life-cycle costs of EVs may ultimately be equal to or less than the life-cycle costs of gasoline vehicles, due to fewer parts, lower maintenance, lower operating costs, and longer component life. ZEVs are an air quality program that may eventually pay for itself, and could even create additional savings for manufacturers and consumers through avoided costs of emission control equipment, Smog Checks, emission control system failures and potential emissions-related vehicle recalls.

4.3 Hybrids and Equivalent Zero-Emission Vehicles

The primary question with regard to hybrid-electric vehicles (HEVs) and other clean car technologies which have potential to emit fewer pollutants than ULEVs is whether these vehicles should receive credit as ZEVs. HEVs offer driving ranges similar to gasoline vehicles while using an electric drive system at least part of the time. This enhances their capability to serve a wider variety of functions than a pure EV. Equivalent zero-emission vehicles (EZEVs) are defined as vehicles having exhaust, evaporative and refueling emissions equivalent to the power plant emissions associated with EVs. However, HEVs and EZEVs are not yet available for real-world testing of their emissions benefits, making it difficult to evaluate how much credit they should receive under the ZEV regulation.

While not specifically incorporated into the current ZEV program modifications, the ARB staff is evaluating HEVs and EZEVs and will prepare a separate proposal addressing these issues for the Board in late 1996. The ARB staff believes that a delay in presenting an HEV/EZEV proposal to the Board will not hurt the prospects of HEVs in the California market. There is significant interest at the federal level in funding HEV technology research and development, matched by private contributions from auto manufacturers. It is widely perceived among industry experts that HEVs have strong market potential. A relatively short delay in presenting an HEV proposal, allowing the ARB staff additional time to address important HEV issues, is unlikely to affect this, especially since the technology is still several years away from pilot production. In the end, the ARB seeks to encourage

commercialization of this technology as a means of expanding the market for clean technologies and achieving healthful air quality.

4.4 Infrastructure

Infrastructure for EVs includes commonly discussed items such as EV recharging systems as well as less apparent tasks such as modifying building codes and training emergency personnel to respond to incidents involving EVs. In their efforts to address infrastructure issues, stakeholders have faced a "chicken and egg" dilemma. While it is important to ensure that infrastructure for EVs is ready by the time the vehicles are produced and sold, it is difficult to secure commitments to accomplish this without an immediate need for infrastructure availability and use. The modifications to the ZEV program would allow auto manufacturers more flexibility regarding how soon and how many EVs they introduce, which could exacerbate the uncertainty surrounding infrastructure development.

For this reason it is critical, now more than ever, that stakeholders work together to develop the necessary infrastructure. State and local governments, utilities, auto manufacturers, battery manufacturers, environmental groups and others will need to coordinate efforts to modify codes, develop training programs for emergency response personnel and EV service personnel, ensure that adequate battery recycling is available, ensure that consumers can easily finance, insure and register their EVs, establish recharging stations, and develop safety standards. Many efforts are already underway to accomplish these goals, and they cannot be set aside now. By formalizing commitments between the automakers and the ARB, the staff believes the MOAs provide the maximum certainty regarding the pace and timing of ZEV introduction while also allowing needed market flexibility. While all infrastructure stakeholders are not signatories to the MOAs, the ARB staff will work to assume their continued involvement in preparing California for ZEVs is of the utmost importance.

4.5 Partnerships

The proposed modifications to the ZEV program are designed to foster partnerships among stakeholders to successfully implement the program on all levels.

California state agencies such as the Energy Commission, Department of General Services, and Trade and Commerce Agency have all assumed leadership positions to promote EVs in California. The ARB staff will work with these agencies in their continued efforts to secure purchase commitments for EVs in public and private sector fleets, assist in EV demonstrations, and provide valuable support on infrastructure and economic development issues. California air quality districts and local governments also have important roles in adopting local incentives for EV purchase and use (as has already been done in the South Coast Air Basin), assisting in

local infrastructure preparations and securing purchase commitments from local government fleets.

Electric utilities have demonstrated their commitment to providing the necessary infrastructure for EVs in California. Utilities are leading efforts to ensure that EV buyers have any necessary wiring upgrades for home recharging within a few days of purchase, establish convenience recharging sites where feasible, and address issues related to load management, connector standards, and charger safety standards. California business groups are integral to spurring interest among business communities to invest in EVs, through both private purchase commitments and research funds. And, environmental groups can actively promote EVs in California by providing educational materials for consumers on EVs and their air quality benefits.

Two good examples of existing public-private partnerships include a rental car demonstration program jointly sponsored by the Department of General Services, Honda, National Rent-A-Car and the Sacramento Municipal Utility District, and an EV-incentive program sponsored by the South Coast Air Quality Management District (SCAQMD) with the participation of Southern California Edison and local authorities. The rental car program will allow state employees an opportunity to rent an EV from the Sacramento airport, while the SCAQMD "quick charge" program provides a $5,000 incentive per EV purchase to reward early users of the technology. The success of these types of partnerships depends on cooperation between automakers, utilities, other companies and government agencies, and will undoubtedly enhance the successful launch of ZEVs in California.

5.0 ENVIRONMENTAL AND ECONOMIC IMPACTS

5.1 Environmental Impact Analysis

The staff is proposing amendments to the LEV regulations to eliminate the percentage ZEV requirements contained in 13 CCR §1960.1(g)(2) note (9) for the 1998 through 2002 model years. Under staff's proposal during this period the ARB and the seven automakers subject to the ZEV requirements in 1998 will enter into a Technology Development Partnership formalized by MOAs to ensure the successful launch of a sustainable market for ZEVs. To ensure the emission reductions associated with the percentage ZEV requirements are still realized, the MOAs will require auto manufacturers to achieve the NMOG and NOx emission reductions through the production of cleaner light-duty vehicles. This approach ensures there will be no double counting of emission reductions already included in the SIP, since the only measures in the SIP that apply to light-duty vehicles are vehicle scrapping (Measure 1) and improved control technology (Measure 2, which would not become effective until the 2004 to 2005 time frame).

The total NOx and NMOG emission benefits of the 1998 through 2002 model year percentage ZEV requirements has been determined using the ARB's mobile source emission inventory model EMFAC 7F, modified to account for OBD II and enhanced inspection and maintenance programs. The ARB staff has determined that, by 2010, voluntary compliance by manufacturers with a NLEV program for model years 2001 to 2003 would provide NMOG and NOx emission benefits for the SCAB that are equivalent to the emission benefits of the 1998 through 2002 model year percentage ZEV requirements. The results of the staff's analysis are presented in section 3.2.6 of this report, and a detailed description of the methodology and assumptions used is provided in Appendix B.

In addition to reducing emissions of ozone precursors, ZEVs will reduce emissions of carbon monoxide (CO) and toxic pollutants when compared to gasoline vehicles. As with NMOG and NOx, equivalent CO and toxic emission benefits may not be achieved in the early years. However, the staff believes that the long term success of the ZEV program can only be assured if auto makers are allowed flexibility during the introductory years of the program. Thus, the staff believes it is appropriate to forego a small portion of the total program benefits during the early years, since the long-term benefits of a successful ZEV program are so significant.

5.2 Economic Impact Analysis

This section evaluates the potential economic impact that the proposed modifications to the ZEV program may have on individuals and business enterprises in California. Section 11346.3 of the Government Code requires that, in proposing to adopt or amend any administrative regulation, state agencies assess the potential for adverse economic impact on California business enterprises and individuals, as well as the ability of California businesses to compete with businesses in other states. This section also requires state agencies to assess the potential impact of their regulations on California jobs and on business expansion, elimination, or creation.

ZEV technologies have the potential to boost California's economy by creating jobs in advanced technology industries that supply components to EV manufacturers and services to EV purchasers, and by increasing exports of high-technology products to an emerging global industry. For this reason, it is important to maintain the momentum of the program. Toward this end the staff has proposed establishing MOAs with the automakers which will formalize commitments of the ARB and manufacturers to develop a long-term market for ZEVs in California. The ARB staff believes the MOAs will assure investors that research and development will continue on ZEVs and that California's commitment to ZEVs is strong. Also, maintaining the 2003 model year ZEV requirement signals investors that the program is still on track.

The Board's Executive Officer has determined, pursuant to Government Code section 11346.5(a)(3)(B), the proposed regulatory action will affect small business. If manufacturers produce fewer ZEVs in the near term, economic growth in California's advanced transportation industries may be slowed. However, the staff believes that, in its current form, the ZEV program may not result in a successful ZEV launch, which could slow the growth of these businesses, if not eliminate them altogether. The staff's proposal is designed to promote a positive market launch of ZEVs and ramp-up the number of ZEVs in California's vehicle fleet, which is intended to sustain the growth of advanced transportation industries in the long run.

The proposed modifications to the ZEV regulation are likely to have beneficial impacts on California consumers. By providing added flexibility regarding when and how ZEVs are introduced to the California market, the proposed modifications could reduce total program costs by allowing manufacturers to:

1) **Avoid the production costs of near-term technologies:** Auto manufacturers will be able to invest in longer-term technology that has the potential for broader market success, thereby avoiding the production development costs associated with technology that could be quickly outdated.

2) **Improve manufacturing processes:** Auto manufacturers and EV component and battery suppliers will have additional time to move further along the learning curve in developing their manufacturing processes. This could lower the costs of EVs for manufacturers and consumers.

3) **Prove out new systems:** Manufacturers will have additional time to conduct on-road tests of their EVs in order to prevent system failures that could be costly to both manufacturers and EV purchasers.

4) **Achieve greater economies of scale:** The market demand will be greater for higher-performance EVs than for the EVs that would be available for sale under the current regulation in 1998. This will encourage manufacturers to spread their costs over production of more units domestically and internationally, enabling lower prices for California buyers.

However, the modifications may lower or, at a minimum, delay for a few years the expected economic benefits of the ZEV program as reflected in business creation or expansion and job growth. This is because some California companies have made business plans based on the current regulation, and the modifications raise the risk of making significant investments in the near-term. Small California companies without the financial capability to withstand an investment delay may lose the ability to compete in this market, thereby losing the investments they have made to date in the expectation of a two percent EV market penetration in 1998. Nonetheless, the long-

term potential for economic benefits and job growth still exists, and should be more certain due to the increased market potential of higher-performing EVs. Therefore, even though it is possible that certain small businesses may be adversely affected by the proposed regulatory action in the short-term, the staff anticipates no broad negative impacts on employment and the viability and competitiveness of California businesses overall.

6.0 REFERENCES

ARB Public Forums

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"Public Forum to Discuss Consumer Marketability of Zero-Emission Vehicles," June 28, 1995, El Monte, California.

"Public Forum to Discuss the Status of Electric Vehicle Infrastructure Development," July 12, 1995, El Monte, California.

"Public Forum to Discuss Proposed Revisions to the Low-Emission Vehicle Regulations," August 9, 1995, El Monte, California.

"Public Forum to Discuss Issues Regarding the Implementation of Electric Vehicles in Fleet Applications," September 13, 1995, El Monte, California.

"Public Forum to Discuss Technological Progress of Zero-Emission Vehicles," October 11, 1995, Los Angeles, California.

"Public Forum to Discuss the Benefits and Costs of Zero-Emission Vehicles," November 8, 1995, Los Angeles, California.

"Public Forum to Discuss Potential Modifications to the Zero-Emission Vehicle Program," December 6, 1995, El Monte, California.

Board meetings

"Public Meeting to Update the Board on the Technological Progress of Zero-Emission Vehicles," Item 95-11-3, October 26, 1995, Sacramento, California.

"Public Meeting to Update the Board on the Technological Progress of Zero-Emission Vehicles," Item 95-12-4, November 15, 1995, Sacramento, California.

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Reports

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M. Coates, R. Cogan, D. Gautreau, S. McGillivray, "Pricing for Success: Using Auto Industry Models to Review Electric Vehicle Costing and Pricing," Green Car Media, November 1995.

APPENDIX A

Proposed Amendments to Title 13, CCR, Sections 1900 and 1960.1

PROPOSED REGULATION ORDER

Sections 1900 and 1960.1, Title 13, CCR

1. Amend title 13, California Code of Regulations, section 1900 to read as follows:

§1900. Definitions.

[Subsections (a)(1) through (14) -- No change]

(a)(15) ~~"Zero-emission vehicle" (or "ZEV") means any vehicle which is certified by the Executive Officer to produce zero emissions of any criteria pollutants under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40 degrees Fahrenheit and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.~~ *[Reserved]*

[Subsection (a)(16) -- No change]

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101 and 43104, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39500, 40000, 43000, 43013, 43100, 43101, 43101.5, 43102, 43103, 43104, 43106 and 43204, Health and Safety Code; and section 27156, Vehicle Code.

2. Amend title 13, California Code of Regulations, section 1960.1 to read as follows: [1]

§1960.1. Exhaust Emission Standards and Test Procedures - 1981 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

[Subsections (a) through (f) -- No Change]

(g)(1) The exhaust emissions from new 1992 and subsequent model-year light-duty transitional low-emission vehicles, low-emission vehicles, and ultra-low emission vehicles *, and new 2003 and subsequent model-year light-duty zero-emission vehicles* shall not exceed:

[1] The proposed amendments are shown in italics to indicate additions to and strikeout to indicate deletions from the California Code of Regulations (CCR). This proposal does not reflect the amendments to section 1960.1 approved by the Board in September of 1995. Those amendments have not yet been formally adopted and submitted to the Office of Administrative Law for review and filing with the Secretary of State and inclusion in the CCR. The amendments proposed here will have no effect on those amendments.

EXHAUST EMISSION STANDARDS FOR TRANSITIONAL
LOW-EMISSION VEHICLES, LOW-EMISSION VEHICLES , ~~AND~~
ULTRA-LOW-EMISSION VEHICLES *AND ZERO-EMISSION VEHICLES* IN
PASSENGER CAR AND LIGHT-DUTY TRUCK VEHICLE CLASSES [6,7,8,9,10]
[grams per mile (or "g/mi")]

Vehicle Type[1]	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane OrganicGases[3,4]	Carbon Monoxide	Oxides of Nitrogen[5]
PC and	All	50,000	TLEV	0.125 (0.188)	3.4 (3.4)	0.4 (0.4)
LDT	0-3750		LEV	0.075 (0.100)	3.4 (3.4)	0.2 (0.3)
			ULEV	0.040 (0.058)	1.7 (2.6)	0.2 (0.3)
			ZEV[2.1]	--	--	--
		100,000	TLEV	0.156	4.2	0.6
			LEV	0.090	4.2	0.3
			ULEV	0.055	2.1	0.3
			ZEV[2.1]	--	--	--
LDT	3751-5750	50,000	TLEV	0.160 (0.238)	4.4 (4.4)	0.7 (0.7)
			LEV	0.100 (0.128)	4.4 (4.4)	0.4 (0.5)
			ULEV	0.050 (0.075)	2.2 (3.3)	0.4 (0.5)
			ZEV[2.1]	--	--	--
		100,000	TLEV	0.200	5.5	0.9
			LEV	0.130	5.5	0.5
			ULEV	0.070	2.8	0.5
			ZEV[2.1]	--	--	--

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.

(2) "TLEV" means transitional low-emission vehicle.
"LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"ZEV" means zero-emission vehicle.

(2.1) a. The Executive Officer shall certify as ZEVs vehicles that produce zero exhaust or evaporative emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40 degrees Fahrenheit and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.

b. Prior to the 2003 model year a manufacturer that voluntarily produces vehicles that meet the ZEV emission standards applicable to 2003 and subsequent model year vehicles may certify those vehicles as ZEVs for the purposes of calculating fleet average NMOG exhaust emission values under section (g)(2), note (4) or (5); NMOG credits under section (g)(2), note(7); and ZEV credits under section (g)(2), note (9)a.

[Notes (3) through (10) -- No change]

[Section (g)(2), table and notes (1) through (8) -- No change]

(9) While meeting the fleet average requirements, each manufacturer shall certify, produce and deliver for sale in California at least ~~2% ZEVs each model year from 1998 through 2000, 5% ZEVs in 2001 and 2002, and~~ 10% ZEVs in 2003 and subsequent model years. These percentages shall be applied to the manufacturer's total production of PCs and LDTs 0-3750 lbs. LVW delivered for sale in California.

a. Manufacturers ~~which~~ *that* produce for sale in California more ZEVs than required in a given model year shall earn ZEV credits, which shall have units of g/mi NMOG. The amount of ZEV credits earned shall be equal to the number of ZEVs required to be produced and delivered for sale in California for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year and then multiplied by the fleet average *NMOG* requirement for PCs and LDTs 0-3750 lbs. LVW for the model year.

In calculating the number of ZEV credits under this note (9)a, each ZEV produced and delivered for sale prior to the 2003 model year may be counted as follows:

1. ZEV Credits based on vehicle range:

Number of ZEVs	*Vehicle Range (miles)*		
	Model Years 1996 and 1997	*Model Years 1998 and 1999*	*Model Years 2000, 2001 and 2002*
2	*any*	*≥ 100*	*≥ 140*
3	*≥70*	*≥ 130*	*≥ 175*

Range shall be determined using the Federal Urban Dynamometer Driving Schedule, Part 86, Appendix I, Code of Federal Regulations.

2. ZEV Credits based on the specific energy of the battery:

Number of ZEVs	*Specific Energy of Battery (w-hr/kg)*		
	Model Years 1996, 1997 and 1998	*Model Years 1999 and 2000*	*Model Years 2001 and 2002*
2	*any*	*≥ 50*	*≥ 60*
3	*≥40*	*≥ 60*	*≥ 90*

For model years 1999 through 2002, additional ZEV credits will be determined by linear interpolation between the values shown in the above schedule. "Specific energy" of batteries will be the specific energy as determined in accordance with the US Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in Appendix F of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

3. For purposes of calculating ZEV credits, a ZEV may be counted according to (9)a.1. or (9)a.2. above, but not both.

4. For purposes of calculating manufacturer's fleet average NMOG value under note (4) or (5), each ZEV shall be counted as one vehicle.

All ZEV credits earned prior to the ~~1998~~ *2003* model year shall be treated as if earned in the ~~1998~~ *2003* model year and shall be discounted in accordance with notes (7)c and 7(d).

b. A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits. These credits may be earned previously by the manufacturer or acquired from another manufacturer. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year.

c. Manufacturers ~~which~~ *that* certify, produce, and deliver for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year from the the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model year in which the deficit is incurred.

d. Any manufacturer ~~which~~ *that* fails to produce and deliver for sale in California the required number of ZEVs or submit an appropriate amount of ZEVs credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer ~~which~~ *that* sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation: (No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No. of ZEVs actually produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model year)].

e. ZEVs classified as MDVs or as LDTs 3751-5750 lbs. LVW may be counted toward the ZEV requirement for PCs and LDTs 0-3750 lbs LVW and included in the calculation of ZEV credits as specified in (9)a., if the manufacturer so designates.

f. Small volume manufacturers *as defined in note (6)* shall not be required to meet the percentage ZEV requirements. However, small volume manufacturers may earn and market credits for ZEVs they produce and deliver for sale in California.

~~g. Intermediate volume manufacturers as defined in section 1960.1(o) shall not be required to meet the percentage ZEV requirements before the 2003 model year.~~

[Subsection (h)(1) -- No Change]

(h)(2) The exhaust emissions from new 1992 and subsequent model-year medium-duty low-emission vehicles and ultra-low-emissions vehicles *, and new 2003 and subsequent model-year medium-duty zero-emission vehicles* shall not exceed:

EXHAUST EMISSION STANDARDS FOR LOW-EMISSION VEHICLES *,* ~~AND~~ ULTRA-LOW-EMISSION VEHICLES *AND ZERO-EMISSION VEHICLES* IN THE MEDIUM-DUTY VEHICLE WEIGHT CLASSES [8,9,10,11,12,13,14,15,16]
[grams per mile (or "g/mi')]

Test Weight (lbs.)[1]	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane OrganicGases[3,4]	Carbon Monoxide	Oxides of Nitrogen[5]	Particulates [6,7]
0-3750	50,000	LEV	0.125 (0.188)	3.4 (3.4)	0.4 (0.4)	n/a
		ULEV	0.075 (0.100)	1.7 (2.6)	0.2 (0.3)	n/a
		ZEV[2.1]	--	--	--	--
	120,000	LEV	0.180	5.0	0.6	0.08
		ULEV	0.107	2.5	0.3	0.04
		ZEV[2.1]	--	--	--	--
3751-5750	50,000	LEV	0.160 (0.238)	4.4 (4.4)	0.7 (0.7)	n/a
		ULEV	0.100 (0.128)	2.2 (3.3)	0.4 (0.5)	n/a
		ZEV[2.1]	--	--	--	--
	120,000	LEV	0.230	6.4	1.0	0.10
		ULEV	0.143	3.2	0.5	0.05
		ZEV[2.1]	--	--	--	--
5751-8500						
	50,000	LEV	0.195 (0.293)	5.0 (5.0)	1.1 (1.1)	n/a
		ULEV	0.117 (0.156)	2.5 (3.8)	0.6 (0.8)	n/a
		ZEV[2.1]	--	--	--	--
	120,000	LEV	0.280	7.3	1.5	0.12
		ULEV	0.167	3.7	0.8	0.06
8501-10,000		*ZEV*[2.1]	--	--	--	--
	50,000	LEV	0.230 (0.345)	5.5 (5.5)	1.3 (1.3)	n/a
		ULEV	0.138 (0.184)	2.8 (4.2)	0.7 (1.0)	n/a
		ZEV[2.1]	--	--	--	--
	120,000	LEV	0.330	8.1	1.8	0.12
		ULEV	0.197	4.1	0.9	0.06
10,001-14,000		*ZEV*[2.1]	--	--	--	--
	50,000	LEV	0.300 (0.450)	7.0 (7.0)	2.0 (2.0)	n/a
		ULEV	0.180 (0.240)	3.5 (5.3)	1.0 (1.5)	n/a
		ZEV[2.1]	--	--	--	--
	120,000	LEV	0.430	10.3	2.8	0.12
		ULEV	0.257	5.2	1.4	0.06
		ZEV[2.1]	--	--	--	--

(1) "Test Weight" (or "TW") shall mean the average of the vehicle's curb weight and gross vehicle weight.

(2) "LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"ZEV" means zero-emission vehicle.

(2.1) a. The Executive Officer shall certify as ZEVs vehicles that produce zero exhaust or evaporative emissions of any criteria pollutant (or precurson pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40 degrees Fahrenheit and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.

b. Prior to the 2003 model year a manufacturer that voluntarily produces vehicles that meet the ZEV emission standards applicable to 2003 and subsequent model year vehicles may certify those vehicles as ZEVs for the purposes of calculating ZEV credits under section (g)(2), note (9)a. and (9)e.

[Notes (3) through (16) and subsections (i) through (p) -- No change]

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43103, 43104, 43105, 43106, 43107, 43204, 43205.5, Health and Safety Code.

APPENDIX B

Methodology for the Quantification of the Benefits of a National Low Emission Vehicle Program on California Air Quality

Methodology for the Quantification of the Benefits of a National Low Emission Vehicle Program on California Air Quality

Introduction

California's Low Emission Vehicle standards call for progressively more stringent fleet average non-methane organic gas (NMOG) emission standards for on-road motor vehicles between 1998 and 2003. The Air Resources Board (ARB) staff has suggested a plausible implementation schedule whereby a combination of three specific low-emission vehicle categories referred to as transitional low-emission vehicles (TLEVs), low-emission vehicles (LEVs), and ultra low-emission vehicles (ULEVs), might be produced in order to comply with these standards. In addition, vehicles having no tailpipe emissions, zero-emission vehicles (ZEVs), were required to be produced for sale beginning in 1998 as two percent of passenger cars and light-duty truck production, increasing to five percent in 2001, and ten percent in 2003.

For reasons set forth in the staff report, the staff is proposing to eliminate the ZEV production requirement for the 1998 through 2002 model years. The 10 percent production requirement in 2003 and subsequent model years would be retained.

In the Memoranda of Agreement (MOA) being developed with affected manufacturers, each manufacturer would agree to meet the fleet average NMOG tailpipe standard even in the absence of ZEV production. While this assumes no increase in tailpipe emissions of NMOG, reductions in exhaust emissions of oxides of nitrogen (NOx) and evaporative emission of hydrocarbons (HC) may be lost due to the delay of the introduction of ZEVs.

An analysis has been performed to quantify the emission benefits lost due to a delay in the introduction of ZEVs in California from 1998 through 2002, and to quantify the potential benefits of a proposal by vehicle manufacturers to voluntarily produce a National Low Emission Vehicle (NLEV) beginning in 2001, which for the years 2001 through 2003, has the objective of offsetting this potential loss of benefits.

ZEV Benefit Calculation

The benefits of ZEVs were calculated by establishing a baseline in which the ARB staff suggested a plausible implementation schedule for TLEVs, LEVs and ULEVs, and the required production of ZEVs. This calculation is used to establish a ton-per-day inventory for the South Coast Air Basin for the evaluation years of 2004 and 2010 (See Table 1).

This ton per day estimate was contrasted to an alternative implementation schedule in which the fleet average exhaust emission rate of NMOG is maintained without ZEVs

(See Table 2). Because both LEVs and ULEVs have NOx and evaporative emissions, a disbenefit will be realized when more of these vehicles are produced in lieu of ZEVs in order to comply with the NMOG fleet average tailpipe emission standard. ZEVs, which have no NOx or evaporative emissions, do have NOx emissions resulting from power generation to charge their batteries of one tenth the NOx emissions of a ULEV.

The category specific emission factors used in this analysis are from EMFAC7F modified for enhanced I/M and changes to OBDII, and are listed in Table 3. The ton per day estimates were derived through the use of EMFAC7F and are listed in Table 4.

TABLE 1
BASELINE IMPLEMENTATION ASSUMED PRODUCTION MIX (Fraction)
(To Comply with Average NMOG Tailpipe Standard)

Model Year	Tier I	TLEV	LEV	ULEV	ZEV
1998	0.48	0	0.48	0.02	0.02
1999	0.23	0	0.73	0.02	0.02
2000	0	0	0.96	0.02	0.02
2001	0	0	0.90	0.05	0.05
2002	0	0	0.85	0.10	0.05
2003+	0	0	0.75	0.15	0.10

TABLE 2
ALTERNATIVE IMPLEMENTATION
ASSUMED PRODUCTION MIX (Fraction)
(No ZEVs - But Maintain Same Average NMOG Tailpipe Standard)

Model Year	Tier I	TLEV	LEV	ULEV	ZEV
1998	0.48	0	0.46	0.06	0.00
1999	0.23	0	0.71	0.06	0.00
2000	0	0	0.94	0.06	0.00
2001	0	0	0.85	0.15	0.00
2002	0	0	0.80	0.20	0.00
2003+	0	0	0.75	0.15	0.10

TABLE 3
CATEGORY SPECIFIC BASIC EMISSION RATES
EMFAC7F (Adjusted to Reflect Enhanced I/M & OBDII)

Category	Pollutant	Zero Mile	Deterioration*
0.25	HC	0.1453	0.0152
TLEV	HC	0.0992	0.0093
LEV	HC	0.0351	0.0055
ULEV	HC	0.0219	0.0028
ZEV	HC	0	0
0.25	NOx	0.2846	0.0208
TLEV	NOx	0.3588	0.0167
LEV	NOx	0.1694	0.0089
ULEV	NOx	0.1694	0.0089
ZEV	NOx	0	0

*Grams/Mile/10,000 miles

TABLE 4
BENEFIT OF ZEV REQUIREMENT 1998 - 2002 (LIGHT-DUTY VEHICLES)
SCAB EMISSIONS IN TONS PER DAY

Scenario		A	B	(B-A)		A	B	(B-A)
Year			2004				2010	
TOG								
Diurnal Evaporation	15.18	15.25	0.07		12.26	12.33	0.07	
Hot Soak Evaporation		9.42	9.47	0.05		7.10	7.15	0.05
Running Losses	44.96	45.00	0.04		33.62	33.83	0.21	
Resting Losses	6.78	6.80	0.02		4.00	4.01	0.01	
Total Evap	76.34	76.52	0.18		56.98	57.32	0.34	
NOx								
Running Exhaust	100.55	101.34	0.79		76.47	76.92	0.45	
Cold Start	27.85	28.13	0.28		21.80	21.92	0.12	
Hot Start	10.07	10.16	0.09		7.54	7.59	0.05	
Total NOx Emissions		138.47	139.63	1.17		105.81	106.43	0.62

TABLE 5
BENEFIT OF ZEV REQUIREMENT 1998 - 2002 (LIGHT-DUTY TRUCKS)
SCAB EMISSIONS IN TONS PER DAY

Scenario		A	B	(B-A)		A	B	(B-A)
Year			2004				2010	
TOG								
Diurnal Evaporation	3.06	3.07	0.01		2.25	2.27	0.02	
Hot Soak Evaporation		1.65	1.66	0.01		1.11	1.13	0.02
Running Losses	9.65	9.66	0.01		6.34	6.40	0.06	
Resting Losses	1.30	1.31	0.01		0.64	0.65	0.01	
Total Evap	15.66	15.70	0.04		10.34	10.45	0.11	
NOx								
Running Exhaust	35.06	35.39	0.33		29.39	29.69	0.30	
Cold Start	8.38	8.47	0.09		7.00	7.06	0.06	
Hot Start	2.94	2.97	0.03		2.40	2.42	0.02	
Total NOx Emissions		46.38	46.83	0.45		38.79	39.17	0.38

Scenario A - With ZEVs Scenario B - Without ZEVs

Calculation of the NLEV Benefit

To offset the loss of benefit attributable to the delay of the ZEV production requirement, a strategy has been suggested by which a national low emission vehicle, or NLEV, could be introduced nationally in the year 2001. It is assumed, based upon United States Environmental Protection Agency (U.S. EPA) existing authorities, that an NLEV program will be instituted by regulation in the year 2004, therefore, no benefit can be attributed to an NLEV strategy for purposes of offsets beyond the 2003 model year.

Through the early introduction of NLEVs, model year 2001 through 2003 vehicles migrating into California from other states would be certified to LEV rather than Tier I (0.25) levels. The lower emissions of the migrant fleet are evaluated to determine if they offset the emission shortfall of a delay in ZEV production.

The EMFAC model was again used to quantify the relative tons-per-day emissions in the years 2004 and 2010 for a Tier I and NLEV scenario. In carrying out this analysis the following assumptions were made:

1) 18 percent of all new registration transactions in California between the years 2001 and 2003 were assumed to be associated with vehicles which originate from outside of California. This is the average of the percentage migration for 1980 to 1994, which ranged from 14 percent to 22 percent.

2) In the baseline assumption, all 2001 to 2003 model year vehicles originating from outside of the state were assumed to be certified to Tier I levels.

3) In the alternative analysis, all 2001 to 2003 model year vehicles originating from outside of the state were assumed to be certified to a LEV standard.

4) Vehicles certified to similar standards were assumed to emit identically once in California regardless of their origin (EMFAC7F emission rates were used for both migrating and native fleets)

.

5) Vehicles of the same vintage display identical use patterns regardless of origin (BURDEN activity data was used for both migrating and native fleets).

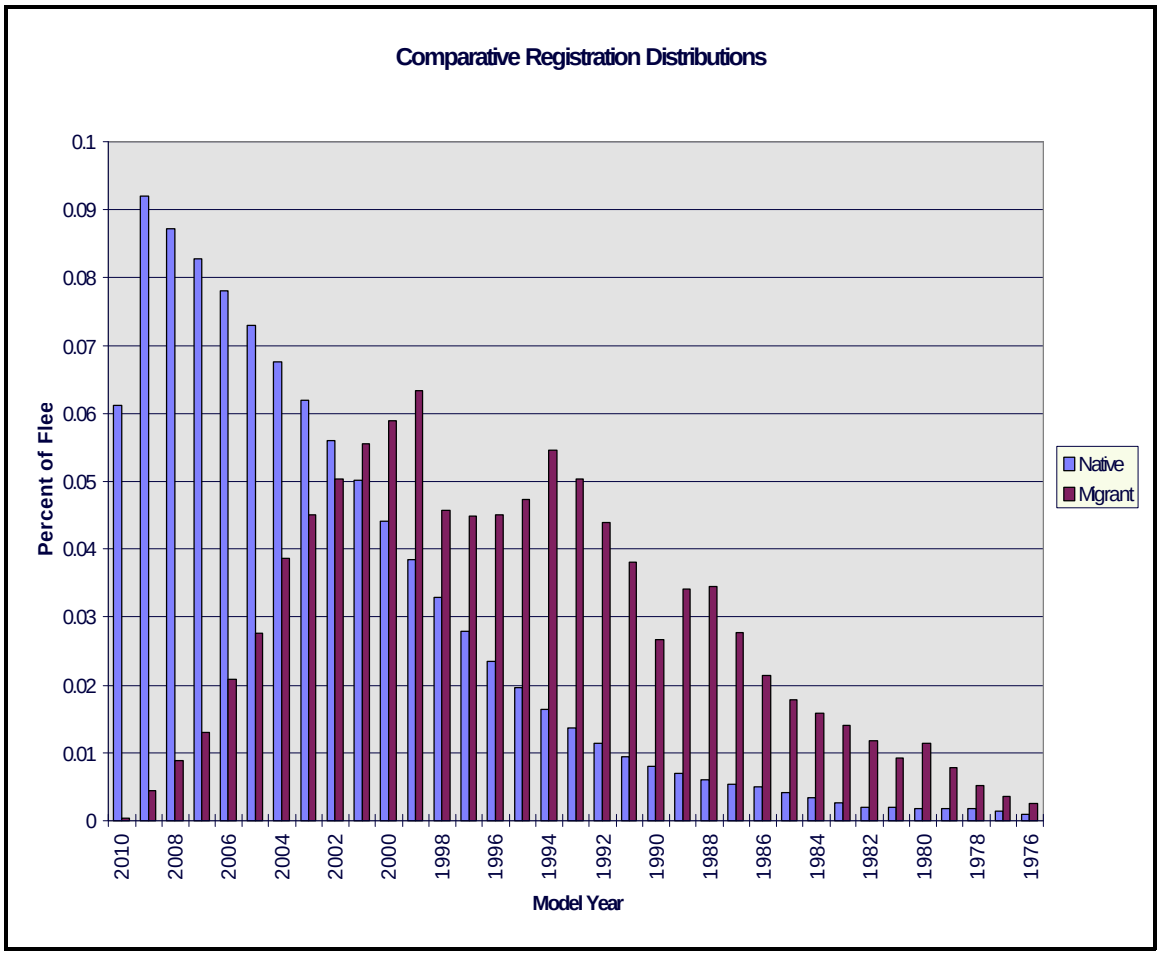
Modification of Activity Assumptions

Concerned that the relatively small benefits associated with perturbing three model years within the migrant fleet may be lost in the analysis of all vehicles within the

South Coast Air Basin, the activity assumptions used in the inventory model were modified to reflect only the activity and emissions of the migrant fleet.

Using data supplied by the California Department of Motor Vehicles, an analysis of 1,700,000 registration records was performed to determine the current age distribution of vehicles which were originally registered outside of California. Figure 1 contrasts the California native and migrant registration age distributions. As can be seen, the migrant fleet is considerably older on average than the California native fleet, and a marked delay is seen in the appearance of new vehicles in the migrant fleet. This model year distribution was used for the migrant fleet in the calculating the NLEV benefit.

Figure 1



In addition to adjusting the registration distribution to reflect the migrant fleet in California, it was also necessary to adjust the vehicle population, daily vehicle miles of

travel (VMT) and total trips. These adjustments were derived outside of the models and were used to overwrite the default assumptions in BURDEN. For additional information, see Table 6 and the data provided at the end of this appendix.

TABLE 6
COMPARISON OF
SCAB NATIVE AND MIGRANT FLEETS
(Catalyst Equipped Passenger Cars in 2010)

Activity	Combined Fleet	Migrant Fleet Only
Average Age	7.31 years	14.68 years
Population	9,425,536	1,625,339
VMT	301,337,000	32,284,252
Total Trips	34,320,646	4,204,593
2001-2003 Population	1,583,584 (16.8%)	245,295 (15.09%)
2001-2003 VMT	46,418,714 (15.4%)	6,230,960 (19.3%)

Once the activity had been properly adjusted, the analysis was completed by substituting either the Tier I or LEV emission rates (listed earlier) for model years 2001 to 2003 and the EMFAC/BURDEN models were run to produce inventories for the SCAB for 2004 and 2010. The results of this analysis are shown in Tables 7 and 8.

TABLE 7
LIGHT DUTY AUTOMOBILE NLEV BENEFIT
SCAB EMISSIONS IN TONS PER DAY

Scenario	A	B	(A-B)	A	B	(A-B)
		2004			2010	
TOG						
Running Exhaust	0.10	0.03	0.07	0.96	0.29	0.67
Cold Start	0.21	0.06	0.15	1.13	0.35	0.78
Hot Start	0.02	0.01	0.01	0.10	0.03	0.07
Total TOG Emissions	0.33	0.10	0.23	2.19	0.67	1.52
NOx						
Running Exhaust	0.40	0.23	0.17	2.69	1.41	1.28
Cold Start	0.17	0.10	0.07	0.87	0.46	0.41
Hot Start	0.05	0.03	0.02	0.30	0.16	0.14
Total NOx Emissions	0.62	0.36	0.26	3.87	2.03	1.83

TABLE 8
LIGHT DUTY TRUCK NLEV BENEFIT
SCAB EMISSIONS IN TONS PER DAY

Scenario	A	B	(A-B)	A	B	(A-B)
TOG		2004			2010	
Running Exhaust	0.04	0.01	0.03	0.28	0.12	0.16
Cold Start	0.05	0.01	0.04	0.24	0.10	0.14
Hot Start	0.00	0.00	0.00	0.02	0.01	0.01
Total TOG Emissions	0.09	0.02	0.07	0.54	0.23	0.31
NOx						
Running Exhaust	0.12	0.06	0.06	0.72	0.35	0.37
Cold Start	0.04	0.02	0.02	0.18	0.09	0.09
Hot Start	0.01	0.01	0.00	0.06	0.03	0.03
Total NOx Emissions	0.17	0.09	0.08	0.96	0.47	0.49

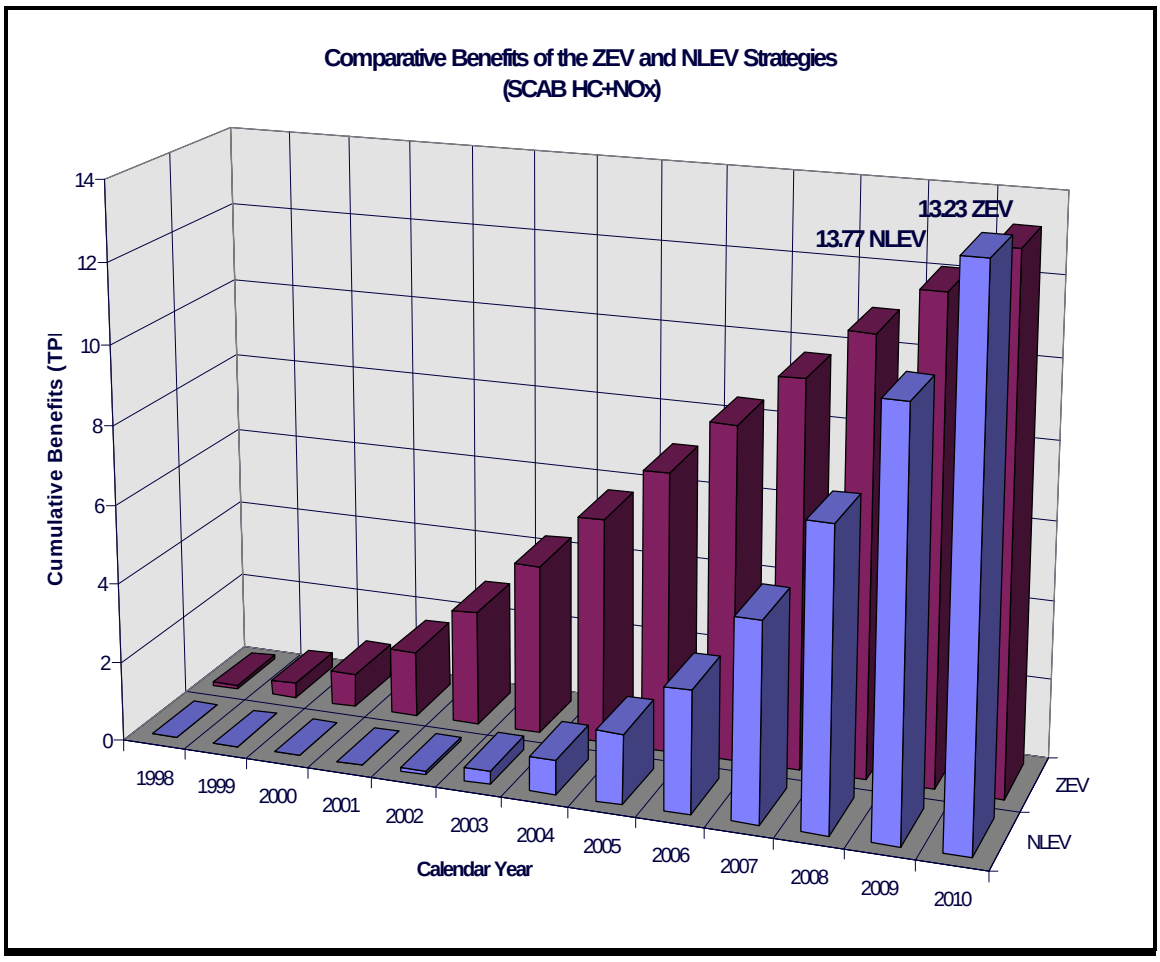
Scenario A - 2001 to 2003 Tier I Scenario B - 2001 to 2003 NLEV

TABLE 9
RELATIVE ZEV AND NLEV BENEFITS
SCAB TONS PER DAY

Year	Vehicle Type	HC Exhaust	HC Evap	Marketing (0.06 g/mi)	Power Plant HC (0.004 g/mi)	NOx Exhaust	Power Plant NOx (0.02 g/mi)	HC + NOx
ZEV Benefit								
2004	PCs		0.18	0.28	-0.02	1.17	-0.09	1.52
	LDTs		0.04	0.05	-0.00	0.45	-0.02	0.52
	Total							**2.04**
2010	PCs		0.34	0.13	-0.01	0.62	-0.04	1.04
	LDTs		0.11	0.03	-0.00	0.39	-0.01	0.52
	Total							**1.56**
NLEV Benefit								
2004	PCs	0.23				0.26		0.49
	LDTs	0.07				0.08		0.15
	Total							**0.64**
2010	PCs	1.52				1.83		3.35
	LDTs	0.31				0.49		0.80
	Total							**4.15**

As can be seen in Table 9, it appears that although the NLEV scenario falls short of achieving the equivalent benefits of ZEVs in the 2004 time frame, the strategy exceeds that of ZEVs by the year 2010. To determine when the entire shortfall associated with a delay in the ZEV requirement may be compensated by an NLEV strategy, the cumulative benefits (summation of the comparative ton per day per year emissions reductions) were also determined. This analysis was performed by calculating each scenario's potential benefit between 1998 and 2010. The results are shown in Figure 2 and show an equivalent cumulative benefit for NLEVs and ZEVs of approximately 13 tons/day for passenger cars in 2010.

Figure 2



The data provided on the following pages was used in the derivation of the activity assumptions for the California migrant fleet.

Base Assumption							
Average Age =			7.31				
Population=			9,425,536				
VMT=			301,337,000				
2001-2003 Populati		16.80%	1,583,584				
2001-2003 VMT		15.40%	46,418,714				
Trips			34,320,646				
	A	B	C	D=A*B	E=Dmy/Dtot	Year*B	F=Trips*E/POP*B
				WEIGHTED			
	ACCRUAL	REG	CUMUL	ACCURAL			
YEAR	RATE	FRACTION	MILES	RATE	TF	AGE	Trips/VD
2010	14169	0.0612	5313	867.143	0.085	123.012	5.056
2009	13563	0.09196	18876	1247.253	0.122	184.748	4.839
2008	12956	0.08717	31832	1129.375	0.111	175.037	4.623
2007	12349	0.08274	44181	1021.756	0.100	166.059	4.406
2006	11742	0.07807	55923	916.698	0.090	156.608	4.190
2005	11135	0.07299	67058	812.744	0.080	146.345	3.973
2004	10528	0.06756	77586	711.272	0.070	135.390	3.757
2003	9921	0.06187	87507	613.812	0.060	123.926	3.540
2002	9314	0.05604	96821	521.957	0.051	112.192	3.323
2001	8707	0.0501	105528	436.221	0.043	100.250	3.107
2000	8101	0.04417	113629	357.821	0.035	88.340	2.891
1999	7597	0.03839	121226	291.649	0.029	76.742	2.711
1998	7164	0.03294	128390	235.982	0.023	65.814	2.556
1997	6788	0.02795	135178	189.725	0.019	55.816	2.422
1996	6457	0.02351	141635	151.804	0.015	46.926	2.304
1995	6214	0.01964	147849	122.043	0.012	39.182	2.217
1994	6071	0.01637	153920	99.382	0.010	32.642	2.166
1993	5940	0.01364	159860	81.022	0.008	27.185	2.119
1992	5819	0.0114	165679	66.337	0.007	22.709	2.076
1991	5707	0.00936	171386	53.418	0.005	18.636	2.036
1990	5603	0.00797	176989	44.656	0.004	15.860	1.999
1989	5505	0.00702	182494	38.645	0.004	13.963	1.964
1988	5414	0.00612	187908	33.134	0.003	12.167	1.932
1987	5328	0.00526	193236	28.025	0.003	10.452	1.901
1986	5247	0.00493	198483	25.868	0.003	9.791	1.872
1985	5170	0.00413	203653	21.352	0.002	8.198	1.845
1984	5098	0.00335	208751	17.078	0.002	6.646	1.819
1983	5029	0.00262	213780	13.176	0.001	5.195	1.794
1982	4963	0.00203	218743	10.075	0.001	4.023	1.771
1981	4901	0.00188	223644	9.214	0.001	3.724	1.749
1980	4842	0.00186	228486	9.006	0.001	3.683	1.728
1979	4785	0.00171	233271	8.182	0.001	3.384	1.707
1978	4730	0.00175	238001	8.278	0.001	3.462	1.688
1977	4678	0.00137	242679	6.409	0.001	2.708	1.669
1976	4628	0.00095	247307	4.397	0.000	1.877	1.651
		1.00002		**10204.9059**	**1**	**2003**	

Migrant Fleet									
Average Age =			14.68						
Population=			1,625,339						
VMT=		10.71%	32,284,252						
2001-2003 Population		15.09%	245,295						
2001-2003 VMT		19.30%	6,230,960						
Trips		12.25%	4,204,593						
					E=				
	A	B	C	D=A*B	Dmy/Dtot	Year*B	A*B/365	F	F*B
				WEIGHTED					
	ACCRUAL	REG	CUMUL	ACCURAL				Trips/	
YEAR	RATE	FRACTION	MILES	RATE	TF	AGE	Avg. Mileage	VD	Wt Trips
2010	14169	0.000300602	5313	4.2592	0.0006	0.6042	0.0117	5.0557	0.0015
2009	13563	0.004371613	18876	59.2922	0.0082	8.7826	0.1624	4.8395	0.0212
2008	12956	0.008846289	31832	114.6125	0.0158	17.7633	0.3140	4.6229	0.0409
2007	12349	0.013003186	44181	160.5763	0.0221	26.0974	0.4399	4.4063	0.0573
2006	11742	0.02075872	55923	243.7489	0.0336	41.6420	0.6678	4.1897	0.0870
2005	11135	0.027638213	67058	307.7515	0.0424	55.4146	0.8432	3.9731	0.1098
2004	10528	0.038545773	77586	405.8099	0.0560	77.2457	1.1118	3.7565	0.1448
2003	9921	0.045038778	87507	446.8297	0.0616	90.2127	1.2242	3.5399	0.1594
2002	9314	0.050320785	96821	468.6878	0.0646	100.7422	1.2841	3.3234	0.1672
2001	8707	0.05555985	105528	483.7596	0.0667	111.1753	1.3254	3.1068	0.1726
2000	8101	0.058909416	113629	477.2252	0.0658	117.8188	1.3075	2.8905	0.1703
1999	7597	0.06333256	121226	481.1375	0.0664	126.6018	1.3182	2.7107	0.1717
1998	7164	0.045725868	128390	327.5801	0.0452	91.3603	0.8975	2.5562	0.1169
1997	6788	0.044815473	135178	304.2074	0.0420	89.4965	0.8334	2.4220	0.1085
1996	6457	0.044970069	141635	290.3717	0.0401	89.7603	0.7955	2.3039	0.1036
1995	6214	0.047306176	147849	293.9606	0.0405	94.3758	0.8054	2.2172	0.1049
1994	6071	0.054615101	153920	331.5683	0.0457	108.9025	0.9084	2.1662	0.1183
1993	5940	0.050269254	159860	298.5994	0.0412	100.1866	0.8181	2.1195	0.1065
1992	5819	0.043982376	165679	255.9334	0.0353	87.6129	0.7012	2.0763	0.0913
1991	5707	0.038142107	171386	217.6770	0.0300	75.9409	0.5964	2.0363	0.0777
1990	5603	0.026659109	176989	149.3710	0.0206	53.0516	0.4092	1.9992	0.0533
1989	5505	0.034088274	182494	187.6559	0.0259	67.8016	0.5141	1.9643	0.0670
1988	5414	0.034595003	187908	187.2973	0.0258	68.7749	0.5131	1.9318	0.0668
1987	5328	0.027818574	193236	148.2174	0.0204	55.2755	0.4061	1.9011	0.0529
1986	5247	0.021437221	198483	112.4811	0.0155	42.5743	0.3082	1.8722	0.0401
1985	5170	0.017726933	203653	91.6482	0.0126	35.1880	0.2511	1.8447	0.0327
1984	5098	0.015794491	208751	80.5203	0.0111	31.3363	0.2206	1.8190	0.0287
1983	5029	0.013999468	213780	70.4033	0.0097	27.7609	0.1929	1.7944	0.0251
1982	4963	0.01166336	218743	57.8853	0.0080	23.1168	0.1586	1.7709	0.0207
1981	4901	0.009327253	223644	45.7129	0.0063	18.4773	0.1252	1.7487	0.0163
1980	4842	0.011431467	228486	55.3512	0.0076	22.6343	0.1516	1.7277	0.0198
1979	4785	0.007807065	233271	37.3568	0.0052	15.4502	0.1023	1.7073	0.0133
1978	4730	0.005187533	238001	24.5370	0.0034	10.2609	0.0672	1.6877	0.0088
1977	4678	0.00351275	242679	16.4326	0.0023	6.9447	0.0450	1.6692	0.0059
1976	4628	0.002499291	247307	11.5667	0.0016	4.9386	0.0317	1.6513	0.0041
		1		**7250.0254**	**1.0000**	**1995**	**19.8631**		**2.5869**

APPENDIX C

Master Memorandum of Agreement

MASTER MEMORANDUM OF AGREEMENT

The California Air Resources Board ("ARB") and [manufacturer] ("Manufacturer") hereinafter collectively referred to as the "Parties," enter into this Memorandum of Agreement ("MOA") to help ensure continued progress toward a successful launch of a sustainable market for zero-emission vehicles in California by using market-based strategies for introduction of zero-emission vehicles.

Whereas, many areas of California exceed the national ambient air quality standard for ozone and virtually all areas of the state exceed the state ozone standard; and

Whereas, ARB has adopted a state implementation plan (SIP) to provide for attainment of the national standards in all areas of the state by the deadlines specified in federal law; and

Whereas, ARB has determined that motor vehicles are the source of significant ozone precursor emissions in California and that light-duty vehicles are major contributors to mobile source emissions; and

Whereas, ARB has adopted a regulation creating the Low Emission Vehicle (LEV) program, which established increasingly more stringent emissions standards for four types of lower emitting passenger cars and light duty trucks 0-3750 lbs. loaded vehicle weight (LVW) (hereinafter "light duty vehicles") and requires manufacturers to meet a production weighted fleet average for non-methane organic gas (NMOG) exhaust emission requirement; and

Whereas, the LEV program adopted by ARB requires certain manufacturers, beginning with the 1998 model year, to produce and deliver for sale in California zero emission vehicles (ZEV) in volumes equal to specific percentages of the total of vehicles produced and delivered for sale in California by that manufacturer ("percentage ZEV requirements"); and

Whereas, the only currently available technology to meet the percentage ZEV requirements in the 1998 through early 2000s time frame is electric vehicles powered by electrochemical batteries; and

Whereas, the current SIP as adopted by ARB includes emission reductions attributable to the LEV program including the percentage ZEV requirements; and

Whereas, the Battery Technology Advisory Panel ("Battery Panel") established by ARB found that improved lead acid batteries will be available for ZEVs in 1998 but that major automakers believed they would be purchased in quantities less than those required to meet the percentage ZEV requirements; and

Whereas, the Battery Panel concluded that given a complete success scenario electric vehicles with commercial-production advanced technology batteries could become available in the 2000-2001 time frame; however, as the Battery Panel further reported, "estimated dates for availability of advanced batteries from commercial-scale production have significant uncertainties;" and

Whereas, ARB and Manufacturer desire to see a smooth and orderly introduction of ZEVs into the market and to foster market acceptance of ZEVs with products that meet customer needs; and

Whereas, ARB and Manufacturer agree that good faith marketing of ZEVs is critical to their initial introduction and long term success and the Parties intend to work together to increase customer awareness to facilitate ZEV introduction, and Manufacturer will make good faith efforts as appropriate to market and promote its ZEV products and ARB will pursue funding for co-sponsored programs; and

Whereas, ARB believes that, if an emissions control program is modified in any way that would reduce the emissions reductions assumed in the SIP, equivalent emission reductions must be obtained to ensure the approvability of California's SIP; and

Whereas, ARB believes that marketability of ZEVs and advanced technology batteries will be promoted by deployment of ZEVs in demonstration fleets and that rapid development of technologies will best be assured if manufacturers continue research and development while investment is being made in ZEV infrastructure planning and development; and

Whereas, the Parties agree that a market-based approach to the introduction of ZEVs in California will provide flexibility and help ensure the best possible product at the least cost; and

Whereas, the Parties intend to enter into this MOA to provide a mechanism to ensure the implementation of demonstration projects necessary to permit the evaluation of the performance, reliability, safety, and life of advanced technology batteries in ZEVs and to support pilot scale production of advanced technology batteries to validate production processes in terms of product quality and process economics, and to permit evaluation of other factors including infrastructure, market incentives and market acceptance;

Now, Therefore the Parties agree to the following:

I. Manufacturer's Obligations.

A. Cleaner Cars Nationwide Manufacturer commits to participate in a 49 state program. For purposes of this MOA, "49 state program" means a voluntary program, beginning not later than the 2001 model year, entered into by Manufacturer to produce and deliver for sale cleaner light duty vehicles (up to 6000 lbs. GVW), i.e. vehicles certified to standards equivalent to California standards, in the 49 states, excluding states which have adopted the California program through section 177 of the Clean Air Act. Under such a program the fleet average NMOGs, for the 2001 model year and beyond, for passenger cars and light duty trucks up to 3750 lbs. LVW will be 0.075 gpm and for light duty trucks up to 6000 lbs. GVW the fleet NMOG average shall be 0.10 gpm. If a 49 state program as described above is not implemented, then "49 state program" shall also mean other program(s) of choice undertaken by Manufacturer which offer emissions reduction benefits for the State of California equivalent, as determined by the Executive Officer, to those that would have been realized by the State of California under the above described 49 state program as calculated in Exhibit B.

B. Market Based ZEV Launch. In addition to any vehicles produced and placed in a demonstration project under I.D.2 below, Manufacturer commits that it will have the capacity to produce specified numbers of ZEVs that could be sold in California if warranted by customer demand. Capacity numbers for model years 1996 and beyond were previously submitted to ARB on or about November 13, 1995. This submission is attached as Exhibit A and shall continue to be treated as confidential and proprietary business information, and is intended to provide accurate information for business and regulatory planning purposes for infrastructure development and funding.

C. ZEV Product Plans (Ramp-Up/Transition Plans). Prior to November 1 of the year preceding each of the scheduled reviews pursuant to section IV of this MOA, Manufacturer shall submit to ARB confidentially its ZEV product plans for model years through the 2003 model year. ZEV product plans shall include to the extent available projections for model-type(s), vehicle features and specifications, production capacity, prospective battery suppliers, capital allocation, and identification of products that will meet the ZEV regulatory requirement in 2003. Such product plans shall be consistent with approved product plans used by manufacturer for internal funding purposes.

D. Technology Development Partnership. Both ARB and Manufacturer agree to make good faith efforts to promote and develop a market for ZEVs, and to ensure ongoing ZEV-related research and development. Further ARB and Manufacturer agree to discuss and identify barriers to successful launch of a sustainable market for ZEVs in California and to identify ways to overcome these barriers.

1. Research and Development: Manufacturer commits to continuing ZEV and battery research and development throughout the term of this MOA to facilitate

the earliest possible commercial introduction of, and a sustainable market for, ZEVs. These research and development activities will include the acquisition and evaluation of advanced technology battery prototypes prior to 1998. [For AAMA members: Specifically Manufacturer commits to contributing funding in the amount of at least $____[2] million during Phase II of the US Advanced Battery Consortium (USABC) currently scheduled to be completed by 1999, and in any case Manufacturer shall contribute said amount by 2002.

2. Advanced Technology Battery Demonstration Project: (a) Manufacturer commits to placing ZEVs in one or more demonstration projects intended to determine the capabilities and marketability of one or more advanced technology batteries. This commitment shall include some placements to provide sufficient feedback to the Manufacturer as necessary to meet data and information needs regarding consumer use and acceptance, vehicle and battery performance, and market development. The Parties intend that the placed vehicles will remain in use in California for 3 years or more. In any event, Manufacturer shall retain maximum flexibility to move or relocate these vehicles within California or to suspend a project for good cause. If a demonstration project is suspended for good cause, Manufacturer shall submit a report to the Executive Officer indicating the number of vehicles involved and describing the cause of the suspension and whether Manufacturer plans to resume the project.

(i) Manufacturer will place a specified number of new ZEVs with advanced technology batteries into service in California urban areas in accordance with the following table:

Calendar Year	Specified Number of Vehicles
through 1998	
1999	
2000	

The numbers in this table reflect Manufacturer's pro rata share of 750 vehicles through 1998 and Manufacturer's pro rata share of 1500 vehicles annually for 1999 and 2000.[3]

[2] MOA's for individual manufacturers will reflect the following amounts: Chrysler, $3.34 million; Ford, $6.67 million; and GM, $8.90 million.

[3] MOA's for individual manufacturers will reflect that manufacturer's allocation of the 3750 vehicles based on the manufacturer's pro rata share of the market as set out in the definition section of the agreement

The Executive Officer will adjust these requirements for a calendar year, including extending the program up to one year, if Manufacturer demonstrates that the adjustments being sought would better serve the purposes and policies of the demonstration project than the specified requirements. Unless an extension is granted by the Executive Officer, all cumulative demonstration requirements must be met by the end of the 2000 calendar year.

(ii) Manufacturer may reduce the total number of ZEVs required to be placed in demonstration projects if the batteries in the vehicles have a specific energy of 50 w-hr/kg or more. Vehicles will receive placement credit by linear interpolation between the values shown in the following schedule:

Vehicles powered by a battery with a specific energy of :	Shall be credited As:
50 w-hr/kg*	One ZEV
60 w-hr/kg	Two ZEVs
90 w-hr/kg	Three ZEVs

* Through 1998 calendar year, 40 through 50 w-hr/kg shall receive one ZEV credit with no interpolation between 40 and 50 w-hr/kg.

(iii) For purposes of determining compliance with the volumes specified in (i) above Manufacturer may include advanced technology battery vehicles placed other than through the demonstration projects. Manufacturer may also comply with the volumes specified in (i) by utilizing credits generated by Manufacturer or obtained from other manufacturers pursuant to (d) below.

(b) Vehicles placed through a demonstration project under I.D.2 will be placed in commerce in accordance with regulations issued by the National Highway Traffic Safety Administration.

(c) Manufacturer will provide service and support for ZEVs placed under I.D.2. Such service and support will be available for the term of the demonstration program up to a maximum of three years after a vehicle is

(§X.E).

placed, unless the program is suspended in accordance with I.D.2(a), or the vehicle is no longer in operation in California.

(d) Manufacturer will not be allowed to earn credits under 13 CCR section 1960.1(g) (2), note (9) for any ZEV produced and delivered as a part of any demonstration project under this paragraph, except to the extent the number of ZEVs placed exceeds the number required to be placed under I.D.2(a) above. Credits earned for vehicles placed in excess of the number required shall be fully transferable among manufacturers and may be used to satisfy any obligation under I.D.2(a) or under the LEV program.

E. Annual Report. Manufacturer shall file a report with the Executive Officer within 90 days after the close of each calendar year providing the following:

1. Information regarding ZEVs placed in California and the United States in the most recently ended calendar year, including the number and type of vehicles, the MSRP if any, and the type of battery, including major battery specifications, incorporated in the vehicles; and

2. Information regarding the purchase of advanced technology battery prototypes prior to 1998 [For AAMA members: and, for the reports covering 1996-1999, Manufacturer must identify its contribution during the year to Phase II of the USABC program]; and

3. Information concerning the placement of ZEVs under I.D.2 and related feedback.

F. Manufacturer will continue to collaborate with ARB and the State Fire Marshal to develop the curriculum and materials necessary for the comprehensive ZEV safety training program currently under development by the agencies.

G. Not later than three months prior to the biennial review under IV below, the Manufacturer, at ARB's request, shall provide the duly authorized representatives of ARB's Executive Officer on-site review of activities and hardware related to Manufacturer's ZEV program. Such on-site review shall be at a mutually agreeable time.

II. ARB's Obligations. ARB shall work with state and local authorities and others to ensure the development of ZEV infrastructure and the removal of barriers to the introduction of ZEVs. Specifically ARB shall:

A. Facilitate the purchase of ZEVs for appropriate applications in state fleets by working with the California Department of General Services (DGS) and the

California Energy Conservation and Development Commission to establish vehicle specifications for the State Bid List and by working with the DGS Office of Fleet Administration to ensure the sale or lease of ZEVs to selected state agencies;

B. Work with the California Department of Insurance to establish reasonable rates for insuring new ZEVs, to promote insurance industry awareness of ZEVs, and to resolve other issues related to insuring ZEVs;

C. Work with the California Department of State Banking to develop risk assessment data to assist in securing financing for the purchase or lease of ZEVs;

D. Work with the Department of Toxic Substance Control, the Integrated Waste Management Board, and the Office of Environmental Health Hazard Assessment to ensure the availability of sufficient battery recycling capacity;

E. Work with local governments to provide assistance in planning and permitting quick charge and public charging stations;

F. Work with utilities and trade groups representing electrical contractors to provide training for installation and maintenance of electric vehicle charging systems;

G. Continue to support the efforts of the Infrastructure Working Council on standardization of power supply, emergency disconnect, standard conductive and inductive charging systems;

H. Continue to work with the State Fire Marshal and other state and local emergency response officials (fire, ambulance, law enforcement) and towing companies to create a comprehensive ZEV training program to ensure preparedness for incidents involving ZEVs;

I. Maintain its commitment to observe the activities of the USABC regarding the development of advanced technology batteries; and

J. Support the development and implementation of reasonable incentive programs that enhance the near-term marketability of ZEVs.

III. SIP Credits. Based on ARB's analysis, which is attached as Exhibit B, ARB finds that if, for the duration of this MOA, Manufacturer meets the current NMOG curve and implements a 49 state program, the emissions reduction benefits are at least equivalent to the benefits attributable to the 1998 through 2002 percentage ZEV requirements in the current SIP.

IV. Review. ARB will hold biennial public hearings, commencing in 1998, to conduct comprehensive reviews of the ZEV program, including the status of battery technology.

V. Enforcement. A. Breach of Manufacturer's obligations for which liquidated damages are prescribed under B below, shall be determined by the Executive Officer, in accordance with the provisions of 1 below, with de novo review by the Board. After Board review, Manufacturer has the right to a de novo review in the Superior Court of California for Sacramento County.

1. If the Executive Officer makes a preliminary determination that a Manufacturer has failed to comply with any requirement of this MOA for which liquidated damages have been prescribed under B below, he or she will notify Manufacturer in writing of the reasons supporting the preliminary determination and provide Manufacturer all information from any source upon which the preliminary determination was based. Within 15 business days of receipt of such a notice, Manufacturer must notify the Executive Officer of the following:

(a) The grounds (if any) on which Manufacturer contends it has fully complied with the requirement identified by the Executive Officer;

(b) The good faith steps (if any) Manufacturer took before the deadline for compliance; and

(c) The subsequent steps (if any) Manufacturer has taken or proposes to take to come into compliance with the requirement.

2. Manufacturer will be in breach of this MOA only if the Executive Officer determines, in good faith, based on the information submitted by Manufacturer and on other relevant information made available to Manufacturer, that Manufacturer has not fully complied with the requirements for which liquidated damages have been prescribed under B below, and that either (a) Manufacturer failed to take good faith steps before the deadline for compliance to verify with ARB the conditions necessary for compliance or (b) Manufacturer is not taking good faith steps that will bring it into compliance with the requirement as quickly as possible and consistent with the principles of this MOA. Where a breach has been found, Manufacturer's obligations, including liquidated damages prescribed under B below, may be waived or lessened as appropriate by the Executive Officer or by the Board. The Executive Officer must give Manufacturer prompt written notice of the determination of breach. Within 30 business days of receipt of

notice of the determination, Manufacturer may appeal the determination to the Board.

3. In making the determination regarding Manufacturer's obligations, consideration shall be given to whether the failure to fulfill Manufacturer's obligations was caused by events or circumstances outside Manufacturer's reasonable control not caused by the fault or negligence of the Manufacturer, which causes the Manufacturer to be unable to perform its obligations under this MOA, including but not limited to flood, earthquake, storm, fire and other natural catastrophes, epidemic, war, riot, civic disturbance or disobedience, strikes, labor dispute, sabotage of facilities, any order or injunction made by a court or public agency, or the failure of battery manufacturers to develop, produce and make available viable advanced technology batteries at a reasonable pilot-level price. If it is found that such condition(s) occurred, then it shall be found that the failure to fulfill the obligations does not constitute a breach of this MOA. In the event such condition(s) occurs, manufacturer must promptly notify ARB and must use its best efforts to resume performance as quickly as possible, and may suspend performance only for such period of time as is necessary as a result of such condition.

B. At the time Parties enter into this MOA they recognize that any harm that results from the Manufacturer's failure to comply with the provisions of the MOA is unknown and extremely difficult to quantify. Therefore, upon advice of legal counsel, Manufacturer agrees to pay liquidated and agreed damages for the Manufacturer's noncompliance, as determined in accordance with A above, in an amount specified in the following table:

1. Failure to implement a 49 state program under I.A either (a), (b) or (c) as appropriate	
(a) for complete failure to implement	pro rata share of $100,000,000
(b) if Manufacturer implements later than required and does not offset the emissions reduction benefit of a 49 state program	$100,000 plus $22,000 per ton of non-offset emissions
(c) if Manufacturer implements later than required and offsets the emissions reduction benefit of a 49 state program	$100,000
2. Failure to submit ZEV product plans as required in I.C	$5,000 *

[For AAMA members:	
3. Failure to contribute to research and development as required by I.D.1	$ equal to unpaid portion of funding commitment]
4. Failure to place advanced technology battery ZEVs in California as required by I.D.2(a)	$25,000 per vehicle shortfall
5. Failure to file annual report as provided in I.E	$5,000 *

* per occurrence per day to a maximum of 30 days, unless a notice by ARB of non-compliance has been received by Manufacturer

C. The liquidated damages will be payable by Manufacturer into an account opened by Manufacturer with a third-party escrow holder acceptable to the ARB's Executive Officer. The escrowed funds will be used for projects that are mutually agreeable to the Parties and that will develop a sustainable market for ZEVs. Any unexpended funds shall revert to the Air Pollution Control Fund.

D. If Manufacturer is in breach of this MOA, the ARB may pursue both liquidated damages under this section V and appropriate regulatory action including reinstating the percentage ZEV requirements as to Manufacturer.

VI. Term of the Agreement. Except as provided in V.D above, this MOA shall terminate at the end of the 2002 model year; or, at Manufacturer's option if at any time after 180 days after execution of this MOA, ARB has in effect, with respect to any period of time prior to the 2003 model year, any ZEV related production or sale requirement(s) or other emissions related requirement(s) that Manufacturer can demonstrate would cause or require the production or sale of ZEVs.

VII. Confidentiality. Any information submitted as part of, or in accordance with, this MOA and designated as confidential by the submitter shall be handled in accordance with the confidentiality provisions of the California Public Records Act (Government Code section 6250 *et seq*.) and ARB's implementing regulations (17 CCR section 91000 *et seq).* Manufacturer's failure to comply with any requirement of this MOA may not be claimed to be confidential.

VIII. No alteration or variation of the terms of this MOA may be made, unless the modification is in writing and signed by the Parties. Any changes to similar agreements entered into with other manufacturers will, at Manufacturer's option, be made to this MOA. ARB commits to advising Manufacturer of changes and alterations made to similar agreements with other manufacturers.

IX. Each Party and each signatory to this MOA warrants that it, he or she has the requisite authority to execute, deliver and consummate the actions contemplated by this MOA.

X. Definitions. For purposes of this MOA the following definitions shall apply:

A. "Place", "placement", or "placing" (or any derivative of these terms) means to sell, lease or otherwise transfer a vehicle to a person or entity in California that is expected to use the vehicle on a frequent, regular basis.

B. "Advanced technology battery" means a battery that has a specific energy of at least 40 watt-hours per kilogram (w-hr/kg) for 1998, and of at least 50 w-hr/kg for 1999 and beyond.

C. "Specific energy" of batteries will be the specific energy as determined in accordance with the USABC's January 1996 Electric Vehicle Battery Procedure Manual, Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in Appendix F of the Manual, including pack(s), required support ancillaries (e.g. thermal management), and electronic controller. [For AAMA members: ARB, with the concurrence of the Technical Advisory Committee of the USABC, will determine the specific battery system elements to be included in the burden calculation in order to achieve uniform specific energy rating methodology for all battery systems. For other Manufacturers: ARB will determine the specific battery system elements to be included in the burden calculation in order to achieve uniform specific energy rating methodology for all battery systems.]

D. "Capacity to produce" means that the manufacturer has available adequate vehicle production facilities either in-house or contractually with others, including the in-house ability or outside contracts sufficient to supply major vehicle parts and components needs. "Capacity to produce" does not obligate the Manufacturer to produce, deliver or sell a specified number of ZEVs.

E. "Pro rata share" means historical share attributable to a manufacturer, based on its share of the California market for passenger cars and light duty trucks up to 3750 lbs. LVW; and for purposes of this MOA shall be as follows: Chrysler-- 6.86%, Ford -- 24.19%, GM -- 24.33%, Honda -- 13.49%, Toyota -- 18.06%, Mazda -- 3.68%, and Nissan -- 9.39%.

XI. Notices. All notices, demands, requests, consents, approvals, or other communications (Collectively, "Notices") required or permitted to be given pursuant to this MOA, or which are given with respect to this MOA, shall be in writing and shall be personally served or deposited in the United States mail, registered or certified, return receipt requested, postage prepaid, or delivered by overnight courier

service with charges prepaid, addressed as set forth below, or such other address as such party shall have specified most recently by written notice. Notice shall be deemed given on the date of receipt.

To Manufacturer:

[specify]

with a copy to: [specify]

To ARB:

James D. Boyd
Executive Officer
Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

or: 2020 L Street
Sacramento, CA 95814

with a copy to:

K.D. Drachand, Chief
Mobile Source Division
Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731-2990

Michael P. Kenny
General Counsel
Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

XII. This MOA shall be governed by and construed in accordance with the laws of the State of California.

XIII. Assignment. This MOA and the rights, duties and obligations under it may not be assigned by ARB or Manufacturer without the prior written consent of the other party. Any assignment or delegation of rights, duties, or obligations under the MOA made without the prior written consent of the other party to this MOA hereto shall be void and of no effect.

Dated:

_____
_
James D. Boyd
Executive Officer
AIR RESOURCES BOARD

Dated:

_____
_
[name]
[title]
[Manufacturer]

Initialed: _____
[name]
[title]
[Manufacturer]