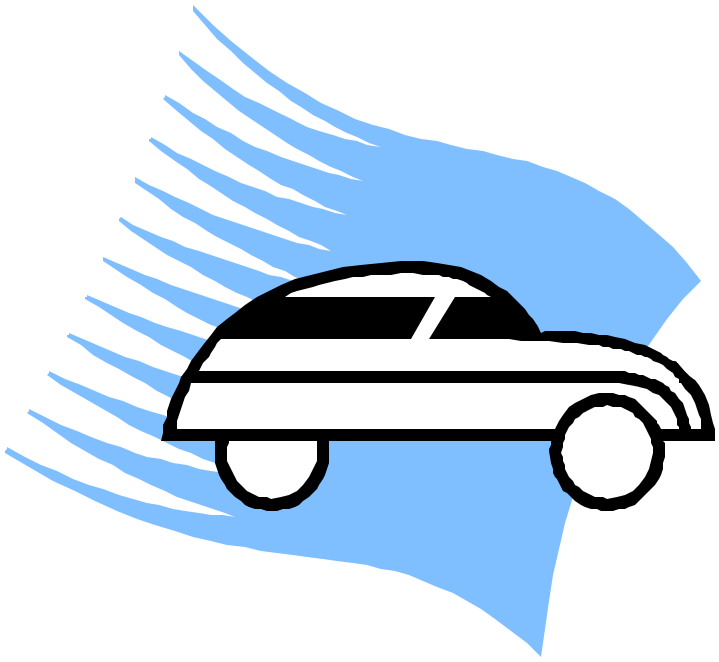
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

2003 PROPOSED AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE PROGRAM REGULATIONS



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EXECUTIVE SUMMARY

In 1990, the California Air Resources Board adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles through the gradual introduction of zero emission vehicles (ZEVs) into the California fleet. Specifically, the Air Resources Board (ARB) required that at least 2 percent, 5 percent and 10 percent of new car sales be zero-emitting by 1998, 2001 and 2003, respectively. To provide flexibility, the regulations allow automakers to bank and trade ZEV credits. Although the ZEV regulations did not require a specific technology, the expectation at that time was that the requirement would be met through the introduction of battery electric vehicles (EVs).

The ZEV requirements for passenger cars have been changed three times since the program's inception – in 1996, 1998 and 2001. Although the program implementation has been changed when necessary to reflect the status of technology, the original objective has not changed. California continues to maintain a strong commitment to zero emissions performance in the passenger car and light-duty truck fleet. In response to the ZEV requirements, automakers have developed and placed a limited number of zero emission vehicles into the market to evaluate technological and commercial feasibility. Additionally, automakers have demonstrated and marketed an array of near zero emission and advanced technology vehicles supportive of the zero emission vehicle goals.

In 1996, the ARB modified the regulations to allow additional time for technology to develop. The requirement for ten percent ZEVs in model years 2003 and beyond was maintained, but the sales requirement for model years 1998 through 2002 was eliminated. At that same time, ARB entered into Memoranda of Agreement with the seven largest vehicle manufacturers to place several thousand ZEVs in California. These ZEVs demonstrated the performance capabilities of battery EVs. They also resulted in a group of consumers who were, and continue to be, passionate about the new technology.

In 1998, the Board adopted amendments that allowed automakers to meet a portion of their ZEV requirement with a new class of vehicle, the Partial ZEV Allowance Vehicle, or PZEV. To certify as a PZEV, the vehicle must meet the ARB's most stringent emission standard, have zero evaporative emissions and carry a warranty of 15 years or 150,000 miles on all emissions related components. Seven models are now available to consumers that meet these extremely low emission levels.

In January 2001 the ARB approved further amendments to the ZEV regulations that were designed to maintain progress towards the commercialization of zero emission vehicles while recognizing the market constraints created by the cost of battery technology. The amendments preserved the fundamental requirement that 10 percent of all new passenger cars and the lightest light-duty trucks be

ZEVs. A new credit approach was established, however, to provide additional credits for early introduction, increased range and improved vehicle efficiency. These changes served to substantially reduce the number of pure ZEVs that would be needed beginning in 2003. It was hoped that these changes would provide for a spectrum of clean ZEVs (full-function, city, neighborhood, and fuel-cell vehicles). Unfortunately, at this time, manufacturers have generally limited production to neighborhood electric vehicles.

An important element of the 2001 amendments was the establishment of a new vehicle category, referred to as the "Advanced Technology PZEV" or "AT PZEV." Per the amended regulations, vehicles meeting the AT PZEV certification standard (which includes gasoline hybrid-electric vehicles) could be used to meet up to one-half of a manufacturer's pure ZEV obligation. This provision was included to provide greater incentives for the continued development of advanced technologies that are supportive of zero emission vehicle commercialization and to offer additional flexibility to automakers in meeting the program requirements.

In June 2002, a federal district judge issued a preliminary injunction that prohibits the ARB from enforcing the 2001 ZEV Amendments with respect to the sale of new motor vehicles in the 2003 or 2004 model years. The preliminary injunction resulted from the AT PZEV provisions that provide manufacturers with the option of earning additional ZEV credit if they produce vehicles that make use of advanced ZEV componentry such as that used in gasoline hybrid-electric vehicles. The judge issued the preliminary injunction after finding that the plaintiffs were likely to succeed in their claim that the provisions are related to fuel economy standards and thus preempted by the Energy Policy and Conservation Act of 1975. While the ARB has appealed the issuance of the preliminary injunction to the U.S. Court of Appeals for the Ninth Circuit, the preliminary injunction remains in effect.

When the Board amended the regulation in 2001, it did so with the understanding that the near-term compliance with the pure ZEV portion of the regulation would be expensive for automakers, but that continued vehicle and technology development would lead to less costly approaches. Since that time, there have been no significant reductions in the cost of battery EVs. Meanwhile, the marketing of battery EVs has achieved only modest success. These factors, along with the lawsuit, have slowed or even halted automaker plans regarding battery EV development.

In addition, projections regarding the pace of commercialization of fuel cells, which were projected to provide a second ZEV technology late in this decade, have become less certain, although automakers remain fully committed and continue to invest heavily in the technology. As a result, it appears that under the current regulation manufacturers will need to develop additional battery EV

products to bridge the interim years until fuel cells are available in larger quantities in the next decade.

There is considerable disagreement over the effects and relative benefits of the current ZEV program. Supporters of battery EV technology have argued that the additional battery EV products required per the current regulation will help build the market for ZEV products. They have also maintained that continued development of battery products provides a "safety net" in the event that fuel cell technology encounters impenetrable barriers. The auto manufacturers, on the other hand, have argued that the need to devote engineering staff and resources to mid-term battery EVs will actually detract from the pace of fuel cell commercialization. Moreover, many manufacturers have stated that they would prefer to target their investment towards fuel cell technology rather than battery EV technology, because they believe that fuel cells show promise of future market commercialization while battery EVs do not.

In light of the current uncertainty the Board needs to re-affirm its commitment to ZEVs by removing the legal issues, restructuring the transition years of the program and allowing automakers to refocus their efforts into technology areas that have long-term commercialization potential.

Proposed Amendments to the Regulations

To address the issues raised by the preliminary injunction, staff has developed a proposal that removes all references to fuel economy and efficiency and thus responds to the preemption concerns raised in the district court's decision. At the same time, staff has developed additional amendments that are designed to maintain pressure on the commercialization of ZEV technologies while recognizing the current state of the technology and the cost implications related to their development. The staff proposes the following specific amendments:

2005 Program Start. Restart the ZEV requirement in 2005 while allowing manufacturers to earn and bank for future use credit earned by any vehicles produced prior to 2005.

Amend AT PZEV Calculation Method. Staff proposes amendments that would remove all references to fuel economy and efficiency from the calculation of AT PZEV credits. The restructuring of the calculation method includes several elements that simplify the structure of the calculation. Staff proposes amendments that would establish flat credits for vehicles with advanced hybrid componentry or gaseous storage systems. Staff further proposes amendments that would revise the calculation of the low fuel-cycle emissions credit. The credit for zero emission vehicle miles traveled for hybrid electric vehicles is adjusted upward and the phase-in multiplier for AT PZEVs with any zero emission vehicle miles traveled is increased under staff's proposal. Post 2011, staff proposes amendments that would cap the total AT PZEV credit that can be earned by any

technology type at 3.0. Finally, staff proposes amendments that permit each element of the AT PZEV credit calculation and each general provision to be severed from the remainder of the program if warranted.

Amend ZEV Calculation Method. Staff also proposes amendments that remove the efficiency multiplier from the ZEV credit calculation. To restructure the ZEV credit calculation, staff proposes a series of amendments aimed at simplifying the calculation and encouraging sustainable commercialization of ZEVs. Staff proposes amendments that create ZEV "types" that will be the basis for the ZEV credits. These types include NEVs, Type 0 (utility low-range ZEVs), Type I (mid-range ZEVs, like City EVs), Type II (longer-range ZEVs, like full-function battery EVs) and Type III (long range, fast-refueling ZEVs, like fuel cell vehicles). The proposed amendments do not change the amount of credit earned by NEVs. Type 0 ZEVs would earn 1.5 credits until 2008 and then one credit for 2009 and later under staff's proposal. Type I, II, and III ZEVs earn an increased level of credits in staff's proposal through the 2011 timeframe. In 2012 and beyond, Type I vehicles (City EVs) continue to earn somewhat enhanced credits as compared to the 2001 amendments while credits for other vehicles are similar to the amounts provided by the 2001 amendments.

Additional changes are proposed to the ZEV credit calculations. These proposed changes include amendments to the fast refueling definition and the elimination of the in-service/warranty credit for model year 2005 and later vehicles.

Amendment of Compliance Options. The 2001 amendments allowed automakers to satisfy up to half of the pure ZEV requirement with certain other advanced technologies that are not ZEVs. Staff proposes amendments that permit automakers to satisfy up to three-quarters of the pure ZEV portion of the ZEV requirement with such vehicles during the transition period from 2005 through 2011. This adjustment to the amount of AT PZEV credit that can be used to satisfy the pure ZEV requirement has been proposed to reflect the reality of current ZEV technology and to take advantage of current opportunities in AT PZEV technology.

Additionally, staff proposes amendments that 1) remove ZEVs from the sales volume used to calculate the ZEV requirement and 2) eliminate the cap on use of banked NEV credits when used for the PZEV or AT PZEV compliance options.

Miscellaneous Changes. The 2001 amendments required HEVs to have a 15-year/150,000 mile warranty on the battery. Staff is proposing amendments that reduce this warranty requirement to 10-years/150,000 miles. Staff also proposes amendments that extend the sunset date on the award of "transportation system" credits from 2007 to 2011, remove credits earned by vehicles from the cap on the use of transportation system credits, and clarify the regulatory definition of placed in service.

LDT2 Vehicles. Staff proposes that the Board reconsider and affirm its January 2001 action to add LDT2 vehicles to the base against which manufacturers' ZEV obligations are determined.

Effect of Proposed Amendments

Staff has developed scenarios that illustrate the number of vehicles that would be required under the 2001 amendments and the staff proposal. Due to the flexibility afforded by the ZEV regulation, it is not possible to accurately predict manufacturer strategies, and therefore these scenarios should be viewed as illustrations rather than firm predictions.

In general, the staff proposal would decrease the number of ZEVs required during the transition period from 2005 through 2011, while increasing the number of AT PZEVs (assuming that manufacturers take full advantage of that option). In 2012 and beyond, after the conclusion of the transition period, a manufacturer's ZEV obligation would be essentially the same as that required under the 2001 amendments.

Adding up the total cost of the program (ZEV, PZEV and advanced-technology PZEV production), and taking into account the use of banked credits, the staff proposal results in slightly increased costs in the early years as compared to the 2001 amendments (due to the larger number of AT PZEVs) but significant cost savings in model years 2008 through 2011 (due to the smaller number of pure ZEVs required). Over the entire 2005-2011 transition period, the estimated savings under the staff proposal range from $256 million to $3.5 billion. This extreme range reflects the uncertainty regarding manufacturer compliance strategies. In all cases, however, the staff proposal results in savings.

Staff has estimated the 2010 and 2020 emissions impact of the staff proposal for the South Coast Air Basin, as compared to the current regulation and the "no-ZEV program" alternative. These estimates assume that compliance begins in 2005 even under the 2001 amendments.

ARB staff estimates that the proposed changes will result in a net decrease of about 0.04 tons per day of direct emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx) in 2010 when compared to the 2001 amendments. For 2020, staff estimates a net decrease of about 0.1 tons per day of direct emissions of ROG and NOx from the proposed amendments as compared to the 2001 amendments.

Staff estimates the proposed amendments will reduce approximately 1.37 and 4.84 tons per day of ROG and NOx by 2010 and 2020, respectively, as compared to a "no-ZEV" alternative.

Staff Recommendation

The ARB staff recommends that the Board adopt the amendments as proposed in this Initial Statement of Reasons. The proposed amendments address the issues raised by industry litigation, respond to the current state of ZEV technology, and reduce the overall cost of compliance to industry while maintaining the push toward ZEV commercialization.

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Table of Acronyms

AER…….. All Electric Range
ARB …….. California Air Resources Board
AT PZEV ….. Advanced Technology Partial ZEV Allowance Vehicle
CAFE …… Corporate Average Fuel Economy
CNG …….. Compressed Natural Gas
EIR ……. Environmental Impact Report
EMFAC ……. ARB's mobile emissions inventory modeling program
EV …….. Electric Vehicle
FSOR ……. Final Statement of Reasons
GVWR …….. Gross Vehicle Weight Rating
HEV ……... Hybrid-Electric Vehicle
ISOR ……. Initial Statement of Reasons
LDT1 ……. Light Duty Truck with a loaded vehicle weight of 0-3750 pounds
LDT2…….. Light Duty Truck with a loaded vehicle weight of 3751 pounds to a gross vehicle weight of 8500 pounds, or a "LEV I" light-duty truck with a loaded vehicle weight of 3751-5750 pounds
LEV I ……..First generation Low Emission Vehicle program, adopted in a 1990-1991 rulemaking, and generally applicable in the 1994-2003 model years
LEV II …….Second generation Low Emission Vehicle program, adopted in a 1998-1999 rulemaking, and generally applicable in the 2004 and subsequent model years
MOA …….. Memoranda of Agreement
MY ……. Model Year
NEV ……... Neighborhood Electric Vehicle
NiMH ……. Nickel Metal-Hydride
NMOG ……. Non-Methane Organic Gases
NOx ……. Oxides of Nitrogen
OBD ……... On-Board Diagnostic
PC ……. Passenger Car
PEM ……... Proton Exchange Membrane
PZEV ……. Partial ZEV Allowance Vehicle
ROG …….. Reactive Organic Gases
SAE ……. Society of Automotive Engineers
SULEV …….. Super Ultra-Low Emission Vehicle
SUV …….. Sport Utility Vehicle
Type 0 ……. Utility EV, < 50 miles
Type I ……. City EV, >= 50, < 100 miles
Type II ……. Full Function EV, >= 100 miles
Type III …….. ZEV, >= 100 miles plus fast refueling
UDDS ……. Urban Dynamometer Driving Schedule
ULEV I …….. Ultra-Low Emission Vehicle, pre-1998 regulations
ULEV II …….. Ultra-Low Emission Vehicle, post-1998 regulations
U.S. EPA ….. United States Environmental Protection Agency
VMT …….. Vehicle Miles Traveled
ZEV ……. Zero-Emission Vehicle

1. INTRODUCTION

In 1990, the California Air Resources Board adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles through the gradual introduction of zero emission vehicles into the California fleet. The Zero Emission Vehicle (ZEV) program, which affects passenger cars and light-duty trucks, has been adjusted three times since its inception, in 1996, 1998, and 2001. The fundamental goal of the program, however, has not changed. California remains committed to the commercialization of zero emission vehicle technologies wherever feasible. The challenge facing the Board is determining how to achieve a sustainable commercial market given the uncertainties in cost and the pace of technological development.

California's strong commitment to the ZEV program reflects the essential need for zero-emission vehicle technology in order to achieve the State's public health protection goals. Health-based state and federal air quality standards continue to be exceeded in regions throughout California. California's growing population and increasing use of motor vehicles mean continued upward pressure on statewide emissions. Manufacturing, power generation, petroleum refining, goods transport, home heating and cooling, personal mobility and a wide range of human activities all have direct air pollution consequences. Achieving zero emissions from these source categories is critical to mitigating their impacts on human health.

Zero-emission technologies can greatly reduce or even eliminate some of the persistent problems with conventional vehicles. Combustion-based engines are prone to deterioration over time and result in higher fuel cycle emissions. Catastrophic failures are also a concern. Older gasoline-powered vehicles, for example, become gross emitters if their emission control systems fail. Combustible fuels also have significant "upstream" impacts. Refining, fuel storage and delivery all have associated emissions from routine operations, accidents (breakdowns, fuel spills), and ongoing compliance problems (e.g., leaking underground tanks). Apart from upset conditions that may occur during electric power generation or hydrogen fuel production and distribution, zero emission vehicles have none of these vulnerabilities.

While ZEVs can provide significant environmental benefits, it is also necessary that they be economically viable. Since the program's inception, substantial technological improvements have occurred. These improvements have raised the level of vehicle performance and have resulted in attractive solutions to personal mobility. However, the cost goals necessary for such technologies to compete successfully in the marketplace have not been met, preventing the more widespread introduction of the technology.

In January 2001 the ARB approved amendments to the ZEV regulations that maintained the requirement for pure ZEVs while recognizing the market constraints associated with the cost of available battery technologies. Under the amendments, a new credit mechanism was implemented to provide additional credits for early introduction, increased range and improved vehicle efficiency. The changes served to substantially reduce the number of pure ZEVs beginning in 2003 and the attendant costs to industry.

The 2001 amendments also created the "Advanced Technology Partial Zero Emission Vehicle" or "AT PZEV" certification standard. Vehicles meeting the AT PZEV certification standard could be used to meet up to one-half of a manufacturer's pure ZEV obligation of four percent. The AT PZEV was included to provide incentives for the continued development of advanced technologies and to offer additional flexibility to automakers in meeting the program requirements.

In June 2002, however, a federal preliminary injunction was issued that prohibits the ARB from enforcing the 2001 ZEV amendments. The preliminary injunction resulted from the AT PZEV provisions that provide manufacturers with the option to earn additional ZEV credit if they produce vehicles that make use of advanced ZEV componentry such as that used in gasoline hybrid-electric vehicles. The judge issued the preliminary injunction after finding that the plaintiffs were likely to succeed in their claim that the provisions are related to fuel economy standards and thus preempted by the Energy Policy and Conservation Act of 1975. The ARB has appealed the issuance of the preliminary injunction and expects to receive a ruling on the appeal in early 2003. Given the uncertainty of the current litigation, the ARB is now proceeding with a regulatory process to remove all references to fuel efficiency. This process has also provided ARB staff with an opportunity to propose additional changes to the program that reflect the status of technology two years after the Board last amended the regulations.

When the Board adopted the changes in 2001, it did so with the understanding that the near-term compliance with the pure ZEV portion of the regulation would be expensive for automakers. However, the Board maintained the requirements believing that continued research and development would lead to more economical approaches that could be developed in modest quantities as an interim step to larger scale commercialization. Unfortunately, significant reductions in cost have not occurred.

In response to the preliminary injunction, staff has developed recommendations that remove all references to fuel economy and that address the preemption concerns raised in the district court's decision. In addition, staff's proposal also includes proposed amendments that are designed to further encourage commercialization of ZEV technologies. The staff proposal and its rationale are presented in this Initial Statement of Reasons.

2. BACKGROUND

2.1 Staff Objectives

The ongoing amendments to the ZEV program are the result of the continuing need to maintain a balance between pressure on vehicle manufacturers to pursue zero emission vehicles, and recognition of the real-world status of the available technologies. Historically, the objective of the ZEV program has been to push the boundaries of ZEV development, but to take into account the cost, performance, suitability for volume production and long-term prospects of the technologies at hand.

This same philosophy holds true today. While manufacturers have argued that the Board should abandon its pure ZEV requirement and focus solely on the air quality benefits achievable from technologies ready for volume production, staff believes that the ARB needs to maintain a core zero emission requirement to provide an incentive for further vehicle development. While the program has not yet resulted in the sustained commercial introduction of ZEVs, the tremendous developments that have been made in a variety of advanced technologies can, at least in part, be attributed to the existence of the ZEV requirement. Furthermore, ARB staff believes that continued regulatory requirements are needed to push the development of pure ZEVs.

At the same time, the ZEV program should provide flexibility for manufacturers to pursue specific clean vehicle strategies that they believe offer the best hope for commercial viability. While the introduction of any new vehicle technology requires sizable up-front investment for research and development, vehicles meeting the ZEV requirements must ultimately succeed in a competitive market in volume production. The number of vehicles required in the pure ZEV or "gold" category under this proposal reflects what ARB staff believes is necessary to sustain serious research and development efforts which will sustain progress toward commercialization while not arbitrarily requiring high volumes of not-yet-ready technologies. In more specific terms, the objectives of the proposed amendments are:

- To achieve long-term public health goals,
- Maintain a pure ZEV requirement and the goal of zero emissions,
- Resolve issues raised by the federal preliminary injunction,
- Accelerate ZEV technology development,
- Provide support for future ZEV commercialization,
- Take full advantage of technology options that are available today, to achieve air quality improvement and provide a bridge to ZEV commercialization,
- Provide manufacturers with the option to pursue their preferred path towards ZEV commercialization, and

- Provide flexibility with respect to fuels, technologies, and compliance pathways.

2.2 Timing Considerations

Staff has developed proposed amendments to be brought before the Board at a February 27, 2003 public hearing. Major milestones in this regulatory process are:

December 5, 2002	Public Workshop Possible Amendments to the ZEV Regulations Sacramento
January 10, 2003	Release of the Initial Statement of Reasons
February 27, 2003	Board Hearing Sacramento

The staff has developed the proposed amendments in a relatively short time frame to return certainty to the regulatory system as quickly as possible. As a result, the proposal does not address and resolve every issue. The ARB staff intends to fully engage with interested parties during the 45-day comment period through collection of comments and further conversations with interested stakeholders. Staff may develop and release additional proposed amendments prior to the Board meeting that reflect this consensus building process.

Possible topics that may be considered during the 45-day comment period include:

- Measures to avoid a possible sustained “blackout” of pure ZEV production due to the availability of banked credits
- Measures to consider the aggregate effect of California production requirements in light of the parallel adoption of California requirements in other states
- Further refinement of the minimum requirements that a vehicle must meet in order to earn advanced componentry credit
- Methods to award credit for placement of hydrogen infrastructure
- Providing ZEV credit for stationary fuel cell applications that support the commercialization of fuel cell and infrastructure technology that can be applied to vehicles
- Measures to encourage the voluntary production of model year 2003 and 2004 PZEVs
- Measures to ensure that “specialty” vehicles receive appropriate levels of credit

These issues are discussed in more detail in Section 8.2 below.

2.3 Air Quality in California

Air quality in California has improved dramatically over the past 25 years, largely due to continued progress in controlling pollution from motor vehicles. Faced with ever more stringent regulations, vehicle manufacturers have made remarkable progress in advancing vehicle technology. Vehicles meeting the ARB's most stringent emission certification standards achieve emission levels that seemed impossible when the Low Emission Vehicle Program was adopted in 1990.

Despite this progress, however, air quality in many areas of the state still does not meet federal or state health-based ambient air quality standards. Mobile sources still are responsible for well over half the ozone-forming emissions in California. The relative contribution of passenger cars and small trucks is expected to decline over time as new standards phase in, but in 2020 such vehicles will still be responsible for about 10 percent of total emissions. State and federal law requires the implementation of control strategies to attain ambient air quality standards as quickly as practicable.

Mobile sources also produce toxic air contaminants and are a major contributor to greenhouse gas emissions. Furthermore, facilities needed to refuel conventional vehicles such as service stations, bulk terminals and refineries are significant sources of smog precursors, air toxics, water pollution, and hazardous waste.

2.4 Zero Emission Vehicle Program

The ZEV program was originally adopted in 1990, as part of the first ARB Low-Emission Vehicle regulations. The ZEV program is an integral part of California's mobile source control effort, and is intended to encourage the development of advanced technologies that will provide increasing air quality benefits for California now and into the future.

Under the 1990 regulations, the seven largest auto manufacturers were required to produce ZEVs beginning with model year 1998. In model years 1998 through 2000, two percent of the passenger cars and lightest light-duty trucks offered for sale in California by large volume manufacturers were to be ZEVs, and this percentage was to increase to five percent in model years 2001 and 2002. The requirement became ten percent for all but small volume manufacturers starting in model year 2003. To provide flexibility, the regulations allow automakers to bank and trade ZEV credits.

In the early years of the program, ZEV technology focused on battery EVs. In 1996 the ARB modified the regulations to allow additional time for battery research and development. The requirement for ten percent ZEVs in model years 2003 and beyond was maintained, but the ZEV requirement for model

years 1998 through 2002 was eliminated. At that same time, the ARB entered into Memoranda of Agreement (MOA) with the seven largest vehicle manufacturers in the California market. Under the MOAs, these manufacturers placed more than 1,800 advanced-battery EVs in California during 1998 to 2001, ensuring a significant near-term market for advanced battery manufacturers. This market was expected to allow battery manufacturers to be able to transition to commercial production. The MOAs also required the ARB to work with state and local governments to help develop the necessary recharging infrastructure and to address other issues such as building codes modifications and emergency response training that would result from use of the technology. These ZEVs demonstrated the performance capabilities of battery EVs. They also resulted in a group of consumers who were, and continue to be, passionate about the new technology.

Meanwhile, manufacturers achieved rapid progress on extremely clean near-zero emission conventional vehicles. In recognition of the air quality benefits afforded by such technologies and the status of pure ZEV development, in 1998 the ARB provided additional flexibility in the ZEV program by allowing an additional certification standard, the Partial ZEV Allowance Vehicle (PZEV), to be used to meet a portion of the program requirements. More specifically, the 1998 amendments allowed intermediate-sized manufacturers to use PZEVs to meet the entire 10 percent ZEV requirement, while large manufacturers could meet up to 60 percent of their ZEV requirement with such vehicles. To certify as a PZEV, a vehicle must meet the ARB's super ultra low emission standard (SULEV), have zero evaporative emissions and provide a warranty of 15 years/150,000 miles on all emissions related components.

2.5 2001 Board Hearing

In January 2001 the ARB approved amendments to the ZEV regulations designed to maintain progress towards the commercialization of zero emission vehicles while recognizing the near-term constraints due to cost, lead-time, and technical challenges. The amendments preserved the fundamental requirement that 10 percent of all new passenger cars and light-duty trucks be classified as ZEVs. However, a new credit mechanism was established to provide additional ZEV credits for early vehicle introduction, greater range and improved vehicle efficiency. These changes served to substantially reduce the number of pure ZEVs that would be needed beginning in 2003.

An important element of the 2001 amendments was the establishment of a new vehicle category, referred to as the "Advanced Technology Partial Zero Emission Vehicle" or "AT PZEV." Per the amended regulations, vehicles meeting the AT PZEV certification standard (including qualifying gasoline hybrid-electric vehicles) could be used to meet up to one-half of a manufacturer's pure ZEV obligation of four percent. This provision was included to provide greater incentives for the

continued development of advanced technologies and to offer additional flexibility to automakers in meeting the program requirements.

2.6 Preliminary Injunction

On June 11, 2002, a federal district judge issued a preliminary injunction that prohibits the ARB's Executive Officer from enforcing the 2001 ZEV Amendments with respect to the sale of new motor vehicles in the 2003 or 2004 model years, pending final resolution of the underlying lawsuit. The suit was brought by General Motors, DaimlerChrysler and various Fresno-area auto dealers. The ARB has appealed issuance of the preliminary injunction to the U.S. Court of Appeals for the Ninth Circuit. The appeal has been fully briefed with oral arguments scheduled for February 13, 2003.

In the lawsuit, the two manufacturers claimed that components within the AT PZEV provisions are preempted by federal law. There are three options for qualifying gasoline hybrids as AT PZEVs and calculating the number of ZEV credits they earn. One option is based on the amount of carbon dioxide (CO_2) emissions that are reduced. Another is based on the vehicle's efficiency as measured by fuel economy. The third provided credit based on the percentage of maximum available power that is provided by the electric storage system, but only through 2007 model year.

The judge issuing the preliminary injunction found that the plaintiffs were likely to succeed in their claim that the first two AT PZEV provisions mentioned above are related to fuel economy standards and preempted by the Energy Policy and Conservation Act of 1975. This Act directs the National Highway Traffic Safety Administration to establish corporate average fuel economy (CAFE) standards. The judge rejected arguments that the optional nature of the AT PZEV provisions eliminated preemption concerns on the basis that the disparities in costs among the various compliance options in effect required manufacturers to produce gasoline hybrids. The judge enjoined enforcement of all of the 2001 amendments after concluding that the challenged AT PZEV provisions likely were not severable from the rest of the ZEV program.

2.7 Status of Technology Development

Battery Electric Vehicle Technology

When the Board adopted the 2001 amendments, it did so with an understanding that near-term compliance with the "pure ZEV" portion of the regulation would be expensive for manufacturers. The Board anticipated, however, that continued development work would lead to more economical approaches that could be employed in modest quantities as the required vehicle volumes increased. The cost projections available in 2001 were based on a report provided by a panel of experts hired by the ARB to assess the state of technology. The report

concluded that the most widely used advanced battery technology, nickel metal hydride (NiMH), would cost vehicle manufacturers between $9,500 and $13,000 per vehicle in quantities of 10,000 to 20,000 per year. When manufactured at production levels exceeding one hundred thousand packs per year, total battery cost was estimated to be approximately $7,000 to $9,000 per vehicle.

ARB staff believes there have been only modest improvements in battery cost since the extensive review undertaken by the Battery Panel in 2000. A recent report entitled The 2002 Industry Report – A Critical New Assessment of Automotive Battery Trends, authored by one of the Battery Panel experts, focuses on batteries for advanced vehicles, primarily hybrid electric vehicles. Findings within this report pertaining to battery EVs are consistent with staff's assessment that current and reasonably projected battery electric vehicles will not play a significant role in personal transportation due to their inability to provide sufficient range at affordable cost. The technology may prove attractive for certain limited applications, but does not at this point appear to hold promise for widespread commercial introduction. Consequently, requiring that automakers place substantial numbers of battery EVs will not be a catalyst for cost reduction but rather will draw resources away from other promising technologies now being developed.

In response to battery costs, several automakers focused on placing Neighborhood Electric Vehicles (NEVs) as a means of earning early credit towards the ZEV requirements. Such vehicles are limited in size and speed, but have the potential to provide air quality benefits by displacing cold starts and short trips, and may have a small but stable self-supporting market. In general, however, it appears that manufacturers sought to place large numbers of NEVs primarily because they provided the lowest cost approach toward compliance with the regulations.

Fuel Cell Vehicle Technology

Automakers have chosen to pursue proton exchange membrane (PEM) fuel cells for vehicle applications due to their low temperature operation and potential for low-cost manufacturing. Over the last decade, industry has made impressive advances in hydrogen-air PEM fuel cell stack technology. As a result, several automakers are now placing the first prototype vehicles into research and demonstration applications, and almost all large automakers are committed to demonstration fuel cell fleets over the next several years.

While technical challenges remain to integrate all essential components into a complete system that provides acceptable weight, volume and operating characteristics, the most daunting challenge is to significantly reduce cost. Widespread introduction of the technology will be possible only when the technology can be produced and sold at a price comparable to that of today's conventional vehicles. Although prototypes are being placed in research

programs, considerable time is still needed for engineering development and for achieving the necessary cost reductions. Projections regarding the pace of commercialization of fuel cells, which were expected to provide a second ZEV technology late in this decade, have become less certain, although automakers remain fully committed and continue to invest heavily in the technology. Based on the most recent information and announcements regarding technology development, ARB staff believes that a true commercial introduction will not occur before 2011. As a result, it appears that under the current regulation manufacturers will need to develop additional battery EV products to bridge the interim years until fuel cells are available in larger quantities in the next decade.

The draft proposal reflects this expectation and provides regulatory incentives based on three stages of development prior to 2012. Each stage is designed to foster the placement of vehicles in order to push toward viable commercialization as quickly as possible.

There is considerable disagreement over the effects and relative benefits of the current ZEV program. Supporters of battery EV technology have argued that the additional battery EV products required by the current regulation will help build the market for ZEV products. They have also maintained that continued development of battery products provides a "safety net" in the event that fuel cell technology encounters impenetrable barriers. The auto manufacturers, on the other hand, have argued that the need to devote engineering staff and resources to mid-term battery EVs will actually detract from the pace of fuel cell commercialization. Moreover, many manufacturers have stated that they would prefer to target their investment towards fuel cell technology rather than battery EV technology, because they believe that fuel cells show promise of future marketability while battery EVs do not.

Near-Zero Emission Vehicle Technology

Meanwhile, technical progress in the AT PZEV and PZEV categories continues at a rapid pace, with a number of models in each category either already introduced or under active development. Currently, seven passenger car models have been certified to the PZEV standard with additional vehicles expected soon. Given the uncertainties created by the preliminary injunction, no AT PZEVs have been certified. However, staff believes that automakers are poised to introduce these vehicles in the near future once certainty in the regulations is provided. Staff believes that it is critical to provide regulatory incentives to ensure their continued commercial introduction.

3. SUMMARY OF PROPOSED AMENDMENTS

To achieve the objectives identified above, staff proposes that the Board adopt the following amendments to the program.

- Delay the start of the percentage ZEV requirements until model year 2005, and allow vehicles placed prior to 2005 to earn credit towards compliance.
- Amend the method used to calculate credit earned by AT PZEVs:
    - Simplify the Advanced Componentry credit awarded
    - Amend the low fuel-cycle emissions credit equation
    - Increase the credit for grid-connected HEVs for their zero emission miles traveled
    - Increase the phase-in multiplier for AT PZEVs with any zero emission vehicle miles traveled
    - Cap total AT PZEV credit earned by any technology at 3.0 after 2011
    - Make each element of the AT PZEV credit calculation (and each provision in the regulation) severable from the remainder of the regulation
- Amend the method used to calculate credit earned by ZEVs.
    - Create ZEV Type definitions: NEV, Type 0, I, II, and III
    - Establish credit levels by ZEV Types that achieve approximately the same number of vehicles by 2012 as envisioned by the 2001 amendments
    - Eliminate the In-service/Warranty credit
    - Amend the definition of fast refueling
- Amend the compliance options available to manufacturers:
    - During the 2005-2011 time period reduce the pure ZEV requirement to one half of its value under the 2001 amendments (new value would be one percent in 2005-2008 and 1.25 percent in 2009-2011) and increase the AT PZEV category by that same amount. At the conclusion of this demonstration period, in model year 2012, the full function ZEV credit levels would revert to the level needed to meet the 2001 ZEV amendments
    - Remove ZEVs from the sales base used to determine a manufacturer's obligation
    - Remove the cap on the use of NEV credits in the AT PZEV and PZEV categories
- Make other miscellaneous amendments, including:
    - Modify the required warranty on HEV energy storage devices to 10 years/150,000 miles
    - Extend the sunset date on award of "transportation system" credits from 2007 to 2011, and remove credits earned by vehicles from the cap on the use of transportation system credits
    - Clarify provisions relating to the placed-in-service requirement

- In addition, staff proposes that the Board reconsider and affirm its January 2001 action to add LDT2 vehicles to the base against which manufacturers' ZEV compliance obligations are calculated.

The following sections describe each of these proposed amendments in turn.

3.1 Delay of Start-up

Staff proposes amendments that delay the start of the ZEV program until model year 2005. 2002 and earlier model year vehicles meeting the ZEV requirements and offered for sale prior to the 2003 model year would earn ZEV credits based on the 2001 amendments. All further changes to the regulation described below pertain to 2003 and subsequent model year vehicles.

Timing elements of the regulation that are not changed by staff's proposal include the schedule for early introduction multipliers that apply to model years 2001 through 2005, and the schedule for inclusion of light-duty truck 2 (LDT2) volumes in ZEV obligation calculations in model years 2007 through 2012.

3.2 Amendments to AT PZEV Credit Determination

The incentives provided to AT PZEVs under the regulation are primarily intended to accelerate the development and deployment of ZEV technologies in the marketplace. Examples of such technologies include electric drive, battery storage and regenerative braking used in hybrid electric vehicles, and gaseous fuel storage used in compressed natural gas and hydrogen internal combustion engine vehicles. Promoting the widespread adoption of these technologies in PZEVs will lead to performance improvements and cost reductions that are necessary for ZEVs to become mass-market vehicles in the future. Progress has recently accelerated in the following key technology areas, in part due to the AT PZEV option:

- Greater battery calendar life, cycle life capacity, and specific power, as manufacturers expand the use of batteries in mild HEVs,
- Higher pressure gaseous fuel storage for CNG vehicles
- More efficient and less costly drive system motors and power electronics

The AT PZEV incentives are specifically designed to further the development and use of technologies and components that contribute to the commercialization of pure ZEV vehicles, including battery EVs and fuel cell vehicles. These linkages are described in comments provided to staff, which note that:

- Hybrid electric vehicles and pure ZEV technologies such as fuel cells share many of the same electric drive components, especially traction motors and motor controllers. Hybridizing fuel cell vehicles adds electric storage devices

(e.g. batteries and ultracapacitors) and regenerative braking systems to the list of common components.

- Hybridization of fuel cell vehicles can improve performance and reduce cost, and there is a clear trend towards hybridization of fuel cell vehicles for these reasons. This trend strengthens the technological linkages between hybrids and pure ZEVs. For example, Toyota's latest fuel cell prototype, the FCHV4, derives its drivetrain from its hybrid electric vehicle, the Prius. Ford uses the same battery pack and regenerative braking system for its more recent Focus fuel cell vehicle prototype and its forthcoming hybrid version of the Escape. The Nissan Xterra fuel cell vehicle uses hybrid control technologies developed for the Tino hybrid.

- In terms of technology and cost innovations, electric drive components are not fully mature. Increased volume production of electric drivetrain components will reduce the cost of critical components common to both hybrids and pure ZEVs. Researchers from University of California, Davis, for example, have quantified the cost benefits of producing critical electric drive components at high volumes.

These same points are made by automakers themselves. In keynote presentations at the December 2002 Electric Transportation Industry Conference, representatives from Toyota, Honda and Ford all noted that their hybrid electric vehicle programs are building blocks that support their move towards future deployment of fuel cell vehicles. Along the same lines, a recent article in Automotive News quoted a General Motors executive as stating that GM will benefit from hybrid technology because engineers can use some of the powertrain's electrical components, such as the software, controllers and electric motors, for fuel cell vehicles, and that "Hybrids are a medium-term bridging strategy to the hydrogen economy".

Although manufacturers will continue to be given a wide variety of AT PZEV options, staff is currently unaware of any near-term plans for manufacturers to produce AT PZEVs other than CNG and mild HEVs in significant volumes. Staff believes it is likely that the vast majority of near-term AT PZEVs will be compressed natural gas and non grid-connected hybrid electric vehicles.

3.2.1 PZEV Allowance for Advanced ZEV Componentry

The advanced componentry credit is awarded to PZEVs that utilize technology that is supportive of ZEV commercialization. Staff is proposing the following changes to the amount of credit provided and the criteria to be met in order for advanced componentry credit to be awarded.

Hydrogen Storage Systems

Hydrogen internal combustion engine vehicles qualify as AT PZEVs due to their use of hydrogen storage systems. Staff proposes amendments that increase the credit for hydrogen storage systems in dedicated-hydrogen vehicles from 0.1 to 0.2. This change is proposed in order to recognize the value of development of this technology to ZEV commercialization and the additional costs and challenges associated with on-board hydrogen storage. Additionally it recognizes the importance of deployment of hydrogen infrastructure to support these vehicles.

Hybrid Electric Drive Systems

Although the staff believes that the AT PZEV provisions challenged in the federal lawsuit are not preempted by federal law and that the preliminary injunction should be reversed on appeal, there is no doubt that the injunction has introduced considerable uncertainty regarding the ZEV regulation that would not necessarily be ended by a reversal by the Ninth Circuit Court of Appeal. Removal of this uncertainty is essential for the ZEV program to move ahead. While there are advantages to the scoring provisions for gasoline hybrid AT PZEVs and the efficiency multiplier in the 2001 amendments, the staff has developed what it considers to be a satisfactory alternative approach that addresses the preemption concerns.

The 2001 amendments established three methods for the calculation of advanced componentry credit for hybrid electric drive systems. Staff proposes amendments that remove all references to fuel economy from the advanced ZEV componentry determination. Instead, a flat advanced ZEV componentry credit of 0.4 through 2011 and 0.35 in 2012 and beyond will be provided to all PZEVs that meet either of the following criteria:

- A “peak power ratio” of greater than 13 percent, or
- A “peak power ratio” of greater than 8 percent and a zero emission drive system maximum power rating of at least 10 kilowatts.

As is the case under the current regulation, the peak power ratio is equal to the maximum system power output available from the electrical storage device divided by the sum of the electrical storage device plus the Society of Automotive Engineers (SAE) net power of the heat engine. The intent of setting these threshold values for peak power or peak power and motor size is to define the minimum characteristics of a HEV that is supportive of the advancement of ZEV commercialization.

Staff notes that “peak power ratio” measures the degree to which a vehicle relies upon electric drive, and thus is a useful indicator of the extent to which the componentry on the vehicle supports the commercialization of pure ZEV

technologies. The peak power ratio is not, on the other hand, correlated with fuel economy. Manufacturers seeking to improve vehicle fuel economy can follow a number of different design and engineering strategies, some of which involve increased use of electric drive and others of which do not. As a result, vehicles with very different peak power ratios can achieve similar fuel economy ratings. For example, the unadjusted U.S. Environmental Protection Agency fuel economy ratings for the Toyota Prius and Honda Civic hybrid are similar, but the Prius has a peak power ratio of 0.29 while the Civic ratio is 0.14.

Meanwhile, increased use of electric drive, as measured by the peak power ratio, can provide benefits other than fuel economy. Vehicles with high peak power can have increased acceleration relative to conventional vehicles and also provide smooth zero-emission performance at low speeds. This point is emphasized, for example, in an Automotive News article which quotes a Toyota source as stating that while fuel economy will be improved [by the hybridization of the Lexus RX 330 and Toyota Highlander], the main goal of the hybrids will be advances in horsepower and acceleration.

Staff invites comment regarding the appropriate threshold for the minimum motor size and power ratio needed to earn advanced componentry credit or other ways to establish an appropriate threshold.

3.2.2 PZEV Allowance for Low Fuel-Cycle Emissions

Staff proposes amendments that increase the maximum overall cap for low fuel-cycle emissions credit from 0.2 to 0.3, using the following equation:

(0.3) X (percent of vehicle miles traveled with low fuel-cycle emission fuels) / 100

Furthermore, this low fuel-cycle emissions credit would be limited to a maximum of 0.15 for PZEV HEVs that still make use of any non-low fuel-cycle emission fuels for propulsion, for example, grid-connected gasoline HEVs.

3.2.3 PZEV Zero Emission VMT Credit for Grid-Connected Hybrid Electric Vehicles

Staff believes it is appropriate to increase the amount of credit awarded to grid-connected HEVs in relation to the amount of zero emission vehicle miles traveled (VMT). Zero emission VMT from grid HEVs is extremely valuable to the success of the commercialization of ZEVs and may have significant air quality benefits depending on how the vehicle is used. In a study with EPRI, ARB learned that grid-connected HEVs with 20 miles of zero-emission VMT have the potential to reduce criteria pollutants approximately 30 percent compared to conventional new vehicles. In recognition of these benefits which are proportional to the amount of zero emission VMT – staff proposes that the Board amend the zero emission VMT allowance formula as shown in Table 3.1.

Table 3.1
Zero Emission Vehicle Miles Traveled Credit Calculation

	Urban All-Electric Range (AER)	Zero-emission VMT Credit
2001 Amendments	<10 miles	0.00
	10- 120 miles	(10 + [0.5 x Urban AER])/ 35
	>120 miles	2.00
Proposed Amendments	<10 miles	0.00
	10- 90 miles	(33.8 +[0.5 x Urban AER])/ 35
	>90 miles	2.25

This amendment will provide additional AT PZEV credit for grid-connected HEVs to recognize the potential benefits of this class of HEV. The effect of these changes, in combination with other amendments to AT PZEV credits, will raise the grid-connected HEV credit to the level first proposed at the December 5, 2002 public workshop. The proposed increase in the zero emission VMT credit is shown in Table 3.2.

Table 3.2
Comparison of 2001 Amendments and Proposed Amendments
Example Zero Emission VMT Credit

ZER	ZEVMT Credit Under 2001 Amendments	ZEVMT Credit Under Proposed Amendments
10 miles	0.43	1.11
20 miles	0.57	1.25
60 miles	1.14	1.82

3.2.4 Phase-In Multipliers for AT PZEVs with Zero Emission VMT

Under the 2001 amendments, an extended “early introduction” multiplier through the 2011 model year is provided for grid-connect hybrid vehicles, but not for other AT PZEVs (the early introduction multiplier for other AT PZEVs expires in 2005). This was intended to recognize that grid-connected HEVs needed additional time for commercialization. Staff proposes amendments that increase the phase-in multiplier for AT PZEVs with zero emission VMT according to Table 3.3. The proposed amendments also align the model year groupings with the Stage I, Stage II and Stage III concept used elsewhere in the staff proposal.

Table 3.3
Phase-In Multiplier for AT PZEVs with Zero Emission VMT

	Stage I	Stage II			Stage III		
Phase-In Multiplier for PZEVs with ZE-VMT Credit	**2000-2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
2001 Amendments	2.0	2.0	2.0	1.5	1.5	1.25	1.25
Current Proposal	6.0	6.0	6.0	6.0	3.0	3.0	3.0

In addition, this phase-in multiplier is proposed to apply to all AT PZEVs with zero emission VMT including those with zero emissions of a single pollutant (for example, a vehicle with zero emissions of NOx, but SULEV level NMOG emissions). AT PZEVs subject to this multiplier include grid-connected HEVs, hydrogen internal combustion engine vehicles, and methanol reformer fuel cell vehicles. This early introduction is intended to encourage and accelerate the development and deployment of classes of AT PZEVs that are significantly further from commercialization than non-grid connected HEVs or CNG AT PZEVs.

3.2.5 Elimination of Efficiency Multiplier for AT PZEVs

In consideration of its relationship to fuel economy standards, staff proposes elimination of the efficiency multipliers that have been available to qualifying AT PZEVs and ZEVs.

3.2.6 Cap on Total AT PZEV Credit Post-2011

Staff further proposes to apply a cap to the maximum value of AT PZEV credits per vehicle of 3.0 for 2012 model year and beyond. This would ensure that AT PZEVs cannot earn more credit than pure ZEVs.

3.2.7 Combined AT PZEV Credit Examples

The following table provides examples of proposed potential credits for a variety of AT PZEV types. These examples are for illustration purposes only and are, in some cases, dependent on a successful application to the Executive Officer for particular credits on vehicle configurations. It is entirely possible that different manufacturers' vehicles of the same general type may earn different AT PZEV credit.

Table 3.4
Example Credit Calculations for Different AT PZEV Types

AT PZEV Vehicle Type	Base	Zero Emission VMT	Advanced Componentry	Low Fuel Cycle	Intro Mult.	Total AT PZEV Credit
Non-Grid HEV	0.20		0.40		N/A	0.6
Non-Grid HEV post 2011	0.20		0.35		N/A	0.55
CNG	0.20		0.10	0.30	N/A	0.6
Hydrogen Internal Combustion Engine ('09-'11)	0.20	1.00	0.20	0.30	3.0	5.1
Methanol Reformer Fuel Cell Vehicle ('09-'11)	0.20	1.00	0.40	0.30	3.0	5.7
P20 Grid HEV ('09- '11)	0.20	1.25	0.40	0.12	3.0	5.9
P60 Grid HEV ('09- '11)	0.20	1.82	0.40	0.15	3.0	7.7
P20 Grid HEV ('12+)	0.20	1.25	0.40	0.12	N/A	2.0
MAXIMUM AT PZEV Post 2011						3.0

3.2.8 AT PZEV Severability

Staff proposes amendments that sever, under certain circumstances, a manufacturer's option to earn ZEV credit for AT PZEVs from the remaining provisions of the ZEV regulation. If found unenforceable, the AT PZEV provisions will be eliminated as options to the pure ZEV requirements, resulting in AT PZEVs earning 0.2 credit. Manufacturers must make up any credit shortfall with pure ZEVs. Furthermore, if individual credit provisions of the AT PZEV determination are found to be unenforceable, they may also be severed individually and the remaining credits shall be used to determine AT PZEV credit at a reduced overall level. The proposed amendments also contain a more general severability clause that applies to all provisions in the regulation.

3.3 Amendments to ZEV Credit Calculations

3.3.1 ZEV Types

The proposed amendments eliminate the use of the efficiency multiplier for ZEV credit determination. Because the efficiency multiplier and the range multiplier were used together in a complementary fashion in the determination of overall ZEV credit, the range multiplier must also be altered with the removal of the efficiency multiplier. Staff proposes amendments that, beginning in 2003, permit the ZEV credit determination to be based only upon vehicle range and fast refueling capability according to a 5 "tier" system. The ZEV tiers are defined as follows, and described separately below.

Table 3.5
Proposed ZEV Credit Tiers

ZEV Tier	Description	ZEV Range (UDDS)*	Fast Refueling Capability
NEV	NEV	No minimum	N/A
Type 0	Utility EV	<50 miles	N/A
Type I	City EV	>= 50, <100 miles	N/A
Type II	Full Function EV	>= 100 miles	N/A
Type III	Fuel Cell EV	>= 100 miles	Must be capable of replacing 95% maximum rated energy capacity in <= 10 minutes

* Urban Dynamometer Driving Schedule

3.3.2 ZEV Credit Levels

Under the staff proposal, credits for NEVs remain the same as under the 2001 regulation, but credits for other ZEV types are increased. Specifically, staff proposes amendments establishing the following ZEV credit values for each of the 5 new tiers.

Table 3.6
Proposed ZEV Credit Values

	Stage I			Stage II			Stage III			
Tier	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
NEV	**1.25**	**0.625**	**0.625**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**
Type 0 (Utility)	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1
Type I (City)	8	8	8	7	7	5	2	2	2	2
Type II	12	12	12	10	10	7	3	3	3	3
Type III	40	40	40	15	15	15	4	4	4	3

The proposed ZEV credits shown in Table 3.6 replace the former base credit, efficiency, range, and early introduction multipliers, as well as the in-service/ under-warranty credit from the 2001 amendments. For comparison purposes, the former credit levels are shown in Table 3.7 below. Staff anticipates that all vehicles (other than NEVs) produced to date or likely to be produced in the near term would receive higher credit levels under the staff proposal than under the 2001 amendments.

Table 3.7
2001 Amendments ZEV Credit Values

Tier	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
NEV	**1.25**	**0.625**	**0.625**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**
Type I (City)	1.75	1.75	1.96	2.01	2.33	1.38	1.4	1.42	1.42	1.4
Type II	5.87	5.87	5.94	5.17	5.21	3.44	3.34	3.2	3.2	2.9
Type III	12.5	12.5	11.3	8.03	7.07	4.36	3.92	3.46	3.46	2.92

The various vehicle types are further described as follows:

- NEVs, which are low speed vehicles as defined in California Vehicle Code section 385.5, are only now beginning to sell in significant quantities. Because they are still new to the marketplace, there is still a less than complete understanding of customers' use patterns and the resulting air quality benefits. Staff proposes amendments such that NEVs continue to earn the same credit as defined in the 2001 amendments. Staff also

proposes that the credit value for 2006 and beyond be reexamined and possibly revised at a later date when more detailed NEV customer usage and vehicle durability information is available to ARB.

- Type 0 or "utility" ZEVs will earn 1.5 ZEV credits until 2008, and then 1.0 credit in 2009 and beyond. This lower credit level corresponds to the reduced functionality of these vehicles as compared to Types I, II and III. Type 0 ZEVs typically would be vehicles with smaller battery packs, or low range city electric vehicles.

- Type I ZEVs (typically city electric vehicles) would earn approximately two-thirds the credit value of a Type II ZEV. This change is proposed to provide more consistent credits for Type I ZEVs and to help offset the additional marketing challenges that are expected for these reduced-range and, usually, reduced-size vehicles. Staff believes that Type I battery EVs have the potential to be sold at a profit before full function ZEVs because they are equipped with smaller, more affordable battery packs that are better suited to their driving mission. Longer-range battery EVs are equipped with relatively large and expensive battery packs, but seldom make complete use of their entire capacity to drive longer distances. Recent improvements in NiMH batteries have increased their cycle life relative to their calendar life, and Type I battery EVs will benefit the most from this trend because they are more deeply cycled than longer range battery EVs where battery life is primarily limited by calendar life.

  Staff believes that zero emission VMT accumulated by Type I ZEVs will be higher in relation to Type II ZEVs than was reflected in the credit ratios proposed in the 2001 amendments. Staff believes this class of ZEV provides an attractive option for automakers and has proposed an increase in ZEV credit to further encourage their development and deployment.

- Type II ZEVs (typically full function battery EVs) would earn approximately double the 2001 amendment level in model years 2005-2008, and approximately the same as the 2001 amendments thereafter. The increase is intended to provide an incentive for manufacturers to continue to pursue these vehicle types and to act as an extension of the early introduction credits offered in the 2001 amendments. The proposed increase is also provided to offset the elimination of the in-service/ under-warranty credit and to maintain parity with the credit levels earned by fuel cell vehicles.

- Type III ZEVs (typically fuel cell vehicles) would earn credit increased by a factor of 3.5 over the 2001 amendments in Stage I, 2.5 times in Stage II, and approximately 13% in Stage III. Staff proposes an increase of this credit relative to Type 0, I and II ZEVs because Type III vehicles are far from fully developed, and because of the more challenging infrastructure challenges they face. It is expected that most Type III ZEVs will be hydrogen fuel cell

vehicles which, because of their ability to fast recharge, may be less challenging to market than battery EVs as direct replacements for conventional gasoline vehicles. Credits proposed for 2012 and beyond remain the same as Type II ZEVs, and are similar to the values proposed for fuel cell vehicles in the 2001 amendments.

Type 0, Type I, and Type II ZEVs are distinguished according to range performance only, while Type III ZEVs meet the Type II range requirement but must also be capable of routine fast-refueling (they can attain 95% of their maximum rated energy capacity in 10 minutes or less when starting from any operationally allowable state).

3.3.3 Fast Refueling Definition

Staff proposes amendments that eliminate the existing fast refueling credit for ZEVs that are able to restore 60 miles of range in less than 10 minutes. This option was most commonly intended for fast charging of battery EVs. Staff recommends elimination of this provision because of high infrastructure costs, lack of a clearly defined market for this modest improvement in capability, and a lack of combined infrastructure supplier/automaker interest. While fuel cell refueling infrastructure imposes significant costs, these costs are spread over many more vehicles because they refuel much faster, and because hydrogen storage or generation systems can be fitted with multiple dispensers for simultaneous use.

3.3.4 In Service/Warranty Credit

Staff proposes amendments that delete the additional credit for ZEVs kept in service and under warranty beyond 3 years for model year 2005 and later vehicles. Staff believes that the complexities involved in tracking compliance with this option are overly burdensome to both automakers and ARB staff and that other avenues should be explored to encourage automakers and ZEV users to extend the useful lives of ZEVs.

3.4 Compliance Option Limits

Staff proposes several amendments to the options available to manufacturers in order to comply with the percentage ZEV requirements.

3.4.1 Category Percentages

Staff proposes a restructuring of the percentages associated with the category options that can be used to comply with the regulation. Specifically, the amount of AT PZEV (sliver) credit that could be used to satisfy the pure ZEV (gold) requirement would be adjusted to create a slower ramp up of volumes of pure ZEVs and to encourage an increase in AT PZEV volumes in the early years.

Table 3.8 below shows the proposed restructuring of categories through the transition years of the program from 2005 through 2011. The amount of PZEV (bronze) credit that can be used to satisfy the ZEV obligation is not changed. In 2012 and beyond the program returns to the structure of the current regulation.

Table 3.8
Credit Option Limits

	Stage I			Stage II			Stage III			Return to 2001 Amendment Level			
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1%													Gold 4%
1%													
1%										Gold 3%	Gold 3%	Gold 3%	
1%							Gold 1.25%	Gold 1.25%	Gold 1.25%				
1%			Gold 1%	Gold 1%	Gold 1%	Gold 1%							
1%							Silver 3.75%	Silver 3.75%	Silver 3.75%				Silver 4%
2%			Silver 3%	Silver 3%	Silver 3%	Silver 3%				Silver 3%	Silver 3%	Silver 3%	
6%			Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%	Bronze 6%

As shown above, the portion of the regulation that must be met with pure ZEVs (gold) is reduced from 2 percent to 1 percent between for model years 2005 through 2008. From 2009 to 2011, the pure ZEV requirement is 1.25 percent compared to 2.5 percent in the current regulation. Starting in 2012, the pure ZEV obligation returns to the 3 percent as exists in the current regulation, and increases in future years as defined in the 2001 amendments.

To compensate for the reduction in the pure ZEV requirement, the amount of credit that can be earned from AT PZEVs (silver) is increased by one percent between 2005 and 2008 and by 1.25 percent between 2009 and 2011. Like the pure ZEV category, the portion of the regulation that can be met by AT PZEVs returns to the requirements contained within the 2001 amendments in 2012.

The PZEV (bronze) category is unchanged in the staff's proposal compared to the existing regulation.

3.4.2 ZEVs Exempt from Obligation Determination

A manufacturer's ZEV obligation is calculated as a percentage of the volume of passenger cars and covered light-duty trucks it produces and delivers for sale in California. Staff proposes amendments that omit ZEVs, including NEVs, placed in service in California from the manufacturer's total sales used to calculate the ZEV obligation. ZEVs do not include PZEVs and AT PZEVs for purposes of this calculation. This reduced volume does not affect a manufacturer's classification in terms of size. Eligible vehicles must be manufactured by the automaker or a majority owned subsidiary. This amendment is proposed to encourage manufacturers to produce ZEVs without causing their overall obligation under the ZEV requirements to increase as a result of that production.

3.4.3 Expansion of Banked NEV Credit Applicability

The 2001 amendments restrict the use of credits from 2001-2005 NEVs in 2006 to 75 percent of an automaker's ZEV obligation. This is reduced to 50 percent in 2007 and beyond. This restriction applies to all credit categories (PZEV, AT PZEV, and ZEV). Staff recommends that restrictions on yearly NEV credit allocation be amended to continue to restrict ZEV applicability but allow unlimited NEV credit usage for meeting PZEV and AT PZEV percentage options. Staff proposes this change to increase flexibility for manufacturers who may need additional time to commercialize PZEV and AT PZEV technologies.

3.5 Other Changes

3.5.1 Hybrid Electric Vehicle Energy Storage Device Warranty Requirement

Staff proposes amendments to the PZEV extended warranty requirement for HEV batteries. The 2001 amendments require a 15-year or 150,000 mile (whichever occurs first) warranty for an HEV traction battery used in AT PZEVs. Staff proposes amendments that exempt PZEV and AT PZEV "zero emission energy storage devices" used for traction power from the 15 year/150,000 mile PZEV warranty period, and replace this requirement with a 10 year/150,000 mile warranty. Examples of ZEV energy storage systems include batteries, ultracapacitors, and hydrogen storage. On-board diagnostic elements of these

storage systems that monitor performance would not be exempt from the 15-year/150,000 requirements.

3.5.2 Transportation System Credit

Under the 2001 amendments, a cap is placed on the amount of credit from transportation systems programs that can be used to meet a manufacturer's obligation. The cap includes the credit generated by both the vehicle and its placement in the program. Staff proposes amendments making this cap apply only to the credits earned from participation in the transportation system program. Thus, the credit earned by the vehicle would not be subject to the cap applicable to transportation system credits.

Staff also proposes to extend the opportunity to earn ZEV credits from transportation systems from 2007 to 2011. This change is proposed to provide more certainty to entities that are already working on plans for these programs and projects that extend beyond 2007.

Staff plans to reexamine the progress made and benefits attributable to transportation systems and to reassess the credit values at a future date.

3.5.3 "Placed in Service" Requirement

Staff proposes amendments providing that in order to earn any credit a 2003 and subsequent model year NEV must be placed in service. This change is intended to ensure that manufacturers continue to seek appropriate market niches for these vehicles.

In addition, there have been recent discussions regarding the date by which a vehicle must be placed in service in order to earn the early introduction multiplier provided in section 1962(d)(3)(A) of the ZEV regulation. When this issue first surfaced, staff realized that the regulation itself was unclear about whether there was a deadline for placement of vehicles to qualify for early introduction credits. The rulemaking record, however, was replete with statements that the early introduction credits would be available for vehicles placed during the model year, which by regulation ends no later than December 31. Based on information provided by some manufacturers, however, staff became concerned that they had not understood the regulation to establish a deadline; that is, some manufacturers assumed they could earn early introduction credits for 2001 through 2005 model year vehicles regardless of when they were placed. Additionally, staff understood that some manufacturers would be producing 2002 model year NEVs with the intention of qualifying for the early introduction credit multiplier through the end of the model year, thus making it very difficult if not impossible to place those 2002 MY NEVs by December 31, 2002.

In order to address these issues, on November 21, 2002, the Executive Officer issued a letter to affected vehicle manufacturers informing them that early introduction credits would be available for 2002 model year vehicles placed through March 31, 2003 (with a similar "sell through" period for the remainder of the early introduction credits). On December 17, 2002, however, in a lawsuit filed in December by DaimlerChrysler and General Motors, a Fresno County Superior Court Judge announced he would issue a temporary restraining order (TRO) enjoining ARB from implementing the provisions of the November 21 advisory. The judge issued the TRO after determining that the plaintiffs, DaimlerChrysler and General Motors, would likely prevail on the claim that the advisory constituted an underground regulation -- ruling, in effect, that the creation of a "sell through" date could not be accomplished without formal rulemaking. As a result of the TRO, the "sell through" period provided by the advisory is not available. Consequently, unless the Board takes action to establish a "sell through" date, early introduction credits will be available only for vehicles placed during the applicable model year.

The amendments would provide that a 2001-2002 model year ZEV qualifies for the early introduction multiplier of 4.0 only if it is placed in service in California by April 15, 2003. If it is placed in service after that time, it would be subject to the credit provisions applicable to 2003 and subsequent model year ZEVs. These provisions would explicitly award credits beyond one (all credit in the case of NEVs) according to the model year in which the vehicle is placed in service, with a cut-off date of March 31st after the end of the specified model year.

3.5.4 Addition of LDT2 Vehicles

At the January 2001 hearing the Board decided to modify the originally proposed amendments to phase in a new requirement that LDT2 vehicles be included in the base for determining a manufacturer's full percentage ZEV obligation, along with the passenger cars and LDT1 vehicles that had always been included. The LDT2 category includes most sport utility vehicles (SUVs), minivans, and larger pickup trucks. The addition of LDT2 vehicles was phased in beginning in the 2007 MY, when 17 percent of the manufacturer's California LDT2 production is to be counted. The percentage increases by 17 percent increments through the 2011 MY, with a 100 percent requirement starting in the 2012 MY. Full inclusion of LDT2 vehicles increases the base across all manufacturers by an average of roughly 70 percent, although the impacts differ among individual manufacturers.

One of the claims in a state court lawsuit filed in January 2002 challenging the ZEV regulation is that the Board's addition of LDT2 vehicles was unlawful because it was beyond the scope of the hearing notice. To remove any possible basis for this claim, which has not yet been adjudicated, staff recommends in addition to the amendments proposed above that the Board reconsider and affirm the addition of LDT2 vehicles to the sales base in the 2001 amendments. During the comment period in this rulemaking, the Board will accept comment on

whether it should affirm the earlier action regarding the LDT2 category. The effect of the action regarding LDT2 vehicles on the total number of vehicles required and the estimated incremental cost are discussed below.

There are two primary reasons for the phased addition of LDT2 vehicles to the sales base for applying the percentage ZEV requirements. First, while a large percentage of vehicles in the LDT2 category have traditionally been used for work purposes, it is now very common for the SUVs, pick-up trucks and minivans making up the category to be used primarily for personal transportation, i.e. as passenger cars. In recognition of this phenomenon, a key element of the LEV II rulemaking in 1998-1999 was to make these vehicles subject to the same exhaust emission standards as passenger cars. This requirement is being phased in during the 2004 – 2007 model years. For the same reason it is appropriate for these vehicles to trigger the same ZEV obligations as passenger cars. Secondly, the absence of LDT2 vehicles from the sales base encourages a manufacturer to sell more large vehicles in order to reduce the number of zero and near zero emission vehicles it must produce.

3.6 Effect of Proposed Changes

The following section provides scenarios illustrating the number of vehicles that may be produced under the staff proposal as compared to the current regulation.

To estimate the number of ZEVs in the early years this analysis assumes that manufacturers will use banked credits first. Banked credits are those credits that are earned from voluntary vehicle placements prior to the implementation of the ZEV regulation. Banked credits are assumed to be used only to satisfy the pure ZEV requirement and any 2005-2007 shortfall in the AT PZEV option.

Each manufacturer is in a unique situation. Some manufacturers have small numbers of banked credits, while others have credits sufficient for a number of years. Some manufacturers have both NEV and non-NEV credits, while others do not. In addition, manufacturers differ in the status of fuel cell development, the availability of PZEV or AT PZEV products in the near term, and the technologies to be emphasized in their corporate strategy. All of these factors affect each manufacturer's compliance status, and therefore the compliance pathways they pursue.

Finally, staff emphasizes that due to the flexibility afforded by the regulation, it is impossible to predict with accuracy the number of vehicles in each category that will actually be produced. The following scenarios show plausible outcomes but should not be viewed as firm estimates.

3.6.1 Number of Vehicles

This section outlines two scenarios regarding vehicle production, which differ in their treatment of banked credits. The ZEV regulation allows credits to be freely bought, sold or traded among manufacturers. Thus credit trading is possible, but the extent to which credit trading will actually occur is unclear.

The first scenario assumes no trading of banked credits among manufacturers. This is consistent with views expressed by manufacturers, who have stated that it is unlikely that significant trading of banked credits will occur in their competitive environment. The second scenario represents in some ways a "worst case" approach that assumes that manufacturers freely trade credits to postpone ZEV production as long as possible, and also assumes that manufacturers abandon their current plans to place demonstration quantities of fuel cells over the next several years.

No Trading Scenario

As noted above, manufacturers have stated that it is unlikely that ZEV credits would be freely traded to any significant extent. To better understand the effect of credit trading on vehicle production totals, staff has reviewed credit status on a manufacturer-by-manufacturer basis. Viewed in this light and using currently available information, it appears that some manufacturers would exhaust their supply of available banked credits as early as the 2005 and 2006 model years. Those manufacturers thus would be required to produce some number of ZEVs in those years.

Tables 3.9 and 3.10 below show examples of the number of ZEVs, AT PZEVs, and PZEVs that could be produced between model years 2005 and 2011 under the 2001 amendments and the staff proposal, assuming no credit trading.

Table 3.9
Additional Vehicle Production Scenarios, No Credit Trading, 2001 Amendments

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	1300	1500	2700	13000	16700	20600	22300
If Full Function	900	1100	1900	9300	11200	13700	14800
If Fuel Cell	270	700	1300	4300	8400	10300	11100
AT PZEVs	13400	19500	28100	47100	64800	70600	76500
PZEVs	274600	410200	460800	511400	562000	612600	663200

Table 3.10
Additional Vehicle Production Scenarios, No Credit Trading, Staff Proposal

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	200	500	800	1400	4600	8200	9600
If Full Function	100	400	600	1000	3100	5500	6400
If Fuel Cell	40	200	400	500	2300	4100	4800
AT PZEVs	18400	27000	43500	64100	88100	96100	104100
PZEVs	274600	410200	460800	511400	562000	612600	663200

With regard to AT PZEV production, staff recognizes that not all manufacturers have the capability to take full advantage of the AT PZEV option in the initial years of the program at either the 2 percent level (the 2001 amendments) or the 3 percent level (the staff proposal). Instead, staff assumes that industry-wide, manufacturers are able to fulfill the portion of the AT PZEV option specified in Table 3.11 below:

Table 3.11
Assumed AT PZEV Production Capability

	2005	2006	2007	2008
2001 Amendments (2 percent)	60	60	75	100
Staff Proposal (3 percent)	50	50	75	100

That is, staff assumes that in 2005 manufacturers have the ability to take advantage of 50 percent of the 3 percent AT PZEV option under the staff proposal, or 60 percent of the 2 percent AT PZEV option under the 2001 amendments (the totals do not move proportionally because staff assumes that some but not all manufacturers have the ability to move from 2 to 3 percent). Staff has assumed that automakers will produce HEVs or CNG vehicles to meet their AT PZEV option.

For PZEVs, the number of vehicles expected under the staff proposal is the same as under the 2001 amendments because no changes are proposed that would affect this total. The totals shown above cover PZEV production by both large and intermediate manufacturers. (Intermediate manufacturers have the option to fully comply with the regulation by producing PZEVs, and staff assumes that all intermediate manufacturers will adopt this strategy).

Credit Trading Scenario

Staff also has developed a "worst case" scenario that assumes free credit trading among manufacturers and no voluntary fuel cell production. Tables 3.12 and 3.13 below show examples of the number of ZEVs, AT PZEVs, and PZEVs that could be produced between model years 2005 and 2011 under the 2001 amendments and the staff proposal, using these assumptions.

Table 3.12
Additional Vehicle Production Scenarios, With Credit Trading, 2001 Amendments

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	0	0	0	13700	25200	27100	29300
If Full Function	0	0	0	5500	10500	12000	13000
If Fuel Cell	0	0	0	4300	9000	11100	12000
AT PZEVs	13400	19800	27900	47100	64800	70600	76500
PZEVs	274600	410200	460800	511400	562000	612600	663200

Table 3.13
Additional Vehicle Production Scenarios, With Credit Trading, Staff Proposal

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	0	0	0	0	4600	9600	10400
If Full Function	0	0	0	0	3100	6400	6900
If Fuel Cell	0	0	0	0	2300	4800	5200
AT PZEVs	17200	25600	43300	64100	88100	96100	104100
PZEVs	274600	410200	460800	511400	562000	612600	663200

In addition to the effect of credit trading, staff notes that manufacturers have plans in place to produce demonstration numbers of fuel cell vehicles over the next several years. Given the aggressive pursuit of fuel cell technology to date, the sizable investments underway, and manufacturer announcements regarding future product development, staff believes it is unlikely that manufacturers would abandon fuel cell placements until 2009 as is implied by Table 3.13 above. Rather, staff expects that manufacturers will continue to pursue fuel cell commercialization, which will necessitate ongoing vehicle placements.

A comparison of Table 3.10 (the "no credit trading" staff proposal scenario) and Table 3.13 (the "with credit trading" staff proposal scenario) shows that credit trading significantly shifts the timing of ZEV production. Under the "no credit trading" scenario there are more vehicles produced in the early years (no blackout exists) but fewer vehicles in the later years. This occurs because fewer banked credits are used in the early years in the "no trading" scenario (without trading not all manufacturers have banked credits available for use), leaving more banked credits available for use in the later years.

3.6.2 Addition of LDT2 Vehicles

As noted above, staff recommends that the Board reconsider and affirm its 2001 action to add LDT2 vehicles to the sales base against which manufacturers' compliance obligations are calculated.

Table 3.14 below shows the estimated manufacturer sales base, with and without the phased-in inclusion of LDT2 vehicles, for model years 2005 through 2012. The estimates in Table 3.14 assume that manufacturers base their obligation on the prior three years average sales, rather than using the option to base their obligation on current year sales. Please note that after 2006, the sales numbers used by staff assume no sales growth over time.

Table 3.14
Sales Base for Manufacturers' Compliance Obligation

Sales Base	2005	2006	2007	2008	2009	2010	2011	2012
Without LDT2	917398	1025457	1025457	1025457	1025457	1025457	1025457	1025457
With LDT2	917398	1025457	1153419	1281380	1409342	1537304	1665266	1778173

Table 3.15 below shows how the number of vehicles required under the staff proposal changes with the addition of LDT2 vehicles to the sales base. The numbers shown are the additional vehicles of each type that are needed in order to satisfy the increased compliance obligation stemming from the addition of LDT2 vehicles to the sales base.

Table 3.15
Number of Additional Vehicles Needed
Due to Addition of LDT2 Vehicles to Sales Base, Staff Proposal

	Stage I	Stage II			Stage III			
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011	2012
ZEVs								
If City	0	0	0	0	4600	3400	4000	11300
If Full Function	0	0	0	0	3100	2300	2600	7500
If Fuel Cell	0	0	0	0	2300	1700	2000	7500
AT PZEVs	0	0	4800	12800	24000	32000	40000	41100
PZEVs	0	0	50600	101200	151800	202400	253000	297700

Please note that these volumes are included in the totals shown in Tables 3.9, 3.10, 3.12 and 3.13 above, which already take into account the addition of LDT2 vehicles to the sales base. Thus the totals given in Tables 3.9, 3.10, 3.12 and 3.13 would decrease by the amounts shown here if LDT2 vehicles were excluded.

4. REGULATORY ALTERNATIVES

4.1 Do Not Amend Program

Staff considered not recommending any amendments to the ZEV regulations. In this case, manufacturers would ultimately need to produce and offer for sale vehicles sufficient to comply with the 2001 amendments, taking into account the use of banked credits. Tables 3.9 and 3.12 above show two such scenarios.

This assumes, of course, that the state prevails in the current litigation. If the state is not successful, the "do nothing" alternative would result in the loss of the ZEV program until necessary amendments are adopted. In addition, staff is concerned about the risk of the program becoming dormant if we wait and stand by while the lawsuits play out. This idle time could deter progress towards commercialization of zero and near zero emission technologies. In addition, it is likely that the federal preliminary injunction has affected some manufacturers' marketing and product plans.

Production at this level would impose a large cost burden on the manufacturers. The vehicles would need to be priced aggressively to meet the sales targets, and this would reduce the revenue available to the manufacturers to offset their costs. To the extent that the state provides subsidies in order to assist with vehicle marketing, such a large number of vehicles needing subsidies would result in large state expenditures. Under the 2001 amendments, moreover, manufacturers would need to develop additional ZEV products (likely battery EVs) to meet near-term credit needs.

4.2 Amend Program Only to Address Federal and State Lawsuits

As discussed in Section 2.6, a federal district court judge has issued a preliminary injunction that prohibits the ARB from enforcing the 2001 ZEV amendments with respect to the sale of motor vehicles in the 2003 and 2004 model years. The ARB has appealed issuance of the preliminary injunction and is hopeful of a decision in the first part of 2003. To remove uncertainty, staff considered proposing amendments that remove all references to fuel economy in the ZEV regulation to address the preemption concerns raised in the court's decision, but make no further changes.

Staff did not adopt this approach because as noted above, staff believes that additional changes are warranted in light of the current status and trends in ZEV technology. There has not been a significant reduction in the cost of battery EVs, with only NEVs emerging as a commercial, although limited use product. In addition, projections regarding the pace of commercialization of fuel cells, which were expected to provide a second ZEV technology late in this decade, have become less certain, although automakers remain fully committed and continue

to invest heavily in the technology. As a result, it appears that under the current regulation, manufacturers will need to develop additional battery EV products to bridge the interim years until fuel cells are cost effective in the next decade.

In addition, ARB staff believes that the delay imposed by the June 11, 2002 preliminary injunction against the ARB could have significantly affected manufacturers' marketing and production plans.

4.3 Adopt Substantial Revisions to the ZEV Regulation

Staff's proposal addresses litigation issues, delays implementation and restructures the credit calculation system to address near term technology and marketing concerns. Since 1990, ZEV regulations for passenger cars have been modified several times. Adjustments were made for cost, technology and market concerns. The ultimate goal, however, remains – to achieve significant and growing numbers of zero emission vehicles on California's roads.

The substantially revised regulation would maintain the pressure to continue the development of emerging ZEV technologies. It would take advantage of all the technology options that are available today and provide manufacturers the flexibility to pursue their individual paths towards ZEV commercialization.

5. ECONOMIC IMPACTS

The proposed amendments to the ZEV program are projected by ARB staff to reduce the costs of compliance for automobile manufacturers. Staff believes, therefore, that the proposed amendments would cause no noticeable adverse impact on California employment, business status, and competitiveness. Because the ZEV regulations provide considerable flexibility to manufacturers, the magnitude of these savings is difficult to estimate with any certainty. A more detailed discussion follows.

5.1 Legal Requirement

Sections 11346.3 and 11346.54 of the Government Code require state agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include consideration of the impact of the proposed regulation on California jobs, business expansion, elimination, or creation, and the ability of California businesses to compete.

State agencies are also required to estimate the cost or savings to any state or local agency and school districts in accordance with instruction adopted by the Department of Finance. This estimate is to include any nondiscretionary costs or savings to local agencies and the costs or savings in federal funding to the state.

5.2 Directly Affected Businesses

Any business involved in manufacturing passenger cars and light-duty trucks would be directly affected by the proposed amendments. Also affected are businesses that supply parts for these vehicles. California accounts for only a small share of total nationwide motor vehicle and parts manufacturing. There are about 40 companies worldwide that manufacture California-certified light- and medium-duty vehicles and heavy-duty gasoline engines. Only one motor vehicle manufacturing plant is located in California, the NUMMI facility, which is a joint venture between GM and Toyota.

5.3 Potential Impact on Manufacturers

The proposed amendments are expected to reduce costs to motor vehicle and parts manufacturers. The key factors that determine the cost of compliance with the current ZEV regulation, or an amended version, are (1) the number of vehicles that are required to be placed, and (2) the incremental cost per vehicle. Both are estimated, and both estimates are subject to considerable uncertainty.

Tables 3.9, 3.10, 3.12 and 3.13 in Section 3.6.1 above provide staff-developed scenarios as to the number of ZEVs, AT PZEVs and PZEVs that would be

produced by large and intermediate manufacturers and offered for sale in order to satisfy the 2001 amendments compared to the proposed amendments. Because of the flexibility provided in the regulation, it is not possible to present a single point estimate. For ZEVs, different totals are provided assuming that the manufacturers use 100 percent City EVs (Type I), 100 percent full function EVs (Type II), or 100 percent Fuel Cell Vehicles (Type III). All ZEV estimates assume that manufacturers take full advantage of the possible 6 percent PZEV offset. In addition, the ZEV estimates assume that beginning in 2008 manufacturers will make full use of the AT PZEV option to meet the maximum allowed percentage of the ZEV obligation (between 3 and 3.5 percent). As discussed in Section 3.6.1, staff assumes that prior to that date not all manufacturers have the capability to take full advantage of the AT PZEV option.

Section 3.6.1 provides two scenarios, the first of which assumes no credit trading and the second of which represents a worst case approach which assumes free credit trading and no voluntary production. The cost estimates developed here use the worst case scenario of vehicle production. Because the number of vehicles needed in the early years (when per vehicle incremental costs are highest) is smaller under this approach, using it provides a conservative estimate of the savings achieved under the staff proposal.

5.3.1 Incremental Per-Vehicle Cost Estimates

With regard to incremental cost per vehicle, the starting point for the staff estimates is the staff analysis from the 2001 regulatory amendment process, with further refinements and updates as described below.

PZEVs

In the 2001 Initial Statement of Reasons, ARB staff estimated that the incremental cost for PZEV compliance was $500. In the 2001 Final Statement of Reasons, this estimate was reduced to $200 based on new information. Today, based on staff analysis of recently certified PZEVs, staff estimates that the incremental cost for PZEV compliance is $100.

As of December 31, 2002, the ARB has certified seven gasoline PZEVs in California. These are primarily four cylinder engines, with one in-line five cylinder and one in-line six cylinder model. Displacements range from 1.8 to 2.5 liters. The models include the Honda Accord, Toyota Camry, Nissan Sentra, Volkswagen Jetta, Volvo V70 & S60 FWD, Ford Focus, and the BMW 325.

In evaluating the emission control systems, it is clear that some manufacturers have been able to simplify and reduce cost more effectively than others. Staff estimates that in a few years, manufacturers will converge on optimized designs as experience increases.

Honda's PZEV Accord utilizes one under-floor catalyst, two oxygen sensors and exhaust gas recirculation. The Nissan Sentra utilizes a warm-up and under-floor catalyst, two oxygen sensors, but no exhaust gas recirculation. The Toyota Camry utilizes a warm-up and under-floor catalyst, three oxygen sensors and no exhaust gas recirculation. Other PZEVs utilize various combinations of multiple catalysts, several oxygen sensors, exhaust gas recirculation, and an air pump.

Initially, Honda submitted a SULEV application for the 2003 Accord 4-cylinder. Subsequently, Honda modified its application to a PZEV. Doing so required Honda to increase the emission warranty to 150,000 miles and to add a zero evaporative emission control system. No additional hardware changes were required for this SULEV to qualify as a PZEV (even though PZEVs are required to meet the tailpipe standard for 15 years or 150,000 miles instead of 120,000 miles). Honda's SULEV had minimal deterioration and a large enough compliance margin that no hardware or catalyst loading changes were required for the vehicle to qualify as a PZEV.

Honda also certified an identical 2004 Accord as a LEV vehicle for sale in California. In examining the emission control hardware, it appears that the basic architecture is identical for both the LEV and the PZEV. The catalyst loading is increased to achieve the lower emission level. Staff obtained the difference in price for this vehicle and the identical PZEV model for 2003. For a 4-door Accord EX with automatic transmission, the LEV model price is $22,860 while the same model PZEV is $23,010, a difference of $150. While pricing may not necessarily reflect the actual costs of a model, it can provide some basis for gauging the relative cost of one emission control system versus another when the basic hardware is the same. In this case, staff estimates that the incremental cost covers only the additional precious metal content of the catalyst in the PZEV. Therefore, it appears that Honda is not charging significantly more for the improved warranty (and staff continues to believe that zero evaporative emission control costs about $10 based on our earlier analysis).

Toyota also sells the same model Camry as both a ULEV and a PZEV, without any cost differential. This may be because the dominant sales package is expected to be the PZEV whereas in the case of Honda, the LEV and PZEV models are expected to be produced in similar volumes.

Given the further progress in producing simpler PZEVs, and the apparent similarity of the tailpipe emission control systems in terms of architecture and catalyst loadings in the case of the Honda SULEV and PZEV applications, plus no apparent attempt to recover warranty costs in the case of the PZEV Accord, staff now estimates that the incremental cost of PZEVs relative to SULEVs is likely to be less than $100 as vehicles are optimized in the next few years. The additional cost would cover some improvement in components should manufacturers design for less than a 150,000 mile life currently (we expect manufacturers would design for the same failure rate, but at a higher mileage so

warranty costs themselves shouldn't increase much), and an additional $10 for zero evaporative emission control system upgrades.

Overall, as in the past, the automotive industry continues to significantly exceed expectations in terms of their ability to simplify, refine, and reduce the costs of their emission control systems.

AT PZEVs

In the 2001 Initial Statement of Reasons and 2000 Biennial Review Staff Report, the incremental cost for an AT PZEV was estimated to be $3,300 in the near term and $1,100 in volume production.

In this staff analysis, AT PZEV incremental costs for 2012 and beyond are based on the long-term estimates prepared by ARB and California Energy Commission staff as part of the AB 2076 report on reducing petroleum dependency. Estimates for earlier years are based on staff's understanding of current and projected incremental costs for various production HEVs.

Specifically, staff estimates that the incremental cost for an AT PZEV is $3,300 in Stage I (2003-2005), $1,500 in Stage II (2006-2008), $1,200 in Stage III (2009-2011) and $700 in 2012 and beyond.

These estimates do not take into account the fact that AT PZEVs that make use of hybrid electric drive will have vehicle attributes (such as increased performance or fuel economy, or in some cases 4-wheel drive) that are of value to customers. Thus, customers might be expected to pay a premium for such vehicles, and in fact the hybrids on sale in the market today sell for a premium compared to their conventional counterparts.

In an October 2001 report entitled ARB Staff Review of Report Entitled "Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study" staff discussed the valuation of HEV fuel savings. That report noted that an analysis cited by the automakers estimated a lifetime fuel savings of $350 for each 10 percent fuel efficiency improvement, using a gasoline price of $1.30 per gallon. Using a staff methodology, the ARB Staff Review estimated that the net present value of lifetime fuel savings for passenger vehicles with a 50 percent fuel economy improvement was approximately $1,600, using a fuel price of $1.75 per gallon.

The hybrid vehicles on the market today achieve fuel economy improvements of from 25 percent to 50 percent or more. For purposes of this analysis, staff assumes a fuel economy improvement of 30 percent, which results in a lifetime fuel savings net present value of about $1,040 under the staff methodology or $1,050 under the methodology cited by the automakers. This is rounded to

$1,000 for the calculations in this report. This value appears to be conservative in light of the fuel price premiums achieved in the market today.

Staff notes that the use of this value results in a "negative" incremental cost in 2012 and beyond—in other words the HEV is estimated to be less expensive to own and operate over its lifecycle than a conventional vehicle.

Battery EVs

In the 2000 Biennial Review Staff Report, the total near term incremental cost for full function battery EVs was estimated to range between $13,000 and $24,000, depending on the type of vehicle and the battery employed. For City EVs the near term incremental cost ranged from $7,500 to $10,000. Costs in volume production were estimated to range from $1,500 to $11,000, again depending on the type of vehicle and the battery used. In the 2001 Initial Statement of Reasons staff used near term estimates of $17,000 for full function EVs and $8,000 for City EVs.

Battery EV costs in this report are based on the 2001 staff analysis. Staff is not aware of changes since that time that significantly affect these cost estimates. Thus, for the purposes of the cost discussion here we assume an incremental cost of $17,000 for full function EVs and $8,000 for City EVs. We do not use lower "volume production" estimates for battery EVs because we do not expect volume production of battery EVs to occur in this timeframe.

Fuel Cell EVs

The 2001 Initial Statement of Reasons and the 2000 Biennial Review Staff Report did not provide estimates for fuel cell EV incremental cost. The October 2001 ARB Staff Review used an Arthur D. Little report that estimated a long-term incremental cost for a hydrogen fuel cell of roughly $9,300.

Estimates for near term fuel cell vehicle costs are highly speculative. Fuel cell costs can range considerably among manufacturers. In addition, fuel cell costs are considered highly sensitive information and are carefully guarded by manufacturers. In the early years the majority of the fuel cell vehicle cost is attributed to research and development, and the prototype nature of the vehicles produced.

In this analysis, near term cost estimates are based on currently held views in the fuel cell community. The cost for 2012 and beyond is based on estimates from the AB 2076 analysis, which in turn draws on long term estimates prepared by Arthur D. Little. The AB 2076 analysis assumed an incremental per vehicle cost for a hydrogen fuel cell of between $6,300 and $12,300.

Specifically, in this analysis incremental costs for a fuel cell vehicle are estimated to be $1 million in Stage I (2003-2005), $300,000 in Stage II (2006-2008), $120,000 in Stage III (2009-2011), and $9,300 in 2012 to 2020.

Table 5.1 below presents our incremental cost estimates in summary form.

Table 5.1
Incremental Vehicle Cost Estimates

	Stage I	Stage II			Stage III			
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011	2012+
ZEVs								
If City	$8,000	$8,000			$8,000			$8,000
If Full Function	$17,000	$17,000			$17,000			$17,000
If Fuel Cell	$1,000,000	$300,000			$120,000			$9,300
AT PZEVs								
Initial cost	$3,300	$1,500			$1,200			$700
Customer value	$1,000	$1,000			$1,000			$1,000
Net cost	$2,300	$500			$200			-$300
PZEVs	$100	$100			$100			$100

Staff notes that estimates for all the vehicle types are subject to great uncertainty associated with projecting future costs for evolving technology. Finally, the actual impact on manufacturers depends upon the extent to which they are able to pass along any increased costs to consumers, and the amount of any public subsidies that are provided.

For all of these reasons, staff notes that although the direction of the cost impact of the proposed amendments is clear – they will reduce the cost of the program – the magnitude of the savings is much more difficult to assess. We present our best estimates, based upon what we believe are reasonable assumptions, but we emphasize that the reader should recognize the uncertainty. We first address the anticipated cost of compliance with the 2001 amendments. We then discuss the anticipated cost of compliance with the staff proposal, and then finally the savings due to the staff proposal (the difference between the two). At the end of this section there is a summary table that lays out the results of our cost estimation in comparison form.

5.3.2 Estimated Program Costs – 2001 Amendments and Staff Proposal

This section provides a review of the incremental cost of the 2001 amendments and the staff proposal under the no credit trading scenario. Please note that manufacturers make significant use of banked credits in the early years. The cost that was incurred to acquire those banked credits is not taken into account here—it is a sunk cost that has no bearing on the relative cost of the staff proposal versus the 2001 amendments.

The estimated incremental cost for each program category in each year is the product of the number of vehicles produced in that year (taken from Tables 3.12 and 3.13 above) times the incremental cost per vehicle in that year (taken from Table 5.1 above). The results for the 2001 amendments are shown in Table 5.2 below, and the results for the staff proposal are shown in Table 5.3. As noted above, these cost estimates are based on the "worst case" ZEV production scenario.

Table 5.2
Estimated Annual Incremental Cost, 2001 Amendments
(Dollars in Thousands)

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	$0	$0	$0	$109,600	$201,600	$216,800	$234,400
If Full Function	$0	$0	$0	$93,500	$178,500	$204,000	$221,000
If Fuel Cell	$0	$0	$0	$1,290,000	$1,080,000	$1,332,000	$1,440,000
AT PZEVs	$30,820	$9,900	$13,950	$23,550	$12,960	$14,120	$15,300
PZEVs	$27,460	$41,020	$46,080	$51,140	$56,200	$61,260	$66,320
Total							
If City	$58,280	$50,920	$60,030	$184,290	$270,760	$292,180	$316,020
If Full Function	$58,280	$50,920	$60,030	$168,190	$247,660	$279,380	$302,620
If Fuel Cell	$58,280	$50,920	$60,030	$1,364,690	$1,149,160	$1,407,380	$1,521,620

Table 5.3
Estimated Annual Incremental Cost, Staff Proposal
(Dollars in Thousands)

	Stage I	Stage II			Stage III		
Type of Vehicle	2005	2006	2007	2008	2009	2010	2011
ZEVs							
If City	$0	$0	$0	$0	$36,800	$76,800	$83,200
If Full Function	$0	$0	$0	$0	$52,700	$108,800	$117,300
If Fuel Cell	$0	$0	$0	$0	$276,000	$576,000	$624,000
AT PZEVs	$39,560	$12,800	$21,650	$32,050	$17,620	$19,220	$20,820
PZEVs	$27,460	$41,020	$46,080	$51,140	$56,200	$61,260	$66,320
Total							
If City	$67,020	$53,820	$67,730	$83,190	$110,620	$157,280	$170,340
If Full Function	$67,020	$53,820	$67,730	$83,190	$126,520	$189,280	$204,440
If Fuel Cell	$67,020	$53,820	$67,730	$83,190	$349,820	$656,480	$711,140

A comparison of Table 5.2 and Table 5.3 brings forth several key points. First of all, the staff proposal has no effect on the estimated cost of the PZEV option.

The number of vehicles needed to take full advantage of this option is the same under the staff proposal as under the 2001 amendments.

Second, the estimated cost of the AT PZEV option increases somewhat. This is due to the fact that the allowable use of this option is increased during the 2005-2011 transition period, resulting in larger numbers of vehicles being produced in this category.

Finally, the estimated cost of the pure ZEV portion of the regulation decreases significantly under the staff proposal, due to the fact that this category in total is reduced to one-half of its former size, while the credits earned per vehicle are increased, particularly in the early years.

5.3.3 Cost Savings

Adding up the total cost of the program (ZEV, AT PZEV and PZEV production), the estimated savings due to the staff proposal in model years 2005 through 2011 range from an estimated $375 million to $3,623 million. These estimates are summarized below in Table 5.4.

Table 5.4
Estimated Total Savings Under Staff Proposal, 2005 –2011
(Dollars in Thousands)

Type of Vehicle	Stage I	Stage II	Stage III	Total
ZEVs				
If City	$0	-$109,600	-$456,000	-$565,600
If Full Function	$0	-$93,500	-$324,700	-$418,200
If Fuel Cell	$0	-$1,290,000	-$2,376,000	-$3,666,000
AT PZEVs	$8,740	$19,100	$15,280	$43,120
PZEVs	$0	$0	$0	$0
Total				
If City	$8,740	-$90,500	-$440,720	-$522,480
If Full Function	$8,740	-$74,400	-$309,420	-$375,080
If Fuel Cell	$8,740	-$1,270,900	-$2,360,720	-$3,622,880

5.3.4 Addition of LDT2 Vehicles

As noted above, staff recommends that the Board reconsider and affirm its 2001 action to add LDT2 vehicles to the sales base against which manufacturers' compliance obligations are calculated.

Table 5.5 below shows the estimated additional cost to manufacturers due to the addition of LDT2 vehicles to the sales base, using the staff proposal credit and

compliance structure. The estimated additional costs for each program category in each year are the product of the number of additional vehicles assumed to be needed in that year (taken from Table 3.15 above) times the incremental cost per vehicle in that year (taken from Table 5.1 above).

Table 5.5
Additional Cost Due to Addition of LDT2 Vehicles to Sales Base
(Dollars in Thousands)

Type of Vehicle	Stage I	Stage II	Stage III	Total
ZEVs				
If City	$0	$0	$96,000	$96,000
If Full Function	$0	$0	$136,000	$136,000
If Fuel Cell	$0	$0	$720,000	$720,000
AT PZEVs	$0	$8,800	$19,200	$28,000
PZEVs	$0	$15,180	$60,720	$75,900
Total				
If City	$0	$23,980	$175,920	$199,900
If Full Function	$0	$23,980	$215,920	$239,900
If Fuel Cell	$0	$23,980	$799,920	$823,900

As is shown in Table 5.5, the addition of LDT2 vehicles to the sales base has no impact in Stage I, due to the fact that the phase-in of LDT2 vehicles only begins in 2007. In Stage II there is no impact on pure ZEV cost, because under the "worst case" production scenario used here manufacturers have sufficient banked credits to cover the entire pure ZEV obligation even accounting for the addition of LDT2 vehicles. There is, however, an increased cost in Stage II for the AT PZEV and PZEV categories. The full effect of the addition of LDT2 vehicles to the base is felt in Stage III and beyond.

Once again, the incremental costs shown in Table 5.5 above are already included in Tables 5.2 and 5.3 above, which take into account the addition of LDT2 vehicles to the sales base. Removal of LDT2s from the sales base thus would decrease the totals given in Tables 5.2 and 5.3.

5.4 Potential Impact on Dealerships

The extent to which motor vehicle dealerships are affected by the current ZEV regulation, or the amended regulation, depends on the specifics of the interaction between the dealership and the manufacturer. During the course of the last biennial review in September 2000 dealership representatives stated their concern that they would be forced to absorb increased costs stemming from the increased incremental cost of vehicles produced to meet the regulation. Staff is

unable to estimate the magnitude of any such effect. It is clear, however, that by reducing total program costs the proposed amendments would also reduce any cost impact on motor vehicle dealerships.

5.5 Potential Impacts on Vehicle Operators

As is the case with dealerships, the impact of the current regulation or the amended regulation on vehicle purchasers will depend on the extent to which manufacturers choose, and are able, to pass along any increased costs. Once again, staff cannot estimate the extent to which this would occur, but it is clear that the proposed amendments would serve to reduce any possible cost increases for vehicle purchasers as compared to the current regulation.

5.6 Potential Impact on Business Competitiveness

Because the proposed amendments are anticipated to reduce costs faced by California businesses, they would have no adverse impact on the ability of California businesses to compete with businesses in other states.

5.7 Potential Impact on Employment

The proposed amendments are not expected to cause a noticeable change in California employment because California accounts for only a small share of motor vehicle and parts manufacturing employment.

5.8 Potential Impact on Business Creation, Elimination or Expansion

The proposed amendments are not expected to affect business creation, elimination or expansion.

5.9 Potential Costs to Local and State Agencies

The proposed amendments are not expected to result in an increase in costs for state and local agencies.

6. ENVIRONMENTAL IMPACTS

This section includes a discussion of the emission impacts of the proposed regulatory amendments, the model used to determine the emissions, and the assumptions made concerning the emissions.

6.1 Introduction

The Mobile Source Emission Inventory, EMFAC2002, was used to assess the emission impacts of the current regulation as amended by the 2001 ZEV amendments adopted in final form on April 12, 2002, and the proposed amendments. Using EMFAC, staff modeled various implementation scenarios applicable to the South Coast Air Basin representing the emissions from vehicles subject to this regulation. This includes passenger cars and light-duty trucks weighing less than 3,751 pounds gross vehicle weight (LDT1s), plus light duty trucks weighing less than 8,500 pounds gross vehicle weight (LDT2s) phased in beginning in 2007.

In summary, the proposed amendments would temporarily reduce the required number of pure ZEVs to one half the current requirement. The new requirement for pure ZEVs would be 1 percent in 2005 through 2008 and 1.25 percent in 2009 through 2011. The current regulation requires 2 percent in 2005 through 2008 and 2.5 percent in 2009 through 2011.

After 2011 there is no modification to the percentage ZEV requirements. The pure ZEV requirement is 3 percent from 2012 through 2014, 4 percent from 2015 through 2017, and 5 percent from 2018 through 2020 in both the 2001 amendments and the staff proposal. The number of pure ZEV vehicles required under the staff proposal in 2012 and beyond will decrease slightly due to minor changes in the credit value earned by vehicles in those years. The number of AT PZEV vehicles likewise will change slightly, assuming that manufacturers choose to take advantage of that option.

6.2 Emissions Scenarios and Assumptions

To determine the emission impact of the proposed amendments, staff prepared emission estimates for the South Coast Air Basin using the current and proposed regulations. In both cases staff used the worst case (free credit trading and no voluntary production) scenario. For the reference or baseline emission values staff used the assumptions contained in the December 8, 2000 ZEV Program Regulations amendments staff report.

- The current regulation scenario assumes that all manufacturers take full advantage of the 6 percent PZEV option, and take full advantage of the AT PZEV option beginning in 2008. Prior to that date manufacturers would make

partial use of the AT PZEV option, as outlined in Section 3.6.1 above. Although the current regulation requires that compliance begin in 2003, for purposes of this emission analysis we assume that the start of the program is delayed until 2005. Other than that the compliance structure and credit values are taken from the 2001 amendments.

- The proposed amendments scenario assumes that manufacturers take full advantage of the PZEV option, and take full advantage of the AT PZEV option beginning in 2008. Prior to that date manufacturers would make partial use of the AT PZEV option, as outlined in Section 3.6.1 above. The compliance structure and credit values are taken from the staff proposal.

The net impact of the staff proposal would result in a decrease in the number of ZEVs and an increase in the number of AT PZEVs as compared to the 2001 amendments.

Tables 6.1 and 6.2 below present the difference in direct emissions for the South Coast Air Basin in 2010 and 2020 for the staff proposal as compared to the 2001 amendments. As shown in the Table 6.1, staff estimates that the proposed changes will result in a net decrease of about 0.04 tons per day of direct emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx) in 2010 as compared to the 2001 amendments. For 2020, Table 6.2 shows a net decrease of about 0.1 tons per day of direct emissions of ROG and NOx from the proposed amendments when compared to the 2001 amendments.

Table 6.1
Summertime Direct Emissions, South Coast Air Basin in 2010
(Tons per day)

	ROG	NOx	CO	PM
NO ZEVs	155.50	144.24	1574.80	5.85
2001 Amendments	155.13	143.28	1570.85	5.85
Proposed 2003 Amendments	155.10	143.27	1570.82	5.85
Net change from 2001 Amendments	-0.03	-0.01	-0.03	0
Net change from no Program	-0.40	-0.97	-3.97	0

Table 6.2
Summertime Direct Emissions, South Coast Air Basin in 2020
(Tons per day)

	ROG	NOx	CO	PM
NO ZEVs	90.86	67.81	807.38	7.20
2001 Amendments	88.07	65.86	790.89	7.18
Proposed 2003 Amendments	87.98	65.85	790.41	7.18
Net change from 2001 Amendments	-0.09	-0.01	-0.48	0
Net change from no Program	-2.88	-1.96	-16.97	-0.02

The ZEV program, with the proposed amendments, remains beneficial to air quality. Tables 6.1 and 6.2 list the total emissions benefits compared to having no ZEV program. Staff estimates the proposed amendments will reduce approximately 1.37 and 4.84 tons per day of ROG and NOx by 2010 and 2020, respectively, as compared to the "No-ZEV" case.

In addition to direct vehicle emissions, staff considered the indirect emissions that result from vehicle refueling, fuel transport, fuel processing, and feedstock extraction. As direct emissions decrease, indirect emissions represent a larger share of the total emissions that are attributed to vehicle operations. ARB staff did not provide updated estimates of indirect emissions as part of this analysis. With regard to indirect emissions attributable to hydrogen fuel cell vehicles, taking into account the limited number of vehicles affected by the proposed amendments emissions from hydrogen production are expected to be extremely low and comparable to emissions from the production of electricity for battery zero emission vehicles. Based on contract work performed by Acurex Environmental (now part of TIAX) in 1996 and updated in 1999, staff projects that that the impacts from the staff proposal on indirect emissions will be negligible.

"Fleet Turnover" Effect

During the development of the 2001 amendments, General Motors Corporation filed extensive written comments asserting that the ZEV regulations will ultimately increase rather than decrease emissions. GM claimed that this will happen because assumed increases in the prices of new California cars and light trucks resulting from the ZEV mandate will depress sales of new vehicles, to the extent that emission increases from the greater number of higher-emitting older vehicles on the road due to reduced "fleet turnover" will more than offset the emission decreases attributable to the presence of ZEVs in the new vehicle fleet. To support this position, GM relied on a report dated January 2001 by National Economic Research Associates, Inc. and Sierra Research, Inc. entitled Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study (the NERA/Sierra Report).

The ARB staff analysis of these arguments was outlined in the ARB Staff Review of Report Entitled "Impacts of Alternative Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study". The ARB staff review concluded that the NERA/Sierra report significantly overstated the purported effect of the ZEV program on fleet turnover and resulting fleetwide emissions. Major considerations included:

- The cost increases assumed by NERA/Sierra were overstated.
- Manufacturers will not necessarily be able to pass along all increased costs.
- Small price increases can be addressed by a variety of manufacturer marketing practices and will not necessarily reduce sales.
- The NERA/Sierra emission modeling failed to take into account recent changes to the LEV II program.

The ARB staff analysis went on to demonstrate that when using more reasonable ARB staff assumptions rather than the assumptions used in the NERA/Sierra analysis, the NERA/Sierra model projected an average per vehicle increased cost of roughly $25 to $40 rather than the $250 to $400 estimated in the NERA/Sierra report. Staff believed that at these modest levels, such increases would have an insignificant effect on vehicle sales. Even if one accepts the NERA/Sierra premise that any cost increase, no matter how small, will reduce vehicle sales, staff concluded that the 2001 amendment version of the ZEV program will still result in an emission decrease, rather than the emission increase alleged in the NERA/Sierra report.

The proposed changes put forth in the staff proposal serve to reduce the number of pure ZEVs that will be needed in model years 2005-2011 as compared to the 2001 amendments. As is shown in Table 5.4 above, this will significantly reduce the cost of the ZEV program to manufacturers. The estimated savings range from $375 million to almost $3.7 billion over the 2005-2011 transition period, depending on the types of vehicles manufacturers choose to build.

In addition, staff's estimate of the incremental cost of a PZEV has been further reduced from the level assumed in the 2001 rulemaking. Based on staff's analysis of recently certified PZEVs, staff now concludes that the incremental cost to build a PZEV is $100 per vehicle rather than the $200 per vehicle assumed in the Staff Review and the 2001 Final Statement of Reasons. Although the cost difference per vehicle is small, it has a large effect on the total cost of the program given the large number of PZEVs that will be built as compared to the other vehicle types. (Under the vehicle production scenarios outlined in Section 5, in 2011 there will be some 663,000 PZEVs produced versus roughly 90,000 AT PZEVs and ZEVs). The reduction in estimated total incremental cost to manufacturers over the 2005-2011 transition period due to this reduced PZEV cost is roughly $350 million.

Moreover, the analysis conducted as part of the 2001 rulemaking did not take into account the use of banked credits. As is shown in the worst case scenario outlined in Section 5 above, the use of banked credits could under some circumstances allow manufacturers to significantly reduce or eliminate the production of pure ZEVs during the early years of the program. This would serve to dramatically reduce manufacturer compliance cost from the levels assumed in the NERA/Sierra report.

Based on the above considerations, staff concludes that the modified ZEV program described in the staff proposal will have an even smaller effect on fleet turnover than the 2001 amendment version. Given that the effect of the 2001 amendment version was demonstrated to be minimal, staff concludes that fleet turnover will likewise play a minimal role under the staff proposal.

Finally, staff also notes that a recent RAND report entitled Driving Emissions to Zero – Are the Benefits of California's Zero Emission Vehicle Program Worth the Costs? contains an evaluation of the fleet turnover effect. The authors chose not to include any fleet turnover effect in their quantitative emission and cost effectiveness analyses. They instead address it in narrative form as an "uncounted potential cost," stating that "While this feedback is possible in principle, we found that there is a great deal of uncertainty about its size." (RAND page xviii). More specifically, after summarizing previous work on the topic the report contains the following evaluation:

> There are good arguments on both sides of this debate. The ZEV program does create a cost of selling an additional ICEV in states that have adopted the program. Simple models of profit maximization conclude that manufacturers set prices on products according to the costs of producing and selling those products. The ZEV program creates no additional costs in states that have not adopted the program, so prices should not rise in those states. Complications in the real world raise doubts about this reasoning, however. First, competition from small- and intermediate-volume manufacturers not subject to the pure ZEV portion of the program may dissuade the large-volume manufacturers from concentrating price increases in California. Now that the cutoff between intermediate- and large-volume manufacturers has risen to 60,000 vehicles per year (from 35,000 previously), large price increases by large-volume manufacturers may have real consequences for their market share. Second, manufacturers have spread costs outside the markets that generate them in a number of circumstances. Dixon and Garber (1996) were told by observers inside and outside the auto industry that companies typically spread vehicle transportation and delivery costs across geographic areas. The Green Car Institute found that manufacturers had recently dropped the $100 typically added to a vehicle's retail price to cover California emission requirements because "from a market standpoint the automakers viewed the separate charge for

> the California emissions programs as negative to their other marketing efforts" (Green Car Institute, 2001, p. 24). Manufacturers may be less likely to spread costs if the additional costs are large (as opposed to modest, as in the case of transportation and shipping charges); but in any case, uncertainty remains about the ZEV program's effect on new vehicle prices and any consequent indirect effect on fleet emissions in California.
>
> Even if manufacturers spread costs nation- or even worldwide, there may be some reductions in new vehicle sales and, consequently, increase in emissions both inside and outside California. Thus, consideration of the ZEV program's feedback on new vehicle sales would lead to an increase in the cost-per-ton estimates presented here, but the overall significance of the effect is uncertain. (RAND, pages 93-94).

6.3 Other Environmental Media

ZEVs can provide significant positive contributions in other environmental media. Just as gasoline refining, marketing, and distribution result in air pollution emissions, they likewise result in water pollution due to leaks, spills, and wastewater discharge, and are a source of hazardous waste. Given the relatively small changes in near term fleet composition that result from the proposed amendments, staff expects no significant negative impact in these environmental areas.

6.4 Energy Diversity and Energy Demand

Reducing demand for gasoline can have important benefits for California. A reduction in demand could help reduce potential shortages of cleaner-burning California gasoline and thereby help stabilize prices. A successful effort to reduce gasoline demand would also reduce the need for additional refining, transportation and distribution facilities, thus preventing additional air and water pollution as noted above. The placement of ZEVs and AT PZEVs will provide reductions of CO_2 emissions and other greenhouse gases.

Battery and hydrogen ZEVs, which use electricity directly and indirectly, provide significant alternative fuel benefits because electricity can be produced from a variety of non-petroleum energy sources. Moreover, because electricity and hydrogen can be produced from renewable resources such as solar, wind, or hydropower, or biomass feedstocks, the increased use of ZEV can help pave the way towards a sustainable energy future.

7. COST – EFFECTIVENESS

This section discusses the cost-effectiveness of the various elements of the ZEV program. Determining the cost-effectiveness of the ZEV program has always been more difficult and uncertain than for other regulatory measures due to the far-reaching nature of the program. Predicting the future cost of technologies that are still in the demonstration stage is difficult at best. In addition, the ZEV program has always combined two distinct objectives -- first, achieving emission reductions today through expanded introduction of commercially available near-zero emission technology, and second, accelerating the development of pure ZEV technologies that have the potential to provide significant air quality benefits over the long term, but have minimal immediate air quality impact given their pre-commercial status and limited production.

Cost-effectiveness is a measure of the cost incurred to achieve a specific outcome, as compared to other ways to reach that same end. Thus it is appropriate to separately consider the two distinct objectives outlined above.

Near Term Emission Reductions

The first objective – achieving emission reductions today -- involves the PZEV and AT PZEV options included within the program. These options encourage the mass-market production of commercially available technologies.

Table 7.1 below shows the lifetime emission reductions achieved by a PZEV and HEV PZEV as compared to a conventional SULEV meeting the 0.5 grams per test evaporative emission standard. These values are taken from the 2001 Final Statement of Reasons and are based on information prepared by staff and used by Toyota in its comments on the 2001 staff proposal.

Table 7.1
Lifetime Emission Benefits

Vehicle Type	NMOG (g/mile)	NOx (g/mile)	150,000 mile ROG + NOX (pounds)	Benefit vs. SULEV/0.5 evap (pounds)
SULEV/0.5 evap	0.0703	0.0266	32.02	0.00
PZEV	0.0577	0.0256	27.52	4.50
PZEV HEV	0.0477	0.0251	24.05	7.97

Table 7.2 below shows the cost-per-ton of emissions reduced for each technology, given the incremental cost per vehicle assumed for Stage I, Stage II, Stage III, and 2012 and beyond. Incremental costs are taken from Table 5.1 in Section 5 above.

Table 7.2
Dollars per Ton of Emission Reduction

	Stage I	Stage II	Stage III	2012+
Vehicle Type				
AT PZEV				
Incremental Cost	$2,300	$500	$200	-$300
Dollars per Ton	$577,164	$125,471	$50,188	-$75,282
PZEV				
Incremental Cost	$100	$100	$100	$100
Dollars per Ton	$44,444	$44,444	$44,444	$44,444

Long Term Emission Reductions

The second objective of the program is to accelerate the development of pure ZEV technology to achieve significant future air quality benefits. This is accomplished by the pure ZEV obligation within the program.

In proposing amendments to the regulation in 2001, ARB staff provided data to the Board that showed that in the early years of the ZEV program the dollars spent per ton of pollutant reduced would be much higher than for any other ARB regulatory measure. The Board, however, voted unanimously to maintain the program because of its belief that the ZEV program needs to be viewed and considered on a long-term basis. Simply put, the Board has expressed confidence in the technical capability of industry to reduce cost such that the long-term costs of ZEVs will be comparable to conventional vehicles.

Table 7.3 below shows the lifetime emission reductions achieved by ZEVs as compared to a conventional SULEV meeting the 0.5 grams per test evaporative emission standard. As was the case with the PZEV and AT PZEV estimates given above, these values are taken from the 2001 Final Statement of Reasons and are based on information prepared by staff and used by Toyota in its comments on the 2001 staff proposal.

Table 7.3
Lifetime Emission Benefits

Vehicle Type	NMOG (g/mile)	NOx (g/mile)	150,000 mile ROG + NOX (pounds)	Benefit vs. SULEV/0.5 evap (pounds)
SULEV/0.5 evap	0.0703	0.0266	32.02	0.00
ZEV (BEV)	0.002	0.0003	0.76	31.26

Table 7.4 below shows the cost-per-ton of emissions reduced for a hydrogen fuel cell vehicle, given the incremental cost per vehicle assumed for Stage I, Stage II, Stage III, and 2012 and beyond. Incremental costs are taken from Table 5.1 in Section 5 above.

Table 7.4
Dollars per Ton of Emission Reduction

	Stage I	Stage II	Stage III	2012+
Vehicle Type				
ZEV (fuel cell)				
Incremental Cost	$1,000,000	$300,000	$120,000	$10,000
Dollars per Ton	$63,979,527	$19,193,858	$7,677,543	$639,795

Clearly the dollars per ton estimates given above greatly exceed those for other air pollution control measures. They must, however, be viewed in the context of the objective that the Board is trying to achieve. The purpose of the pure ZEV obligation within the ZEV program is to maintain significant pressure on manufacturers to continue ZEV technology development. Staff knows of no other mechanism that can accomplish this objective in a more economical fashion.

In addition, the staff expects that the long-term cost of ZEV technology will decline beyond the cost estimates shown here. The Board's confidence in the ability of engineering and manufacturing improvements to reduce cost is rooted in the history of vehicular air pollution control programs. Not only were the PZEV and AT PZEV technologies not commercially available when the Board first adopted the ZEV program in 1990, they were not even envisioned or thought possible. Now they are mass-market products with low incremental costs, spurred on by the pressure provided by the ZEV mandate.

The staff expects the same progress to occur with the next generation of technology, such as fuel cell vehicles. The Board's long-term vision is that zero emission vehicles will be cost effective when compared to conventional vehicles. The notion that such vehicles will one day be cost competitive is supported by the tremendous investments being made by all of the automakers. Automakers have invested several billion dollars to date in developing fuel cell technology and have publicly stated plans to continue heavy investment in the next decade. Staff believes it is unlikely that this level of investment would exist or continue without a belief on the part of the automakers that there is a long-term business case to be made for the profitable mass production of fuel cell vehicles.

ARB staff has proposed amendments that provide generous credits for ZEVs during what is referred to as the developmental stage. The proposed amendments are designed to leverage manufacturer investments, and consequently require a relatively small incremental cost to industry during this timeframe. At the same time, the proposed amendments provide certainty that automakers will continue their efforts and send an important signal to industrial suppliers regarding California's commitment to ZEV technologies.

8. SUMMARY AND STAFF RECOMMENDATION

8.1 Summary of Staff Proposal

As presented in the previous sections, the staff proposal addresses the preemption concerns raised in the industry lawsuit by removing all references to fuel efficiency. In addition, proposed amendments are included to maintain pressure on the commercialization of ZEV technologies while at the same time reflecting the current state and cost of ZEV technology.

The staff proposes that the Board make the following specific amendments:

2005 Program Restart. Restart the ZEV requirement in 2005 while allowing manufacturers to earn and bank for future use credit earned by any vehicles produced prior to 2005.

Amend AT PZEV Calculation Method. Staff proposes amendments that remove all references to fuel economy in the calculation of AT PZEV allowances. The resulting restructuring of the calculation method includes several elements that simplify the structure of the calculation. Staff also proposes amendments that would establish flat allowances for advanced componentry for HEVs and gaseous storage systems. Staff recommends a revised calculation of the low fuel-cycle emissions allowance. The allowance for zero emission vehicle miles traveled for hybrid electric vehicles is adjusted upward and the phase in multiplier for AT PZEVs with any zero emission vehicle miles traveled is increased under staff's proposal. Post 2011, staff proposes amendments that cap the total AT PZEV allowances that can be earned by any technology type at 3.0. Finally, staff proposes amendments such that each element of AT PZEV allowance calculation may be severed from the remainder of the program if warranted.

Amend ZEV Calculation Method. Staff proposes amendments that remove the efficiency multiplier from the ZEV allowance calculation. To restructure the ZEV allowance calculation, staff proposes a series of amendments aimed at simplifying the calculation and at encouraging sustainable commercialization of ZEVs. Staff proposes amendments to create ZEV "types" that will be the basis for the ZEV allowances. These types include NEVs, Type 0 (utility low-range ZEVs), Type I (mid-range ZEVs like City electric vehicles), Type II (longer-range ZEVs like full-function battery EVs) and Type III (long range, fast-refueling ZEVs like fuel cell vehicles). The staff's proposed amendments do not change the amount of credit earned by NEVs. Type 0 ZEVs earn 1.5 credits until 2008 and then 1 credit for 2009 and beyond under the proposal. Type I, II, and III ZEVs earn an increased level of credits in staff's proposal through the 2011 timeframe. In 2012 and beyond, Type II vehicles (City EVs) continue to earn somewhat enhanced credits as compared to the 2001 amendments while credits for other vehicles are similar to the 2001 amendments.

Additional changes are proposed to the ZEV credit calculations that reflect the above changes to the structure of the calculation and experience with the program to date. These proposed changes include amendment of the fast refueling definition and elimination of the in-service/warranty credit.

Amendment of Compliance Options. The 2001 amendments allow automakers to satisfy up to half of the pure ZEV requirement with certain other advanced technologies that are not ZEVs. Staff proposes amendments providing that during a transition period of 2005 through 2011 automakers are allowed to satisfy up to three-quarters of the pure ZEV portion of the ZEV requirement with such vehicles. This adjustment to the amount of AT PZEV credit that can be used to satisfy the pure ZEV requirement has been proposed to create a slower ramp up of volumes of pure ZEVs and to encourage an increase in AT PZEV volumes in the early years.

Additionally, staff proposes amendments that remove ZEVs from the sales volume used to calculate the ZEV requirement and that eliminate the cap on use of banked NEV credits when used for the PZEV or AT PZEV compliance options.

Miscellaneous Changes. The 2001 amendments require HEVs to have a 15-year/150,000 mile warranty on the battery. Staff is proposing amendments that reduce this requirement to 10-years/150,000 miles. Staff also proposes amendments to extend the sunset date on the award of "transportation system" credits from 2007 to 2011, remove credits earned by vehicles from the cap on the use of transportation system credits, and clarify the regulatory definition of placed in service.

LDT2 Vehicles. Staff proposes that the Board reconsider and affirm its January 2001 action to add LDT2 vehicles to the base against which manufacturers' ZEV compliance options are calculated.

8.2 Issues

As described in Section 2, staff is continuing to explore additional amendments to the ZEV regulation. The public process of comment and consensus building has been useful and productive. Not all of the concepts that may have merit for the package of proposed amendments have been incorporated into this staff report and the proposed regulatory language. This section briefly describes several open areas of discussion that will continue to be explored during the 45-day comment period and may be presented as part of a modified staff proposal for the Board's consideration.

8.2.1 Floor for ZEVs to Prevent Complete "Blackout"

Staff has received significant comment from interested parties that a blackout of ZEV product availability due to credits earned in years prior to the start of the regulation is possible under both the 2001 amendments and the staff proposal. It has been suggested that staff include a requirement that some quantity of ZEVs be produced in each model year or each stage to ensure that product is available throughout the implementation of the program and to ensure that manufacturers maintain their efforts towards ZEV commercialization. Such a floor requirement could take one of several forms in the regulation. It could be accomplished by requiring a minimum number of ZEV allowances to be earned from ZEVs built in the compliance model year or stage. It could also be accomplished by capping the amount of the ZEV obligation that can be met with banked ZEV credits.

8.2.2 Minimizing the Impact of Section 177

Section 177 of the Clean Air Act allows other states to adopt California's motor vehicle programs. Auto manufacturers have expressed concern that the ZEV program obligations in California are multiplied across other states that have adopted California's ZEV program. This is of particular concern when considering a fuel cell vehicle compliance approach as the volumes necessary to comply are challenging under the California program and even more difficult when considering other states as well. It has been suggested that Type III ZEVs placed in any state that has adopted California's ZEV program be allowed to count towards California's ZEV requirement.

8.2.3 Minimum Requirements for Advanced Componentry Credit

Under the 2001 amendments a vehicle must obtain a minimum of 13 percent of its peak power from electric drive in order to earn advanced componentry credit. The staff proposal adds an alternative path under which 8 percent peak power, plus at least 10 kW of motor power, would suffice. The intent of this restriction is to ensure that vehicles earning advanced componentry credit make use of technical approaches that advance ZEV commercialization. Staff anticipates further discussion as to methods that provide a reasonable floor but allow flexibility for differing manufacturer engineering approaches.

8.2.4 ZEV Credit for Fueling Infrastructure Deployment

At the workshop held on December 5, 2002, staff proposed the generation of credit from the installation of refueling stations that support ZEVs, such as hydrogen refueling stations. While discussion on the appropriateness of such credit has continued, a clear method and appropriate credit levels have not been worked out. The current proposal does not include this credit element as it was felt further development of the credit structure is needed. Preliminary work on this topic suggests that public infrastructure programs deploying significant

numbers of ZEV refueling facilities in California could earn AT PZEV credit. Such credit could depend on the number of ZEVs that could be supported daily by such stations. For private infrastructure, credit could depend on automaker submittal of proposals to the Executive Officer for large scale deployment of private ZEV refueling infrastructure where these systems would be delivered and installed along with the purchase or lease of individual ZEVs. These systems might include, for example small, privately owned reformers, compressors, and pumps for home refueling of ZEVs that would address the challenging early stage deployment of public hydrogen infrastructure.

8.2.5 ZEV Credit for Placement of Stationary Fuel Cells

It has been suggested that the development of fuel cell technology for automobile applications benefits greatly from the improvement and demonstration of the same fuel cell stack technology in stationary applications. Staff has received requests that credit be granted for placement of stationary fuel cells as a means to further development and to reduce costs for eventual commercialization in vehicles.

8.2.6 Encouragement for Production of Model Year 2003 and 2004 PZEVs

Under the staff proposal, manufacturers' compliance obligations do not begin until 2005. However, some manufacturers have the capability to produce PZEVs beginning in 2003 consistent with the requirements of the 2001 amendments as evidenced by the PZEV certification of seven models to date. Staff anticipates discussion as to measures that would encourage manufacturers to voluntarily produce quantities of model year 2003 and 2004 PZEVs, in order to take advantage of these potential air quality benefits.

8.2.7 Specialty Vehicles

Under the 2001 amendments, specialty vehicles that are built on the same platform and use the same battery and drivetrain as an existing vehicle can earn credit according to the characteristics (range) of the base vehicle. This provision was originally drafted in order to avoid penalizing special purpose vehicles such as Postal EVs that use the same components as the base vehicle but have reduced range due to their modified design. This provision as drafted does not accommodate vehicles that are not based on existing ZEVs. Staff invites comment on measures to ensure that such specialty vehicles receive appropriate credit levels under the staff proposal.

8.2.8 Length of Placement

The 2001 amendments do not address how long a vehicle that earns pure ZEV credit must remain in service. ARB staff has become aware of several instances where credit-earning ZEVs have been removed from service prematurely or have

been offered for very short lease terms. This has called into question the appropriateness of allowing such vehicles to earn credit towards compliance with the ZEV regulation since these vehicles are not making any contribution to California's air quality and were removed by the manufacturer. Staff anticipates discussion of measures that would provide incentives for the sale or longer-term lease of vehicles.

8.3 Staff Recommendation

The ARB staff recommends that the Board amend section 1962, Title 13, California Code of Regulations, and the incorporated "California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes". The proposed amendments to section 1962 are set forth in the Proposed Regulation Order in Appendix A.

9. REFERENCES

Atwood, Paul et al., *Degree of Hybridization Modeling of a Fuel Cell Hybrid Electric Sport Utility Vehicle*, SAE 2001 World Congress, Detroit, MI, March 5-8, 2001

Anderman, Menahem, Kalhammer, Fritz and MacArthur, Donald, *Advanced Batteries for Electric Vehicles: An Assessment of Performance, Cost and Availability*, The Year 2000 Battery Technology Advisory Panel, June 22, 2000

Anderman, Menahem, *The 2002 Industry Report – A Critical New Assessment of Automotive Battery Trends,* Advanced Automotive Batteries, April 2002

Arthur D. Little, Inc., *Projected Automotive Fuel Cell Use in California*, consultant report prepared for the California Energy Commission, Sacramento, CA, October 2001

California Air Resources Board, *Staff Report, 2000 Zero Emission Vehicle Program Biennial Review*, August 7, 2000

California Air Resources Board, *ARB Staff Review of Report Entitled "Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study"*, October 31, 2001

California Air Resources Board, *Staff Report: Initial Statement of Reasons, Proposed Amendments to the California Zero Emission Vehicle Program Regulations*, December 8, 2000

California Air Resources Board, *Final Statement of Reasons, Amendments to the California Zero Emission Vehicle Program Regulations*, December 2001

DeCicco, John, M., *Fuel Cell Vehicles: Technology, Market, and Policy Issues*, Society of Automotive Engineers, Warrendale, PA, 2001

Delucchi, M., Burke, Any, Lipman, Tim, Miller, Marshall, *Electric and Gasoline Vehicle Lifecycle Cost and Energy-Use Model*, Institute of Transportation Studies, University of California, Davis, March 2000

Dixon, L., Porche, I., Kulick, J., *Driving Emissions to Zero: Are the Benefits of California's Zero Emission Vehicle Program Worth the Costs?*, RAND, 2002

Ford Motor Company, "Ford Combines Hybrid and Fuel Cell Technology in All-New Focus Sedan," press release, Dearborn, MI, March 20, 2002

Friedman, D., et al. *Hybridization: Cost and Efficiency comparisons for PEM Fuel Cell Vehicles*, 2000 Future Technology Transportation Conference, Costa Mesa, CA, August 21-23, 2000

Lipman, T., *The Cost of Manufacturing Electric Vehicle Drivetrains,* Institute for Transportation Studies, University of California, Davis, May 1999

Lipman, T., *The Cost of Manufacturing Electric Vehicle Batteries*, Institute for Transportation Studies, University of California, Davis, February 1999

Matsumoto, Tadaicha, et al., *Development of Fuel Cell Hybrid Vehicle*, Toyota Motor Corporation, EVS-18, Berlin, Germany, October 2001

National Economic Research Associates, Inc. and Sierra Research, Inc., *Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study*, January 2001

Truett, Richard, "GM and Toyota turn up heat on hybrids," Automotive News article, Detroit, MI, January 6, 2003

Unnasch, Stefan, and Browning, Louis, *Refinement of Selected Fuel-Cycle Emissions Analyses*, Prepared for the California Air Resources Board, Arthur D. Little, Inc., February 2000

Yamanashi, F. and Isaya, M., *Development of Nissan's Direct Hydrogen Fuel Cell Vehicle*, Nissan Motor Company, EVS-18, Berlin, Germany, October 2001

APPENDIX A: PROPOSED AMENDMENTS

1. Proposed Regulation Order: Amendments to the Zero-Emission Vehicle Regulation

   Attached

2. Proposed Amendments to California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes (incorporated by reference in section 1962, title 13, California Code of Regulations)

   Copies of the Test Procedures are available on the ARB's Internet site at http://www.arb.ca.gov/regact/zev2003/zev2003.htm, or may also be obtained by contacting the agency contact person for this rulemaking, Thomas Evashenk, at (916) 445-8811 or via email at tevashen@arb.ca.gov.

APPENDIX B: DESCRIPTION OF LITIGATION INVOLVING THE ZERO EMISSION VEHICLE REGULATION