State of California
Environmental Protection Agency
AIR RESOURCES BOARD

AMENDMENTS TO THE CALIFORNIA
ZERO EMISSION VEHICLE PROGRAM REGULATIONS:

TREATMENT OF MAJORITY OWNED SMALL OR INTERMEDIATE VOLUME MANUFACTURERS AND STANDARDIZATION OF BATTERY ELECTRIC VEHICLE CHARGING SYSTEMS FOR THE ZERO EMISSION VEHICLE PROGRAM

FINAL STATEMENT OF REASONS

May 2002

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State of California
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Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Responses

PROPOSED AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE PROGRAM REGULATIONS:

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Public Hearing Date: June 28, 2001

A

INTRODUCTION

On June 28, 2001, the Air Resources Board (ARB or "Board") conducted a public hearing to consider amendments to sections 1900(b) and 1962(b) of title 13, California Code of Regulations (CCR), and the adoption of section 1962.1. The amendments would make two sets of changes to the California Zero Emission Vehicle (ZEV) regulations. These proposed changes are: (1) requiring aggregation of vehicle sales volumes of two auto manufacturers in determining whether either manufacturer is a small or intermediate volume manufacturer subject to less stringent ZEV requirements, whenever one has a majority ownership interest in the other, and (2) requiring a single charging system, on-board conductive, for most battery electric vehicles (EVs) and grid-connect hybrid electric vehicles (HEVs) beginning with the 2006 model year.

An Initial Statement of Reasons for Proposed Rulemaking (ISOR) was made available to the public starting May 11, 2001. The ISOR, which is incorporated by reference herein, contained a description of the rationale for the proposed amendments. This Final Statement of Reasons for Rulemaking (FSOR) updates the ISOR by identifying and explaining the modifications that were made to the original proposal. The FSOR also summarizes the written and oral comments received during the rulemaking process, and contains the ARB's responses to those comments.

At the hearing, the Board adopted Resolution 01-19, in which it approved the original proposed amendments with several modifications. With one exception, the modifications had been suggested by staff in a June 22, 2001 document entitled

"Staff's Suggested Modifications to the Original Proposal", that was distributed at the hearing and was Attachment B to the Resolution. The one additional modification approved by the Board pertained to provisions covering the aggregation of vehicle sales volumes of manufacturers in majority ownership situations. The modifications to the original proposal are summarized in section B of the FSOR.

In accordance with section 11346.8 of the Government Code, the Board's Resolution directed the Executive Officer to make the text of the modified amendments, with appropriate additional conforming modifications, available to the public for a supplemental written comment period of at least 15 days. He was then directed either to adopt the amendments with such additional modifications as may be appropriate in the light of comments received, or to present the regulations to the Board for further consideration if warranted. In preparing the modified regulatory language after the hearing, the staff identified various additional modifications that were appropriate to best reflect the intent of the Board. These supplemental modifications were incorporated into the text of the proposed amendments, along with the modifications specifically approved at the hearing.

A *"Notice of Public Availability of Modified Text*", along with the full text of the proposed modifications to the regulatory text, and a copy of Resolution 01-19, was mailed on March 01, 2002 to each of the individuals that provided written or oral comments during the 45-day public comment period, or at the June 28, 2001 public hearing, as well as other parties identified in section 44(a) title 1, CCR, and various other parties. Three comments were received. After considering the comments received during this supplemental public comment period, the Executive Officer then adopted the amendments as they had been made available for supplemental comment.

The Board has determined that this regulatory action will neither create costs nor savings as defined in Government Code section 11345.5(a)(6) to any State agency, nor affect federal funding to the State. The Board has also determined that these amendments will not create costs or impose a mandate upon any local agency or school district, whether or not it is reimbursable by the State pursuant to Part 7 (commencing with section 17500) Division 4, title 2 of the Government Code, and will not affect other non-discretionary savings to local agencies.

Incorporated Documents

The regulation incorporates by reference SAE Surface Vehicle Recommended Practice J1772, "*SAE Electric Vehicle Conductive Charge Coupler", Revised November 2001*, into section 1962(b), title 13, CCR. The regulation identifies the incorporated SAE document by title and date. The SAE document is published by the Society of Automotive Engineers, an entity well known to the directly affected parties, and is therefore reasonably available to the public and affected industry.

J1772 is incorporated by reference because it would be impractical to print the document in the California Code of Regulations. Existing ARB administrative practice has been to incorporate by reference SAE standards and recommended practices.

(See, e.g., sections 1968.1(f) and 2180.1(a)(24).) The SAE standard would also be difficult to publish, since it is copyrighted material. Also, incorporation by reference makes it easier for manufacturers to know the exact requirements in other regulations.

Regulatory alternatives for the amendments covering treatment of small or intermediate majority owned manufacturers included: (1) taking no action, (2) amending the definition to define operationally independent, or (3) applying certain U.S. EPA Compliance Assurance Program (CAP) 2000 provisions. Deferring regulatory action was rejected because it would not achieve equity in the way manufacturers are treated for determining their ZEV production requirements. Manufacturers were asked to further define operationally independent. Staff was unable to combine the manufacturers' characterizations of operationally independent into a single clear and enforceable definition and no reasonable consensus could be reached. Lastly, the CAP 2000 approach was rejected, due to comments from vehicle manufacturers that it was too restrictive for application to ZEV program requirements.

ARB also considered alternatives to the proposed infrastructure standardization regulation. The alternatives considered were (1) taking no action, (2) implementing a voluntary public policy initiative, and (3) alternative charging standards. Taking no action and waiting for market forces to move the industry to a standardized system was tried five years ago with no success. The industry remains evenly divided, with no prospects for progress within the foreseeable future. The public policy initiative was rejected because of the limited chance of success and the high costs that it would impose on other government agencies. Finally, alternative charging standards were not recommended, because of their high costs, and lessened ability to incorporate future technology development, such as vehicle-to-grid charging.

The Board has determined that no alternative considered by the agency, or that has otherwise been identified and brought to the attention of the agency, would be more effective in carrying out the purpose for which regulatory action was proposed, or would be as effective and less burdensome to affected private persons, than the action taken by the Board.

B

MODIFICATIONS MADE TO THE ORIGINAL PROPOSAL

This section describes the original proposal and the modifications that were made to the original proposal. These modifications were made as a result of comments received during the 45-day public comment period and to clarify the regulatory language. Consistent with the ISOR, the description of the modifications is separated into two parts. Part I summarizes modifications pertaining to treatment of majority owned small and intermediate volume manufacturers, and Part II summarizes modifications pertaining to requirements of standardized charging systems for battery electric vehicles and some hybrid electric vehicles. These modifications are described below.

ZEV Program Requirements

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

As presently in effect, the ZEV regulations require that 10 percent of the passenger cars and light-duty trucks produced and delivered for sale in California for all but small volume manufacturers be ZEVs – vehicles with no emissions. Manufacturers may use partial credits of 0.2 or more generated from vehicles with extremely low emissions (referred to as partial ZEV allowance vehicles or PZEVs) to meet the 10 percent ZEV requirement. However, large-volume manufacturers must, at a minimum, have 4 percent of their California fleet of passenger cars and lightest trucks be vehicles classified as "full" ZEVs. Auto companies can earn extra ZEV allowances by introducing vehicles before the 2003 model year, thereby reducing their total ZEV obligation. Extra allowance is also available for battery electric vehicles with more than a 100-mile range per charge. The ZEV program also includes a marketable credits system.

At a January 25, 2001, hearing, the Board approved major changes to the ZEV regulations that will significantly reduce the number of ZEVs required during the near term. The amendments will result in an increase in the number of ZEVs and advanced technology vehicles over time. The amendments were resubmitted to the Office of Administrative Law April 12, 2002. At the January 25, 2001, hearing, the Board did not resolve all issues raised. Among other things, it directed staff to investigate joint ownership issues associated with the treatment of small and intermediate volume manufacturers, and issues regarding battery electric vehicle (EV) charger standardization.

Overview of Original Proposal

The regulation was structured to make two changes to the ZEV program. The first change, discussed in Part 1 of the ISOR, modifies the way vehicle production volumes and associated ZEV requirements are calculated for a manufacturer that is majority owned by another manufacturer. The second change, discussed in Part II of the ISOR, would add requirements for a single charging system for battery electric vehicles and grid-connect hybrid electric vehicles.

Part I - Treatment of Majority Owned Small or Intermediate Volume Manufacturers

ARB adopted modifications to ZEV requirements at a public hearing held on January 25, 2001. At that meeting, the Board also asked staff to investigate joint ownership issues associated with the treatment of small and intermediate volume vehicle manufacturers. The ZEV requirement for California vehicle manufacturers is determined by the volume of passenger cars and light-duty trucks each manufacturer produces and delivers for sale in California. Vehicle manufacturers are classified as small, intermediate or large volume.

Small volume manufacturers are not subject to the percentage ZEV requirements, and an intermediate volume manufacturer may satisfy its entire ZEV requirements with partial ZEVs. Large manufacturers must produce specific numbers of ZEVs. In recent years, there has been consolidation among vehicle manufacturers. As a result of these consolidations, it is difficult to delineate individual manufacturers to determine their vehicle volume status for purposes of complying with ZEV requirements. Clarifying these joint ownership relationships will ensure that all manufacturers are treated equitably.

The proposed amendments changed the definition of small and intermediate volume manufacturers to clarify how companies that are partially or wholly owned are treated in determining ZEV requirements. The California sales of two or more manufacturers would be aggregated if one has a greater than 50 percent equity ownership in the other.

The aggregation requirements would become applicable in the 2003 model year, since that is the first model year in which the percentage ZEV requirements apply. As originally proposed, a manufacturer who ceases to be a small or intermediate volume manufacturer in the 2003 model year due to the new aggregation requirements in majority ownership situations would become subject to the stepped up requirements in the 2006 model year - four years after the 2002 model year.

Part II – Standardization of Charging Systems

At the January 25, 2001 public hearing, the Board also asked staff to investigate issues regarding battery electric vehicle charging standardization. After conducting comprehensive technical analyses of the need for standardization and regulatory options, ARB staff proposed adding requirements for a single charging system. The

proposed amendment would apply to all battery electric vehicles that earn 1.0 or greater ZEV credit and extended range hybrid electric vehicles, beginning in the year 2006. Staff recommended that charging requirements be applicable to 2006 and later model year vehicles. The regulation would require electric vehicles subject to the ZEV regulation to use a standardized connector (or plug), and an on-board battery charger, with a specified minimum output. The regulation will result in a standardized charging system, in which all vehicles are compatible with all charging stations.

The current situation of multiple charging systems and plugs has been identified as a major barrier to the successful implementation of the ZEV program. It would be somewhat analogous to a situation in which different gasoline vehicles used different pumps and gas nozzles, and not all gas stations had all of the required pumps and nozzles. Standardization will greatly benefit the consumer by increasing consumer confidence in electric vehicle (EV) technology, and, as well, ensuring access to public charging. In addition, future industry costs will be reduced. It costs less to maintain one technology as opposed to multiple charging technologies.

Modifications to the Original Proposal

Part I - Treatment of Majority Owned Small or Intermediate Volume Manufacturers

Section 1900(b)(18) and Section 1900(b)(19), title 13, California Code of Regulations

The subsection numbering has been changed from 1900(b)(17) and 1900(b)(18) to 1900(b)(18) and 1900(b)(19). These changes correct errors in the original Proposed Regulation Order, which did not accurately reflect the existing numbering in Barclays California Code of Regulations.

Section 1962(b)(4), title 13, and Section 1962(b)(5), title 13, California Code of Regulations

The Board modified the lead-time provisions where a manufacturer ceases to be a small or intermediate volume manufacturer due to application of the new aggregation provisions to a change of owership that occurred prior to the 2001 model year, in other words, prior to this rulemaking. In such situation, the two manufacturers were not aware of the new aggregation requirements at the time of acquisition and additional lead time until the 2010 model year was given to make product plan changes as appropriate.

Section 1962(b)(5)(A) and (B) in the original proposal has been reorganized and headings added, to improve the clarity of the regulation. The modifications are explained in “commentaries” shown along with the modified text made available with the Notice of Availability of Modified Text.

Finally, new language in section 1962 (b)(5)(c) clarifies how production volumes for the three previous consecutive model years are to be calculated in change of ownership

situations. This change has been made to ensure consistency with preexisting regulatory principles.

Part II – Standardization of Charging Systems

Section 1962.1, subsection (a), title 13, California Code of Regulations

Original subsections (a) and (c) are combined in a revised subsection (1) entitled "Applicability", to avoid any confusion from separate provisions on what the regulation applies to and does not apply to. This modification is non-substantive.

The exclusion of neighborhood electric vehicles (NEVs) in the original subsection (c) is eliminated as unnecessary, since in the 2006 and subsequent model years NEVs do not qualify for a 1.0 or greater ZEV credit and on that basis will not be subject to charging requirements.

The reference to "extended range" hybrid electric vehicles (HEVs) has been removed, because that term is not being used in the final version of the pending ZEV 2001 amendments. Also the pending ZEV 2001 amendments no longer provide that extended range HEVs qualify towards the top 2 percent ZEV requirement.

The final regulation order makes all grid-connect (and thus chargeable) HEVs subject to charging requirements. Also, minor language has been added for Level 1 charging, reflecting staff's original intent; without this change, grid-connected hybrids would be subject to additional Level 1 charging requirements that battery electric vehicles are not subject to. Given the exclusion regarding Level 1 charging, the removal of the 20 mile all-electric range for hybrid electric vehicles does not have any practical effect on the applicability of charging provisions.

Section 1962.1, subsection (b), title 13, California Code of Regulations

Two clarifications that affect applicable definitions have been incorporated. A statement was added that the definitions in section 1962 are applicable; this addition was necessary in order to have the section 1962(I) definition of battery electric vehicle apply. In addition, the definition of Level 1 charging is moved to this section, and a minor clarification was added to this definition.

Section 1962.1, subsection (c), title 13, California Code of Regulations

Subsection (c) was re-lettered, and information originally in subsection (d) was moved to subsection (c). Subsection (c) also includes the exact title of SAE J1772. Now that SAE J1772 has been adopted, it is referenced in place of the draft that had been referenced in the original proposal. The statement that the 1996 version of SAE J1772 no longer applies is now unnecessary, since the draft 2001 version has been adopted. These changes are non-substantive.

C

Table 1
TABLE OF ACRONYMS USED

AC	Alternating Current
ACP	AC Propulsion
ALA	American Lung Association
AMPS	Amperage
APA	Administrative Procedures Act
APCD	Air Pollution Control District
AQMD	Air Quality Management District
AVCON	Term for conductive connector; also references manufacturer of conductive connector
BAAQMD	Bay Area Air Quality Management District
(C)ARB	California Air Resources Board
CCR	California Code of Regulations
CEC	California Energy Commission
CEV	City Electric Vehicles
DC	Direct Current
EPRI	Electric Power Research Institute
EVI	Electric Vehicle Infrastructure (Inc.)
EVSE	Electric Vehicle Supply Equipment
(B)EV	Battery Electric Vehicle
EVC3	Electric Vehicle Conductive Charging Coalition
FSOR	Final Statement of Reasons
GFCI	Ground Fault Control Interrupter
GM	General Motors
HEV	Hybrid-Electric Vehicle
IEC	International Electrotechnical Commission
ISOR	Initial Statement of Reasons
IWC	Infrastructure Working Council
JEVA	Japan Electric Vehicle Association
kVA	Kilovolt Amps
Kw	Kilowatt
NEV	Neighborhood Electric Vehicle
OAL	Office of Administrative Law
OEM	Original Equipment Manufacturer
PEVDC	Production Electric Vehicle Drivers Coalition
PZEV	Partial Zero Emission Vehicle
SAE	Society of Automotive Engineers
U/L	Underwriters Laboratory
ZEV	Zero Emission Vehicle

D

SUMMARY OF PUBLIC COMMENTS SUBMITTED DURING 45-DAY PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

The Board received written and oral comments in connection with the June 28, 2001 hearing. Set forth below is a summary of each objection or recommendation specifically directed at the proposed amendments or to the procedures followed by the ARB in proposing or adopting the amendments, together with the agency response.

The comments have been grouped by topic whenever possible. Comments not involving objections or recommendations specifically directed towards the rulemaking are for the most part not summarized below. Table 1 lists the persons and organizations that provided comments, either written or oral, during the 45-day public comment period.

TABLE 2

LIST OF PERSONS AND ORGANIZATIONS THAT SUBMITTED COMMENTS DURING 45-DAY PUBLIC COMMENT PERIOD

COMPANY TITLE	Type of Comment	COMMENTATOR
County of Mendocino	Written	Mr. Chris Brown
Toyota Technical Center, U.S.A	Written, Oral	Mr. Michael Wolterman Mr. Dave Baxter
EVI-Electric Vehicle Infrastructure	Written, Oral	Mr. David L. Packard
General Motors	Written	Mr. Alan R. Weverstad, Director
Nissan Technical Center North America	Written, Oral	Mr. Eiichi Matsumoto Mr. Robert Cassidy
Butte County Air Quality Management District	Written	Ms. Gail Williams
Adobe Systems Inc.	Written	Mr. Terence Dowling
Ford Motor Company	Written, Oral	Mr. Kelly M. Brown, Mr. Rich Bell
Sacramento Municipal Utility District	Written	Mr. Jon Bertolino
	Written, Oral	Mr. Tim Hastrup
Bay Area Air Quality Management District	Written, Oral	Ms. Ellen Garvey Mr. David Burch
American Lung Association	Written, Oral	Mr. Kenneth D. Smith
Electric Vehicle Conductive Charging Coalition	Written, Oral	Ms. Sheral Arbuckle Mr. Craig B. Toepfer
	Written	Mr. Thomas Dowling
	Written	Mr. Phil Karn
	Written	Mr. Bruce Parmenter
	Written	Mr. Bill Hamilton

	Written	Mr. Rory Jaffe
	Written	Mr. Ray Levinson
	Written	Mr. Will Beckett
	Written	Mr. Earl A. Killian
	Written	Mr. Leni Goldberg
	Written	Mr. Kingsley Chen
	Written	Mr. Alec Proudfoot
	Written	Mr. Keith Bierman
	Written	Mr. Paul Rissman
	Written	Mr. David Raboy
	Written	Mr. Dean Grannes
	Written	Mr. Bob Wing
	Written	Mr. Otmar Ebenhoech
	Written	Mr. James F. Montgomery
	Written	Mr. Mike Brown and Ms. Shari Prange
	Written	Mr. Peter Belden
	Written	Mr. Bob Westman
	Written	Mr. Doug Pratt
	Written	Mr. Jason France
	Written	Mr. Frederick G. Fischer
	Written	Mr. Ron Fischer
	Written	Mr. James P. Eniti
	Written	Mr. Peter VanDerWal
	Written	Mr. Scott Hull
	Written	Mr. Jon Pullen
	Written	Mr. Steve Haley
	Written	Mr. Ed Thorpe
	Written	Mr. Lou MacMillan
	Written	Mr. David Butcher
	Written	Mr. Joel Meyn
	Written	Mr. Bill Mason
	Written	Mr. Ben White
	Written	Mr. Gregory West
	Written	Mr. Gardner L. Harris
	Written	Mr. Dave Shepperd
	Written	Mr. Chris Sanders
	Written	Mr. Mike Thompson
	Written	Mr. Greg Brewsaugh
	Written	Mr. Steven Dibner
	Written	Mr. Michael H. Schwabe
	Written	Mr. Ed Miller

	Written	Mr. Chris Reeves
	Written	Mr. Joshua Mark
Energy Control Systems Engineering, Inc.	Written, Oral	Mr. Greg Hanssen
		Mr. Derrell Piper
Ebus, Inc.	Written	Mr. William G. Webster, Jr.
DaimlerChrysler Corporation	Written	Mr. Reg Modlin Mr. Fred Maloney
	Oral	Mr. Steve Heckeroth
AeroVironment, Inc.	Written, Oral	Dr. Paul MacCready, Mr. Dale Foster
Analog Power Design, Inc.	Written	Christopher P. Henze, Ph.D.
BIW Connector Systems, LLC	Written	Mr. Eckhard S. Konkel
Japan Electric Vehicle Association	Written	Shoji Tange
Sierra Research, Inc.	Oral	Mr. Thomas C. Austin
AC Propulsion	Oral	Mr. Alec N. Brooks
Mojave Desert Air Quality Management District	Written	Mr. Chales L. Fryxell

Part I Treatment of Majority Owned Small or Intermediate Volume Manufacturers

1. Comment: The combined revisions of the pending 15-day notice for the ZEV amendments considered at the January 2001 Board Hearing and the charging standardization and multi-manufacturer provisions proposed by staff will overall negatively impact the Ford Motor Company's ability to meet the ZEV regulation. We have incorporated the most recent expected revisions into our plan both positive and negative, and we are penalized over 10,000 credits by 2008. There are no immediate actions that Ford can take to revise our products towards meeting the new goals because essentially we have no lead-time. ARB also committed to helping industry reach resolution in the northeast and resolution has not been reached. ARB should delay implementation of the ZEV mandate until the 2004 model year (MY) or later. These substantive revisions which more than double the base volume subjected to the mandate, affect how the regulation applies to manufacturers, and reduce the credit of planned vehicles by up to 40% should be thoroughly reviewed and allowed public comment and a hearing. (*Ford Motor Company*)

Agency Response: ARB recognizes that the proposal to aggregate in situations of majority ownership is in addition to other changes proposed at the January 2001 Board Hearing which overall may have the affect of increasing Ford Motor Company's ZEV requirements. However, the goal of this proposal is to ensure that all manufacturers in joint ownership situations are treated equitably. We believe that it is appropriate to aggregate the sales volumes of wholly owned subsidiaries in determining the ZEV requirements. The owner of the wholly owned subsidiaries controls the subsidiaries and the subsidiaries have access to the resources of its parent company.

ARB also recognizes that majority owned manufacturers and their owners have relied on the existing regulatory requirements in developing their plans for implementing the

ZEV requirements. In recognition of this, a modification to the proposal has been made to extend the lead-time for manufacturers that are now in majority owned relationships. For manufacturers whose status is changed by the aggregation amendments and became majority owned prior to the 2001 model year, the expanded ZEV requirements start with the 2010 model year instead of the 2006 model year as originally proposed.

2. Comment: Ford urges ARB to maintain the "operationally independent" framework and clarify the definition using current categorizations of manufacturers as the basis of the definition. *(Ford Motor Company*)

Agency Response: In the absence of clear directions in the current regulatory language, the current approach used to determine manufacturers' vehicle volume status is based on a principle of "operationally independent". Application of this principle has been somewhat uncertain, difficult to apply, and subject to individual interpretation. ARB staff must evaluate each new ownership arrangement on a case-by-case basis. One of the alternatives to the proposal was to develop a definition of "operationally independent" and include it in the regulation. Manufacturers were asked at a public workshop in March 2000 how they would interpret a company's operational independence. ARB staff was unable to combine the manufacturers' definitions received into a single clear and enforceable definition. No reasonable consensus could be reached.

In addition, considerations of fairness and equal treatment also support the aggregation amendments. Whether or not a majority owned manufacturer is maintained as "operationally independent", it ultimately can have access to the resources of other commonly-owned manufacturers.

3. Comment: The annual cost for Ford to meet the additional ZEV requirements as a result of the staff proposal for multi-manufacturer ownership relationships would be far in excess of the $2.6 million quoted by the ARB in the Staff Report. Instead of $2.6 million a year, it's over $10 million a year. The discrepancy in the cost is due to ARB using higher credits per ZEV and lower dollar amounts per credit. Additionally, with the phase-in of the ZEV mandate and all vehicles up to 8500 lbs., the cost in future years would increase dramatically. (*Ford Motor Company*)

Agency Response: ARB staff estimated that the cost of the original proposal for Ford Motor Company (Ford) is $2.6 million for the 2006 model year. This is due to an additional 165 pure ZEVs and 953 advanced technology PZEVs (AT PZEVs), an 11 percent increase for each vehicle type from the current requirements. This estimate is based on the assumption that Ford would satisfy the ZEV requirements with 20 percent pure ZEVs, 20 percent AT PZEVs and 60 percent PZEVs. This estimate also includes savings of $2.2 million to Ford due to approximately 4,300 less PZEVs required. This cost estimate is based on 1999 vehicle volumes and is the initial cost of the proposed amendment for the first year. Future year costs are likely to be less as the costs of ZEVs and AT PZEVs are reduced.

Ford Motor Company has not provided details of its cost estimates, thereby making comparisons difficult. ARB staff does not believe that the discrepancy in cost is due to ARB using higher credits per ZEV. Instead the discrepancy may be due to a difference in cost per vehicle. ARB staff has used an incremental cost estimate - the production costs above those for a conventional gasoline vehicle - to estimate vehicle cost. The basis of Ford's cost per vehicle estimates is not known.

Lastly, because of the changes to the proposal adopted by the Board, vehicle manufacturers will not have any direct impacts over the next several years since Ford's current subsidiaries will not be treated as part of a large volume manufacturer until the 2010 model year. This change will allow substantial lead time that will greatly reduce economic impacts.

4. Comment: Product planning is already under way for 2006 MY, and there is insufficient time for Ford to make cycle plan changes to accommodate for increased ZEV and AT PZEV requirements. (*Ford Motor Company*)

Agency Response: ARB recognizes that majority owned manufacturers and their owners have relied on the existing regulatory requirements in developing their plans for implementing the ZEV requirements. In recognition of this a modification to the proposal was made to extend the lead-time. For manufacturers whose status is changed by the aggregation amendments and became majority owned prior to the 2001 model year, the expanded ZEV requirements start with the 2010 model year instead of the 2006 model year as originally proposed.

5. Comment: The multi-manufacturer proposal should apply equally to all manufacturers; however, as presented in the proposal, the aggregation will only significantly affect Ford. (*Ford Motor Company*)

Agency Response: The goal of this proposal is to ensure that all manufacturers in joint ownership situations are treated equitably.

In the past, Volvo and Jaguar after being purchased by Ford have asked ARB to be treated for ZEV requirement purposes as operationally independent. ARB staff agreed at the time of the requests. However, ARB staff now believe operational independence is not an equitable criterion for determining the status of manufacturers and the associated ZEV requirements. Applying the principle of operationally independent has been difficult due to the complexity of each manufacturer's situation and whether it fits the complex and somewhat ambiguous definition of operationally independent. Further, these decisions were subject to individual interpretation on a case-by case basis. Thus, a clear line needed to be established in the ZEV regulations to ensure that all manufacturers in joint ownership situations are treated equitably.

This proposal primarily affects Ford because they have been treated as operationally independent in the past. However, there are other companies that are wholly owned by another company and the volumes have been aggregated for ZEV requirement

purposes. For example, General Motors wholly owns Saab. Neither GM nor Saab has requested to be treated as operationally independent. The volumes of these two companies are currently aggregated to determine ZEV requirements. In terms of equity, the volumes of Ford's wholly owned companies should also be aggregated.

6. Comment: Jaguar, Aston Martin, Volvo and Land Rover are wholly owned subsidiaries of Ford and are operationally independent. *(Ford Motor Company*)

Agency Response: ARB staff believes that it is appropriate to aggregate the sales volumes of wholly owned subsidiaries in determining the ZEV requirements. The owner of the wholly owned subsidiaries controls the subsidiaries and the subsidiaries have access to the resources of its parent company. See also the above response to the preceding comment.

7. Comment: DaimlerChrysler is neutral on the staff proposal for multi-manufacturer ownership relationships so long as manufacturers are treated equally. DaimlerChrysler takes issue with how the ARB has interpreted operational independence. Mercedes-Benz USA and the DaimlerChrysler Corporation are wholly owned subsidiaries of DaimlerChrysler AG yet remain operationally independent. The Staff Report indicates that Mercedes-Benz and the DaimlerChrysler Corporation are combined, while showing other companies with 100 percent owned companies as operationally independent. We do not believe that this is equal treatment. *(DaimlerChrysler Corporation)*

Agency Response: Daimler Benz AG (Mercedes-Benz) acquired Chrysler Corporation in 1998 to create DaimlerChrysler AG. At the time of the acquisition it was explained to ARB staff that DaimlerChrysler AG was one company. However, as ARB prepared to go forward with these modifications, DaimlerChrysler wrote to ARB staff asking that Mercedes-Benz and Chrysler Corporation be considered operationally independent. Based on current information, ARB staff does not believe that Mercedes-Benz and the Chrysler Corporation as wholly owned subsidiaries of DaimlerChrysler AG should be treated as operationally independent.

In this respect, Mercedes-Benz would be treated the same as Saab, which is a wholly-owned subsidiary of General Motors. We note, however, that in this situation Mercedes-Benz would have considerable leadtime before losing the ability to comply with the ZEV regulation with 100 percent PZEVs as an intermediate volume manufacturer. Since the ZEV regulation does not impose percentage ZEV requirements until the 2003 model year, the provisions on increases in a manufacturer's California production volume only refer to increases in the 2003 and subsequent model years. Thus where a merger in the late 1990's eliminated operationally independent manufacturing units, the ARB treats that change as occurring in the 2003 model year. Under the amendments to section 1962(b)(5) adopted following the January 2001 Board hearing, a company that stopped being operationally independent in the late 1990's will no longer be able to take advantage of its prior small or intermediate volume status starting in the 2008 model year – six years after the 2002 model year.

Part II Standardization of Charging Systems for Battery Electric Vehicles

A. LET THE MARKET DECIDE

8. Comment: CARB should not take action to decide between conductive or inductive charging technologies and should let the market decide. The marketplace will reward the system that meets the consumer's requirements. (*Toyota*)

Let the market decide. CARB should be spending all of its time trying to get more EV's out there. (*J. Mark)*

Agency Response**:** ARB agrees that the preferred approach is for the marketplace or industry to decide. That is the approach that ARB selected five years ago. At that time, ARB was considering a regulatory proposal similar to that now adopted by the Board. However, based on industry recommendations, ARB deferred regulatory action to allow time for an industry or market selection of the standardized charging system. This is discussed on page 15 of the *Initial Statements of Reasons for Rulemaking* (ISOR).

Unfortunately, the approach of deferring the selection process to voluntary industry efforts or market forces has failed to achieve any progress in the implementation of a standardized charging system. Five years have passed since ARB deferred regulatory action and a significant number of EVs have been marketed. The industry remains evenly divided between competing and incompatible charging systems; auto manufacturers have not provided any commitments to resolve this issue in the next few years; and there is no non-regulatory selection process available that would allow for a decision to be reached.

The need for standardization is compelling. Although currently the number of EVs is just over 2,000, it is expected that approximately 100,000 vehicles will be on the road by the year 2010. The use of incompatible charging systems with such a large number of vehicles would result in considerable costs to maintain competing technologies. Also it would result in considerable confusion to drivers and potential consumers. The lack of standardization decreases the access and net capacity of the public charging network, and also results in higher costs. Because two technologies must continue to be supported, public and private sponsors pay significantly higher costs to maintain and expand California's public charging network.

Most importantly, the lack of a standard charging system is a major barrier to marketing EVs to the consumer. As ZEV requirements increase from 2003 and onwards, the program's success depends on consumer acceptance of the technology. Consumer acceptance is greatly impacted by the lack of a single charging system. The consumer expects that, similar to gasoline vehicles, every pump (or charger) will fit every vehicle. The lack of a single charging standard contributes to the public perception that the EV market is not yet mature.

9. Comment: We should wait (*and not adopt staff proposals)* to see how many and what kind of EVs are manufactured. And if one kind of car *(conductive or inductive charged EVs)* stops being manufactured, then the decision is made. And this is where the marketplace decides, not at the charger level, but at the vehicle level. *(T. Dowling)*

Agency Response: The EV industry has supported incompatible charging systems for over ten years. ARB has already tried the approach of waiting for a market or industry decision, and this has not resulted in any progress. Please refer to response to Comment #8. The commentator is suggesting that we defer any action on standardization until only cars with one charging system are being manufactured. There are two problems with this approach. Of greatest concern is that it would take many years, perhaps over a decade, to achieve standardization. Second, it does not provide for planning of resources to ensure a smooth transition to a standard.

The seven largest auto manufacturers are currently evenly divided between the inductive and conductive charging systems and have made no commitments to resolve this issue by the year 2006. If standardization does not occur by the year 2006, ARB estimates that over 10,000 battery EVs would be on the road without a standard charging system. If a decision is not reached until the year 2010, when it is estimated in excess of 100,000 vehicles would be on the road, then there could be five times as many vehicles without the charging system selected by ARB. Thus, it is quite feasible that waiting for industry or market decision would result in more, not fewer, vehicles with incompatible charging systems, thus moving California further away from (and not closer to) standardization.

Finally, planning to ensure a smooth transition to a standard is a critical concern with public infrastructure. Public charging sponsors, infrastructure service providers, and equipment manufacturers need sufficient time for planning to ensure that the necessary resources are available to support California's important public charging network.

10. Comment: Mandating conductive charging will have large negative consequences for the EV market now in its infancy. Government is overstepping its bounds here and the market should be allowed to decide; the rivalry between inductive and conductive charging is healthy for public EV charge site funding and maintenance. *(G. Hansen)*

Agency Response: The benefits of standardization are discussed on pages 13-15 of the ISOR. ARB disagrees with the assertion that standardization will have negative consequences for the EV industry. In fact, the benefits of standardization for industry will be very positive. These include benefits to automotive and equipment manufacturers, infrastructure service providers, and sponsors of California's public charging network.

The most important of these are the benefits to the consumer that directly benefit the auto manufacturers. A single charging system will increase consumer confidence in the technology, and removes a major barrier to the expansion of the consumer market.

Expanding the consumer market will help ensure the long-term success to auto manufacturers that are required to produce and place EVs in California.

In addition, the costs for maintaining and servicing charging equipment will decrease, as it will cost less to maintain one technology versus multiple competing technologies. This is expected to not only translate into lower consumer costs, but also encourage additional service providers and equipment manufacturers to become competitive and benefit from participation in this developing industry.

ARB disagrees that competition between conductive and inductive charging technologies has had any positive benefits for public charging. In fact, it has contributed to higher costs for sponsors of public charging. To begin, it must be clarified that the selection of a charging system is currently a decision made by the auto manufacturer. Vehicles are manufactured to be compatible with either the inductive or conductive system, but not both. Public charging sponsors respond to the decisions made by auto manufacturers and thus endeavor to install charging equipment to support the vehicles being produced and driven. The competition between inductive and conductive charging proponents only results in higher costs to install and maintain public charging, because where only one charging station would be required with a standardized system, two or more charging stations are needed to accommodate all of the vehicles on the road. Thus, the current situation has had a detrimental, not a positive, impact on the cost to install and maintain California's public charging network.

11. Comment: The ISOR does not present any overriding reason why standardization should be required. (General Motors*)*

Agency Response: ARB has identified substantial justification for the proposed charging infrastructure standard. The justification for standardization is set forth in the ISOR at pages 13-16. The assertion that ARB needs a "strong overriding reason that the selected design is crucial to the proper charging of ZEVs" is not an accurate statement of the law. As noted in the responses to Comments #8 and #9, the ARB has already tried to "let the market decide," and that approach has failed.

12. Comment: The ARB staff did not adequately justify why any regulatory standard for EV chargers was necessary at all. *(General Motors)*

Agency Response: The ISOR sets forth sufficient grounds for the adoption of the standardization regulation. The need for standardization is set forth in the ISOR at pages 13-16.

13. Comment: Let the marketplace decide whether on-board or off-board charging will prevail. Facilitated by two levels of standardization (*on and off board charging*), EVs will become more attractive to consumers and more widely used. The marketplace would eventually tell whether the economics of on-board or off-board charging will dominate. (*AeroVironment, Inc.)*

Agency Response: Please refer to responses to Comments #8 and #9 regarding the effectiveness of postponing a decision until the "market place decides." Off-board chargers have significantly higher system costs than on-board chargers, as discussed on page 33 of the ISOR. This is because with an on-board charging system, only one charger is needed. The charger goes where the vehicle goes, eliminating the need for installation of a charger at each place where a vehicle needs to be charged. This is an important consideration, as it is estimated that there are currently more than 2 charging stations per EV in California.

In addition, the current costs for the off-board conductive charging equipment is dramatically higher than for the on-board conductive system, as discussed on page 30 of the ISOR. The greatest benefit to the consumer is with an on-board charging system, because costs are kept to a minimum.

14. Comment: Too extreme to require only one charging standard. We want to see as many EV's as possible, conductive or inductive, but I understand why we need a standard, and given what I know conductive seems like the best choice. (*P. Belden)*

Agency Response: This commentator appears to accept the need for a standardized charging system and supports the selection of conductive, but states that requiring a standard may be too extreme. Please refer to responses to Comments #8, #9, and #10 on the need and benefits of standardization.

15. Comment: I don't want one standard imposed, drivers of internal combustion engines can choose between gasoline, diesel, ethanol, etc., why should EV drivers not be able to choose? (*G. Brewsaugh)*

Agency Response: This comment is not directly relevant to this rulemaking. However in response to the comment, the commentator has confused the fuel choice with the fueling infrastructure. Within each fuel (gasoline, diesel, e.g), there is one system for delivering it to the vehicles. Having several EV charging options would be similar to having different gas nozzles and pumps required for different vehicles. Imagine the confusion that would result if a Honda Civic required a different gasoline pump and nozzle than a Toyota Camry, and not all gas stations had all of the different pumps and nozzles.

16. Comment: While DaimlerChrysler supports conductive charging as the preferred method for recharging EVs, we believe that there is too little market data available on which to base this rulemaking. (*DaimlerChrysler)*

Agency Response: ARB disagrees with the comment about the availability of market data. The conductive and inductive systems considered for the standard have been used in California for nearly a decade. The selection of an EV charging system as the standard was based on a thorough, comprehensive, and technical evaluation of information, utilizing objective data and input from all available sources. The

comprehensive technical evaluation undertaken by ARB included an evaluation of market data and also involved extensive public and stakeholder input.

B. TIMING OF PROPOSAL/REQUEST TO DELAY DECISION

17. Comment: It is too soon to adopt a charging standard. *(Nissan)*

Agency Response: Please refer to responses to Comments #8 and #9 on the benefits of standardization. The benefits of standardization will be more difficult to achieve if a decision is delayed. Postponing a decision will result in increased costs as well as greater inconvenience to consumers. As discussed on page 16 of the ISOR, delaying the decision on standardization by only three years is expected to result in thousands of EVs marketed with incompatible charging systems. The costs of retrofitting charging stations to the new standard will increase substantially as the number of EVs increases. The best time to standardize is when EV volumes are low.

18. Comment: The Japan Electric Vehicle Association (JEVA) is an organization that promotes the electric vehicle and hybrid EVs in Japan and deals with international standards for various types of EVs. JEVA has actively been participating in the International Electrotechnical Commission (IEC) meetings where recent discussions on standardizing charging systems for EVs have taken place. With the international standardization of charging systems currently making steady progress, we feel it is premature for ARB to eliminate the inductive charging system and decide the conductive charging system is to be the single unified charging system. *(JEVA*)

Agency Response: Refer to the response to Comment #17 about the impacts of delaying a decision on charging standardization. Appropriate standards in the U.S have already been established for charging. While ARB would like to support international standardization efforts, we cannot delay important programs in California while waiting for international standards to be developed. Additionally, establishing or supporting international charging standards is not within the scope of ARB responsibilities and duties. ARB is relying on national standards developed by the Society of Automotive Engineers and other industry standard setting organizations. These standards are widely accepted throughout the automotive industry.

19. Comment: It is too soon to choose either charging system (*conductive or inductive)* as a single standard. They both need more time to mature. (*Toyota)*

Agency Response: ARB disagrees that the inductive and conductive system needs additional time to mature. In fact, both the inductive and conductive charging systems have matured into attractive consumer products that meet the needs of the users. Both inductive and conductive charging equipment have been sold and used in the consumer market for nearly a decade. This equipment has undergone extensive testing and product development, and complies with established industry standards for safety and durability. While products can always continue to be refined, the basic charging equipment designs have been well established and proven.

20. Comment: There has been insufficient time in the market to judge the real world durability of the conductive connector. *(Nissan)*

Agency Response: ARB disagrees that the durability of the conductive connector has not been demonstrated. In fact, both the conductive connector and inductive connector have had time to be judged in the real world market over the last decade. Both the inductive and conductive connectors have successfully passed extensive laboratory testing to verify durability and safety. The current version of the butt and pin conductive connector (also referred to as the Avcon connector) has been tested in the laboratory and durability verified for up to 10,000 insertions (the industry requirement).

21. Comment: The information currently available to select either an inductive or conductive connector standard is neither complete nor comprehensive due to the limited in-use market data for the newer conductive connector. It is simply too soon to make a choice, and further market experience will ultimately choose the connector that clearly addresses the preferences of the users. (*Toyota, General Motors, Nissan)*.

Agency Response: Please refer to responses to Comments #16, #19, and #20 regarding ARB's comprehensive technical analysis, available market data, and maturity of charging systems. Also, it should be emphasized that the current butt and pin (Avcon) conductive connector is not "new." As discussed on page 31 of the ISOR, improvements have only been made to the manufacturing process; these improvements include higher-grade plastic and improved production mold. These changes are part of usual ongoing product improvement efforts undertaken by manufacturers. However, the basic connector design has not changed. This is in contrast to the inductive connector, which has had a major redesign of the connector. The redesign of the inductive connector includes a smaller size and new communications system (replacement of high frequency alternating current with infrared communication).

22. Comment: We request that the proposed regulatory changes be set aside, or at least delayed, pending additional study because the connector technology recommended by staff is immature and expensive, and the standard will serve as a barrier to the development of fast charging technology. *(BIW Connector Systems)*

Agency Response: Please refer to response to Comments #19, #20, and #21 regarding maturity of the connector technology. ARB has already performed a comprehensive assessment of both the conductive and inductive charging systems. Further study will only delay the benefits of standardization and is not likely to result in additional information because ARB has already evaluated all of the available data.

The charging standardization requirements are not applicable to off-road or heavy-duty vehicle technology, or vehicles that will only be fast charged. Therefore, it should not impact development of fast charging technology. The primary barriers to fast charging technology, as discussed on page 39 of the ISOR, are the high cost of the off-board

chargers and the ability of the vehicle's traction battery to accept a high current without adverse effects, and not issues related to the specific connector utilized.

23. Comment: Our company manufactures electric buses and we have had the opportunity to use the Avcon connectors recommended for standardization and to work with the manufacturer, Avcon. In the process of equipping the Los Angeles Department of Water and Power fleet with Avcon connectors, we found that Avcon connectors work poorly and constantly break. We have also experienced poor customer service. Please review Avcon's track record and customer service in addition to the technical considerations before making this decision. *(Ebus, Inc.)*

Agency Response: In response to the comment on Avcon's customer service, there is nothing to preclude additional manufacturers from producing the connector. They can pay an up-front licensing fee of $100,000 to Avcon, or manufacture the connector based on the design specifications included in SAE J1772.

Please see response to Comment #20 regarding durability of the conductive connector. The durability of the conductive connector has been well demonstrated for light duty passenger EVs covered by this rulemaking. The type of usage that charging equipment (including connectors) are subject to in industrial and heavy duty fleet operations is often quite different than the typical consumer or light duty fleet usage. Since, the charging regulation only covers light duty EVs, bus manufacturers are free to use any connector that they feel is best suited to their vehicles and users.

24. Comment: Our company is trying to implement an automatic mechanical car parking system in the Los Angeles area. We are also trying to implement EVs, up to 300, to provide an inter-modal means of transportation. This type of application should be evaluated in terms of which type of charger and connector to standardize. You should not make a decision now because I don't think we have all the pertinent information on this application to make a decision today. *(Hans-Henning Judek*)

Agency Response: ARB's selection of conductive charging was based on a comprehensive technical analysis of fifteen separate criteria. Special consideration was given to eight criteria identified as "high priority." High priority was assigned to those criteria that provide the greatest contribution of supporting EVs, enhancing consumer acceptance, and supporting market development.

ARB disagrees with the commentator that auto docking charging systems were not considered by ARB. In fact, as discussed on page 41-42 of the ISOR, auto docking was one of the fifteen criteria that ARB considered. ARB evaluated the status of conductive and inductive auto docking technology development, as well as the prospects for commercialization of auto docking systems. ARB concluded that auto docking was not one of the eight "high priority" criteria because the commercialization of this application is not very promising due to the lack of resources or industry commitments to move the technology from product concept into commercial products by the regulatory implementation date (2006).

25. Comment: There is no precise understanding of the cost impacts for a transition to a single standard. The Staff states that $1.4M to $2M costs to transition to a conductive standard will be funded through yet to be determined government agencies and public sponsors. Such funding sources are very uncertain, particularly given the experience to date. The infrastructure requirements, the economic impacts and projected resolutions should be completed prior to accepting the Staff's recommendation. (*General Motors)*

Agency Response: At the time of the staff analysis, transition costs could only be estimated due to lack of product plan information from vehicle manufacturers. Further, without product plan information it would be difficult to develop a transition plan. In addition, ARB believes it would be difficult to develop a transition plan while stakeholders continue to be devoted to and promote a particular charging system. Thus, it is necessary to first determine a standard charging system based on a comprehensive assessment of cost and market considerations, consumer concerns, and technology advancement. Then proceed with a transition plan to implement the standard. ARB is coordinating a stakeholder group that has met over the last two years that is now working on the best way to maintain and expand California's public charging, and effect a smooth transition to the new standard.

26. Comment: We are recommending an alternative to selecting a single connector standard at the June 28 Board hearing. Our alternative consists of the following: 1) Delay for one year the Board decision of selecting a single EV charger connector standard. 2) During the one-year delay, appoint an independent, expert panel to collect and evaluate market and system performance data and recommend a standard for the Board's consideration. The panel would evaluate the market and system performance, and other merits of the two systems, and make a recommendation to the Board. The additional time would also allow additional time to gather data on real world durability. The panel could more systematically tabulate the data. Toyota would accept the recommendations of an independent panel. (*Toyota and Nissan)*

Agency Response: Delaying a regulatory decision will not result in any significant increase in data on which to base a regulatory decision. Additional market data are not expected in the next year, due to the limited number of EVs that will be marketed in 2001 and 2002. ARB has already undertaken a comprehensive review of charging systems, utilizing the available data. The value of an independent panel would be quite limited, since it would end up reviewing the very same data that ARB has already considered as part of this rulemaking. Finally, as discussed earlier, no industry consensus has been achieved in the last ten years. It is anticipated that it would be very difficult to achieve industry agreement on the make-up of such a panel or find technical experts that do not have ties to one of the charging systems, only further delaying the standardization effort.

C. ECONOMIC AND OTHER ADVERSE IMPACTS OF THE PROPOSAL

27. Comment: I am here to argue for dual standards, or at least some relaxed method of achieving your goals, without all of the harsh impacts. *(G. Hansen)*

Agency Response: ARB considered alternatives to the selected regulatory approach. These are discussed on pages 48 and of the ISOR. These alternatives included: (1) deferring regulatory action to market or industry forces, (2) implementing a public policy initiative in lieu of a regulatory standard, and (3) considering either inductive or off-board conductive as the charging standard. Refer to response to Comment #8 about the failure of deferring the decision to industry or market forces. A public policy approach was rejected due to the high level of uncertainty of success.

1.0 Economic & Other Impacts: Impact on Business

28. Comment: The staff report that discussed the effect on employment in California did not acknowledge that more people work at GM on the inductive system (*than on conductive systems).* (*G. Hansen)*

Agency Response: GM does not manufacture this product in California. In addition, the standard does not come into effect until 2006, giving GM substantial lead-time to modify its production plans to meet the requirements and avoid terminating any employees due to the proposed regulation.

29. Comment: We suggest removing the requirement that the charging system must be on-board the vehicle. There are many good applications for off-board charging. Your adoption of staff proposals will make obsolete off-board charging technology. *(AeroVironment, Inc.)*

Agency Response: The regulation does not preclude the use of off-board charging. ARB has elected to require a minimal on-board charger so that EV drivers can take advantage of public charging and use the commonly available low-cost conductive charging stations. Under the proposed regulation, the use of off-board conductive chargers is not excluded because manufacturers can supplement or bypass the on-board charger when connecting to an off-board charger.

30. Comment: The ARB's proposed regulation requires that specified vehicles "must be equipped with a conductive charger inlet port." It is a "prescriptive" standard, because it specifies the sole means of compliance with a performance standard by specific actions, measurements, or other quantifiable means. *(General Motors)*

Agency Response: The purpose of the proposed regulation is to standardize charging infrastructure so that battery EVs and grid-connected hybrid electric vehicles may charge at any charging facility. ARB staff has concluded that conductive charging is the better choice for the standard. Nevertheless, if a manufacturer wished to equip its

vehicles with another charging system, it could do so, so long as the vehicle is also equipped with the specified conductive charger inlet port. Therefore, the proposed regulation is not a prescriptive standard.

31. Comment: Prescriptive standards are disfavored as a matter of state policy and law. *(General Motors)*

Agency Response: Assuming, *arguendo*, that the proposed regulation does establish a prescriptive standard, the record shows that the establishment of performance standards cannot reasonably be expected to produce the same result. As noted in the ISOR, the ARB considered establishing standards five years ago, but was encouraged to "let the market decide". (ISOR at page 15.) Five years later, the market has been unable to decide. Thus, the ARB has considered the alternative to adopting charger standardization and has found that it did not work. Thus the ARB's obligation to consider alternatives to a prescriptive standard has been satisfied.

32. Comment: Under the state's policy, in order to justify a design or "prescriptive" standard there must necessarily be an overriding reason that the specific technology or design must be required. An example of such a paramount concern would be a significant safety issue, health hazard, or factor that makes adoption of a single prescribed design absolutely essential to avoid bodily injury or ensure proper operation of a regulated occurrence. *(General Motors)*

Agency Response: The commentator misstates the law. State law does not in fact require an "overriding" reason for adopting a prescriptive standard. Nor does state law require that there be a safety or health hazard before a prescriptive standard may be adopted.

33. Comment: We are negatively impacted by the regulation. Contrary to what was stated in the Staff Report, we are not under contract to any auto manufacturer; and we sell our product to a variety of customers. The proposed regulations will most impact our on-road PosiCharge 60 kW product in which several million dollars have been invested. The proposed regulation requiring on-board charging will also potentially impact our off-board charging system's product line for industrial and off-road vehicles which use essentially the same battery configurations as some vehicles to which the regulation apply. We would suggest any technology that was developed in good faith and now made obsolete by the regulations be compensated in some way. (*AeroVironment, Inc.)*

Agency Response: There is no evidence to support the contention that manufacturers of off-board high-power chargers will be negatively impacted by the regulation. As described in response to Comment #29, the regulation does not preclude the use of off-board chargers with vehicles equipped with on-board conductive chargers. Additionally many types of vehicles that typically use off-board charging are not covered by the regulation, including buses, other heavy-duty vehicles, and off-road equipment.

2.0 Economic & Other Impacts: Public Infrastructure

34. Comment: The proposed regulation has a negative impact on funding for public infrastructure. GM has put a lot of effort into funding inductive public infrastructure and would not be expected to fund conductive infrastructure. The other auto manufacturers have told me that they have no intention of supporting public infrastructure. So if you mandate conductive, all of the burden for public infrastructure will fall upon the public. (*G. Hansen)*

The maintenance *(of public infrastructure)* is negatively impacted by the proposed regulation. GM has been maintaining their chargers, even those that are no longer covered by warranty. I have been told that maintenance is not being covered as well for the conductive chargers. So inductive is actually at a better point regarding this issue. (*G. Hansen)*

Agency Response: There are different funding mechanisms that may be used for public infrastructure. Ideally, this would evolve into a self-sustaining program that would not require uncertain or intermittent funding from the auto manufacturers. ARB is working with a stakeholder group that is currently attempting to identify self-sustaining funding sources for the maintenance and expansion of California's public charging network.

3.0 Economic & Other Impacts: Public Perception

35. Comment: The main reason for this regulation is not that public perception will be dramatically improved. There are a number of more critical issues that need to be addressed before discussing standardization of charging. I think the public perception of the inductive charger that is going to be abandoned as a result of the proposed regulation may be a much larger public perception issue. *(G. Hansen)*

Agency Response: The public perception that the EV market has not matured due to lack of standardization is great and creates a substantial barrier to consumers participating in the EV market. ARB anticipates that any consumer concerns that occur during the transition to the single charging standard can be addressed through vehicle marketing and education efforts undertaken by auto manufacturers and program supporters. As discussed previously, ARB is also working with a stakeholder group to develop a transition plan that would ensure that inductive public chargers continue to be maintained (and not abandoned) during the transition, further increasing consumer confidence.

36. Comment: People would not want to buy or lease a car *(electric vehicle),* if they knew the charger was going away. *(T. Dowling)*

Agency Response: It is not correct to state that the "charger is going away." Consumers will continue to rely on the charger that is installed at their residence or fleet facility, as this is the primary site where their EVs are recharged. Since most EVs are currently leased, not sold, to consumers, these chargers should continue to be used by

the drivers and fully supported by the manufacturers during the entire vehicle lease period. ARB is also committed to developing an effective transition plan with the previously referenced stakeholder group; the transition plan will identify actions needed to maintain California's public charging network, including public access for drivers of inductively charged vehicles.

37. Comment: I am concerned about the impact on customers that have or would need to purchase inductive chargers. First they would have to switch from large paddle inductive to the small paddle, and now conductive. This is impacting those who would have leased an inductively charged Toyota RAV4 (or kept them from leasing). It makes people question how valuable the vehicle will be to them when they know the charging system is not the required one. Should they invest now in an inductive charger or wait several years? (*G. Hansen)*

Agency Response: To clarify, ARB regulatory action did not have any impact on the move from the large paddle inductive connector to the small paddle inductive connector. This was an independent industry decision that has not been fully implemented to date, causing significant problems and confusion for many drivers and potential consumers of inductively charged vehicles. There is very limited public access in some areas for vehicles designed to be recharged with a small paddle inductive charger. This is the type of problem that standardization will prevent in the future.

Finally as discussed on page 45 of the ISOR, ARB asked all of the auto manufacturers for input regarding impacts of standardization on their marketing efforts. No information was presented to ARB that identified any significant marketing impacts. Inductively charged vehicles are currently being marketed (including the RAV4 EV), and to date, great consumer interest in these vehicles has been shown.

38. Comment: We don't need the proposed regulation. We already have the dual standard and it works well *(conductive and inductive).* If we discontinue either standard it will make it much harder, in the short-run, to get EVs into the marketplace. Availability of EVs will be adversely impacted. Getting more electric vehicles in the market should be our priority. *(T. Dowling)*

Agency Response: ARB strongly disagrees that the current situation works well. In fact, it has been identified as a major barrier to increasing consumer acceptance of EV technology. Rather than relying on multiple charging systems as an incentive to encourage the production of EVs, there are other more effective mechanisms available. These include financial and regulatory incentives.

ARB has implemented grant programs that are intended to offset part of the cost of producing electric vehicles and to encourage auto manufacturers to produce more vehicles in 2002. Modifications to the ZEV regulations currently pending approval by OAL also encourage the production of vehicles in the early years by providing additional regulatory credits. As a result of these incentives and credits, increased numbers of

EVs are now being marketed. The availability of EVs will continue to increase as the requirements of the ZEV regulation increase over the coming years.

39. Comment: People buy vehicles, not charging stations (or chargers). We should make it easier, not harder, for people to lease or buy EVs. The proposed regulation makes it harder for people to lease or buy EVs. *(T. Dowling)*

Agency Response: ARB is committed to removing barriers to consumers to lease or buy EVs. The lack of a single standard charging system represents a significant barrier to marketing EVs to the general public. Many consumers, when learning about EVs and considering the purchase of an EV, are concerned about charging. By having the charger on-board the vehicle as just another component with a standard connector inlet, every EV will fit every charger. Thus, this regulation which increases consumer confidence in charging will make it easier, not harder, for people to buy EVs.

40. Comment: Another concern is the compatibility of parts from different manufacturers. There is no process in place to ensure such compatibility. If consumers are confused today about two charging systems, imagine how confused they will be when there is only one system, but the parts from one supplier don't fit into the inlet from a different supplier. (*Toyota)*

Agency Response: This issue is discussed on page 47 of the ISOR. It will be much easier to address any future compatibility problems that may arise when all resources can be focused on one charging system. It is anticipated that compatibility issues will be addressed as they have been in the past, by industry working together in a collaborative process.

D. LEVEL 1 (110 VOLT) CHARGING

41. Comment: We support the staff proposal, except for one concern. The focus of staff proposals is on full function and City EVs. However, during the next two years our research indicates that there may be 20,000-30,000 small neighborhood electric vehicles (NEVs) in the market. The demand for Level 1 infrastructure development is needed for these vehicles also. We recommend any future infrastructure development include this level of charging as well. (*Green Car Institute*)

Agency Response: In developing the regulation, ARB considered the need for including standardization for Level 1 charging on all vehicles, including NEVs. ARB concluded that, based on input from auto manufacturers and others, including Level 1 charging at this time would unnecessarily increase the cost of the vehicles while providing only modest benefits. Most charging of NEVs occurs at home using readily available connections between vehicle and home. As suggested in the comment, ARB staff will continue to work with the previously discussed stakeholder group to evaluate charging issues, including the need for Level 1 standardization, in future regulatory activities.

Also, the regulation does not preclude the use of Level 1 charging. The AVCON connector is compatible with Level 1 charging, and SAE J1772 (which is incorporated by reference into the charging requirements) identifies the electrical requirements needed for Level 1 charging.

42. Comment: Pertaining to 120 Volt (Level 1) charging for EVs and grid-connected HEVs, it is our opinion that this type of connection should not be exempt from safety requirements and should be referred to an Infrastructure Working Council connection committee for recommendation. (*Electric Vehicle Infrastructure, Inc.)*

Agency Response: ARB is not the appropriate agency for establishing safety standards for charging equipment. Please see the response to Comment #41 for reasons why ARB did not include Level 1 within the regulation. While ARB does not regulate safety, Level 1 chargers must meet safety requirements developed by SAE and other industry standard setting organizations.

43. Comment: It makes sense for EVs to have available with the vehicles a low-power charger. These chargers could utilize standard 110/220 Volt three-prong plugs and the millions of existing outlets already available in homes and other locations. This category would use an on-board charger somehow embedded in, or attached to, the vehicle, and require no special connector, just ordinary conductor with standard plug. (*AeroVironment, Inc.)*

I vote for conductive charging, but it must include a standard 120V 20amp outlet (Level 1) with the circuit breaker mounted right next to it. (*Hill*)

Agency Response: As discussed on page 18 of the ISOR, ARB considered requiring that all EVs be equipped with a Level 1 charger as a convenience to consumers. Staff concluded that Level 1 charging may not be well-suited to all EVs, and that the decision to provide this feature is best left to the auto manufacturers and the demands of the market.

44. Comment: General Motors believes that if Level 1 charging is the primary type of charging for an electric vehicle, then the conductive system is a better choice. However, full-function EVs will not attain any benefit from having Level 1 charging capability. (*General Motors*)

Agency Response: As noted in the responses to Comments #41 and #43, the regulations do not require auto manufacturers to include Level 1 chargers. Rather, the ARB has left it to each auto manufacturer to decide whether to include this option based on its vehicle design and marketing needs.

E. LEVEL 3—FAST CHARGING

45. Comment: Fast charging greatly enhances the market viability and acceptance of EVs. Fast charging is best accomplished with off-board chargers. While standards are important, they should not limit advances in this technology. (*AeroVironment, Inc.*)

The proposed regulation will serve as a barrier to the extremely important fast charge technology. The lengthy charge cycles of seven to twelve hours, consistent with the standardization recommendation, will serve as a key disincentive to the widespread adoption of EVs. Lengthy charge times will likely mean that a small quantity of vehicles will use the proposed public charging stations for extended periods, making these facilities unavailable for other users. Fast charging, while more expensive, will make charging facilities truly useful to a large number of cars, that can obtain a significant charge in less than an hour. (*BIW Connector Systems)*

Agency Response: The regulation focuses on Level 2 charging as it is the most likely charging level for the foreseeable future. As discussed in response to Comment #29, fast charging utilizing an off-board conductive charger is not precluded for cars equipped with an on-board conductive charger. The barriers to fast charging are the high cost of the off-board charge station and the ability of the battery to accept a high charge without adverse impacts. Consequently, ARB staff does not believe that the regulation serves as a barrier to Level 3 fast charging development. If the issues noted above are successfully resolved, ARB staff will propose modifications that provide standards for this Level 3 charging, if appropriate, at that time.

46. Comment: In fleet applications, an off-board high-power fast charging system using a conductive connector that is compatible with all vehicles makes sense. The EV charge port receptacle should be standardized and permanently attached to the vehicle. We support a single connector configuration for high-power charging as the standard so long as it is capable of supporting high-power fast charging with both an off-board and on-board charger. (*AeroVironment, Inc.*)

Agency Response: See response to Comment #45 for reasons why ARB has decided not to require fast charging. However, it is not precluded. The specifications for the conductive connector and inlet provided in SAE J1772 includes optional provisions for delivery of high-power to the EV for fast charging, if manufacturers choose to implement these features**.**

47. Comment: We encourage the ARB to provide state funding to finalize production readiness of the Avcon Level 3 connector. This is to ensure that the connector design most market-ready for the market conforms to the proposed regulation for standard connectors and that it will continue to be available for fast charging. Without funding support to allow continuation of this key component, AeroVironment will pursue alternatives to the Avcon connector for our 60 kW product that may be counterproductive to the intent of the proposed standards since it may not be compatible with the Avcon design in the proposed regulation. (*AeroVironment, Inc.*)

Agency Response: As mentioned in the response to Comment #45, ARB staff does not believe that developing standards for Level 3 charging is necessary at this time due to high cost and the unknown impacts to battery technologies. Likewise, until these issues are resolved and a mature market exists, ARB staff does not believe that funding such technology development is necessary or in the best interests of the State.

F. ON-BOARD VERSUS OFF-BOARD CHARGING

48. Comment: A significant consumer advantage of off-board charging is that when the charger will not operate, the consumer does not lose the use of the vehicle, having to tow the vehicle to the dealership and wait for repair of the on-board charger. The consumer simply drives to another charger. (*General Motors)*

Agency Response: The charging system for an inductively charged EV includes a cooled inlet, rectification and filtering components, and a battery management system which is on-board the EV regardless of the charger location. This management system contains a processor, numerous sensors, and many more interconnections than the charger itself. Since these charging system components remain on-board the inductive vehicle, many charging system failures will still require a tow to a dealership whether or not another off-board charger is available.

Additionally, when a Level II inductive charger that is attached to a customer's garage wall fails, a skilled technician will have to be dispatched to the residence to diagnose, repair, or replace the inductive charger. There will be significant cost and time penalty associated with servicing these more complex charger systems in the field. It may, in fact, be cheaper to tow an EV to a dealership than to transport a skilled technician to and from a residence for a home service appointment.

49. Comment: It is more cost effective to have the chargers on board each vehicle instead of off-board. Additionally, to maximize system operating efficiency and battery performance, the battery pack and its charging peripherals must be designed as a complete system. And the added weight of the charger has little impact on vehicle efficiency. (*Electric Vehicle Conductive Charging Coalition)*

Agency Response: ARB agrees with your comment that on-board chargers will be more cost effective and has chosen not to make any changes to the proposed regulation.

50. Comment: For other less predictable applications than fast charging, EVs could use either on-board or off-board charging. The conductive connector should be able to provide either AC or DC power to the vehicle via an on-board or off-board connector. We support conductive charging as the standard as long as it is capable of supporting high-power fast charging with both an off-board and on-board charger. (*AeroVironment, Inc.)*

Agency Response: The proposed regulation requires EVs to be equipped with a vehicle inlet port conforming to SAE J1772 specifications. This connector and inlet includes provisions for optional delivery of high-power AC or DC power to the EV for fast charging if manufacturers choose to implement these features.

51. Comment: We do not support requiring on-board charging as a standard. We support having on-board charging for low-power charging, but we believe this is best left up to the marketplace to determine if on-board or off-board charging for high-power charging is best. Therefore, we support the ARB taking no position on requiring on-board versus off-board charging. (*AeroVironment, Inc.)*

Agency Response: ARB has elected to require a minimal on-board charger requirement so that EV drivers can take advantage of commonly available low-cost conductive charging stations and use public charging stations. Under the proposed regulation, the market may still choose whether additional charger power capability on the vehicle is desirable, and manufacturers may supplement or bypass the on-board charger when connecting to a high-power off board charger.

52. Comment: We continue to believe the approach implemented in our PosiCharge products, of power output on the order of 60 kW, will be the right approach. If you accept that those power levels are appropriate, we believe this can best be accomplished with off-board charging. (*AeroVironment, Inc.)*

Agency Response: ARB agrees that, given existing technology, charging at >60kW is more likely to be implemented with off-board instead of on-board chargers. The proposed regulation does not rule out Level 3 off-board chargers at all. The regulation may, in fact, encourage the deployment of Level 3 off-board chargers because it is now more likely that manufacturers may choose to consistently implement the Level 3 features of the SAE J1772 coupling instead of a variety of incompatible coupling alternatives.

53. Comment: The proposed language includes a requirement for an on-board charging system of at least 3.3 kW. While this does not explicitly exclude off-board chargers, it will greatly diminish vehicle manufacturers' desire to accommodate off-board charging. We think it is not appropriate to mandate on-board charging. Specifying on-board charging as the future standard will significantly restrict market and technical opportunities for fast charging of future EVs. (*AeroVironment, Inc.)*

Agency Response: The main impediments to manufacturers supplying high-power charging capability are the high cost of off-board charging stations and the difficulty of demonstrating a business case for this feature. Also, the unknown impacts to EV traction batteries is also a barrier to the further use of Level 3 charging. The requirement for a minimal on-board charger is insignificant when compared to these other issues.

54. Comment: We support on-board chargers for low-power charging being supplied with every EV. However, requiring on-board chargers, as proposed in the current recommendations, will potentially have broader negative implication for other vehicles not covered by the proposed regulations including airport ground support equipment vehicles, NEVs, and heavy-duty vehicles. We suggest that ARB modify their proposed regulation by eliminating the requirement for an on-board charger. (*AeroVironment, Inc.)*

Agency Response: ARB disagrees that the proposed regulation has a negative impact on EVs not covered by the regulation. These vehicles generally have different charging strategies, and use different battery packs than the light duty EVs covered by the regulation. The regulation could, however, have several positive impacts in the future should manufacturers decide to make use of the SAE J1772 standard coupling interface, thereby reducing costs and improving marketability for all who make use of these components.

55. Comment: DaimlerChrysler submitted comments supporting conductive as the standard, but not the requirement for on-board charging and use of the Avcon connector. The limited power of an on-board charger will increase charge time, thereby limiting the functionality of the electric vehicle. Off-board chargers are capable of a higher capacity. DaimlerChrysler used an off-board charger for the 1999 model year EPIC minivan so that a battery pack capable of a 100 mile range could be charged in approximately three hours rather than nine hours if only a 6.6 kilowatt charger was used. There are other advantages of off-vehicle conductive charging including: (1) Efficient transfer of power through conductive coupling, (2) reduced vehicle weight, (3) improved charger reliability, and (4) lower cost to consumers. *(DaimlerChrysler)*

Agency Response: While ARB agrees with much of the comment regarding the merits of conductive chargers, we disagree with the claim for lower overall cost to the consumer for an off-board charger. The high cost of off-board conductive chargers is discussed on page 30 of the ISOR. Under the proposed regulation, DaimlerChrysler would still be able to offer vehicles compatible with Level 3 off-board conductive chargers and may choose to either bypass or supplement the small on-board charger. However, with the required small on-board charger, customers of DaimlerChrysler EVs would be able to use the public charging network, a resource that they presently cannot connect to.

56. Comment: I cannot support a conductive standard. In my view, having the charger electronics on board the car, a production EV1, would only serve to complicate an otherwise already complex vehicle and would make the vehicle unusable should a mandated on-board system fail. Currently we have an option if we should plug into a defective charger by simply moving to another charger. (*G. Harris)*

Agency Response: On-board conductive chargers are a proven and “off the shelf” technology, and are widely used in off-road equipment and buses, in addition to passenger EVs. Please refer to response to Comment #48 regarding the issue of being

able to use another charger in the event that there is a problem with a charger or charging station.

57. Comment: Off-board charging systems are more cost effective for public infrastructure than on-board charging systems when considering the societal costs. For vehicles with conductive on-board chargers, there is a fixed cost of one charger per vehicle in all cases. With off-board charging, especially as the number of EVs in operation increases, the ratio of public chargers per vehicle will recede to less than one charger for every five vehicles. As a result, off-board charging provides a more cost-effective solution on a per vehicle basis. (*General Motors)*

Agency Response: The commentator is proposing that costs for public charging would eventually be lower with an off-board charging system. However, ARB believes that it is a mistake to compare costs in this manner. Any comparison of costs must include the entire societal costs. This includes the cost for the charger needed to recharge the vehicle on a daily basis, as well as the additional public and workplace chargers that provide extra convenience to drivers.

For an off-board charging system, a charger must be installed at each location. With an on-board charging system, the charger is on the vehicle and goes where the vehicle goes; consequently only a lower cost conductive charging station needs to be installed at each site where the vehicle needs to charge. Thus, total costs of providing the primary charging for the vehicle and public and work charging are lower for an on-board charging system than for an off-board charging system, as discussed on pages 33 and A3 of the ISOR.

58. Comment: On-board charging systems are detrimental to electric vehicle range and efficiency. Current on-board systems average about 100 cubic inches in volume and 15 to 17 kilograms in mass. For an EV, such as the GM EV1, the range penalty is one mile lost for each kilogram of weight added. 6.6kW on-board charging systems will be especially difficult to integrate into smaller city EVs due to their volume. There needs to be a study of the trade-offs between the impacts of off-board chargers versus on-board chargers. (*General Motors)*

Agency Response: The proposed regulation does not require small City EVs to incorporate large 6.6 kW on-board chargers. EVs subject to this regulation are required to incorporate chargers with approximately half of this charge capacity. ARB has received alternative information regarding the estimated mass of the required on-board charger and its associated range penalty, and believes that the other advantages associated with an on-board charger outweigh this mass penalty. Additionally, several other auto manufacturers have successfully produced and marketed high performance EVs using an on-board conductive charger.

Furthermore, ARB believes customers may demand backup Level 1 charge capability for their EVs. The Level 1 inductive charger originally installed in the EV1 and Nissan Altra weighed more than 7kg by itself, and can now be replaced by a simpler,

lightweight SAE J1772-compatible cordset that allows the on-board charger to operate from standard 120 Volt AC outlets. This weight savings in the Level 1 charge equipment compensates for some of the weight gain from addition of the on-board charger.

59. Comment: The Staff Report does not fully clarify the cost profiles for off-board high-power charging. On-board charging is limited to the voltage and current specifications of the propulsion system and typically will be limited to 20kW. Beyond this capability will require off-board charging. (G*eneral Motors)*

Agency Response: The proposed regulation does not require or recommend exclusive consideration of on-board chargers for high-power charging. The proposed regulation is also fully compatible with the use of off-board chargers taking advantage of either the SAE J1772 coupler or any other alternative standard, as long as a SAE J1772 compliant inlet is also provided and enables use of a minimal on-board charger.

60. Comment: The cost of charging is better evaluated on a per vehicle basis. Assuming the high-power charger is $45,000 and can charge up to 60kW, the charger could support charging for 80 to 120 EVs per week. This assumes 15 minutes per charge. This equates to a non-recurring cost of $375 per vehicle. Conversely, the on-board system for high-power charging assumes a cost of $1,000 per vehicle. Off-board high-power charging is a 63% less expensive investment per vehicle than on-board high-power charging. There are also issues with modifications to the house electrical service to support the increased amperage requirements. (*General Motors)*

Agency Response: The proposed regulation does not preclude or discourage the use of off-board high-power chargers. Additionally, high-power charging systems of the same power capability, whether on-board or off-board, conductive or inductive, will all have similar electrical service requirements and may not be practical for home use.

G. SUGGESTIONS FOR MODIFICATIONS OR FUTURE ARB ACTIONS

61. Comment: EVI recommends that, in addition to technology and connector-type, ARB should also standardize the pedestal bolt pattern. Standardization would allow construction to begin prior to the selection of a charger purchase and be another step in keeping the market open to competition. (*Electric Vehicle Infrastructure, Inc.)*

Agency Response: While this suggestion would help reduce cost and time for charger installations, ARB does not have regulatory authority to set such standards. The recommended standard could be established by a number of potential industry standard setting organizations, or through voluntary initiatives on the part of equipment manufacturers.

62. Comment: EVI would recommend that the ARB or the governing entity look at programs in other states in developing public infrastructure. States such as Georgia are ahead of California in the promotion of public infrastructure. EVI would suggest that

ARB recommend California put in place a tax credit system similar to Georgia to encourage businesses to install and promote public infrastructure and move away from the Grant programs in place to date. (*Electric Vehicle Infrastructure, Inc.)*

Agency Response: ARB established a stakeholder group to address issues specifically related to the charging infrastructure. This group is pursuing alternatives such as incentives to ensure that the appropriate charging infrastructure is in place and well maintained to meet the needs of California's electric vehicle fleet.

63. Comment: The Board should adopt regulations requiring a single type of on-board charging system to be installed by the automotive manufacturers for all EV's produced to meet the 2003 and beyond ZEV regulations. We are not opposed to staff's choice of the conductive system, but would like a regulation requiring implementation of a standardized, uniformly produced on-board charging system. (*American Lung Association of California, Coalition for Clean Air, National Resources Defense Council, Planning and Conservation League, Union of Concerned Scientists*)

Agency Response: While there would be advantages to the suggestion that all on-board chargers be standardized, ARB staff believes that it would be overly proscriptive to the industry to do so. The goal of this rulemaking is to simplify the charging system to reduce costs and to assure access to public infrastructure. These objectives have been met and do not require the standardization of on-board charging systems. Moving up the implementation date to 2003 would not provide sufficient time for inductive auto manufacturers currently using inductive charging to redesign future vehicles to meet the new charging requirements.

64. Comment: A well-developed standardization transition plan is essential to ensure that the existing public infrastructure grows and expands. Continued near-term investment in the charging equipment product and installation services network is needed to achieve the long-term goals of enhanced public access and cost reduction. (*Sacramento Municipal Utility District*)

Agency Response: ARB has established an infrastructure group comprised of auto and equipment manufacturers, government entities and infrastructure providers to address all issues related to recharging infrastructure. Their work includes the development of a transition plan as suggested in the comment. A staff representative from the Sacramento Municipal Utility District has been participating in this stakeholder group.

65. Comment: It is incumbent upon ARB to apply the ZEV regulations to every manufacturer of vehicles that burn non-renewable fuels, regardless of their size. *(Heckeroth)*

Agency Response: This comment is outside the scope of the proposed regulation.

66. Comment: ARB should only allow full credit for vehicles which meet one of the two current standards (inductive or AVCON conductive) in order to discourage

introduction of yet another charging technology. The AVCON conductive charging technology is cumbersome and would prove difficult to use by an individual lacking a certain level of physical ability. Choosing one technology over the other would create obstacles for manufacturers to continue releasing and creating EVs. Furthermore, public charging stations should contain both charging options as cost is not much of an issue between the two when all the expenses are compared. (*T. Dowling*)

Agency Response: Please refer to the response to Comment #27. ARB has previously considered alternatives to this regulation; however, these alternatives will not accomplish the goals that this regulation is intended to achieve. The regulation will have several positive effects on EV drivers and ultimately clean air for all Californians by increasing consumer confidence and access to EV charging. It will focus technological improvements and foster competition among charger manufacturers resulting in a potential reduction in charger equipment costs.

Contrary to the comment, ARB staff believes that the conductive equipment is as easy, or easier to use, than a gasoline pump, and should not be an issue with consumers. In response to the concern about public charging, ARB is working with a previously discussed stakeholder group to ensure that public charging for inductively charged vehicles is maintained until the conductive standard is fully implemented. Please refer to the response to Comment #37 regarding expressed concern of potential impacts on EV marketing.

67. Comment: All EVs should be required to carry on-board charging technology capable of supporting 120V charging which can be safely operated in rain. Vehicles that have charging needs not satisfied by a 120V system should be required to support the "small paddle inductive" system based on cost, flexibility, safety, reliability, and ease of use. The real cost when considering the primary electrical supply and charger mechanical mounting favors the inductive system. The inductive system can support a wider range of current capacities. The inductive system reflects obvious safety advantages such that I would ask my two and a half year old to plug it in while I would ward him away from the conductive charging. I know of quite a few failures with the conductive systems while I know of none with the inductive. *(T. Dowling)*

Agency Response: In developing the regulation, ARB staff considered the need for including standardization for Level 1 charging on all vehicles. Staff concluded that, based on input from auto manufacturers and others, including Level 1 charging at this time would unnecessarily increase the cost of the vehicles while providing only modest benefits. The ARB staff will continue to evaluate the need for Level 1 standardization in the future.

ARB staff disagrees with the comment that inductive charging should be the standard because it is less expensive, safer, and more reliable. Based on a thorough analysis of the two systems utilizing fifteen separate criteria, ARB chose the conductive system after evaluating all attributes, finding conductive charging to be less costly, as safe as inductive charging, and just as reliable.

68. Comment: I would like to see a pressure sensitive switch on the disengage button of the AVCON connector that turns off the power so that I don't have to push the 'stop' button. (*Fischer)*

Agency Response: ARB does not believe that regulating such a minor design criterion is appropriate. There is nothing in the regulation that prevents a manufacturer from adding this feature if the market calls for it in the future.

69. Comment: I vote for a conductive standard. CARB has too many other important things to do than worry about charging standards, and I think they are doing all of this because they caved in to the auto manufacturer's demands for allowing NEVs. Now the need for lots of fast charging stations is even greater as NEVs will give the public the idea that EVs are slow charging and short ranged. We need to promote infrastructure for full-function ZEVs because morning/evening commuting on freeways contributes most to air pollution. *(Thorpe)*

Agency Response: The decision to adopt a single standard was not a result of auto manufacturers' demands concerning NEVs. NEVs are not impacted by this regulation, as they are excluded from the requirements since they will earn less than 1.0 ZEV credit in the year 2006. Because there are so few NEVs in the market, there are no data to support their future use or reliance on fast charging technology. Since there currently is no public fast charging, it does not appear that NEVs would in any way contribute to a negative public perception regarding charging time for full function vehicles utilizing Level 2 charging.

The charging regulation supports full function vehicles by requiring them to have a standard charging system. ARB adopted a charging standard to increase consumer confidence and access to EV charging. ARB believes that this will focus technological improvements and foster competition among charger manufacturers resulting in a reduction in charger equipment costs. Having a single charging system will require fewer public charging stations per vehicle, thus reducing equipment costs for the affected parties.

70. Comment: I want conductive charging as a standard but an "open" system must be enacted in such a way that the power is delivered in a standard way that can then be adapted to each vehicle. Imagine having to buy the "correct" home appliance (based on the plug) for the electric sockets in your house. The charge receiver should not be constrained to a specific design, why couldn't a conductive or an inductive adapter be supplied for each vehicle and used with a standard connection at the recharging station. (*Butcher)*

Agency Response: Standardization of connectors is necessary to provide the most cost effective and efficient public charging infrastructure. These benefits will not be fully realized if the system is left "open" as suggested by the commentator.

71. Comment**:** Neither of the available two systems is suitable to be standards. The conductive AVCON charger is not easy to use and lacks durability and robustness. The inductive system is far too expensive. CARB should provide incentives for fast charging systems for longer trips. (*Thompson)*

Agency Response: While the conductive charger has not achieved the same level of ease of use as the inductive paddle, the equipment is as easy, or easier to use than a gasoline pump and should not be an issue with consumers. ARB staff disagrees that the conductive connector lacks durability and robustness. ARB did an extensive review of the available data on charging systems; this data demonstrates that both systems have similar levels of durability. Results of ARB technical analyses support the comment regarding the higher cost of the inductive system. Regulatory incentives to encourage fast charging are included in ZEV regulations, currently pending OAL approval.

H. STAFF EVALUATION OF CHARGING SYSTEMS

1.0 General/Unclassified/Efficiency/Auto Docking Considerations

72. Comment: EVI is in full support of Staff's recommendation to standardize the industry to conductive on-board charging. EVI's staff analysis concludes that conductive charging technology is the superior option for California's near term and long term EV infrastructure due to much lower cost, higher reliability and durability, greater efficiency, and an excellent level of safety. The conductive systems are also fully compatible with fast charging, bi-directional power flow, and integrated charging. *(Electric Vehicle Infrastructure, Inc.)*

Agency Response: ARB agrees with your comments and has made no changes to the proposed regulation.

73. Comment: I would like to offer the attached document entitled, "*Comparison of SAE J-1772 Conductive and SAE J-1773 Inductive Charging Systems for EVs*" for consideration. As described in the paper, both charging systems are nearly identical, however, there are some subtle differences. In general, a subtle difference that appears as an advantage in one system is offset by another subtle difference that appears as a disadvantage. (*Analog Power Design)*

Agency Response: ARB's comprehensive technical analysis favors a conductive standard, but we are encouraged that this study is apparently standard-neutral and does not conclude that there would be a significant disadvantage if either standard were selected.

74. Comment: Toyota is the only auto manufacturer to have utilized both charging systems. Based on our experience, we have found inductive to be a better system than the conductive system. If a single standard has to be chosen, then it should be inductive. *(Toyota)*

Agency Response: ARB has elected to proceed with the proposed regulation for the reasons summarized on page 43 of the ISOR. As a result of a comprehensive technical evaluation, ARB has concluded that on-board conductive charging has greater benefits than inductive charging. Since Toyota has experience with both charging systems, ARB is hopeful that this experience will ease the ultimate transition back to an on-board conductive charging system.

75. Comment: Test data for inductive systems reflect that charging efficiencies at the higher power levels are higher than conductive. The Staff Report addresses the efficiency differences at the standard 6kW-charge level. Charging at levels below 6kW are short in duration, so the efficiency losses for inductive are negligible. More importantly, the efficiency of the vehicle is the primary determinant for the cost impacts for charging. *(General Motors)*

Agency Response: Although ARB considers charging efficiency to be a high priority criterion, selection was not based only on a significant efficiency difference between these alternatives. The selection was based on a comprehensive evaluation of fifteen criteria including eight "high priority" criteria.

However, in response to the comment on the efficiency differences between inductive and conductive systems, conductive systems have a slight benefit over inductive systems. Based on the available information, ARB has concluded that inductive systems are only 1-2% less efficient at peak power levels. However, efficiency differences potentially are significantly greater when EVs charge at lower power levels. Therefore, some City EVs, as well as EVs with lead acid technology, would be expected to have efficiency losses, as compared to comparable conductively charged vehicles.

76. Comment: On-board conductive and inductive charging have the same levels of efficiency. Because they are similar, efficiency should not be used as criteria to select a charging system. *(Nissan)*

Agency Response: Please refer to the response to Comment #75.

77. Comment: Inductive charging exceeds the safety protections of that for conductive connectors. The simple fact is it has no contact or friction during operation ensuring there is no grounding connection between the vehicle and grid. Therefore, if there is any earth ground degradation the inductive charging process is not affected. Conductive relies on ground monitoring to suspend charging if it detects a problem with the earth ground. *(General Motors)*

Agency Response: On page 34 of the ISOR, it is acknowledged that both the inductive and conductive systems meet stringent industry safety standards. Charging equipment generally exceeds safety standards of conventional consumer products and assures the consumer of an extremely high level of safety. In addition, all charging equipment meets Underwriters Laboratory testing requirements. Inductive paddles may have a greater "perception of safety" than the conductive connector, but any concerns in this

area can be addressed through consumer education. Also, ARB does not agree that inductive charging paddles would never experience some degree of contact and friction, because they are also, apparently, fitted with a conductive plastic shielding contact feature that may, under certain circumstances, short to earth ground.

78. Comment: ARB staff has not identified any justification for mandating on-board conductive technology. (*General Motors*)

Agency Response: ARB staff has identified substantial justification for the proposed charging infrastructure standard. The justification for standardization is set forth in the ISOR at pages 13-16.

79. Comment: Summarized below are comments received from Toyota, Nissan, and General Motors that provide their rationale for selecting the inductive charging system.

The decision *(to select inductive charging)* was based on ease of use, convenience, safety of the inductive paddle, proven durability and reliability, and the capability to standardize on a single size inductive paddle to charge at all levels (from 1kW to 120kW). Also, the preponderance of accessible inductive public infrastructure in California; an established distribution and service network; and the compatibility of inductive chargers with worldwide grid systems are also important advantages of the inductive system. (*General Motors and Nissan)*

The philosophy underlying inductive charging technology is that any vehicle can charge with any charger - universal compatibility. The off-board charger requires no modifications, and the on-vehicle components are the ones that are sized to the vehicle's traction battery. There is theoretically no need to add any specifically designed chargers to the infrastructure to accommodate the variation of vehicles used in the marketplace. (*General Motors)*

Inductive is the preferred system over conductive for the following reasons:

- The total system costs are comparable to conductive.
- The reliability and durability is better than conductive.
- The safety, both actual and perceived, is better than conductive.
- The ergonomics are far superior to conductive.
- Better access to public charging.
- Efficiency comparable to conductive.
- Product support far superior to conductive.
- Able to accommodate Level 1 charging.
- Better prospects for technology advancement.

(Toyota)

Agency Response***:*** ARB conducted an objective evaluation of fifteen separate criteria, and concluded that based on this comprehensive analysis, on-board conductive provided overall greater benefits than inductive charging technology. However, ARB acknowledges that both inductive and conductive charging systems have evolved into

excellent products that meet the needs of consumers. The need to select one system as the standard necessitated the selection of the charging system that would provide the greatest benefit to consumers while at the same time acknowledging that both charging systems have been demonstrated and proven. Other auto manufacturers have selected on-board conductive systems for many of the same reasons cited above, and this reflects the current impasse that the industry has reached in moving toward the voluntary selection of an EV charging system.

Regarding the comments on the universal compatibility, on-board conductive has this same compatibility. A vehicle with an on-board conductive charger can use any SAE J1772-compliant conductive charging station. However, economy of scale can be achieved because the size of the charger, which is part of the vehicle, can be adjusted to the needs of the vehicle traction battery, thus significantly reducing costs for smaller vehicles.

Regarding the comment on public infrastructure, ARB acknowledges that inductive has a current advantage with regards to public infrastructure. About 60% of the current public charging stations are inductive. However, this is only a short-term situation; as EVs transition to the conductive standard, the public charging network will gradually retrofit inductive charging stations to the conductive stations.

Please refer to the responses to Comment #75 on efficiency, #91 on costs, #77 on safety, #19 and #20 on reliability and durability, #83 on product distribution, and #90 regarding the lack of industry movement towards a single standard.

In response to the comment on Level 1 charging, ARB agrees that both inductive and conductive can provide Level 1 charging. However, inductive Level 1 chargers are more expensive, heavier, and more difficult to use. In addition, one auto manufacturer using inductive charging technology has acknowledged that on-board conductive provides greater benefits for this feature (see Comment #44 by General Motors).

80. Comment: A prospective adoption by reference is not permitted. *(General Motors)*

Agency Response: The proposed regulation does not make a prospective adoption by reference. A prospective adoption by reference is one that purports to adopt and incorporate by reference a particular document and any subsequent changes or amendments to the document. The proposed regulation adopts SAE J1772 as of a certain date and does not purport to adopt or incorporate any subsequent changes or amendments to SAE J1772.

81. Comment: SAE J1772 – Electric Vehicle Conductive Charge Coupler, should not be referenced in the regulation for the following reasons:

- It is a draft and may change to an unacceptable form before is approved.
- It is not a "build-to" specification.
- It does not address the communications needed for station car and neighborhood car programs.
- It does not address interoperability issues.
- It may not be acceptable as an International Standard. *(Toyota)*

Agency Response**:** Several of these concerns have already been addressed in the final version of SAE J1772, released November 2001. SAE J1772 is no longer in draft form and provides additional levels of details and specifications for the vehicle inlet and connector design. ARB is hopeful that, as discussed on page 47 of the ISOR, Toyota will work with other manufacturers and industry representatives to address any future issues related to interoperability that may arise.

There are many options available for meeting the specific communication needs for station car programs. First of all, the conductive standard does have the capability for higher level communication. This optional communication protocol uses direct metal-to-metal contact rather than the infrared signal used by the inductive standard, and can be incorporated into the vehicles and chargers used in station car programs. Second, the communication method is not necessarily linked to the charging method. If, in practice, it appears that an infrared method is superior to metal-to-metal contact, then an infrared method could be incorporated into the conductive standard.

2.0 Market/Warranty/Public Infrastructure

82. Comment: Inductive patents exist for the purpose of protecting competitive positions in the marketplace. GM has stated its position that the requirement for licensing is no longer a strategic competitive issue. GM has stated its intent to proliferate the inductive technology throughout the industry to encourage the build up of a competitive supplier base. No license is required and the patents protection issue will be directly resolved with the suppliers. (*General Motors)*

Agency Response: In developing this regulation, market competition was one of a wide variety of objective criteria considered by staff. On page 32 of the ISOR, it is acknowledged that ARB received written comments from GM stating that they encourage new manufacturers and do not currently require license fees as a prerequisite for producing inductive chargers based on their designs. However, this results in considerable uncertainty regarding future licensing fees and represents a potential hurdle to expanding market competition. The future impact on new manufacturers could range from no impact (if licensing or patent fees continue to not be required) to a significant impact (if substantial licensing fees are ever required in the future). The patent holder, GM, would be the entity that would determine whether any future fees would be imposed.

Patents cover many aspects of inductive technology. This is in contrast to the conductive connector. The connector is the only part of the conductive charging system in which a licensing fee could apply. This fee has been established, and represents less than 1% of the current cost of manufacturing the charging system, as discussed on page 32 of the ISOR.

83. Comment: The distribution and service structure for EV charging products was developed and implemented by GM. The distributors sell and service both inductive and conductive products. It was envisioned by GM that the distribution network should not be exclusive to inductive only, and therefore did not place any restriction on the distributors' ability to sell and service competing products. The operational structure for distribution is complex because of the size of the territories and the investment required to establish a proper network of licensed contractors, inventory management systems, regulatory compliance procedures, etc. It is important to note the distribution system continues due to the sponsorship and involvement of a large corporation. (*General Motors)*

Agency Response: Comment noted. Staff believes that standardization will encourage multiple manufacturers to enter the market and that vehicle manufacturers will be motivated to continue involvement in the marketing and distribution system to ensure product availability.

84. Comment: EVI will not argue the fact that at times *EVSE (charging equipment*) products in this market have been behind schedule. However, this is not due to "difficulty of small companies being able to keep pace with changing demand….". It is due to the unpredictable nature of the market and the difficulty of producing the small volumes needed at the costs that are demanded by the market. EVI has adequate capacity today to supply ARB's estimated supply needs for the whole market through 2004. EVI works very closely with its auto manufacturer partners ensuring company viability and product availability. *(Electric Vehicle Infrastructure, Inc.)*

Agency Response: Comment noted. Standardization is intended to help with realization of higher volume production.

85. Comment: While GM should be commended on the service of their units in the field, they do not provide this type of service for their internal combustion engine vehicles in general and could not be expected to provide this type of service indefinitely. EVI on the other hand, has been attempting to contain these costs by handling customers as they are accustomed to with other products they have purchased. Further, EVI has given its customers a range of products to select from with a range of warranty offerings letting the customer decide what type of coverage they are most comfortable with. (*Electric Vehicle Infrastructure, Inc.)*

Agency Response: Comment noted. Staff believes that standardization will encourage additional product distributors and service providers to become involved in this market.

86. Comment: While there is always need for improvement, EVI suggests that alternative strategies need to be investigated for maintenance of public infrastructure, such as a possible lease arrangement. Maintenance and service of public infrastructure will be an ongoing cost long after the warranty has expired. While government or private funds may be available for installation of public charging stations, acquiring funds for ongoing "non-warranty" maintenance or service may be difficult. (*Electric Vehicle Infrastructure, Inc.)*

Agency Response: This comment is outside of the scope of the regulation. However, at the direction of the Board, ARB staff is working with a stakeholder group that is exploring the options and identifying the resources needed to address these maintenance and service issues. This group has met quarterly during the last two years.

87. Comment: Support for the transition plan will be one of the easier tasks for the suppliers to support. It will be a much more predictable roll-out than any other program this market has seen. EVI would like to participate in the Transition Planning Group. *(Electric Vehicle Infrastructure, Inc.)*

Agency Response: Please refer to the response to Comment #86. EVI has been actively participating in the stakeholder group.

88. Comment: The technology recommended by staff is incredibly expensive. An up-front licensing fee of $100,000 is required, along with a payment of four percent of profits. Additional tooling and engineering costs are expected to total at least $650,000. As a result, the probability of multiple sources for the proposed design, even if it were suitable, would be so high as to be uninteresting to most connector manufacturers. *(BIW Connector Systems)*

Agency Response: The commentator is stating its concerns about the cost of producing the conductive connector. As discussed on page 32 of the ISOR, the cost of producing the conductive connector represents less than 1% of the total cost for producing all of the on-board and off-board components of the charging system. This is the only part of the on-board conductive system for which a manufacturer would potentially have to consider paying a licensing fee. In contrast, there are a number of patents covering inductive technology.

It should be noted, regardless of which charging system is selected, any manufacturer of new equipment would need to consider the cost to produce and market a product, including licensing fees, tooling and engineering costs, and potential sales before committing to a new product. The on-board conductive system keeps licensing fees to a minimum and the cost of the licensing fee has been established and is known. Please refer to the response to Comment #82 regarding uncertainty of future inductive licensing fees by patent holders.

89. Comment: There is only one small manufacturer of conductive off-board charging equipment *(e.g., a conductive charging station or wall box)* with limited technology development resources. The cost of the technology is not the primary issue. Rather, it is the price to the consumer. Without competing suppliers in the market, there should be apprehension that the price of infrastructure will not decrease and may actually go up. *(General Motors)*

Agency Response: ARB considered cost, price to consumer and the need for a competitive market to encourage continued product development, among a wide variety of criteria, prior to making a decision. ARB believes that standardization of both the connector and charger location will encourage higher volume equipment production and lower manufacturing costs in the long term. Lower costs should allow the manufacturers to offer lower prices to consumers. Additionally, the cost of installing public and workplace infrastructures will be reduced with standardization, as the need to install multiple charging technologies will be avoided.

90. Comment: The market has moved toward adopting inductive as the EV charging standard**.** Three of the seven affected auto manufacturers have reached consensus on a single inductive connector standard. GM, Toyota, and Nissan have conducted individual evaluations of the competing technologies. All three have selected and fully implemented the inductive technology. *(General Motors)*

Agency Response: ARB disagrees that the market has moved towards inductive as the EV charging technology. As discussed on pages 15-16 of the ISOR, the industry is evenly divided between conductive and inductive technologies. GM, Toyota and Nissan are currently using the inductive system, but the conductive system is used by Ford and Honda and with EVs produced by small manufacturers. Thus there is no consensus in the industry on the selection of a charging standard and no non-regulatory selection process that would be able to move the industry towards a standard by the implementation year of 2006.

3.0 Costs

91. Comment: One of the important considerations addressed by staff is cost. We disagree with staff in that the cost of the two systems (*on-board conductive and inductive*) are basically the same. We should not be confused by the current selling price, because they don't reflect the actual volume production costs. *(Nissan)*

Costs for charging equipment are the same between conductive and inductive systems. A system to system comparison, including on-board and off-board electric vehicle support equipment, reveals the cost profiles between inductive and conductive systems are essentially the same. *(General Motors)*

Agency Response: It is not true that the comprehensive evaluation of cost criteria that ARB conducted was based on current selling price rather than manufacturing costs. Information on current sales price of charging equipment was provided in the ISOR;

however, the evaluation of cost criteria primarily focused on current and future projected manufacturing costs.

Pages 30-31 and A1-A2 of the ISOR discuss both current and future projected system costs for both the conductive and inductive charging systems. The system cost includes the cost for producing the charging equipment, as well as any on-board vehicle components. These estimates are a summary of detailed confidential information provided to ARB staff. Because this information is confidential and could impact the competitiveness of different manufacturers, the detailed information provided to ARB cannot be disclosed.

On-board conductive charging systems currently have achieved lower production costs than inductive charging, and are projected to be equal to or lower than inductive systems by the implementation year of 2006. In addition, there are other important cost benefits of the conductive system. Since the charger is on the vehicle, the auto manufacturer can size the charger to the battery, thus substantially reducing costs for smaller vehicles. This is in contrast to the inductive system, in which the size of the off-board charger is fixed, and cost reductions cannot be achieved with smaller vehicles. Please refer to the response to Comment #57 about the specific economic advantages associated with having the charger on the vehicle.

92. Comment: The Staff Report distorts the issue about only one charger per vehicle with on-board conductive systems. There is the charger plus the off-board conductive charging equipment. Power access to the grid for the on-board chargers is only through connection with an off-board box, which is priced from $800 to $1,800. Inductive charges are priced at $1,899. A conductive off-board box needs to be installed in the same manner and quantity as the inductive charger. (*General Motors**)***

Agency Response: In both systems, the largest cost is associated with the charger. In the conductive system, the charger is part of the vehicle, and in the inductive system it is a separate piece of equipment that the consumer must purchase. The charging station for a conductive system is a simple wall box that interfaces with the electrical outlet and ensures that all safety conditions are met prior to allowing electricity to flow from the outlet to the vehicle's battery charger. The charging station for an inductive system consists of the more complex charger. As discussed on page A4 of the ISOR, a conductive wall box can be purchased for as little as $350, while inductive chargers retail on the low end for $2084. Some inductive chargers retail for as high as $6,000.

Another important consideration is whether the price of the charging station represents costs with a profit margin, or subsidized costs. If the price represents a subsidized cost, this would infer that the price could increase in the future should a subsidy be removed. Based on information available to staff, conductive charging equipment that currently retails between $800-$2100 represents cost plus a profit margin, whereas inductive charging equipment is currently subsidized by auto manufacturers, except for equipment at the high end of the price range.

ARB agrees that the installation costs are similar for the conductive wall box and inductive charger, because the electric specifications are similar. Because there is no difference in installation costs, it was not included in ARBs technical analyses. However, ARB is working with the previously discussed stakeholder group to identify ways that future installation costs can be reduced; options include pre-wiring of new construction and other voluntary strategies that could be effectively implemented by State or local government entities. These options are discussed in the ISOR on page 56-57, under the topic "Non Regulatory Proposals."

93. Comment: EVI does not argue that considerable money has been spent in developing inductive systems and infrastructure. However, EVI would contend that considerable money has also been invested in conductive charging development when all stakeholders are taken into consideration. Similar amounts of money will be stranded regardless of which technology is recommended by the ARB. It would appear that much less new money would need to be spent on a single, conductive standard to achieve the cost targets Staff has set forth. *(Electric Vehicle Infrastructure, Inc.)*
Agency Response: Comment noted. Commentator is supporting the need for a standard, as well as selection of conductive charging as the standard.

94. Comment: Nissan believes that one of the largest impediments to the widespread adoption of EVs is the cost of the vehicles. We want to do what we can to reduce the cost of the vehicle. The inductive charging system *(because it is not part of the vehicle--but off the vehicle)* allows us to reduce the cost of the vehicle. Other community groups should assume responsibility for the infrastructure so that responsibility for the ZEV mandate can be shared.
(Nissan)

Agency Response: The most important consideration is the cost to the consumer. The consumer pays for the vehicle and any needed charging equipment. The consumer pays this cost whether the charger is located on the vehicle or off the vehicle. However, there will be less overall cost to the consumer with a conductive charging system.

The commentator also states that responsibility for EV infrastructure should be assumed by community groups to divide up the responsibility for the ZEV mandate. ARB disagrees with this proposal. Community organizations are not asked to share the responsibility for the cost of diesel or gasoline fueling infrastructure, so it is not clear why they should be mandated to do so for zero emission vehicles, including EVs.

However, it should be pointed out that there has been an impressive level of investment in the development of public infrastructure for EVs. An investment of several million dollars by a wide variety of entities, including public agencies, business, community organizations, and some auto manufacturers, has resulted in nearly 1,000 public charging stations throughout California. Many sponsors are continuing these investments, and are working with the previously discussed stakeholder group to identify long-term funding mechanisms to maintain the public infrastructure that has been put in place through these voluntary investments.

95. Comment: The inductive system is less costly and complex to integrate into an existing or a new vehicle platform. The cost and negative near-term market impact to a conductive connector standard is not defined or understood. There is no comprehensive assessment of the consequences to the inductive auto manufacturers or a study of the tradeoffs auto manufacturers face between conductive versus inductive. *(General Motors)*

Agency Response: Costs to auto manufacturers to integrate a charging system into a new or existing vehicle are a subset of the total cost to develop and produce a vehicle. The cost of a vehicle charging system represents an extremely small fraction of the total cost of producing an EV. By far, the greatest production cost results from the high costs of the vehicle traction battery. Vehicle integration costs will ultimately be recouped as any vehicle research and development costs are - through future product pricing of that model or the family of vehicles produced.

Staff did evaluate the consequences to auto makers of switching from one charging system to the other. There are costs associated with switching to either charging technology. However, these costs are kept to a minimum if the transition is done when vehicle volumes are low. The most important consideration is the timing of the transition. The proposed implementation date of 2006 assures that costs will be kept to a minimum because vehicle volumes are still relatively low, while giving auto manufacturers sufficient time to adapt their new vehicles to the conductive standard.

96. Comment: The cost for an inductive 50kW Fast Charger would be from $4,500 to $8,000 *(as compared to much higher costs for conductive fast chargers*). This is predicated on the ability to parallel nine 6kW chargers, which at high volume will cost approximately $500 each. This concept was developed and demonstrated with significant success in 1999 – 2000 with Southern California Edison, DARPA, Calstart, and South Coast Air Quality Management District. This project demonstrated the viability of the inductive paddle and system to charge at Level 2 and 3. Reliability of the components was excellent during the demonstration. *(General Motors)*

Agency Response: Comment noted. ARB did not include fast charging as one of the eight “high priority” criteria because most of the major auto manufacturers provided information to ARB staff that they did not believe that a business case for this feature exists now or in the near to mid-term. Another reason that fast charging was not identified as a “high priority” criteria is because significant barriers to the commercialization of fast charging currently exist (they are discussed in the response to Comments #45 and #47).

Pages A-9 and 40 of the ISOR, however, acknowledge the demonstration study discussed in this comment. ARB concluded that this study successfully demonstrated the technical feasibility and usefulness of a high-power inductive charging system. But the impact of this study on the commercialization of fast charging is somewhat limited. This is because there are no inductively charged vehicles that are commercially

available to the consumer that are capable of accepting a Level 3 or fast charge and no indication that such vehicles will be available by the regulatory implementation date of 2006. And conductively charged vehicles are equally capable of fast-charging.

4.0 Durability

97. Comment: Real world durability is the key concern with the staff proposal of conductive charging as the standard. The inductive system has no moving parts, but the conductive system relies on pressure contact, is made up of moving parts, including pins and springs, and is mechanically complicated. It is subject to external contamination and we are concerned that the reliability of the system over time will deteriorate. *(Nissan and Toyota)*

The conductive product has not achieved a maturity level that ensures durability and robustness for long life in a commercial environment. Its basic connector design, using butt and pin metal contact and moving components, is inherently susceptible to degradation. This translates into a loss of efficiency and into potential degradation of safety protection. Further technical and commercial testing needs to be conducted prior to adopting any regulations to ensure the recent new product design will meet the reliability requirements of the consumer and the industry stakeholders. *(General Motors and Toyota)*

The connector technology recommended by staff is not mature. The connectors proposed have by most accounts failed to perform reliably for any extended period. No independent engineering assessment has been performed, which might support the staff recommendation to adopt the Avcon connector technology. *(BIW Connector Systems)*

Agency Response: Please see the responses to Comments #19 and #20 regarding durability of the conductive connector. Regarding efficiency, the measured efficiency of conductive systems is equal to or slightly greater than inductive systems. These measurements include test results for efficiencies when the vehicle is charging and connected to the conductive plug.

Regarding the expressed concern for durability concerns due to moving pins and springs, independent testing performed by industry experts (in testing connectors for safety and durability) has verified the safety and durability of the conductive connector to industry specifications. It is not needed nor warranted for the State to conduct additional product testing.

98. Comment: The comparison of reliability between the two technologies should take into consideration the reliability of the on-board equipment. The only comparison, without benefit of actual data, is between the conductive off-board box and the inductive charger. GM maintains reliability data, which it shared with ARB staff. There is no indication that any actual reliability data was relied on in ARB staff's assessment.

Inductive has achieved an improvement of close to 200% in reliability from its first generation to its second-generation product. *(General Motors)*

Agency Response: ARB concluded that the reliability of the two systems was very similar. As discussed on page 34 of the ISOR, ARB reviewed reliability data maintained by Southern California Edison, which has one of the largest EV fleets in the country. This data covered 203 charging stations, and indicated that inductive and conductive charging stations had similar levels of reliability. Also, ARB has funded more than 150 permanent charging stations, and 300 temporary charging stations; this ARB experience has also confirmed that both inductive and conductive charging stations have similar levels of reliability.

ARB received general data from auto manufacturers using both the inductive and conductive systems regarding the reliability of the on-board charging components. However, this data is confidential and cannot be disclosed because it could impact the competitiveness of manufacturers. The data provided to ARB did not identify any significant differences between the reliability of inductive and conductive charging components that are located on the vehicle.

However, it should also be noted that if there were significant failures of the on-board charging components, this would be experienced by the consumer as a "vehicle problem," necessitating repairs. There are no data that indicate higher than average vehicle repair rates for EVs equipped with an on-board conductive charger, as compared to inductively charged vehicles. Also, as discussed in the response to Comment #48, inductively charged vehicles also have some important charging components located on the vehicle that could fail. As an example, GM recently recalled its 1997 model EV1s; this recall was attributed to a failure of a defective component located in the vehicle inlet or charge port (which is on the vehicle).

5.0 Communication/Interoperability

99. Comment: SAE J1772 currently defines three options for a conductive connector, of which the Avcon connector is one. (*General Motors)*

Agency Response: This comment has already been addressed. The 2001 version of SAE J1772 has been incorporated by reference into the charging standardization regulatory language. There is now only one connector option in the standard and that is the butt and pin (or Avcon) connector.

100. Comment: Given all of the technical uncertainties (draft standard, interoperability and communication issues), it is impossible for auto manufacturers to use the conductive standard to design future vehicles. (*Toyota)*

Agency Response: SAE J1772 is no longer in draft form. As discussed in the response to Comment #107, SAE J1772 was revised and re-issued by the Society of Automotive Engineers in November 2001. The basic connector design is unchanged; however, the

revisions include additional dimensional test requirements for the vehicle inlet/connector interface. This additional detail should make it easier, not harder, for auto manufacturers to use the standard to design future vehicles. Also see the response to Comment #81 regarding the interoperability issue.

101. Comment: The conductive standard documentation is inadequate to ensure compatibility or interoperability of conductive inlets and connectors between various manufacturers. The Staff references SAE J1772 as the governing standards document for its recommendation. SAE J1772 is a Recommended Practice, not a standard, and is seriously devoid of any interoperability specifications and communications protocols to adequately ensure that suppliers will be capable of manufacturing compatible products. (*General Motors, Toyota)*

Agency Response: Please refer to the response to Comment #81 regarding interoperability. In response to the expressed concern about relying on a Recommended Practice rather than a Standard, ARB has successfully used SAE Recommended Practices in many motor vehicle regulations; on-board diagnostic equipment is just one example among many. It takes many years for SAE Recommended Practices to become standards, and it is not feasible to delay important air quality programs while waiting for industry to formalize Recommended Practices into standards.

ARB disagrees with the comment that SAE J1772 is devoid of adequate communication protocols to adequately ensure that suppliers will be capable of manufacturing compatible products. The conductive system relies on a very inexpensive and simple pilot circuit to communicate between the charging station and the vehicle. The pilot circuit communicates information to determine if electricity can safely be transferred from the charging station to the vehicle's battery charger. The conductive standard also provides the option for higher level communication. This optional communication protocol uses direct metal-to-metal contact rather than the infrared signal used by the inductive standard, and can be incorporated into the vehicles and chargers.

102. Comment: The communication protocol specified in the conductive standard will be obsolete by the year 2007. Some other type of communications will be required if conductive is to be operable in the future. Additionally, message sets need to be developed and communications interoperability to the various manufacturers' gateways needs to be verified. (*Toyota)*

Agency Response: As with many SAE Recommended Practices, these standards need to evolve to keep pace with technological advancements in the field. Just as the inductive standard has moved from one communications protocol to a new one recently, the conductive standard is also capable of doing so. There is nothing to prevent the inductive communications protocols from also having to be revised in the future. This is also true of many other automotive systems that rely on the same communications protocol that is used in SAE J1772.

103. Comment: The inductive standard is one iteration ahead of the conductive practice, in that communication and interoperability issues have already been addressed. (*Toyota)*

Agency Response: ARB disagrees that there is any real difference in the status of the inductive and conductive standard. Both conductive and inductive charging standards have been developed by many of the same technical experts. Both of the standards have had several iterations to further refine these standards, and both are Recommended Practices. It should be noted that the two iterations of the conductive standard have resulted in a greater refinement of the butt and pin (or Avcon) connector.

However, the current inductive standard reflects a major change in the connector design (large to small paddle) and different communications protocols (to an infrared system). New inductively charged vehicles based on SAE J1773 are not compatible with older inductive chargers that are equipped with the older communication protocols and the large paddle connector. Staff is not aware of any compatibility problems for conductively charged vehicles based on previous iterations of SAE J1772, and no comments to this effect were submitted during the regulatory process.

104. Comment: The inductive connector standard is consistent with and in place with SAE, IEC, and with JEVA. Interoperability test protocols exist and field data is monitored to actively resolve any revealed compatibility problems. (*General Motors)*

Agency Response: As discussed in the response to Comment #103, there is no difference between the status of the conductive and inductive Recommended Practices. The monitoring of field data for inductively charged EVs is done through the voluntary efforts of auto and charging equipment manufacturers. ARB sees no reason why similar efforts, if needed, could not be applied to resolve any identified future issues that may arise with the conductive standard.

105. Comment: Nissan and Toyota are now undertaking a joint Station Car Program. A Station Car Program requires a robust communication system between the vehicle, its charger, and the control center for the Station Car Program. This communication is complex, and we dismissed using the conductive system because of concerns about it being able to provide a reliable communication connection. *(Nissan)*

Communications is a key component for Station Car Programs and technological advances. The inductive system utilizes an infrared communications system that is standardized worldwide, while the conductive system's communication is optional. (*Toyota)*

The conductive standard does not require communications. Communications will be required for station car projects, neighborhood car projects, and future technologies. Even if the standard were changed to require communications, most of the existing infrastructure would not support it. (*Toyota)*

Agency Response: ARB recognizes and agrees that station car projects may require more complex communication between the vehicle and the charger, and that other future technologies may impose similar communication needs. ARB does not concur, however, that the conductive standard is incapable of meeting these emerging requirements.

First of all, the existing conductive standard does have the capability for higher level communication. This optional communication protocol uses direct metal-to-metal contact rather than the infrared interface used by the inductive standard, and can be incorporated into the vehicles and chargers used in station car programs.

Second, the communication method is not necessarily linked to the charging method. If, in practice, it appears that an infrared interface is superior to metal-to-metal contact, then an infrared method could be incorporated into the conductive standard.

Third, there are other ways to meet station car communication needs. Vehicles are increasingly offering wireless communication capability, and such systems could be adapted to meet station car program requirements.

Finally, staff notes that the decision to recommend conductive over inductive charging was based on a variety of factors. Thus even if the inductive method does offer some advantages, on balance staff concluded that the conductive method was superior.

6.0 National and International Standards

106. Comment: We have concerns related to the ability of the conductive charging standard to become an international standard. Auto manufacturers must produce vehicles for the worldwide market. Vehicles must be designed to meet international standards. The inductive system has made great progress in international standardization. The International Electrotechnical Commission (IEC) only started to consider the standardization of the conductive coupler last year. There is concern that Japanese and European auto manufacturers may not accept the conductive coupler due to size and complexity of the coupler. Thus, there is a possibility that the IEC could standardize a coupler that is not the one proposed under this regulation. *(Toyota)*

Further compounding the issue is that the conductive connector standards in Europe are also in a state of flux and the IEC has yet to define a single conductive connector for EV charging. *(General Motors)*

Agency Response: Establishing an international standard is not within the scope of this regulation. As previously noted by ARB, there is a need for this regulatory action because the industry required to meet California's ZEV requirements has not agreed to a single charging standard and further postponing standardization will result in increased costs as well as greater inconvenience to consumers. ARB encourages vehicle manufacturers to continue working cooperatively with SAE and IEC.

107. Comment: The conductive charging standard (SAE Recommended Practice) is now in draft form. As the conductive charging standard evolves, the contents may become unacceptable to what the ARB is looking for. What will happen to the ZEV regulations if the conductive standard is substantially changed in the final document? (*Toyota)*

In the current draft version *(of the SAE Recommended Practice)*, there is no geometric tolerance data. The current review of geometric tolerance data is not complete by the SAE committee, and it is too early to determine if this data could be used to build interoperable components. (*Toyota)*

The conductive standard *(SAE Recommended Practice)* is still evolving, and they need to be allowed to evolve naturally, not by force. Force these recommended practices, and the only result will be a substandard document. *(Toyota)*

The SAE document being used as the design standard is not a specification, but rather is a recommended practice that is currently in draft form. *(General Motors)*

Agency Response: It is true that the SAE document was in draft form at the time that these comments were submitted. However, the SAE document (J1772) has now been finalized and re-issued by SAE. The public has been provided a 15-day review and comment opportunity on revisions to the regulation to incorporate the final SAE standard. No comments were received on this issue as a result of the 15-day comment period. It is the final version of SAE J1772 that the regulation incorporates by reference. Please refer to Comment #101 regarding reliance on a recommended practice.

7.0 Vehicle-to-Grid Power Flow

108. Comment: There exist many barriers and challenges at this time toward implementing vehicle-to-grid requirements and systems. It is too early to decide whether one charging technology may be able to better serve this perceived future need. There is significant investment required of the auto manufacturers to develop and integrate this capability into their vehicle features. In regards to staff's technical assessment, the key issues to clarify are that inductive technology can accommodate bi-directional power transfer, and that the conductive auto manufacturers are at the same starting point as inductive auto manufacturers in developing and producing vehicles with this capability. (*General Motors)*

Agency Response: While the specific prospects for vehicle-to-grid are still under evaluation, it is already clear that existing inductive charger designs can only be operated in one direction, with power flowing from the electric grid into the battery. ARB had received no comment or testimony regarding plans for a charger manufacturer to introduce inductive bi-directional systems or to quote the resulting cost and weight penalty of such systems.

Conductive charging hardware, on the other hand, is capable of bi-directional power flow with no or minor modifications. Several projects are under way to demonstrate this with off-the-shelf SAE J1772-compliant conductive connection equipment. While vehicle-to-grid power flow is theoretically possible for inductive systems, ARB believes the installation of the additional on-board components necessary for inductive bi-directional power flow would significantly increase the cost and weight of on-board inductive systems.

109. Comment: Integrated charging has significant challenges with efficiency and isolation. The system requirements from the grid side are not yet defined. This is a long term issue, and the report does not address any timing requirement, the market benefits, the business case for consumers, impact analyses of competitive stationary distributed energy systems, the offsets of new power generation plants, the regulatory barriers, and other issues. *(General Motors)*

Agency Response: The proposed regulation does not require or depend on deployment of integrated charging, and neither does bi-directional conductive power flow for vehicle-to-grid applications. ARB agrees that vehicle-to-grid deployment may be a long-term issue, but ARB also believes that it may still be a significant one with a clear advantage for conductive-based connection systems**.** In fact, the prospects for the commercialization of integrated charging, utilizing an on-board conductive charger, appear to be very promising because of the number of resources currently being allocated within the automotive industry to move this from prototype into commercial product by the implementation year of 2006.

110. Comment: The staff report cites vehicle-to-grid power services as one of the justifications for a conductive charging requirement, by saying that this would provide another source of value to the vehicle. Our analysis indicates that the potential for vehicle-to-grid power flow is not a sufficient reason to require a conductive charging requirement. Vehicle-to-grid power delivery does not come close to providing an economic benefit to the vehicle owner. *(Sierra Research)*

Agency Response: The selection of conductive charging was based on a comprehensive technical evaluation of fifteen separate criteria. Vehicle-to-grid charging was only one of eight criteria identified as “high priority.” The potential of vehicle-to-grid charging was not used alone to select conductive charging as the standard. However, there are other analyses which indicate that vehicle-to-grid could benefit EV owners in the future. This includes potential economic benefits of other electric drive vehicle power services besides energy sales. These include spinning reserves, grid regulation, and other auxiliary services. ARB agrees that direct energy sales to the grid may not be economically viable for future EVs.

111. Comment: The staff analysis did not account for the effects of battery life when using vehicle-to-grid power flow. Shortening the battery life with additional charge and recharge cycles has not been accounted for (*in the staff analysis).* Our analysis indicates that the economic damage to the battery associated with the extra

charge/recharge cycles is 50 cents per kilowatt hour as the additional battery cost the owner will end up incurring for vehicle-to-grid power flow. *(Sierra Research)*

Agency Response: ARB staff did not perform an analysis of vehicle-to-grid economic viability. The study cited by ARB in the ISOR (REF 5, Kemption, et al.) does, however, consider the effects of additional cycling on battery life for the EV cases considered. This study assumes that the cost of battery degradation is the dominant cost to the owner and is more expensive than the cost of electricity to charge by a factor of 3.8-8.6X.

112. Comment: Charging and discharging losses are another factor that adds to the cost of vehicle-to-grid power flow. Charging and discharging losses are typically 30%. This means that to send a kilowatt hour back to the grid, you are going to have to use more than a kilowatt-hour drawn from the grid to charge the battery. Our estimate is that it would take 1.4 kilowatt hours to send 1.0 kilowatt back to the grid. Based on current prices charged by Southern California Edison (8 cents/kilowatt) it would cost 11 cents for every kilowatt-hour to transfer energy back to the grid. *(Sierra Research)*

Agency Response: This issue was already addressed on page 34 of the vehicle-to-grid reference cited in the ISOR (REF 5, Kemption, et al.).

113. Comment: Because we have to use more fossil fuel to provide electricity with vehicle-to-grid power, we will increase greenhouse gas emissions. *(Sierra Research)*

Agency Response: Vehicle-to-grid power services, including off-peak storage, should be compared to alternative storage or generation means during these same time periods. A substantial and growing fraction of off-peak California power to charge EVs does not produce carbon dioxide and is not fossil fuel derived. EVs providing peak power to the electric grid will not necessarily make use of fossil fuels at all.

114. Comment: There is a practical problem associated with vehicle-to-grid power flow. The cost for electricity peaks at 3:00 p.m, which is the beginning of the afternoon commute period. Any vehicle that is used to sell electricity to the grid when it is most economical to do so will have a depleted battery and will not be available to use for transportation during the commute period. You need to account for the cost of not having the vehicle available during the normal commute periods. We estimate the cost of $1.67 per kilowatt-hour as the cost of coming up with replacement transportation if the vehicle is not available for transportation. *(Sierra Research)*

Agency Response: This issue was already addressed on page ii of the vehicle-to-grid reference cited in the ISOR (REF 5, Kemption, et al.).

115. Comment: Most analyses of the benefits of vehicle-to-grid power flow are based on current electricity costs. However, the current costs are an aberration. By 2002, we estimate that the cost is unlikely to exceed 15 cents per kilowatt-hour during peak periods, because many new and efficient power plants will be on-line. Electricity

production cost is going to be under 10 cents per kilowatt-hour. The long range forecast for the value to electricity sold by vehicle-to-grid power flow is going to be much lower than the 50-60 cents per kilowatt hour that some have estimated. *(Sierra Research)*

Agency Response: Vehicle-to-grid proponents are exploring the potential economic benefits of other electric drive vehicle power services besides energy sales. These include spinning reserves, grid regulation, and other auxiliary services. The Sierra Research information that was provided appears to only consider energy sales and not the potential for these other grid power services to be economically viable for future electric drive vehicles.

116. Comment: The concept of vehicle-to-grid charging doesn't come close to working if you send power back to the grid early in the morning or overnight, because the marginal cost of electricity is so low that you are not able to justify the inefficiency of charging and discharging the battery. *(Sierra Research)*

Agency Response: This issue is already addressed in the vehicle-to-grid reference cited in the ISOR (REF 5, Kemption, et al.). Neither the ISOR nor the vehicle-to-grid study cited in the FSOR claim that this vehicle-to-grid scenario is at all viable.

I. COMMENTS SUBMITTED ON OTHER PUBLIC COMMENTS

117. Comment: The Electric Vehicle Charging Coalition (EVC^3) also submitted an attachment that provided responses to questions resulted from briefing several ARB Board members in Carlsbad on June 18, 2001. (*Electric Vehicle Conductive Charging Coalition)*

EVI (a member of the Electric Vehicle Charging Coalition) is respectfully submitting comments that rebut GM's public document submitted June 18, 2001. EVI supports CARB's process, its decision of choosing a standard and the standard it has chosen to be in the best interest of the market and is the best approach for containing the cost of implementation to the State of California. EVI presented a point by point response to cost and technical issues raised by GM in the submittal. The following provides an example of EVI comments in response to GM's submittal. (*Electric Vehicle Infrastructure, Inc.*)

- We disagree with the statement that conductive technology has not yet achieved a maturity level that ensures durability and robustness for long life in a commercial environment. Material chosen for the production model has held up very well under general day to day use.

- We disagree that off-board charging systems are more cost effective for public infrastructure than on-board charging systems when considering the societal costs. No numbers were given to support this claim.

- While we agree with the statement that on-board charging systems have an effect on EV range and efficiency, we believe that GM has overstated the impact and that it is insignificant.

- We disagree with the GM statement that costs for charging equipment are the same for conductive and inductive systems. Conductive equipment is significantly lower in cost now and will continue to be lower in cost in the future, and current conductive designs cut installation costs in half.

Agency Response: The comment essentially endorses the ARB's regulatory decision while providing a response to the issues raised by GM. These comments are consistent with ARB's decision and included in the FSOR for sake of completeness.

E

SUMMARY OF COMMENTS TO PUBLIC COMMENTS SUBMITTED DURING 15-DAY SUPPLEMENTAL COMMENT PERIOD AND AGENCY RESPONSES

Table 3 lists the persons or organizations that provided written comments during the 15-day public comment period.

Set forth below is a summary of each comment received during the 15-day public review period for the modified regulatory language.

Table 3

	Mr. Gardner L. Harris
	Mr. Will Beckett
DaimlerChrysler	Mr. Reg Modlin

Part I Treatment of Majority Owned Small or Intermediate Volume Manufacturers

118. Comment: Under the test of "operational independence" that has been in force until now, DaimlerChrysler Corporation and Mercedes-Benz USA should be considered separate corporations, and ARB should not aggregate the sales of these two companies when considering compliance with the ZEV mandate if the same regulatory treatment as given to other manufacturers is applied. The staff's position is arbitrary and capricious because staff has no rational basis for treating DCC and MBUSA any differently than Ford and Volvo or Jaguar, or any differently from Volkswagen and its subsidiaries.

The inequitable effect of the staff's error is exacerbated by the modifications that staff has proposed that have the effect of allowing Ford's wholly-owned subsidiaries Jaguar and Volvo to be treated as small or intermediate until the 2010 model year. By contrast, DaimlerChrysler and Mercedes-Benz USA would need to begin complying with stepped-up ZEV requirements in the 2003 model year. DaimlerChrysler and Mercedes-Benz USA are entitled to equal treatment. Accordingly, DaimlerChrysler Corporation and Mercedes-Benz USA, Inc. sales should not be aggregated until the 2010 model year. *(DaimlerChrysler)*

Agency Response: See the response to Comment #7. This rulemaking is not the appropriate forum for any reconsideration of the status of Mercedes-Benz following the merger with Chrysler. It is important to note that Mercedes-Benz will not in any event lose the ability to meet its full ZEV obligation with 100 percent PZEVs in the 2003 model year as assumed by the commenter. As explained in the response to Comment #7, a company that stopped being operationally independent in the late 1990's will no longer be able to take advantage of its prior small or intermediate volume status starting in the 2008 model year – six years after the 2002 model year.

Part II **Standardization of Charging Systems**

119. Comment: The regulation references two measurements for charging capacity that are not consistent: kilovolt amps and kilowatts. Technically they are the same, but it seems it would be easier to understand if they were written in the same way. It may be confusing to have the on-board charger requirement as 3.3 kilovolt amps, and Level 1 charging specified as 1.44 kilowatts. *(William Beckett)*

Agency Response: The definition of Level 1 charging which included a power description in kilowatts was provided only for reference purposes. Vehicles equipped exclusively with Level 1 charging are exempt from the charging regulation. Also, in most cases, these two alternative measurements for electrical power will yield very nearly the same results.

120. Comment: When I heard that the Board arbitrarily made the decision to turn EV charging infrastructure into conductive only systems, I was horrified. I had hopes that this decision would be made by the market. The benefits of inductive charging include reducing vehicle weight and internal complexity, the inductive paddle is easy for a child to use, and no electrical shock can result, even when used in the rain. I have found the Avcon connector to be much more exacting to use, and I am concerned with all of the moving parts in the connector, as well as the possibility of an electrical malfunction. I am also concerned about the impact on drivers who have invested in inductive chargers, as well as the impact on inductive public infrastructure. Finally, since GM will not allow me to release my EV1, my inductive charger that I own will just become another piece of clutter. If the Board finalizes this action, I will not be able to fully amortize that investment. *(G. L. Harris)*

Agency Response: These comments are outside the scope of the 15-day notice, and have already been addressed in response to numerous comments made during the 45-day public comment period. The Board's decision is not arbitrary; the Board carefully considered alternatives to the proposed regulations, and also considered the advantages and disadvantages of adopting the proposed regulations at this time. The ISOR and this FSOR set forth the basis for the Board's decision.