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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 15 1992

OFFICE OF
AIR AND RADIATION

C. Boyden Gray
Counsel to the President
The White House
Washington, DC

Dear Boyden,

As we agreed at our meeting last week, I am sending you a draft copy of EPA's decision to grant a "Waiver of Federal Preemption of California's Low Emission Vehicle (LEV) Exhaust Emission Standards". This decision would allow the state to establish new exhaust emission standards, certification procedures and enforcement procedures for 1994 and later model year passenger cars and light-duty trucks.

We understand that your office will coordinate review with Jim MacRae, Jr. at OMB. An extra copy is enclosed for this purpose. Our goal is to have a decision document which has completed all review and is ready for Bill Reilly to sign on Friday, December 18. Therefore, we request your comments, if any, by 4:00 pm on Thursday, December 17.

I appreciate the assistance of you and your staff on this matter. If you have any questions, please call me or Dick Wilson.

Sincerely,

Bill

William G. Rosenberg

Enclosures

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California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption, Decision of the Administrator (Low-Emission Vehicle Standards Waiver)

I. INTRODUCTION

By this decision, issued under section 209 (b) of the Clean Air Act, as amended (the Act), 42 U.S.C. §7543(b), I am granting California its request for a waiver of Federal preemption to enforce amendments to its motor vehicle pollution control program. Those amendments [1] establish new standards, certification procedures, and enforcement procedures for

[1] The amendments are set out in Title 13 of the California Code of Regulations and the documents incorporated by reference within; § 1900; § 1904; § 1956.8 and the standards and test procedures incorporated therein; § 1960.1 and the incorporated documents entitled "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" and "California Non-Methane Organic Gas Test Procedures"; § 1960.1.5; §§ 1960.5 and 2061 and the incorporated "Guidelines for Certification of 1983 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles For Sale in California"; § 1965 and the incorporated "California Motor Vehicle Control Label Specifications"; §§ 2111, 2112, 2125, and 2139; and the document entitled "California Test Procedures for Evaluating the Emission Impacts of Substitute Fuels or New Clean Fuels" adopted and incorporated by reference in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Card, Light-Duty Trucks and Medium-Duty Vehicles."

1994 and later model year passenger cars and light duty trucks.[2]

Section 209 (a) of the Act provides:

> No State or any political subdivision thereof shall adopt or attempt to enforce any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines subject to this part. No State shall require certification, inspection or any other approval relating to the control of emissions from any new motor vehicle or new motor vehicle engine as condition precedent to the initial retail sale, titling (if any), or registration of such motor vehicle, motor vehicle engine, or equipment.

Section 209(b)(1) of the Act requires the Administrator, after notice and opportunity for public hearing, to waive application of the prohibitions of section 209(a) for any State which has adopted standards (other than crankcase emission standards) for the control of emissions from new motor vehicles or new motor vehicle engines prior to March 30, 1966, if the State determines that the State standards will be, in the aggregate, at least as protective of public health and welfare as

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[2] The instant waiver request (LEV waiver request) also included new standards for certain low-emission and ultra-low emission medium duty vehicles (MDVs). There is a pending waiver request from CARB for regulatory amendments pertaining to MDVs (Docket A-91-55), which was submitted to EPA before the LEV waiver request. Because my action on the LEV waiver request will precede my action on Docket A-91-55, I will defer action on the portions of the LEV waiver that add new standards and requirements for low-emission and ultra-emission MDVs until action is taken on the MDV waiver request. Therefore, these MDV sections should not be considered as included in the CARB regulations referenced in Note 1 above.

applicable Federal standards. The waiver shall not be granted, however, if the Administrator finds that: (A) the determination of the State that the state standards are, in the aggregate, at least as protective of public health and welfare as applicable Federal standards, is arbitrary and capricious; (b) the State does not need the State standards to meet compelling and extraordinary conditions; or (C) the State standards and accompanying enforcement procedures are not consistent with section 202(a) of the Act. [3]

As previous decisions granting waivers of Federal preemption have explained, State standards are inconsistent with section 202(a) if there is inadequate lead time to permit the development of the necessary technology given the cost of compliance within that time period or if the Federal and State test procedures impose inconsistent certification requirements. [4]

With regard to enforcement procedures accompanying standards, the Administrator must grant the requested waiver unless he finds that these procedures may cause the California standards, in the aggregate, to be less protective of public health and welfare than the applicable Federal

[3] California is the only state which meets the section 209(b)(1) eligibility requirement for receiving waivers. See, e.g., S. Rep. No. 403, 90th Cong., 1st Sess. 932 (1967).

[4] See, e.g., 43 Fed. Reg. 32,182 (July 25, 1978).

standards promulgated pursuant to section 202(a), or unless the Federal and California certification and test procedures are inconsistent.[5]

After California has received a waiver of Federal preemption for its standards and enforcement procedures for a class of vehicles, it may adopt other conditions precedent to initial retail sale, titling or registration of the subject class of vehicles without the necessity of receiving an additional waiver of Federal preemption.[6]

By letter dated October 4, 1991, the California Air Resources Board (CARB) requested that the Administrator grant a waiver of Federal preemption for the amendments to its motor vehicle pollution control program that establish four new categories of low-emission vehicles (LEVs) based on new, more stringent emission standards. On January 9, 1992, the Environmental Protection Agency (EPA) published a Notice of Opportunity for Public Hearing and request for comments regarding this

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[5] See, e.g., Motor and Equipment Manufacturers Association Inc. v. EPA, 627 F.2d 1095, 1111-14, (D.C. Cir. 1979), cert. denied, 446 U.S. 952 (1980) (hereinafter cited as "MEMA I"); 43 Fed. Reg. 25,729 (June 14, 1978).

To be consistent, the California procedures need not be identical to the Federal procedures. California procedures would be inconsistent, however, if manufacturers would be unable to meet both the state and the Federal requirements with the same vehicle. See, e.g., 43 Fed Reg. 32,182 (July 25, 1978).

[6] See 43 Fed.Reg. 36,679, 36,680 (August 18, 1978).

waiver request. [7] EPA received two requests for a hearing, [8] and the hearing was held on February 19, 1992. [9] The public comment period closed on March 24, 1992.

Subsequent to the close of the public comment period, EPA continued to receive copies of correspondence exchanged between CARB and counsel representing MVMA and AIAM and the General Motors Corporation (GM) pertaining to continuing discussions among these parties on CARB's pending waiver request. [10] To ensure all other parties interested in this

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[7] 57 Fed. Reg. 909 (January 9, 1992).

[8] EPA received two letters requesting a hearing. The first letter was signed by officials of the Motor Vehicle Manufacturers Association of the United States, Inc. (MVMA), and the Association of International Automobiles Manufacturers, Inc. (AIAM) (Docket entry II-D-01); the second letter was from the American Petroleum Institute (Docket entry II-D-02).

The MVMA member companies are: Chrysler Corporation, Ford Motor Company, General Motors Corporation, Honda of America, Mfg., Inc., Navistar International Transportation Corporation, PACCAR, Inc., and Volvo North America Corporation. The AIAM member companies are: American Honda Motor Co., Inc., American Isuzu Motors Inc., American Suzuki Motor Corporation, BMW of North America, Inc., Daihatsu America, Inc., Fiat Auto U.S.A., Inc., Hyundai Motor America, Mazda Motor of America, Inc., Mitsubishi Motor Sales of America, Inc., Nissan North America, Inc., Porsche Cars North America, Inc., Rolls-Royce Motor Cars Inc., Rover Group USA, Inc., Subaru of America, Inc., Toyota Motor Sales, U.S.A., Inc., Volkswagen of America, Inc., Volvo North America Corporation, and Yugo America, Inc.

[9] The transcript of this hearing is filed in the Docket of this proceeding (Docket entry IV-F-01).

[10] MVMA and AIAM jointly submitted comments to the Public Docket of this proceeding on March 27, 1992 (Docket entry IV-G-14) and on June 23, 1992 (Docket entry IV-G-37 and IV-G-38).

proceeding remained fully informed of the new information and developments which could have a bearing on the Agency's review of the waiver request, all documents received from CARB and the industry parties were placed in the public record unless they contained information submitted under a claim of business confidentiality (also referred to as Confidential Business Information or CBI), as the Agency's regulations define this term. [11]

[11] EPA's regulations, at 40 C.F.R § 2.201(f) state:

> *Reasons of business confidentiality* include the concept of trade secrets and other related legal concepts which give (or may give) a business the right to preserve the confidentiality of business information and to limit its use or disclosure by others in order that the business may obtain or retain business advantages it derives from its rights in the information. The definition is meant to encompass any concept which authorizes a Federal agency to withhold business information under 5 U.S.C. § 552(b)(4), as well as any concept which requires EPA to withhold information from the public under 18 U.S.C. § 1905 or any of the various statutes cited in § 2.301 through § 2.309.

In an effort to ensure as much information as possible was placed in the public docket of this proceeding, EPA requested that all persons who chose to submit CBI as part of their comments also submit for the public docket a non-confidential version of the CBI which summarizes the key data or information. In most cases, parties who submitted CBI also submitted redacted, rather than summarized, versions of the CBI for the public docket

In addition, EPA received a filing dated June 21, 1992, from MVMA/AIAM, this time directed to EPA, which contained information the industry believed to be "highly relevant to CARB's waiver application."[12] These comments included specific descriptions of automobile technology needed to produce vehicles that would comply with the LEV standards, projections of the cost of compliance, and other product planning information.[13] This filing included material claimed to be CBI provided by the General Motors Corporation, and a public version that excluded the CBI material. Because the industry asserted that this information was important to my decision in this matter, I thought it was equally important to receive comments on this filing from interested outside

[12] This characterization was made preceding the actual filing of the information, in a letter from counsel for MVMA/AIAM to EPA. See letter from Stuart A.C. Drake, Kirkland & Ellis, to Charles N. Freed, Director Manufacturers Operations Division, dated March 20, 1992, Docket entry IV-G-02.

[13] See Supplemental Comments of the Motor Vehicle Manufacturers Association of the United States, Inc. and the Association of International Automobile Manufacturers, Inc. on the Request For a Waiver of Federal Preemption for the California Low-Emission Vehicle Standards and Vehicle Test Procedures, dated June 23, 1992, Docket entry IV-G-37 and IV-G-38 ("MVMA/AIAM June 1992 Comment").

parties. [14] For this reason, EPA published a Federal Register notice to announce an "Opportunity for Written Comments on Additional Information Submitted to the Public Docket of the Low-Emission Vehicle Standards Waiver Request." [15] EPA allowed an additional period of thirty days in which comments could be filed; several parties (including CARB and GM) submitted additional written comments. [16] In addition, GM made additional submissions to the docket on some late-developing information which it considered important to the proceeding. Finally, at the request of the Assistant Administrator for Air and Radiation, various organizations and entities interested in this waiver request were invited to present their

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[14] As noted earlier, EPA had requested all persons, including GM, who chose to submit CBI to also submit to the public docket a non-confidential version of the CBI. EPA has reviewed GM's CBI submission and, while it contained information relevant to this proceeding, EPA has determined that the information contained only in the CBI submission would not affect the conclusions reached in this waiver decision. EPA further notes that, as discussed more fully below, the burden of proof in this proceeding lies on the opponents to the grant of this waiver. A corollary of that is that the consequences of failing to present information to the agency in such a way that it can be relied upon in a final decision (i.e., in a public form that is available in the docket) rest upon them as well.

[15] 57 Fed. Reg. 32,217 (July 21, 1992).

[16] Some parties filed comments which criticized this additional period of opportunity for written public comment. EPA believes, however, that it was appropriate to reopen the comment period so that interested members of the public could comment on the information submitted by the associations. Moreover, both the noted associations' June submissions and the comments received on this new information from some of the parties provided EPA with a more complete and more current assessment of the many technical issues in this waiver request, thus allowing the Agency to make the most informed decision possible.

views at meetings with the Assistant Administrator foe Air and Radiation held on November 30 and December 1, 1992 and were given the opportunity to submit brief written summaries of their positions by December 2, 1992. The organizations and entities attending the meetings or submitting written comments included numerous states, several environmental, groups, MVMA, the American Petroleum Institute, and the Ford Motor Company. [17]

On the basis of the record before me, I cannot make the findings required for a denial of a waiver under section 209(b)(1) of the Act and applicable case law with respect to the amendments to California's motor vehicle pollution control program. Therefore, EPA is granting to the state of California a waiver of Federal preemption for these amendments.

II. BACKGROUND

By letter dated October 4, 1991, CARB submitted to EPA a request for waiver of Federal preemption to enforce certain amendments to its motor vehicle pollution control program. [18] These amendments set up new

[17] These meetings are summarized in memoranda to the Docket (see Docket entries ******); the written statements appear as Docket entry ****).

[18] Letter from James D. Boyd, Executive Officer, CARB, to William K. Reilly, Administrator, EPA, dated October 4, 1992 , Docket entry II-A-1 (hereinafter "CARB Waiver Request Letter").

standards for various types of low emission vehicles, generically called "LEVs," which would be required in California beginning in the mid 1990's.[19] CARB states that the LEV program "will be the cornerstone of California's efforts to control pollution from motor vehicles in the coming years."[20]

There are several aspects to the LEV program. The regulations establish four new categories of light-duty vehicles (passenger cars and light-duty trucks) based on levels of exhaust emission standards. The vehicle categories, in order of increasing stringency, are called transitional low-emission vehicles (TLEVs), low-emission vehicles (LEVs), ultra-low-emission vehicles (ULEVs), and zero emission vehicles (ZEVs). Each vehicle category has specific exhaust emission certification standards for hydrocarbons (expressed in terms of "non-methane organic

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[19]CARB has grouped all these vehicles under the rubric "low-emission vehicles." Additionally, one specific category of these new vehicles bears the designation "Low-Emission Vehicle."

[20]See letter from James D. Boyd, Executive Officer, CARB to Charles N, Freed, Director, Manufacturers Operations Division, dated August 20, 1992, enclosing Supplemental Submittal of the California Air Resources Board and Appendices to Supplemental Comments, Docket entry IV-G-49, (hereinafter "CARB August 1992 Comments"), at 75-76. At the hearing, CARB acknowledged the technology-forcing nature of this program: "We wanted to push hard, and we think these regulations do push hard. They're clearly forcing the development of new technologies, and we wanted to do that because we've got countries (sic) where there's (sic) air pollution problems and it's only going to be solved if we have clean cars and near zero emitting cars." Hearing Transcript, Docket entry IV-F-01, p. 51.

gases," or "NMOG"), carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM) and formaldehyde (HCHO). These standards would be effective as early as the 1994 model year, but the more stringently controlled categories would not have to be introduced until later model years when needed to meet an increasingly more stringent "fleet average" requirement, discussed below.

Beginning with model year 1994, each manufacturers' fleet of light-duty vehicles (including both passenger cars and small light-duty trucks (of up to 3750 lbs. loaded vehicle weight)) is required to meet an average NMOG requirement that declines each year from a level of 0.250 gpm in 1994 to 0.062 gpm in 2003 and later years. (A similar declining NMOG fleet average requirement is established for larger light-duty trucks with a loaded vehicle weight of 3751-5750 lbs.) Manufacturers would decide how many vehicles to produce to what categories of standards for their light-duty vehicle fleet to comply with the fleet average requirements, subject only to a sales requirement for ZEVs. The ZEV sales requirement begins in model year 1998, when two percent of a manufacturer's sales of light duty vehicles must be ZEVs, and increases at certain points in succeeding model years until it reaches a maximum requirement of 10 percent of sales for model year 2003 and beyond. Small volume manufacturers (sales of 3000 or fewer vehicles) are not required

to comply with the ZEV sales mandate. The ZEV sales mandate applies only to light-duty vehicles (passenger cars and small light-duty trucks); it does not apply to the heavier light-duty trucks.

Manufacturers may earn marketable credits for having a sales-weighted fleet emission average lower than the fleet average requirement. Manufacturers who do not meet the fleet average requirement will be assessed debits which must be made up within certain time limits. The availability (and marketability) of credits will allow more compliance options for manufacturers. For example, manufacturers may postpone initial participation in this program past the 1994 model year[21] and delay the introduction of the more stringent vehicle categories in later years. [22]

The following tables show 1) a comparison of various California LDV standards under this program to the federal standards; and 2) the LDV NMOG Fleet Averages (with an implementation schedule suggested by CARB showing one possible scenario for the composition of the LDV fleets for those years):

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[21] Hearing Transcript, Docket entry IV-F-01, at 34.

[22] See CARB Staff Presentation Before the Air Resources Board - LEV/CF Status Update, dated June 11, 1992, Docket entry IV-G-31, at 4-5.

TABLE ONE -- COMPARISON OF CALIFORNIA AND FEDERAL STANDARDS

Category	NMOG*(HC)	CO	NOx
Transitional Low Emission Vehicle	0.125	3.4	0.4
Low Emission Vehicle	0.075	3.4	0.2
Ultra Low Emission Vehicle	0.040	1.7	0.2
Zero Emission Vehicle	0.0	0.0	0.0
(FED) Tier I	0.25**	3.4	0.4
Tier II	0.125**	1.7	0.2

(All measurements grams per mile)

* NMOG = NMHC + alcohols + carbonyls
** NMHC

TABLE TWO -- CARB LDV FLEET AVERAGE REQUIREMENT[23]

(Percentages of New CA Vehicle Sales)

Year	CA NMOG FLEET AVG*	0.39	0.25	TLEV	LEV	ULEV	ZEV**
1994	0.250	10	80	10			
1995	0.231		85	15			
1996	0.225		80	20			
1997	0.202		73		25	2	
1998	0.157		48		48	2	2
1999	0.113		23		73	2	2
2000	0.073				96	2	2
2001	0.070				90	5	5
2002	0.068				85	10	5
2003	0.062				75	15	10

*Grams per mile
** Mandatory requirement

[23] As noted earlier, this is only one possible scenario. Particular low-emission vehicle categories are not legally required until the fleet average requirement drops below the NMOG standard for the vehicle category. This means that TLEVs are not required until 1995, LEVs are not required until 1999, and ULEVs are not required until 2000. Manufacturers who generate credits by producing greater numbers of cleaner vehicles than necessary to meet the NMOG fleet average in a given year may push these "deadlines" for introduction of LEVs and ULEVs even farther back. For example, by producing TLEVs in model year 1998 in numbers greater than necessary to meet the NMOG fleet average requirement for that year, a manufacturer could generate credits that would allow it to defer introducing LEVs in 1999, or ULEVs in 2000.

The amendments also include two measures which CARB alleges are designed to offer manufacturers relief to ease the burdens of compliance. First, the regulations establish interim in-use standards which are up to 30 percent less stringent than the corresponding certification standards for TLEVs, LEVs and ULEVs.[24] These interim in-use standards will apply to TLEVs introduced in model years 1995 and to LEVs and ULEVs introduced through model year 1998. Also for these periods, CARB will suspend compliance with the full useful life (i.e., 100,000 miles) standard, so the in-use regulations will only apply for 50,000 miles.[25] After the interim in-use standard period is over, the vehicle category certification standards will also apply to in-use performance over the vehicle's full useful life.

Second, the regulations establish a two-tiered NMOG standard for "flexible-fueled" vehicles (FFVs), which are vehicles capable of operation on both gasoline and an alternate fuel. Because CARB wants to encourage the use of FFVs, it will allow a FFV which is certified to a particular emission category using alternate fuel to be certified to the next less stringent category using gasoline. For example, a FFV certified as a LEV using methanol (.075 grams per mile or gpm NMOG) need only meet the

[24] In-use standards would apply to any of these vehicles tested by CARB after a period of significant actual mileage accumulation .

[25] See CARB Staff Report, Docket entry II-A-3, at 21, Hearing Transcript, Docket entry IV-F-01 at 35.

TLEV standards (.125 gpm NMOG) on gasoline. According to CARB, this will allow manufacturers to use less extensive emission control systems in FFVs without losing emission reduction benefit because the NMOG emissions from such vehicles are likely to exhibit a lower ozone forming potential than NMOG emissions from gasoline-fueled vehicles.[26]

In an additional step that CARB believes will encourage the development of alternate fuel vehicles, the regulations establish a mechanism for adjusting the NMOG emissions from vehicles powered by fuels other than conventional gasoline, based on whether the emissions from such vehicles are more or less ozone-reactive.[27] As described more fully below at ******, under these mechanisms, the mass NMOG emissions are multiplied by a reactivity adjustment factor ("RAF") to establish a reactivity-adjusted measure of NMOG emissions.

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[26] See CARB Staff Report, Docket entry II-A-03, at 21, Hearing Transcript, Docket entry IV-F-01, at 46-48.

[27] See CARB Staff Report, Docket entry II-A-03, at 19-20, 35-36; CARB Technical Support Document, Docket entry II-A-4, Part C; CARB Final Statement of Reasons, Docket entry II-A-07, at 59-68; Supplemental Submittal of California Air Resources Board and Attachments, dated March 25, 1992 (CARB March 1992 Comment), Docket entry IV-G-09, at 8-11. The RAFs were also the subject of numerous comments filed by members of the automobile and petroleum industries and was discussed at the EPA hearing. This topic is reviewed further below at pages XX - XX.

CARB has also set up a program to periodically review the status of the LEV program. As stated by CARB, there will be a required report "at least biennially ... to identify any significant problems and to include proposals for any significant regulatory modifications. This will provide a structured mechanism for allowing consideration of modifications of the standards ... if the ARB's projections turn out to be overly optimistic." [28]

III. STANDARD OF PROOF

A. Standard and Burden of Proof in Waiver Proceedings

In Motor and Equipment Manufacturers Assn. v. EPA, 627 F.2d 1095 (D.C. Cir. 1979) (hereinafter referred to as "MEMA I", the U. S. Court of Appeals for the District of Columbia set out the role of the Administrator in a section 209 proceeding. This role is to :

> [C]onsider all evidence that passes the threshold test of materiality and ... thereafter assess such material evidence against a standard of proof to determine whether the parties favoring a denial of the waiver have shown that the factual circumstances exist in which Congress intended a denial of the waiver. [29]

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[28] CARB Waiver Request Letter, Docket entry II-A-1, at 13-14.

[29] MEMA I, 627 F.2d at 1122.

The court in MEMA I considered the standards of proof under section 209 for the two findings necessary to grant a waiver for an "accompanying enforcement procedure" (as opposed to the standards themselves): the "protectiveness in the aggregate" and "consistency with section 202(a)" findings (See pp. X - Y, *supra*). The court instructed, "The standard of proof must take account of the nature of the risk of error involved in any given decision, and it therefore varies with the finding involved. We need not decide how this standard operates in every waiver decision." [30]

The court upheld the Administrator's finding that, to deny a waiver, "there must be `clear and compelling evidence' to show that the proposed procedures undermine the protectiveness of California's standards." The court noted that this standard of proof "also accords with the congressional intent to provide California with the broadest possible discretion in setting regulations it finds protective of the public health and welfare...." [31]

With respect to the consistency finding, the court did not articulate a standard of proof applicable to all proceedings, but found that the opponents of the waiver were unable to meet a standard based on the

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[30] Id.

[31] Id.

preponderance of the evidence. Although MEMA I did not explicitly consider the standards of proof under section 209 in connection with a waiver request for "standards", there is nothing in the opinion to suggest that the Court's analysis would not apply with equal force to such determinations.

EPA's past waiver decisions have consistently made clear that: "Even in the two areas concededly reserved for Federal judgment by this legislation -- the existence of "compelling and extraordinary" conditions and whether the standards are technologically feasible -- Congress intended that the standards of EPA review of the State decision be a narrow one."[32]

Congress' intent that EPA review of California's decisionmaking be narrow has led EPA in the past to reject arguments that are not specified as grounds for denying a waiver:

> The law makes it clear that the waiver requests cannot be denied unless the specific findings designated in the statute can properly be made. The issue of whether a proposed California requirement is likely to result in only marginal improvement in air quality not commensurate with its cost or is otherwise an arguably unwise exercise of regulatory power is not legally pertinent to my decision under section 209, so long as the California requirement is consistent with section

[32] See, e.g., 40 Fed Reg. 23,102, 23,103 (May 28, 1975).

> 202(a) and is more stringent than applicable Federal requirements in the sense that it may result in some further reduction in air pollution in California. [33]

Thus, the consideration of all the evidence submitted in connection with this waiver decision is circumscribed by its relevance to those questions which must be considered under section 209.

Finally, it is important to remember the MEMA I court's holding that the burden of proof in a section 209 proceeding is squarely upon the opponents of the waiver:

> The language of the statute and its legislative history indicate that California's regulations, and California's determinations that they comply with the statute, when presented to the Administrator are presumed to satisfy the waiver requirements and that the burden of proving otherwise is on whoever attacks them. California must present its regulations and findings at the hearing and thereafter the parties opposing the waiver request bear the burden of persuading the Administrator

[33] See 36 Fed Reg. 17,458 (August 31, 1971). Note that the "more stringent" standard expressed here, in 1971, was superseded by the 1977 amendments to Section 209, which established that the California standards must be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards.

See also MEMA I, 627 F.2d at 1116-17 (holding that EPA properly declined to consider the alleged anti-competitive effects of California's in-use maintenance regulations).

that the waiver request should be denied. [34]

With respect to the burden of proof on the issue of consistency with section 202(a), the automobile industry opponents of this waiver request have argued that because they "have come forward with evidence that undercuts 'the statistical reliability' of the basic CARB analysis, the burden shifts back to CARB 'to support its methodology as reliable." [35] For the reasons explained below, I find that the burden of proof has not shifted to CARB; rather, it remains squarely on the opponents of the waiver request.

The industry opponents assert that "the key decision that governs EPA's resolution of the present controversy" [36] is International Harvester Company v. Ruckelshaus, (hereinafter referred to as "International Harvester") 478 F.2d 615 (D.C. Cir. 1979). In International Harvester, the court was asked to review EPA's decision to deny applications by several automobile and truck manufacturers who sought a one-year suspension (i.e., delay) of the 1975 emission standards for light-duty vehicles (passenger cars and certain light-duty trucks) that the Clean Air Act allowed under certain circumstances. The Administrator stated

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[34] MEMA I, 627 F.2d at 1121.

[35] MVMA/AIAM March 1992 Comment, Docket entry IV-G-14, at 41, n. 17 and at 44.

[36] MVMA/AIAM June 1992 Comment, Docket entry IV-G-37, at 35.

affirmatively that: "[O]n the record before me, I do not believe that it is in the public interest to grant these applications, where compliance with 1975 standards by application of present technology can probably be achieved, and where ample additional time is available to manufacturers to apply existing technology to 1975 vehicles."[37]

The Administrator made his determination in the suspension proceeding by applying an EPA methodology to test result data submitted by the manufacturers in support of their applications. On its face, the manufacturers' data offered scant hope of compliance with the 1975 standards. However, because the data contained many uncertainties and inconsistencies regarding test procedures and parameters, the Administrator developed a plan to adjust the data systematically. After reviewing the adjusted data, the Administrator concluded that "compliance with the 1975 standards by application of present technology can probably be achieved" and so denied the suspension applications.[38]

In reviewing the Administrator's denial of the suspension applications, the court found that even though the applicants had the

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[37] Id. at 626.

[38] Id. at 626.

burden of coming forward with data showing that they could not comply with the standards, EPA had the burden of demonstrating that the methodology it used to predict compliance was sufficiently reliable to permit a finding of technological feasibility, and failed to meet this burden.[39] The court reasoned that as the "underlying issue is the reasonableness and reliability of the Administrator's methodology ... [i]t is the Administrator who must bear the burden on this matter, because the development and use of the methodology are attributed to his knowledge and expertise. Where certain material lies particularly within the knowledge of a party he is ordinarily assigned the burden of adducing the pertinent information."[40]

The industry opponents compare the instant waiver proceeding to International Harvester, noting that "because EPA is now confronted with an array of data and analysis refuting CARB's position on the central question raised by its waiver application, EPA must require CARB to respond to that data and analysis in kind, if it can."[41]

CARB, however, maintains that International Harvester does not

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[39] Id. at 648.

[40] Id. at 643.

[41] MVMA/AIAM June 1992 Comment, Docket entry IV-G-37, at 36.

compel a shifting of the burden of proof to CARB to show technological feasibility by refuting the industry data and arguments presented in this record. CARB asserts that the burden of proof remains with the industry opponents to show technological infeasibility.

Based on the court's decision in MEMA I,[42] I do not believe that the industry has shifted the burden of proof to CARB by virtue of the fact that the industry has presented information in opposition to the CARB request. Instead, as stated by the MEMA I court in the passage quoted above, California's regulations and determinations "are presumed to satisfy the waiver requirements and ... the burden of proving otherwise is on whoever attacks them."[43] The court in MEMA I also found that "the legislative history makes clear that the burden of proof lies with the parties favoring denial of the waiver. Petitioners lost the battle they now wage twelve years ago when Congress specifically declined to adopt a provision which would have imposed on California the burden to demonstrate that it met the waiver requirements."[44] Furthermore, the MEMA I court specifically rejected the manufacturers' contention that International Harvester required the Administrator to carry "the burden of demonstrating the reliability of CARB's technological feasibility studies"[45] and found that

[42] See above, Section III, at xxx.

[43] 627 F.2d at 1121.

[44] Id.

[45] Id, at 1126.

manufacturers had failed to provide evidence sufficient to support the conclusion that CARB had not provided adequate leadtime..." [46]

Any "burden" remaining is upon EPA to demonstrate a reasonable and fair evaluation of the information in this record in coming to the decision on the waiver request. As the court in MEMA I stated, "Here, too, if the Administrator ignores evidence demonstrating that the waiver should not be granted, or if he seeks to overcome that evidence with unsupported assumptions of his own, he runs the risk of having his waiver decision set aside as arbitrary and capricious. His 'burden' is the burden of acting reasonably." [47]

IV. DISCUSSION

A. Public Health and Welfare

The criteria for review of the public health and welfare protectiveness issue as it pertains to both emission standards and accompanying enforcement procedures for which California requests a waiver have already been set forth in the introduction to this decision..

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[46] Id, at 1126-27.

[47] MEMA, 627 F.2d at 1123.

When CARB approved its LEV regulations in September 1990, it compared its standards to the existing Federal standards and found that "the regulations pertaining to motor vehicle emissions approved herein, in conjunction with the rest of the California motor vehicle emission regulations, will in the aggregate be at least as protective of public health and welfare as applicable federal standards." [48] Subsequent to this resolution, the 1990 amendments to the Clean Air Act were enacted on November 15, 1990. These amendments directed EPA to issue revised, more stringent emission standards for certain light duty vehicles; these new standards (called "Tier I" standards) were issued as final regulations on June 5, 1991. [49]

Because the Federal standards changed, the CARB Executive Director compared the LEV standards to the new set of Federal standards, and issued Executive Order G-673 setting his forth his determination that California's standards are still, in the aggregate, at least as protective of public health and welfare as the applicable Federal standards including the new Tier I standards and the cold temperature CO regulations required pursuant to section 202(j) of the Clean Air Act. [50] As the basis for this conclusion, CARB has asserted that the amended California standards are either equal to or more stringent than the corresponding Federal standards. The CARB waiver request letter includes a series of tables showing an extensive comparison of these sets of standards. [51]

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[48] CARB Resolution 90-58, dated September 28, 1990, Docket entry II-A-5, at 13.

[49] 56 Fed. Reg. 25,724 (June 5, 1991).

[50] CARB Executive Order G-673, October 2, 1991, Docket entry II-A-9.

[51] CARB Waiver Request Letter, Docket entry II-A-1, at 9-10 and accompanying tables.

In its request, California noted that there are four exceptions to its determination that each of its emissions standards is equal to or more stringent than its Federal counterpart. These exceptions concern the three federal standards for which there is no California counterpart: 1) the proposed (but now final) Federal cold CO standards, 2) the Federal standards for total hydrocarbons, and 3) the Federal particulate matter standards for non-diesels; and 4) the absence of a 100,000 mile NOx standard for non-diesel California passenger cars and light-duty trucks certified to the 0.25 gpm NMHC standard.

CARB stated in its request letter that:

> the overall stringency of the California program greatly outweighs these relatively minor and limited instances. Furthermore, as the California fleet average NMOG requirement declines (i.e. grows more stringent) year-by-year, the number of vehicles subject to the substantially more stringent California low-emission vehicle standards will consistently increase. Accordingly, my determination that the California emission standards as amended by the low-emission vehicle regulations will be, in the aggregate, at least as protective of public health and welfare as the applicable federal standards is clearly not arbitrary or capricious.[52]

[52] CARB Waiver Request Letter, Docket entry II-A-1, at 9-10.

No comments were received from any party that questioned CARB's protectiveness determination on the basis of the limited differences between the programs described above.

Several trade associations representing the petroleum industry and one petroleum manufacturer have commented to EPA about their concerns with the fuel components of this program which could affect the CARB protectiveness determination.[53] As stated by the American Petroleum Institute (API),

> [F]irst, [CARB's] proposal lacks reactivity factors [to adjust NMOG emissions from alternative-fuel vehicles to account for their lower reactivity], which are critical to verifying the program's viability. Second, the methodology used to determine reactivity adjustments factors (RAFs) is technically flawed. Because the information submitted by California in its October 4, 1991 waiver request is incomplete, California cannot make the required determination under section 209(b) that the proposed emission controls are more protective than the federal standards. ..... As a result of CARB's oversimplifications and technical errors, its methodology yields erroneous results, which could result in an arbitrary and capricious determination of the LEV program's

[53] See generally, comments from American Petroleum Institute (Hearing Transcript at at 136-142, Docket entries IV-F-09 and IV-G-10); Western States Petroleum Association (Hearing Transcript at 113-136, Docket entries IV-F-07, IV-F-08 and IV-G-13); the Eastern States Petroleum Advisory Group (Hearing Transcript at 142-146, Docket entries IV-F-10 and IV-G-07); and, the Mobil Oil Corporation, Docket entry IV-G-08.

protectiveness.[54]

Some background on CARB's particular RAF procedures is necessary to provide the context for this contention that the CARB protectiveness determination is improper. Throughout this proceeding, CARB has affirmatively noted that the fuel to be used in LEVs is important to the manner of the vehicle's compliance with the standards. The CARB test procedures offer manufacturers a choice of fuels on which to test their vehicles for compliance with the certification standards. Manufacturers can use either the gasoline (called "Indolene Clear") used by EPA in Federal certification testing, or Indolene Clear with a lower Reid Vapor Pressure (RVP). This lower RVP certification fuel is to correspond to the specifications for commercial gasoline required for sale in California since January 1, 1992 as a result of CARB's "Phase 1 reformulated gasoline" rulemaking.[55]

CARB also anticipates that, in future years, alternative fuels will be used in California vehicles. As noted in its Staff Report:

> [A]lthough the proposal does not favor the use of any particular fuel, it does recognize that the use of alternate [clean] fuels may reduce ozone compared to conventional fuels. Clean-fueled and

[54] Letter from Terry F. Yosie, Vice President, American Petroleum Institute, to Richard D. Wilson, Director of Office of Mobile Sources, dated March 26, 1992, Docket entry IV-G-10, at 1-2 of attached comments.

[55] CARB Final Statement of Reasons, Docket entry II-A-7, at 7 and 75.

> gasoline-fueled vehicles may emit similar amounts of hydrocarbons, but the capability of those hydrocarbons to form ozone in the atmosphere can vary greatly. To evaluate the air quality impacts of vehicles powered by different fuels, it is appropriate to compare the ozone impact rather than just the mass of the hydrocarbon emissions.....[56]

CARB recognized that although emissions from alternate fuel vehicles may have lower ozone-forming potential (or reactivity) than emissions from gasoline-fueled vehicles, the alternate fuel vehicle may emit a higher mass of hydrocarbons. For this reason, CARB decided to establish Reactivity Adjustments Factors (RAFs) as a means of comparing the reactivity of emissions from alternative fuels with the reactivity of conventional fuel. By multiplying the measured mass of NMOG emissions produced by an alternative fuel by the appropriate RAF, the ozone-forming potential of the alternative fuel can be compared easily to conventional gasoline. With this approach, CARB seeks to establish a "level playing field" in terms of the ozone-forming potential for all fuels.

As the petroleum (and automobile) industry commenters have pointed out, the CARB regulations do not contain the RAFs for all types of alternative fuels; in fact, there is only a single RAF (for methanol-fueled

[56] CARB Staff Report, Docket entry II-A-3, at XX.

TLEVs) established to date. [57] CARB has indicated that because it believes the reactivity of the emissions from a vehicle operating on clean fuels will differ depending on the control technology on the vehicle, it was unable to set RAFs across the board but rather decided to wait for additional data. [58]

The CARB regulations do include, however, the procedures and protocols a manufacturer can follow to formulate a RAF for any alternative fuel which has not yet been assigned a RAF by CARB. [59] Thus, a manufacturer desiring to gain the advantage of using a "cleaner" alternative fuel for certification has the opportunity to do so by developing the RAF for the particular fuel using the CARB procedures and submitting it to the CARB Executive Director for approval.

The petroleum industry is not convinced that CARB chose the correct RAF procedures in its attempt to provide a level playing field. There was extensive criticism of the CARB regulations pertaining to reactivity, both

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[57] CARB Staff Presentation Before the Air Resources Board - LEV/CF Status Update, June 11, 1992, Docket entry IV-G-31, at 7. The RAF established by CARB for methanol is .45.

[58] Hearing Transcript, Docket entry IV-F-01, at 37. Additionally CARB is expected to approve additional RAFs at its January 1993 meeting, and CARB is continuing to develop additional RAFs for other alternative fuels.

[59] Hearing Transcript, Docket entry IV-F-01, at 20 and 59; CARB March 1992 Comment, Docket entry IV-G-09, at 10.

at the hearing and in written comments, alleging that technical flaws in the reactivity adjustment factor mechanism may result in ozone increases, contrary to the goal and expectation of CARB.[60] In its most recent comments, the industry urged that, if EPA approves this waiver request, it should be approved on a mass emissions basis only and reactivity adjustment factors should not be included.[61]

EPA has considered carefully the petroleum industry comments relating to the RAFs and the RAF procedures in the CARB regulations as well as CARB's responses to the specific concerns raised at the hearing and in the subsequent written comments. On the basis described below, the Agency has determined that the CARB protectiveness determination is not rendered arbitrary and capricious by the CARB regulations relating to RAFs for the following reasons.

First, regarding alternative fuels other than methanol (the only alternative fuel for which CARB has established a RAF), CARB has, in

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[60] CARB asserts that the petroleum industry critique of the reactivity adjustment approach CARB selected is not pertinent to the waiver issues before EPA, but nevertheless responded to the points raised by the industry in detail. CARB March 1992 Comment, Docket entry IV-G-09, Attachment A.

[61] Letter from Charles J. DiBona, President, American Petroleum Institute, to Administrator Reilly, dated December 2, 1991, Docket entry IV-G-**.

effect, established a mechanism for regulating vehicles powered by alternative fuels for which no corresponding Federal regulations exist. CARB has established the RAF process to apply to fuels other than conventional gasoline. By virtue of its RAF process, CARB can effectively set standards for alternative-fueled vehicles in California which are not currently regulated under the Federal program because no Federal standards apply (e.g., vehicles powered by Compressed-Natural Gas or "CNG"). CARB states correctly that "obviously the California TLEV, LEV and ULEV standards with reactivity adjustments are more protective than having no standards."[62] Because these standards with reactivity adjustments serve to regulate vehicles not currently regulated by EPA, California's conclusion that its standards are at least as protective as the Federal standards is not arbitrary and capricious.[63]

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[62] CARB March 1992 Comment, Docket entry IV-G-09, at 13.

[63] This finding is based on the absence of corresponding Federal standards for these fuels. This situation will likely change; e.g., CNG standards have been proposed by EPA. Accordingly, it may be necessary in the future for EPA to reexamine this protectiveness determination as it pertains to alternative fuels. I note, however, Because the CARB standards for NMOG for the new low-emission vehicles begin at .125 gpm NMOG and become more stringent, even if the mass emissions of hydrocarbons from an alternative-fueled vehicle are greater than the CARB NMOG standards, it is not likely that these emissions would exceed a Federal hydrocarbon standard for the alternative fuel that corresponds to the Federal Tier I gasoline standard of .25 NMHC because of the significant "cushion" between the CARB standards and the Federal hydrocarbon standard. In any event, I note that CARB will be required to seek from EPA a determination that any future RAFs are within the scope of this waiver.

Second, I have compared the only alternative fuel standards which "overlap" between the Federal and the CARB programs (M100 and M85.[64]) and I find that the CARB standards are more protective than the Federal standards. As CARB has stated:

> The federal hydrocarbon exhaust emission standards for M100 and M85 are based on Organic Material Hydrocarbon Equivalent (OMHCE"). OMHCE measurements factor out roughly 50% of the reactivity effect of the exhaust. Since the California low-emission vehicle standards are all at least twice as stringent numerically than the federal 0.41g/mi. and 0.25 g/mi. OMHCE methanol standards, and the California regulations include a mass standard for formaldehyde, the California standards for methanol vehicles will always be more stringent than the federal standards.[65]

Because of the numerical relationship between the CARB and federal standards and because the RAF established by CARB for methanol is 0.45, the HC emissions from a methanol TLEV could not possibly exceed those from a methanol-fueled vehicle certified to the current federal methanol standards.

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[64] See 40 C.F.R §§ 86.090-8, 86.090-9, 86.094-8 and 86.094-9.

[65] CARB March 1992 Comments, Docket IV-G-09, at 13.

Third, I find that CARB's decisions regarding the RAF procedures were not arbitrary and capricious. CARB took a reasoned and reasonable approach to this aspect of its program. CARB, after extensive study, adopted the "maximum incremental reactivity" (MIR) scale for calculation of RAFs, one of several options it evaluated. The principle advantage of the MIR scale, according to CARB, is that it defines reactivity in areas where hydrocarbon control has its greatest benefits, the upwind areas where the highest emission densities are found. Additionally, the MIR scale allows for "ease of RAF calculations, a single scale for use in the statewide regulations, and a framework that can easily incorporate chemical mechanism updates."[66]

The reasonableness of CARB's reactivity-based approach to NMOG emissions is also indicated by the fact that Congress directed EPA to adopt CARB's reactivity-based approach to NMOG emissions in the provisions of Part C of Title II of the Clean Air Act concerning the clean fuel vehicles program. In section 241(3), Congress provided that "[i]n the case of vehicles using fuels other than base gasoline, the level of NMOG emissions shall be adjusted based on the reactivity of the emissions relative to vehicles using base gasoline [which is defined in section 241(4)]." Congress also provided that to demonstrate compliance with an

[66] CARB March 1992 Comment, Docket entry IV-G-09, Attachment A.

NMOG standard NMOG emissions are to be measured in accordance with CARB's NMOG test procedures. and in section 241(4) directed EPA to "modify the definitions of NMOG, base gasoline, and the methods for making reactivity adjustments, to conform to the definitions and method used [by CARB in its LEV regulations] so long as the California definitions are, in the aggregate, at least as protective of public health and welfare as the definitions in this section." (Emphasis added) As CARB's definition of NMOG[67] is identical to that in section 241(3) and CARB has proposed a definition of base gasoline substantially identical to that in section 241(4) of the Act, it appears likely that the CARB definitions will satisfy the "at least as protective" test of section 241(4). Consequently, it appears likely that section 241(4) will require EPA to follow CARB's methods of making reactivity adjustments in EPA's clean-fuel vehicle program.[68]

Fourth, as CARB has noted, it is expected that the "substantial majority" of the vehicles introduced pursuant to the LEV program will be gasoline-fueled vehicles.[69] Consequently, it is extremely likely that any

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[67] Docket entry II-A-8, Attachment C, "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," at 4.

[68] See also Clean Air Act section 244 (in general requiring EPA to administer and enforce clean-fuel vehicle standards in the same manner as CARB when the federal standards are numerically identical to CARB's).

[69] CARB March Comment, at 13, n. 8.

increases in mass emissions of hydrocarbons that might result from the use of RAFs in connection with alternative fuels would have only a minimal impact in the context of the overall program.

In a comment submitted December 8, 1992,[70] GM requested that EPA reopen the docket in this proceeding in order to accept additional information regarding a legal challenge to CARB's "Reactivity Regulations" brought by the Western States Petroleum Association. According to GM, this legal challenge creates uncertainties because California may have to change its test procedures as a result of the litigation. GM also requested that, if EPA grants any portion of the waiver request in the docket, EPA "require expedited action (both by CARB and by EPA) that will allow full and timely review of any revisions to the current LEV/CF rules. If the problem cannot be addressed satisfactorily in that way, a modification of CARB LEV/CF implementation will, at a minimum, be required." In a response to this letter, dated December 11, 1992,[71] CARB noted that the WSPA challenge to the reactivity regulations concerned regulations adopted by CARB on November 9, 1992, not any of the regulations currently before EPA in this waiver proceeding. CARB also noted that the lawsuit has no legal effect on the LEV regulations at this time and that CARB has provided no indication that it intends to revise its

[70] ****GM 12/8 LETTER

[71] ****12/11 CARB LETTER *****

regulations as a result of WSPA's claims.

EPA rejects GM's request to reopen the docket to address the WSPA lawsuit against CARB. As CARB notes, WSPA's challenge does not concern regulations subject to this waiver proceeding. Regardless of whether a lawsuit concerns regulations at issue in a waiver proceeding, the pendency of a lawsuit does not affect the legal status of the regulations. Should WSPA prevail in its challenge and CARB be required to modify its regulations, such modifications will be the subject of future waiver proceedings. The uncertainty created by the possibility of revisions to CARB's regulations is always present, however, as CARB could revise its regulations on its own, without being prompted by a court decision.

EPA also rejects GM's request that EPA at this time require expedited action by CARB and EPA on future revisions to California's LEV regulations. EPA will act as expeditiously as possible on waiver requests concerning revisions to the LEV program in the future, and such requests will be subject to the requirement of section 209 concerning consistency with section 202 of the Clean Air Act, which will ensure that revisions to California's program provide the manufacturers with adequate leadtime. Any impact that such future revisions should have on the LEV program's implementation schedule may be raised in the California regulatory

proceedings leading to the adoption of the revisions and in the waiver proceedings concerning those revisions.

- For the same reasons, I also reject the new request presented by API in its December 2, 1992 comments - that EPA grant the waiver only to the extent NMOG emissions are measured on a mass basis. EPA also received comments relating to the CARB's protectiveness determination after the August 20, 1992 closing date of the additional period for public comment. In these comments, General Motors Corporation asserted that new developments regarding Federal inspection & maintenance ("I/M") regulations would impact California's protectiveness determination. Specifically, GM noted that the new EPA I./M regulations are designed to insure better in-use vehicle emission performance. GM contended that because California's current I/M program is inferior to the new Federal program, and because there is no assurance that California will adopt the I/M program required by the Federal regulations, the LEV standards combined with an inferior I/M program in the state will be less protective of the public health and welfare than the corresponding federal program

mandated by the Clean Air Act.[72]

In response to the GM comments, CARB pointed out that, under the requirements of the Act, all states with "Serious" nonattainment areas (which include California) must submit to EPA a State Implementation Plan revision providing for an enhanced I/M program.[73] In order to comply with section 182(c)(3)(A) of the Act, CARB has submitted a letter to EPA committing to comply with the Act's requirements and EPA's regulations

[72] These additional comments are: Motion To Reopen the Record to Receive Additional Evidence on the Request for a Waiver of Federal Preemption for the California Low-Emission Vehicle Standards (Motion to Reopen), dated November 7, 1992, Docket entry IV-G-**, and Supplementary Submission in Support of Motion to Reopen the Record on the Request for a Waiver of Federal Preemption on the California Low-Emission Vehicle Standards (Supplementary Submission), dated November 18, 1992, Docket entry IV-G- **.

[73] Letter from Tom Cackette, Chief Deputy Executive Officer, CARB, to Charles N. Freed, Director, Manufacturers Operations Division, dated November 19, 1992, Docket entry IV-G-**.

in this area.[74]

In its comments, CARB also contends that the existence and effectiveness of I/M programs in California and other states is irrelevant to the analysis of protectiveness under section 209(b) because the state standards at issue in a waiver proceeding are those that are otherwise preempted by section 209(a). As I/M requirements are not subject to preemption under section 209(a), they are irrelevant to the comparison of Federal and California standards.

After reviewing this exchange of comments, EPA finds that there is no reason to accept GM's contentions regarding the alleged impact of the I/M issue on the protectiveness analysis. EPA does not believe that I/M is pertinent to the protectiveness analysis because it is not subject to preemption by section 209(a). I/M programs are not the "accompanying enforcement procedures" referred to in section 209. Unlike I/M programs, which apply to vehicle owners, those procedures are for enforcing the standards against motor vehicle manufacturers. In any event, California has submitted a commitment to adopt an enhanced I/M program in

[74] See Supplemental Submission, Attachment A, Docket entry xxx.

accordance with the requirements of section 182(c) the Act.[75]

In a comment dated December 8, 1992, *** FN *** GM raised questions about CARB's protectiveness determination on the basis of a report prepared by CARB's Technical Support Division in October of 1992. According to GM, the October 1992 report indicated that decreases in NOx emissions could cause ozone increases, suggesting that the NOx decreases that would result from the LEV program would worsen California's air quality problems. GM requested that EPA reopen the docket in this proceeding to allow further evaluation of the significance of this report. CARB responded to GM's December 8, 1992 comment with a letter dated December 11, 1992 ***FN*** In that letter, CARB pointed out that GM had failed to mention other parts of the October 1992 report that indicated that reductions in emissions of VOCs which would also be brought about by the LEV program, consistently resulted in ozone decreases. CARB also pointed out that NOx emissions decreases result in decreases in levels of PM10, which is also a problem for the South Coast Air Basin. Finally, CARB stated that, as discussed in the report, the focus of the October 1992 paper was "to investigate a particular methodology used in conjunction with the Urban Airshed Model, rather than to predict the air quality impacts of an emission control strategy." The paper itself noted

[75] I also am unable to find that GM's comments present any reason to reopen formally the record of this proceeding, so I therefore deny the GM request (or "motion") to reopen the proceeding and schedule an additional public hearing.

that the example presented in the paper was not for the purpose of evaluating "emission control strategies for the South Coast Air Basin of California. As noted in the performance section below, this application does not meet the ARB's performance goals for typical model performance." (Attachment C to GM December 8, 1992 comment at 3.) The paper further noted that additional analysis of the model's performance was necessary.

In addition to the issues raised by CARB in its December 11, 1992 letter, it should be noted that GM's suggestion that the LEV program would worsen California's air quality problems is contradicted by the modeling results introduced into this proceeding by MVMA/AIAM. [76] Those results indicated that the LEV program would result in small decreases in ozone levels; they did not indicate that the LEV program would increase ozone levels. It also appears that questions about the impact of NOx emission reductions were raised by the motor vehicle manufacturers in the course of California's regulatory proceedings leading up to California's adoption of the LEV program and that CARB responded to those concerns at that time. [77]

For the reasons given by CARB in its response to GM's December 8,

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[76] *****MARCH COMMENT PP ????

[77] CARB FSR pp ????????

1992 comment and for the additional reasons discussed in the preceding paragraph, GM's request to reopen the docket in order to evaluate further the significance of the October 1992 paper is rejected. CARB's response makes clear that it would be inappropriate and premature (given the status of the modeling underlying the paper) to rely on the October 1992 paper to find that CARB's protectiveness determination was arbitrary and capricious.

Therefore, based on the record before me, I cannot find that CARB's determination that its state standards are, in the aggregate, at least as protective of public health and welfare as applicable Federal standards is arbitrary and capricious.

B. Compelling and Extraordinary Conditions

Under section 209(b)(1)(B) of the Act, I cannot grant the waiver if I find that California "does not need such State standards to meet compelling and extraordinary conditions ....". In comments relating to this criterion, MVMA/AIAM believe that I should make this finding. First, they

assert that the question before EPA is whether these specific LEV program standards are needed, rather than whether California continues to need its own motor vehicle emission control program, of which these standards are a part. Second, applying this standard of review, they assert I should find that the LEV standards are not needed by California because, using calculations they endorse, the standards will provide only a very small air quality benefit to the state.[78]

EPA has considered carefully the testimony and comments of CARB and MVMA/AIAM regarding this particular prong of the waiver test. EPA agrees with California that the basic inquiry here concerns whether "compelling and extraordinary conditions" exist that justify California's continued need for its own mobile source program. Therefore, I reject the Associations' interpretation of the test of section 209(b)(1)(B) for the following reasons.

In its review of a waiver request under the standard of section 209(b)(1)(B), EPA is guided by the principle, recognized by the MEMA I court, that Congress intended California to be "afford[ed] the broadest discretion"[79] in its choice of air pollution control strategies. This

[78] MVMA/AIAM March 1992 Comment, Docket entry IV-G-14, at 51-56.

[79] H.R. Rep. 95-294, at 301-302 (1977) (cited with approval in MEMA I, 627 F.2d at 1110.

principle is particularly pertinent here, where there is vigorous disagreement between CARB and the waiver opponents over the level of the benefits. (I note here that the industry concedes that there is a benefit to be gained by the California LEV program, but they believe the benefit is insignificant.) [80]

Because it determined that California was entitled to exercise broad discretion in its choice of mobile source air pollution control methods, Congress acted to ensure that EPA's review of California's decisionmaking be narrow. From the outset, EPA has consistently complied with Congressional intent. For example, in a 1971 decision, (then) Administrator Russell Train said:

> The law makes it clear that the waiver requests cannot be denied unless the specific findings in the statute can properly be made. The issue of whether a proposed California requirement is likely to result in only marginal improvement in air quality not commensurate with its cost or is otherwise an arguably unwise exercise of regulatory power is not legally pertinent to my decision under section 209, so long as the California requirement is consistent with section 202(a) and is more stringent than applicable Federal requirements in the sense that it may result in some further reduction in air pollution in California. [81]

[80] Letter from Thomas H. Hanna, President, MVMA and George C. Nield, President, AIAM, to William K. Reilly, Administrator, EPA, dated January 29, 1992, Docket entry II-D-01, at 7.

[81] 36 Fed. Reg. 17,458 (August 31, 1971).

Later waiver decisions amplified and clarified this position. In a 1975 case granting a waiver for California's light-duty vehicle standards for model years 1977 and beyond, the Administrator noted that:

> The structure and history of the California waiver provision clearly indicate a Congressional intent and an EPA practice of leaving the decision on ambiguous and controversial public policy to California's judgment ... Sponsors of the (waiver) language eventually adopted referred repeatedly to their intent to make sure that no 'Federal bureaucrat' would be able to tell the people of California what auto emission standards were good for them, as long as they were stricter than the Federal standards.[82]

In a 1976 decision granting a waiver to California's motorcycle emission standards for 1978 and beyond model years, the Administrator further elaborated on this standard of review:

> Arguments concerning ... the marginal improvements that will allegedly result (from implementations of the standards at issue in this waiver request), and the question of whether these particular standards are actually required by California ... fall within the broad area of public policy. The EPA practice of leaving the decision on such controversial matters of public policy to California's judgment is entirely consistent with the Congressional intent.[83]

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[82] 40 Fed. Reg. 23,101, 23,102 (May 28, 1975) (emphasis added).

[83] 41 Fed. Reg. 44,209, 44,210 (October 10, 1976).

Congress affirmed its intent in the 1977 amendments to section 209(b). At that time, Congress amended the section to require California to determine that its standards will be as protective as Federal standards in the aggregate. This amendment, as noted above, allowed California to choose to adopt individual standards less stringent that the corresponding Federal standards when California determined that such a strategy is appropriate for their air pollution control efforts. The House Committee noted that "[t]he Committee amendment is intended to ratify and strengthen the California waiver provision and to affirm the underlying intent of that provision, i.e., to afford the broadest discretion [to California] in selecting the best means to protect the health of its citizens and the public welfare."[84]

After the 1977 amendments, EPA addressed the issue of whether California had to demonstrate a need for its own motor vehicle program or a need for the particular standard at issue in the waiver proceeding. In a 1984 decision, EPA rejected arguments raised by the auto manufacturers and agreed with California that the basic "inquiry concerns whether compelling and extraordinary conditions exist that justify California's continued need for its own mobile source emissions control program."[85]

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[84] H.R. Rep. 95-294, 301-302 (1977), (cited with approval in MEMA I, 627 F.2d at 1110.

[85] 49 Fed. Reg. 18,887, 18,890 (May 3, 1984).

In that decision, the Administrator discussed how the legislative history of section 209 showed that Congress' concern for industry was largely focused on problems the industry might face from the administration of two programs. The Administrator proceeded to conclude: "Therefore, as CARB points out "[t]he "need" issue thus went to the question of standards in general, not the particular standards for which California sought [a] waiver in a given instance.'" [86] The Administrator determined that he could not deny the waiver on the basis of a lack of need because "the manufacturers have not demonstrated that California no longer has a compelling and extraordinary need for its own program." [87] This determination was not challenged at the time of the 1984 waiver decision and, in fact, has remained unchallenged until the instant waiver proceeding.

This approach to the "need" criterion is also consistent with the fact that because California standards must be as protective as Federal standards in the aggregate, it is permissible for a particular California standard (or standards) to be less protective that the corresponding

[86] 49 Fed. Reg. 18,887, 18,890 (May 3, 1984).

[87] Id. at 18,890.

Federal standard.[88] For example, for many years, California chose to allow a carbon monoxide standard for passenger cars that was less stringent than the corresponding Federal standard as a "trade-off' for California's stringent nitrogen oxide standard.[89] Under a standard of review like that proposed by MVMA/AIAM, EPA could not approve a waiver request for only a less stringent California standard because such a standard, in isolation, necessarily could be found to be contributing to, rather than helping, California's air pollution problems.

Based upon EPA's review of the comments pertaining to the "compelling and extraordinary conditions" test of Section 209(b)(1)(B), I have determined that my inquiry in this area continues to be limited to

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[88] The Administrator noted that:

> Indeed, to find that the 'compelling and extraordinary conditions' test should apply to each pollutant would conflict with the amendment to section 209 in 1977 allowing California to select standards 'in the aggregate' at least as protective as federal standards.' In enacting that change, Congress explicitly recognized that California's mix of standards could 'include some less stringent than the corresponding federal standards.' See H.R. Rep. No. 294, 95th Cong., 1st Sess. 302 (1977). Congress could not have given this flexibility to California and simultaneously assigned to the state the seemingly impossible task of establishing that 'extraordinary and compelling conditions' exist for each standard.

[89] See 43 Fed. Reg. 25,729, 25,731 (June 14, 1978).

whether California needs its own motor vehicle control program to meet compelling and extraordinary conditions and not whether any given standards are necessary to meet such conditions.

I turn now to the industry's second contention under this test, namely, that because the LEV standards will provide such a small air quality benefit to California, they are not needed by the state. The industry argues that the LEV standards will offer only *de minimis* air quality benefits to California. In support, MVMA/AIAM note that "the record does not indicate that CARB has provided EPA with any data or analysis to quantify or estimate the reductions in ozone levels in any part of the State that it could attribute to the CF/LEV program."[90] The associations based this opinion on a comparison of CARB's projections of the emission reductions expected from the LEV program to the results of air-quality modeling performed by the joint Auto/Oil Air Quality Improvement Research Program.[91]

CARB, on the other hand, has commented that the LEV program will provide significant benefit to the state's air quality. For example, CARB

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[90] Letter from Thomas H. Hanna, President, MVMA and George C. Nield, President, AIAM to William K. Reilly, Administrator, EPA, dated January 29, 1992, Docket entry II-D-01, at 6.

[91] Id., see also Hearing Transcript, Docket entry IV-F-01, Testimony of Reg Modlin, Chrysler Corporation at 86-95.

staff, using emission factors for the various vehicle categories in CARB's emission model, has projected emission reductions of 29 tons per day in emissions of NMOG and 36 tons per day for NOx in the year 2000. These numbers represent four percent and three percent decreases, respectively, in the statewide on-road emissions that would occur without the LEV program regulations.[92] Further projections by the CARB staff for the year 2010 show even greater reductions in NMOG, CO and NOx.[93] EPA has also received compelling comments on the need for the LEV program from the South Coast Air Quality Management District.[94]

As discussed above in connection with the analysis of the nature of the "compelling and extraordinary conditions" test, EPA is guided by the principle that Congress intended California to be afforded broad discretion in its choice of air pollution control strategy. Thus, as Administrator

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[92] CARB Technical Support Document, Docket entry II-A-4, at IX-1 to IX-4. Other discussion of air quality benefits appears in: CARB Waiver Request Letter, Docket entry II-A-1, at 10-11; CARB Staff Report, Docket entry II-A-3, at 12-13 and 59-62; Hearing Transcript, Docket entry IV-F-01, at 9 and 21-22; CARB March 1992 Comments, Docket entry IV-G-09, at 14-16 and Attachment B; CARB August 1992 Comments, Docket entry IV-G-49, at 72-75.

[93] CARB March 1992 Comments, Attachment B, Docket entry IV-G-09.

[94] Letter from James M. Lents, Ph.d, Executive Officer South Coast Air Quality Management District, to Charles Freed, Director, Manufacturers Operations Division, dated August 19, 1992, enclosing their "Response to Supplemental Comments Filed By The Motor Vehicle Manufacturers Association (SCAQMD Comment), Docket entry IV-G-50.

Train concluded in a 1971 waiver decision: "The issue of whether a proposed California requirement is likely to result in only marginal improvement in air quality not commensurate with its cost ... is not legally pertinent to my decision under section 209." [95]

Consequently, as California has noted correctly, "[T]he extent to which a given set of California standards will reduce air pollution in California is not pertinent to the need question. As long as compelling and extraordinary air pollution problems continue to exist in California -- as they surely do -- there will continue to be a need for the standards." [96]

For the reasons stated above in connection with the analysis of the "compelling and extraordinary conditions" test, I believe that California's assessment of the need question is correct, and that the extent of the benefits that will be produced by the California LEV program is not pertinent to my decision.

Finally, I turn to a consideration of whether the compelling and extraordinary conditions that justify California's motor vehicle emission control program still exist. I believe that CARB has demonstrated in its waiver request the continuing and pervasive existence of the compelling

[95] 36 Fed. Reg. 17,458 (August 31, 1971).

[96] CARB March 1992 Comment, Docket IV-G-09, at 14.

and extraordinary conditions justifying California need for its own motor vehicle pollution control program. In its letter of request for this waiver, CARB discussed how air pollution continues to affect the area:

> The South Coast Air Basin is the only area in the country designated as having an 'extreme' air pollution problem in the 1990 amendments to the Clean Air Act. The unique geographical and climatic conditions and the tremendous growth in vehicle population and use which moved Congress to authorize California to establish separate vehicle standards in 1967 are still in existence today. Indeed, these conditions were precisely the reason the Board has adopted the low-emission vehicle regulations. [97]

The South Coast Air Quality Air Management District also provided a current assessment of the air quality situation in that part of California:

> The Basin has the most serious air quality problem in the nation. Ozone and carbon dioxide reach maximum levels nearly three times the national standard set to protect public health. Fine particulate matter reaches levels of nearly twice the national health-based standards. The Basin is the only area in the nation exceeding the nitrogen dioxide health standards. As a result of non-compliance with the federal standards for ozone and fine particulate matter, Basin residents incur billions of dollars in damage to health, materials, agriculture and visibility each year.
>
> A combination of poor atmospheric ventilation, frequent sunshine and neighboring mountain barriers makes the Basin an area of high

[97] CARB Waiver Request Letter, Docket entry II-A-1, at 11.

> air pollution potential. As a result, the Basin cannot absorb large amounts of pollutant emissions without exceeding health-based air quality standards.[98]

No commentor disputed California's determination of the existence of a continuing problem; indeed, the industry itself commented that "[T]here is no question that California continues to face severe ozone air-quality problems."[99]

Based on previous showings by California in this regard, the submissions to the record by CARB and other parties in support of CARB's position and CARB's response to the the MVMA comments, I agree that California continues to face the requisite compelling and extraordinary conditions. Thus, I cannot deny the waiver request on the basis of a lack of compelling and extraordinary conditions.

C. Consistency with Section 202(a)

1) The Standard of Review for Consistency

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[98] SCAQMD Comment, Docket entry IV-G-50, at 4.

[99] Letter from Thomas H. Hanna, President, MVMA and George C. Nield, President, AIAM to William K. Reilly, Administrator, EPA, dated January 29, 1992, Docket entry II-D-01, at 6.

Under section 209(b)(1)(C), I cannot grant California its waiver request if I find that California standards and accompanying enforcement procedures are not consistent with section 202(a) of the Act. California's standards are not consistent with section 202(a) if there is inadequate leadtime to permit the development of technology necessary to meet those requirements, giving appropriate consideration to the cost of compliance within that time frame. California's accompanying enforcement procedures would also be inconsistent with section 202(a) if the Federal and California test procedures were inconsistent.[100] CARB has determined that these amendments to its standards, certification procedures, and enforcement procedures do not cause the California requirements to be inconsistent with section 202(a).[101]

The scope of my review of whether California's action is consistent with section 202(a) is narrow; it is limited to determining whether those opposed to the waiver have met their burden of establishing that California's standards are technologically infeasible, or that California's test procedures impose requirements inconsistent with the Federal test

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[100] See Section I above ("INTRODUCTION") for discussion of Section 202(a).

[101] CARB Resolution 90-58, dated September 28, 1990, Docket entry II-A-5, and Executive Order G-673, dated October 2, 1991, Docket entry II-A-9.

procedures.[102]

As discussed earlier in Section III (Standard and Burden of Proof), the burden of proof in waiver proceedings lies squarely with the parties who oppose the waiver. In the instant proceeding, automobile industry opponents of the waiver request have presented evidence for my consideration which they believe will permit me to make the finding of inconsistency with section 202, and therefore cause me to deny this waiver request.

CARB has reviewed the cases in which the court has opined on the test for technological feasibility, and believes that "the most relevant decision is National Resources Defense Council v. EPA (hereinafter referred to as "NRDC"), 655 F.2d 318 (D.C. Cir. 1981). In NRDC (which was a consolidated case), several automobile manufacturers and the NRDC petitioned the Court of Appeals for the D.C. Circuit to review EPA's particulate standards for diesel cars and light trucks because they were too stringent (the industry argument), or not stringent enough (the NRDC argument). In upholding the Agency's actions, the court concluded:

> Given this time frame [a 1980 decision on 1985 model year standards], we feel that there is substantial room for deference to the EPA's expertise in projecting the likely course of

[102] See MEMA I, 627 F.2d at 1126.

> development. The essential question in this case is the pace of that development, and absent a revolution in the study of industry, defense of such a projection can never possess the inescapable logic of a mathematical deduction. We think that the EPA will have demonstrated the reasonableness of its basis for prediction if it answers any theoretical objections to the (projected control technology), identifies the major steps necessary in refinement of the technology, and offers plausible reasons for believing that each of those steps can be completed in the time available. [103]

CARB points to NRDC as important for my consideration of its LEV waiver request because it stands for the proposition that Congress intended regulators to project future advances in pollution control technology rather than be limited to the technology existing when the standards were set. CARB used the framework of the three-part test articulated in the NRDC case to present its evidence of technological feasibility in its submissions. Detailed discussion of CARB's information, the information from MVMA/AIAM and other parties, and my evaluation of these submissions appears below at pages XX to YY.

The industry opponents disagree with CARB's contentions regarding the applicability of NRDC. MVMA/AIAM argue that CARB has failed to satisfy the criteria set forth in the NRDC decision, and that its principles

[103] NRDC, 655 F.2d at 331-32 (emphasis added).

should not apply to this waiver request. They contend that the "core principle of general importance in NRDC was that 'the presence of substantial leadtime for development before manufacturers will have to commit themselves to mass production of a chosen prototype gives the agency greater leeway to modify its standards if the actual future course of technology diverges from expectations.'" [104] Accordingly, MVMA/AIAM argue that NRDC requires CARB to conduct a meaningful technological feasibility/cost review at appropriate intervals before the industry must commit fully to major expenses in new pollution control technologies. MVMA/AIAM conclude that CARB has neither set adequate rules for these periodic reviews nor allowed for adequate leadtime for development of necessary technology for this program, and therefore has failed to satisfy the criteria set forth in NRDC.

Rather than relying on NRDC, the industry opponents invoke International Harvester as the controlling case. As already discussed, the industry opponents assert that International Harvester requires that the burden of proof on technological feasibility be shifted to CARB. For the reasons stated above in Section III, I rejected that contention.

With respect to the standard to be applied in this decision in

[104] MVMA/AIAM March 1992 Comment, Docket entry IV-G-13, at 47, n. 93.

determining whether I should find that California's LEV program standards are technologically feasible in the lead time provided, I note that the court in NRDC pointed out that the court in International Harvester "probed deeply into the reliability of EPA's methodology" because of the relatively short amount of lead time involved (a May 1972 decision regarding model year 1975 vehicles) and because "the hardship if a suspension were mistakenly denied outweighed the risks of a suspension needlessly granted." [105] The NRDC court continued: "The present case is quite different; the 'base hour' for commencement of production is relatively distant, and until that time the probable effect of a relaxation of the standard would be to mitigate the consequences of any excessive strictness in the initial rule, not to create new hardships." [106] The NRDC court further noted that International Harvester did not involve an agency's prediction of future technological advances, but an evaluation of presently-available technology. [107]

Similarly, CARB points out that the fundamental difference in these two cases was the amount of lead time available to the industry to comply with the contested EPA rules, a shorter time in International Harvester, and a longer period in NRDC. While the shorter time period in International

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[105] 655 F.2d at 330

[106] Id.

[107] Id.

Harvester "necessitated the Court's searching scrutiny of EPA's methodology," [108] CARB argues that International Harvester is not an appropriate test where there is substantial lead time to develop or refine technologies. [109] Because of the extent of lead time available to the industry before it must begin to comply with the more stringent elements of the California LEV program, CARB believes the rule derived from NRDC is more appropriately applied to its technological feasibility analysis than the International Harvester rule, which should apply to relatively short leadtimes.

In ensuring that my review of the record in this proceeding is a reasoned one, I reviewed carefully the parties' discussion of the above court decisions. A review of EPA's history of waiver decisions shows that, in previous evaluations of whether a California standard must be found inconsistent with section 202(a), the Administrator has looked to court decisions applying section 202(a) to the adoption of Federal standards. While these cases are helpful to this process, I must also evaluate waiver requests through the prism of Congressional intent for the waiver program generally, which is to foster California's growth as a laboratory for emission control technology progress, in order "to continue the national benefits that might flow from allowing California to continue

[108] Id. at 53.

[109] Id., at 56, quoting NRDC, 655 F.2d at 331.

to act as as a pioneer in this field."[110]

For this reason, I believe I must give California substantial deference in its choice of approach to solve its air pollution problems. This view has guided past waiver decisions. As stated by the Administrator in the 1975 waiver to the CARB 1977 model year standards:

> [E]ven on this issue of technological feasibility I would feel constrained to approve a California approach to the problem which I might also feel unable to adopt at the Federal level in my own capacity as a regulator. The whole approach of the Clean Air Act is to force the development of new types of emission control technology where that is needed by compelling the industry to 'catch up" to some degree with newly promulgated standards. Such an approach to automotive emission control might be attended with costs, in the shape of a reduced product offering, or price or fuel economy penalties, and by risks that a wider number of vehicle classes may not be able to complete their development work in time. Since a balancing of these risks and costs against the potential benefits from reduced emissions is a central policy decision for any regulatory agency, under the statutory scheme outlined above I believe I am required to give very substantial deference to California's judgment on that score.[111]

Further, I believe that while both the International Harvester and

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[110] 40 Fed. Reg. 23,102, at 23,103 (waiver decision citing views of Congressman Moss and Senator Murphy), (May 28, 1975).

[111] Id. at 23,103 (emphasis added).

NRDC cases offer valuable guidelines for review, the test of NRDC applies more closely to the particular facts of this LEV waiver request, for two reasons.[112] First, NRDC demonstrates better the analysis of the feasibility of new standards when a greater amount of lead time is available to the industry to comply with the standards at issue. In reaching this conclusion, I reviewed CARB's comparison of the amount of leadtime provided to the industry in the two key cases and in this proceeding, illustrated by a table in the CARB comments. In International Harvester, CARB noted that there were only 2 years and 7 1/2 months from the time EPA denied the manufacturers' suspension applications (putting manufacturers on notice of compliance obligations) and the 1975 model year when the new standards would apply. In NRDC, however, there were 4 years and 9 months between the date EPA promulgated the particulate matter standards and the 1985 model year, the first model year of their application, according to CARB.

Second, regarding the LEV program standards, CARB notes that the standards were approved by the Board in September 1990. CARB notes

[112] Although I believe that the three-part test in NRDC is more suitable in this waiver request, I note that CARB has expended a great deal of effort in responding to the most recent points of contention raised by the industry opponents in the June 1992 filing. Thus, CARB has responded to the industry data and analysis in kind as MVMA/AIAM believe they are required to do under International Harvester.

that the lead time for LEVs is 6 years and 3 months based on the projection that LEVs will be needed for the 1997 model year. As I noted previously, this understates the leadtime for LEVs. LEVs are not required until the 1999 model year, when the Fleet Average first falls below the TLEV NMOG standard of .125 gpm. Therefore the leadtime for the LEV category is actually 8 years and 3 months, consistent with the CARB method of predicting leadtime.[113] CARB also notes that the lead time for ULEVs, which are not required until the 2000 model year is 9 years and 3 months.[114]

CARB, therefore, suggests that its time periods for compliance will allow more lead time for refinement of LEV and ULEV technology than the approximately five years of leadtime provided to the industry in NRDC and more than twice as much as was provided in CARB's illustration from International Harvester. As CARB's comments and my analysis of lead time reveals, the industry will not be required to produce LEVs until the 1999 model year and ULEVs until the 2000 model year, and even these

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[113] See Table Two and the accompanying explanation at xxx.

[114] CARB August 1992 Comment, Docket entry IV-G-49, at 54. In accordance with CARB's methodology, the leadtime for TLEVs from the time the Board approved the standards is 4 years and 3 months (from September 1990 to model year 1995, the first year in which the NMOG fleet average drops below 0.25 gpm) and the leadtime for ZEVs is 7 years and 3 months.

targets are subject to deferral with the use of earlier acquired credits and/or making up deficits after target years. (ZEVs will be required in model year 1998).) CARB notes that the court in NRDC "pointed out that a longer lead time gives the agency 'a greater scope for confidence that theoretical solutions will be translated successfully into mechanical realizations ...'" and that "[t]he presence of substantial lead time for development before manufacturers will have to commit themselves to mass production of a chosen prototype gives the agency leeway to modify its standards if the actual future course of technology diverges from expectation."[115]

I also note that, along with substantial lead time, CARB has complied with the MVMA/AIAM contention that periodic reviews are necessary by its commitment to the biennial review meetings. I believe that such meetings will provide adequate ability to modify the standards if necessary and reject the associations' contention regarding the insufficiency of CARB's review process.

Moreover, I believe that the NRDC test is in harmony with the intent of Congress to allow California maximum flexibility in its choice of motor vehicle emission control regulations. This test provides a basis for me to

[115] See CARB August 1992 Comment, Docket entry IV-G-49, at 52-53, quoting from NRDC, 655 F.2d at 329.

judge the reasonableness of California's program without resorting to a more restrictive and potentially progress-thwarting standard of review that would frustrate California's efforts in air pollution control. The D.C. Circuit in NRDC discussed the need for EPA to have reasonable flexibility in predicting future technology; this test is an appropriate one for application to CARB waiver requests:

> The defense of a projection methodology in such (current technology) cases has required 'that variables be accounted for, that the representativeness of test conditions be ascertained, that the validity of tests be assured and that the statistical significance of results determined' ... But statistically-based techniques for reviewing the methodology of contemporary projections do not translate well into rules for reviewing predictions of future progress. If the agency is to predict more than the results of merely assembling preexisting components, it must have some leeway to deduce results that are not represented by current data.[116]

In my review of this waiver proceeding, I have evaluated the information presented in support of the request, making appropriate note of CARB's reliance on NRDC as the correct test for technological feasibility. I also have evaluated the information provided by the industry in support of their position that I should deny this waiver request, making appropriate note of their reliance on the technological feasibility test in International Harvester. Based on my review of this record, I am unable to make the finding that there is inadequate leadtime to permit the

[116] NRDC, 655 F.2d at 331.

development of technology necessary to meet those standards giving appropriate consideration to the cost of compliance with the required time frame. My review of these issues follows. Because of the different technology needs for the new CARB vehicles, I first review and evaluate technological feasibility for TLEVs, LEVs and ULEVs, and then, in a separate section, the same for ZEVs.

2.) The State of Development of TLEV, LEV, and ULEV Technology

a) Introduction

The record of this proceeding contains considerable information relating to the views of CARB and of the major automotive industry commenters (the Motor Vehicle Manufacturers Association and the Association of Imported Automobile Manufacturers, or "MVMA/AIAM") on the current state of development of various technology strategies designed to meet the standards of the California LEV program. What follows is a summary of this discussion together with an evaluation and response to the various issues. The summary is organized into the major categories of TLEV and LEV/ULEV. Within the LEV/ULEV category both electrically-heated catalyst (EHC) and non-EHC technology issues are presented.[1]

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[1] Besides reviewing information submitted to the record by the various parties, EPA has also reviewed other published information pertaining to current developments in vehicle emission control technology to ensure that the Agency makes fully informed determinations. Additionally, EPA notes that several parties submitted confidential business information ("CBI") to assist in review of this waiver request. EPA will refer only to the public redacted versions of this CBI, or will offer analysis of CBI in a manner that does not disclose any specific data or information considered proprietary by the submitter.

CARB maintains that all of the proposed standards, TLEV, LEV, ULEV and ZEV, are technologically feasible. While CARB does not claim that the ZEV standards can be attained by vehicles with internal combustion engines, CARB asserts that even gasoline-fueled vehicles can achieve all other standards. CARB has identified various technologies which it believes are necessary or may be used to achieve these standards and to maintain sufficient compliance margin. (See AWMA Paper "The Effectiveness of the California Low Emission Vehicle Program"[2]). These technologies can be broadly characterized as fuel control measures and catalyst or aftertreatment controls.

The fuel control measures (e.g. dual oxygen sensors, aerated fuel injectors) are, for the most part, technologies which are currently found on some production vehicles, but are "advanced" in the sense that they are not widely utilized, may be subject to further refinement, and may have a greater emissions reduction potential when compared to more commonly-used technologies.

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[2] Albu, S., Kao, L., and Cackette, T., "The Effectiveness of the California Low-Emission Vehicle Program," Paper 92-168.01, presented at Air & Waste Management Association Meeting, June 21-26, 1992 ("AWMA Paper"), Attachment B to CARB August 1992 Comment, Docket entry IV-G-49. This is the final version of this paper; a draft version of this paper appears earlier in the record of this proceeding.

The primary catalyst control measure which CARB identified was the electrically heated catalyst ("EHC"). EHCs are intended to control cold start emissions of non-methane organic gases and carbon monoxide by reducing or eliminating the time during which the catalyst temperature is below that necessary for effective control of emissions. EHCs are a new technology, not yet utilized in production vehicles. EPA notes that all parties agree that EHC technology is not yet refined to the point where EHCs are ready to be incorporated into production vehicles. The parties differ, however, in their predictions of when this will occur.

The catalyst control measures also include increased catalyst loading, particularly with rhodium for NOx control. Since rhodium is commonly used in three-way catalysts[3], and since there is no standard or universally used loading for rhodium, increased catalyst loading is not considered a new technology.

CARB has also classified air injection as a catalyst-related

[3] A three-way catalyst ("TWC") is a catalytic converter which controls hydrocarbon ("HC"), carbon monoxide ("CO"), and nitrous oxide ("NOx") emissions. Early catalytic systems used oxidation catalysts, which only controlled HC and CO. See Husselbee, W. L., Automotive Emission Control, at 341-345 (1984).

control technology.[4] Air injection is not new technology; it has been used extensively in the past but is used less frequently in current vehicles. Air injection might be considered an "advanced technology" only in the sense that air injection is expected to be used in conjunction with EHCs, and that future air pumps, at least in EHC applications, are likely to be electrically powered rather than belt-driven.

CARB has projected that various combinations of these technologies will be used to achieve various levels of control (i.e. TLEV, LEV, ULEV). Over the course of the comment period, CARB has modified certain of its technology/standards combination forecasts based on information gathered from early certification of TLEVs.

The critical comments regarding the technological feasibility of CARB's low emission vehicle program have focused on the effectiveness of these technologies to achieve and maintain emissions at the various required levels and, additionally, with respect to EHCs, on the ability to

[4] Air injection systems have been demonstrated to be beneficial during cold start. The air pump provides excess oxygen to the catalyst during this time period, which helps control the associated rich air-fuel mixture. By providing an excess of 1-2 % oxygen, the catalyst light off temperatures for HC and CO are reduced by 20-50 C. A 1 % surplus provides a slight improvement in NOx light-off temperature. See Gottberg, I. et al, New Potential Exhaust Gas Aftertreatment Technologies for "Clean Car Legislation, Society of Automotive Engineers, Inc. (SAE) Technical Paper No. 910840 ("SAE 910840").

overcome technological barriers to implementation. These barriers include durability/deterioration and energy supply issues. MVMA/AIAM, in hearing testimony and several lengthy written comments, submitted information and data in opposition to the CARB determination of technological feasibility and its supporting information and data. General Motors, an MVMA member, submitted information, including confidential business data, in support of MVMA/AIAM's positions.[5]

b) TLEV standards

CARB stated, in its March 1992 comments, that TLEV standards are achievable with only moderate improvements to today's vehicles. CARB cited data from several 1991 and earlier in-use vehicles which have emissions at or below the TLEV level.

CARB concluded, in its March 1992 comments that TLEV emission levels are achievable by conventional gasoline-fueled vehicles utilizing

[5] See letter from Alan Weverstad to Tom Jennings, August 20, 1992;GM Comments, Docket entry IV-G-54.

dual oxygen sensors,[6] steady-state adaptive fuel control,[7] secondary air injection and close-coupled catalysts[8]. These are all current technologies found on production vehicles. CARB stated that some manufacturers, to provide a safety margin, may also implement multipoint sequential fuel injection[9] and aerated fuel injectors,[10] or heated fuel preparation[11] for certain engines. Again, these too are current technologies. A number of manufacturers have used sequential fuel injection in some models. For example, Toyota has used aerated fuel injectors and Mercedes Benz has used heated fuel preparation in recent

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[6] A dual oxygen sensor system utilizes two oxygen sensors in the exhaust stream - one before the catalyst and one after the catalyst. An oxygen sensor are used to sense changes in the air/fuel ratio of the exhaust. This information is used to adjust the air/fuel mixture to provide more efficient combustion and reduce emissions. See CARB August 1992 Comment, Docket entry IV-G-49, Appendix B, at 10.

[7] Steady state adaptive fuel control adjusts the fuel control system during steady state operating conditions based on various inputs such as engine speed and load. Id., at 12.

[8] A close coupled catalyst is one mounted near the intake manifold in order to take advantage of high exhaust temperature, which facilitates emissions conversion.

[9] Sequential fuel injection delivers fuel to the intake port just before or while the intake valve is opening. Duffy, J.E., Auto Fuel Systems, at 337 (1987).

[10] An aerated injector mixes air and fuel in the injector itself, resulting in both improved fuel atomization and spray direction. Harada, K. et. al., Development of Air-Assisted Injector System, SAE Technical Paper 920294 ("SAE 920294").

[11] Heated fuel preparation systems heat fuel before it reaches the combustion cylinder. e.g., CARB August 1992 Comment, Docket entry IV-G-49, at Attachment E.

model year vehicles.[12]

Dual oxygen sensors, while not currently in widespread use, are used by Toyota. The purpose of the secondary sensor is to correct for any deterioration of the primary sensor. Dual oxygen sensors are also likely to be used to monitor catalyst efficiency to comply with on-board diagnostic requirements.[13] CARB noted that a dual oxygen sensor system compensates for the rich or lean shift in the front sensor, thereby providing an emissions benefit by reducing deterioration in the control of the air-fuel ratio.[14]

One month after CARB submitted its March 1992 comments, Ford certified the first TLEV, a 1993 MY gasoline-fueled Ford Motor Company 1.9L Ford Escort/Mercury Tracer engine family equipped with sequential fuel injection and a close-coupled catalyst.[15] According to CARB, this family does not utilize dual oxygen sensors, which CARB had previously identified (in documents placed in the docket[16]) as a technology "expected to be necessary" for TLEVs. This family is equipped with sequential fuel

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[12] CARB August 1992 Comment, Docket entry IV-G-49, at 12-14, and 17.

[13] Id., at Attachment B, at 12.

[14] Id., at. 11.

[15] CARB August 1992 Comment, Docket entry IV-G-49, at Appendix A. This engine family was certified with indolene as the certification fuel.

[16] E.g., CARB August 1992 Comment, Docket entry IV-G-49.

injection, which CARB classified as an optional "margin of safety" technology for TLEVs. GM and Honda have since certified gasoline-fueled TLEVs.[17] GM certified a TLEV passenger car and light duty truck while Honda certified a TLEV passenger car.[18] CARB has indicated that GM's passenger car TLEV is not equipped with any of the technologies which it considers "advanced controls" (i.e. dual oxygen sensors, sequential multipoint fuel injectors, aerated fuel injectors, adaptive transient control, or close-coupled catalysts) while the Honda engine family utilizes sequential multiport fuel injection from the "advanced controls" list.

In its comments to the record, MVMA/AIAM did not explicitly claim that TLEV standards were technologically infeasible. MVMA/AIAM stated in its March comment that four specific requirements in the July 1991 Low Emission Vehicle rules warrant particular scrutiny: the NMOG standard for LEV and ULEV passenger cars and light duty trucks; the NOx standard for LEV and ULEV passenger cars and light duty trucks; the 50

[17] CARB August 1992 Comment, Docket entry IV-G-49, at Appendix A.

[18] GM's TLEVs were conditionally certified on Phase 2 reformulated gasoline, while Honda certified its TLEV on indolene. CARB August 1992 Comment, Docket entry IV-G-40, at Appendix A.

degree F testing requirement for passenger cars and light duty trucks[19]; and the formaldehyde standards for vehicles tested on methanol or on blends such as methanol and gasoline.[20] MVMA/AIAM included TLEVs in two of its four concerns; the 50 degree F testing requirement and the formaldehyde standard for non-gasoline, and gasoline blend vehicles. MVMA/AIAM claimed that CARB conducted no tests at 50 degree F and hence had no data to directly support its claim that manufacturers can meet the 50 degree F requirement.[21]

As noted above, gasoline-fueled TLEVs have already been certified.

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[19] The 50 degree F test requires that an emissions data or developmental vehicle, when tested at 4,000 miles, must be able to comply with certification standards without deterioration factors after cold soaking at 45 to 55 degrees F for at least 12 hours. CARB Technical Support Document, Docket entry II-A-4, at I-18. In its August 1992 Comment, Docket entry IV-G-49, CARB noted that it does not intend the 50 degree F requirement to force manufacturers to apply additional technology to meet the requirement. Instead, it is meant to prohibit manufacturers from using defeat devices that effect emission control systems at low temperatures. To insure that its objective is attained and in response to test data showing additions required to meet its 50 degree requirements, CARB has approved modifications to this requirement which change the 50 degree F requirements for NMOG and formaldehyde. CARB has proposed a new 50 degree F requirement equal to the 50,000 mile TLEV and LEV certification standards for NMOG and formaldehyde multiplied by a factor of 1.75. CARB does not believe test data show a need to adjust the 50 degree F standards for CO and NOx for TLEV and LEV or for any pollutant in the ULEV standards. CARB Notice of Public Hearing on November 12, 1992, Docket entry IV-G- , at 3.

[20] MVMA March 1992 Comment, Docket entry IV-G-14, at 11-12.

[21] Id., at 42-43.

In addition, both EPA and CARB have tested in-use vehicles which, although certified to meet less stringent standards, meet TLEV emission levels in-use.[22] The four TLEV engine families certified by CARB met all the TLEV standards, including the original 50 degree F requirement. Also, MVMA/AIAM's comments regarding the formaldehyde standard for non-gasoline vehicles did not actually address the ability of vehicles to meet the standard, but expressed concerns regarding the formaldehyde measurement technique.[23] However, MVMA/AIAM did not provided any

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[22] The following table lists engines and their respective in-use emission levels:

Class	Veh. No.	Eng. Family	HC	CO	NOx
EPA					
A638	3	J1G1.6V5XRG7	0.11	1.61	0.25
A638	23	J1G1.6V5XRG7	0.11	1.84	0.13
A689	33	JTK2.2V5FFG1	0.11	1.06	0.28
A689	113	JTK2.2V5FFG1	0.10	1.02	0.31
A692	63	J1G2.0V9T4B1	0.12	1.63	0.32
A692	129	J1G2.0V9T4B1	0.11	1.54	0.32
A931	41	KTY2.0V5FFFX	0.10	0.82	0.25
A931	70	KTY2.0V5FFFX	0.11	1.25	0.13
V344	22	JFM1.3V2FZF7	0.11	1.89	0.33
V344	40	JFM1.3V2FZF7	0.09	1.74	0.22
CARB					
5200	04	HNS1.6V9FAC2	0.080	3.11	0.21
6200	08	HVW1.8V6FAC5	0.100	1.18	0.34
6200	11	HVW1.8V6FAC5	0.100	1.47	0.16
6200	12	HVW1.8V6FAC5	0.097	1.93	0.13
2014	10	KFM1.6V5FXC9	0.123	2.66	0.38

EPA and CARB In-Use test results, Docket entry IV-G-

[23] MVMA March 1992 Comment, Docket entry IV-G-14, at 29-32.

support regarding their concerns with measurement problems in relation to TLEV development. Instead, their comments were addressed towards formaldehyde measurement in relation to LEV and ULEV development.[24]

c) LEV/ULEV standards

It is generally accepted that compliance with LEV and ULEV standards will require more emission control hardware and fuel control strategy modifications than compliance with the TLEV standards. As noted earlier, there is disagreement about the potential effectiveness of these modifications. There are additional specific issues relating to EHCs.

i) Fuel Control Technology

CARB predicted in its March 1992 comments that, in addition to the technology forecast as necessary for TLEVs (closed loop with dual oxygen sensors, adaptive steady-state control, air injection), liquid fueled (gasoline, methanol, ethanol) LEVs and ULEVs will use sequential fuel

[24] Id., at 29-31.

injection, aerated injectors and/or heated fuel preparation, and adaptive transient control of the air/fuel ratio [25] as possible fuel control technologies. CARB also predicted that "cylinder torque adjustment" might be utilized to achieve individual cylinder fuel control. [26] CARB noted that adaptive transient control of the air/fuel ratio is already in use on some production vehicles. [27]

CARB believes the above-listed fuel control technologies can be beneficial in reducing emissions. Specifically, sequential fuel injection could be used to reduce fuel puddling and intake manifold wall wetting during fuel injection, thereby improving combustion. [28] Aerated fuel injectors and heated fuel preparation systems could be used to improve fuel atomization. [29] Adaptive transient control could be used to provide

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[25] Most current fuel control systems adapt to changing engine conditions, fuel composition, and engine wear. These adaptations help to maintain a stoichiometric air/fuel ratio under steady-state engine operating conditions. Adaptive transient control will allow fuel control systems to adjust the air/fuel ratio during periods of changing engine throttle conditions. CARB August 1992 Comment, Docket entry IV-G-49, Appendix B, at 12.

[26] Each cylinder in an engine produces a level of torque that, when analyzed in conjunction with engine torque levels, can be used to identify faulty components, improve engine idling, or detect engine knock. Citron, C.J. et. al., Cylinder-by-Cylinder Engine Pressure and Pressure Torque Wave-form Determination Utilizing Speed Fluctuations, SAE Technical Paper 890486 ("SAE 890486").

[27] CARB March 1992 Comment, Docket entry IV-G-09, at 25.

[28] CARB August 1992 Comment, Docket entry IV-G-49, Appendix B, at 13.

[29] Id., at 14.

precise air/fuel ratio control during all phases of vehicle operation.[30] Individual cylinder torque control could also be used to improve overall fuel control.[31]

CARB initially predicted that the above technologies would be applied in conjunction with EHCs, in order to meet LEV and ULEV standards. CARB has since stated that it believes smaller displacement vehicles (i.e., engines smaller than three liters) may be able to meet the LEV standards without the use of an EHC by using the appropriate advanced fuel control technologies.[32]

CARB acknowledged that while current emission measurement techniques were probably adequate for measurement at the LEV levels, emission measurement at the ULEV level needs improvement.[33] CARB noted that industry and the ARB are currently expending considerable resources in working to improve measurement techniques.

In its June 1992 comment, MVMA/AIAM claimed that non-EHC LEVs are infeasible based on their belief that the technologies CARB claims have the potential for better control of air/fuel ratio are not likely to result in

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[30] Id., at 13.

[31] Id., at 14.

[32] CARB August 1992 Comment, Docket entry IV-G-49, Appendix B, at 13.

[33] CARB March 1992 Comment, Docket entry IV-G-09, at 36-38.

compliance with the LEV standards.[34] More specifically, the associations claim that dual oxygen sensors represent a potential for a very minimal improvement in high mileage in-use emissions variation. MVMA/AIAM stated that many current closed loop systems provide adaptive control under both steady-state and transient conditions, but claimed that further refinements in adaptive fuel controls have been found to have only limited impact in reducing emissions. MVMA/AIAM also asserted that while sequential fuel injection may be helpful in minimizing steady state hydrocarbon emissions by minimizing the fuel calculation delay, (i.e. the quantity of fuel required by a cylinder may be calculated closer to the time it is required), a potential misapplication of this technology could result in increased emissions under cold conditions.

Further, MVMA/AIAM claimed that heated fuel injectors have been investigated and found to have little effect on fuel vaporization.[35] MVMA/AIAM acknowledged that Toyota has found aerated fuel injectors beneficial to emissions relative to a non-aerated design, but believes that they may not be beneficial when compared to other current non-aerated injectors with a smaller fuel droplet size. MVMA/AIAM also claimed that "individual cylinder torque control" is an inappropriate fuel control technology because there is no appreciable change in torque near the

[34] MVMA June 1992 Comments, Docket entry IV-G-37, at 10.
[35] Id., at 11.

stoichiometric point. MVMA/AIAM stated that a variation of as much as one air-fuel ratio might occur before a change in torque could be detected, while control to better than plus or minus one half air fuel ratio must be achieved. In addition, in its June 26, 1992 submission GM claimed that the use of torque as an air-fuel ratio control depends on the assumption that cylinder to cylinder torque imbalance is entirely attributed to fueling error. [36]

MVMA/AIAM also claimed that difficulties in accuracy and repeatability of formaldehyde measurement will hinder methanol vehicle development efforts. [37]

MVMA/AIAM asserted that the requirement to meet the LEV standard at 50 degree F is the limiting factor for technological feasibility of non-EHC LEVs. MVMA/AIAM stated that even if non-EHC vehicles could meet the LEV standards at 76 degree F, they could not meet the standards at 50 degree F. [38] MVMA provided data it claimed showed that HC and CO "emissions are nearly twice as high at 50 degree F as at normal laboratory ambient levels [76 degree F]." [39]

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[36] GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A3.

[37] Id., at 31.

[38] MVMA June 1992 Comment, Docket entry IV-G-37, at 8.

[39] Id., at 8.

In evaluating this issue, it is relevant to note that both Ford and GM have certified engine families as TLEVs, which, based on certification results with deterioration factors and tested at normal temperatures (68 to 86 degree F), are projected to meet the more stringent 50,000 mile and 100,000 mile in-use LEV standards. Honda's certified TLEV family meets 100,000 mile LEV standards for all pollutants and only misses meeting all the 50,000 mile LEV certification levels by 0.001 g/mi NMOG.[40] Also, the Honda and Ford engine families, when tested under the 50 degree F requirements, met the ULEV standards for CO and NOx.[41] NMOG results for both engines were 0.098 g/mile, which is above the LEV standard of 0.075 g/mile.[42] The Agency recognizes that, while a certification-based prediction of compliance at high mileage does not guarantee in-use compliance, this does identify the potential for non-EHC compliance with the LEV standards (to which vehicles are not required to be certified until

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[40] CARB August 1992 Comment, Docket entry IV-G-49, at 8.

[41] Id., at 33.

[42] When CARB's revised 50 degree F requirements (see Hearing Notice for November 12, 1992 ARB Proceeding, Docket entry IV-G- , at , and footnote ,) are applied, both the Ford and Honda 50 degree F NMOG emission levels are below the revised 50 degree F LEV standard of 0.131 g/mile. Both engine families meet LEV 50 degree F pollutant requirements for CO and NOx. Additionally, all pollutant levels for the GM passenger car TLEV engine family are also below LEV standards, including 50 degree F requirements. As noted above, the GM engine family was certified on Phase 2 reformulated gasoline, while both the Ford and Honda engine families were certified on indolene.

model year 1999 at the earliest). This contrasts with MVMA/AIAM's position that an EHC-equipped vehicle, incorporating all the control features projected by CARB for emissions from the engine prior to entering the catalyst (i.e. "engine out" emissions) and greater catalyst rhodium loading, would not meet even LEV standards at high mileage in-use.

There is disagreement even within the industry relative to the emission levels achievable on current technology non-EHC equipped vehicles. Research engineers from Ford recently published a report which discusses LEV levels on large-platform vehicles at low mileages using EHCs.[43] The authors observed that "careful sizing, design, and location of ceramic [non-heated] catalysts when coupled with engine calibration strategies to reduce engine out may achieve comparable results but with considerably less complexity."[44]

MVMA/AIAM may disagree with CARB's analysis that the benefit of sequential fuel injection is the reduction of fuel puddling and intake manifold wall wetting, yet they did acknowledge that precise injection timing may be helpful in minimizing a steady state hydrocarbon emissions

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[43] Hurley, R.G. et. al., Experiences with Electrically Heated Catalysts, SAE Technical Paper 912384 ("SAE 912384").

[44] Id., at 9.

peak.[45] After reviewing the record, EPA believes that MVMA/AIAM's concerns regarding misapplication of sequential fuel injection could possibly be alleviated through the use of aerated fuel injectors in conjunction with sequential fuel injection technology. Also, as with any technology, potential misapplications are a concern but could be avoided through careful testing and development.

While reviewing the comments received on the fuel control strategies, the Agency has also examined published materials relating to the Toyota air-mix two-hole injector which indicate that both steady state and transient HC emissions are reduced when compared to a non-aerated two-hole design.[46] Toyota attributes the steady state decrease in HC emissions to better fuel atomization and the transient decrease to a minimization of wall wetting brought about by decreased transient compensatory fuel injection.[47] GM has submitted information which states its claim that it has been unable to measure any emissions benefit from aerated injectors when compared with its current injectors with a much smaller baseline fuel droplet size [than the Toyota non-aerated injector].[48]

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[45] MVMA June 1992 Comment, Docket entry IV-G-37, at 11.

[46] See SAE 920294; Sugimoto, T. et. al., Toyota Air-Mix Type Two-hole Injector for 4-valve Engines, SAE Technical Paper 912351 ("SAE 912351").

[47] SAE 920294.

[48] GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A2.

While information from the record shows that the current research on aerated injectors is insufficient, it is reasonable to determine, based on information provided by Toyota, that aerated injectors may provide a significant benefit when compared to some current injector designs.

EPA has examined additional published materials which indicate that there is also ongoing research to develop better methods for controlling air-fuel ratios under transient conditions. One report demonstrated a two-thirds decrease in air-fuel ratio fluctuations due to a new design method for air-fuel ratio control.[49] This control method provides an estimation of the fuel quantity and air flow rates at the cylinder port, something conventional control methods are unable to accomplish.[50] Using this new technique, transient control is possible. Another study reported improvements in catalyst efficiency through artificial modulation of the air-fuel control signal. Improvements in efficiency were reported for steady-state and transient conditions.[51]

GM commented that individual cylinder torque sensing may not be a

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[49] Sekozawa, T. et. al., Development of a Highly Accurate Air-Fuel Ratio Control Method Based on Internal State Estimation, SAE Technical Paper 920290 ("SAE 920290").

[50] Id.

[51] Katashiba, H. et.al, Fuel Injection Control Systems that Improve Three Way Catalyst Conversion Efficiency, SAE Technical Paper 910390 ("SAE 910390").

useful input for air/fuel ratio control because it claims there is no substantial variation in engine torque near the stoichiometric air/fuel ratio point.[52] However, both GM and MVMA/AIAM acknowledge that minimizing cylinder to cylinder air-fuel ratio variation will be helpful,[53] hence implying that individual cylinder air-fuel ratio control is theoretically beneficial.[54] EPA understands that cylinder pressure is considered to be a fundamental indicator of the operating state of the engine, and that pressure measurements would provide feedback which could theoretically be used for individual cylinder control of engine variables such as spark timing and fuel injection. Although direct measurement of cylinder pressure has been considered, technical publications included in the record indicate that by measuring speed fluctuations and appropriately analyzing the measurements, the pressure torque and, hence, cylinder pressure can be estimated.[55] One paper states that the hardware required for this sensor is not new, consequently cost and reliability are not severe limitations. This paper also concluded that possible applications of this sensor include use in adaptive engine control and spark advance systems, as well as detection of faulty cylinders and associated components (i.e. misfire detection).

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[52] GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A3.

[53] MVMA/AIAM June 1992 Comment, Docket entry IV-G-37, at 12.

[54] See CARB August 1992 Comment, Docket entry IV-G-49, at 15-16.

[55] See, e.g. SAE 890486.

Regarding torque sensing, CARB has stated that direct application of torque sensing to engine control could optimize engine performance subject to emission and fuel consumption constraints. In support, CARB submitted with its August 1992 comments a paper discussing a certain torque sensing strategy.[56] CARB maintains that individual cylinder torque variations are generally more pronounced than for the engine overall, hence potentially more readily measured.[57] An SAE paper which was cited earlier[58] discusses the determination and potential utilization of individual cylinder torque rather than average engine torque. However, no information has been provided to the record which establishes that torque sensing is of no use in an engine control strategy. Furthermore, examination of the materials in the record leads to the reasonable projection that torque sensing can be accomplished with current technology, and could be utilized for engine control, given development of appropriate software to extract torque data from sensor input and effect torque-based control.

The Agency examined both the CARB and the MVMA/AIAM assessments

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[56] CARB August 1992 comments, Docket IV-G-49, Appendix D, "Estimate of Indicated Torque from Crankshaft Speed Fluctuations: A Model for the Dynamics of the IC Engine."

[57] CARB August 1992 Comment, Docket entry IV-G-49, at 16.

[58] See SAE 890486.

of the effectiveness and feasibility of the fuel control technologies which CARB believes are necessary or possible for LEV level control in non-EHC vehicles or LEV/ULEV level control in EHC vehicles. The fuel control technologies which CARB projects as likely to be necessary are technologies found in current production vehicles.[59] Information contained in the record shows that each of the proposed fuel control strategies, with the exception of torque-derived fuel correction (which CARB classifies as a "may be used" rather than an "expected to be necessary" strategy), has been used by at least one manufacturer in some vehicle applications. CARB has suggested cylinder torque-derived fuel correction as a possible technology because torque sensing is likely to be used to detect misfires to comply with new on-board diagnostic requirements (OBD II). While CARB has not directly quantified the emissions benefit of these technologies, MVMA/AIAM has not presented data demonstrating that these technologies have no benefit. It is therefore reasonable to determine that manufacturers who have chosen to incorporate "advanced" emission control technologies in their vehicles have determined that these technologies provide an emissions benefit when compared to their own baseline technologies. Therefore, it is reasonable to project these technologies could be used to control emissions in LEV and ULEV vehicles.

[59] See, generally, CARB March 1992 Comment, Docket entry IV-G-09, at 23-26.

In general, measures which reduce engine-out emissions, compensate for engine or component changes which could adversely affect emissions (i.e. adaptive controls), or provide more precise control of air-fuel ratio to maintain effective aftertreatment of emissions could be effective control strategies either in non-EHC or EHC applications. The Agency therefore believes it is reasonable to project that each of the "advanced" engine control measures which CARB has identified is likely to have one or more of these effects when compared with more common technology. In addition, it is reasonable to project that measurement techniques sufficient to detect LEV and ULEV-level emissions will be developed within the time-frame necessary for development of these vehicles.

ii) EHC Issues

1) Effectiveness

CARB stated in its March 1992 Comment, that it believes the single most important technology for achieving the LEV and ULEV standards is the EHC, with LEVs using post-start heating, while ULEVs may require

some prestart heating. [60]

CARB maintains that there are sufficient data to demonstrate that LEV and ULEV standards can be met by conventionally-fueled as well as alternative-fuel vehicles. [61] CARB has submitted emissions data from current technology gasoline-fueled vehicles which were equipped with EHC systems. These vehicles included a 1990 Buick LeSabre and a 1990 Toyota Celica, equipped with prototype EHC systems from Camet (a subsidiary of W.R. Grace). CARB states that these data "clearly demonstrate the potential of EHC systems to achieve LEV and ULEV levels." [62] CARB provided additional data in its August 1992 comments on four additional vehicles (model years 1988, 1990, 1991, and 1992) equipped with EHCs and run on 1989 industry average gasoline. [63]

In their June 1992 comments MVMA/AIAM entitled one of the major

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[60] CARB March 1992 Comment, Docket entry IV-G-49, at 25.

[61] Id. at Attachment C.

[62] Id. at 26.

[63] For example, CARB tested a 1992 Lexus which showed emissions results of 0.041 g/mi NMHC, 0.429 g/mi CO, and 0.201 g/mi NOx. Similarly, a 1991 Jetta had results of 0.034 g/mi NMHC, 1.392 g/mi CO, and 0.144 g/mi NOx. Both vehicles utilized an EHC. Both of these engines only had marginal failures when compared to the ULEV standards, and these engines did not have the benefit of the projected fuel control technology improvements. The ULEV standards are: 0.040 g/mi NMHC, 1.2 g/mi CO, and 0.2 g/mi NOx. CARB August Comment, Docket entry IV-G-49, at 24.

comment sections "CARB Lacks any Reliable basis for Projecting LEV/ULEV compliance with EHC Technology Because its Assessment of Current EHC Technology Is Unrealistic".[64] In this section, the associations cited emission results from EHC-equipped vehicles tested in a joint Western States Petroleum Association (WSPA)/GM/CARB test program. MVMA/AIAM assumed that emissions from "bag 3" [the third phase of the Federal Test Procedure ("FTP")-"hot transient"] represent the limit of potential EHC performance, and substituted "bag 3" values for "bag 1" values [the first phase of the FTP-"cold transient"].[65] Before and after the "bag 3" values were substituted for "bag 1" values, these vehicles did not comply with LEV and ULEV emission standards. MVMA/AIAM concluded that, "in addition to reduction of cold start emissions, a major reduction in emissions under fully warmed up conditions" would be required.[66]

Not enough is known about the WSPA/GM/CARB vehicles (e.g. calibration, catalyst size and loading, fuel system technology, engine-out controls, test conditions, EHC modification details, etc.) to draw any conclusion about the effectiveness of EHCs from MVMA/AIAM's analysis.

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[64] MVMA June 1992 Comment, Docket entry IV-G-37, at 13.

[65] The FTP is the accepted test procedure used to determine emissions compliance of vehicles. The procedure simulates three different typical in-use phases of vehicle operation, namely cold start, cold stabilized, and hot start. Emissions from each phase are collected in separate bags and samples from each bag are then analyzed.

[66] MVMA June 1992 Comment, Docket entry IV-G-37, at 14-15.

According to CARB, data generated from this testing were not meant to be used to assess EHC performance; rather, these vehicles were tested to "assess the emissions impact and drivability performance of different gasoline formulations as compared to current California average gasoline." [67]

Furthermore, MVMA/AIAM's implication that for a given vehicle substituting "bag 3" emissions for "bag 1" emissions represents the limit of EHC emissions reduction is incorrect. MVMA/AIAM is stating, in essence, that the only effect of an EHC is to reduce excess cold start emissions in "bag 1". However, an EHC may reduce emissions in all three phases of the FTP, not necessarily because it can be electrically heated, but because it is a catalytic converter. Substituting another EHC with a larger volume, and/or increased loading of precious metals could conceivably reduce composite emission levels of these vehicles below MVMA/AIAM's adjusted levels because the total catalyst volume and/or loading was increased. More importantly, CARB has pointed out that these vehicles were not optimized by calibration adjustment for lowest emissions, and that they do not necessarily incorporate the advanced

[67] CARB August 1992 Comment, Docket entry, IV-G-49, at 22.

engine-out controls that CARB has projected for LEVs and ULEVs.[68]

After reviewing these data, EPA agrees that the specific vehicles tested in the WSPA/GM/CARB program would require a reduction in emissions under fully warmed up conditions to comply with LEV or ULEV standards. However, EPA is unable to conclude from these data that they represent a generalized limit of EHC capability, particularly EHC capability in conjunction with the appropriate mix of engine-out and conventional catalyst controls.

Besides the information provided by CARB, the Agency has reviewed several examples of recently published data from other sources, as discussed below, which support the finding that current technology vehicles, when equipped with EHC systems, can achieve LEV and ULEV standards at low mileages.

A researcher from W.R. Grace (owner of an EHC manufacturer, the Camet Company) reported emissions testing of a 1990 Oldsmobile 2.3L vehicle. This vehicle was equipped with an EHC installed in front of the stock main catalytic converter, and the system was aged for 4,000 miles

[68] Additionally, CARB believes that it is reasonable to expect a further emissions reduction benefit from Phase 2 gasoline. Status Report on Low-Emission Vehicle and Clean Fuels Program, June 11, 1992, Docket entry IV-G-31.

on an Automotive Manufacturers Association ("AMA") cycle. The reported emissions levels were below the ULEV standards. (Non-methane hydrocarbons (NMHC) rather than NMOG results were reported).[69]

Corning researchers tested their EHC and main converter in various configurations on a vehicle with a 2.2L engine in order to investigate various heating and system design strategies. Tests were performed after 44 hours of engine dynamometer aging of the converters. They reported emission results below the ULEV standards. (NMHC rather than NMOG results were reported.)[70]

Volvo and Emitec researchers reported "0-mileage" testing of an EHC in a 1988 2.3L Volvo 740.[71] They performed a variety of tests and described their results as falling "within TLEV and ULEV numbers depending on calibration."[72] (A total hydrocarbons ("THC") result was reported). The only specific data reported in this paper showed the benefits of an EHC system. The EHC system reduced THC emissions from 0.17 g/mi to 0.06

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[69] Kubsh, J. E. and Lissiuk, P. W., Vehicle Emission Performance with an Electrically Heated Converter System, SAE Technical Paper 912385 ("SAE 912385").

[70] Socha, Jr. , L. S. and Thompson, D. F., Electrically Heated Extruded Metal Converters for Low Emission Vehicles, SAE Technical Paper 920093 ("SAE 920093").

[71] SAE 910840.

[72] Id. at Section 9.

g/mi, CO emissions from 1.88 g/mi to 0.46 g/mi, and NOx emissions from 0.20 g/mi to 0.07 g/mi.[73]

Ford researchers tested a 5.0L Crown Victoria with close-coupled EHCs in conjunction with various three-way and conventional oxidation catalyst combinations.[74] They reported emission results, after 4,000 miles aging, in the LEV range. (NMHC rather than NMOG results were reported.) Adding an EHC to the base catalyst system resulted in emissions results of 0.058 g/mi NMHC, 0.939 g/mi CO, and 0.231 g/mi of NOx. Modifying this system from the base configuration (EHC-TWC-Conventional Oxidation Catalyst ("COC") to an EHC-TWC-TWC-TWC configuration lowered emissions to 0.053 g/mi NMHC, 0.711 g/mi CO, and 0.177 g/mi NOx.[75] Each configuration was tested three times "to insure statistically repeatable data."[76]

Based on the Agency's review of CARB's information and the recent work in this area, EPA believes that some "EHC system optimization" will be necessary to determine optimum EHC location, heating strategy and air injection strategy. In addition, calibration changes may be necessary to reduce engine-out emissions. However, it is plausible to project that these steps can be completed for incorporation into LEVs and ULEVs.

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[73] Id. at. 12.

[74] SAE 912384.

[75] Id. at. 8.

[76] Id. at. 4.

2) EHC Durability and Deterioration

In both of its major comments, CARB has presented its view on EHC durability and deterioration. While CARB recognizes that the durability of EHCs has not been fully established, CARB believes that EHCs will prove durable (used here to refer to both emissions deterioration and mechanical durability) in-use because EHCs can be preheated to the "deteriorated" light-off temperature, which could mask any increase in the light-off time of an aging EHC. In addition, CARB believes that EHCs will prove more durable than conventional non-EHC, but close coupled, catalysts used on Tier I[77] or TLEV vehicles, because they can be located further from the exhaust manifold where temperatures are lower. (CARB predicts that deterioration factors[78] for EHCs will be much lower than for close-coupled units.)[79]

CARB also believes that information from catalyst manufacturers indicates that EHCs have achieved mechanical durability levels approaching production readiness. This is based on information from

[77] Tier I vehicles are vehicles which meet the federal emissions standards beginning in 1994.

[78] A deterioration factor is is a number applied to baseline emission levels in order to estimate end-of-useful life emission levels.

[79] CARB March 1992 Comment, Docket entry IV-G-09, at 9.

foreign manufacturers, hot vibration test results from Camet, and engine dynamometer aging to a simulated 50,000 and 100,000 miles. FTP results from these dynamometer-aged EHCs address emissions deterioration as well. [80]

MVMA/AIAM maintains, in their March 1992 comment, that to their knowledge, "no vehicle manufacturer or component vendor has successfully operated and tested an EHC-equipped vehicle over CARB's full useful life period, with a driving pattern that simulates customer usage." [81] MVMA/AIAM stated that they are unaware of any EHC units that have maintained both mechanical integrity and acceptable converter efficiencies for more than 15,000 miles of "customer-type" vehicle operation and that failures have occurred in dynamometer aging evaluations as well. MVMA/AIAM also stated that evaluations of aged EHCs have been limited to engine dynamometer-aged components, aged under a cycle that simulated certification rather than in-use operation. Additionally, MVMA/AIAM stated that, based on "generally-accepted in-use deterioration calculation methodologies," GM testing has shown that low-mileage NMOG levels below the levels attained by the CARB vehicles [Buick LeSabre/Toyota Celica] would be necessary to pass CARB's

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[80] Id. at 28.

[81] MVMA March 1992 Comment, Docket entry IV-G-14, at 14.

in-use LEV standards.[82] The analysis itself is contained in GM's confidential submission of March 26, 1992.[83]

In evaluating durability issues of EHCs, it is important to note that the components making up an EHC are in-use in motor vehicle applications today.[84] Therefore, durabilities of the individual components have been demonstrated through their continued in-use operation.

Both Camet and Volvo/Emitec researchers reported that they have tested units which survived 900 degree C hot vibration and thermal cycling tests. The Camet researchers initially reported failures in hot vibration tests at 900 degree C [85], but have apparently made design changes which allow their units to survive 900 degree C hot vibration tests.[86] The Manufacturers of Emission Controls Association ("MECA") reported that Camet was successfully performing mechanical durability testing on its new EHCs (which were developed in 1991).[87] Furthermore,

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[82] Id. at 16.

[83] GM confidential submission, March 26, 1992. Docket entry IV-G- , at Appendix A. See GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at Appendix A for summary of analysis.

[84] MECA Comment, Docket entry IV-G-46, at 3.

[85] Whittenburger, W. A. and Kubsh, J. E., Electrically Heated Metal Substrate Durability, SAE Technical Paper 910613 ("SAE 910613").

[86] CARB March 1992 Comment, Docket entry IV-G-09, Attachment E.

[87] MECA Comment, Docket entry IV-G-46, attachments 3-5.

Camet researchers reported they were currently evaluating their systems in a 20 vehicle fleet representing a broad spectrum of vehicles under in-use conditions.[88]

MECA, in its August 1992 comments, also reported that in Europe a Volkswagen with a 1.8L, 4 cylinder engine equipped with an EHC designed to meet ULEV standards has accumulated over 40,000 miles "at demanding high speed operation." MECA reported that several EHC manufacturers expect to complete the durability demonstration phase of their development efforts in 1993. One manufacturer, MECA said, "has indicated it expects to be able to provide limited quantities [of EHCs] as early as 1994.[89]

Developing sufficient mechanical durability logically precedes a comprehensive assessment of emissions deterioration. This is particularly true given the interrelationship of design factors in an EHC system. Both the mechanical durability of the EHC, and the amount of deterioration expected in the EHC and the total catalyst system efficiency influence the choice of location of the EHC relative to the engine and other converters. Location, in turn, influences the energy requirements, and the

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[88] Whittenberger, W. A. et. al., Experiences with 20 User Vehicles Equipped with Electrically Heated Catalyst Systems, SAE Technical Paper 920722 ("SAE 920722").

[89] MECA August 1992 Comment, Docket entry IV-G-46, p.2.

design of the power supply system. EHC and total catalytic converter system deterioration will, to a large extent, determine the amount of engine-out emission control necessary to provide sufficient low mileage margin to ensure compliance at higher mileage. This will determine what, if any, changes beyond calibration changes must be made to current technology vehicles in order to meet LEV/ULEV standards.

I have carefully examined the GM analysis which MVMA/AIAM claims to show that low-mileage NMOG emission levels below the levels attained by the CARB vehicles would be necessary to pass CARB's in-use LEV standards.[90] Although these analyses may well be a "generally-accepted in-use deterioration calculation methodologies", as claimed by MVMA/AIAM,[91] these procedures involved making estimates and assumptions about relevant data. As such, this should be considered an estimate, rather than a precise calculation of the necessary low mileage emissions level to assure compliance at high mileage.

Clearly, the comments received in this proceeding offer differing views on the assumptions that can be made about the durability of EHCs. Based upon EPA's review of these comments and other published results,

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[90] See GM Submittal of confidential business information - Public Disclosure Version, March 26, 1992, Docket entry IV-G-38, at A1-A6 for summary of analysis.

[91] MVMA March 1992 Comment, Docket entry IV-G-14, at 16.

the Agency has determined that significant progress has been made in improving the mechanical durability of currently available prototype EHCs, that EHCs are currently being evaluated in an in-use environment, and that any remaining technological challenges to EHC's in-use durability can be met by 1999 and probably earlier.

3) EHC Energy Source/Power Supply Issues

All parties in this proceeding agree that the power demands of an EHC system are significant. Comments that I have received suggest that the life of a conventional lead-acid automotive battery, in an EHC application, is likely to be substantially shorter than the useful life of the vehicle.[92] The EHC's high energy demand over a short time (perhaps 20 seconds) may drain a battery of a significant portion of its charge. The battery must subsequently be recharged by the vehicle's alternator. Commentators have stated that this "deep discharge" cycling shortens the life of a battery, and puts a high demand on the vehicle's charging system. There are, in essence, two major interrelated issues; what has and will be done to reduce EHC energy demand and what has and will be done to ensure adequate energy storage and supply for the EHC.

[92] However, batteries in most current model year vehicles are not warranted for the full useful life of the vehicle.

CARB's submittals concerning EHC energy requirement issues conclude that improvements in EHC durability have reduced energy requirements. In its August 1992 comment, CARB furnished energy and NMHC emission data which it identified as "EHC Energy Requirements of Recent ARB Tests" [test dates 7/10/92-7/31/92] and "Corning EHC Test Results (6/8/92)". These data were submitted to rebut MVMA/AIAM's position that CARB has underestimated EHC energy requirements.

CARB also claims that new design batteries will soon be available. In the March 1992 comment, CARB stated that a major [unidentified] battery manufacturer will "soon unveil a deep-cycle lead-acid battery designed specifically for use in EHC systems." CARB indicates that this new battery will be significantly smaller and lighter than current batteries and is expected to last more than five years without maintenance.[93] CARB also projects that other new design energy storage devices will be available for application to EHC systems (i.e., sealed bi-polar lead acid batteries, and ultracapacitors.)[94] CARB claims these new devices could also facilitate vehicle recharging.[95]

CARB has also noted that the Idaho National Engineering Laboratory has

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[93] CARB March 1992 Comment, Docket entry IV-G-09, at 29.
[94] CARB August 1992 Comment, Docket entry IV-G-49, at 29.
[95] Id., at 30.

provided them with test data from a Panasonic carbon-based ultracapacitor and a mixed metal oxide ultracapacitor. CARB stated that the data indicate that the Panasonic ultracapacitor is capable of surviving 350,000 EHC charge-discharge cycles with minimal performance loss.[96]

MVMA/AIAM claimed, in the March 1992 comments, that CARB, the component vendors, and the vehicle manufacturers have all found it necessary to recharge the batteries used in EHC units with off-board power sources in order to achieve stabilized emission levels. MVMA/AIAM suggests that current technology charging systems are inadequate for EHC equipped vehicles. MVMA/AIAM claimed that since off-board recharging does not simulate in-use operation, CARB has failed to demonstrate that EHC-equipped vehicles can pass emissions tests in actual use.

MVMA/AIAM also stated that an ultracapacitor will be needed to solve this [energy storage] problem, but that an "ultracapacitor" is not currently available for use in vehicle development. General Motors submitted comments in support of MVMA/AIAM's position.

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[96] The charge/discharge cycle relationship to useful life is not quantifiable, but it is valid to state that a 350,000 cycle life would not be exceeded by the 100,000 mile vehicle useful life requirements. Otherwise, the average trip length for a vehicle would have to be under one-third of a mile.

In its June 1992 comment, MVMA/AIAM stated that CARB lacked any basis for reliable projections of meeting LEV/ULEV compliance through EHC utilization because CARB's assessment of the technology was unrealistic. MVMA/AIAM claimed CARB has underestimated EHC power requirements as well as overstated the capability of EHC-equipped vehicles to recharge.[97] The associations provided data from the CARB-WSPA program showing that "power requirements", i.e., actually energy requirements expressed in watt-hours, were in excess of those claimed by CARB. MVMA/AIAM also asserted that CARB has not substantiated projections about "ultracapacitors" or advanced batteries.

The EHC energy requirements will necessarily dictate the battery/charging system requirements. The sufficiency of a battery/charging system is thus related to EHC location, durability, and deterioration, and there are tradeoffs associated with these factors. Placing a catalyst close to the engine decreases the time it takes the catalyst to heat up to operating temperature, but it could also decrease catalyst life through thermal degradation (caused by exposure to high temperatures) or increased poisoning. Since the increased energy demand of an EHC system places an additional load on the engine via the alternator, the EHC may potentially have an adverse effect on engine-out emissions because of

[97] MVMA June 1992 Comment, Docket entry IV-G-37, at 20-22.

that increased load. In addition, failure to provide a stable power supply to the EHC may adversely affect emissions.[98]

After reviewing published research on EHC technology, EPA has found that some, but not all, researchers chose to recharge the batteries used in EHC units with off-board power sources. For example, Ford researchers reported that they had used an on-board production 850 cold cranking ampere (CCA) battery "successfully" for a number of tests, and that this battery was recharged via the alternator.[99] A report on testing of a Camet EHC in a GM "Quad4" car indicated that a single 900 CCA battery was installed in the vehicle in place of the vehicle's stock battery.[100] This report did not indicate any charging system modifications, or identify any problems encountered during testing due to insufficient energy supply.

Portions of the data and data analysis submitted by MVMA/AIAM and GM suggest that CARB may have underestimated EHC energy requirements in

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[98] This logic applies to testing as well. CARB stated the reason they use off-board charging is to provide a constant charge level to each battery before testing. (see CARB August 1992 Comment, Docket entry IV-G-49, at 28). CARB believes "it makes little sense to focus on modifying vehicle recharging capability until minimum energy requirements are established. (Letter to Mr. Weverstad from CARB, July 10, 1992, Docket entry IV-G-40).

[99] see SAE 912384 at 4.

[100] see SAE 912385.

certain instances.[101] However, other data and information submitted by CARB indicate that GM's selection of data from the CARB-WSPA test program may not be representative of EHC power requirements.[102] The "watt-hour" numbers in the August 1992 CARB comment were in general, lower than the numbers in the June 1992 MVMA/AIAM comment. Clearly, it is difficult to compare EHC energy usage "watt-hour" numbers collected under different or unspecified conditions. EHC design, exhaust system location, heating strategy, vehicle, measurement conditions (e.g. energy consumption of the EHC circuit including cables or the EHC only) etc. are all variables affecting energy consumption.

The Agency has reviewed the comments in this proceeding pertaining to EHCs and energy consumption and other published information on this area. and believes, based on this information, that the mechanical durability of EHCs has improved significantly, allowing them to be placed closer to the engine. Locating the EHC close to the engine is optimum from an energy standpoint because the temperature of the exhaust gas is highest and more heat energy from the exhaust gas is transferred to the EHC, reducing the amount of electrical energy required. EPA also notes that

[101] See, e.g., MVMA March 1992 Comment, Docket entry IV-G-14, at 18, GM; GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A5-A6.

[102] CARB noted that these vehicles were assembled with little or no opportunity for optimization of either power or emissions. CARB August 1992 Comment, Docket entry IV-G-49, at 22-23.

work is underway to improve the thermal durability and stability of the coating and precious metal components of starter catalysts under high temperature conditions.[103] Any such improvements should be applicable to EHCs as well as conventional catalysts. Thermal stability relates to catalyst deterioration and loss of efficiency. If thermal durability and stability were improved, emissions deterioration concerns would be less of a barrier to locating the EHC close to the engine.

The Agency notes that the reduction of EHC mass can also reduce the energy required to heat an EHC to a given temperature.[104] Corning researchers demonstrated that lower mass EHCs yield higher heater temperatures and lower emissions for the same energy input.[105] This paper was published in February, 1992. This same company claimed, in an April 22, 1992 press release, that it was able to pass the ULEV standards using less than one-third the energy required by its earlier prototype, introduced in February, by reducing the mass of the heating element by

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[103]Vol. 100, Cooper, Barry, The Future of Catalytic Systems, Automotive Engineering, April 1992.

[104] The relationship between catalyst temperature and electrical energy is shown in the equation E = M•C (T-25), where E = energy supplied, M = mass of heater, C= specific heat of heater (a constant), T= temperature of the EHC, and 25 = 25 C, the nominal ambient temperature during FTP emissions testing. Applying this formula shows that if the mass of the heater is reduced, the energy required to heat an EHC to a given temperature can also be reduced.

[105] SAE 920093.

two thirds.[106] Corning's product improvement succeeded in reducing the energy requirements from 38 watt-hours to 12.1 watt-hours.[107] In addition, W.R. Grace reported that since 1987, EHC "[h]eating times have been substantially reduced, from 100 seconds pre-crank to the 5 to 10 second post-crank range."[108]

Based upon my review, I find that progress in reducing EHC energy requirements has occurred rapidly, and that extensive research and development continues. Therefore, energy consumption data cited by MVMA/AIAM which was generated in conjunction with emissions tests using EHCs different than the most recent designs may not accurately characterize future EHC energy requirements.

Information exists in the record which indicates that energy systems using conventional lead-acid batteries, despite their perceived shortcomings, are being tested and analyzed for EHC applications. It is theoretically possible to avoid "deep discharge" by reducing the energy required to heat the EHC and/or increasing the electrical storage capacity

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[106] MECA Comment, Docket entry IV-G-46. at 8.

[107] C. Smith, Remarks at the Clean Air Marketplace Conference (April 22-23, 1992), *reprinted* in The Clean Air Marketplace: Summary of Conference Proceedings.

[108] W.R. Grace Submittal - Public Disclosure Version, November 30, 1992, Docket entry IV-G- , at 3.

through use of an additional or a higher voltage battery. For example, an EHC system on a Toyota Celica utilizing a dual battery configuration was recharged by the vehicle's alternator during FTP testing.[109] EPA also notes that an in-use study being conducted by Camet is evaluating different battery designs in different configurations.[110] In this study, involving 20 in-use vehicles, vehicle charging systems were not upgraded. Published results (six-month results) for this two year/50,000 mile study indicate that while one "new design battery" has proven inadequate, a conventional design battery is holding up well.[111] It appears that, while the adequacy of new technology batteries for EHC applications has not been proven, neither has the inadequacy of more conventional designs. This study also indicates that new technology batteries and power controllers will be substituted for evaluation as they become available.

MECA reported in its August 1992 comment that an EHC manufacturer noted that prototype batteries specifically designed for EHC service are undergoing testing. According to MECA, this manufacturer reported that bench testing continues without problem after 5,000 heating cycles (identified as roughly equivalent to three years or 36,000 miles of driving), and that fleet vehicles using these batteries are performing well

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[109] SAE 910612.

[110] SAE 920722.

[111] Id., at 8.

after 6 months.[112]

While CARB has not substantiated all of its claims relative to the state of development of "new design" battery systems and ultracapacitors for EHC applications, CARB included, in its August 1992 comment, a report prepared for the U.S. Department of Energy entitled "Laboratory Testing of High Energy Density Capacitors for Electric Vehicles".[113] This report concluded that life cycle tests of certain Japanese capacitors showed a cycle life in excess of one hundred thousand charge/discharge cycles. The report did observe that there was a significant degradation in the performance of the capacitor during the life cycle test. The report, dated October 1991, stated that "[h]igh energy density capacitor technology is improving rapidly at the present time, so that there are undoubtedly higher energy density devices than those tested in this program under development in laboratories around the world."[114]

EPA believes it is reasonable to conclude, from the information in the record, that progress is being made in the design and development of ultracapacitors. Furthermore, the information in the record suggests that ultracapacitor development is occurring for application to electric vehicle

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[112] MECA Comment, Docket entry IV-G-46, at 4.

[113] CARB August 1992 Comment, Docket entry IV-G-49, Appendix H.

[114] Id. at 7.

technology. Since there is a broader application of ultracapacitor technology than just providing an adequate energy storage for EHC applications, the incentive for rapid development of this technology may be higher than for a single-use technology.

EPA's review of the record suggests that progress is being made in reducing EHC energy requirements, and that it is reasonable to project that further reductions are likely to be possible through, for example, EHC mass reductions or enhanced thermal durability, both of which appear feasible to achieve in the available leadtime. EPA has also found that battery and supercapacitor technologies applicable to EHCs are undergoing significant development, although this development is less well documented and may be lagging EHC development. However, materials in the record indicate that current battery technology may be adequate, at least as an interim solution, in some EHC applications.

4) Conclusions on EHC Technical Feasibility

EPA's review of the record suggests that it is reasonable to project that EHCs will be technically feasible. The record demonstrates EHC's capability to reduce emissions and further optimization of EHC systems could improve the emission reductions. EHC durability has been and is

being demonstrated in the laboratory and in on-road testing. Review of the record also leads the Agency to reasonably believe that energy requirements of EHC systems will be met by some combination of reduced energy demands of the EHC, improved electrical storage systems, and improved electrical delivery systems. In further support of EPA's conclusions, the Agency recognizes that W.R. Grace is planning on producing 50,000 EHCs in 1993 at pilot production facilities,[115] evidence of the aftertreatment industry's confidence in and commitment to EHC technology.

iii) Other Aftertreatment Technologies

CARB's March 1992 comments identified increased catalyst loading,[116] particularly rhodium for NOx control. as an aftertreatment technology which could help vehicles meet LEV and ULEV emission standards.[117] The benefit of increased loading would be to "ensure that enough active sites for catalytic action are maintained with aging."[118] In its August 1992 comments, CARB identified other aftertreatment

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[115] W.R. Grace Submittal - Public Disclosure Version, November 30, 1992, Docket entry IV-G- , at 3.

[116] Catalyst loading refers to the amount of catalytic material (noble metals rhodium, palladium, and/or platinum) present in a catalytic converter. e.g., Id., at 14.

[117] CARB March 1992 Comment, Docket entry IV-G-09, at 25.

[118] Id.

alternatives to EHCs which could potentially be used to achieve LEV and ULEV emission levels.[119]

One such alternative is the bypass start catalyst, a small, quick light-off catalyst mounted close to the exhaust manifold. Exhaust emissions are initially routed to this catalyst during cold start, but this catalyst is bypassed once the main catalyst has reached a sufficient temperature for light-off.[120] Light-off temperature has generally been defined as the catalyst temperature at which HC and CO conversion efficiencies equal 50%.[121] Since the bypass start catalyst is used only for a short period of time during cold starts, CARB predicts that it should be fairly durable despite its close-coupled position.

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[119] CARB August 1992 Comment, Docket entry IV-G-49, at 31-32.

[120] CARB misstated the operating procedure of the bypass catalyst in its August 1992 submittal. CARB claimed that during cold-starts, exhaust emissions are routed to bypass the main catalyst. However, the system does not bypass the main catalyst at any time. Instead, it merely routes the exhaust stream through the bypass start catalyst first. The exhaust stream continues through the main catalyst, thereby heating it to its light off temperature. The bypass catalyst reaches light off temperature before the main catalyst, and thereby treats the exhaust gases sooner than the main catalyst. Durability of bypass catalysts is not expected to be an issue because they are only exposed to exhaust gases for a short period of time. CARB August 1992 Comment, Docket entry IV-G-49, at 31.

[121] Whittenberger, W. A. and Kubsh, J. E., Recent Developments in Electrically Heated Metal Monoliths, SAE Technical Paper 900503 ("SAE 900503"); Hammerle, R.H. and Wu, C.H., Effect of High Temperatures on Three-way Automotive Catalysts, SAE Technical Paper 840549 ("SAE 840549").

CARB has also identified other strategies that may be used to met LEV or ULEV standards. Two of these strategies which are potentially applicable to conventional four stroke cycle gasoline engines are hydrocarbon vapor traps and exhaust gas ignition.[122] A hydrocarbon trap consists of a ceramic material which absorbs hydrocarbons from the cold exhaust. When the exhaust reaches a sufficient temperature, the hydrocarbons are released and oxidized by the catalytic converter. Exhaust gas ignition uses exhaust gases from an engine calibrated to run rich and air injection to create a combustible mixture, which is ignited in the exhaust system in front of the catalyst. These burning exhaust gases heat the catalyst and thereby reduce catalyst light-off time.[123]

MVMA/AIAM asserted that increased rhodium loading [for NOx compliance] has not been shown to provide statistically significant improvement in emissions performance, and that if it is beneficial, will add costs not considered in the cost analysis.[124] GM submitted certain comments in support of MVMA/AIAM's positions.[125]

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[122] CARB August 1992 Comment, Docket entry IV-G-49, at 32.

[123] Ma, T. et. al., Exhaust Gas Ignition (EGI) - A New Concept for Rapid Light-off of Automotive Exhaust Catalyst, SAE Technical Paper 920400 ("SAE 920400").

[124] MVMA June 1992 Comment, Docket entry IV-G-37, at 12-13.

[125] GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A7.

MECA has reported that some of the ongoing catalyst research is aimed at developing catalyst performance in areas such as catalyst formulations which are more active at lower temperatures, catalysts which light off at lower temperatures, and catalysts which have better thermal stability. [126]

MECA also reported another technology being designed which will help decrease the time required to light off catalysts. A modification is made to the exhaust pipe to provide a thin-wall liner which gives an air gap between the exhaust stream and the exhaust pipe. This air gap acts as an insulator and provides a quicker rise in temperature to the catalyst. [127]

MECA identified hydrocarbon traps as a control strategy that shows promise. [128] MECA noted that the concept had been evaluated in the 1970s and 1980s, and that considerable advances have been made in making the ceramic material more resistant to high temperature degradation and in improving trapping efficiency. MECA also characterized exhaust gas ignition as requiring additional development and demonstration of durability but "theoretically elegant and simple". [129]

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[126] MECA August 1992 comments, Docket entry IV-G-46, at 6-7.

[127] Id. at 8.

[128] Id. at 8.

[129] Id. at 8.

EPA's review of the information in the record leads the Agency to conclude that there are other aftertreatment technologies which may be appropriate alternatives to EHCs. For example, EPA conducted tests on a flexible-fueled vehicle utilizing the Schatz Heat Battery, a heat storage device which stores waste heat from the engine's coolant during vehicle operation.[130] "This excess energy may be returned to the coolant upon the ensuing cold start, [thereby] shortening the engine warm-up period."[131] This, in turn, could reduce cold start emissions related to partially burned or unburned fuel (i.e. NMOG, hydrocarbons) as well as CO. It is well-documented that the vast majority of HC and CO emissions are generated during the cold-start period of vehicle operation.[132] EPA conducted tests on this vehicle using indolene (certification gasoline) and M85 (a methanol/gasoline blend containing 85% methanol).

After examination of comments and other published materials in the

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[130] Hellman, K. H. et. al, Evaluation of Heat Storage Technology for Quick Engine Warm-Up, SAE Technical Paper 922244 ("SAE 922244").

[131] Id., at 1.

[132] See e.g. "Cold start emissions can contribute up to 70% of HC and CO tailpipe emissions during the Federal Test Procedure ("FTP")." Hurley, R.G. et. al., Experiences with Electrically Heated Catalysts, SAE Technical Paper 912384 ("SAE 912384"); "80-90 % of HC emissions... produced... before catalyst light off" Fraidl, G.K. et. al., Improvement of LEV/ULEV Potential of Fuel Efficient High Performance Engines, SAE Technical Paper 920416 ("SAE 920416").

record, EPA believes the aftertreatment alternatives to EHCs which CARB identified are theoretically viable technologies which are currently the subject of much investigation and research by various parties. EPA recognizes that these technologies need to be further developed. For instance, both bypass catalysts and hydrocarbon traps will require valves in the exhaust system, and the durability of such valves for full useful life has not been established. The authors of SAE Paper 920400, which describes the exhaust gas ignition concept, note that there are open issues related to the adverse effects on the engine due to the very rich combustion required for exhaust gas ignition. The Agency's review of the information in the record suggests it is reasonable to determine that these other aftertreatment technologies could be used as emission control devices in LEVs and ULEVs.

4) Other Issues

a): Evaporative Interaction

In addition to meeting exhaust emission requirements, vehicles are required to meet evaporative emissions standards. In order to meet these requirements, vehicles are equipped with charcoal canisters which store hydrocarbons from vaporized fuel. When a vehicle is running, hydrocarbons

are purged from the canister and burned in the engine. Since these purged hydrocarbons affect the air fuel ratio, they can potentially increase exhaust emissions. This effect is sometimes referred to as evaporative interaction."

CARB maintains that its proposed new evaporative emissions test procedure requirements and the design changes necessary to meet these requirements will not cause fuel control problems related to increased evaporative system operation [evaporative interaction] which would impede meeting the NMOG standards. CARB presented data from Buick LeSabre testing which they suggest shows that the evaporative interaction effect on NMOG emissions is small. CARB also maintains that changes in canister purge strategy may be used to help facilitate proper fuel control. CARB reported in its August 1992 comment that Ford Motor Company is currently using purge systems that slowly meter the purged fuel during cold starting.[133] Other manufacturers are expected to utilize similar systems.

MVMA/AIAM claimed, in its March 1992 comment, that CARB's EHC tests on indolene were generally conducted without use of evaporative storage canisters in the saturated condition, as required by CARB's new

[133] CARB August 1992 Comment, Docket entry IV-G-49,at 36.

evaporative emission test procedure listed in CARB's waiver request.[134] MVMA/AIAM also claimed, in its June 1992 comment, that there was a statistically significant evaporative interaction effect, as evidenced by "bag 1" emissions.[135]

The data do not necessarily show that the effects of evaporative interaction are negligible. The observed "bag 1" differences may be a more appropriate measure of evaporative interaction than composite FTP emissions. However, EPA notes that careful design of purge strategy may be used to help mitigate any such effects. Clearly, the purge system would have to slowly meter purge at cold start, similar to the Ford system referenced by CARB. Purge systems are now generally controlled by the on-board computer, and no new technology would be required.

b): Meeting the LEV/ULEV NOx standard

As stated earlier, CARB believes that the NOx standard can be met by increasing rhodium loading in the three-way catalyst(s) in conjunction with fuel control strategies that will allow more precise control of air-fuel ratio. CARB stated in its March 1992 comment that greater catalyst loading will help ensure that "enough active sites for catalytic action are

[134] MVMA March 1992 Comment, Docket entry IV-G-14, at 19.

[135] MVMA June 1992 Comment, Docket entry IV-G-37, at 26..

maintained with catalyst aging."[136] CARB attributes the failure of their EHC-equipped Buick LeSabre to meet the LEV/ULEV NOx standard to insufficient rhodium loading coupled with an unusually lean air-fuel ratio during warmup.[137]

CARB reported that it surveyed its 1992 certification data and found that GM used less rhodium in its catalysts than did virtually all other major manufacturers.[138] CARB called attention to one manufacturer which used significantly more rhodium than did GM. This manufacturer was cited for having one of the best records for in-use compliance and low emissions. In addition, CARB recognized that adding rhodium is not the only possible alternative to improving NOx emissions.

MVMA/AIAM, in its March 1992 comment, noted the difficulty of simultaneously meeting low NOx and NMOG standards. MVMA/AIAM also stated that GM's confidential business comment of March 1992 contains a deterioration analysis which projected that even CARB's Toyota Celica would not meet the LEV/ULEV NOx standard at 75,000 miles.[139] As stated

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[136] CARB March 1992 Comment, Docket entry IV-G-09, at 25.

[137] Id. at 30.

[138] CARB August 1992 Comment,Docket entry IV-G-49, at 19-20.

[139] See GM Submission of confidential business information - Public Disclosure Version, June 26, 1992, Docket entry IV-G-38, at A5 for summary of analysis.

earlier, MVMA/AIAM, in its June 1992 comment questioned the benefit of increased rhodium loading.

MVMA/AIAM also claimed that vehicle-to-vehicle variation makes it difficult to meet development targets, especially for NOx.[140] MVMA/AIAM described some GM component transfer and calibration experiments which it performed on a 3.8L V6. NOx emissions were reported to be 60% higher on the second vehicle when compared to the NOx emission level of the first vehicle.[141] MVMA/AIAM concluded that CARB has not tried to replicate its emission results on a second identical vehicle, therefore not addressing the vehicle variability issue.

EPA notes that neither MVMA/AIAM nor GM (in its supplemental submittal) provided data or theoretical analysis to refute CARB's conclusion that increased rhodium loading will help attain and maintain NOx compliance. However, GM researchers reported that palladium, a less expensive element, could be a viable option in replacing some of the rhodium in catalytic converters.[142] This could allow for increased precious metal loading of the catalysts, therefore providing better emission control.

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[140] MVMA June 1992 Comment, Docket entry IV-G-37, at 16-18.

[141] Id., at 16.

[142] Fisher, G. B. et. al., Rhodium Alternatives in Emissions Catalysts, Automotive Engineering, Vol. 100, No. 7, at 37-40 (July 1992).

While GM's deterioration analysis using the 3.8 liter V^ engine component transfer and calibration appears to show difficulty in meeting the NOx standards, EPA does not believe that this analysis should be considered a precise methodology and therefore determinative. If vehicle-to-vehicle variability proves to be a particular problem at the calibration development stage, or at the production stage, it must be addressed. Neither the public submission by MVMA/AIAM, nor the GM comment describes the "calibration experiments" in sufficient detail for a thorough EPA evaluation. Therefore, the automotive industry has not met its burden of refuting CARB's findings regarding the feasibility of the LEV/ULEV NOx standard.

c): LEVs and On Board Diagnostic Requirements (OBD II)

The new CARB OBD II rules require that emissions related systems and components providing input to or receiving output from the on-board computer be monitored.[143] Monitoring requirements include monitoring of catalyst efficiency and, if an EHC is used, EHC heating.

Although both CARB and MVMA/AIAM have referred to on-board

[143] CARB OBD II waiver has not been granted yet by EPA.

diagnostics in their comments, the only pertinent question is whether any OBD II requirement would preclude or impede meeting any of the low emission vehicle requirements.[144] The comment received from MVMA/AIAM suggested that monitoring of catalyst efficiency by use of dual oxygen sensors may be an area of potential conflict.[145]

CARB believes that new OBD II requirements will help ensure that low emissions are maintained in-use. CARB expects that most manufacturers will mount an EHC immediately in front of another small conventional catalyst, and that there will be sufficient oxygen storage capacity in this front catalyst system to monitor catalyst efficiency by using dual oxygen sensors. CARB, in its August 1992 comment, noted manufacturers had performed or would perform effective monitoring of close coupled catalysts with normal levels of cerium.[146] CARB has also received OBD II system descriptions for 1994 model year certifications from three manufacturers which meet the level of catalyst monitoring discrimination called for in the regulation.[147]

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[144] A related question is whether any of the low emission vehicle requirements would preclude or impede meeting any of the on board diagnostic requirements. This question is expected to be addressed in EPA's waiver proceeding regarding CARB's request concerning on board diagnostics.

[145] MVMA June 1992 Comment, Docket entry IV-G-37, at 24.

[146] CARB August 1992 Comment, Docket entry IV-G-49, at 36.

[147] CARB August 1992 Comment,Docket entry IV-G-49, at 36.

MVMA/AIAM claimed that dual oxygen sensors, which provide a relative measure of the oxygen storage capacity of a catalyst, are not a viable method of monitoring catalyst efficiency in EHC systems. MVMA/AIAM claimed that EHCs are designed with low cerium levels to alleviate rapid sintering. (Sintering is a type of thermal degradation that can result in loss of catalyst efficiency). MVMA/AIAM noted that cerium is related to oxygen storage capacity. MVMA/AIAM stated that in order for the dual oxygen sensor system to be effective, the catalyst in front of the rear sensor must have an HC conversion efficiency greater than 90%. With efficiencies below this number, the rear oxygen sensor has trouble consistently differentiating between catalysts with different HC conversion efficiencies.[148] Cerium, in the form of ceria (CeO_2), aids catalyst efficiency by facilitating oxygen storage in catalysts[149] and promoting the water-gas shift reaction in three way catalysts, which occurs during rich conditions when oxygen is limited.[150]

EPA notes that work is underway to improve the thermal stability of the alumina and ceria components of the washcoat and the stability of the

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[148] MVMA June 1992 Comment, Docket entry IV-G-37, at 25, (citing SAE 920831).

[149] SAE 920831.

[150] Vol. 100, Cooper, Barry, The Future of Catalytic Systems, Automotive Engineering, (April 1992).

precious metal component.[151] This would suggest that even if EHCs are currently being designed with a low level of cerium because of thermal stability concerns, and even if this cerium level is too low to permit monitoring of EHC efficiency, future developments are likely to allow the cerium levels in EHCs to be increased. Additionally, if EHCs are proven to control emissions then they should also have sufficient oxygen storage capacity for OBD purposes since oxygen storage is essential to proper catalyst operation.[152] As a result, the Agency does not believe that the concerns industry raised are sufficient to refute CARB's claims that OBD and EHCs are compatible systems.

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[151] Id.

[152] See SAE 920831.

e) Conclusion on Technological Feasibility

As discussed above, EPA has determined that NRDC provides the most appropriate guidelines for my analysis of the technological feasibility of the CARB LEV standards in the context of their consistency with section 202(a) of the Clean Air Act. To reiterate, this decision sets up a general three-part test to show that the EPA has made a reasonable basis for a conclusion that technology will be available to meet future standards, and the test can be applied to CARB standards to demonstrate their technological feasibility. As CARB paraphrased the court's test to apply to this waiver decision:

"Under the (NRDC) test, the low-emission vehicle regulations meet the requirement of technological feasibility if the following three questions have been satisfactorily addressed:

i. Have the theoretical objections been answered?

ii. Have the major steps needed to refine the technology been identified?

iii. Have plausible reasons been offered for believing that the steps can be completed in the time available?[1]

I have reviewed the information in the record of this proceeding which relates to the NRDC test, and I have determined that the test has been satisfied. Therefore, I am unable to make the finding that the TLEV,

[1] CARB August 1992 Comment, Docket entry IV-G-49, at 61-62.

LEV and ULEV standards are not technologically feasible within available lead time, which is determined by the relationship of the NMOG fleet average to the categories of vehicle standards. My discussion of these points follows.

i) TLEVs

Based on EPA's review of the record, I find that it is reasonable to conclude that the TLEV standards are technologically feasible within the leadtime provided by CARB's regulations. TLEVs, which must meet a .125 gpm NMOG standard, will not be required until the model year 1995, when the fleet average NMOG requirement first falls below .25 gpm, the standard that can be met by producing the .25 NMHC vehicles already required by CARB's current regulations. The fact that several model year 1993 TLEVs have already been certified by various manufacturers demonstrates clearly the feasibility of meeting these standards by model year 1995. Moreover, the fact that the manufacturers have been able to certify vehicles to these standards that do not embody technologies that CARB initially expected to be "necessary" to meet the TLEV standards indicates that these standards will be easier to meet than CARB initially expected. Additional ample evidence of the feasibility of TLEVs is the testing data indicating that numerous engine families certified to less

stringent emission standards meet TLEV emission standards in-use. Indeed, based on the record, it is apparent that the TLEV standards can be met with existing technology.

Furthermore, as CARB has noted, the technological feasibility of TLEVs is no longer contested by the industry.[2] Both the MVMA and the Ford Motor Company have commented specifically that EPA should grant a waiver for TLEVs (but deny the waiver for the other vehicle categories.)[3]

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[2] CARB August 1992 Comment, Docket entry IV-G-49, at 62.

[3] Letter from Thomas H. Hanna, President, MVMA to Administrator Reilly, dated December 2, 1992, Docket entry IV-G-XX and letter from D.R. Buist, Director, Automotive Emissions and Fuel Economy Office, Ford Motor Company, to Charles N. Freed, Director, Manufacturers Operations Division, August 20, 1992, Docket entry IV-G-53.

EPA rejects the request of MVMA and Ford to grant a waiver only for TLEVs and deny the waiver for the other categories of standards. Section 209 does not provide EPA with the authority to grant a waiver with a condition such as the one requested, which is a condition that would result in a fundamental change in the nature of the program for which California has sought a waiver. Due to the nature of the LEV program, which depends on the integral relationship of the NMOG fleet average requirement to the standards for the various categories of vehicles, severing the TLEV standards from the remainder of the program would result in drastically different emissions benefits than California contemplated in preparing its waiver request, particularly the comparative protectiveness finding required of every request. If EPA determined that the other aspects of the program did not satisfy the criteria set forth in section 209, EPA would simply have to deny the waiver.

ii) LEVs and ULEVs

As outlined in detail in Section C) 2) above, CARB believes that many smaller (4 and 6 cylinder) vehicles will be able to certify to LEV standards with some combination of fuel and catalyst controls, while larger vehicles will probably require post-started heated EHCs to certify to LEV standards. CARB believes that ULEVs will need the same basic equipment as LEVs, with refinements in both the fuel systems and catalysts, and also EHCs (including pre-start EHCs for some engines).[4] These projections of the technologies needed are predicated on the assumption that these vehicles will be certified on conventional gasoline (i.e., Indolene Clear or reduced-RVP Indolene).

As CARB acknowledges, the industry has raised some objections to CARB's contentions. To recap these objections, MVMA/AIAM believe it is premature to suggest that vehicles can comply with the LEV standards without EHCs because the fuel and catalyst strategies advocated by CARB offer little promise either separately or in combination.[5] Regarding EHCs, the associations offered information critical of the current performance of these units in terms of the emissions reductions produced by them,

[4] CARB August 1992 Comment, Docket entry IV-G-49, Part II.

[5] MVMA/AIAM June 1992 Comment, Docket entry IV-G-37, at 10-12; GM August 1992 Comment, Docket entry IV-G-54, at 10.

their power requirements and their durability.[6]

Based on EPA's review of the record, described above in section ****, I conclude that the opponents of the grant of this waiver have not demonstrated the technological infeasibility of meeting the LEV and ULEV standards in the leadtime provided. Rather, I believe that it reasonable to project, as CARB has, that these standards are technologically feasible in the relevant time frames assuming the certification of vehicles on conventional gasoline (i.e., Indolene Clear or reduced RVP Indolene).

Regarding the smaller engine vehicles, I believe it is probable that LEV standards can be met with the advanced fuel control strategies, dual and/or heated oxygen sensors and air pumps and injectors. CARB has pointed to the promising emission results of two model year 1993 TLEVs certified on Indolene which showed NMOG emission numbers below the LEV standards without any extensive use of advanced technologies.[7] Further, CARB notes that Toyota has been using some of this advanced fuel control technology on production vehicles for several years with promising results.[8]

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[6] MVMA/AIAM June 1992 Comment, Docket entry IV-G-37, at 19-25.

[7] CARB August 1992 Comment, Docket entry IV-G-49, at 7-10, and Appendix A.

[8] Id. at 2 and 12-13; and SAE Paper 90XXXX.

Based on EPA's review of the information in the record on control strategies other than EHCs, EPA believes that the assessment of the MECA on meeting the LEV standards is accurate:

> We would like to emphasize that [using EHCs] is only one of several technologies being developed to help meet the LEV program standards. For example, we believe that advanced catalyst formulations for use in a close-coupled position near the engine to take advantage of the higher exhaust temperatures and catalyst formulations which are more active at lower temperatures to improve the emission control performance of converters located in the conventional underbody position will be available control strategies to help meet the LEV Program standards. We anticipate that improved catalyst technology combined with other control strategies will allow the TLEV and in some cases the LEV standards to be meet [sic] without the use of advanced design concepts such as the EHC or hydrocarbon traps.[9]

Regarding EHCs, EPA believes that the record contains plausible reasons to project that EHC effectiveness, durability and power requirements will continue to be developed and refined within the appropriate time frame to allow vehicle manufacturer compliance with the LEV standards. It is important to point out the earliest time at which EHCs will be needed by manufacturers to comply with CARB standards. As noted earlier, CARB has asserted that EHCs will likely be necessary for

[9] Letter from Bruce I. Bertelsen, MECA, to Charles N. Freed, Director Manufacturers Operations Division, Docket entry IV-G-46, at 1-2.

larger engine LEVs and for ULEVs. As discussed earlier, LEVs will not be required until the 1999 model year (and ULEVs in the 2000 model year) at the earliest. The record indicates that the needed improvements are well within manufacturers' capabilities within this time frame. For example, as MECA has commented:

> EHC catalyst manufacturers have indicated that they plan to complete development efforts, including to continue to supply prototypes to vehicle manufacturers so systems can be optimized for particular models, and have adequate production capability to meet the expected demand beginning with the 1997 model year. One EHC manufacturer has indicated it expects to be able to provide limited quantities as early as 1994 (emphasis added).[10]

Camet, an EHC manufacturer, projects, based upon progress to date, that it will be ready to ship catalysts to automobile manufacturers by 1995, and that implementation of EHC systems should be achieved by 1997 with the help of the automobile industry.[11]

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[10] Letter from Bruce I. Bertelsen, MECA, to Charles N. Freed, Director Manufacturers Operations Division, Docket entry IV-G-46, at 2.

[11] CARB March 1992 Comment, Docket entry IV-G-09, at 28 and Tab E, and "The Clean Air Marketplace - Summary of Conference Proceedings, April 22 - 23, 1992" ("Clean Air Marketplace Conference Proceedings"), excerpt on "Clean Air Marketplace in Transportation - Panel A: Control Technologies - Automobile Emissions," Docket Entry IV-G-(NOT YET ENTERED)

Other companies are also involved in this work, and are optimistic about success.[12] MECA has stated that its "member companies alone plan to spend several hundred million dollars in the 1990's to develop and commercialize technologies to meet more stringent motor vehicle standards anticipated for this decade and beyond. For example, one member has plans underway to build increased capacity specifically to produce EHC technology. These companies would not be making this substantial investment if they did not believe that the technological challenges could be met."[13]

W.R. Grace (the parent corporation of Camet) has also commented that EHC performance will improve as EHCs are incorporated into original production vehicles, rather than being retrofitted on existing vehicles (as is currently the case for the testing that has been undertaken:

"EHC system information presented (in the Grace comments) reflects the experience of retrofitting EHCs to existing vehicles. Estimates do not reflect certain efficiencies to be gained by inclusion of the technology in the original engineering and production of the vehicles. Such efficiencies will result from:

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[12] Clean Air Marketplace Conference Proceedings, Docket entry IV-G-XX, at 37 - 39.

[13] Letter from Bruce I. Bertelsen, Executive Director, MECA, to Charles N. Freed, Director, Manufacturers Operations Division, August 20, 1992, Docket entry IV-G-46, at 5-6.

1) integration of EHC with the engine management system control and adjustments of the fuel/air ratios under various operating conditions;

2) mechanical integration with existing close-coupled or main converters;

3) performance gains of down-stream converters resulting from the synergistic release of chemical heat triggered by the EHC.

All of these elements are favorable to performance, material durability and cost reductions. Not only are substantial gains in performance expected, but significant savings in cost are possible if the performance gains are directed toward reduced engine, fuel and catalyst materials and fabrication requirements." [14]

CARB provided information to answer the associations' assertions on the EHC effectiveness, durability and electrical power requirements. CARB has provided emission data from its own testing which demonstrates the capability of EHC-equipped vehicles to meet LEV emission standards.[15] EPA has also received comments from MECA noting that typical pre-heat EHCs have the potential for a 70% reduction in NMHC emission, and post-start EHCs for a 60% reduction.[16]

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[14] Letter from Alan Fiers, Vice President & Director of Government relations, W.R. Grace & Co., to Charles N. Freed, Manufacturers Operations Division, dated November 30, 1992, Docket entry IV-G-XX.

[15] CARB March 1992 Comment, Docket entry IV-G-09, at 25-26 and Attachment B, CARB August Comment, Docket entry IV-G-49, at 23-24.

[16] Letter from Bruce I. Bertelsen, MECA, to Charles N. Freed, Director Manufacturers Operations Division, Docket entry IV-G-46, at 3.

Concerning the durability of EHCs, CARB submitted its engineering analysis offering reasons why these units can be expected to be durable in use.[17] CARB also referred to data from an EHC manufacturer showing promising test results from high-mileage bench-aged EHCs.[18] MECA provided data from another manufacturer's tests showing large reductions in HC based on extensive durability studies using accumulated aging bench tests with severe dynamometer cycles. MECA also noted that new technological advances are expected to have a favorable impact on catalyst durability (both conventional and electrically heated units).[19]

Regarding electrical power requirements, CARB offered results from its own tests and an EHC manufacturer's tests showing that the current energy demand of EHCs is less than what the associations claim is needed, and projected that the power requirement will decrease further over time.[20] MECA also offered results from EHC manufacturers' tests showing both increased durability of electrical systems over extensive test cycles, and reduced power requirements.[21]

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[17] CARB March 1992 Comment, Docket entry IV-G-09, at 26-28.

[18] CARB March 1992 Comment, Docket entry IV-G-09, Attachment E.

[19] Letter from Bruce I. Bertelsen, MECA, to Charles N. Freed, Director Manufacturers Operations Division, Docket entry IV-G-46, at 4 and Attachment 6.

[20] CARB August 1992 Comment, Docket entry IV-G-49, at 64-65.

[21] Letter from Bruce I. Bertelsen, MECA, to Charles N. Freed, Director Manufacturers Operations Division, Docket entry IV-G-46, Attachments 3 through 6.

Again, based on EPA's review of the record, EPA believes it is reasonable to conclude that LEVs are technologically feasible within the timeframe available because of the development of various non-EHC strategies that can be used in the smaller engine LEVs and the continued promising development of EHCs which may be needed by the larger engine LEVs.

The reasonableness of this conclusion is buttressed by the fact that in the 1990 Clean Air Act amendments Congress established a clean-fuel vehicle program that requires the sale or purchase of vehicles certified to exhaust emission standards equal to CARB's LEV standards in the 1998 - 2001 timeframe. Under the clean-fuel vehicle program required by section 246 of the Act, certain fleet operators are required to purchase LEVs beginning in the 1998 - 2001 period. Moreover, under section 249, motor vehicle manufacturers are required to produce LEVs for sale in California beginning in model year 2001. Thus, Congress required that these be vehicles certified to LEV standards in the same time frame as they will be required under CARB's LEV program (upon which Congress based the Federal program). Congress plainly viewed such vehicles as being technologically feasible in this timeframe.

Concerning ULEVs, EPA believes that the record information on EHCs and other strategies makes it reasonable for me to conclude that these are technologically feasible in the timeframe available. CARB reasonably projects that the continued development and refinement of both EHCs and other strategies in vehicles using conventional fuel (or alternative fuels) will likely be necessary to meet the ULEV emission levels.[22] Because this progress appears likely, and because of the long lead time before ULEVs are required (the 2000 model year), I agree with the assessment of CARB that ULEVs are technologically feasible in the timeframe allowed.

Regarding the relationship between the technological feasibility of both LEV and ULEV standards and the fuel used to meet those standards, I have determined that CARB has shown that these standards can be met using either current Indolene Clear or reduced RVP Indolene as certification fuel.

f) Zero Emission Vehicles

As discussed in the "Background" section above, the CARB LEV program includes emission standards for ZEVs and a requirement that ZEVs be part of a manufacturers' fleet of light-duty vehicles, beginning at

[22] CARB August 1992 Comment, Docket entry IV-G-49, at 65.

2% of sales in 1998 and increasing upward to 10% in the years 2003 and beyond. CARB believes that "the significant penetration of ZEVs is crucial to long-term achievement of the ambient standards in the South Coast, and there is no assurance that ZEVs will be developed without the limited, measured ZEV sales requirements in the regulations."[23]

CARB does, however, provide some flexibility to manufacturers with respect to this requirement. First, not all manufacturers are subject to the requirement. Small volume manufacturers (sales of 3000 or fewer vehicles) are completely exempt from this requirement. CARB also established a new category called "intermediate volume manufacturer," which it defined as a manufacturer having average sales of light-duty and medium-duty vehicles from 1989 to 1993 of less that 35,000 vehicles per year. Intermediate volume manufacturers would not have to include ZEVs in their sales fleets until 2003, but they would be subject to the 10% requirement at that time, the same as the larger manufacturers face. Second, credits are available to manufacturers who produce ZEVs before the sales fleet requirements begin and/or produce ZEVs in numbers greater than the minimum required. These credits will be available for purchase or trade by manufacturers who do not meet the ZEV requirement in any given year.

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[23] CARB Final Statement of Reasons, Docket entry II-A-7, at 48.

During CARB's LEV program rulemaking proceeding, several manufacturers and others offered comments relating to the technological feasibility of ZEVs, generally criticizing CARB's ZEV requirements as too ambitious. CARB responded to these comments by noting that current electric vehicle technology shows promise, that industry efforts in research and development in battery technology were continuing, and that the 1998 implementation date for the sales requirement allowed sufficient leadtime to refine electric vehicle technology for widespread commercial use.[24]

In the instant waiver request proceeding, however, no comments opposing the ZEV requirements were submitted by manufacturers to EPA until late in the process. The one significant comment was submitted to EPA by AIAM on August 20, 1992, with its views on ZEVs.[25] AIAM expressed the view that ZEVs may not be technologically feasible because of their limited range, and because of tradeoffs between range,

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[24] CARB Final Statement of Reasons, Docket entry II-A-7, at 46-52.

[25] AIAM August 1992 Comment, Docket entry IV-G-52. Unlike all other comments received in this proceeding from AIAM, the ZEV comment was not a joint submission from AIAM and MVMA. EPA notes the absence in this proceeding of any detailed comments in opposition to CARB's ZEV regulations by the MVMA or any individual domestic manufacturers. EPA also notes that General Motors, Ford and Chrysler are involved in several areas of electric vehicle development. See, e.g., "Chrysler, Westinghouse to Jointly Build Electric Car," Washington Post March 4, 1992.

performance and useful load carrying capacity. AIAM also contended that CARB has not provided any "serious discussion" of how an infrastructure for powering ZEVs will be developed.

CARB and other parties have provided information in this proceeding on the prospects for technologically feasible ZEVs. CARB has noted that recent research efforts on electric vehicles' power needs are demonstrated by advances in battery technology, metal hydrides, sealed bipolar lead acid batteries, and zinc-air batteries. Some of this research is being sponsored by the U. S. Advanced Battery Consortium (ABC), whose members include General Motors, Ford, Chrysler, the Electric Power Research Institute, and the U.S. Department of Energy. The purpose of the U.S. ABC is to accelerate the commercial development of batteries for electric vehicles in California and elsewhere.[26] Several other projects are currently underway in California. For example, Chrysler Corporation is working with the South Coast Air Quality Management District, Southern California Edison and the Electric Power Research Institute, to develop the Chrysler TEVan, which is powered by nickel-iron batteries and is projected to have a range of up to 120 miles.[27]

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[26] CARB March 1992 Comment, Docket entry IV-G-09, at 35 and SCAQMD Comment, Docket entry IV-G-50, at 16.

[27] SCAQMD Comment, Docket entry IV-G-50, at 16; see generally Docket entry IV-G-50.

CARB also has reported that the first ZEV, the Solectria Force, has been certified for sale in California. This vehicle is based on the body of a Geo Metro, and can travel 50 to 80 miles between charges.[28] Moreover, GM has been working on electric vehicles for several years and has shown significant progress on them. CARB has stated that GM has announced it will be producing its "Impact" electric vehicle in 1995, a full three years before CARB's ZEV requirements begin.[29] Other reports indicate that GM could begin selling electric cars as early as 1994, with an initial market offering of 300 to 1,700 vehicles, depending on consumer demand.[30] By 1998, production is expected to fall in the range of 3,300 to 16,900 vehicles.[31]

A recent study prepared for EPA has summarized the industry activities being undertaken to develop ZEV technologies.[32] In addition to discussing the general state of battery development, the study highlighted nickel metal-hydride batteries as promising candidates for ZEV use. The Sobotka study reported that these batteries can be recharged in 15 minutes, have an

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[28] CARB Staff Presentation Before the Air Resources Board, LEV/CF Status Update, June 11, 1992, Docket entry IV-G-31 at 9.

[29] CARB Final Statement of Reasons, Docket entry II-A-7, at 46, SCAQMD Comment, Docket entry IV-G-50, Appendix F, and letter from Chairwoman Jananne Sharpless, CARB, to Administrator Reilly, dated December 2, 1992, Docket entry IV-G-XX.

[30] Automotive News, April 17, 1992, at 1.

[31] Ibid.

[32] Zero Emission Vehicles: A Review of Emissions, Costs, and Cost-Effectiveness of Emission Reductions, Contract No. 68-W9-0077, Sobotka & Company, Inc. ("Sobotka study").

approximate life-cycle of 100,000 miles, can provide the required energy levels, and are basically maintenance free. Manufacturing technology for metal-hydrides is relatively simple and can be done with low processing costs. ABC has awarded a $18.5 million contract for further development of this battery to Ovonic Battery Co.[33]

The Sobotka study also reported that further improvements in electric vehicle technology are occurring through advancements in microelectronics. These advancements allow the use of alternating current (ac) instead of direct current (dc) motors. Alternating current systems are less expensive, more compact, more reliable, more efficient, and easier to maintain than dc systems.[34] Ford is developing an electric van which will use an ac system. Another benefit to ac systems is that they are more adaptable to regenerative braking than are dc systems. Regenerative braking occurs in electric vehicles during vehicle deceleration. The "motor turns into a generator when the vehicle slows down, turning kinetic energy into electricity which recharges the battery."[35]

Regarding the infrastructure needed for ZEVs, CARB candidly

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[33] Id., at 8.

[34] Id., at 7.

[35] Id., at 4.

acknowledges that this is an area that needs further coordination among the parties -- CARB, other California air quality agencies, the vehicle manufacturers and the electric utilities. CARB has identified the major areas of work as "standardization of recharging interfaces, availability of charging stations away from home, battery recycling, disposal, and possibly leasing, [and] the types of consumer incentive programs needed."[36]

CARB also points out that there are task forces in place to study these issues and try to solve the challenges of ZEVs and ZEV infrastructure. Two recent reports on this topic show that prospects are encouraging. A California Energy Commission study shows that the California electric generation system can absorb all of the electric vehicles expected by the CARB ZEV requirement without the need for additional generation facilities. The U.S. Department of Energy estimates that 40 million electric vehicles can be recharged, primarily during the off-peak hours, without constructing new power plants. [37] In addition, projects are underway in California to develop systems to recharge vehicles at commercial sites.[38]

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[36] CARB Staff Presentation Before the Air Resources Board, LEV/CF Update, dated June 11, 1992, Docket entry IV-G-31 at 9-10.

[37] Letter from Charles B. McCarthy, Senior Vice President, Southern California Edison Company, to Charles N. Freed, Director, Manufacturers Operations Division, Docket entry IV-G-51.

[38] SCAQMD Comment, Docket entry IV-G-50, at 17.

I have reviewed carefully the information provided by CARB and other parties supporting the technological feasibility of ZEVs, and the comments provided by parties who believe that these vehicles are not technologically feasible. Because of the extent of industry effort devoted to ZEV development to date, the long lead time allowed by the CARB ZEV requirement, the small percentage of vehicles required to be ZEVs, and the ongoing work on power issues associated with ZEVs, I believe it is reasonable to expect that manufacturers will be able to meet the CARB ZEV requirements in the time frame allowed.

g) Cost of Compliance

Another important part of the review of this waiver request is the evaluation of the costs associated with California's LEV program over the leadtime allowed, which is necessary to make a determination of consistency with section 202(a). This section states, in part, that any regulation promulgated under its authority "shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period." Therefore, I

must find that California's standards are not consistent with section 202(a) if there is inadequate lead time to permit the development of technology necessary to meet those requirements, giving appropriate consideration to the cost of compliance within that time frame. As I have already determined that the adequate technology either already exists, or can be developed and applied in the time frame available, I must now consider the costs associated with the development and application of the technology required to meet the California standards.

It is important to note that, as previous waiver decisions have held, the cost of compliance is relevant to a waiver decision only when the technology needed for compliance with California's standards does not exist.[39] This is because section 202(a) is concerned with the cost of compliance during the period "necessary to permit the development and application of the requisite technology."

In MEMA I, the court addressed the "cost of compliance" issue at some length in the context of reviewing a waiver decision. According to the court:

> Section 202's "cost of compliance" concern, juxtaposed as it is with the requirement that the Administrator provide the requisite lead time to allow technological developments, refers to the

[39] 41 Fed. Reg. 42,209 (October 7, 1976) cite to previous decisions -- 1976 MC, and 1990 HC wvr

> economic costs of motor vehicle emission standards and accompanying enforcement procedures. See S. Rep. No. 192, 89th Cong., 1st Sess. 5-8 (1965); H.R. Rep. No. 728 90th Cong., 1st Sess. 23 (1967), U.S. Code Cong. & Admin. News 1967, p. 1938. It relates to the timing of a particular emission control regulation rather than to its social implications. Congress wanted to avoid undue economic disruption in the automotive manufacturing industry and also sought to avoid doubling or tripling the cost of motor vehicles to purchasers. It therefore requires that emission control regulations be technologically feasible within economic parameters. Therein lies the intent of the "cost of compliance" requirement.[40]

Prior waiver decisions are fully consistent with this discussion in MEMA I, which indicates that the cost of compliance must reach a very high level before a waiver can be denied. They indicate that the costs must be extraordinary in order to find that the California standards are not consistent with section 202(a). [41]

Before undertaking a discussion of the comments on the issue submitted in the course of this waiver proceeding, it should be noted that, as with the other issues related to the determination of consistency with section 202(a), the burden of proof regarding the cost issue falls upon the opponents of the grant of the waiver.

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[40] 627 F.2d at 1118 (emphasis in original). See also id. at 1114 n. 40 ("[T]he 'cost of compliance' criterion relates to the timing of standards and procedures.").

[41] *******Previous decisions w/ "extraordinary" ???

It is uncontroverted that the California LEV program will entail costs to the industry. CARB and MVMA/AIAM disagree, however, how much the costs will they be, and when they will occur.[42]

In its original waiver request and subsequent submissions, CARB has provided information on the probable costs of various technological strategies needed to meet the different vehicle categories.[43] Generally, CARB points to its predictions of how much additional cost could be attributable to the extra hardware and/or recalibrations needed for each type of vehicle. CARB predicts that, using gasoline as fuel, TLEVs would cost an additional $70 and LEVs and ULEVs would cost an additional $170.[44]

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[42] MVMA/AIAM also question whether the costs of the LEV program are justified in terms of the benefits they will provide. I need not make a determination on this question, because, in deciding waiver requests, I am not empowered under the Act to consider the cost effectiveness of California regulations, since Congress intended that California should be the judge of the best means to protect the health of its citizens and protect its public welfare. See, e.g., 47 Fed. Reg. 7,306, 7,310, quoting legislative history of Section 209 (b), H.R. Rep. No. 294, 95th Cong., 1st Sess., 301-302 (1977).

[43] CARB Staff Report, Docket entry II-A-3, at 62-72; CARB Technical Support Document, Docket entry II-A-4, Chapter IX; CARB Final Statement of Reasons, Docket entry II-A-7, at 77.

[44] CARB points out that the cost of electrically heated catalyst systems, which will be needed in some LEVs and all ULEVs may initially cost as much as $300 when sold by catalyst suppliers to manufacturers, but the price may fall to about $170 under large scale commercial production. CARB Staff Presentation before the Air Resources Board, LEV/CF Update, June 11, 1992, Docket entry IV-G-31, at 7.

CARB also asserts that vehicles which use methanol or ethanol would have higher sticker prices and higher fuel prices, while vehicles designed for use with CNG and/or LPG would have higher sticker prices, but could recover a substantial portion of that increase in lower fuel prices.[45] To date, CARB's prediction for TLEV costs has been reasonably accurate; the model year 1993 Ford Escort TLEV which was certified by CARB in May 1992 has an incremental cost of about $100 more than the comparable model year Federal version of this vehicle (i.e., a vehicle meeting the 0.39 NMHC Federal standard). CARB notes that "the Ford estimate is the incremental cost over the federal version, however, so the cost would be less than 100 dollars if the comparison was done on a Tier I vehicle as was done in our staff report."[46]

During the CARB rulemaking, CARB was criticized for not including the costs of development of this technology in its predictions. CARB responded:

> Since the low-emission vehicle regulations involve long-range implementation, cost estimates have been projected for the most likely technologies to be used in meeting the standards. It is true that these estimates only reflect the cost of the hardware because it is impossible for the ARB to project research and development costs

[45] CARB Staff Report, Docket entry II-A-3, at 67-68; CARB Technical Support Document, Docket entry II-A-4, at IX-13 to IX-16.

[46] CARB Staff Presentation before the Air Resources Board, LEV/CF Update, June 11, 1992, Docket entry IV-G-31, at 3.

> which can vary significantly from manufacturer to manufacturer. This information is also not readily available to the ARB. However, research and development expenses amortized over the number of years which a particular technology can be utilized will be minimal.[47]

The industry has attacked CARB's cost analysis in two ways. First, they have criticized CARB's cost projections as lacking a reasonable basis. Second, using information from GM, they have asserted that California cannot claim to have given appropriate consideration to costs because it failed to consider the heavy capital investments costs of the LEV program in the mid-1990's.

Regarding CARB's cost projections, MVMA/AIAM notes that the CARB projection of EHC system costs presented at the EPA waiver hearing was based on information from a single EHC vendor and was accepted by CARB "uncritically."[48] The industry presents an independent analysis prepared by the Automotive Consulting Group (ACG), based upon confidential information obtained from member companies, which projected the cost of EHC systems to be slightly over $1,000 per vehicle (compared to the

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[47] CARB Final Statement of Reasons, Docket entry II-D-7, at 77.

[48] MVMA/AIAM March 1992 Comment, Docket entry IV-G-13, at 33.

vendor estimate of a $200 to $290 range). The industry states that the discrepancy in these projections may have been because ACG included investment costs as they affected unit costs, while there was no indication that the vendor did this.

The industry also argues that CARB has failed to account for the costs from the loss in fuel economy attributable to EHC technology, for the costs of EHC maintenance, and the extra costs associated with 50 degree F testing of vehicles.[49]

Concerning the investment costs associated with this program, MVMA/AIAM submitted cost information based on financial information from General Motors Corporation pertaining to the company's cost estimates for the LEV program.[50] As background to its data, the company explained its particular method for deriving the number called the "manufacturers suggested retail price or "MSRP." According to GM, the MSRP includes four elements: 1) the manufacturers' variable costs of production, 2) the manufacturers' cost of capital, 3) tooling, engineering and mark-up expenses, and 4) in the case of new vehicles, a dealer markup

[49] MVMA/AIAM March 1992 Comment, Docket Entry IV-G-13, at 35-37.

[50] The basis for the cost estimates in the MVMA/AIAM submissions is among the CBI GM has submitted to EPA in this proceeding. The company does discuss the information generally in some of its submissions to the public docket of this matter.

to cover the dealers' costs of doing business.[51] GM points out that CARB has not attempted to assess any part of the cost formula except for the "piece cost" or "hardware cost" for the EHC systems.

Regarding the actual costs of the LEV program, GM estimates that, excluding costs for ZEVs, 1) its total investment for the LEV program will be approximately $1 billion by 2002, 2) of that $1 billion, $550 million would be needed for LEVs and $330 million would be needed for ULEVs, and 3) that about one fifth of the total sum of investment will be spent by the end of 1994, and about one half will be spent by the end of 1996. The confidential version of the data outlines the technologies that GM assumed would be necessary to meet the various categories of emission standards and GM's "vehicle rollout" which is its schedule of new model introductions over the next several years, presumably intended to meet the CARB NMOG fleet average requirements.

CARB responded by stating that the industry has not presented data on how the costs of the LEV program are affected by the timing of the standards:

> [A]s far as [the industry] data indicate, the costs

[51] GM August Comment, Docket entry IV-G-54, Tab B.

> would ultimately be the same whether the LEV technology was required by the 1997 model year or by the 2002 model year; the same goes for ULEV technology. While they do claim that substantial costs will be incurred in the first several years of implementation, they provide no data or argument showing that the same overall costs would not be incurred with a longer compliance schedule. Thus their cost claims cannot provide the basis for denial of the waiver.[52]

CARB also responded to GM's comments on CARB's cost projections and commented on the company's own cost information. CARB noted that the LEV expenses predicted by GM -- $550 million by 2002 -- may be reduced by a significant amount if, as CARB predicts, vehicles with smaller displacement engines can meet LEV emission levels without the use of EHCs, or with bypass start catalysts instead of EHCs.

Regarding GM's estimates of the large overall cost of compliance with this program, CARB offered various reasons to believe that the estimates may be too high. First, as discussed above, much of the design and development work on advanced emission control hardware such as

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[52] CARB August 1992 Comment, Docket entry IV-G-49, at 43-44. CARB noted, in these comments, that GM had submitted (in its June 23, 1992 comment) only a single page summary of Confidential Business Information showing expected costs for the program. On August 20, 1992, GM submitted additional Confidential Business Information showing additional details of their cost projections to CARB and to EPA (with a redacted version for the public docket of this proceeding).

EHCs has already been undertaken by the component manufacturers, who are continuing that work. For example, the Camet Company has been working with CARB and others on prototype EHC testing. The industry itself has formed a cooperative research and development group in an effort to reduce expenses by consolidating their resources.[53]

We have also received comments from W.R. Grace & Company (the corporate parent of Camet Company) offering information on costs (some of which was submitted under a claim of confidentiality requested by the company). Grace noted that "the cost to an original equipment manufacturer of an installed EHC system will be $200 to $330, depending on engine size, in the first years of production."[54] These estimates include the costs of both the EHC system components as delivered to a vehicle manufacturer and the manufacturer's costs associated with integrating the technology with the vehicle's computer control system and the vehicle's electrical system. The Grace lower-end estimate of $200 is consistent with the estimate of CARB that EHC cost may bottom out at

[53] CARB August Comment, Docket entry IV-G-49, at 48.

[54] Letter from Alan Fiers, Vice President & Director of Government relations, W.R. Grace & Co., to Charles N. Freed, Manufacturers Operations Division, dated November 30, 1992, Docket entry IV-G-XX.

$170 at mass-production levels.[55]

Further support for CARB's projection that the costs of EHCs will decrease is found in the Grace submission. The company expects that the costs for EHCs will decrease as EHCs become integrated into original production vehicles.[56]

Regarding fuel economy penalties, CARB notes that the Associations may believe that the extra weight of EHCs will cause fuel economy to worsen. EHC testing on this point is inconclusive to date.[57] EPA notes that if, as CARB predicts, a significant number of LEVs will not require EHCs, these vehicles will not face a possible fuel economy penalty from extra weight. In any event, CARB asserts that at worst, the extra weight of the EHC (and system) would be about 20 pounds, which, it concludes, will translate into additional fuel consumption of no more than one ounce of gasoline for an entire FTP cycle, which is _____ unless **** for a

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[55] CARB Staff Presentation Before the Air Resources Board, LEV/CF Status Update, June 11, 1992, Docket entry IV-G-31, at 7. (CARB staff states that "a heated catalyst supplier ... has announced that its initial EHC systems would be sold to manufacturers for 200 to 300 dollars in 1993 or 1994. The EHC manufacturer's numbers are consistent with estimates made by the ARB staff.").

[56] Letter from Alan Fiers, Vice President & Director of Government relations, W.R. Grace & Co., to Charles N. Freed, Manufacturers Operations Division, dated November 30, 1992, Docket entry IV-G-XX. See note ** quoted above at XX.

[57] See, e.g., SAE 910840; but, see e.g., SAE 910612.

decrease in fuel efficiency. This estimate is in keeping with current information regarding the relationship between vehicle weight and fuel efficiency. Additionally, CARB believes that some advanced fuel control technology techniques which contribute to vehicle emission control also may improve fuel economy.[58] As with other "cost" issues , I don't believe I may overrule CARB's decision to exact such cost unless they are extraordinary. The worst potential fuel penalty projected by CARB does not rise to the level of extraordinary and in fact is no more than other emission control devices now in use exacted in their early years of implementation.

Regarding the 50 degrees F testing requirement, CARB believes that there would be no extra vehicle cost associated with this requirement. Rather, CARB developed this requirement to prevent manufacturers from producing such designs that could cause unexpected increases in emissions in periods where the California temperature may drop to 50 degrees F (e.g., the summer ozone season). CARB notes that this requirement is now proven to be technologically feasible for TLEVs because the first four TLEVs certified by CARB have passed the 50 degrees

[58] CARB August 1992 Comment, Docket entry IV-G-49, at 49 - 50.

F test.[59]

With respect to the costs of ZEVs, AIAM commented that these vehicles may be very expensive to consumers, because of the high costs of development and of batteries these vehicles will need. AIAM, however, provided no evidence or estimates regarding the costs of ZEVs.[60] The Sobotka study referred to above also concluded that electric vehicles could be expensive. The study estimated costs attributed to owning and operating an electric vehicle would be 65% to 100% greater than similar costs associated with conventional vehicles.[61] However, these estimates do not take into account cost estimates for metal hydride batteries, which the the study identified as the most promising battery technology.[62] Therefore, as the study concedes, there is an uncertainty associated with

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[59] See CARB August 1992 Comment, Docket entry IV-G-49, at 32-34. CARB stated in August 1992, however, that because the 50 degrees F requirement may cause manufacturers to utilize technologies that would not otherwise be needed to meet the certification standards, CARB may change these requirements. CARB has proposed modifications to the 50 degree F testing requirement which should ensure that manufacturers face no extra hardware costs associated with complying with this requirement. These modifications are slated to be considered at the January 1993 Board meeting.

[60] As noted earlier, MVMA and GM provided no cost information regarding ZEVs.

[61] Sobotka study, table 11.

[62] Id., at 18.

projecting costs for ZEVs. The Sobotka study also noted that this new technology will require significant research and development costs.

At the same time, some recent developments show promise. The nickel-metal hydride battery, like the one to be developed by Ovonics under the ABC contract mentioned above, is expected to cost electric vehicle owners about half as much as lead-acid batteries over a vehicle life of 100,000 miles ($5000 compared to $10000). Additionally, a nickel-metal hydride battery pack can provide the same power as as a lead-acid battery pack weighing twice as much, thus reducing overall vehicle weight and operating costs.[63]

CARB is aware that these ZEV-related costs exist, and admits that the ZEV production requirement is a technology-forcing step that is not without costs. CARB nevertheless believes that this step is needed to meet its long-range air quality goals. During its rulemaking, CARB was challenged on its prediction that a ZEV would cost about $1,300 more that a comparable conventional vehicle. In response, CARB noted:

> The ARB's cost estimates for electric vehicles are based on consultations with experts from Aeroenvironment, an engineering firm involved in the development of the GM Impact electric vehicle.

[63] "EV Battery Breakthrough?," Automotive Industries, September 1992, at 63-64.

> These estimates take into account high production volumes and technological advancements expected by the year 2000. The higher incremental costs claimed by manufacturers would apply only to today's conditions where technology needs development and there is no volume production of electric vehicles. Lower priced, better performing batteries are expected to emerge from research programs such as the United States Advanced Battery Consortium. Electric vehicles of the future are also expected to operate more efficiently and, thus, be less demanding of the battery. As the ZEV production requirements increase, vehicular cost will decrease.[64]

Based on the record developed in this proceeding, I conclude that the opponents of this waiver have not met their burden of demonstrating that the cost of compliance is extraordinary. Earlier in my decision I reviewed the technological feasibility for the LEV program, and concluded that it was technologically feasible in the lead time provided. Regarding lead time, I determined that because the more stringent, and presumably more technologically challenging, new vehicle categories of LEVs and ULEVs did

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[64] GM August 1992 Comment, Docket entry IV-G-54, at 13-14. This comment from GM fails to mention that CARB has certified two 1993 model year vehicles at the TLEV category based on the vehicles passing all TLEV certification tests, including the 50 F requirement.

I note again that CARB staff responded to the industry concerns on this point by proposing modifications to the 50 degree F requirement requested by the manufacturers to ensure that no vehicle will need additional technology solely to comply with this requirement.

not need to be available for sale until the 1999-2000 time frame at the earliest, it is reasonable to expect manufacturers to be able to achieve compliance with the California standards at that time. Likewise, the sales requirement for ZEVs begins with the 1998 model year[65]

With respect to the level of costs necessary for the costs of compliance to be considered excessive, MEMA I clearly indicates that section 202(a) contemplates that extraordinarily high levels must be demonstrated. I believe that I am also circumscribed in my consideration of the costs associated with the LEV program by the direction of Congress to grant California broad discretion in choosing the program that is best suited to the State's air pollution problems. As noted earlier, hand in hand with this concept is the principle that Congress wanted California to remain the pioneer in the field of motor vehicle emission control. This was discussed in MEMA I: "...Congress intended the state to continue and expand its pioneering efforts at adopting and enforcing motor vehicle emission standards different from and in large measure more advanced than the corresponding Federal program; in short, to act as a kind of laboratory for innovation."[66]

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[65] As discussed above at XX, the CARB procedures allow for the possibility for adjustments to the LEV program requirements should CARB determine that additional time is needed for compliance.

[66] MEMA I, 627 F.2d at 1111. See also,113 Cong. Rec. H 14407 (Congressman Moss), (daily ed. 11/2/67), S 16395 (Senator Murphy (daily ed. 11/14/67).

For this reason, when faced with a waiver request, EPA is not required to perform a searching review of the economic, environmental and cost-benefit implications of California's decisions.[67] Rather, EPA is directed by Congress to perform a narrow review because California is presumed to have made the "tough calls" on controversial issues such as cost and the forcing of technology. This was discussed by the Administrator in the 1975 waiver of California's 1977 vehicle standards:

> [I] would feel constrained to approve a California approach to the problem which I might also feel unable to adopt at the Federal level in my own capacity as a regulator. The whole approach of the Clean Air Act is to force the development of new types of emission control technology where that is needed by compelling the industry to "catch up" to some degree to newly promulgated standards. Such an approach to automotive emission control may be attended with costs, in the shape of a reduced product offering, or price or fuel economy penalties, and by risks that a wider number of vehicle classes may not be able to complete their development work in time. Since a balancing of these risks and costs against the potential benefit from reduced emissions is a central policy decision for any regulatory agency, under the statutory scheme outlined above I believe I am required to give very substantial deference to California's judgment on this score (emphasis added).[68]

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[67] See MEMA I, 627 F.2d at 1114, n. 40 (rejecting contention that EPA was obligated to conduct a cost-effectiveness study as part of examination of "cost of compliance").

[68] 40 Fed. Reg. 23,102, 23,104 (May 28, 1975).

My review of the costs associated with the LEV program has taken into account the substantial deference due California's judgement on such ambiguous and controversial matters of public policy. I believe that while the expenses that will result from the California LEV program will be greater than the expenses usually associated with California standards, these costs will not be extraordinary.

Several points lead to this conclusion. First, as I have concluded that the TLEV standards are achievable using existing technologies, any costs attributable to meeting those standards are not deemed to be costs of compliance for purposes of this inquiry. For this reason alone, the cost estimates presented by the manufacturers overstate significantly the cost of compliance with the LEV program.[69] Even assuming that TLEV costs were appropriate to consider, the costs of $70-100 per vehicle indicated by CARB's projections and by the incremental costs of TLEVs already certified do not rise to the level of extraordinary costs.

Second, with respect to the costs of LEVs, the manufacturers' cost estimates are predicated on the assumption that EHCs -- a new technology

[69] MVMA/AIAM's comment indicated that approximately $120 million of the alleged $1 billion in investment costs was attributable to TLEV vehicles. MVMA/AIAM June Comment at 31.

not yet used in production vehicles -- will be necessary to meet the standards. I have concluded, however, that California has reasonably determined that many vehicles will be able to achieve the LEV standards through the use of fuel-control strategies that are already available. Consequently, the costs of compliance with the LEV standards will be less than asserted since existing technologies are likely to be used to achieve the standards in many cases. Furthermore, while CARB's projections may underestimate the cost of EHCs, the cost information provided by component manufacturers indicates that the cost of EHCs is likely to be in the range of $200-300 per vehicle, not the $1000 per vehicle cost asserted by MVMA/AIAM. Even if the manufacturers' estimate was correct, however, a cost of $1000 per vehicle is not adequate to render the costs extraordinary. The MEMA I court spoke in terms of "doubling or tripling" the costs of vehicles; a $1000 per vehicle cost increase, however, amounts to less than ****% of the average cost of a passenger car today.[70] Of course, a cost in the range of $200-300 per vehicle represents a much smaller percentage. Moreover, it is inappropriate for the manufacturers to attribute all of the costs of complying with the LEV standards to California's LEV program because the manufacturers will be required to produce LEVs to comply with the requirements of the clean-fuel vehicle program under Part C of Title II of the Clean Air Act.

[70] The average cost of a passenger car in 1992 is $ *******

Third, with respect to the ULEV standards, the costs of meeting the standards by utilizing EHCs are the pertinent inquiry and, for the reasons stated above, it has not been shown that the costs of EHCs amount to extraordinary costs. It should also be noted that the manufactures failed to present any evidence on the investment costs of meeting the ULEV standards through the use of EHCs on gasoline powered vehicles, which I have determined to be a technologically-feasible way of meeting those standards. Instead, the manufacturers' estimate assumed the use of alternative fuels such as compressed natural gas,[71] which is not necessary to meet the standards and which CARB believes would be more costly than gasoline powered-vehicles.[72]

Fourth, with respect to the ZEV standards, the industry opponents of the waiver offered no evidence with respect to the costs of ZEVs. AIAM asserted that the costs would be higher than conventional vehicles, but provided no supporting documentation or even estimates of the higher costs. Thus, the opponents of the waiver have not met their burden of proof with respect to this issue. While CARB's projections and other information in the record indicates that ZEVs are likely to have higher

[71] June comment at 31, ????

[72] CARB Staff Report, Docket entry II-A-3, at 67-68; CARB Technical Support Document, Docket entry II-A-4, at IX-13 to IX-16.

costs than LEVs or ULEVs, I do not find that the costs of ZEVs are likely to be extraordinary.

Finally, the magnitude of GM's asserted $1.2 billion in investment costs over the 1992-2002 period should be placed in perspective. GM's most recent 10-K report that is filed with the Securities and Exchange Commission indicates that GM has spent more than $5 billion per year in the 1988-91 period for research and development for environmental matters. This figure indicates that costs of $1.2 billion over a ten-year period are a small percentage of GM's overall spending on environmental

research and development.[73]

Although neither the industry nor CARB has expressly acknowledged it, manufacturers can recover the costs of this program by passing the costs on to the vehicle purchasers. The fact that CARB has made a judgment that the emission reduction (and consequent public health) benefits resulting from the LEV program will eventually be borne by California citizens in the form of higher vehicle prices is precisely the type of "controversial" public policy decision that Congress believed should be made by California.

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[73] Manufacturers of motor vehicles are faced routinely with financial obligations needed to comply with government regulations. For example, the General Motors Corporation most recent 10-K report (dated March 27, 1992) listed the company's expenditures in recent years for "Research & Development -- Environmental Matters, " further categorized as "Company-sponsored." The explanation of "Company-sponsored" was "research, manufacturing engineering, product engineering and development activities related primarily to the development of new products or services or the improvement of existing products or services, including activities related to vehicle emission control, improved economy and the safety of persons using General Motors products." The amounts spent were:

1989	$5,247,500,000
1990	$5,341,500,000
1991	$5,887,400,000

Because the expenditure amounts in this category are aggregated, it is not possible to tell (just from the 10-K report) exactly how much was spent each year on just vehicle emission control R & D.

I have evaluated the information submitted to this docket regarding the costs of compliance of the LEV program. In light of the above information, I believe that it is reasonable to conclude that the costs of compliance in the leadtime provided are not so excessive as to warrant a denial of a waiver on these grounds particularly given the deference owed California's decisions on controversial matters of public policy.

3. Consistency of Certification Procedures

California's standards and accompanying enforcement procedures would also be deemed inconsistent with section 202(a) if the California test procedures were to impose certification requirements inconsistent with the Federal certifications test requirements. Such inconsistency means that manufacturers would be unable to meet both the State and the Federal test requirements with the same test vehicle.[74] CARB asserts that its LEV test procedures continue to be patterned after the Federal Test Procedures, do not conflict with any federal requirement, and would not prevent manufacturers from using the same test vehicle or vehicles to comply with both sets of procedures.[75]

[74] See, e.g., 43 Fed. Reg. 32,182 (July 25, 1978).

[75] CARB Waiver Request Letter, Docket entry II-A-1.

There are two primary differences between CARB's certification procedures and the Federal certification procedures for light duty vehicles. In both cases, California has added requirements beyond the Federal program requirements. First, because CARB was concerned about emission performance at lower temperatures, manufacturers must submit emission data from three vehicles demonstrating that their vehicle designs could comply with applicable standards at 50 degrees F. Manufacturers must test these vehicles, which must have accumulated at least 4000 miles, after cold soaking at 45 to 55 degrees F for 12 hours. In addition, for each engine family, manufacturers must submit an engineering evaluation of the performances of the emission control system with variances in temperature from 20 to 86 degrees F.[76]

Second, because of the NMOG standards established for the new vehicle categories, manufacturers must submit measurements of the NMOG levels in the certification application, rather than the measurement of NMHC required in the Federal application. Manufacturers can measure NMHC levels (as they do currently) using a flame ionization detector ("FID") and a methane analyzer. To calculate the NMOG levels, manufacturers must measure aldehydes and ketones (and alcohols if

[76] CARB Technical Support Document, Docket entry II-A-4, at I-18.

present in the certification fuel). The NMOG mass emission level is the sum of the NMHC, aldehydes, ketones and alcohol emissions.

Regarding the 50 degree F test requirement as it relates to this particular prong of the section 202 consistency analysis, I note that the parties who have commented on this requirement have posited that the test appears difficult to pass. They have not alleged, however, that the requirements of performing the 50 degree F test make it impossible to certify a single test vehicle to both sets of standards, notwithstanding the point raised by GM that the 50 degrees F test requirement cannot be met without altering vehicle design.[77]

Regarding the procedures for measuring NMOG, the industry has suggested that there may be repeatability problems with emission measurements at the LEV and ULEV levels. In other words, there may be variability in test results because of 1) the lack of accuracy in instrumentation or testing methods (of particular concern for methanol

[77] GM August 1992 Comment, Docket entry IV-G-54, at 13-14. This comment from GM fails to mention that, at that time, CARB had certified two 1993 model year vehicles at the TLEV category based on the vehicles passing all TLEV certification tests, including the 50 degree F requirement. As noted earlier, CARB staff has responded to the industry concerns on this point by proposing modifications to the 50 degree F requirement requested by the manufacturers to ensure that no vehicle will need additional technology solely to comply with this requirement.

vehicles), or 2) differences between vehicles. The industry is concerned that, because the emission level targets for these vehicles are so low, and the associated "margin for error" narrow, "precise measurement capability is necessary early in the vehicle development effort."[78]

In response to the industry concerns on instrumentation for testing for NMOG measurements, CARB stated that manufacturers can use a FID and a methane analyzer for routine testing where speciation (i.e., a breakdown of the emissions into chemical compounds) is not needed, but when the manufacturer needs speciated results (e.g., to generate RAFs), full range gas chromatographs (GC) are used (GCs are also thought to be more accurate). CARB acknowledges that measuring NMHC from a vehicle using a FID and a GC may produce different values, and that while this variability is acceptable at the TLEV and LEV levels, manufacturers may face difficulties in obtaining reliable measurements of emissions at ULEV levels.

CARB also notes that "efforts are ... underway to develop specific instrumentation for low level NMHC measurement" by CARB and by the Environmental Research Consortium, consisting of Chrysler, Ford, GM and Navistar. Because of the lead time available until the earliest required

[78] MVMA/AIAM March 1992 Comment, Docket entry IV-G-14, at 31.

introduction of LEVs (1999 model year) and ULEVs (2000 model year), CARB believes that the current limitations in testing can be addressed successfully in this time period.[79]

Regarding variability between vehicles, General Motors commented that problems may occur when the same emissions control system is used on two (or perhaps more) similar vehicles in a test sequence, (i.e., the system is moved from vehicle to vehicle as the test sequence progresses.) The company performed such a test on two vehicles; after the first vehicle demonstrated near-ULEV emission levels with an unaged EHC at low mileage, GM put the emission control hardware from that vehicle on a second vehicle. The second vehicle had higher HC and NOx levels before a recalibration brought the numbers back down. The company concluded that "[I]f the results of controlled laboratory testing result in such variations in emission results between similar vehicles, the problem of controlling this variation in a production is even larger."[80]

CARB responded that it was not able to evaluate the significance of the test results here without knowing if the vehicles underwent proper

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[79] CARB March 1992 Comment, Docket entry IV-G-09, at 36-38; CARB August 1992 Comment, Docket entry IV-G-49, at 37-38.

[80] Hearing Transcript, Docket entry IV-F-01, at 81-83; GM March 1992 Confidential Submission/Public Disclosure Copy, Docket entry IV-G-38, Appendix C.

preconditioning needed for the adaptive feature of the fuel control system to adjust for the new components placed on the vehicle. In any event, CARB notes that the results of this test on GM production vehicles appear promising for meeting the LEV NMOG standard, and, with additional expected incorporation of improved hardware, the ULEV standard.[81]

Finally, I note CARB's comment that although "MVMA/AIAM appear to assert that the requirement for consistency with section 202(a) includes a requirement that the ARB's test requirements be objective and repeatable,...MVMA/AIAM point to no administrative or judicial waiver decisions suggesting that 'objectivity and repeatability' is included in the requirement for consistency with section 202(a)."[82] The industry did comment in a footnote that "the importance of the objectivity requirement has been recognized by EPA in section 209(b) waiver proceedings," citing the 1977 waiver for CARB's motorcycle fill pipe regulations" (fill pipe waiver). While this statement is accurate, I do not believe that the fill pipe waiver, which dealt primarily with a narrow technical issue, establishes or supports a the contention of MVMA/AIAM that I am required to make a finding that CARB test procedures are objective and repeatable in order to find that the test procedures are

[81] CARB March 1992 Comment, Docket entry IV-G-09 at 39-40.

[82] CARB March 1992 Comment, Docket entry IV-G-09, at 36.

consistent with section 202(a).

In this 1976 proceeding, California sought a waiver for several amendments to its regulations, including amendments which set design requirements for motorcycle fuel tank fill pipes to allow effective operation of vapor recovery nozzles. The regulations also contained provisions whereby manufacturers could apply for exemptions from the requirements for a certain model year (or years) if the manufacturer could show technological infeasibility. The exemption provision was designed to allow manufacturers to make the design changes for the proper fill pipe and vapor recovery nozzle fit when they made other scheduled changes to the motorcycle bumper and body panel surrounding the fill pipe.

During the proceeding, Chrysler Corporation asserted that the CARB exemption authority improperly put the CARB Executive Director in the place of the Administrator in a determination of lead time required to achieve compliance. The Administrator rejected this contention. First, he was able to make a determination that technology available at that time would permit motorcycles to comply with the California regulations as early as the 1978 model year, and thus lead time was not a concern (in terms of lead time in the context of section 202(a)). Second, the Administrator noted that the CARB Executive Officer, in granting

exemptions to manufacturers on a case by case basis, would simply apply the "unambiguous" requirements of the exemption criteria to the manufacturers application for exemption: "[T]he criteria for an exemption under Executive Order G-70-3, which relates compliance (with the fill pipe requirements) to required scheduled changes to the bumper and body panel surrounding the fill pipe, are sufficiently definite such that reasonable decisions regarding available lead time can be made for each manufacturer."[83] The Administrator noted that the Executive Order solved what would otherwise be serious lead time problems, and General Motors and Ford apparently agreed, because they stated that the Executive Orders represented a reasonable, flexible and cost effective way of implementing the fill pipe specifications.

I have reviewed the fill pipe waiver in some detail to highlight the differences between the facts of that waiver and the facts of the instant proceeding. The Administrator noted that the CARB exemption criteria could help CARB achieve full compliance with the fill pipe requirements at the earliest possible date while at the same time providing an effective relief measure for manufacturers faced with economic or technological burdens. The idea that the exemption criteria were "unambiguous" and therefore objective render the CARB Executive Director's decisionmaking

[83] 42 Fed. Reg. 1,502, 1,506 (January 7, 1977)

a largely ministerial task, which would not rise to the level of the careful consideration which the Administrator must devote to his review of consistency under 202(a) as it relates to lead time.

The industry, on the other hand, is asking that I review the issue of "objectivity" in CARB's test procedures, and make a determination on this subject, as part of my review of the consistency with section 202 test for CARB's certification procedures. As stated above, I would deem the California test procedures inconsistent if manufacturers are unable to meet both the Federal and California test requirements with the same vehicle. In keeping with Congressional intent of the scope of my review of waiver requests, my determination of test procedure consistency does not extend to an examination of the objectivity of CARB test procedures. I therefore cannot deny a waiver request for inconsistency when manufacturers can meet both sets of testing requirements with the same vehicle, regardless of any questions on the objectivity of the CARB test requirements.[84]

Based on the my review of the record in this proceeding, I concur with CARB's finding that the California test procedures are not

[84] I believe that the MVMA/AIAM concerns in this area are adequately addressed by CARB. See CARB August 1992 Comment, Docket entry IV-G-54, at 37 - 42.

incompatible or inconsistent with the Federal test procedures. Manufacturers will be able to satisfy both the current Federal certification requirements and the new CARB certification requirements by running the same tests on the same vehicle, (with some additional tests for CARB).[85] As discussed above, the manufacturers assertions that the CARB certification procedures will be inconsistent with the Federal requirements are unfounded. Therefore, I cannot find that California's standards and accompanying regulatory requirements are inconsistent with section 202(a) of the Act.

D. Other Issues

1) Request To Condition Waiver on Use of California Phase II Gasoline

[85] California may impose reasonable additional testing requirements over those under the Federal procedures. 43 Fed. Reg. 1,829, 1,830 (January 12, 1978). Also, there is no absolute requirement that the test requirements be identical. For example, in the 1975 waiver for California evaporative test procedures, the Administrator noted that because the California tests required a "more intense effort to perfect the technology already required," EPA would accept evaporative test passing results from California as "valid evidence that the Federal evaporative standards has been applied with for certification purposes." 40 Fed. Reg. 30,311, 30,313 (July 18, 1975).

FUELS INSERT, TO BE ITS OWN SECTION TO BE INSERTED JUST PRIOR TO SECTION (NOT) DEALING WITH 177 ISSUES

REQUEST TO CONDITION WAIVER ON USE OF CALIFORNIA PHASE II GASOLINE

Well after the close of the second comment period, EPA received comments from MVMA and Multinational Business Services, Inc. (MBSI), requesting that, if EPA were to grant California's current waiver request, the Agency condition the grant of the waiver on the commercial availability of California's Phase II reformulated gasoline. CARB has passed regulations requiring in-use fuel to meet increasingly stringent emission reduction requirments. Its "Phase II" reformulated gasoline requirements to which the commenters refer take effect beginning January 1, 1996 (?). In view of this change to its in-use fuel requirements, CARB has announced its intention to revise the LEV program to allow manufacturers to certify their vehicles as meeting LEV standards on Phase II reformulated gasolines. It has yet to complete the necessary rulemaking, however, and it has not made the change part of the waiver request at issue here.

On behalf of their request, MVMA and MBSI asserted that the technolocial feasibility and the environmental benefits of the LEV standards depend substantially on the Phase II fuels requirement. (CITE to their comments) They contended that if the LEV standards can be met at all, Phase II gasoline will be critical to their achievement. MBSI also noted that if vehicles are certified on Phase II gasoline but operated on higher-emitting in-use gasoline, the LEV program may not be as protective as the federal standards under actual in-use emissions.

CARB responded (CITE) by pointing out that the program for which it has requested the waiver under consideration here does not include the Phase II fuel requirement itself or the optional use of Phase II gasoline as a certification fuel. It noted that since California's fuel program is not subject to federal preemption, the State has not sought waivers of preemption to impose fuel requirements. CARB also reiterated that it assessed the feasibility of the LEV standards based on the use of indolene fuels for certification, and that it found the LEV standards feasible on that basis. As for the use of Phase II gasoline in certifying low-emission vehicles, California stated that once it changes its regulations to allow such use, it intends to submit those regulations to EPA for a waiver determination at that time. FN 1/

On the basis of the record in this proceeding, I cannot condition a grant of California's waiver request on the commercial availability of Phase II gasoline, as MVMA and MBSI desire. California has defended the feasibility of its program

without resort to Phase II gasoline, and as explained in an earlier section of this notice, I have concluded that California's determination is reasonable. California has also made its case that the LEV program is at least as protective as the federal program without reference to Phase II gasoline, the requirements for which were not even adopted at the time CARB submitted its LEV program waiver request to EPA. As also explained earlier, I have found that CARB's protectiveness determination satisfies the protectiveness criterion of section 209. FN 2/ When California revises the LEV program to include Phase II gasoline as a certification fuel, it will be an issue in the waiver proceeding for that revision whether the change affects the protectiveness determination California made here.

1/ California also asserted that even assuming the use of Phase II reformulated gasoline as a certification fuel, its LEV standards are sufficiently more stringent than the federal standards so as to be at least as protective as the federal standards.

2/ In addition, I note that BMSI's assertions go no farther than a claim that there are "serious doubts" about the protectiveness of the California V program without in-use fuel requirements and a claim that the air quality benefits would be reduced. MBSI alleges that emissions would increase only if California does not adopt an enhanced I&M program, a matter that has already been dealt with earlier in this decision. Thus, MBSI has not even claimed that the California LEV program, on the basis of a lack of in-use fuel requirements alone, would be less protective than the federal program.

2 1.) Impact of California's Program on the Activities of Other States

Under Section 177 of the Clean Air Act, other states may adopt California vehicle emission standards under certain conditions.[86] In this waiver proceeding, various parties have commented that two states have already adopted California LEV program standards, and several other states have proposed, or are considering, the adoption of California LEV program standards. Some of these parties believe I should deny the

[86] The text of Section 177 spells out what these states must do:

Notwithstanding section 209(a), any State which has plan provisions approved under this part may adopt and enforce for any model year standards relating to the control of emissions from new motor vehicles or new motor vehicle engines and take such other actions as are referred to in section 209(a) respecting such vehicles if --

(1) such standards are identical to the California standards for which a waiver has been granted for such model year, and

(2) California and such state adopt such standards at least two years before commencement of such model year (as determined by regulations of the Administrator). Nothing in this section or in Title II of this Act shall be construed as authorizing any such state to prohibit or limit, directly or indirectly, the manufacture or sale of a new motor vehicle or motor vehicle engine that is certified in California as meeting California standards, or to take action of any kind to create, or have the effect of creating, a motor vehicle or motor vehicle engine different from a motor vehicle or engine certified in California under California standards (a "third vehicle") or otherwise create such a "third vehicle." 42 U.S.C. §7507.

waiver request [87] and others believe I should grant the request.[88]

I note the concern of these parties over this particular matter, but I also must note that the actions of other states relating to the adoption of California motor vehicle emission standards by these states is not a factor I am to consider under section 209(b). That section requires me to grant California's waiver request unless I determine that California has not met the given criteria, and it compels me to deny the request if it has not. Section 209(b) does not authorize me in reviewing a waiver request to consider the impacts of actions or potential actions taken by other

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[87] Besides the MVMA/AIAM comments, comments from other parties can be found throughout the record: Hearing Transcript, Docket entry IV-F-01, at 117-118 (Western States Petroleum Association), at 141 and 145 (American Petroleum Institute); Written Hearing Statements from American Petroleum Institute, Docket entry IV-F-09; Eastern States Petroleum Advisory Group, Docket entry IV-F-10; Comment of Eastern States Petroleum Advisory Group, Docket entry IV-G-07; Comment of Mobil Oil Corporation, Docket entry IV-G-08; Comment of American Petroleum Institute, Docket entry IV-G-10; Comment of Nissan Research & Development, Docket entry IV-G-11.

Additionally, see Docket entry IV-G-XX, which includes letters received after the November 30 and December 1, 1992 meetings from MVMA and API.

[88] Comment of State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials, Docket entry IV-G-48; Comment of American Gas Association, Docket entry IV-G-57; and, Comment of New York State Department of Environmental Conservation, Docket entry IV-G-58.

Additionally, see Docket entry IV-G-XX, which includes letters received after the November 30, 1992 meetings from STAPPA/OTC, Maryland Department of the Environment, and ALA/NRDC/Sierra Club.

states under section 177 of the Act.[89]

3 2) Application of Executive Order 12291 to This Waiver Request

The industry, in a footnote in its March Comment, stated that EPA "must comply with the requirements of Executive Order 12291." Under this Executive Order, "rules" (as the Executive Order defines that term) are subject to review by the Office of Management and Budget (OMB) before promulgation, and the agency promulgating the rule must prepare a Regulatory Impact Analysis. This point was also made in filings received after the additional period for public comment closed from Multinational Business Associates, Inc.[90] Other interested parties have expressed the view that EPA need not and/or should not submit this waiver decision for OMB review under Executive Order 12291.[91]

In previous waiver proceedings that have arisen since the implementation of Executive Order 12291, EPA has determined that

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[89] 43 Fed. Reg. 1,829, 1833 (January 12, 1978).

[90] Letters from Jim Tozzi, Executive Director, Multinational Business Services, Inc., dated October 15, 1992, Docket entry IV-G-63, and dated December 7, 1992, Docket entry IV-G **.

[91] These parties include CARB, STAPPA/OTC, the American Lung Association, the National Resources Defense council, and the Sierra Club. See letters from these parties filed after November 30, 1992 meetings, Docket entry IV-G-XX.

submission to OMB of EPA's waiver decisions was not required under the terms of Executive Order 12291. The industry is aware of these earlier determinations, but states that they involved "uncontested" waiver proceedings, unlike this one. Additionally, the industry believes this waiver review should trigger Executive Order 12291 because it would have a major impact on costs for consumers in California and possible elsewhere.[92]

To the contrary, EPA made the determination that submission to OMB was not required under Executive Order 12291 in previous decisions that were contested.[93] Concerning the "major impact of costs" on California consumers, I have noted above (see section **, PP ** **) that I am unable to make the only legally relevant cost determination that the costs of compliance to manufacturers and therefore to the ultimate purchasers are extraordinary. In addition, I am bound to give California very substantial deference with respect to whether the benefits of its emission standards justify the costs they entail. Consequently, performing a cost/benefit

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[92] MVMA/AIAM March Comment, Docket entry IV-G-14 at 39, n. 73.

[93] See, e.g., 55 Fed. Reg. 43,028 (October 25, 1990) (waiver granted to California for 1993 and beyond model year LDV standards). In this waiver proceeding, parties commented on technology feasibility concerns, but data was not sufficient to satisfy their burden of persuading EPA that the standards were not technologically feasible within the available lead time, considering costs.

analysis or cost effectiveness analysis would serve no purpose.[94]

I further note that EPA's action in granting this waiver to California does not impose any impact on the affected parties which results from Federal regulation of the affected parties. It is simply a determination that California's LEV program is not preempted by the the Clean Air Act.

Based upon the industry comments on Executive Order 12291 and my review of this Executive Order's applicability in past waiver decisions, I find nothing in this waiver request that would make me change my determination that my action here is exempt from OMB review under Executive Order 12291.

V. DECISION

Having given due consideration to the record of the public hearing of February 12, 1992, all material submitted for this record, and other relevant information, I find that I cannot make the determinations required for a denial of a waiver under section 209(b) of the Act, and therefore, I hereby waive application of section 209(a) of the Act to the

[94] See also MEMA I, 627 F.2d at 1114, n. 40 (rejecting contention that EPA was obligated to conduct a cost-effectiveness study regarding regulations for which California requested a waiver).

state of California with respect to the following sections of Title 13 of the California Code of Regulations (in which the LEV program amendments are contained) and the documents incorporated by reference within: section 1900; section 1904; section 1956.8 and the standards and test procedures incorporated therein; section 1960.1 and the incorporated documents entitled "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" and "California Non-Methane Organic Gas Test Procedures"; section 1960.1.5; sections 1960.5 and 2061 and the incorporated "Guidelines for Certification of 1983 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles For Sale in California"; section 1965 and the incorporated "California Motor Vehicle Control Label; Specifications"; sections 2111, 2112, 2125, and 2139; and the document entitled "California Test Procedures for Evaluating the Emission Impacts of Substitute Fuels or New Clean Fuels" adopted and incorporated by reference in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." As stated above, this waiver does not include those portions of the above regulations which pertain to low-emission and ultra-low emission medium-duty vehicles; actions on these portions will be taken in conjunction with my forthcoming decision in Docket A-91-55.

Dated: _____

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William K. Reilly

Administrator