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# CALIFORNIA LOW-EMISSION VEHICLE PROGRAM: FORCING TECHNOLOGY AND DEALING EFFECTIVELY WITH THE UNCERTAINTIES

*Leslie Harrison Reed, Jr.\**

## I. INTRODUCTION

Motor vehicles, considered as a whole, cause more air pollution than any other single human activity.<sup>1</sup> National estimates attribute approximately fifty percent of the total air pollutants in the country's urban areas to vehicular sources.<sup>2</sup> In California, mobile sources cause nearly sixty percent of the pollutants—hydrocarbons (HC) and oxides of nitrogen (NO<sub>x</sub>)—that react with the sun to form harmful ozone, and ninety percent of the carbon monoxide (CO) emissions.<sup>3</sup> This huge share of total emissions occurs, despite more than two decades of increasingly stringent controls in California and the rest of the nation, in part due to the ever-increasing numbers of motor vehicles and the

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<sup>1</sup> CURTIS MOORE & ALAN MILLER, *GREEN GOLD: JAPAN, GERMANY, THE UNITED STATES, AND THE RACE FOR ENVIRONMENTAL TECHNOLOGY* 131 & n. 11 (1994).

<sup>2</sup> ENERGY INFORMATION ADMINISTRATION, OFFICE OF COAL, NUCLEAR, ELECTRIC AND ALTERNATE FUELS, U.S. DEPARTMENT OF ENERGY, *ALTERNATIVES TO TRADITIONAL TRANSPORTATION FUELS: AN OVERVIEW* 41 (1994).

<sup>3</sup> See MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, STAFF REPORT: 1994 LOW-EMISSION VEHICLE AND ZERO-EMISSION VEHICLE PROGRAM REVIEW 2 (Apr. 1994) (available from the California Air Resources Board, Public Information Office, P.O. Box 2815, Sacramento, California 95812, (916) 322-2990) [hereinafter 1994 STAFF REPORT].

miles they are driven.<sup>4</sup> Thus, short of drastically changing the living and commuting choices of a majority of Americans,<sup>5</sup> some of the regulatory options for significantly controlling and reducing these emissions further include: requiring retrofitting of older in-use motor vehicles with emission control equipment; imposing stringent transportation control measures to reduce vehicle miles traveled (VMT) such as no-drive days or fees for VMT; squeezing more emission reductions from new gasoline-powered motor vehicles; or developing an advanced transportation industry around either low-emission, alternative-fueled vehicles or zero-emission vehicles, or both. Public resistance to retrofit requirements for used vehicles makes effective implementation of these options nearly impossible.<sup>6</sup> Changing the driving habits or preferences of Americans significantly, through transportation controls, presents a nearly insurmountable task as well, especially in light of the post-World War II growth of the automobile industry and transportation infrastructure, suburban sprawl, and our acclimation to the results.<sup>7</sup> These obstacles to change inevitably have led regulators to choose to require motor vehicle manufacturers to

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<sup>4</sup> See Henry A. Waxman et al., *A Review of Major Provisions: Cars, Fuels, and Clean Air: A Review of Title II of the Clean Air Act Amendments of 1990*, 21 ENVTL. L. 1947, 1949-50, 1956 (1991); MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, TECHNICAL SUPPORT DOCUMENT ZERO-EMISSION VEHICLE UPDATE 3 (Apr. 1994) (available from the California Air Resources Board, Public Information Office, Sacramento, California) [hereinafter 1994 ZEV UPDATE].

<sup>5</sup> America is a motor vehicle-oriented society, logging over 2 trillion vehicle miles traveled (VMT) annually, roughly equivalent to 10,000 round trips to the sun and constituting as many VMT as the rest of the world in the aggregate. STEVE NADIS & JAMES J. MACKENZIE WITH LAURA OST, WORLD RESOURCES INSTITUTE GUIDE TO THE ENVIRONMENT, CAR TROUBLE 11 (1993). Over 85% of working Americans commute to and from work in passenger cars and light-duty trucks, and these vehicles constitute over 80% of the country's annual VMT. See *id.* at 10.

<sup>6</sup> See JAMES E. KRIER & EDMUND URSIN, POLLUTION AND POLICY: A CASE ESSAY ON CALIFORNIA AND FEDERAL EXPERIENCE WITH MOTOR VEHICLE AIR POLLUTION 1940-1975, 150-52, 245-47 (1977). In the mid-1960s, and again in the mid-1970s, regulatory efforts by both the California Motor Vehicle Pollution Control Board (MVPCB) and its successor agency, the Air Resources Board, to require the installation of emission control devices on used vehicles, as part of the motor vehicle registration requirement, were overturned by the California legislature, due in large part to the intense public outcry. See *id.*

<sup>7</sup> See *id.* at 247 n.r.; NADIS & MACKENZIE, *supra* note 5, at 8-10, 12-13. In the late 1970s in California, two efforts to convert freeway lanes to car pool and bus only lanes failed, largely due to the extreme public resistance. KRIER & URSIN, *supra* note 6, at 247 n.r. More recently, Congress rescinded the EPA's proposed ozone Federal Implementation Plan (FIP) for the Sacramento, Ventura, and South Coast nonattainment areas, which proposed, among many other controls, a no-drive day once every five weekdays for all highway-registered vehicles in the Sacramento nonattainment area. Pub. L. No. 104-6, 109 Stat. 88 (1995); Approval and Promulgation of State and Federal Implementation Plans; California—Sacramento and Ventura

meet stricter emissions standards for the new motor vehicles they seek to produce.<sup>8</sup> However, compelling motor vehicle manufacturers to produce cleaner cars and trucks remains a formidable task as well, especially when the regulations are far-reaching or technology-forcing.<sup>9</sup> Technology-forcing mandates are particularly difficult to implement and enforce because the benefits are uncertain.<sup>10</sup>

With this background in mind, this article presents the low-emission vehicle portion of the California Low-Emission Vehicle and Clean Fuels Program (CLEV/CFP) as a largely successful model for implementing a technology-forcing regulatory program for new motor vehicles in this decade and beyond. Coverage will include the technology-forcing aspects of the California LEV program; the various market incentives built into the regulations; the program's built-in flexibility, including the manufacturers' options and the flexible rulemaking permitted by the program's commitment to biennial reviews; and the partnering efforts involving government and industry that have developed.

## II. THE 1990 CALIFORNIA LOW-EMISSION VEHICLE PROGRAM

### A. Introduction

In 1988, the California legislature directed the California Air Resources Board (CARB or Board)<sup>11</sup> "to achieve the maximum degree

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Ozone; South Coast Ozone and Carbon Monoxide; Sacramento Ozone Area Reclassification: Notice of Proposed Rulemaking, 59 Fed. Reg. 23,264 (1994).

<sup>8</sup> See, e.g., Waxman, *supra* note 4, at 1949-53.

<sup>9</sup> See *id.* at 1949-50; NADIS & MACKENZIE, *supra* note 5, at 25.

<sup>10</sup> See generally KRIER & URSIN, *supra* note 6, at 23-24, 204-09, 234-40, 257-63 (cost and effects of vehicular pollution control strategies are often uncertain; and typically our legislative or judicial institutions, or both, have placed burden of uncertainty upon regulatory agency seeking to impose changes to ongoing trends). For technology-forcing mandates, the burden of uncertainty has historically meant proof that any new controls are both economically and technologically feasible; and previous attempts to impose vehicular controls have been stymied for lack of such proof. See, e.g., *id.* at 204-06, 235-36 (implementation of health-based, technology-forcing standards for Title II mobile sources under 1970 amendments to federal Clean Air Act (CAA) was delayed through judicial, legislative, and administrative actions).

<sup>11</sup> The CARB is the eleven-member body appointed by the Governor of California "with the consent of the Senate, on the basis of their demonstrated interest and proven ability in the field of air pollution control and their understanding of the needs of the general public in connection with air pollution problems." CAL. HEALTH & SAFETY CODE §§ 39510(a)-(b) (West 1996). The chairperson, appointed by the Governor from among the 11 members, serves full-time, while the remaining 10 members serve part-time. See *id.* §§ 39511(b), 39512.5(a). For a description of the mix of specific qualifications among the Board members required by law, see *id.* § 39510(b)-(c). For a complete list of all acronyms used throughout this article, see appendix B, *infra*.



of emission reduction possible from vehicular and other mobile sources” to help achieve state air quality standards as soon as practicable.<sup>12</sup> Using 1987 as a baseline year, the legislature directed a minimum fifty-five percent reduction in emissions of reactive organic gases (ROG) and a fifteen percent reduction in emissions of oxides of nitrogen (NO<sub>x</sub>) from motor vehicles by December 31, 2000.<sup>13</sup> The CARB became obliged, by January 1, 1992, to take any “necessary, cost-effective, and technologically feasible” actions required to achieve these reductions before 2001.<sup>14</sup> The new law also required the CARB to take the necessary steps to “achieve the maximum feasible reductions in particulates [PM], carbon monoxide [CO], and toxic air contaminants from vehicular sources.”<sup>15</sup> The legislature also directed the CARB to adopt regulations and standards that would combine pollution control measures for both vehicles and their fuels.<sup>16</sup> The California legislature, while not limiting the CARB’s ability to adopt any necessary and feasible action, expressly directed that such standards and regulations include improved emission system durability and performance for in-use vehicles and specifications for new vehicle fuels.<sup>17</sup>

Acting pursuant to this statutory mandate, its own Long-Range Motor Vehicle Plan (LRMVP), and recommendations of the California Advisory Board on Air Quality and Fuels, the CARB proposed regulations for a low-emission vehicles<sup>18</sup> and clean fuels program on August 13, 1990.<sup>19</sup> These regulations require a vehicle and its fuel to meet stringent, technology-forcing exhaust emission standards that encourage the use of cleaner burning alternative fuels.<sup>20</sup> They also con-

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<sup>12</sup> See *id.* § 43018(a).

<sup>13</sup> See *id.* § 43018(b).

<sup>14</sup> See *id.*

<sup>15</sup> See *id.*

<sup>16</sup> See CAL. HEALTH & SAFETY CODE § 43018(c) (West 1996).

<sup>17</sup> See *id.* § 43018(c)(2), (4).

<sup>18</sup> Low-emission vehicle means a vehicle certified in California as a transitional low-emission vehicle (TLEV), a low-emission vehicle (LEV), or as an ultra-low-emission vehicle (ULEV). CAL. CODE REGS. tit. 13, § 1960.1(g)(1) (1996); *cf.* MOBILE SOURCE DIVISION & STATIONARY SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, PROPOSED REGULATIONS FOR LOW-EMISSION VEHICLES AND CLEAN FUELS, STAFF REPORT at 2 (Aug. 13, 1990) (available from the California Air Resources Board, Public Information Office, Sacramento, California) (including zero-emission vehicles (ZEVs) within the meaning of low-emission vehicles) [hereinafter 1990 STAFF REPORT]; CAL. CODE REGS. tit. 13, § 2300(a)(16) (including vehicles meeting California ZEV standards within the meaning of low-emission vehicles); see generally CAL. CODE REGS. tit. 13, §§ 1956.8, 1960.1 [available in Westlaw, CA-ADC database].

<sup>19</sup> 1990 STAFF REPORT, *supra* note 18, at 3, 15.

<sup>20</sup> *Id.* at 1, 15.

tain a technology-forcing mandate to sell an increasing number of zero-emission vehicles (ZEVs) beginning in 1998.<sup>21</sup> The term ZEV “means any vehicle which produces zero emissions under any and all possible operational modes and conditions.”<sup>22</sup> The CARB determined that the proposed regulations were necessary to meet state requirements and to attain National Ambient Air Quality Standards (NAAQS).<sup>23</sup>

At the time of the proposed regulations, more than seventy-five percent of California’s residents lived in non-attainment areas for at least one criteria pollutant; and motor vehicles were a major source of most of those pollutants.<sup>24</sup> While its air quality is improving, California continues to suffer the most serious air pollution problems of any state—with five of the seven worst areas in the United States for ozone nonattainment.<sup>25</sup>

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<sup>21</sup> *Id.* at 2, 5. In March, 1996, the CARB adopted revisions to the regulations that will curtail the 1998 through 2002 model year fixed-percentage-production requirements for ZEVs that the regulations originally imposed upon large-volume manufacturers. Section V.F., *infra*.

<sup>22</sup> CAL. CODE REGS. tit. 13, § 1900(b)(15) (1996). A ZEV is more particularly described as a vehicle certified by the CARB as having “no exhaust or evaporative emissions of any regulated pollutant” throughout its useful life. 1990 STAFF REPORT, *supra* note 18, at 32. At the time of the proposed regulations, only electric vehicles (EVs) that would not incorporate fuel-fired heaters were expected to meet the regulatory requirements. MOBILE SOURCE DIVISION ET AL., CALIFORNIA AIR RESOURCES BOARD, PROPOSED REGULATIONS FOR LOW-EMISSION VEHICLES AND CLEAN FUELS: TECHNICAL SUPPORT DOCUMENT I-20 (Aug. 13, 1990) (available from the California Air Resources Board, Public Information Office, Sacramento, California) [hereinafter TECHNICAL SUPPORT DOCUMENT]. The CARB staff noted that auxiliary fuel-fired heaters could have significant emissions of HCs, CO, and NO<sub>x</sub>. *See id.* The CARB staff proposed a ZEV requirement to ensure vehicle manufacturers worked toward developing the cleanest possible vehicle, a task they likely would not undertake absent regulatory requirements. 1990 STAFF REPORT, *supra* note 18, at 5-6.

<sup>23</sup> 1990 STAFF REPORT, *supra* note 18, at 3.

<sup>24</sup> *Id.* at 3, 13. Mobile sources continue to cause more than one-half of the ozone-forming emissions in the state, and passenger cars and light-duty trucks constitute a significant share of those emissions. MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, PROPOSED AMENDMENTS TO THE ZERO-EMISSION VEHICLE REQUIREMENTS FOR PASSENGER CARS AND LIGHT-DUTY TRUCKS, STAFF REPORT: INITIAL STATEMENT OF RULEMAKING 1 (Feb. 9, 1996), available in <<http://www.arb.ca.gov>> or bulletin board system (BBS) at (916) 322-2826, Zero-Emission Vehicle Program database, File srcomple.fin [hereinafter 1996 STAFF REPORT: ZEV RULEMAKING].

<sup>25</sup> MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, STAFF REPORT: LOW-EMISSION VEHICLE AND ZERO-EMISSION VEHICLE PROGRAM REVIEW 1 (Nov. 1996), available in <<http://www.arb.ca.gov>>, or BBS, Zero-Emission Vehicle Program database, File levstr3.wpd [hereinafter 1996 STAFF REPORT: LEV/ZEV REVIEW]. In 1994, California possessed six of the seven worst cities in the United States for ozone nonattainment. *See* 1994 STAFF REPORT, *supra* note 3, at 2.

On September 28, 1990, the CARB approved the staff's proposed regulatory amendments to California's motor vehicle emission standards and test procedures.<sup>26</sup> A little less than a year later, the CARB formally adopted these amendments and they were submitted to the California Office of Administrative Law (OAL) for legal review and final approval.<sup>27</sup> The OAL granted final approval of the CARB's rule-making on August 30, 1991,<sup>28</sup> several months before the legislative deadline. Then, on October 4, 1991, the CARB asked the U.S. Environmental Protection Agency (EPA) to waive federal preemption, per Federal Clean Air Act (CAA) Section 209(b),<sup>29</sup> for its low-emission vehicle (LEV) amendments to Title 13 of the California Code of Regulations.<sup>30</sup> On January 13, 1993, the EPA Administrator granted the waiver that the CARB requested for the LEV part of the CLEV/CFP, pertaining to light-duty vehicles.<sup>31</sup>

The CARB's regulatory action amended the California Code of Regulations to provide LEV standards and test procedures, including

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<sup>26</sup> Letter from James D. Boyd, Executive Officer, California Air Resources Board, to William K. Reilly, Administrator, EPA 1 (Oct. 4, 1991) (on file with the EPA Air Docket, Docket No. A-91-71) [hereinafter CARB Letter].

<sup>27</sup> California Office of Administrative Law, Notice of Approval of Regulatory Action 1 (Aug. 30, 1991) (on file with the EPA Air Docket, Docket No. A-91-71) [hereinafter OAL, Notice of Approval of Regulatory Action]. The CARB Executive Officer adopted the amendments by Executive Order G-604 on July 12, 1991. See CARB Letter, *supra* note 26, at 1. The delegable powers of the CARB are conclusively presumed to have been delegated to the CARB Executive Officer by law, unless the CARB affirmatively votes to reserve a power for its own action. CAL. HEALTH & SAFETY CODE § 39516 (West 1996). The CARB Executive Officer may, except where required to act personally, redelegate these duties and powers to subordinates on the CARB staff. See *id.*

<sup>28</sup> CARB Letter, *supra* note 26, at 1.

<sup>29</sup> 42 U.S.C. § 7543(b) (1994).

<sup>30</sup> CARB Letter, *supra* note 26, at 1; California State Motor Vehicles Pollution Control Standards; Opportunity for Public Hearings, 57 Fed. Reg. 909, 910 (1992). CARB's request for waiver of federal preemption did not include the Clean Fuels part of the LEV/CF regulations. CARB Letter, *supra* note 26, at 1 n.1. Under the CAA, California does not need EPA approval to enforce its own fuel regulations. See *id.* (citing 42 U.S.C. § 7545(c)(4)(B)).

<sup>31</sup> California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption; Decision, 58 Fed. Reg. 4166 (1993). CARB already had another pending waiver request before EPA relating to medium-duty vehicles (MDVs), Docket A-91-55, and agreed to a deferral of the waiver on the LEV regulations for MDVs until the Administrator took action on Docket A-91-55. See *id.* CARB's other MDV waiver request, submitted July 15, 1991, involved its amended exhaust emission standards for hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), and particulate matter (PM); certification and in-use test procedures; revised weight categories; and durability requirements for light-duty trucks and medium-duty and light heavy-duty vehicles and engines. See California State Motor Vehicle Pollution Control Standards; Opportunity for Public Hearings, 57 Fed. Reg. 909, 911 (1992).

the requirements for ZEVs.<sup>32</sup> The CARB's rulemaking also resulted in the adoption of a number of new sections of the California Code of Regulations to create the clean fuels program.<sup>33</sup> This article focuses primarily on the various requirements of the CLEV/CFP pertaining to vehicles, particularly the controversial ZEV requirements.

### III. THE 1990 LEV REGULATIONS

#### A. *Basic Requirements for Light-Duty Vehicles*

##### 1. Exhaust Emission Certification and In-Use Standards

The California LEV regulations seek significant reductions in exhaust emissions from passenger cars (PCs) and light-duty trucks (LDTs) through three interrelated steps. First, the regulations establish certification and durability standards for exhaust emissions from four new classes of LEVs<sup>34</sup>—transitional low-emission vehicles (TLEVs), low-emission vehicles (LEVs), ultra-low-emission vehicles (ULEVs), and zero-emission vehicles (ZEVs). The four new levels of exhaust emission standards apply increasingly stringent requirements for emissions regulated under preexisting California regulations—HC, CO, NO<sub>x</sub>, PM, and formaldehyde (HCHO)—with two notable variations.<sup>35</sup> The HC standards for the four new categories of LEVs are referred to as non-methane organic gases (NMOG), instead of non-methane hydrocarbons (NMHC), to reflect the fact that emissions of all reactive hydrocarbons will be measured.<sup>36</sup> Also, the HCHO standards apply to the new categories of LEVs certified on any type of fuel, whereas previously the HCHO requirements applied only to 1993 and subsequent model year methanol-fueled vehicles.<sup>37</sup> The regulations soften the manufacturers' burden of demonstrating the in-use durability of their vehicles' emission control systems by providing for

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<sup>32</sup> CARB Letter, *supra* note , at 1-2; CAL. CODE REGS. tit. 13, §§ 1900, 1904, 1956.8, 1960.1, 1960.1.5, 1960.5, 1965, 2061, 2111-2112, 2125, 2139 (1996).

<sup>33</sup> OAL, Notice of Approval of Regulatory Action, *supra* note 27, at 1. *See* CAL. CODE REGS. tit. 13, §§ 2300-2317 (clean fuels program created by CARB's rulemaking).

<sup>34</sup> *See supra* note 18 and accompanying text.

<sup>35</sup> CARB Letter, *supra* note 26, at 2.

<sup>36</sup> *See, e.g.*, CAL. CODE REGS. tit. 13, § 1960.1(e)(1) (1996); 1990 STAFF REPORT, *supra* note 18, at 18.

<sup>37</sup> *See* CAL. CODE REGS. tit. 13, § 1960.1(e)(2), (e)(3) & n.(4); CARB Letter, *supra* note 26, at 2-3.

less stringent intermediate in-use performance standards for 50,000 miles.<sup>38</sup> These intermediate standards, which are up to thirty percent less stringent, and waivers of compliance with the 100,000 mile in-use standards are applicable through model year 1995 for TLEVs and through model year 1998 for LEVs and ULEVs.<sup>39</sup> These intermediate standards and waivers recognize that manufacturers might initially encounter problems meeting the in-use standards.<sup>40</sup> The emission standards for these new classes of LEVs, except for HCHO and PM for diesel vehicles, appear in table III-1, appendix A.

Comparison of the California LEV program exhaust emission certification standards for PCs and LDTs, from 0-5750 pounds loaded vehicle weight (LVW), to the federal Tier I phase-in certification standards reveals that the TLEV standards for NMOG are twice as stringent as the federal Tier I NMHC standards.<sup>41</sup>

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<sup>38</sup> See CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6); 1990 STAFF REPORT, *supra* note 18, at 21. The CARB has the authority and obligation to adopt and implement, by regulation, "motor vehicle emission standards, in-use performance standards, and motor vehicle fuel specifications . . . [that it] has found to be necessary, cost-effective, and technologically feasible . . . unless preempted by federal law." CAL. HEALTH & SAFETY CODE § 43013(a),(b) (West 1996). The California legislature's 1988 directive to achieve the maximum feasible emission reductions from mobile sources included the requirement for CARB to adopt control measures that would result in "[r]eductions in emissions from in-use emissions from motor vehicles through improvements in emission system durability and performance." *Id.* § 43018(c)(2). Manufacturers are required to warrant to the ultimate purchaser and subsequent purchasers that their California certified light- and medium-duty vehicles will pass the California smog inspection for the first three years or 50,000 miles. See *id.* § 43205(a)(3). Also, manufacturers must warrant that emission-related components for their California certified light- and medium-duty vehicles that cost more than \$300 at the time CARB certified them will be free from defects for seven years or 70,000 miles. See *id.* § 43205(a)(4). Sections 2061-2062 and 2100-2153, among other things, define the useful life of the various categories and model years of light-, medium-, and heavy-duty vehicles; establish test procedures for enforcement of in-use vehicle emission standards; establish record-keeping and reporting requirements for manufacturers; provide for surveillance testing of assembly lines and car dealerships; and establish procedures for voluntary, influenced, and ordered recalls of vehicles for noncompliance with applicable standards. See CAL. CODE REGS. tit. 13, §§ 2061-62, 2100-53 (1996). For 1992 and subsequent model year passenger cars and light-duty trucks in the TLEV, LEV, and ULEV categories, the regulations establish a useful life of ten years or 100,000 miles, whichever occurs first. See *id.* § 2112(l)(10). For 1992 and subsequent model year medium-duty LEVs and ULEVs, the useful life is eleven years or 120,000 miles. See *id.* § 2112(l)(9). Any vehicle of an engine family manufactured for sale in California is subject to in-use compliance testing during its useful lifetime. See *id.* § 2137(a).

<sup>39</sup> See CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6); 1990 STAFF REPORT, *supra* note 18, at 21.

<sup>40</sup> 1990 STAFF REPORT, *supra* note 18, at 21.

<sup>41</sup> Compare CAL. CODE REGS. tit. 13, § 1960.1(g)(1) and table III-1, *infra* app. A with 42 U.S.C. § 7521(g)(1) table G (1996). The California LEV program's NMOG exhaust emission standard measures not only the hydrocarbons addressed by the traditional NMHC standard, but also oxygenated hydrocarbons, like alcohols, aldehydes, ketones, and ethers, "to fully evaluate the ozone-forming potential of hydrocarbon emissions from candidate vehicle/fuel systems."

For “fuel-flexible and dual-fuel PCs and LDTs,” two separate sets of both NMOG certification and in-use compliance standards for 50,000 and 100,000 miles, as well as intermediate in-use NMOG standards for 50,000 miles, apply.<sup>42</sup> Dual-fueled, low-emission PCs and LDTs must be certified to both the NMOG standards applicable to their alternative fuel and to separate NMOG standards for gasoline.<sup>43</sup> The CARB staff determined that separate, less stringent, gasoline-related NMOG emission standards were necessary for dual-fueled vehicles because these vehicles, when operating on the alternative fuels, would likely require fewer emission control devices or techniques to comply with applicable exhaust emission standards than gasoline-powered LEVs in the same emission category and weight class.<sup>44</sup> The staff reasoned

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1990 STAFF REPORT, *supra* note 18, at 18. The federal Tier I exhaust emission certification standards are to be phased in over a three-year period beginning with model year 1994. *See* 42 U.S.C. § 7521(g)(1). The TLEV NMOG exhaust emission certification standard, for PCs and LDTs from 0–3750 pounds LVW, is identical to the federal Tier II NMHC certification standard that the EPA could establish for the same weight class of PCs and LDTs for model year 2004. *Compare* CAL. CODE REGS. tit. 13 § 1960.1(g)(1) and table III–1, *infra* app. A with 42 U.S.C. § 7521(i)(1) table 3. The TLEV exhaust emission certification standards for all PCs and LDTs for NO<sub>x</sub> and CO are identical to the federal Tier I exhaust emission certification standards for these pollutants. *Compare* CAL. CODE REGS. tit. 13 § 1960.1(g)(1) and table III–1, *infra* app. A with 42 U.S.C. § 7521(g)(1) table G. The ULEV exhaust emission certification standards for CO and NO<sub>x</sub> for PCs and LDTs from 0–3750 pounds LVW are identical to the federal Tier II standards, while the NMOG certification standard for these ULEVs is more than three times more stringent than the federal Tier II NMHC emission standard. *Compare* CAL. CODE REGS. tit. 13 § 1960.1(g)(1) and table III–1, *infra* app. A with 42 U.S.C. § 7521(i)(1) table 3. These federal Tier II standards, or more stringent federal standards, will not become effective nationwide until the 2004 model year. *See* 42 U.S.C. § 7521(i)(1), (i)(3)(B).

<sup>42</sup> *See* CAL. CODE REGS. tit. 13, §§ 1960.1(g)(1) nn.(4)a–c & (6)a–c. These fuel-flexible and dual-fueled PCs and LDTs must be certified to the NMOG standards applicable to both their alternative fuel and to gasoline. *See id.* at n.(4).

<sup>43</sup> *Id.* at n.(4). Dual-fueled TLEVs, LEVs, and ULEVs certified for operation on alternative fuels multiply the applicable NMOG standard, shown in table III–1, *infra* app. A, by the generic reactivity adjustment factor (RAF) established for that alternative fuel, vehicle emission category, and weight class. *See* CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(4)a; TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I–11. If a generic RAF does not already exist for a particular vehicle and alternative fuel, a manufacturer may apply for a specific RAF to be applied. *See id.* at I–11. Similarly, for dual-fueled TLEVs, LEVs, and ULEVs operating on alternative fuels, to determine compliance with the intermediate in-use NMOG standards shown in table III–1, *infra* app. A, the “exhaust NMOG mass emission results shall be multiplied by the applicable reactivity adjustment factor.” CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6)a. Reactivity adjustment factors (RAFs) are discussed in more detail *infra* Sections III.A.2.a., III.F.2., & V.B.

<sup>44</sup> *See* TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I–3. Dual-fueled TLEVs, LEVs, and ULEVs certify to NMOG standards for gasoline that are less stringent than both the 50,000 and the 100,000 mile standards shown in table III–1, *infra* app. A. *See* CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(4)b–c. For example, the 50,000 and 100,000 mile NMOG exhaust emission standards for dual-fueled ULEVs in the 0–3750 pound loaded vehicle weight class certifying for

that forcing dual-fueled vehicles to meet the same NMOG emission standards for both fuels would probably hinder their production, because manufacturers would simply design vehicles to meet the conventional fuel standards.<sup>45</sup> Along the same lines, the gasoline related intermediate in-use NMOG standards for dual-fueled vehicles are less stringent than the NMOG intermediate in-use compliance standards applicable to gasoline-powered vehicles in the same emission category and weight class.<sup>46</sup> Dual-fueled TLEVs, LEVs, and ULEVs are subject to the same emission standards for CO, NO<sub>x</sub>, PM (if applicable),<sup>47</sup> and HCHO,<sup>48</sup> for both their alternative and conventional fuels, as other LEVs in the same emission category and weight class.<sup>49</sup>

## 2. Fleet Average Non-Methane Organic Gas (NMOG) Requirements

Second, the regulations establish progressive annual fleet-average emission requirements for non-methane organic gases (NMOG) emissions.<sup>50</sup> NMOG means "the total mass of oxygenated and non-oxygenated hydrocarbon emissions."<sup>51</sup> The California LEV regulations' NMOG emission standard delineates the first mobile source emission control program to control all reactive hydrocarbon emissions, both oxygen-

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operation on gasoline are 0.075 g/mi and 0.090 g/mi, respectively. *See id.* § 1960.1(g)(1) n.(4)b(iii). As table III-1, *infra* app. A, shows, these gasoline-related NMOG emission standards for a dual-fueled ULEV are equivalent to the less stringent LEV NMOG emission standards applicable to gasoline-powered vehicles in the same weight class.

<sup>45</sup> *See* TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-3.

<sup>46</sup> *See* CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6)b-c.

<sup>47</sup> For diesel PCs and LDTs from 0-5750 pounds LVW, including dual-fueled vehicles, a 100,000 mile exhaust emission certification standard for PM was established for TLEVs and LEVs as 0.08 g/mi, and for ULEVs as 0.04 g/mi. *See id.* § 1960.1(g)(1) n.(7). Also, for diesel PCs and LDTs certifying to the standards shown in table III-1, *infra* app. A, NMOG means non-methane hydrocarbons (NMHC). *See id.*

<sup>48</sup> For 1992 and subsequent model years, the 50,000 mile HCHO standards for PCs and LDTs less than 3750 pounds LVW, including dual-fueled vehicles, are 15(23) milligrams per mile (mg/mi) for TLEVs, 15(15) mg/mi for LEVs, and 8(12) mg/mi for ULEVs. *See id.* § 1960.1(e)(3). For PCs and LDTs from 3751-5750 pounds, the 50,000 mile HCHO standards are 18(27) mg/mi for TLEVs, 18(18) mg/mi for LEVs, and 9(14) mg/mi for ULEVs. *See id.* The numbers in parentheses show the intermediate in-use compliance standards. *See id.* § 1960.1(e)(3) n.(5). The 100,000 mile HCHO standard for PCs and LDTs (0-3750 pounds LVW) for TLEVs and LEVs increases to 18 mg/mi; for ULEVs increases to 11 mg/mi; for PCs and LDTs (3751-5750 LVW) increases to 23 mg/mi for TLEVs and LEVs; and increases to 13 mg/mi for ULEVs. *See id.* § 1960.1(e)(3).

<sup>49</sup> *See* TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-5.

<sup>50</sup> 1994 STAFF REPORT, *supra* note 3, at 1, 3; *see* 1990 STAFF REPORT, *supra* note 18, at 22, 24.

<sup>51</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(3).

ated and non-oxygenated, from vehicle exhaust.<sup>52</sup> Prior to the adoption of the LEV program, the California regulations controlled only non-methane hydrocarbons (NMHC), because the amounts of oxygenated hydrocarbons emitted by conventional gasoline-powered and diesel-powered vehicles, though measurable, were small.<sup>53</sup> The CARB staff reasoned that the increasing use of oxygenated hydrocarbons in gasoline and the potential use of alcohols as alternative fuels warranted a standard measuring oxygenated hydrocarbons.<sup>54</sup> The staff pointed out that alcohol-fueled vehicles emit significant amounts of oxygenated compounds, like HCHO, that are “highly reactive in forming ozone.”<sup>55</sup> The EPA applies an Organic Material Hydrocarbon Equivalent (OMHCE) procedure to equalize emissions from methanol-fueled vehicles to the NMHC emissions standard for gasoline-powered vehicles.<sup>56</sup> However, in the CARB’s opinion, the OMHCE procedure would be inadequate for the various classes of LEVs, because “the OMHCE approach does not fully address the relative reactivity of these emissions.”<sup>57</sup> The CARB staff deemed the NMHC emissions standard inadequate because it fails to measure “aldehydes, alcohols, or other oxygenates . . . [that] may contribute significantly to the overall reactivity of the exhaust emissions.”<sup>58</sup> For conventional methanol-fueled and ethanol-fueled vehicles in the passenger car through medium-duty vehicle classes, California’s regulations apply an “Organic Material Non-Methane Hydrocarbon Equivalent” (OMNMHCE) standard, whereas the various categories of LEVs in the same classes must meet the applicable NMOG standard.<sup>59</sup> The fleet average NMOG requirements for passenger cars and light-duty trucks appear in table III-2, appendix A.

Actual compliance with the fleet average NMOG requirements became effective for model year 1994.<sup>60</sup> For the 1993 model year, however, each manufacturer was required to certify at least forty percent of its total projected new PCs and LDTs certified for sale in California

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<sup>52</sup> See 1990 STAFF REPORT, *supra* note 18, at 18; TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-2.

<sup>53</sup> See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-1 to I-2.

<sup>54</sup> See 1990 STAFF REPORT, *supra* note 18, at 18.

<sup>55</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-1.

<sup>56</sup> See *id.* at I-2.

<sup>57</sup> See *id.*

<sup>58</sup> See *id.*

<sup>59</sup> Compare CAL. CODE REGS. tit. 13, § 1960.1(f)(2) n.(2) and §1960.1(h)(1) n.(4) with CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(3) and §1960.1(h)(2) n.(3)a.

<sup>60</sup> See CAL. CODE REGS. tit. 13, § 1960.1(f)(1) n.(7).



to the more stringent phase-in standards established for that model year, or to the even more stringent standards for TLEVs, LEVs, or ULEVs for the 1992 and subsequent model years.<sup>61</sup> The phase-in standards for the 1993 model year were identical to exhaust emission standards established for new 1995 and subsequent model year PCs and LDTs.<sup>62</sup>

These fleet average emission standards for NMOG, at least in the early years, reflect decreasing production percentages of total new sales for conventional vehicles plus increasing production percentages of total new sales for the four new classes of LEVs.<sup>63</sup> The CARB staff determined the fleet average NMOG cap for each model year by multiplying a feasible implementation rate for each category of vehicle by its applicable 50,000 mile certification standard.<sup>64</sup> The affected manufacturers may meet these fleet average NMOG requirements by certifying any combination of conventional vehicles, TLEVs, LEVs, ULEVs, and ZEVs for a particular model year that, after averaging, does not exceed the NMOG fleet average cap for that year.<sup>65</sup> A manufacturer may tailor many combinations of LEVs and conventional

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<sup>61</sup> See *id.* § 1960.1(f)(1) & n.(7), (g)(1).

<sup>62</sup> Compare *id.* § 1960.1(f)(1) & n.(7) with § 1960.1(f)(2) (showing that phase-in standards (in parentheses) for 1993 model year are same as exhaust emission standards for new PCs and LDTs in 1995 and subsequent model years).

<sup>63</sup> 1990 STAFF REPORT, *supra* note 18, at 23–24.

<sup>64</sup> *Id.* at 23. Table III–1, *infra* app. A, shows the 50,000 mile certification standards for light-duty TLEVs, LEVs, ULEVs, and ZEVs. For instance, the CARB staff determined that in 1998 motor vehicle manufacturers could produce, as a percentage of all new passenger car and light-duty truck sales, LEVs at 48% and ULEVs and ZEVs at 2% each. See *id.* at 24. Thus, the 1998 fleet average standard for passenger cars and light-duty trucks of 0.157 g/mi represents the sum of the LEV NMOG standard multiplied by 48%, the ULEV and ZEV NMOG standards each multiplied by 2%, and the conventional vehicle non-methane hydrocarbon (NMHC) standard multiplied by the remaining 48%:  $(0.075 \times 0.48) + (0.040 \times 0.02) + (0.00 \times 0.02) + (0.25 \times 0.48) = 0.157$ . See *id.* at 23–24. For 1995 and subsequent model years, all conventional passenger cars and small conventional light-duty trucks, 0–3750 pounds LVW, must meet a NMHC standard of 0.25 g/mi at 50,000 miles. See CAL. CODE REGS. tit. 13, § 1960.1(f)(2) (1996).

<sup>65</sup> *E.g.*, 1994 STAFF REPORT, *supra* note 3, at 3. For example, in the 1998 model year one manufacturer might produce and distribute for sale in California new vehicles in amounts identical to those predicted feasible by the CARB and used by it to determine the 0.157 g/mi fleet average standard for that model year—48% conventional vehicles, 48% LEVs, 2% ULEVs, and the mandatory 2% ZEVs. However, another manufacturer's 1998 model year sales fleet could contain 54% conventional vehicles certified to a 0.25 g/mi NMHC standard, 8% LEVs certified to a 0.075 NMOG standard, 36% ULEVs certified to a 0.040 NMOG standard, and the mandatory 2% ZEVs. This manufacturer's sales-weighted NMOG emissions average would be 0.0016 below the 0.157 fleet average NMOG standard:  $(0.54 \times 0.25) + (0.08 \times 0.075) + (0.36 \times 0.040) + (0.02 \times 0.0) = 0.1554$ . See 1990 STAFF REPORT, *supra* note 18, at 23–24. The CARB staff's example illustrating the flexibility of the fleet average standard uses a 0.125 g/mi fleet average NMOG standard. It points out that under this standard one manufacturer's passenger

vehicles that would ensure its fleet average NMOG emissions (and NMHC emissions for conventional vehicles) in a particular model year would not exceed the applicable standard. In addition to the flexibility offered by fleet averaging of NMOG emissions, the LEV regulations include provisions for a "two-tiered NMOG standard for vehicles capable of operating on both conventional and alternate fuels."<sup>66</sup> Fuel-flexible and dual-fueled vehicles, in the passenger cars through medium-duty vehicle classes, are to be certified to an NMOG standard for the alternative fuel and to the gasoline standard.<sup>67</sup> This allows the manufacturers of these vehicles to use the potentially less stringent, reactivity-adjusted NMOG standard for the alternative fuel and encourages the use of less reactive alternative fuels.<sup>68</sup> Along these lines, the California LEV regulations also build in additional flexibility and equity by allowing an ozone reactivity adjustment of the NMOG standards.<sup>69</sup>

a. *The Reactivity Adjustment Factor (RAF)*

The CARB staff recognized that emissions from alternative-fueled vehicles might prove to "have lower ozone-forming potentials" than gasoline-powered vehicles.<sup>70</sup> To level the playing field, they built into the regulations criteria for determining the ozone reactivity of NMOG emissions from gasoline-powered and alternative-fueled vehicles called "Maximum Incremental Reactivity (MIR) procedures."<sup>71</sup> The MIR procedures would be used to develop a reactivity baseline for gasoline-powered vehicles, and to determine the relative reactivity of NMOG emissions from alternative-fueled vehicles.<sup>72</sup> The initial LEV regulations prescribed the use of MIRs and reactivity adjustment factors (RAFs) using procedures developed by Dr. William Carter of the Statewide Air Pollution Research Center, University of California, Riverside.<sup>73</sup> The CARB anticipated, however, that adjustments to

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car sales fleet could be made up solely of TLEVs certified to the 0.125 g/mi NMOG standard, while another's could be made up of one-half conventional vehicles certified to the 0.25 g/mi NMHC standard and one-half ZEVs.

<sup>66</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-3.

<sup>67</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(4), 1960.1(h)(2) n.(4).

<sup>68</sup> 1990 STAFF REPORT, *supra* note 18, at 21-22.

<sup>69</sup> CARB Letter, *supra* note 26, at 2.

<sup>70</sup> See 1990 STAFF REPORT, *supra* note 18, at 19.

<sup>71</sup> *Id.*

<sup>72</sup> *Id.*

<sup>73</sup> *Id.*

the MIR procedures and specific RAFs for alternative-fueled vehicles would be considered in future rulemaking sessions.<sup>74</sup> For alternative-fueled vehicles demonstrating NMOG emissions with lower ozone-forming potentials, the regulations provide criteria for developing RAFs that would equalize the NMOG emission standard for these “vehicle/alternative fuel systems” by permitting a less ozone-reactive alternative-fueled vehicle to emit up to the gasoline equivalent NMOG standard.<sup>75</sup> For instance, an alternative-fueled TLEV with an approved RAF of 0.5 could emit 0.25 grams per mile (g/mi) NMOG—the 0.125 g/mi NMOG for a gasoline-powered TLEV divided by 0.5.<sup>76</sup>

### 3. The ZEV Mandate

Third, the initial California LEV regulations required certain motor vehicle manufacturers to produce and offer ZEVs for sale in the state beginning in 1998. Each affected manufacturer in model year 1998 would be required to both meet the fleet average NMOG standard of 0.157 g/mi shown in table III-2 of appendix A, and also “certify, produce, and deliver for sale in California at least 2% ZEVs.”<sup>77</sup> The fixed percentage of ZEVs each manufacturer would be obligated to certify and produce—two percent for model years 1998 through 2000—would apply to its total production of passenger cars and light-duty trucks 0–3750 pounds LVW delivered for sale in California.<sup>78</sup> Under the 1990 LEV regulations, this ZEV mandate increases to five percent in 2001 through 2002, and to ten percent for model year 2003 and later years.<sup>79</sup> The ZEV mandate does not apply to small volume manufacturers.<sup>80</sup> Motor vehicle companies that fit the small volume manufacturer exemption from the ZEV mandate “include Rolls Royce, SAAB, and Ferrari.”<sup>81</sup> Another group of motor vehicle manufacturers, intermediate volume manufacturers, will not be required to certify and produce ZEVs until the 2003 model year.<sup>82</sup> “Intermediate volume

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<sup>74</sup> CARB Letter, *supra* note 26, at 5. The CARB staff anticipated RAFs “for TLEVs, LEVs, and ULEVs powered by Phase 2 gasoline, methanol, ethanol, and CNG” by September, 1991. See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-11.

<sup>75</sup> 1990 STAFF REPORT, *supra* note 18, at 19. “The ratio of the ozone-forming potential of clean fuel to base gasoline would constitute the reactivity adjustment factor for the particular vehicle/clean fuel system.” See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-10 to I-11.

<sup>76</sup> 1990 STAFF REPORT, *supra* note 18, at 19.

<sup>77</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9).

<sup>78</sup> *Id.*

<sup>79</sup> *Id.*

<sup>80</sup> *Id.* § 1960.1(g)(2) n.(9)f.

<sup>81</sup> 1994 ZEV UPDATE, *supra* note 4, at 6.

<sup>82</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)g (1996).

manufacture” means any motor vehicle manufacturer that had average new light-duty and medium-duty vehicle sales in California from 1989 to 1993 between 3001 units and 35,000 units.<sup>83</sup> It also includes any manufacturer with projected first-time sales between 3001 units and 35,000 units of such vehicles in California.<sup>84</sup> “Most of the European and some small Japanese manufacturers . . . [fit] in this category.”<sup>85</sup> That leaves only the major motor vehicle manufacturers—those that sell more than 35,000 new light-duty and medium-duty vehicles in California per year—subject to the ZEV requirements beginning in 1998. General Motors (GM), Ford, Chrysler, Honda, Nissan, Mazda and Toyota are the major manufacturers that, under the 1990 LEV regulations, would be required to certify, produce, and distribute ZEVs equivalent to at least two percent of their new passenger car and light-duty truck sales in California in 1998.<sup>86</sup> The California LEV regulations currently impose no requirement for medium-duty vehicles<sup>87</sup> in the ZEV category.

### B. *Basic Requirements for Medium-Duty Vehicles (MDVs)*

The California LEV regulations seek to drastically reduce medium-duty vehicle exhaust emissions through two new categories of LEVs and a fixed implementation schedule. Only two of the four new LEV categories discussed above apply to medium-duty vehicles—LEVs and ULEVs.<sup>88</sup> Also, the CARB determined that categorized fleet emissions averaging would be impractical for medium-duty vehicles (MDVs), due to both the limited number of engine families in each weight class and low production numbers.<sup>89</sup> Rather, affected manufacturers would be required to certify and produce a fixed percentage of medium-duty LEVs and ULEVs beginning in 1998.<sup>90</sup> The fixed per-

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<sup>83</sup> *Id.* § 1960.1(o).

<sup>84</sup> *Id.*

<sup>85</sup> 1994 ZEV UPDATE, *supra* note 4, at 6.

<sup>86</sup> *See id.*

<sup>87</sup> Table III-4, *infra* app. A, depicts the medium-duty LEV emission categories and weight classes. Under California’s regulations, “[m]edium-duty vehicle’ means any pre-1995 model year heavy-duty vehicle having a manufacturer’s gross vehicle weight rating of 8,500 pounds or less, any 1992 and subsequent model year heavy-duty low-emission vehicle or ultra-low-emission vehicle having a manufacturer’s gross vehicle weight rating of 14,000 pounds or less, or any 1995 and subsequent model year heavy-duty vehicle having a manufacturer’s gross vehicle weight rating of 14,000 pounds or less.” CAL. CODE REGS. tit. 13, § 1900(b)(9). “‘Heavy-duty vehicle’ means any motor vehicle having a manufacturer’s gross vehicle weight rating greater than 6,000 pounds, except passenger cars.” *Id.* § 1900(b)(6).

<sup>88</sup> CARB Letter, *supra* note 26, at 5; *see also* CAL. CODE REGS. tit. 13, § 1960.1(h)(2).

<sup>89</sup> 1990 STAFF REPORT, *supra* note 18, at 25; CARB Letter, *supra* note 26, at 5.

<sup>90</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(10)a-b.

centages for each category in the applicable model year appear in table III-3, appendix A. These percentages apply to the manufacturer's entire medium-duty vehicle fleet, meaning all MDVs 0-14,000 pounds test weight (TW) "certified, produced and delivered for sale in California."<sup>91</sup> However, small volume manufacturers<sup>92</sup> are initially exempt from these requirements.<sup>93</sup>

For each model year, the number of vehicles required to be certified, produced, and delivered for sale in California to meet the required percentage will be determined from sales data for the previous model year or from projected sales.<sup>94</sup> The exhaust emission standards for medium-duty LEVs and ULEVs for NMOG, carbon monoxide (CO), NO<sub>x</sub>, HCHO, and particulates (PM) are proportionately as stringent as the exhaust emission standards for light-duty vehicles.<sup>95</sup> The exhaust emission standards, except for HCHO, for complete MDVs chasis-certified and tested in these new classes of LEVs appear in table III-4, appendix A.

The 120,000 mile in-use compliance standards will be waived through the 1999 model year.<sup>96</sup> The 50,000 and 120,000 exhaust emission standards and the intermediate in-use standards for 50,000 miles also apply to fuel-flexible and dual-fueled LEVs and ULEVs, when operating on alternative fuels.<sup>97</sup> However, like the light-duty dual-fueled-low-emission vehicles, these standards are multiplied by the RAF applicable to the particular alternative fuel.<sup>98</sup> Also, the medium-duty, dual-fueled LEVs and ULEVs must meet the NMOG standards for both the alternative fuel and for gasoline.<sup>99</sup> The gasoline certification and intermediate in-use NMOG standards for these dual-fueled vehicles, though, are less stringent than standards shown in table III-4, appendix A.<sup>100</sup> Dual-fueled LEVs and ULEVs from 0-14,000 pounds TW must meet

<sup>91</sup> *Id.* § 1960.1(h)(2) n.(10).

<sup>92</sup> In this portion of the regulations, a small volume manufacture means one with average new passenger car, light-duty truck, and medium-duty vehicle sales in California "each model year from 1992 to 1994" of 3000 or less, or one with first-time projected sales of 3000 or less. *Id.* § 1960.1(h)(2) n.(16).

<sup>93</sup> *See id.* § 1960.1(h)(2) n.(10)c.

<sup>94</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-17.

<sup>95</sup> CARB Letter, *supra* note 26, at 5.

<sup>96</sup> *Id.*

<sup>97</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) nn.(3)a & (9)a.

<sup>98</sup> *Id.*

<sup>99</sup> *Id.* § 1960.1(h)(2) n.(4).

<sup>100</sup> Compare *id.* § 1960.1(h)(2) nn.(4)b-f & (9)b-f with *id.* § 1960.1(h)(2) and table III-4, *infra* app. A. (showing less stringent certification and intermediate in-use NMOG standards for dual-fueled LEVs and ULEVs from 0-14,000 pounds TW when operated on gasoline).

the same CO, NO<sub>x</sub>, HCHO, and PM (if applicable) exhaust emission standards for their alternative fuel and for gasoline as conventional LEVs and ULEVs in the same test weight.<sup>101</sup>

However, manufacturers of medium-duty LEVs and ULEVs in the 8501–14,000 pounds TW were given some flexibility under the regulations. Manufacturers of gasoline engines used in incomplete MDVs—typically an incomplete chassis and an engine that can be used for a variety of MDVs including delivery vans, large pick-up trucks, and motor homes<sup>102</sup>—and diesel MDVs were given the option of certifying their engines to the heavy-duty engine standards and engine dynamometer test procedures.<sup>103</sup> These optional exhaust emission standards appear in table III–5, appendix A. For MDVs tested and certified under this option, the 50,000 and 120,000 mile standards for medium-duty LEVs and ULEVs, and the corresponding test procedures for certification and in-use compliance do not apply, unless manufacturers opt to apply them using approved correlation factors.<sup>104</sup> Manufacturers certifying MDV engines under this option use one of two separate engine test procedures under Section 1956.8(c) for Title 13, California Code of Regulations.<sup>105</sup>

### C. *Small Volume Manufacturers*

The California LEV regulations provide various temporary or permanent exemptions, or other special considerations, to small volume manufacturers. Generally, the regulations define small volume manufacturers as: those with California sales of new vehicles not exceeding 3000 units the preceding year; those with projected first-time sales in California not exceeding 3000; or those that were subject to the “standards in lieu of” provision of CAA § 202(b)(1)(B).<sup>106</sup> However, a few variations of the general definition, for the most part more lenient, appear throughout the regulations.

As discussed above, average sales of 3000 or fewer new light- and medium-duty vehicles from 1992 to 1994 would qualify a manufacturer

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<sup>101</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I–5.

<sup>102</sup> See MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, STAFF REPORT: INITIAL STATEMENT OF RULEMAKING; PROPOSED AMENDMENTS TO LOW-EMISSION VEHICLE REGULATIONS 18 (Aug. 11, 1995), available in <<http://www.arb.ca.gov>> [hereinafter 1995 STAFF REPORT: LEV RULEMAKING].

<sup>103</sup> CAL. CODE REGS. tit. 13, §§ 1956.8(h) n.A, 1960.1(h)(2) n.(8).

<sup>104</sup> See *id.* §§ 1956.8(h) n.A, 1960.1(h)(2) n.(8), 2139(c)(2).

<sup>105</sup> *Id.* § 1960.1(h)(2) n.(8).

<sup>106</sup> *Id.* § 1960.1(n).

as small volume for purposes of the medium-duty LEV and ULEV exhaust emissions requirements.<sup>107</sup> A manufacturer meeting that definition could avail itself of an initial exemption—until 2001 and later model years—from both the medium-duty LEV and the ULEV requirements. In model year 2001 small volume manufacturers must produce one hundred percent LEVs, but they continue to be exempt, if they wish, from the progressive requirement to certify, produce, and distribute medium-duty ULEVs.<sup>108</sup> Under the general definition, a manufacturer would not meet the small volume manufacturer criteria in a model year succeeding a year of California new vehicle sales at or above 3001. Under the medium-duty LEV and ULEV variation, the same manufacturer would have to experience average new light- and medium-duty vehicle sales in California greater than 3000 based on three consecutive model years' sales.<sup>109</sup> Once this occurs, the manufacturer loses small volume manufacturer treatment and is subject to the medium-duty LEV and ULEV requirements in “the fourth model year”—the model year after the three consecutive model years with sales greater than 3000.<sup>110</sup> Conversely, under the general definition a manufacturer would be able to demand treatment as a small volume manufacturer in the model year after a year of 3000 or less new vehicle sales in California. For purposes of the medium-duty LEV requirements, however, a manufacturer can not claim small volume manufacturer status until its average California sales of new light- and medium-duty vehicles dips “below 3,000” for three consecutive model years.<sup>111</sup> Once this occurs, the manufacturer is treated as a small volume manufacturer “with the next model year.”<sup>112</sup> Thus, it takes a manufacturer three consecutive model years of sales greater than 3000 units to lose, and three consecutive model years of sales at, or below, 3000 units to gain, or regain, small-volume status.<sup>113</sup>

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<sup>107</sup> See *supra* note 93 and accompanying text.

<sup>108</sup> See CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(16)b.

<sup>109</sup> *Id.* § 1960.1(h)(2) n.(16)c.

<sup>110</sup> *Id.* § 1960.1(h)(2) n.(16)d.

<sup>111</sup> See *id.* § 1960.1(h)(2) n.(16)e. A subtle difference in the threshold number appears in this note and in its kindred note under § 1960.1(g)(2). Cf. *id.* § 1960.1(g)(2) n.(6)e. Small volume manufacturers retain their status by having new vehicle sales in California during the applicable period equal to or less than 3000 units. See *id.* § 1960.1(g)(2) n.(6), 1960.1(h)(2) n.(16). Conversely, a manufacturer of greater than 3000 units must attain average sales under 3000 units during the applicable period.

<sup>112</sup> See *id.* § 1960.1(h)(2) n.(16)e.

<sup>113</sup> See CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(16)c, e.

Small volume manufacturers receive a temporary waiver—from model year 1994 through model year 1999—of the fleet average NMOG exhaust emission requirements for passenger cars and light-duty vehicles.<sup>114</sup> Beginning in model year 2000, small volume manufacturers become subject to special fleet average NMOG values that range from one percent to seventeen percent less stringent than the values required of larger manufacturers.<sup>115</sup> Unlike the general definition, for purposes of this section, a small volume manufacturer means one with average sales in California of new light- and medium-duty vehicles, from model years 1989 to 1991, equal to or less than 3000 units.<sup>116</sup> Like the medium-duty LEV requirements, a manufacturer will lose small volume treatment after average California sales exceed 3000 units for three consecutive model years.<sup>117</sup> Once this occurs, the manufacturer is subject to the larger manufacturers' fleet average NMOG requirements in "the fourth model year," the model year after the three consecutive model years with sales greater than 3000 units.<sup>118</sup> Over the three consecutive, intervening years, the manufacturer could regain small-volume status by having average California sales of light- and medium-duty vehicles below 3000 units.<sup>119</sup>

Finally, and perhaps most importantly, small volume manufacturers will not be required to comply with the ZEV mandate. Nonetheless, if they choose to certify, produce, and deliver ZEVs for sale in California, they will earn marketable credits.<sup>120</sup>

#### D. *Debits and Credits*

The California LEV regulations for passenger cars and light-duty trucks provide for the accumulation of marketable credits for both the fleet average NMOG requirements, including additional NMOG cred-

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<sup>114</sup> See *id.* § 1960.1(g)(2) nn.(6) & (7).

<sup>115</sup> In 2000 and subsequent model years, they must meet fleet average NMOG values of 0.075 g/mi for passenger cars and light-duty trucks 0–3750 pounds LVW and 0.100 g/mi for light-duty trucks 3751–5750 pounds LVW. See *id.* § 1960.1(g)(2) n.(6)b–c. The comparable fleet average NMOG value for larger manufacturers is 0.073 to 0.062 g/mi and 0.099 to 0.093 g/mi, respectively. See *infra* table III–2, app. A.

<sup>116</sup> See *id.* § 1960.1(g)(2) n.(6). Projected sales will be used to determine small volume manufacturer status for manufacturers certifying for the first time in California. See *id.*

<sup>117</sup> See *id.* § 1960.1(g)(2) n.(6)d.

<sup>118</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(6)d (1996).

<sup>119</sup> See *id.* § 1960.1(g)(2) n.(6)e. Average sales of light- and medium-duty vehicles in California below 3000 units for three consecutive years entitles the manufacturer to avail itself of small volume treatment commencing with the next model year. See *id.*

<sup>120</sup> See *id.* § 1960.1(g)(2) n.(9)f.



its for hybrid electric vehicles (HEVs),<sup>121</sup> and the ZEV mandate.<sup>122</sup> The regulations for medium-duty vehicles create a marketable credit system for manufacturers that produce ZEVs, or that produce HEVs, or more LEVs and ULEVs than required in a particular model year.<sup>123</sup>

### 1. Passenger Cars and Light-Duty Trucks: Fleet Average NMOG Credits

For the fleet average NMOG requirements, the regulations set up a system providing for debits and credits for each covered manufacturer.<sup>124</sup> Any credits earned may be held for future use—"banked internally"—or traded or sold to another manufacturer.<sup>125</sup> Although the fleet average NMOG requirement did not become effective until model year 1994, manufacturers became eligible to accumulate fleet average NMOG credits in the 1992 and 1993 model years.<sup>126</sup> Manufacturers that sold new conventional vehicles in California, during those two model years, that were certified as meeting the phase-in exhaust emission standards of the regulations could earn emissions credits.<sup>127</sup> Manufacturers would earn credits for passenger cars and light-duty trucks 0–3750 pounds LVW for 1992 and 1993 by attaining fleet average NMOG values below 0.390 and 0.334 g/mi NMOG, respectively.<sup>128</sup> Manufacturers could also earn credits during model years 1992 and

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<sup>121</sup> HEVs "are battery-powered vehicles that use a small combustion engine for additional range." 1990 STAFF REPORT, *supra* note 18, at 25. Such vehicles typically use an internal combustion engine (ICE) called an auxiliary power unit (APU), to provide the extended range. MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, PRELIMINARY DRAFT STAFF REPORT: PROPOSED AMENDMENTS TO THE LOW-EMISSION VEHICLE REGULATIONS TO ADD AN EQUIVALENT ZERO-EMISSION VEHICLE (EZEV) STANDARD AND ALLOW ZERO-EMISSION VEHICLE CREDIT FOR HYBRID-ELECTRIC VEHICLES 5 (July 14, 1995), available in <<http://www.arb.ca.gov>> [hereinafter 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS].

<sup>122</sup> See CAL. CODE REGS. tit. 13, § 1960.1(g)(2) nn.(7)–(9).

<sup>123</sup> See *id.* § 1960.1(h)(2) n.(12).

<sup>124</sup> See *id.* § 1960.1(g)(2) nn.(7)–(8).

<sup>125</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-14; see CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7)b.

<sup>126</sup> See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-13; CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(8).

<sup>127</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(8). The phase-in standard was 0.25 g/mi of NMHC and was identical to the 1995 and subsequent model year NMHC standard for conventional passenger cars and light-duty trucks 0–3750 pounds LVW. See *id.* § 1960.1(f)(1), 1960.1(f)(2). A manufacturer could also earn credits in the 1992 and 1993 model years for producing and delivering new conventional vehicles certified to the 1995 and later model year exhaust emission standards of § 1960.1(f)(2). See *id.* §§ 1960.1(f)(2), 1960.1(g)(2) n.(8).

<sup>128</sup> *Id.* § 1960.1(g)(2) n.(8)a. For light-duty trucks 3571–5750 pounds LVW, the manufacturer would earn credits by attaining fleet average values of less than 0.500 g/mi NMOG in model year 1992 and less than 0.428 g/mi in 1993. See *id.* § 1960.1(g)(2) n.(8)b.

1993 by producing and delivering new vehicles in California certified as TLEVs, LEVs, ULEVs, or ZEVs.<sup>129</sup> Credits “could be used to offset requirements” in the other class of light-duty vehicle.<sup>130</sup> The value of these credits, as well as credits earned in later years, is expressed in units of g/mi NMOG.<sup>131</sup> Such credits would also be subject to the same discount schedule as credits earned and banked during the 1994 and later model years.<sup>132</sup> Banked credits decline to fifty percent of their original value “at the beginning of the second model year after being earned.”<sup>133</sup> Unused credits held beyond the beginning of the third model year after they were earned drop to twenty-five percent of their original value and become worthless if they are not used by the beginning of the fourth model year after being earned.<sup>134</sup> A manufacturer calculates its fleet average NMOG value, beginning model year 1992, for passenger cars (PCs) and light-duty trucks (LDTs) 0–5750 pounds LVW it produced and delivered for sale in California.<sup>135</sup>

<sup>129</sup> See *id.* § 1960.1(g)(1), 1960.1(g)(2) n.(8).

<sup>130</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I–14; see CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7)a (stating that credits or debits earned during any model year for PCs and LDTs 0–3750 lbs LVW and for LDTs 3751–5750 pounds LVW must be added together).

<sup>131</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7). The manufacturer determines its g/mi NMOG credits or debits (debits are identical to “negative credits”) by subtracting its fleet average NMOG value for the model year from that year’s fleet average NMOG requirement, and by multiplying that number by the total number of vehicles, including ZEVs and HEVs, it produced and delivered for sale in California. See *id.* § 1960.1(g)(2) n.(7), (7)(a). Any emission credits earned during the 1992 and 1993 model years would be deemed to be earned in the 1994 model year. See *id.* § 1960.1(g)(2) n.(8).

<sup>132</sup> *Id.*

<sup>133</sup> *Id.* § 1960.1(g)(2) n.(7)d. Retained credits maintain full value throughout the model year after the one in which they were earned. See *id.*

<sup>134</sup> See *id.*

<sup>135</sup> See *id.* § 1960.1(g)(2) nn.(4)–(5). The fleet average NMOG is determined by the following calculations:

([Total conventional PCs and LDTs certified to the 1989 through 1994 exhaust emission standards of section 1960.1(e)(1)] x [the applicable NMHC standard of 0.39 or 0.50]) + ([Total conventional PCs and LDTs certified to the 1993 through 1994 phase-in exhaust emission standards of section 1960.1(f)(1)] x [the applicable phase-in NMHC standard of 0.25 or 0.32]) + ([Total conventional PCs and LDTs certified to the 1995 and later model year exhaust emission standards of section 1960.1(f)(2)] x [0.25]) + ([Total PCs and LDTs 0–3750 pounds LVW certified to federal Tier 1 exhaust emission standards] x [0.25 or 0.32]) + ([Total TLEVs, LEVs, and ULEVs, not including HEVs, certified to the exhaust emission standards of section 1960.1(g)(1)] x [0.125 for TLEVs, 0.075 for LEVs, and 0.040 for ULEVs]) + (the HEV contribution factor) / (Total number of vehicles certified, produced, and delivered for sale in California, including ZEVs and HEVs).

See *id.*

a. *The HEV Contribution Factor*

The HEV contribution factor, included in the fleet average, means “the NMOG emission contribution of HEVs to the fleet average NMOG value.”<sup>136</sup> The California LEV regulations specifically recognize only three types of HEVs—types A, B, and C—for each emission category of LEV for PCs and LDTs 0–3750 pounds LVW, LDTs 3751–5750 pounds LVW, and MDVs. Type A HEVs must attain at least a range of sixty miles on the California “All-Electric Range Test (AERT).”<sup>137</sup> Type A HEVs also include vehicles that, although they have zero exhaust emissions, have fuel-fired heaters and are not certified as ZEVs.<sup>138</sup> Type B HEVs must accomplish a range of forty to fifty-nine miles in the AERT, while Type C HEVs cover all remaining HEVs—HEVs with an all-electric range of zero to thirty-nine miles.<sup>139</sup> Manufacturers calculate the HEV contribution factor for PCs and LDTs 0–5750 pounds LVW in the TLEV, LEV, and ULEV emission categories by multiplying the total number of each type in each emission category certified, produced, and delivered for sale in California by the applicable g/mi NMOG standard.<sup>140</sup>

To obtain a g/mi NMOG standard for the HEV contribution factor, first the emissions from the vehicle’s auxiliary power unit (APU) must be certified to meet one of the LEV standards under conditions simulating worst-case vehicle operating conditions.<sup>141</sup> Type C HEVs receive no additional NMOG credit. They receive the same g/mi NMOG as conventional LEVs.<sup>142</sup> However, Types A and B HEVs receive an additional NMOG credit, through the use of an adjusted NMOG value,

<sup>136</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(4)a.

<sup>137</sup> *See id.* § 1960.1(g)(2) n.(3).

<sup>138</sup> *See id.* § 1960.1(g)(2) n.(3)a.

<sup>139</sup> *See id.* § 1960.1(g)(2) n.(3).

<sup>140</sup> *See id.* § 1960.1(g)(2) n.(4)a. For example, a manufacturer would calculate the HEV contribution factor for PCs and LDTs 0–3750 pounds LVW as follows:

$$\begin{aligned} \text{HEV contribution factor} = & ([\text{No. of “Type A HEV” TLEVs Produced}] \times (0.100) + [\text{No.} \\ & \text{of “Type B HEV” TLEVs Produced}] \times (0.113) + [\text{No. of “Type C HEV” TLEVs} \\ & \text{Produced}] \times (0.125)) + ([\text{No. of “Type A HEV” LEVs Produced}] \times (0.057) + [\text{No. of} \\ & \text{“Type B HEV” LEVs Produced}] \times (0.066) + [\text{No. of “Type C HEV” LEVs Produced}] \\ & \times (0.075)) + ([\text{No. of “Type A HEV” ULEVs Produced}] \times (0.020) + [\text{No. of “Type B} \\ & \text{HEV” ULEVs Produced}] \times (0.030) + [\text{No. of “Type C HEV” ULEVs Produced}] \times \\ & (0.040)). \end{aligned}$$

*See id.*

<sup>141</sup> 1990 STAFF REPORT, *supra* note 18, at 25; TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at 1–21.

<sup>142</sup> *See* table III–1, *infra* app. A; 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121, at 5.

based on a predetermined differential between the certified standard and the next, more stringent, standard.<sup>143</sup> The adjusted NMOG value for Type A HEVs equals the certified NMOG standard “minus one-half the difference between that standard and the NMOG standard which is one level more stringent.”<sup>144</sup> The adjusted NMOG value for Type B HEVs equals one-fourth the difference between the certified NMOG standard and the next most stringent standard.<sup>145</sup> Thus Types A and B HEVs receive additional NMOG credits by the application of a g/mi NMOG emissions level that is slightly lower than the emissions level they were certified as meeting.

To calculate credits or debits, the manufacturer first subtracts its fleet average NMOG sum from the fleet average NMOG requirement. Then the manufacturer multiplies this figure by the total number of vehicles it produced and delivered for sale in California.<sup>146</sup> If this calculation results in negative credits, the manufacturer receives an equivalent amount of debits expressed in units of g/mi NMOG.<sup>147</sup> Manufacturers with debits, as a general rule, must make up the deficit by the end of the next model year.<sup>148</sup> However, manufacturers may carry a deficit forward during model years 1994 through 1997. A deficit incurred during this period must either be erased within three model years of its accumulation or by the end of model year 1998, whichever occurs sooner.<sup>149</sup> Manufacturers that do not equalize debits by the applicable deadline will suffer the civil penalties discussed below.

## 2. Passenger Cars and Light-Duty Trucks: ZEV Credit Banking and Trading System

For the ZEV mandate, the California LEV regulations established a credit banking and trading system to provide manufacturers a flexible means of compliance.<sup>150</sup> For instance, manufacturers may fulfill their ZEV production percentage requirements by submitting ZEV credits acquired from another manufacturer.<sup>151</sup> The CARB also designed the credit system to provide manufacturers an incentive to

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<sup>143</sup> See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-21.

<sup>144</sup> See *id.*

<sup>145</sup> See *id.*

<sup>146</sup> See *supra* text accompanying notes 106—14.

<sup>147</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7)a (1996).

<sup>148</sup> *Id.* § 1960.1(g)(2) n.(7)b; CARB Letter, *supra* note 26, at 4.

<sup>149</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7)b; CARB Letter, *supra* note 26, at 4.

<sup>150</sup> CARB Letter, *supra* note 26, at 13.

<sup>151</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)b.

produce ZEVs earlier or in higher numbers.<sup>152</sup> Manufacturers earn ZEV credits expressed in units of g/mi NMOG for making more ZEVs than required in a given model year.<sup>153</sup> A manufacturer may use ZEV credits earned in an earlier model year to help meet its ZEV requirement for a given model year, or sell them to another manufacturer.<sup>154</sup> ZEV credits earned prior to the 1998 mandatory fixed percentage requirement will be deemed to be earned during the 1998 model year.<sup>155</sup> The credits earned before the 1998 model year will be discounted according to the same schedule as fleet average NMOG emission credits.<sup>156</sup> Manufacturers calculate ZEV credits by first subtracting the number of ZEVs required to be produced for the model year from the number produced and delivered for sale in California.<sup>157</sup> Then the manufacturers multiply the result by the fleet average requirement for passenger cars and light-duty trucks 0–3750 pounds LVW for the model year.<sup>158</sup> Manufacturers may include ZEVs they certify and deliver for sale in California in the light-duty trucks 3751–5750 pounds LVW classification and in the medium-duty vehicle classification in the foregoing calculation for ZEV credits.<sup>159</sup> Manufacturers that fail to, or choose not to, produce enough ZEVs to meet the model year requirement must submit ZEV credits sufficient to make up the deficit by the end of the following model year.<sup>160</sup> Manufacturers calculate the number of ZEV credits they must submit to the CARB Executive Officer by first subtracting the number of ZEVs produced from the number of ZEVs required for the model year.<sup>161</sup> Next the manufacturers multiply this figure by the fleet average NMOG requirement for passenger cars and light-duty trucks 0–3750 pounds LVW to determine the number of ZEV credits they must make up.<sup>162</sup>

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<sup>152</sup> 1990 STAFF REPORT, *supra* note 18, at 26.

<sup>153</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.

<sup>154</sup> *See id.* § 1960.1(g)(2) n.(9)b–c.

<sup>155</sup> *Id.* § 1960.1(g)(2) n.(9)a.

<sup>156</sup> *See id.* Under the fleet average discounting schedule, ZEV credits earned prior to the 1998 model year retain their full value through model year 1999. *See id.* § 1960.1(g)(2) n.(7)c. Any of the pre-1998 model year credits held until the beginning of model year 2000 retain only 50% of their original value. *See id.* § 1960.1(g)(2) n.(7)d. If any of these credits are held until the beginning of model year 2001, they drop to 25% of their value. *See id.* They become worthless if held to the beginning of model year 2002, the fourth model year after they were deemed earned. *See id.*

<sup>157</sup> *Id.* § 1960.1(g)(2) n.(9)a.

<sup>158</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.

<sup>159</sup> *Id.* § 1960.1(g)(2) n.(9)e.

<sup>160</sup> *Id.* § 1960.1(g)(2) n.(9)c.

<sup>161</sup> *Id.*

<sup>162</sup> *Id.*

Manufacturers that fail to produce enough ZEVs, or ZEV credits, or both for a particular model year by the applicable deadline will suffer civil penalties, as discussed below. It appears ZEV credits earned in 1998 or subsequent model years retain their full original value, and will not be discounted like fleet average NMOG credits for passenger cars and light-duty trucks or vehicle equivalent credits (VECs) for medium-duty vehicles.<sup>163</sup>

### 3. Medium-Duty Vehicles: Vehicle Equivalent Credits (VECs)

For medium-duty vehicles, the California LEV regulations create a system of trading ratios and marketable credits.<sup>164</sup> The credits are called vehicle equivalent credits (VECs) and, unlike the fleet average NMOG and ZEV credits for light-duty vehicles, they are expressed in numbers of LEVs, ULEVs, and ZEVs.<sup>165</sup> Although the requirements for LEV and ULEV medium-duty vehicles do not begin until model year 1998, manufacturers could begin earning VECs as early as model year 1992.<sup>166</sup> All VECs earned prior to model year 1998 become treated as though they were earned in model year 1998.<sup>167</sup> The medium-duty vehicle credit system assigns constant ratios, or coefficients, to the various emission categories of LEVs, including HEVs and ZEVs.<sup>168</sup> These coefficients range from a low of 1.1 for a medium-duty "Type B HEV" LEV to a high of 2.0 for medium-duty ZEVs.<sup>169</sup> Manufacturers calculate whether they met the requirements, earned VECs, or accumulated vehicle equivalent debits (VEDs), by summing

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<sup>163</sup> Compare CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a-g (containing only a requirement that ZEV credits earned prior to model year 1998 be discounted like fleet average NMOG credits) with *id.* § 1960.1(g)(2) n.(7)c-d (stating that fleet average NMOG emission credits retain full value in the model year following the year in which they were earned, but decline to 50% of their value in the next model year and to 25% of their value in the third model year) and *id.* § 1960.1(h)(2) n.(12)c-e (containing discount provisions in notes (12)c and (12)d regarding MDV VECs virtually identical to § 1960.1(g)(2) n.(7)c-d; and containing a provision in note e that treats credits earned prior to model year 1998 as earned in 1998 and discounts them per note (12)d).

<sup>164</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-16 to I-17.

<sup>165</sup> See CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12); TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-17 to I-18.

<sup>166</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12).

<sup>167</sup> *Id.* § 1960.1(h)(2) n.(12)e. VECs retain their full value through the end of the model year following the year in which they were earned. See *id.* § 1960.1(h)(2) n.(12)c. They drop to 50% of their value in the next model year, decline to 25% of their original value in the third model year, and become worthless if held until the beginning of the fourth model year. See *id.* § 1960.1(h)(2) n.(12)d.

<sup>168</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-17.

<sup>169</sup> See CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12); TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-17.

each category of medium-duty LEVs delivered for sale in California, multiplying the category total by the applicable ratio, and subtracting the equivalent number of vehicles required to be produced for each category.<sup>170</sup>

If the manufacturer's calculations result in zero, it satisfied the LEV and ULEV requirements for the model year.<sup>171</sup> If calculations result in a negative number, the manufacturer produced fewer LEVs and ULEVs than required and must make up the VEDs by the end of the next model year with offsetting VECs.<sup>172</sup> To equalize the VEDs, the manufacturer may earn extra VECs in the following model year, use VECs earned in a previous model year, or acquire them from another manufacturer, or any combination of these options.<sup>173</sup> A manufacturer that fails to equalize the debits in the allotted time will suffer the civil penalties discussed below.<sup>174</sup>

### E. Civil Penalties

A manufacturer's failure to meet any one of the three basic requirements of the California LEV regulations discussed above triggers the same type of civil penalty. Violation of any one of the requirements invokes the penalty that applies when a manufacturer sells a new motor vehicle in the state that does not meet emissions standards adopted by the CARB.<sup>175</sup> The California LEV regulations set forth when a violation is deemed to occur and how to determine the number of vehicles involved for purposes of applying the civil penalty found in California Health and Safety Code Section 43211.<sup>176</sup> A manufacturer's sale of a new motor vehicle that fails to comply with California

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<sup>170</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12). A manufacturer calculates VECs, or VEDs, as follows:

$$\begin{aligned} & \{[(\text{No. of LEVs Produced excluding HEVs}) + (\text{No. of "Type C HEV" LEVs Produced})] \\ & + [(\text{No. of "Type B HEV" LEVs Produced}) \times (1.1)] + [(\text{No. of "Type A HEV" LEVs Produced}) \times (1.2)] - [(\text{Equivalent No. of LEVs Required to be Produced})]\} + \{[(\text{No. of ULEVs Produced excluding HEVs}) \times (1.4)] + [(\text{No. of "Type C HEV" ULEVs Produced}) \times (1.4)] + [(\text{No. of "Type B HEV" ULEVs Produced}) \times (1.5)] + [(\text{No. of "Type A HEV" ULEVs Produced}) \times (1.7)] - [(\text{Equivalent No. of ULEVs Required to be Produced}) \times (1.4)]\} + [(\text{No. of ZEVs Produced as MDVs}) \times (2.0)]. \end{aligned}$$

*Id.*

<sup>171</sup> See TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-17.

<sup>172</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12), (12)b.

<sup>173</sup> *Id.*

<sup>174</sup> *Id.*

<sup>175</sup> See *id.* §§ 1960.1(g)(2) n.(7)b, 1960.1(g)(2) n.(9)d, 1960.1(h)(2) n.(12)b.

<sup>176</sup> *Id.*

emission standards triggers a civil penalty of five thousand dollars (\$5,000) for each occurrence.<sup>177</sup>

### 1. Medium-Duty Vehicles

For the medium-duty LEV and ULEV requirements, the civil penalty provision is triggered when a manufacturer fails to equalize VEDs by the end of the model year after they were accrued.<sup>178</sup> When this occurs, each VED becomes equivalent to a vehicle that fails to meet the CARB's emission standards.<sup>179</sup> Thus, each unequalized VED at the end of the model year following the one in which it was earned becomes a \$5,000 liability to the manufacturer still holding it. The civil penalty applicable to an unequalized VED will probably tend to, at least indirectly, establish an upper limit on the value of VECs. It seems that manufacturers will only be willing to pay a per unit price for VECs that costs somewhat less than the total cost of unequalized VEDs, any court costs, and attorneys' fees.

### 2. Passenger Cars and Light-Duty Trucks

For the fleet average requirements for passenger cars and light-duty trucks 0–3750 pounds LVW, the cause of action also arises if debits are not made up by the end of the following model year, beginning in model year 1998.<sup>180</sup> Before model year 1998, manufacturers may take up to three years to equalize debits, or make them up before the end of model year 1998. To figure the civil penalty for manufacturers that fail to equalize these debits before the required deadline, one divides the g/mi NMOG debit total by the g/mi fleet average requirement for the model year in which the debits accrued.<sup>181</sup>

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<sup>177</sup> CAL. HEALTH & SAFETY CODE § 43211 (West 1996). Any penalties recovered under this provision are to be “deposited into the General Fund.” *Id.* The CARB is required to enforce this civil penalty provision, and it “may be enforced by the Department of the California Highway Patrol, the Department of Motor Vehicles, and the bureau.” *Id.* § 43213. The CARB also may seek injunctive relief in a civil court action, brought on behalf of the people of the State of California, for a violation of any of the vehicular pollution control provisions in the California Health and Safety Code or of any CARB order, rule, or regulation. *See id.* § 43017.

<sup>178</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12)b.

<sup>179</sup> *Id.*

<sup>180</sup> *Id.* § 1960.1(g)(2) n.(7)b.

<sup>181</sup> *Id.* As stated previously, in order to calculate debits, the manufacturer subtracts its g/mi fleet average NMOG value from the fleet average NMOG requirement and multiplies that figure by the total number of vehicles certified, produced, and delivered for sale in California. Also, in order to determine its fleet average NMOG value a manufacturer adds the HEV contribution factor and the total number of each category of vehicle it delivered for sale in California



For illustrative purposes, take manufacturer X, which in model years 1997 and 1998 certifies, produces, and delivers 50,000 total vehicles for sale in California each year. In both years manufacturer X produced no HEVs or vehicles certified to federal Tier 1 exhaust emission standards, and its California vehicles were exclusively passenger cars and light-duty trucks 0-3750 pounds LVW. In 1998 manufacturer X's California passenger car and light-duty truck sales fleet breaks down as follows: 1,000 ZEVs (2% of the total); 2,000 ULEVs (4% of the total); 20,000 LEVs (40% of the total); and 27,000 conventional vehicles (54% of the total). Manufacturer X calculates its model year 1998 fleet average NMOG as follows:  $(2,000 \times 0.040) + (20,000 \times 0.075) + (27,000 \times 0.25) / 50,000 = 0.167 \text{ g/mi}$ .<sup>182</sup> Since its 0.167 g/mi fleet average NMOG exceeds the model year 1998 requirement of 0.157 g/mi by 0.010 g/mi, manufacturer X would calculate its negative credits as follows:  $(0.157 - 0.167) \times 50,000 = -500$  (500 debits).<sup>183</sup> Assuming manufacturer X fails to eradicate any of these debits before the end of model year 1999, it would become subject to the civil penalty discussed above. Manufacturer X's vehicles for purposes of the civil penalty would equate to the above debits divided by the fleet average NMOG requirement for model year 1998:<sup>184</sup>  $500 \times 0.157 = 3185$ . The applicable civil penalty, then, would be calculated by multiplying the representational number of vehicles above by the \$5,000 per vehicle penalty:<sup>185</sup>  $3185 \times \$5,000 = \$15,925,000.00$ .

### F. *The Biennial Review Mechanism*

#### 1. Technological Feasibility and Cost-Effectiveness

In its initial report on the proposed LEV regulations, the CARB staff acknowledged that, except for TLEVs, some of the new and in-use standards proposed for all classes of LEVs surpassed then-current feasible technology.<sup>186</sup> Due to the technology-forcing aspects of the LEV regulations, especially the far-reaching ZEV mandate, the CARB staff stated it would work closely with the vehicle and fuel

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multiplied by the appropriate NMOG emission standard, and then divides the sum by the total number of vehicles it produced and delivered for sale in California, including ZEVs and HEVs.

<sup>182</sup> See *id.* § 1960.1(g)(2) n.(4).

<sup>183</sup> See CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7).

<sup>184</sup> *Id.* § 1960.1(g)(2) n.(7)b.

<sup>185</sup> See CAL. HEALTH & SAFETY CODE § 43211 (West 1996).

<sup>186</sup> See 1990 STAFF REPORT, *supra* note 18, at 32-33.

industries to identify any appropriate changes to the regulations.<sup>187</sup> In this regard, the staff recommended that it conduct a biennial review of the LEV program, and report its findings to the CARB.<sup>188</sup> In turn, the CARB directed, through resolution 90–58, the CARB Executive Officer to review and report on the status of the program’s implementation biennially in public hearings before the CARB, beginning with the spring of 1992.<sup>189</sup> The CARB anticipated that some of the technology-forcing standards adopted in the program were potentially subject to challenge or denial of the waiver of federal preemption under the consistency requirements of CAA Section 202(a).<sup>190</sup> It determined, however, that the lead-time built into the regulations in conjunction with a biennial review mechanism designed to flush-out and modify any major problem areas would meet the requirements of CAA Section 202(a) and the case law interpreting its application.<sup>191</sup> In their consolidated comments on CARB’s request for waiver of federal preemption,<sup>192</sup> the Motor Vehicle Manufacturers Association of the United States, Inc., (MVMA) and the Association of International Automobile Manufacturers, Inc., (AIAM) argued that the technology-forcing standards in the LEV portion of the LEV/CFP program were inconsistent with CAA Section 202(a), because they were not “technologically feasible and commercially practicable within the time allowed by CARB for compliance.”<sup>193</sup> These industry associations contended in

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<sup>187</sup> *Id.* at 11.

<sup>188</sup> *Id.*

<sup>189</sup> Board Resolution 90–58 (Sept. 28, 1990) (on file with the EPA Air Docket, Docket No. A–91–71); CARB Letter, *supra* note 26, at 13.

<sup>190</sup> See CARB Letter, *supra* note 26, at 11–14 (arguing that biennial review coupled with regulations’ flexibility—the credit banking and trading provisions, fleet average requirements, and initial, less stringent in-use standards—demonstrated consistency for technological feasibility purposes); see also 1990 STAFF REPORT *supra* note 18, at 11, 32–33 (recommending biennial review to implement necessary changes, and citing adequate lead time for technological innovations). Under 42 U.S.C. § 7543, the Administrator must grant a waiver of federal preemption for new motor vehicle emissions standards adopted by California if: (1) California did not arbitrarily and capriciously determine that the standards are as protective of human health as the applicable federal standards; (2) California has compelling reasons for its own standards; and (3) the California standards are not inconsistent with 42 U.S.C. § 7521(a). See 42 U.S.C. § 7543(b) (1994). To be consistent with 42 U.S.C. § 7521(a), the regulations must provide adequate lead time for development of the technology to meet the standards. See 42 U.S.C. § 7521(a)(2); 58 Fed. Reg. 4166 (1993).

<sup>191</sup> CARB Letter, *supra* note 26, at 11–14 (citing *NRDC v. EPA*, 655 F.2d 318 (D.C. Cir. 1981); *International Harvester Co. v. Ruckelshaus*, 478 F.2d 615 (D.C. Cir. 1973)).

<sup>192</sup> See *supra* notes 20–22 and accompanying text.

<sup>193</sup> Letter from Motor Vehicle Manufacturers Association of the United States, Inc., (MVMA) and the Association of International Automobile Manufacturers, Inc., (AIAM) to the Honorable

the joint letter that the CARB, by adopting the biennial review mechanism, was “[i]mplicitly conceding the unproven nature of its technological assumptions . . . .”<sup>194</sup> The associations argued that the biennial review mechanism failed to meet the requirements of the *NRDC* decision<sup>195</sup> for at least two reasons.<sup>196</sup> First, they reasoned that CARB’s lack of high-mileage test results or durability data for the electrically-heated catalyst (EHC)—the technology CARB predicted as one of the feasible means for gasoline-powered vehicles to meet the ULEV standards for the 1997 model year<sup>197</sup>—prohibited “meaningful and timely review.”<sup>198</sup> Second, they complained that the timing of the first review left insufficient lead-time “to avoid impermissible economic hardship for the motor vehicle industry and its customers.”<sup>199</sup> At the time, according to the MVMA/AIAM joint letter to the Administrator, the CARB staff had announced that it would not present its first biennial review until “the fall of 1992.”<sup>200</sup> However, before the Administrator acted on the request for waiver, the CARB staff presented its first required biennial review in a public hearing during early June 1992.<sup>201</sup> At the conclusion of the first biennial review, the CARB determined that the program remained technologically feasible within the established lead-time and required no modifications.<sup>202</sup> The Administrator determined that the opponents to the waiver request did not present enough information to persuade him that “the standards are not technologically feasible within the available lead

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William K. Reilly, Administrator, EPA 3 (Jan. 29, 1992) (on file with the EPA Air Docket, Docket No. A-91-71 II-D-01) [hereinafter MVMA/AIAM Letter]. MVMA members included Chrysler; Ford; GM; Honda of America Mfg., Inc.; Navistar International Transportation Corp.; PACCAR, Inc.; and Volvo North America Corp. *See id.* at app. AIAM membership included American Honda Motor Co., Inc.; American Isuzu Motors, Inc.; American Suzuki Motor Corp.; BMW of North America, Inc.; Daihatsu America, Inc.; Fiat Auto U.S.A., Inc.; Hyundai Motor America; 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, USA, Inc.; Volkswagen of America, Inc.; Volvo North America Corp.; and Yugo America, Inc. *See id.*

<sup>194</sup> *See id.* at 5.

<sup>195</sup> *See NRDC v. EPA*, 655 F.2d 318, 318 (D.C. Cir. 1981).

<sup>196</sup> *See MVMA/AIAM Letter*, *supra* note 193, at 5.

<sup>197</sup> *See CARB Letter*, *supra* note 26, at 13; 1990 STAFF REPORT, *supra* note 18, at 33.

<sup>198</sup> MVMA/AIAM Letter, *supra* note 193, at 5.

<sup>199</sup> *Id.* at 5-6 (citing *NRDC v. EPA*, 655 F.2d at 330).

<sup>200</sup> *See id.* at 5 (quoting CARB Mail-Out 92-03, at 1 (Jan. 15, 1992)).

<sup>201</sup> 1994 STAFF REPORT, *supra* note 3, at 1.

<sup>202</sup> *Id.* at 17. The CARB made these findings through its adoption of Resolution 92-46 on June 11, 1992. *See id.* at 1.

time, considering costs,” and granted the requested waiver for LEV and ZEV regulations pertaining to light-duty vehicles.<sup>203</sup>

## 2. Adjustments for Maximum Incremental Reactivity (MIR) Procedures and Reactivity Adjustment Factors (RAFTs)

In addition to the biennial review requirement, the CARB recognized that its new two-pronged approach—measuring the full mass of NMOG emissions from gasoline-powered and alternative-fueled vehicles and adjusting for lower ozone reactivity by applying a RAFT—would require further development and implementation.<sup>204</sup> As discussed in Section III.A.2.a. above, the RAFTs equalize the stringency of the NMOG emission standard applicable to the various categories of LEVs by permitting less ozone-reactive-alternative-fueled vehicles to emit up to the gasoline equivalent NMOG standard. The regulations established a complete process for the Executive Director of CARB to promulgate RAFTs through the use of explicit criteria for determining exhaust emission profiles of gasoline-powered and alternative-fueled vehicles, determining reactivity, and calculating RAFTs.<sup>205</sup> These procedures did not require establishment of RAFTs through rulemaking by the CARB.<sup>206</sup> However, since 1991 the CARB has used rulemaking procedures to develop RAFTs and the procedures for calculating them; and it anticipates that all RAFTs will be established through the public rulemaking process.<sup>207</sup>

By 1995, the CARB had established, through rulemaking, a reactivity baseline for gasoline-powered-light-duty TLEVs, LEVs, and ULEVs; a methanol (M85) RAFT for light-duty TLEVs; and RAFTs for Phase 2 reformulated gasoline for light-duty TLEVs and LEVs.<sup>208</sup> This rulemaking approach allows the affected motor vehicle manufacturers, alternative-fuel industry, and others to participate in their development.<sup>209</sup> This part of the California LEV regulations also dem-

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<sup>203</sup> 58 Fed. Reg. 4166 (1993); *supra* note 31.

<sup>204</sup> See CARB Letter, *supra* note 26, at 5; 1990 STAFF REPORT, *supra* note 18, at 18–20; TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at pt. C 1–2, and VI–1 to VIII–4.

<sup>205</sup> CARB Letter, *supra* note 26, at 5. The MVMA and the AIAM also attacked this part of the program as premature because the RAFTs and the procedures to develop them were not final. MVMA/AIAM LETTER, *supra* note 193, at 1–2.

<sup>206</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 6.

<sup>207</sup> See, e.g., *id.* at 6, 53.

<sup>208</sup> Board Resolution 95–40, at 2 (Sept. 28, 1995), available in <<http://www.arb.ca.gov>> [hereinafter Board Resolution 95–40]; 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 9.

<sup>209</sup> See, e.g., 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 9, 11, 13–14. The

onstrates flexibility, by providing motor vehicle manufacturers the option of providing their own RAF for specific engine families and fuels that have no assigned generic RAF, or in lieu of the applicable generic RAF implemented by the CARB.<sup>210</sup>

G. *The Auto Manufacturers' Reaction to Other States'  
Interest in the California LEV Program*

The initial overall reaction of the auto industry was to strongly oppose, or delay, any production quota for ZEVs in California by a certain date.<sup>211</sup> The auto industry not only fought to roll back, or even kill, the ZEV requirements in California, but also vigorously attacked the adoption of the California LEV and ZEV requirements by other states.<sup>212</sup>

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California Natural Gas Vehicle Coalition made conversion vehicles available to the CARB staff to help develop RAFs for natural gas. *Id.* at 9. The Western Propane Gas Association (WPGA) provided conversion vehicles designed to run on liquefied petroleum gas (LPG) to assist the CARB staff's development of a LPG RAF for light-duty vehicles. *Id.* at 11. The American Automobile Manufacturers Association submitted data relevant to the development of the reactivity baseline for medium-duty vehicles and for the RAF for Phase 2 reformulated gasoline. *Id.* at 13.

<sup>210</sup> TECHNICAL SUPPORT DOCUMENT, *supra* note 22, at I-11 to I-12; 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 7, 10.

<sup>211</sup> See, e.g., *Air Resources Board Would Suspend Sales Quotas for ZEVs in 1998, 2001*, 26 *Env't Rep. (BNA) No. 34*, at 1587 (Jan. 5, 1996). Auto manufacturers fought the California ZEV mandate from the time of its adoption in 1990 until 1996 when, in part due to manufacturers' intense lobbying efforts, the CARB relaxed the fixed-percentage requirements. See *id.*; discussion *infra* Section V.F.2.

<sup>212</sup> See, e.g., NADIS & MACKENZIE, *supra* note 5, at 25; MOORE & MILLER, *supra* note 1, at 128-29; Gary Lee, *California Recharges Electric Car Development*, WASH. POST, Apr. 18, 1995, at A1, A8; MVMA/AIAM Letter, *supra* note 193, at 1. Chrysler, Ford, and General Motors (GM), the Big Three, and the other auto manufacturers were not the only opponents of the ZEV mandate in California and elsewhere. The major oil companies; the Western States Petroleum Association; the California Manufacturers Association; the Howard Jarvis Taxpayers Association, United Californians for Tax Reform; the National Tax Limitation Committee; and the Reason Foundation, a libertarian think tank also opposed the ZEV mandate. Howard Fine, *Manufacturers Clash Over State Emissions Mandate*, ORANGE COUNTY BUS. J., June 12, 1995, at 1, available in 1995 WL 8233289. Nevertheless, at the same time they were vehemently opposing any ZEV production quota anywhere in the country, the affected U.S. automakers were hedging, by positioning themselves on both sides of the regulatory fence. The Big Three entered into a cooperative advanced battery research and development effort called the United States Advanced Battery Consortium (USABC). NADIS & MACKENZIE, *supra* note 5, at 78. The USABC includes the U.S. Department of Energy (DOE), the Electric Power Research Institute (EPRI), battery makers, and Southern California Edison. See *id.* The USABC, formed in 1991, committed to spend about \$260 million over the first four years to come up with a better battery for EVs. See *id.* Around the same time, consortia devoted to advanced vehicle or battery development sprang up in Japan, France, and Germany. See VICKI L. BRUCH, SANDIA NATIONAL LABORATORIES FOR THE U.S. DEPARTMENT OF ENERGY, AN ASSESSMENT OF RE-

Not long after the CARB's adoption, the California LEV program attracted the attention of New York and Massachusetts, as well as the Ozone Transport Commission (OTC), a group comprised of twelve northeastern states from Virginia to Maine, including the District of Columbia.<sup>213</sup> In October, 1991, all the OTC members signed a pledge to adopt the California LEV program.<sup>214</sup> Initially, only New York and Massachusetts adopted the California LEV requirements, including the requirement for ZEVs.<sup>215</sup> The other OTC members hesitated, awaiting the outcome of litigation brought by the auto industry.<sup>216</sup> On July 9, 1992, the MVMA and the AIAM filed a complaint in the United States District Court for the Northern District of New York, challenging the adoption of the California LEV regulations by the New York State Department of Environmental Conservation (DEC) and seeking declaratory and injunctive relief against their implementation

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SEARCH AND DEVELOPMENT LEADERSHIP IN ADVANCED BATTERIES FOR ELECTRIC VEHICLES 2 (Feb. 1994) (available from the National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161). In Germany, BMW joined a cooperative effort involving government and industrial partners to build a solar electric plant where it tests its prototype EV and hydrogen-fueled test vehicles. See MOORE & MILLER, *supra* note 1, at 22, 32; NADIS & MACKENZIE, *supra* note 5, at 84-85. Other affected large-volume manufacturers also began individual ZEV research and development efforts. In 1992, Honda reassigned nearly 100 of its engineers, normally assigned to its Formula One Grand Prix efforts, to work on increasing performance and mileage for a battery-powered Honda. MOORE & MILLER, *supra* note 1, at 129. Mazda developed and began testing hydrogen-fueled vehicles. *Id.* at 22; NADIS & MACKENZIE, *supra* note 5, at 84-85. Although EVs are the only feasible technology for ZEVs in the near-term, hydrogen-powered fuel cells show promise for the long-term. 1994 ZEV UPDATE, *supra* note 4, at 1, 8.

<sup>213</sup> See Lee, *supra* note 212, at A1, A8.

<sup>214</sup> Motor Vehicle Mfrs. Ass'n of the U.S., Inc., v. New York State Dep't of Envtl. Conservation, 17 F.3d 521, 530 (2d Cir. 1994) [hereinafter *MVMA III*].

<sup>215</sup> See *MVMA III*, 17 F.3d at 530; Approval and Promulgation of Air Quality Implementation Plans; Commonwealth of Massachusetts; Substitution of the California Low Emission Vehicle Program for the Clean Fuel Fleet Program (Opt Out), 60 Fed. Reg. 6027, 6028 (1995) (to be codified at 40 C.F.R. pt. 52); Approval and Promulgation of Implementation Plans; State of New York; Clean Fuel Fleet Program (Opt Out), 60 Fed. Reg. 2022, 2023 (1995) (to be codified at 40 C.F.R. pt. 52); Lee, *supra*, note 212, at A8. Under CAA § 177, states with nonattainment areas may adopt and enforce California emission standards for new motor vehicles and engines as part of their state implementation plan (SIP). 42 U.S.C. § 7507 (1994). The SIP provisions, however, must meet all three of the following conditions:

- (1) they must be identical to California standards that have received a waiver under CAA § 209(b), 42 U.S.C. § 7543(b);
- (2) both the California standards and the SIP provisions must be adopted at least two years before the model year they affect commences; and
- (3) the adoption of the standards must not, in effect, create a "third vehicle."

*Id.*

<sup>216</sup> See *MVMA III*, 17 F.3d 521, 530.

and enforcement.<sup>217</sup> The district court ruled against the manufacturers on some counts of the complaint. The court initially agreed, however, with the manufacturers' claims that the LEV portion of New York's regulations violated the "third vehicle" prohibition of CAA Section 177 and that the ZEV mandate in the regulations would both create a "third vehicle" and, in effect, limit the sales of other categories of

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<sup>217</sup> Motor Vehicle Mfrs. Ass'n. of the U.S., Inc. v. New York State Dept. of Env'tl. Conservation, 810 F. Supp. 1331, 1335 (N.D.N.Y.) [hereinafter *MVMA I*], modified on reconsideration, 831 F. Supp. 57 (N.D.N.Y. 1993) [hereinafter *MVMA II*], *aff'd in part, rev'd in part*, 17 F.3d 521, 530 (2d Cir.) [hereinafter *MVMA III*], on remand, 869 F. Supp. 1012 (N.D.N.Y.) [hereinafter *MVMA IV*], *aff'd*, 79 F.3d 1298 (2d Cir. 1994) [hereinafter *MVMA V*]. The complaint filed in *MVMA I* by the MVMA and AIAM attacked the validity of the DEC's adoption of the LEV portion of the California LEV/CF regulations on six grounds as follows:

(1) that DEC's failure to adopt the clean fuels part of the California LEV/CF program counted two requirements of CAA § 177: (a) the identical standards requirement (count one of the complaint); and (b) the 'third vehicle' prohibition (count two);

(2) that DEC's adoption of the ZEV requirement of the California LEV program violated two prohibitions of CAA § 177: (a) the prohibition against directly or indirectly limiting the sale of California certified vehicles (count five), and (b) the 'third vehicle' prohibition (count six);

(3) that DEC adopted the California standards before California received the required waiver of federal preemption (count three); and

(4) that DEC failed to comply with the mandatory two year lead-time requirement (count four).

*MVMA I*, 810 F. Supp. at 1335. Regarding the prohibited indirect limitation on the sale of California certified vehicles, the manufacturers contended that the 2% ZEV mandate in 1998 would, in effect, cause them to limit their sales of California certified non-ZEV vehicles to meet the ZEV sales quota. *Id.* at 1346. The manufacturers also argued the ZEV mandate adopted by the DEC violated the "third vehicle" requirement, because New York's climate would require design modifications to California ZEV's to include an enhanced heating system. *Id.* at 1346-47.

The auto manufacturers also sought injunctive and declaratory relief from the United States District Court for the District of Massachusetts, alleging that the adoption of the California LEV program by the Massachusetts Department of Environmental Protection (DEP) failed to meet the requirements of CAA § 177. *American Auto. Mfrs. Ass'n v. Commissioner, Mass. Dept. of Env'tl. Protection*, 31 F.3d 18, 22 (1st Cir. 1994). Like *MVMA I*, the complaint alleged that the DEP's failure to adopt the clean fuels portion of the California LEV program violated the identicality and "third vehicle" prohibition requirements of CAA § 177, the regulations were improperly adopted before California received a federal waiver for the LEV program, and that the lead-time requirement of CAA § 177 prohibited enforcement of the regulations in the 1995 model year. *Id.* The district court denied the manufacturers' request for a preliminary injunction on these grounds and, with the consent of the parties, stayed the summary judgment proceedings. *Id.* The manufacturers appealed the district court's denial of the preliminary injunction, but voluntarily dismissed their identicality, third vehicle prohibition, and improper waiver claims due to the unfavorable holdings in *MVMA III*. *Id.* On the remaining issue of lead-time, the First Circuit Court of Appeals held that the district court's decision to deny the manufacturers injunctive relief from enforcement of the California LEV standards in Massachusetts in the 1995 model year was not an abuse of discretion. *Id.* at 28.

California certified vehicles in violation of CAA Section 177.<sup>218</sup> However, pursuant to the DEC's motion for reconsideration, the district court reversed its ruling that the LEV portion of New York's regulation violated the "third vehicle" prohibition of CAA Section 177, as a matter of law, and ordered that issue to trial on the merits.<sup>219</sup> Both parties appealed the district court's rulings on various counts to the United States Court of Appeals for the Second Circuit.<sup>220</sup> In February, 1994, the court of appeals upheld most portions of New York's regulations, including the part mandating the California ZEV quota beginning in 1998.<sup>221</sup> In light of this decision, the DEC moved the district

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<sup>218</sup> *MVMA I*, 810 F. Supp. at 1343–49. The district court ruled that the DEC's adoption of the California LEV standards before California received a federal waiver was not a violation of CAA § 177. *Id.* at 1347. The court reasoned that New York could adopt the standards before a federal waiver was granted, but simply could not enforce the standards until a model year beginning two years after California received its waiver. *See id.* at 1347–48. Also, the district court held that the DEC's failure to adopt California's clean fuel regulations did not violate the identical standards requirement of CAA § 177, because fuel standards were not emissions standards subject to the "identity" requirement. *Id.* at 1343. However, the court agreed with the manufacturers' claim that the DEC's failure to adopt California's clean fuel requirements would have the effect of creating a third vehicle, because the high sulfur content of fuels in New York would force them to redesign the connections for catalytic converters on California certified vehicles destined for sale in New York and likely force them to have to replace the catalytic converters during the applicable warranty period. *Id.* at 1343–45. Further, the district court held that the DEC's adoption of the ZEV mandate, given New York's lack of incentive programs and climate, would both improperly limit the sale of other classes of California certified vehicles and have the effect of creating a third vehicle in violation of CAA § 177. *Id.* at 1346–47. Finally, the court ruled that the DEC failed to adopt the California LEV standards at least two years before the beginning of the 1995 model year, and therefore it could not enforce the standards during the 1995 model year. *Id.* at 1348.

<sup>219</sup> *MVMA II*, 831 F. Supp. at 57, 61, 66. The district court determined on reconsideration that it should not have granted the plaintiffs' motion for summary judgment on this count of the complaint because the experts for both sides disagreed regarding the nature and degree of the effects of the higher sulfur content of fuels in New York on the emission control systems of California certified vehicles. *Id.* at 61. The district court also modified its ruling prohibiting the DEC's enforcement of the California LEV standards against all manufacturers during the 1995 model year, to a prohibition against enforcement of the regulations against manufacturers that "commenced production of the 1995 vehicles prior to May 28, 1994." *Id.* at 64.

<sup>220</sup> *See MVMA III*, 17 F.3d at 521, 531.

<sup>221</sup> *Id.* at 531–37. The court of appeals held that DEC's failure to adopt the California clean fuels requirement did not violate the identity requirement, because CAA § 177 precluded New York from adopting the clean fuels portion of the California LEV program. *Id.* at 532. The court of appeals also held that the DEC's adoption of the ZEV mandate neither improperly limited the sale of other categories of California certified vehicles, nor violated the third vehicle prohibition of CAA § 177. *Id.* at 536–38. However, the court of appeals reversed the modified holding of the district court regarding lead-time by ruling that "[b]ecause model year 1995 commences prior to May 28, 1994, . . . DEC should be enjoined from enforcing its LEV plan for model year 1995 as against all manufacturers." *Id.* at 535. Since New York's regulations adopting



court to reconsider its ruling to refer to trial the remaining count of the complaint alleging that DEC's failure to adopt the clean fuels portion of the California regulations would, in effect, create a third vehicle.<sup>222</sup> Upon further consideration, the district court found that the DEC had adopted standards identical to the California standards, and that "any vehicle certified in California can properly be certified and sold in New York."<sup>223</sup> The district court granted summary judgment on the remaining count of the complaint to the DEC because the manufacturers could not demonstrate that the design changes they would make to California certified vehicles for sale in New York flowed from the DEC's adoption of the California LEV program.<sup>224</sup> The manufacturers appealed the district court's summary dismissal of the remaining count to no avail.<sup>225</sup>

Shortly after the February, 1994, decision of the United States Court of Appeals for the Second Circuit, the OTC urged EPA to adopt the California LEV program for the entire Northeast Ozone Transport Region (OTR).<sup>226</sup> In response, the auto industry offered to build and market a so-called "49 state car" to try to dissuade New York and Massachusetts from adopting California's ZEV mandate, and to persuade the EPA to disapprove the OTC proposal.<sup>227</sup> Despite the United States auto industry's opposition, the EPA approved the OTC's proposal to apply the California LEV regulations throughout the entire OTC.<sup>228</sup> However, EPA's ruling left it up to each state to determine whether to mandate ZEVs, and also left open the possibility of a "LEV-equivalent new motor vehicle program," favored and advocated by the EPA.<sup>229</sup> Thus, the door remained open for the auto industry to lobby the OTC states to adopt its proposal for a voluntary

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the California LEV program were not adopted until May 28, 1992, they would violate the two year lead-time requirement of CAA § 177 if enforced in the 1995 model year. *Id.* at 534-35. The court of appeals ordered the district court to enjoin the enforcement of the LEV portion of the DEC's regulations for the 1995 model year. *Id.* at 538.

<sup>222</sup> *MVMA IV*, 869 F. Supp. 1012, 1015 (N.D.N.Y. 1994).

<sup>223</sup> *Id.* at 1016.

<sup>224</sup> *See id.* at 1020-21. The district court held that the manufacturers' claims that California certified vehicles operating on New York's high sulfur fuels would likely fail in-use compliance testing regulations to be adopted in the future were not ripe for review. *See id.* at 1016-17.

<sup>225</sup> *MVMA V*, 79 F.3d 1298, 1301, 1308 (2d Cir. 1994).

<sup>226</sup> Ozone Transport Commission; Recommendation That EPA Adopt Low Emission Vehicle Program for the Northeast Ozone Transport Region, 59 Fed. Reg. 12,914 (1994).

<sup>227</sup> Lee, *supra* note 212, at A8.

<sup>228</sup> Final Rule on Ozone Transport Commission; Low Emission Vehicle Program for the Northeast Ozone Transport Region, 60 Fed. Reg. 4712 (1995) (to be codified at 40 C.F.R. pts. 51, 52, 85).

<sup>229</sup> *Id.* at 4712, 4728-29.

"49 state car," which the industry did.<sup>230</sup> The EPA continued to advocate a voluntary national program, to be agreed to by the OTC states and the auto industry, that would provide emission reductions equivalent to, or greater than, the OTC LEV program.<sup>231</sup> However, the automakers indicated that they would not voluntarily undertake the plan unless all of the OTC states agreed to drop the California ZEV mandate, and Massachusetts and New York continued to adhere to their plans to implement the California ZEV mandate.<sup>232</sup> In the summer of 1995, the Big Three sent a joint ultimatum to regulators in the thirteen OTC jurisdictions, threatening at least a one-year delay in the proposed 1997 model year implementation of its 49 state car plan unless all OTC members unanimously, and quickly, agreed to not adopt the California ZEV mandate.<sup>233</sup>

On September 27, 1995, the EPA Administrator signed a proposed rule for a voluntary national LEV (NLEV) program.<sup>234</sup> The proposed NLEV program is based on the auto manufacturers' proposed 49 state car plan, the LEV-equivalent program for the OTR favored by the EPA, that the automakers and OTC members have been haggling over since OTC first proposed the adoption of California's LEV regu-

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<sup>230</sup> See *California Delay May Undercut Northeast Electric Vehicle Mandates*, XIII Env'tl. Policy Alert (EPA) No. 2, at 19, 20 (Jan. 17, 1996).

<sup>231</sup> See Final Rule on Ozone Transport Commission; Low Emission Vehicle Program for the Northeast Ozone Transport Region, 60 Fed. Reg. 4712 (1995) (to be codified at 40 C.F.R. pts. 51, 52, 85). Under the LEV-equivalent program advocated by the EPA, automakers would phase-in California certified low-emission passenger cars and light-duty trucks in the Northeast Ozone Transport Region (OTR) in model years 1997-2000, and in the 2001 and subsequent model years automakers would sell the light-duty, California certified LEVs nationwide. *Id.* at 4713-14. The automakers would have to consent to such a program, because the EPA could not enforce similar motor vehicle emission reductions until the 2004 model year. *Id.* at 4714. In May, 1995, the EPA floated a draft plan for a national LEV program for consideration by the auto manufacturers and the OTC members, but indications were that as long as the auto manufacturers, or New York and Massachusetts, refused to budge from their respective positions a voluntary program would not be implemented. See *EPA Draft for Voluntary 49-State LEV Program Floated for Discussion*, XII Env'tl. Policy Alert (EPA) No. 12, at 20 (June 7, 1995).

<sup>232</sup> See *California Delay May Undercut Northeast Electric Vehicle Mandates*, *supra* note 230, at 20; *Foreign Carmakers Fear Deadlines Threaten Low Emission Car Program*, 16 Inside EPA Weekly Rpt. (EPA) No. 45, at 3 (Nov. 10, 1995).

<sup>233</sup> Oscar Suris, *Big Three Fight Sales Mandates for Electric Cars*, WALL ST. J., July 3, 1995, at A2, available in 1995 WL-WSJ 8732033. Also, in an October 31, 1995, letter to the Chairman of the OTC, the AIAM expressed similar concerns regarding the manufacturers' ability to meet the 1997 model year requirements proposed in the "49-state program." See *Foreign Carmakers Fear Deadlines*, *supra* note 232, at 3.

<sup>234</sup> Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines: Voluntary Standards for Light-Duty Vehicles, 60 Fed. Reg. 52,734 (1995) (to be codified at 40 C.F.R. pts. 51, 85-86).

lations for the entire OTR.<sup>235</sup> In December, 1995, the CARB announced its plans to delay the California ZEV mandate until the 2003 model year in exchange for Memoranda of Understanding (MOUs) committing affected manufacturers to a national LEV program.<sup>236</sup> This move by the CARB appeared to pave the way for an agreement, between the automakers and the OTC members, implementing the proposed NLEV program.<sup>237</sup> Despite the apparent compromise struck between the CARB and the affected manufacturers, Massachusetts officials continued to publicly maintain that the state would implement the adopted ZEV mandate on schedule.<sup>238</sup> However, on May 3, 1996, Massachusetts officials relented, saying that the state would adopt a revised course for ZEVs similar to California's.<sup>239</sup> Nevertheless, by late August, 1996, the automakers and the OTC members still had not finalized mutually agreeable MOUs to implement a NLEV program.<sup>240</sup> Despite lack of agreement between the OTC and the automakers—and a final NLEV rule that is contingent upon such agreement—some states have already banked on the emission reductions attributable to a NLEV program to demonstrate attainment of NAAQS.<sup>241</sup>

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<sup>235</sup> See *id.*; *Foreign Carmakers Fear Deadlines*, *supra* note 232, at 3. The OTC members and the auto manufacturers have been working to reach agreement, for nearly two years, on a Memorandum of Understanding (MOU) to implement the voluntary 49-state plan, and they prefer that any final national LEV program rule promulgated by the EPA incorporate the provisions of any finalized MOU. *States, Automakers Insist EPA Make Changes to National LEV Program*, XIII Env'tl. Policy Alert (EPA) No. 11, at 21 (May 22, 1996).

<sup>236</sup> See *California Delay May Undercut Northeast Electric Vehicle Mandates*, *supra* note 230, at 19–20; see also discussion *infra* Section V.F.2.

<sup>237</sup> See *California Delay May Undercut Northeast Electric Vehicle Mandates*, *supra* note 230, at 20.

<sup>238</sup> See, e.g., *id.*; *Massachusetts to Press Ahead With Zero-Emission Vehicle Mandate*, XIII Env'tl. Policy Alert (EPA) No. 5, at 19–20 (Feb. 28, 1996). However, various industry sources and other analysts predicted that Massachusetts and New York would be forced to realign their programs consistent with the changes in California or become embroiled in new litigation over the identicality requirement. See *Massachusetts to Press Ahead With Zero-Emission Vehicle Mandate*, *supra*, at 20; *AAMA Presses Massachusetts, New York to Alter ZEV Programs*, XIII Env'tl. Policy Alert (EPA) No. 3, at 23 (Jan. 31, 1996).

<sup>239</sup> *Massachusetts Follows California, Drops Electric Car Mandate*, XIII Env'tl. Policy Alert (EPA) No. 11, at 23 (May 22, 1996).

<sup>240</sup> See *Air Pollution: Auto Makers Exempt From Electric Vehicle Under Their Version of 19-State Agreement*, 166 Daily Env't. News (BNA) A-7 (Aug. 27, 1996), available in Westlaw, BNA-DEN database, 166 DEN A-7, 1996.

<sup>241</sup> Approval and Promulgation of Implementation Plans and Redesignation of Areas for Air Quality Planning Purposes; States of Washington and Oregon, 62 Fed. Reg. 10,501 (to be codified at 40 C.F.R. pts. 52, 81) (Mar. 7, 1997). Oregon's and Washington's state implementation plan (SIP) revisions include emission reductions from a NLEV program in the maintenance plans submitted as part of requests for redesignation of marginal ozone areas from nonattainment. See *id.* at 10,501, 10,504–05. EPA noted that its implementation of the NLEV program hinges upon the automobile manufacturers and the OTC states reaching an agreement,

## IV. THE SECOND BIENNIAL REVIEW (MAY 1994)

A. *Technological Feasibility of LEVs*

After the first biennial review in June of 1992,<sup>242</sup> the CARB staff continued to monitor the development of various promising technologies and other issues relating to the implementation of the LEV program by consulting with emission control suppliers, the affected industry, and various other authoritative sources.<sup>243</sup> Also, the CARB engineering staff obtained the “latest available hardware from component suppliers” and conducted emission tests on many prototype LEVs and ULEVs to directly assess the feasibility of the program.<sup>244</sup> For the most part, its assessment of technological feasibility and cost-effectiveness of hardware capable, either alone or in combination, of meeting the LEV and ULEV emission standards involved components already being installed by auto manufacturers on some new vehicles.<sup>245</sup> These in-production emission control technologies included sequential multi-port fuel injection systems, dual oxygen sensor systems, adaptive transient fuel control systems, leak-free exhaust systems, heat-optimized exhaust pipes, close-coupled catalysts, and air-assist fuel injectors.<sup>246</sup> The two emerging technologies CARB

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and that since the NLEV program is not effective yet it has not authorized SIP credit for the program. *See id.* at 10,505.

<sup>242</sup> *See supra* note 201. At the conclusion of the first biennial review, the CARB determined that the California LEV program, including the ZEV mandate, remained technologically feasible within the available lead-time. *See supra* note 202.

<sup>243</sup> CALIFORNIA AIR RESOURCES BOARD, SUMMARY OF BOARD MEETING 1 (May 12–13, 1994), available in <<http://www.arb.ca.gov>>, General Information database, Board Meeting Summaries File Library, File ms051294.txt [hereinafter MAY 1994 BOARD MEETING SUMMARY]; *see generally* 1994 STAFF REPORT, *supra* note 3, at 5–82 (discussing, among other things, CARB staff’s assessments of technology, implementation costs, marketability, and environmental benefits relating to LEVs and ZEVs); 1994 ZEV UPDATE, *supra* note 4, at 7–51 (supplementing CARB staff’s assessments regarding ZEV program in 1994 STAFF REPORT).

<sup>244</sup> 1994 STAFF REPORT, *supra* note 3, at 6, 19.

<sup>245</sup> *Id.* at 6.

<sup>246</sup> *Id.* at 6, 11–13. Emission control system configurations designed to meet the certification and in-use standards for each of the LEV categories will likely incorporate some or all of these technologies. *See id.* at 11–13, 19. Apparently industry intends to use sequential fuel injection on all of their California certified Tier I vehicles for their emission-reducing benefits. In California, “Tier I” vehicles are the conventional PCs and LDTs certified to the “phase-in standards” for the 1993 model years, or the conventional light-duty vehicles certified to the 1995 and subsequent model year PC and LDT exhaust emissions standards. *See id.* at 21. Toyota and Honda already employ air-assist injection systems, and Toyota already applies adaptive transient control software. *Id.* at 25. The staff’s report notes that one auto manufacturer already incorporates all of these in-production emission control technologies on some of its models. *Id.* at 6. This particular manufacturer’s in-use emission compliance record, according to the CARB

considered technologically feasible and cost-effective, given the lead-time under the regulations, were electrically-heated catalysts (EHCs) and palladium-only catalysts with an advanced technology cerium washcoat.<sup>247</sup> Also, the CARB staff indicates that to meet the ULEV standards, EHC system-equipped vehicles will likely incorporate an electric air injection system.<sup>248</sup> The CARB staff concluded that the technology necessary to meet the requirements for TLEVs, LEVs, and ULEVs remained feasible and cost-effective under the LEV program's schedule.<sup>249</sup> It recommended that no changes be made to the fleet average emission requirements for LEVs.<sup>250</sup> At the close of the public meeting to consider the staff's report and testimony of the stakeholders, held on May 12–13, 1994, the CARB found the LEV program technologically feasible, cost-effective, and requiring no major changes.<sup>251</sup>

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staff, surpasses the emission compliance records of "virtually all other manufacturers." *Id.* The CARB staff contends that this fact supports its view that "these technologies improve in-use emission durability." *Id.*

<sup>247</sup> *Id.* at 6, 13. CARB's 1990 Buick LeSabre, equipped with a second-generation EHC, had average NMHC emissions below the certification standard for ULEVs after five tests. *Id.* at 14–15. The Buick's average NO<sub>x</sub> emissions from these tests were slightly above the ULEV certification standard, but slightly below the intermediate 50,000 mile in-use standard. Compare table III–1, *infra* app. A with 1994 STAFF REPORT, *supra* note 3, at 15 (table III–1, *infra* app. A, shows certification and intermediate in-use standards for ULEVs for NO<sub>x</sub> as 0.2 g/mi and 0.3 g/mi, respectively, while Buick's average g/mi NO<sub>x</sub> emissions were 0.265). The CARB staff, however, points out that the 1990 Buick LeSabre was not equipped with a fully-optimized cascade EHC system, air-assist injectors, a dual oxygen sensor system, or an adaptive transient fuel control system. See 1994 STAFF REPORT, *supra* note 3, at 14. The cascade EHC system refers to a unit that contains an EHC followed by a light-off unit and a catalyst. See *id.* at 7. The staff opined that addition of these components, including a fully-optimized cascade EHC system, would lower emissions further and contribute toward in-use emissions compliance with the 100,000 mile durability requirements. See *id.* at 14. The CARB staff reported that the EHC used on its Buick showed power and energy demands over 50 percent lower than prototypes reviewed two years before, while meeting ULEV standards. See *id.* at 15. Further, it pointed to one catalyst manufacturer's data showing an EHC attaining ULEV standards, while using one-half of the power and energy required by the prototype tested by CARB. See *id.* The CARB staff states that the lower energy and power requirements for prototype EHCs obviate the need for an extra battery in new vehicles and have allowed their manufacturer's to focus development toward meeting durability requirements. See *id.* at 14–15.

<sup>248</sup> *Id.* at 16. CARB's tests of EHC system-equipped vehicles showed that use of an electric air injection system during the first minute of engine operation helped obtain optimum emission reductions. *Id.* The electric air injector system routes air into the exhaust pipe in front of the EHC. *Id.*

<sup>249</sup> 1994 STAFF REPORT, *supra* note 3, at 4.

<sup>250</sup> See *id.*

<sup>251</sup> MAY 1994 BOARD MEETING SUMMARY, *supra* note 243, at 2; 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 3.

### B. *Cost-Effectiveness of LEVs*

In calculating the incremental costs of each category of LEVs to manufacturers and consumers, the CARB staff compared the costs of the in-production and the likely emission control technologies needed for each category of LEV to the costs of California certified Tier I vehicles.<sup>252</sup> The CARB staff's incremental cost estimates involved four categories—variable costs, support costs, investment recovery costs, and dealer costs.<sup>253</sup> The first category includes the costs of the parts themselves and related variable costs that the auto industry wanted considered—shipping, assembly, and warranty costs.<sup>254</sup> The support costs include administrative, research, and legal costs.<sup>255</sup> Investment recovery costs entail assembly plant changes, vehicle development costs, and a six percent return on the total costs to the manufacturer.<sup>256</sup> The dealer costs involve additional interest dealers will pay to finance the slightly more expensive LEVs and higher commissions to be paid to sales personnel.<sup>257</sup> The CARB staff's estimates show that consumers will have to pay \$61 more for TLEVs, \$114 more for LEVs, and \$221 more for ULEVs, when the foregoing incremental costs are compared to cost estimates for Tier I vehicles.<sup>258</sup> Using these total

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<sup>252</sup> 1994 STAFF REPORT, *supra* note 3, at 18–44. In California, “Tier I” vehicles are the conventional PCs and LDTs certified to the “phase-in standards” for the 1993 model years, or the conventional light-duty vehicles certified to the 1995 and subsequent model year PC and LDT exhaust emissions standards. *See id.* at 21; CAL. CODE REGS. tit. 13, §§ 1960.1(f)(1) n.(7), (f)(2) (1996). In the 1993 model year, 40% of each manufacturer's projected PCs and LDTs certified for sale in California had to meet the stricter phase-in certification standards. CAL. CODE REGS. tit. 13, § 1960.1(f)(1) n.(7). The phase-in standards for the 1993 model year PCs and LDTs were the same as the 1995 and subsequent model year certification standards. *Compare* § 1960.1(f)(1) with § 1960.1(f)(2) (comparison shows that standards in parentheses in § 1960(f)(1) are the same as certification standards in § 1960(f)(2)). The California Tier I certification standards for PCs and LDTs from 0–5750 pounds LVW are identical to the federal Tier I certification standards that were phased-in over a three-year period beginning with the 1994 model year. *Compare* § 1960.1(f)(1) with § 1960.1(f)(2) and 42 U.S.C. § 7521 (1994) (showing same 50,000 mile certification standards for NMHC, CO, and NO<sub>x</sub>).

<sup>253</sup> 1994 STAFF REPORT, *supra* note 3, at 21–42. Table II–9 of the 1994 STAFF REPORT shows a breakdown of the costs under each of these four main categories for TLEVs, LEVs, and ULEVs. *Id.* at 44.

<sup>254</sup> *See id.* at 19–34. CARB noted that the costs of most of the individual parts that make up each of the emission technologies were “fairly well established.” *Id.* at 19.

<sup>255</sup> *See id.* at 34–39.

<sup>256</sup> *See id.* at 39–42. The CARB staff determined that the costs of machinery and equipment to manufacture the new emission control technologies were already included in the costs of the components. *See id.* at 39.

<sup>257</sup> *See id.* at 42.

<sup>258</sup> *See* 1994 STAFF REPORT, *supra* note 3, at 18, 44.

incremental costs and total emission reductions from each category of LEV, the CARB staff estimated the cost effectiveness of LEVs compared to Tier I vehicles.<sup>259</sup> The CARB staff applied two different approaches, and the results showed that the incremental cost-effectiveness of the ULEV, relative to the other LEVs, was \$4.98 per pound of pollutants reduced under one approach and \$1.59 per pound under the other.<sup>260</sup> Using CARB's "California Clean Air Act: Cost-Effectiveness Guidance," the staff determined the cost-effectiveness of all LEV categories compared to Tier I vehicles, in dollars per pound of pollutants reduced, was less than \$1 per pound.<sup>261</sup> Using the same guidance, the CARB staff estimated the relative incremental cost-effectiveness of only the three categories of LEVs as less than \$1.60 per pound of pollutants reduced.<sup>262</sup> The alternative approach taken by the staff involved apportioning one-half of the costs to the reduction of criteria pollutants or their precursors (ROG and NO<sub>x</sub>) and the remaining costs to the reduction of toxic air contaminants (ROG only).<sup>263</sup> Under this second approach, the staff determined that the cost-effectiveness of all LEV categories compared to Tier I vehicles, in dollars per pound of pollutants reduced, was less than \$1.55 per pound.<sup>264</sup> Using the same approach, the CARB staff estimated the relative incremental cost-effectiveness of the three categories of LEVs as less than \$5 per pound of pollutants reduced.<sup>265</sup>

The CARB staff also assessed the technological advances potentially capable of meeting the 1998 ZEV mandate; the projected costs of the vehicles to manufacturers and consumers; the cost-effective-

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<sup>259</sup> *See id.* at 45-46.

<sup>260</sup> *See id.* The CARB staff states that emission controls for vehicles typically cost as much as \$5 per pound of pollutant reduced, while control measures for stationary sources cost as much as \$10 per pound of pollutant reduced. *See id.* at 18.

<sup>261</sup> *Id.* at 45-46. CARB's own cost-effectiveness guidance "divides the total cost of the Low-Emission Vehicle Program by the total emission reductions. The emissions include total reactive organic gases (ROG), oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO) discounted by a factor of seven." *Id.* at 45. Under these calculations, TLEVs cost 68¢ per pound, LEVs 59¢ per pound, and ULEVs 85¢ per pound, when compared to Tier I vehicles. *See id.* at 46.

<sup>262</sup> *See id.* at 18, 46. These calculations revealed the cost per pound of pollutants reduced (ROG + NO<sub>x</sub> + CO<sup>7</sup>) for TLEVs as 68¢, LEVs as 51¢, and ULEVs as \$1.59. *See id.* at 46.

<sup>263</sup> *See* 1994 STAFF REPORT, *supra* note 3, at 45-46.

<sup>264</sup> *See id.* at 46. This approach revealed the cost per pound of pollutants reduced for ROG + NO<sub>x</sub> for TLEVs as 77¢, LEVs as 43¢, and ULEVs as 78¢, and the cost for ROG for TLEVs as 77¢, LEVs as 93¢, and ULEVs as \$1.53. *See id.*

<sup>265</sup> *See id.* This approach revealed the cost per pound of pollutants reduced for ROG + NO<sub>x</sub> for TLEVs as 77¢, LEVs as 29¢, and ULEVs as \$4.98, and the cost for ROG for TLEVs as 77¢, LEVs as \$1.23, and ULEVs as \$4.98. *See id.*

ness of the ZEV portion of the LEV program; and several other related factors, including the potential economic and environmental impacts.<sup>266</sup>

### C. *Technological Feasibility of ZEVs*

At the time of the second biennial review, a ZEV continued to mean a vehicle certified by the CARB as emitting no regulated pollutants through exhaust or evaporative emissions.<sup>267</sup> Electric vehicles (EVs) “powered by electrochemical” batteries were still considered to be the only type of vehicles capable of being certified by the CARB as meeting the ZEV mandate for 1998.<sup>268</sup> The CARB staff acknowledged that the biggest technological hurdle in the four-year path toward development of commercially practicable EVs involved the development of advanced batteries.<sup>269</sup> The CARB staff noted that conventional vehicles using lead-acid batteries and typical drive-train components had a range of only about fifty miles.<sup>270</sup> The staff observed that the mid-term goal of the United States Advanced Battery Consortium (USABC) for an advanced battery involved developing technology that would result in mass production of advanced batteries for EVs during the 1990s.<sup>271</sup> The auto manufacturers considered mass production of an advanced energy storage system an essential element of developing a commercially viable EV to meet the 1998 ZEV mandate.<sup>272</sup> The USABC’s long-term goal, as reported by the staff, is development of battery technologies that will provide vehicle performance competitive with existing conventional vehicle technology by the early part of the next decade.<sup>273</sup> Vehicle manufacturers reportedly consider this technological advancement necessary to gain a level of consumer acceptance capable of replacing a significant number of conventional vehicles.<sup>274</sup> As of the second biennial review, more than twenty separate battery technologies were being actively developed

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<sup>266</sup> See MAY 1994 BOARD MEETING SUMMARY, *supra* note 243. See generally 1994 STAFF REPORT, *supra* note 3, at 47–76 (discussing in detail CARB staff’s assessments relating to ZEV mandate); 1994 ZEV UPDATE, *supra* note 4, at 7–51 (supplements and supports findings of 1994 STAFF REPORT with technical details).

<sup>267</sup> See *supra* text accompanying note 22; 1994 STAFF REPORT, *supra* note 3, at 47.

<sup>268</sup> 1994 STAFF REPORT, *supra* note 3, at 47.

<sup>269</sup> *Id.* at 48.

<sup>270</sup> *Id.*

<sup>271</sup> 1994 ZEV UPDATE, *supra* note 4, at 13.

<sup>272</sup> See 1994 STAFF REPORT, *supra* note 3, at 48.

<sup>273</sup> 1994 ZEV UPDATE, *supra* note 4, at 13.

<sup>274</sup> See 1994 STAFF REPORT, *supra* note 3, at 48.



for use in EVs.<sup>275</sup> Of these, the CARB staff determined that two advanced lead-acid battery technologies could meet most of the US-ABC's mid-term goals by 1998, and the staff identified four other advanced battery technologies projected to meet all of the USABC's mid-term goals by 1998.<sup>276</sup>

The CARB staff identified two advanced lead-acid battery technologies, as well as improvements in the conventional lead-acid battery, that could make EVs so equipped commercially practicable for many California consumers in 1998.<sup>277</sup> The staff noted that under its test program two prototype EVs—the AC Propulsion Honda CRX and the GM Impact—demonstrated high performance capability as well as nearly a 100-mile driving range on a single charge, using conventional lead-acid batteries.<sup>278</sup> The CARB staff identified sealed

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<sup>275</sup> 1994 ZEV UPDATE, *supra* note 4, at 15.

<sup>276</sup> *Id.*

<sup>277</sup> 1994 STAFF REPORT, *supra* note 3, at 53. The improvements in conventional lead-acid batteries include sealed, zero-maintenance batteries with significantly increased energy, power, and useful life characteristics. *See id.* at 54. A battery's "specific energy" means "the total amount of energy (in watt-hours or Wh) the battery can store per kilogram [kg] of its mass for a specified rate of discharge." 1994 ZEV UPDATE, *supra* note 4, at 11. One rate of discharge used to determine Wh/Kg is the Simplified Federal Urban Driving Schedule (SFUDS)—a variable discharging rate that attempts to closely approximate the actual in-use discharge of an EV battery. *See id.* at 11–12. Specific energy relates to the range of an EV. *See id.* "Specific power is the maximum number of watts per kilogram (W/kg) that a battery can deliver at a specified depth-of-discharge (DoD), and is an important factor in . . . [EV] acceleration." *Id.* DoD describes the percentage of energy withdrawn from a battery's energy capacity; and typically specific power is determined when a battery is at 80% DoD (meaning 80% of the battery's energy was discharged). *See id.* Useful life, or lifetime, indicates the battery's expected life in terms of years, whereas the term "cycle life" equates to how many times the battery may be discharged and recharged during its lifetime. *Id.*

<sup>278</sup> *See id.* at 48. The AC Propulsion Honda CRX consistently accelerated from 0–60 miles per hour in less than ten seconds, and had a 100-mile driving range. *See id.* The GM Impact had a shorter city/highway driving range (80 miles), but could accelerate from 0–60 miles per hour in less than nine seconds. *See id.* The CARB staff compares the promising test results of these prototypes with conventional vehicles using the same battery technologies to point out that an EV's design and efficiency can greatly affect its range. *See id.* The GM Impact was designed by Paul MacCready, the world-famous designer of five other vehicles on display in the Smithsonian Museum, and assembled from the ground up using many state-of-the-art components. *See MOORE & MILLER, supra* note 1, at 127–28. The early Impact prototype employed thirty-two lead-acid batteries weighing 870 pounds; a regenerative braking system; aerodynamic tires and lightweight wheels with one-half the rolling resistance of conventional ones; heat-filtering glass; and sported a drag coefficient of 0.19—nearly one-half of the 0.30 attained by some of the most efficient conventional vehicles. *See id.* at 127; NADIS & MACKENZIE, *supra* note 5, at 52, 76. These innovations resulted in an EV capable of accelerating from 0–60 miles per hour in eight seconds, a 100-mile-per-hour top speed, and a maximum driving range of 120 miles. *See id.* at 75. The lead-acid batteries could be recharged in two to eight hours, depending upon power source and extent of discharge. *See id.* at 76.

bipolar and quasi-bipolar lead-acid batteries as the two advanced technologies capable of powering commercially practicable EVs to meet the 1998 mandate.<sup>279</sup> Also, the staff reported that three advanced battery technologies used in test vehicles appeared competent to meet, or nearly meet, the mid-term goals of the USABC by the 1998 model year, and a fourth was potentially capable of meeting USABC's long-term goals.<sup>280</sup> The three advanced batteries already tested in EVs included nickel-metal-hydride, sodium-nickel-chloride, and sodium-sulfur technologies.<sup>281</sup> The fourth promising technology involved a lithium-metal-disulfide battery.<sup>282</sup> The CARB staff pointed out that prototype EV battery packs using nickel-metal-hydride and sodium-sulfur battery technologies were presently available for testing and development.<sup>283</sup> The staff reasoned that the auto industry could begin to design and develop new EVs, for production in 1998, around the projected use of these new technologies.<sup>284</sup> However, the auto industry

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<sup>279</sup> See 1994 STAFF REPORT, *supra* note 3, at 53–54. The CARB staff's comparison of the characteristics to USABC's mid-term goals revealed that they met or exceeded all but the specific energy goal. See *id.* at 55. The sealed bipolar lead-acid (SBLA) battery and the quasi-bipolar lead-acid battery tested at 55 Wh/kg and 50 Wh/kg, respectively, while the USABC's mid-term goal was set at 80 Wh/kg. See *id.* Thus, these batteries would best serve in applications in which long driving ranges will not be a requirement. See *id.*

<sup>280</sup> See *id.* at 49.

<sup>281</sup> See *id.*

<sup>282</sup> See *id.* The lithium-metal-disulfide battery is being developed by Westinghouse Electric Corporation for use in electric gardening equipment. See *id.* at 51. The CARB staff opined that this battery might meet the USABC's long-term goals by providing a power source that could rival the performance of conventional, gasoline-powered vehicles. See 1994 ZEV UPDATE, *supra* note 4, at 18. The CARB staff reported that a lawn mower equipped with such a battery mowed an acre in 2 hours and 45 minutes, whereas a lead-acid-battery-equipped mower only mowed one-tenth of an acre in 30 minutes, on a single charge. See 1994 STAFF REPORT, *supra* note 3, at 49. However, at the time of the biennial review lithium-metal-disulfide battery packs were not yet available for EVs. See *id.* at 51.

<sup>283</sup> See 1994 STAFF REPORT, *supra* note 3, at 49.

<sup>284</sup> See *id.* Ovonic Battery Company, Inc. (OBC) is researching and developing the application of nickel-metal-hydride battery technology to EVs for the USABC. See *id.* The metal-hydride electrode for this application is the same as that already used in small consumer electronic products. See *id.* The nickel-metal-hydride batteries in use in prototype vehicles prior to CARB's second biennial review met all of USABC's mid-term goals, except the 80 Wh/kg specific energy goal—the ones used in prototype EVs tested at 75 Wh/kg. See *id.* Sodium-sulfur batteries, under development for over twenty-five years, have high specific energy and power ratings, and appear attractive for fleet use requiring both range and heavy payload carrying capabilities. See 1994 ZEV UPDATE, *supra* note 4, at 17. However, they are expensive and have a short lifetime. See *id.* at 18. Silent Power, Ltd. and ABB Advanced Battery Systems, Inc., are involved in efforts to extend the useful life and reduce the costs of these batteries, making them potentially viable for use in EVs by 1998. See 1994 STAFF REPORT, *supra* note 3, at 51. Ford is using the sodium-sulfur battery technology to power its prototype EV, the Ecostar. See *id.* Sodium-nickel-chloride battery packs, the CARB staff noted, were being tested in vehicles in

countered that they could not design and produce commercially viable EVs by 1998, since those technologies were not presently in mass production.<sup>285</sup> Nonetheless, the CARB staff concluded that the ZEV mandate remained technologically feasible within the available time frame.<sup>286</sup> The staff projected that nickel-metal hydride, sodium-nickel-chloride, and sodium-sulfur batteries meeting or exceeding USABC's mid-term goals would be commercially available in varying degrees in the 1998 to 2000 time frame.<sup>287</sup>

#### D. *Cost-Effectiveness of ZEVs*

The CARB staff readily conceded that in the introductory years EVs would cost more than conventional vehicles.<sup>288</sup> The staff used low and high incremental cost assumptions for EVs compared to conventional gasoline-powered vehicles.<sup>289</sup> The staff estimated that EV costs in the first five years—1998 through 2002—would range from \$5,000 (low scenario) to \$10,000 (high scenario) more per vehicle than conventional gasoline-powered vehicles.<sup>290</sup> In the low scenario assumptions, the staff estimated that an EV would cost \$5,000 more than a new conventional vehicle in each of the first three years, and thereafter the incremental costs of comparable vehicles would be the same.<sup>291</sup> In the high scenario assumptions, the staff projected that an EV would cost \$10,000 more than a new conventional vehicle in each of the first three years, \$5,000 more in the next two years, and thereafter the incremental costs would be the same.<sup>292</sup> The staff projected that once EV batteries and component parts became produced in high volumes the costs would decline significantly, making the long-term costs of EVs comparable to conventional vehicles.<sup>293</sup> A Tufts University analysis of production costs has recently shown that, due to economies of scale, the costs of producing an EV would decline sub-

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Europe. 1994 ZEV UPDATE, *supra* note 4, at 17. The staff reported that the AEG Corporation projected that sodium-nickel-chloride batteries meeting the USABC's mid-term goals would be commercially available for 1999 model year EVs. See 1994 STAFF REPORT, *supra* note 3, at 50.

<sup>285</sup> See 1994 STAFF REPORT, *supra* note 3, at 49.

<sup>286</sup> See *id.* at 78.

<sup>287</sup> See *id.* at 78–79.

<sup>288</sup> See 1994 ZEV UPDATE, *supra* note 4, at 27.

<sup>289</sup> See *id.* at 32.

<sup>290</sup> See 1994 STAFF REPORT, *supra* note 3, at 65.

<sup>291</sup> See 1994 ZEV UPDATE, *supra* note 4, at 32–33.

<sup>292</sup> See *id.*

<sup>293</sup> See *id.* at 27; 1994 STAFF REPORT, *supra* note 3, at 80.

stantially during the first four years of production, perhaps as much as forty-five percent.<sup>294</sup> The CARB staff noted that the initial costs for air bags, catalytic converters, fuel injection, and power steering declined dramatically after several years of production.<sup>295</sup> For instance, the costs of air bags fell more than fifty percent in four years.<sup>296</sup> Also, the staff pointed to the microcomputer industry as a further example of dramatic price decreases as a result of attainment of economies of scale.<sup>297</sup>

Despite the initial high cost of advanced batteries, the CARB staff projected that the operating costs for EVs, assuming a 100,000 to 120,000 mile vehicle lifetime, would be comparable to the estimated operating costs of a conventional compact vehicle.<sup>298</sup> The cheaper fuel and maintenance costs for EVs compared to conventional vehicles, in conjunction with projected improvements in advanced battery lifetimes, would nearly offset the high cost of batteries over the expected life of the vehicles.<sup>299</sup> The CARB staff estimated that EV lifetime operating costs for quasi-bipolar lead-acid, nickel-metal-hydride, or sodium-nickel-chloride batteries would range from about three cents to five cents per mile compared to no cost for conventional vehicles.<sup>300</sup> However, fuel costs for EVs were projected to be less than one-half the cost of conventional vehicles, and maintenance costs, even consid-

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<sup>294</sup> *EVAA Questions Study That Electric Vehicles May Increase Air Pollution, Depress Economy*, PR NEWSWIRE, May 23, 1995, available in Westlaw, CANEWS database.

<sup>295</sup> See 1994 ZEV UPDATE, *supra* note 4, at 27-28.

<sup>296</sup> See *id.* at 28. From 1989 to 1992 the cost of air bags dropped from about \$1200 to about \$550 each. See *id.* The staff noted air bag costs were expected to decline to about \$250 each by 1995. See *id.*

<sup>297</sup> See *id.* at 27. The staff observed that the cost of microcomputers dropped more than 60% in a four-year period. See *id.*

<sup>298</sup> See *id.* at 30-31; 1994 STAFF REPORT, *supra* note 3, at 80.

<sup>299</sup> See 1994 ZEV UPDATE, *supra* note 4, at 30-31; 1994 STAFF REPORT, *supra* note 3, at 80. The staff estimated that the lifetime vehicle operating costs for 1998 quasi-bipolar lead-acid-battery-powered EVs would range from \$6,500 to \$6,700, while operating costs for 1998 conventional compact vehicles would range from \$6,600 to \$7,500. See 1994 ZEV UPDATE, *supra* note 4, at 31. The staff's estimated lifetime operating costs for nickel-metal-hydride-battery-powered EVs and sodium-nickel-chloride-battery-powered EVs ranged from \$7,400 to \$7,600 and from \$8,700 to \$9,000, respectively. See *id.*

<sup>300</sup> See 1994 ZEV UPDATE, *supra* note 4, at 30. The CARB staff's calculations equitably spread the projected cost of each of these battery technologies out over the expected life of EVs and applied an 8% annual interest rate. See *id.* Under this formula, quasi-bipolar lead-acid batteries would cost between 2.7 and 3.1 ¢ per mile, nickel-metal-hydride batteries would cost between 3.4 and 3.9 ¢ per mile, and sodium-nickel-chloride batteries would cost between 4.5 and 5.3 ¢ per mile. See *id.* For a detailed comparison of the lifetime costs of EVs using these three advanced battery technologies to the lifetime costs of a Ford Escort XLS refer to the CARB staff's operating costs analysis in appendix C of the 1994 ZEV UPDATE, *supra* note 4.

ering a higher cost for tire replacement, were projected to be about one cent per mile less.<sup>301</sup> The CARB staff estimated that EV fuel costs would be less than two cents per mile compared to a cost of almost five cents per mile for conventional vehicles.<sup>302</sup> The CARB staff determined that tires and maintenance for EVs would cost less than two cents per mile over the life of the vehicle compared to a cost of about three cents per mile for conventional vehicles.<sup>303</sup>

To estimate the cost-effectiveness of the ZEV mandate, the CARB staff used the ten-year time frame of 1998 to 2007.<sup>304</sup> They compared the additional incremental cost of EVs, if any, under both the low and high incremental cost assumptions for each of these years and the corresponding emission reductions of ROG, NO<sub>x</sub>, and CO to the emissions of new gasoline-powered vehicles meeting the fleet average NMOG standard for ULEVs for each year.<sup>305</sup> The staff estimated the emissions reduction benefits of EVs by subtracting the lifetime, indirect power plant emissions attributable to an EV from the emissions attributable to a new gasoline-powered ULEV for each year.<sup>306</sup> Also, the CARB staff weighted both the costs and emissions benefits of EVs to reflect the increasing percentages mandated under the program.<sup>307</sup> Then the staff determined the cost-effectiveness in dollars per pound of pollutants reduced, by dividing the incremental costs by the reductions of NO<sub>x</sub>, ROG, and the reductions of one-seventh of the CO.<sup>308</sup> Under this approach the CARB staff estimated that the cost-

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<sup>301</sup> *See id.*

<sup>302</sup> *See id.* at 30. The staff assumed electricity costs of 6.4 ¢ per kilowatt-hour, which resulted in estimated fuel costs for each of the three advanced batteries analyzed of between 1.7 and 1.9 ¢ per mile. *See id.* The costs of oil and gas for conventional vehicles, assuming 5% annual price increases, was determined to be 4.8 ¢ per mile. *See id.*

<sup>303</sup> *See id.* at 30. The staff determined maintenance costs for EVs would be one-half the cost for conventional vehicles, but tire costs for EVs would be 15% higher. *See id.* The staff figured a cost of 1.9 ¢ per mile for EVs using any one of the three advanced batteries it analyzed, whereas maintenance and tires for conventional vehicles would cost 2.9 ¢ per mile. *See id.*

<sup>304</sup> *See* 1994 STAFF REPORT, *supra* note 3, at 64; 1994 ZEV UPDATE, *supra* note 4, at 31.

<sup>305</sup> *See* 1994 STAFF REPORT, *supra* note 3, at 64-65; 1994 ZEV UPDATE, *supra* note 4, at 31-33.

<sup>306</sup> *See* 1994 ZEV UPDATE, *supra* note 4, at 31. The CARB staff used power plant emissions from the South Coast Air Basin (SCAB), where emission controls are much stricter than much of the rest of the state, for this part of the analysis. *See id.* at 31, 39. However, the staff points out that a number of other regions in the state are adopting the more stringent South Coast emission control requirements. *See id.* at 39. Also, the staff points out that the average new conventional vehicle will have higher emissions than the emissions of the ULEVs used in the comparison. *See id.*

<sup>307</sup> *See id.* at 32.

<sup>308</sup> *See id.*

effectiveness of the ZEV mandate would be between \$2.60 and \$9.50 per pound of pollutants reduced.<sup>309</sup>

### E. *Economic and Environmental Impacts of ZEVs*

The CARB staff also assessed the economic and environmental impacts of its ZEV mandate, and determined that both significant economic growth and emissions reductions would result from its continuance.<sup>310</sup> The staff estimated that about seventy percent of the components for EVs designed from the ground up would be “fundamentally different” from the typical parts used in conventional gasoline-powered vehicles.<sup>311</sup> This projected need for atypical parts, according to the staff, could spawn an advanced transportation industry in California.<sup>312</sup> The CARB staff observed that the aerospace and defense industries—industries in which tens of thousands of Californians had recently lost jobs due to defense cutbacks—were already producing composite materials, controllers, and drive trains for EVs.<sup>313</sup> One employment projection, cited by the CARB, estimated that 55,000 new EV-related jobs could be created by the year 2000.<sup>314</sup> Another employment estimate projected the creation of 70,000 EV-industry-related jobs in California by the year 2010.<sup>315</sup> The staff also pointed out that economic growth from an advanced EV transportation industry would be sustainable because of the significant environmental

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<sup>309</sup> 1994 STAFF REPORT, *supra* note 3, at 65. The CARB staff’s low incremental cost assumptions resulted in a cost-effectiveness calculation of \$2.60 per pound, whereas the high incremental cost assumptions revealed a cost-effectiveness determination of \$9.50 per pound of pollutants reduced. 1994 ZEV UPDATE, *supra* note 4, at 32–33.

<sup>310</sup> 1994 STAFF REPORT, *supra* note 3, at 70.

<sup>311</sup> *Id.* at 74.

<sup>312</sup> *Id.*

<sup>313</sup> *Id.* at 74–75.

<sup>314</sup> *Id.* at 75. This projection by CALSTART, a consortium of California public and private entities, assumes that California industry would supply one-third of components necessary to meet the world-wide demand fostered by EVs. *Id.* Regarding world-wide demand, the CARB staff noted that the government of Japan had already announced a goal of 200,000 EVs on the streets of its country by 2000. 1994 ZEV UPDATE, *supra* note 4, at 50.

<sup>315</sup> 1994 STAFF REPORT, *supra* note 3, at 75. This “Project California” employment projection estimated “direct and indirect jobs in manufacturing, construction and installation, and operations maintenance and service.” *See id.* Project California, an initiative of the California Council on Science and Technology, stated that overall an advanced transportation industry could create as many as 400,000 jobs in California by 2010. *Campaign Against Electric Vehicles Termed Misleading and Deceitful*, PR NEWSWIRE, Apr. 21, 1995, available in Westlaw, CANEWS database.

benefits.<sup>316</sup> The staff reasoned that without long-term emissions reductions from mobile sources, the future growth of stationary sources would be hindered by the stringent new source review (NSR) requirements imposed by many air quality management districts in California.<sup>317</sup>

To estimate the environmental impacts of EVs, the CARB staff compared power plant emissions and the emissions associated with lead-acid battery recycling to the emissions from gasoline-powered ULEVs.<sup>318</sup> For this part of its calculations, the staff broadened the scope of its power plant emissions analysis to include not only the South Coast Air Basin (SCAB), but also emissions attributable to EVs from all sources of electricity in the state and to sources outside the state that provide electricity to California.<sup>319</sup> The power plant emissions attributable to recharging EVs depend upon the source of the power generation and emission control equipment in use.<sup>320</sup> Using the California Energy Commission's projections for 1994, the staff estimated the emissions associated with EVs from natural gas, both in and out of SCAB; hydroelectric; coal; nuclear; solar, wind, and geothermal; biomass; and uncommitted sources of electricity in California.<sup>321</sup> The CARB staff also provided a preliminary estimate of emissions associated with EVs due to lead-acid battery recycling, since EVs would most likely cause increases in emissions related to battery manufacturing and recycling.<sup>322</sup> However, at the time of its report it was still analyzing potential emission increases due to manufacturing and its recycling emissions estimates were not final.<sup>323</sup> The CARB staff determined that compared to ULEVs the total emissions associated with EVs would be substantially less, and even more pronounced if compared to average vehicle emissions.<sup>324</sup> In the SCAB, projected emissions attributable to EVs were calculated to be ninety-five percent less than ULEV emissions of ozone precursors and CO.<sup>325</sup> Also, the staff reported that power plant emissions for recharging

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<sup>316</sup> See 1994 STAFF REPORT, *supra* note 3, at 75.

<sup>317</sup> *Id.*

<sup>318</sup> *Id.* at 71.

<sup>319</sup> 1994 ZEV UPDATE, *supra* note 4, at 41-44.

<sup>320</sup> *Id.* at 41.

<sup>321</sup> *Id.* at 44.

<sup>322</sup> *Id.* at 45.

<sup>323</sup> *Id.*

<sup>324</sup> 1994 ZEV UPDATE, *supra* note 4, at 46.

<sup>325</sup> 1994 STAFF REPORT, *supra* note 3, at 70.

EVs would produce substantially less carbon dioxide (CO<sub>2</sub>) and air toxics when compared to emissions from gasoline-powered vehicles.<sup>326</sup>

### F. Safety of ZEVs

Also, the CARB staff briefly assessed safety issues involving EVs.<sup>327</sup> The staff noted that although the National Highway Traffic Safety Administration (NHTSA) was in the process of developing safety standards specifically for EVs,<sup>328</sup> in the interim, EVs were subject to the same safety standards as gasoline-powered vehicles.<sup>329</sup> However, it pointed out that the NHTSA was granting exemptions from Federal Motor Vehicle Safety Standards (FMVSS) that did not make sense for EVs and for standards requiring crash testing.<sup>330</sup> In fact, long before the CARB promulgated its LEV regulations, the NHTSA had granted exemptions from various FMVSS for small companies converting conventional vehicles to EVs.<sup>331</sup> A little before the first biennial review in June, 1992, Chrysler requested and received a temporary exemption from seven FMVSS for four of its 1989 model TEVans, developed in cooperation with the United States Department of Energy (DOE), the South Coast Air Quality Management District (SCAQMD), the EPRI, and Southern California Edison.<sup>332</sup>

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<sup>326</sup> 1994 ZEV UPDATE, *supra* note 4, at 49.

<sup>327</sup> *See id.* at 38.

<sup>328</sup> *See* Federal Motor Vehicle Safety Standards, Electric Vehicles, 56 Fed. Reg. 67,038 (1991) (to be codified at 49 C.F.R. pt. 571) (advanced notice of proposed rulemaking, Dec. 27, 1991); Federal Motor Vehicle Safety Standards, Electric Vehicles Controls and Displays; Windshield Defrosting and Defogging Systems, 58 Fed. Reg. 4644 (1993) (to be codified at 49 C.F.R. pt. 571) (proposed Jan. 15, 1993); Federal Motor Vehicle Safety Standards for Electric Vehicles, 59 Fed. Reg. 49,901, 49,902-03 (1994) (to be codified at 49 C.F.R. pt. 571) (request for comments on Sept. 30, 1994) (reinitiating rulemaking for safety standards—in particular safety issues concerning EV battery electrolyte spillage and electric shock hazard—for both original equipment EVs and also EV conversions, that was ceased as premature in 1992).

<sup>329</sup> 1994 ZEV UPDATE, *supra* note 4, at 38. At the time of the second biennial review, all motor vehicles sold in the United States, including EVs, were subject to the Federal Motor Vehicle Safety Standards (FMVSS). *Id.*

<sup>330</sup> *Id.* The staff cited “fuel system integrity” exemptions as an example of waiver of FMVSS that did not fit EVs. *Id.*

<sup>331</sup> *See* Electric Auto Corp., 47 Fed. Reg. 47,958 (1992) (Grant of Petition for Temporary Exemption) (granting a two-year exemption from eight standards for Buick Regal conversions to EVs on grounds of economic hardship of the petitioner and on the ground that alternative transportation was in the public interest); Conceptor Industries, Inc., 54 Fed. Reg. 46,318 (1989) (Grant of Petition for Temporary Exemption) (granting a one-year exemption from three standards—hydraulic brake systems, accelerator control systems, and fuel system integrity standards—for GM van conversions to EVs on the grounds the exemption would facilitate LEV development, not unreasonably degrade safety, and be in the public interest).

<sup>332</sup> *See, e.g.*, Chrysler Corp., 57 Fed. Reg. 27,506, 27,508 (1992) (Grant of Petition for Temporary



Chrysler also requested and received a temporary exemption from three FMVSS for some of its 1991–1994 TEVans, being developed with the cooperation of DOE, EPRI, and the USABC.<sup>333</sup> Around the same time, several small companies—Solectria Corporation of Arlington, Massachusetts, The Clarity Group, Inc., of Glendale, Arizona, and Solar Electric Engineering of Santa Rosa, California—petitioned the NHTSA for exemptions from the FMVSS for EV conversions.<sup>334</sup> The following year Ford petitioned for exemptions from the FMVSS for three versions of its Ecostar Van—an HEV, and EV with a fuel-fired heater, and an EV with an electric heater.<sup>335</sup> Later the same year, GM requested and received exemptions for its prototype GMEV, based on the Impact experimental car, although the GMEV was designed to comply with all FMVSS.<sup>336</sup>

Electrolyte spills and electrical shock hazards are safety concerns with EV conversions using lead-acid batteries. In 1993, the NHTSA conducted crash tests on two EV conversions using lead-acid batteries.<sup>337</sup> In these tests, substantial electrolyte spillage occurred in both vehicle crashes, and “electrical arcs were observed under the hood of one vehicle during the crash.”<sup>338</sup> Along these lines, the CARB staff

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Exemption) (“In order to grant an exemption, the . . . [NHTSA had to] find that the exemption would facilitate the development and field evaluation of a low-emission motor vehicle, that such exemption would not unduly degrade the safety of the vehicle, and that an exemption would be in the public interest and consistent with the objectives of the National Traffic and Motor Vehicle Safety Act.”).

<sup>333</sup> See *id.* at 27,509 (granting exemptions from September 1, 1992 to August 31, 1994 for 1991–1994 model Dodge and Plymouth vans to be produced beginning September 1, 1992). By June 10, 1994, Chrysler had used this exemption for 52 TEVans; and it petitioned for and received a two-year renewal of the exemption, expiring August 31, 1996. See Chrysler Corp., 59 Fed. Reg. 65,570 (1994) (Grant of Application for Renewal of Temporary Exemption).

<sup>334</sup> See Solectria Corp., 57 Fed. Reg. 12,850 (1992) (Grant of Petition for Temporary Exemption) (granting exemptions for new Geo Metro EV conversions to be marketed as the “Solectria Force”); The Clarity Group, Inc., 57 Fed. Reg. 28,765 (1992) (Grant of Petition for Temporary Exemption) (granting exemptions for EV conversions of 1992 model Ford Escort LX station wagons and Chevrolet S10 and GMC S15 pickup trucks); Solar Electric Engineering, 57 Fed. Reg. 30,997 (1992) (Grant of Petition for Temporary Exemption) (granting exemptions for EV conversions of 1992 model Ford Escort passenger cars and Chevrolet S10 pickup trucks).

<sup>335</sup> See Ford Motor Co., 58 Fed. Reg. 16,907, 16,908–10 (1993) (Disposition of Petition for Temporary Exemption) (granting various exemptions for EV conversions and prototypes based on Ford’s Escort delivery van manufactured in England).

<sup>336</sup> General Motors Corp., 58 Fed. Reg. 48,421 (1993) (Grant of Petition for Temporary Exemption) (granting various one-year exemptions, requested by GM because it would not be able to complete all FMVSS compliance testing, for 50 GMEVs to be distributed for field evaluation).

<sup>337</sup> Federal Motor Vehicle Safety Standards, 49 C.F.R. pt. 571 (1995).

<sup>338</sup> *Id.* The crashes caused spills of more than 10 liters of electrolytes from batteries of one vehicle and more than 17 liters from the other. *Id.*

noted that CALSTART<sup>339</sup> and the EPRI were developing programs to educate emergency response teams regarding the possible dangers surrounding EV accidents.<sup>340</sup> The staff also reported that various electric power companies, vehicle manufacturers, the Society of Automotive Engineers, Underwriter Laboratory, and other organizations were cooperating to ensure safe recharging of EVs.<sup>341</sup>

### G. *The Market for ZEVs*

The CARB staff report acknowledged that the feasibility of the ZEV mandate depended upon consumer marketability of EVs.<sup>342</sup> Consumer demand for EVs will be necessary for the emission reduction benefits associated with them to be realized.<sup>343</sup> The staff observed that a number of factors—including the limited driving range of EVs, EV costs, consumer knowledge of EVs, incentives, and supporting infrastructure—would influence the salability of EVs.<sup>344</sup>

Regarding the currently available driving range, the staff cited several studies supporting its proposition that even limited-range EVs could meet the needs of many California commuters.<sup>345</sup> One of several studies conducted by the Institute of Transportation Studies at the University of California, Davis (ITS-Davis), revealed that over ninety percent of households, considered potential EV consumers, “could adapt to a vehicle with a range of under 120 miles.”<sup>346</sup> Previous market surveys and studies, it was noted, were premised on the assumption that consumers would be reluctant to accept or adapt to the limited range of EVs.<sup>347</sup> The ITS-Davis study, though, prompted participants to consider their commuting needs and some of the benefits of EVs, like home recharging.<sup>348</sup>

The staff pointed out that consumer knowledge of EVs would be an important ingredient of EV salability. The staff opined that con-

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<sup>339</sup> CALSTART is “a California consortium of public and private entities working to create an advanced transportation industry in the state.” 1994 STAFF REPORT, *supra* note 3, at 74.

<sup>340</sup> 1994 ZEV UPDATE, *supra* note 4, at 25, 38.

<sup>341</sup> *Id.* at 38.

<sup>342</sup> 1994 STAFF REPORT, *supra* note 3, at 65.

<sup>343</sup> 1994 ZEV UPDATE, *supra* note 4, at 34.

<sup>344</sup> See 1994 STAFF REPORT, *supra* note 3, at 65–69; 1994 ZEV UPDATE, *supra* note 4, at 34–38.

<sup>345</sup> 1994 ZEV UPDATE, *supra* note 4, at 34–35. For example, the staff cited a GM survey concluding “that nearly 85 percent of drivers in Boston, Houston, and Los Angeles drive less than 75 miles per day, with about 70 percent driving less than 50 miles per day.” *Id.*

<sup>346</sup> *Id.* at 35.

<sup>347</sup> 1994 STAFF REPORT, *supra* note 3, at 67.

<sup>348</sup> See 1994 ZEV UPDATE, *supra* note 4, at 35.

sumer awareness of some of the advantages of EVs over conventional vehicles, like less maintenance, longer life and reliability, and the convenience of home recharging, would enhance their marketability.<sup>349</sup> Although not directly addressed by the CARB staff, promotion of EVs, including sales marketing, by the auto manufacturers will greatly influence consumer awareness and acceptance of EVs as well. Until very recently most of the actions of the Big Three reported in the media and the statements of their executives to the media have tended to undermine consumer confidence in EVs as a vehicle of the future. Their vigorous opposition to any ZEV mandate in California, and elsewhere, has tended to paint a negative picture of EVs.<sup>350</sup> Their executives' comments to the press have maligned notions of mass production of EVs as nonsensical.<sup>351</sup> Even GM, having announced at the Los Angeles Auto Show that it would begin offering its EV1 for sale in the fall of 1996 at twenty-five Saturn dealerships in San Diego County, Los Angeles, Phoenix, and Tucson, has appeared to do less than it could to market this production car effectively based on its Impact prototype.<sup>352</sup> On the first day of the April 2-7, 1996 San Diego International Auto Show, GM appeared to be doing little to promote the EV1 beyond placing it in the Saturn area on a revolving turntable.<sup>353</sup> Though the EV1 will be leased or sold in the San Diego area in late 1996, GM offered no verbal or written information on the vehicle to passersby. No one was behind a microphone touting its

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<sup>349</sup> *Id.* at 34.

<sup>350</sup> See, e.g., Lee, *supra* note 212, at A1, A8; Suris, *supra* note 232, at A2.

<sup>351</sup> See, e.g., Oscar Suris, *Continental Divide: Californians Collide With Folks in Detroit Over the Electric Car*, WALL ST. J., Jan. 24, 1994, at A1 (saying that unanimous refrain from Detroit automakers to suggestions that they should produce EVs was "nonsense"). The article attributed GM's director of auto-emission control as saying that the Big Three could make EVs, but nobody would buy them. *Id.* But cf. Ron Roberts, *Clearing the Air on the Electric-Vehicle Controversy; Give Them a Chance to Work*, SAN DIEGO UNION-TRIB., June 11, 1995, at G3 (noting that GM executives have been frequently quoted about their surprise over enthusiastic acceptance of the GM Impact by the public; and quoting one as saying, "The biggest problem we have with the program is getting people to give the cars back. They love them."). The director of EPRI's battery-powered-vehicles project explains that the Big Three appear to speak with two voices because of different factions in the companies—" [those] who want to work for the development of electric vehicles and those who want to work against it." Warren Brown, *Can It Convince a Battery of Skeptics?*, WASH. POST, July 11, 1995, at D1, D6.

<sup>352</sup> See, e.g., Steve LaRue & Mark Maynard, *GM to Market Electric Car Here in Fall*, SAN DIEGO UNION-TRIB., Jan. 5, 1996, at A1, A23. Cf. Peter Rowe, *Jolting a giant: Teen's electric car zips by GM*, SAN DIEGO UNION-TRIB., Oct. 20, 1996, at D1 (confirming that EV1 will soon appear in San Diego area showrooms of Saturn dealerships, but for lease, not sale, based on a price tag of \$35,000).

<sup>353</sup> Personal observation of the author on April 2, 1996.

features, and no glossy brochures, not even photocopy flyers with technical information, were available.<sup>354</sup> Glossy brochures were available at the show on another niche-market vehicle, the comparably-priced Plymouth Prowler Hot Rod.<sup>355</sup> A glossy brochure picturing the EV1's predecessor, the Impact, being driven in some of the test communities; describing the engineering effort and the \$350 million that went into its ground-up development; detailing its specifications, features, availability, and price; and maybe even quoting some of the favorable comments from those who have driven the prototype, might have gone a long way toward generating interest among the more than one-half million persons who visited the show that week.<sup>356</sup> Also, interested persons could not sit behind the wheel to experience how the EV1 feels.<sup>357</sup> However, attendees could sit in a new, comparably-priced BMW Z3 roadster or in the \$90,000 Mercedes 500 SL roadster.<sup>358</sup>

The CARB staff also pointed out that in the early years of the ZEV mandate, consumer incentives would be needed to promote the sales of EVs.<sup>359</sup> Market surveys that the staff reviewed showed that consumers were unwilling to spend more for an EV than a comparable conventional vehicle.<sup>360</sup> The staff pointed to three incentive programs—federal tax credits and deductions, state tax exemptions and credits, and special electric rates—that could narrow the cost gap between EVs and conventional vehicles, and thus promote EV purchases.<sup>361</sup> Briefly, the staff noted that the federal income tax credit for individuals and businesses from 1993 through 2001 is the lesser of ten percent

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<sup>354</sup> *Id.*

<sup>355</sup> *Id.*; see The Editors of ROAD & TRACK, *Auto Shows '96: A Guide To Cars & Trucks of the Future and Stars of Today From Detroit's Big Three*, PARADE MAG., Mar. 24, 1996, at C, E (listing a price of about \$35,000 for both Plymouth Prowler and GM EV1). The Plymouth Prowler can be characterized as a unique vehicle targeting street-rod enthusiasts, just as the EV1 has been characterized as a niche-market vehicle for electric car enthusiasts. *Id.* at C; see LaRue & Maynard, *supra* note 352, at A23; see generally Editors of ROAD & TRACK, *supra* at C.

<sup>356</sup> See LaRue & Maynard, *supra* note 352, at A1, A23 (discussing the EV1's price, the \$350 million developing it, and a few of the car's features); Steve LaRue & Mark Maynard, *Impact has a Secret Under the Hood*, SAN DIEGO UNION-TRIB., Oct. 9, 1995, at B2, B3 (describing Impact, some of its features, test program involving 800 drivers in 12 cities, and that costs of recharging the Impact are the "gasoline equivalent of about 60 cents a gallon"); electronic-mail reply from Mark Maynard, Wheels Editor, SAN DIEGO UNION-TRIB. (Sept. 12, 1996) (stating that the show's sponsors, the San Diego New Car Dealers Association, reported 526,232 attendees).

<sup>357</sup> Personal observation of the author on April 2, 1996.

<sup>358</sup> *Id.*

<sup>359</sup> See 1994 ZEV UPDATE, *supra* note 4, at 36.

<sup>360</sup> *Id.*

<sup>361</sup> See *id.*

of the purchase price, or \$4,000.<sup>362</sup> Also, the staff's report points out that in California a partial sales tax exemption and state income tax credits were currently available for LEV purchases, including ZEVs; and a number of pending bills in the legislature could provide a wide variety of incentives for would-be EV purchasers.<sup>363</sup> Further, the staff reported that five of the large electric utilities in California were offering, or proposing, special rates for participating EV owners that could be worth as much as \$1,500.<sup>364</sup> These incentives should help equalize the costs between EVs and conventional vehicles and promote the purchase of EVs. A 1994 Southern California Edison survey showed that more than 600 of the 1000 Californians questioned would be interested in EVs if they were no more expensive than comparable conventional cars.<sup>365</sup>

The CARB staff also recognized that electrical infrastructure improvements would help foster ZEV marketability.<sup>366</sup> They noted that although much of the infrastructure needed for EVs was already in place, improvements would be needed to avoid adverse impacts on distribution and transmission capabilities of electric utilities.<sup>367</sup> To help reduce these potential impacts, California electric companies offer to install home EV recharging infrastructure at no cost between 1995 and 2000 to consumers that agree to participate in the utilities' load management plans.<sup>368</sup> Southern California purchasers of GM's EV1, for example, might wish to accept this offer and have the desirable 220-volt infrastructure installed in their homes.<sup>369</sup> A complete recharge of the EV1's batteries on a 220-volt system takes only three hours, whereas complete recharging using the conventional 110-volt battery charger takes about fifteen hours.<sup>370</sup> The 220-volt charging devices

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<sup>362</sup> See 1994 STAFF REPORT, *supra* note 3, at 68; 1994 ZEV UPDATE, *supra* note 4, at 36.

<sup>363</sup> 1994 STAFF REPORT, *supra* note 3, at 68. The report notes that the state tax incentives legislation expires before the ZEV mandate takes effect, but is renewable. *Id.* The other pending bills included provisions "exempting ZEVs from state sales taxes, rebates for cleaner cars (including ZEVs), cutting vehicle registration fees for ZEVs, exempting ZEVs from air pollution district fees, and providing tax incentives for businesses investing in emission-free transportation vehicles." *Id.*

<sup>364</sup> *Id.*

<sup>365</sup> Suris, *supra* note 351, at A1. More than 70% of those surveyed were aware of the limited range of EVs. *Id.*

<sup>366</sup> See 1994 STAFF REPORT, *supra* note 3, at 69.

<sup>367</sup> See *id.*

<sup>368</sup> See *id.*

<sup>369</sup> See, e.g., Jim Wilson, *GM Electric Vehicle Offers 'No Plug' Recharging*, POPULAR MECHANICS, May 1996, at 19; see also LaRue & Maynard, *supra* note 356, at B3.

<sup>370</sup> See LaRue & Maynard, *supra* note 356, at B3.

“are few and far between.”<sup>371</sup> The EV1 uses “Delco Electronics’ new Magne Charge inductive charging system.”<sup>372</sup> This inductive charging system, which uses a weatherproof plastic paddle about twice the size of a person’s hand that fits into a charging port in the top of the front clip of the EV1, solves the potential electric shock hazard posed by conductive systems using a plug with metal prongs.<sup>373</sup> A Ford Motor Company spokesman estimated that the home infrastructure necessary for the EV1’s inductive charging system will cost about \$1,000 more than the conductive system that Chrysler and Ford have agreed to use.<sup>374</sup>

### H. The CARB’s Findings

After two days of public hearings and deliberation, the CARB determined that the ZEV mandate promoted the goals of the California LEV/CFP regulations and should continue unchanged.<sup>375</sup> However, the CARB indicated that it would involve itself in the implementation process, and directed its staff to look into a number of issues that had been raised during the public hearing, “and bring any significant matters to the Board for its consideration.”<sup>376</sup> Eleven months later, the CARB’s Chairman approved an aggressive schedule of public workshops and other public forums involving the issues identified by the staff.<sup>377</sup> The ZEV workshops and public forums, conducted from May, 1995, through January, 1996, involved issues concerning HEVs, consumer marketability, infrastructure, fleet issues, advanced battery technologies, and the costs and benefits of ZEVs.<sup>378</sup> This schedule of workshops and public forums also included a workshop and a CARB public hearing for proposed LEV-related adjustments to the LEV regulations.<sup>379</sup>

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<sup>371</sup> *Id.*

<sup>372</sup> Wilson, *supra* note 369, at 19.

<sup>373</sup> See *id.* at 19; Joan Kirchner, *2 Makers OK a Single Plan for Charging Electric Cars*, SAN DIEGO UNION-TRIB., Dec. 13, 1995, at C2.

<sup>374</sup> Kirchner, *supra* note 373, at C2. The Ford spokesman estimated the conventional conductive system would cost about \$1,000 to install.

<sup>375</sup> MAY, 1994 BOARD MEETING SUMMARY, *supra* note 243, at 1-2.

<sup>376</sup> *Id.* at 2; Letter from John D. Dunlap III, Chairman, California Air Resources Board, to Interested Parties 1 (Apr. 11, 1995) (on file with the California Air Resources Board, Public Information Office, Sacramento, CA) [hereinafter Board Chairman’s Letter].

<sup>377</sup> Board Chairman’s Letter, *supra* note 376, at 1, attached schedule.

<sup>378</sup> See *id.*

<sup>379</sup> *Id.*

## V. THE REVISED LEV REGULATIONS

## A. Introduction

In 1995, the CARB published its proposed amendments to the certification requirements and test procedures for light-duty and medium-duty LEVs.<sup>380</sup> It proposed a baseline specific reactivity for conventional gasoline-powered medium-duty LEVs and ULEVs, adopting new RAFs for light- and medium-duty LEVs and ULEVs, a new category of medium-duty LEV, increasing the requirements for medium-duty ULEVs, slightly relaxing some of the medium-duty ULEV emission standards, extending the intermediate in-use compliance standards for light-duty LEVs and ULEVs, and a variety of other regulatory amendments relating to certification, testing procedures, and reporting requirements for light- and medium-duty LEVs and ULEVs.<sup>381</sup> On September 28, 1995, the staff presented these proposed regulatory amendments to the LEV program—previously published on August 11, 1995, in the *Staff Report: Initial Statement of Proposed Rulemaking; Proposed Amendments to Low-Emission Vehicle Regulations*—along with some recommended changes, to the CARB.<sup>382</sup> The CARB conducted a public hearing on that date—its third regulatory review of the LEV Program—and approved the original proposed regulatory amendments as modified.<sup>383</sup> Some of the modifications recommended by the staff, and approved by the CARB, included adding intermediate in-use compliance standards for medium-duty LEVs and ULEVs certified to the optional heavy-duty engine standards and for chasis-certified medium-duty Super-Ultra-Low-Emission Vehicles, and adjustments to the proposed requirement for a smog index window label for new 1998 and later model year light-duty vehicles.<sup>384</sup> Since

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<sup>380</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 3.

<sup>381</sup> *Id.* at 3, 18, 48–50; see also CALIFORNIA AIR RESOURCES BOARD, FINAL STATEMENT OF REASONS: AMENDMENTS TO THE CERTIFICATION REQUIREMENTS AND PROCEDURES FOR LOW-EMISSION PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES 2 (June 24, 1996), available in <<http://www.arb.ca.gov/msprug/levprog/lev3fsor.htm>> [hereinafter FINAL STATEMENT OF REASONS: LEV RULEMAKING].

<sup>382</sup> CALIFORNIA AIR RESOURCES BOARD, NOTICE OF PUBLIC AVAILABILITY OF MODIFIED TEXT AND SUPPORTING DOCUMENTS AND INFORMATION; PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE CERTIFICATION REQUIREMENTS AND PROCEDURES FOR LOW-EMISSION PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES 1–2 (Oct. 20, 1995), available in <<http://www.arb.ca.gov>> [hereinafter FIRST FIFTEEN-DAY NOTICE: LEV RULEMAKING].

<sup>383</sup> *Id.*

<sup>384</sup> *Id.*

the CARB's action involved approval of modifications to the original proposal, it directed the staff to make the modifications, along with any other appropriate changes, available to the public for further review and comment.<sup>385</sup> Per the CARB's directive, the Executive Officer published a fifteen-day notice on October 20, 1995, informing the public of recent changes to the original proposed regulatory amendments to the LEV program and inviting comments.<sup>386</sup> Then, based on comments it received from industry, the CARB made further modifications to the proposed LEV Program's regulatory amendments, and published a second fifteen-day notice on February 13, 1996.<sup>387</sup> Thereafter, the CARB staff made some further minor changes to the proposed amendments, and published its third fifteen-day notice on April 5, 1996.<sup>388</sup> The CARB published its *Final Statement of Reasons* on June 24, 1996, in which it consolidated and explained all of the modifications to the originally proposed amendments, and addressed comments received in response to the first and second fifteen-day notices.<sup>389</sup> No written comments were received by the CARB in response to the third fifteen-day notice.<sup>390</sup> The CARB Executive Officer formally adopted the final amendments to the LEV regulations on June 24, 1996, in Executive Order G-96-032, and on August 9, 1996, the CARB forwarded the final LEV Program regulatory revisions to the California Office of Administrative Law (OAL) for review and final approval.<sup>391</sup> The CARB's regulatory action will amend, or add, Sections 1956.8, 1960.1, 1965, 2061, 2062, 2101, and 2292.1 of Title 13 of the California Code of Regulations, as well as the provisions contained in six different test procedures documents that are incorporated by reference in some of those Sections.<sup>392</sup> The final amendments to the

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<sup>385</sup> *Id.* at 2; Board Resolution 95-40, *supra* note 208, at 6.

<sup>386</sup> FIRST FIFTEEN-DAY NOTICE: LEV RULEMAKING, *supra* note 382, at 1-2.

<sup>387</sup> CALIFORNIA AIR RESOURCES BOARD, SECOND NOTICE OF PUBLIC AVAILABILITY OF MODIFIED TEXT; PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE CERTIFICATION REQUIREMENTS AND PROCEDURES FOR LOW-EMISSION PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES 1 (Feb. 13, 1996), available in <<http://www.arb.ca.gov>> [hereinafter SECOND FIFTEEN-DAY NOTICE: LEV RULEMAKING].

<sup>388</sup> CALIFORNIA AIR RESOURCES BOARD, THIRD NOTICE OF PUBLIC AVAILABILITY OF MODIFIED TEXT; PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE CERTIFICATION REQUIREMENTS AND PROCEDURES FOR LOW-EMISSION PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES 1 (Apr. 5, 1996), available in <<http://www.arb.ca.gov>> [hereinafter THIRD FIFTEEN-DAY NOTICE: LEV RULEMAKING].

<sup>389</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 3.

<sup>390</sup> *Id.*

<sup>391</sup> *Id.*; LEV Program Update (Aug. 9, 1996), available in <<http://www.arb.ca.gov>>.

<sup>392</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 2-3. The original



LEV regulations, some of which are discussed below, were approved by the OAL on September 23, 1996, and became effective on October 23, 1996.<sup>393</sup>

### B. *Proposed Reactivity Adjustment Factor (RAF) Amendments*

Based on its tests of medium-duty LEV and ULEV F150 Ford trucks powered by conventional gasoline, the CARB staff proposed a baseline specific reactivity value of 3.13 grams of ozone per gram NMOG ( $\text{g O}_3 / \text{g NMOG}$ ) for both categories of LEVs in this class.<sup>394</sup> This baseline is the same as the baseline specific reactivity, previously adopted by the CARB, for both categories of LEVs in the light-duty vehicle class.<sup>395</sup> Specific baseline reactivity data submitted by the American Automobile Manufacturers Association (AAMA) reflected much higher reactivity values in  $\text{g O}_3 / \text{g NMOG}$ .<sup>396</sup> The staff was uncertain of the cause of the significant difference, but it pointed out that the medium-duty Ford trucks it used to establish the baseline reactivity value met the LEV and ULEV NMOG emissions standards of 0.160 g/mi NMOG and 0.100 g/mi NMOG, respectively.<sup>397</sup> Since the CARB staff's tests of these medium-duty trucks revealed a specific baseline reactivity very similar to light-duty vehicles, the staff recommended various interim RAFs for medium-duty LEVs and ULEVs

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rulemaking proposed adoption of a new section, Section 2062, pertaining to assembly-line test procedures for 1998 and Subsequent Model year Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles. *Id.* at 6 n.2. The affected test procedure documents include the following: (1) California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles; (2) California Exhaust Emission Standards and Test Procedures for 1987 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles; (3) California Non-Methane Organic Gas (NMOG) Test Procedures; (4) California Assembly-Line Test Procedures for 1983 Through 1997 Model year Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles; (5) California Assembly-Line Test Procedures for 1998 and Subsequent Model year Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles; and (6) California New Vehicle Compliance Test Procedures. *Id.* The amendments also revised portions of a separate document pertaining to vehicle labels, the California Motor Vehicle Emission Control and Smog Index Label Specifications. *Id.* at 3.

<sup>393</sup> See LEV Program Update (Oct. 1, 1996), available in <<http://www.arb.ca.gov>>.

<sup>394</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 9, 12-13.

<sup>395</sup> *Id.*; Board Resolution 95-40, *supra* note 208, at 2.

<sup>396</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 13. The AAMA figures ranged from 3.53 to 4.07  $\text{g O}_3 / \text{g NMOG}$ , while the CARB staff measurements ranged from 2.422 to 3.257  $\text{g O}_3 / \text{g NMOG}$ . *Id.*

<sup>397</sup> *Id.* These g/mi NMOG emission standards apply to MDV LEVs and ULEVs in the 3751-5750 LVW category. Table III-4, *infra* app. A. The staff thought it noteworthy that these MDV trucks met the NMOG emission standards without the benefit of an electrically-heated catalyst. 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 13-14 n.3.

identical to adopted or proposed RAFs for the same categories light-duty vehicles.<sup>398</sup> The staff's recommendation for the identical RAFs was also based, in part, on the assumption that the medium-duty trucks (3751–5750 LVW) would use “generally the same emission hardware and calibration approaches as light-duty vehicles.”<sup>399</sup> The CARB staff proposed interim RAFs for Phase 2 reformulated gasoline (RFG), methanol (M85), compressed natural gas (CNG), and liquefied petroleum gas (LPG), for both light-duty and medium-duty vehicles.<sup>400</sup> The staff proposed these generic, interim RAFs—effective through model year 2000—at the request of vehicle manufacturers to “allow [them] sufficient lead time to incorporate low specific reactivity strategies into their future production vehicles.”<sup>401</sup> Although alternative fuels were available, the CARB staff had difficulty developing generic RAFs for these remaining categories of LEVs in the light-duty and medium-duty vehicle classes, due to the lack of LEVs and ULEVs in these classes incorporating technologies representative of future production vehicles.<sup>402</sup> The staff reasoned that the lack of generic RAFs could stifle development of alternative-fueled LEVs because of uncertainty regarding emission standards.<sup>403</sup> Without generic RAFs, motor vehicle manufacturers would have to either develop engine-family-specific RAFs for alternative fuels, under established protocols and subject to CARB approval, or forego equivalent NMOG emission standards for their alternative-fueled vehicles.<sup>404</sup> The interim RAF values proposed could be adjusted up or down in the future, depending upon the emission control hardware and engine calibration employed by manufacturers and the resulting ozone reactivity of the particular alternative fuel applied.<sup>405</sup> The CARB approved and adopted

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<sup>398</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 9, 15.

<sup>399</sup> *See id.* at 15; table III-4, *infra* app. A.

<sup>400</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 9–15. The staff proposed a RAF of 0.94 for LDV ULEVs and MDV LEVs and ULEVs—identical to the previously established RAF for LDV LEVs—powered by Phase 2 RFG. *Id.* at 9. The staff proposed a RAF of 0.41 for M85-fueled LEVs and ULEVs in both the LDV and MDV classes, which was the same as the already adopted RAF for LDV TLEVs powered by M85. *Id.* The staff also proposed RAFs of 1.0 for both CNG and LPG for LDV TLEVs, and RAFs of 0.43 for CNG and 0.50 for LPG for the remaining categories of LEVs in both the LDV and MDV classes. *Id.*

<sup>401</sup> *Id.* at 14.

<sup>402</sup> *See id.*

<sup>403</sup> *See id.*

<sup>404</sup> *See id.* at 10, 14.

<sup>405</sup> *See* 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 14–15. The CARB staff noted that some emission hardware and calibration strategies designed to reduce NMOG emissions tend to increase ozone reactivity. *See id.* at 15.

the baseline specific reactivity values for conventional gasoline-powered MDV LEVs and ULEVs and the various interim, generic RAFs recommended by the staff.<sup>406</sup>

### C. Proposed Medium-Duty LEV Amendments

#### 1. Introduction

MDVs are typically vehicles in the 6001 to 14,000 pound gross vehicle weight rating.<sup>407</sup> About seventy percent of these include predominantly gasoline-powered pick-up trucks and sport utility vehicles that weigh less than 8500 pounds.<sup>408</sup> The remainder range from 8501 to 14,000 pounds and include "large pick-up trucks, delivery vans, motor homes and small urban buses."<sup>409</sup> According to the CARB staff, MDVs cause more than their proportional share of the total vehicle population's hydrocarbon (HC), CO, and NO<sub>x</sub> emissions in California.<sup>410</sup> Although MDVs constitute only six percent of California's total vehicle population, they cause an average of eleven percent of the combined on-road HC, CO, and NO<sub>x</sub> emissions.<sup>411</sup> The CARB staff's original proposed amendments and additional modifications provided for creating a new category of medium-duty LEV, ultimately dubbed the Super-Ultra-Low-Emission Vehicle (SULEV); increasing the requirements for medium-duty ULEVs; slight relaxing of some of the medium-duty ULEV emission standards; increasing the NO<sub>x</sub> emission standards for medium-duty LEVs; and adding intermediate in-use compliance standards for chasis-certified SULEVs and medium-duty LEVs and ULEVs certified to the optional heavy-duty engine standards.<sup>412</sup> The CARB approved the staff's original proposal as initially modified at the September 28, 1995 public hearing.<sup>413</sup> The CARB's action regarding MDVs included adoption of a new category of MDV LEV, approval of an accelerated phase-in of MDV ULEVs, as well as

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<sup>406</sup> Board Resolution 95-40, *supra* note 208, at 3-4.

<sup>407</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 19.

<sup>408</sup> *See id.*

<sup>409</sup> *Id.*

<sup>410</sup> *See id.*

<sup>411</sup> *Id.* at 18. MDVs cause 9% of the HC, 13% of the CO, and 11% of the NO<sub>x</sub> emissions. *Id.*

<sup>412</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 3, 18, 48-50; FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 5-11.

<sup>413</sup> Board Resolution 95-40, *supra* note 208, at 1-6.

other changes, as necessary “to achieve the maximum feasible emission reductions” from MDVs.<sup>414</sup>

## 2. The Super-Ultra-Low-Emission Vehicle (SULEV)

Initially the new category of MDV LEVs—with emission standards twice as stringent as MDV ULEVs—were dubbed Super-Low-Emission Vehicles (SLEVs).<sup>415</sup> Shortly after the hearing though, the new category became renamed Super-Ultra-Low-Emission Vehicles (SULEVs).<sup>416</sup> This new SULEV was requested by the natural gas industry and it has no fixed-percentage requirement for phase-in.<sup>417</sup> Nevertheless, as part of the modifications to the original proposed amendments, the CARB established intermediate in-use standards for engine- and chasis-certified medium-duty SULEVs.<sup>418</sup> The proposed in-use exhaust emission standards for chasis-certified SULEVs appear in table III–7, appendix A, in conjunction with the standards applicable to the other categories of MDVs—LEVs and ULEVs. The revised regulations also add calculations for determining vehicle equivalent credits (VECs) for SULEVs (excluding HEVs) and Type A-C HEV SULEVs produced and delivered for sale in California.<sup>419</sup>

## 3. Medium-Duty ULEV Implementation

The fixed-percentage phase-in requirements for MDV ULEVs were raised from a fifteen percent to a forty percent implementation by model year 2003.<sup>420</sup> Manufacturers’ compliance with the phase-in requirements will be verified through new annual reporting requirements.<sup>421</sup> When the revised regulations become effective, manufacturers will be required to submit annual reports of their production

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<sup>414</sup> *Id.* at 5.

<sup>415</sup> *Id.* at 3.

<sup>416</sup> FIRST FIFTEEN-DAY NOTICE, *supra* note 382, at 3.

<sup>417</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 21.

<sup>418</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 7.

<sup>419</sup> FINAL REGULATION ORDER: AMENDMENTS TO SECTIONS 1960.1, 1956.8, 1965, 2101, 2061, AND 2292.1, AND ADOPTION OF SECTION 2062, TITLE 13, CALIFORNIA CODE OF REGULATIONS 25–6 (1996), available in <<http://www.arb.ca.gov/msprog/levprog/lev3regs.oal>> (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12)) (adopted June 24, 1996) [hereinafter FINAL REGULATION ORDER: LEV RULEMAKING].

<sup>420</sup> Board Resolution 95–40, *supra* note 208, at 3.

<sup>421</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 27 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(12)(g)).

numbers by the first day of March in the calendar year following the close of the applicable production model year.<sup>422</sup> This annual report, to be submitted to the CARB Executive Officer, will also be used to verify the manufacturers' accumulation of vehicle equivalent credits or debits.<sup>423</sup> The proposed revisions to the MDV phase-in requirements appear in table III-6, appendix A.

These amendments were prompted by California's revised ozone attainment SIP (state implementation plan) proposal.<sup>424</sup> In table III-6 of appendix A, the MDVs shown as being certified per Section 1960.1 of Title 13, California Code of Regulations, are the complete vehicles—predominantly sport utility vehicles and gasoline-powered trucks—that are “chassis-certified” and tested.<sup>425</sup> The MDVs shown as being certified per Section 1956.8 of Title 13, California Code of Regulations, are MDVs from 8501–14,000 pounds gross vehicle weight (GVW) that are engine-dynamometer-certified vehicles under the optional heavy-duty standards for engines and vehicles.<sup>426</sup> These MDVs are incomplete—usually an incomplete chassis and an engine—mostly gasoline- and diesel-powered vehicles that become large pick-up trucks, delivery vans, small buses, and motor homes.<sup>427</sup> To allow manufacturers to develop future, nationwide emission control strategies for CO, NMHC, and NO<sub>x</sub> emissions from engine-dynamometer-certified MDVs and all heavy-duty Otto-cycle engines, the CARB modified the original proposed amendments to the heavy-duty standards for 2004 and subsequent model year engines and vehicles to align its standards with the proposed federal standards for the same model years.<sup>428</sup> Within one year of the final adoption of the federal emission standards by EPA, the CARB will conduct a public hearing to consider final adoption of the same, or similar, standards.<sup>429</sup>

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<sup>422</sup> See *id.*

<sup>423</sup> See *id.*

<sup>424</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 18–19.

<sup>425</sup> See *id.* at 18, 20.

<sup>426</sup> See CAL. CODE REGS. tit. 13, § 1956.8(h) n.A (1996); 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 18, 20.

<sup>427</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 19 & n.5.

<sup>428</sup> See FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 6; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 31–32 (to be codified at CAL. CODE REGS. tit. 13, § 1956.8(h) n.G) (adopted June 24, 1996, and forwarded to OAL Aug. 9, 1996).

<sup>429</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 23; FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 6.

#### 4. Medium-Duty Exhaust Emission Standards for LEVs, ULEVs, and SULEVs

While the MDV ULEV implementation requirements were increased, the staff proposed, and the CARB approved, a slight relaxation of the MDV ULEV emission standards for CO and PM.<sup>430</sup> The more lenient PM standards apply to medium-duty LEVs, ULEVs, and SULEVs that are engine-dynamometer-certified under the optional heavy-duty standards for vehicles and engines.<sup>431</sup> This relaxation of the CO and PM standards provides manufacturers greater flexibility in designing emission control strategies for reduction of NO<sub>x</sub> emissions.<sup>432</sup> Also, the CARB staff proposed a slight relaxation of the 120,000 mile in-use NO<sub>x</sub> emission standard for ULEVs, at the request of manufacturers, because the more rigorous operating conditions of MDVs might mean greater in-use deterioration of emission control equipment.<sup>433</sup> Nevertheless, the staff's proposal included provisions for making, beginning in 1998, the medium-duty LEV NO<sub>x</sub> in-use standards for 50,000 and 120,000 miles more stringent, by making them equivalent to the medium-duty ULEV standards.<sup>434</sup> The CARB staff calculated that NO<sub>x</sub> reductions from this aspect of the proposal would meet the reductions required by the revised SIP, while alleviating any need to require one hundred percent medium-duty ULEVs beginning in 2002.<sup>435</sup> The proposed revisions to the exhaust emission standards, except the HCHO standards, for chasis-certified LEVs and ULEVs, as well as chasis-certified SULEVs, in the medium-duty class appear in table III-7, appendix A. The revisions to the LEV regulations included the establishment of HCHO exhaust emission standards for the new SULEVs.<sup>436</sup>

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<sup>430</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 21; Board Resolution 95-40, *supra* note 208, at 6. The amended regulations relax the PM standard for engine-certified ULEV MDVs under the optional heavy-duty engine standards, and relax the CO standards for engine- and chasis-certified ULEV MDVs. FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 14.

<sup>431</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 31 (to be codified at CAL. CODE REGS. tit. 13, § 1956.8(h)) (adopted June 24, 1996); compare *id.* with CAL. CODE REGS. tit. 13, § 1956.8(h) (1996), and table III-5, *infra* app. A (showing more lenient PM standards for 1992 and subsequent model year ULEVs under revised regulations that will become effective in late Oct. 1996).

<sup>432</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 20.

<sup>433</sup> *Id.* at 20-21.

<sup>434</sup> *Id.*

<sup>435</sup> *Id.* at 20-23.

<sup>436</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 1-2 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(e)(3)) (adopted June 24, 1996).

The HCHO exhaust emission standards for medium-duty LEVs and ULEVs remained the same.<sup>437</sup>

As the figures in table III-7 of appendix A demonstrate, the CO certification standards for medium-duty ULEVs were substantially relaxed, while the medium-duty LEV NO<sub>x</sub> certification standards for both the 50,000 and 120,000 mile in-use compliance were made more rigorous by aligning them with the medium-duty ULEV standards.

At the same time, though, intermediate in-use NO<sub>x</sub> and NMOG compliance standards for 50,000 miles for medium-duty LEVs and ULEVs from 3751 to 14,000 pounds test weight (TW) were continued and extended, except the LEV intermediate NMOG standard, to give manufacturers "an extra cushion should . . . [these MDVs] exceed the actual standards in-use by a small margin during the first few years of production."<sup>438</sup> The original 50,000 mile intermediate in-use NO<sub>x</sub> and NMOG compliance standards for medium-duty LEVs and ULEVs applied to vehicles from 0 to 14,000 pounds TW, and they were effective through model year 1999.<sup>439</sup> Also, under the initial LEV regulations, the 120,000 mile in-use compliance standards were waived for medium-duty LEVs and ULEVs through model year 1999.<sup>440</sup> However, these provisions were due to "sunset in 1999."<sup>441</sup> The CARB staff's proposed revisions to the LEV regulations, as modified, left the 50,000 mile NMOG and NO<sub>x</sub> intermediate in-use standards through 1999, and the NMOG and NO<sub>x</sub> waivers for standards beyond 50,000 miles through 1999, *mostly* intact for LEVs and ULEVs from 3751-14,000 pounds TW; provided for an additional year of intermediate in-use 50,000 mile NO<sub>x</sub> standards for both vehicle emission categories; and extended the intermediate in-use 50,000 mile NMOG standards for ULEVs from 3751-14,000 pounds TW through the 2002 model year.<sup>442</sup> Also, the revised regulations established 120,000 mile interme-

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<sup>437</sup> Compare *id.* with CAL. CODE REGS. tit. 13, § 1960.1(e)(3).

<sup>438</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 22.

<sup>439</sup> CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(9).

<sup>440</sup> *Id.*

<sup>441</sup> 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 22.

<sup>442</sup> *Id.* at 21-22; THIRD FIFTEEN-DAY NOTICE: LEV RULEMAKING, *supra* note 388, attachment A at A-1 to A-2. FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 22 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(9)) (adopted June 24, 1996). Compare FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 22 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(9)) (adopted June 24, 1996) with CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n.(9), and table III-4, *infra* app. A at A-4 (showing that 50,000 mile NMOG and NO<sub>x</sub> intermediate in-use standards for LEVs and ULEVs remained same through 1999, except as follows: (1) the NO<sub>x</sub> intermediate standards for LEVs, 3751-14,000 pounds TW, were made

diate in-use standards for NO<sub>x</sub> for medium-duty LEVs and ULEVs from 3751–14,000 pounds TW for model year 2000; 120,000 mile intermediate in-use NMOG standards for medium-duty ULEVs from 3751–14,000 pounds TW for the 2000 through 2002 model years; and 50,000 mile intermediate in-use NMOG and NO<sub>x</sub> standards for medium-duty SULEVs from 3751–14,000 pounds TW through 2002.<sup>443</sup> For medium-duty SULEVs from 3751–14,000 pounds TW, in-use compliance with NO<sub>x</sub> and NMOG standards beyond 50,000 miles will be waived, once the regulations become effective, through the 2001 model year.<sup>444</sup> Then for the 2002 model year, 120,000 mile intermediate in-use NMOG and NO<sub>x</sub> standards apply to SULEVs from 3751–14,000 pounds TW.<sup>445</sup> Further, as part of the final modifications to the original rulemaking, the CARB established intermediate in-use standards for the combined NO<sub>x</sub> and NMHC in-use compliance standards for incomplete medium-duty LEVs, ULEVs, and SULEVs engine-certified to the optional heavy-duty standards.<sup>446</sup> These intermediate standards are 0.2 grams per brake horsepower-hour (g/bhp-hr) less stringent than the combined NMHC and NO<sub>x</sub> certification standards for the incomplete medium-duty LEVs, ULEVs, and SULEVs from 8501–14,000 pounds TW certified to the optional heavy-duty standards.<sup>447</sup> For LEVs certified to the 3.5 g/bhp-hr standard for model years 1992–2001, ULEVs certified to the 2.5 g/bhp-hr standard for model years 1992–2003, and SULEVs certified to the 2.0 g/bhp-hr standard for the 1992 and subsequent model years, the less stringent intermediate standards apply to the introduction model year and the following model year.<sup>448</sup> Like the various other intermediate in-use standards for the different emission categories of LEVs these intermediate standards are intended to provide an extra cushion to manufacturers in the introductory years.<sup>449</sup>

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slightly more stringent for 1998 through 1999; and (2) the NO<sub>x</sub> intermediate standards for ULEVs, 3751–8500 pounds TW, were relaxed 0.1 g/mi).

<sup>443</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 22.

<sup>444</sup> See *id.*

<sup>445</sup> See *id.*

<sup>446</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 7; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 32.

<sup>447</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 32 (to be codified at CAL. CODE REGS. tit. 13, § 1956.8(h) n.H) (adopted June 24, 1996).

<sup>448</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 7; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 32 (to be codified at CAL. CODE REGS. tit. 13, § 1956.8(h) n.H) (adopted June 24, 1996).

<sup>449</sup> FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 7.



## D. *Proposed Light-Duty LEV Amendments*

### 1. Introduction

In addition to the proposed light-duty RAFs discussed in Section V.B. above, the proposed revisions to the LEV regulations amended and updated various certification requirements and added new requirements to “facilitate implementation of the Low-Emission Vehicle Program.”<sup>450</sup> The CARB staff’s proposed revisions, as modified, included provisions revising and extending the intermediate in-use standards for light-duty LEVs and ULEVs; revising the 100,000 mile PM certification standards for LDTs from 3751–5750 pounds LVW; adding an annual reporting requirement; revising label specifications, including a smog index window label requirement for all PCs and LDTs; and implementing new on-board diagnostics requirements.<sup>451</sup>

### 2. Exhaust Standards for Passenger Cars (PCs) and Light-Duty Trucks (LDTs) in the LEV and ULEV Emission Categories

The original 50,000 mile intermediate in-use NO<sub>x</sub> and NMOG compliance standards for LEVs in the 0–5750 pound loaded vehicle weight (LVW) classes were to expire at the end of the 1998 model year.<sup>452</sup> Likewise, the original 50,000 mile intermediate in-use NO<sub>x</sub>, CO, and NMOG compliance standards for ULEV in the 0–5750 LVW classes were only effective through the 1998 model year.<sup>453</sup> Also, under the initial LEV regulations, the 100,000 mile in-use compliance standards were waived for these LEV and ULEV PCs and LDTs through model year 1998.<sup>454</sup> In the revisions to the LEV regulations, the staff proposed, and the CARB approved, extending the intermediate in-use compliance standards for these light-duty LEVs and ULEVs through the 1999 and through the 2002 model years, respectively.<sup>455</sup> Also, although the existing waiver of compliance with standards beyond

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<sup>450</sup> Board Resolution 95–40, *supra* note 208, at 3, 5.

<sup>451</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 48–50 app. A; FIRST FIFTEEN-DAY NOTICE: LEV RULEMAKING, *supra* note 382, at 2; THIRD FIFTEEN-DAY NOTICE: LEV RULEMAKING, *supra* note 388, at 1–2; FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 8–11.

<sup>452</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6) (1996).

<sup>453</sup> *Id.*

<sup>454</sup> *Id.*

<sup>455</sup> See, e.g., FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 6–7 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6)) (adopted June 24, 1996).

50,000 miles for LEVs and ULEVs was not extended beyond the 1998 model year, the Board-approved amendments to the LEV regulations established 100,000 mile intermediate in-use standards for LEVs for 1999 and for ULEVs for 1999–2002.<sup>456</sup> The CARB staff reasoned that these extended and new intermediate in-use compliance standards would give manufacturers some additional flexibility to develop technologically feasible emission controls that would meet the LEV and ULEV standards.<sup>457</sup> For example, the initial exhaust emissions from test vehicles or engines representing a new 1997 or 1998 gasoline-powered light-duty truck, 3751–5750 LVW, in the ULEV category, must not exceed the 0.050 g/mi NMOG, 2.2 g/mi CO, and 0.4 g/mi NO<sub>x</sub> 50,000 mile standards and the 0.070 g/mi NMOG, 2.8 g/mi CO, and 0.5 g/mi NO<sub>x</sub> 100,000 mile standards to be certified for sale in California.<sup>458</sup> In model years 1997 to 1998, though, the durability requirements for these representative test vehicles or engines are less stringent. These ULEVs' in-use-exhaust emissions need only meet, or fall below, the less stringent 50,000 mile intermediate standards of 0.075 g/mi NMOG, 3.3 g/mi CO, and 0.5 g/mi NO<sub>x</sub>, and adherence to in-use compliance standards beyond 50,000 miles has been waived.<sup>459</sup> Test vehicles or engines representing a new 1999 through 2002 model year truck in the same vehicle emission (ULEV) and weight categories must not exceed the same 0.50 g/mi NMOG, 2.2 g/mi CO, and 0.4 g/mi NO<sub>x</sub> 50,000 mile standards and 0.070 g/mi NMOG, 2.8 g/mi CO, and 0.5 g/mi NO<sub>x</sub> 100,000 mile standards to be certified for sale in California.<sup>460</sup> Thereafter, these test vehicles or engines are subject to less stringent durability requirements as well. These 1999 through 2002 ultra-low-

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<sup>456</sup> Compare *id.* with CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6) (showing new LEV and ULEV intermediate in-use standards for 100,000 miles and showing waiver of compliance with in-use standards beyond 50,000 miles for LEVs and ULEVs remains unchanged).

<sup>457</sup> See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, app. A at 1–1.

<sup>458</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1); see also table III-1, *infra* app. A. These are the actual in-use emission standards for ULEVs of this vehicle type and weight that remained unchanged by the regulatory amendments to the LEV Program. See *id.*; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 4 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1) (adopted June 24, 1996 and forwarded to OAL Aug. 9, 1996).

<sup>459</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6); see also table III-1, *infra* app. A (showing these intermediate in-use standards in parentheses). These are the intermediate in-use emission standards for ULEVs of this vehicle type and weight effective up to 50,000 miles, through model year 1998, that remained unchanged by the regulatory amendments to the LEV Program. See *id.*; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 6–7 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6)) (adopted June 24, 1996).

<sup>460</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 4 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1)) (adopted June 24, 1996).

emission light-duty trucks' in-use-exhaust emissions need only meet, or fall below, the more lenient 50,000 mile intermediate standards of 0.70 g/mi NMOG, 2.8 g/mi CO, and 0.5 g/mi NO<sub>x</sub>, and the less stringent 100,000 mile intermediate standards of 0.100 g/mi NMOG, 4.4 g/mi CO, and 0.7 g/mi NO<sub>x</sub>.<sup>461</sup>

Also, the revised regulations will make the PM standards for light-duty diesels certifying to the 100,000 mile exhaust emission standards for TLEVs, LEVs, and ULEVs in the light-duty truck class from 3751–5750 pounds LVW less stringent.<sup>462</sup> The revised standards will be relaxed from 0.08 g/mi to 0.10 g/mi for TLEVs and LEVs, and from 0.04 g/mi to 0.05 g/mi for ULEVs.<sup>463</sup> Further, for the purposes of verifying manufacturers' compliance with the fleet average NMOG requirements and determining manufacturers' accumulation of NMOG credits and debits, the revised regulations will require annual production reports from manufacturers.<sup>464</sup> This annual compliance report will be due on the first day of March in the calendar year following the close of applicable production model year.<sup>465</sup>

### 3. The Vehicle Emission Control and Smog Index Label Requirements

The proposed LEV regulatory amendments, as modified, include several modifications and additions to the *California Motor Vehicle Emission Control and Smog Index Label Specifications*.<sup>466</sup> The revised label specifications add a requirement for a smog index window label on all 1998 and subsequent model year passenger cars and light-duty trucks.<sup>467</sup> The smog index window labels will be required to be

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<sup>461</sup> See *id.* at 6–7 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1)) (adopted June 24, 1996). The 50,000 mile intermediate in-use compliance standards for ULEVs of this type are identical to the actual in-use standards for 100,000 miles for the same vehicle. Compare *id.* with CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6) and table III-1, *infra* app. A.

<sup>462</sup> See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 8 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(7)) (adopted June 24, 1996).

<sup>463</sup> See *id.*

<sup>464</sup> *Id.* at 15 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(7)d) (adopted June 24, 1996).

<sup>465</sup> See *id.*

<sup>466</sup> See, e.g., CALIFORNIA MOTOR VEHICLE EMISSION CONTROL AND SMOG INDEX LABEL SPECIFICATIONS 1–11, available in <<http://www.arb.ca.gov>> (amendments adopted June 24, 1996) [hereinafter LABEL SPECIFICATIONS]. The requirements in this document are incorporated by reference in CAL. CODE REGS. tit. 13, § 1965; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note 419, at 34 (to be codified at CAL. CODE REGS. tit. 13, § 1965) (adopted June 24, 1996).

<sup>467</sup> LABEL SPECIFICATIONS, *supra* note 466, at 1.

placed in a conspicuous location, and to conform to either the format specified by the regulations or an alternative format approved by the CARB Executive Officer in advance.<sup>468</sup> The smog index window label uses a bar graph, scaled from 0.1 to 10, designed to reflect the relative level of the vehicle's 50,000 mile NMOG and NO<sub>x</sub> exhaust emissions and its HC evaporative emissions based on the "U.S. EPA's MOBILE 5 emission model."<sup>469</sup> The CARB staff used PCs and LDTs meeting the certification standards for Tier I vehicles for the 1995 model year, which have a smog index of about 1.0, as the baseline for determining the applicable smog index for new vehicles.<sup>470</sup> The smog indices for each new PC and LDT vehicle emission category will then be determined by dividing its NMOG and NO<sub>x</sub> certification standards and model HC evaporative emissions (g/mi of NMOG and NO<sub>x</sub> exhaust and HC evaporative emissions) by the relative emissions for the baseline vehicle.<sup>471</sup> Thus, PCs and LDTs certifying to exhaust and evaporative standards more stringent than the baseline vehicle will be assigned an index lower than 1.0.<sup>472</sup> The smog index 0.00 will be assigned to ZEVs in the PC and LDT classes.<sup>473</sup> The CARB determined that the window label requirement for a smog index was proper and necessary as part of its responsibilities under the California Health and Safety Code.<sup>474</sup>

Other modifications involved various changes or additions to existing motor vehicle labeling requirements. The requirements for "un-leaded gasoline only" labels for instrument panels and fuel filler inlets lapse at the end of the 1996 model year.<sup>475</sup> The vehicle emission configu-

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<sup>468</sup> See FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 8.

<sup>469</sup> THIRD FIFTEEN-DAY NOTICE: LEV RULEMAKING, *supra* note 388, at 2; FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 9-10.

<sup>470</sup> See FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 9. For a description of California Tier I vehicles see *supra* text accompanying note 252.

<sup>471</sup> See FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 9; LABEL SPECIFICATIONS, *supra* note 466, at 10-13.

<sup>472</sup> See FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 9. The CARB staff provided the following example:

[T]he smog index for a 1998 LEV passenger car would be 0.075 g/mi NMOG + 0.2 g/mi NO<sub>x</sub> + 0.14 g/mi evaporative emissions, or 0.415. Compared to the baseline vehicle whose smog index is 0.25 g/mi NMOG + 0.4 g/mi NO<sub>x</sub> + 0.48 g/mi evaporative emissions, or 1.00, the smog index of the 1998 LEV passenger car would be 0.37.

*Id.*

<sup>473</sup> LABEL SPECIFICATIONS, *supra* note 466, at 11, 13.

<sup>474</sup> Board Resolution 95-40, *supra* note 208, at 5.

<sup>475</sup> LABEL SPECIFICATIONS, *supra* note 466, at 1; FINAL STATEMENT OF REASONS: LEV RULEMAKING, *supra* note 381, at 11.

ration (VEC) bar-code labeling requirements were revised to require a ninth character, indicating the vehicle emission category, for all motor vehicles.<sup>476</sup> Also, the exemption for ZEVs from VEC bar-code labeling was removed, and labeling becomes required for ZEVs and "ZEVs certified as HEVs because the fuel-fired heater operates above 40°F."<sup>477</sup> The nine-character VEC-bar-code label for ZEVs will read "ZZZZZZZZZ."<sup>478</sup>

#### 4. New Testing Requirements For Vehicles Equipped With On-Board Diagnostics

The revised regulations will also add new testing requirements for vehicles containing on-board diagnostics systems. The CARB approved an amendment to the *California New Vehicle Compliance Test Procedures* requiring on-board diagnostics systems to be pre-checked and used during new vehicle compliance testing and in quality audit testing.<sup>479</sup> Manufacturers will be required to ensure the on-board diagnostics malfunction indicator light (MIL) is working properly before beginning compliance testing.<sup>480</sup> Then, if the MIL lights up or if a fault code appears during the break-in, preconditioning, or testing, the manufacturer must submit an engineering report of the probable cause of the event, an opinion regarding the nature of the problem, and a proposal for corrective action, if applicable, to the CARB Executive Officer.<sup>481</sup>

#### E. *Proposal for an Equivalent Zero-Emission Vehicle (EZEV) and for Modifications to the Certification and Test Procedures for HEVs and ZEVs*

##### 1. Introduction

Around the time of the second biennial review of the LEV program, manufacturers and advanced-transportation-technology devel-

<sup>476</sup> LABEL SPECIFICATIONS, *supra* note 466, at 7.

<sup>477</sup> *Id.* at 6.

<sup>478</sup> See *id.* at 6-7. Also, language was added to exempt motorcycles from VEC bar-code labeling. *Id.* at 6.

<sup>479</sup> Board Resolution 95-40, *supra* note 208, at 3; CALIFORNIA NEW VEHICLE COMPLIANCE TEST PROCEDURES: CALIFORNIA AIR RESOURCES BOARD 2 (June 24, 1986), available in <<http://www.arb.ca.gov/msprog/levprog/newvehpt.oal>> (amendments adopted June 24, 1996 and forwarded to OAL Aug. 9, 1996).

<sup>480</sup> *Id.*

<sup>481</sup> *Id.*

opers asked the CARB to consider giving ZEV credits to LEVs with extremely low emissions, on the basis of equivalent emission reduction benefits.<sup>482</sup> At the Board hearing in May of 1994, the CARB directed the staff to reconsider the treatment of HEVs under the LEV regulations, including the possibility of permitting ZEV credits for them.<sup>483</sup> Since the CARB's directive, the staff has conducted three public workshops—May 9, 1995, August 9, 1995, and July 2, 1996—focusing on HEV-related issues.<sup>484</sup> At the first workshop in May, 1995, the CARB staff exchanged information about changing the treatment of HEVs under the LEV Program and giving them some form of ZEV credits with vehicle manufacturers and other interested parties.<sup>485</sup> After this workshop, the staff prepared a preliminary draft proposal, dated July 14, 1995, for amendments to the LEV regulations.<sup>486</sup> This preliminary draft revision of the regulations proposed to provide partial credit to certain HEVs<sup>487</sup> and established a new equivalent zero-emission vehicle (EZEV) category of LEV for the passenger car and light-duty truck classes and corresponding emissions standards.<sup>488</sup> Vehicles meeting the proposed EZEV standard would count toward a manufacturer's ZEV production requirements, or confer ZEV credits.<sup>489</sup> The CARB staff presented this draft proposal at a public workshop on August 9, 1995.<sup>490</sup> In light of the comments received at this second workshop, the CARB amended the proposed modifications to

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<sup>482</sup> MOBILE SOURCE DIVISION, CALIFORNIA AIR RESOURCES BOARD, PRELIMINARY DRAFT STAFF REPORT: PROPOSED AMENDMENTS TO THE LOW-EMISSION VEHICLE REGULATIONS TO ADD AN EQUIVALENT ZERO-EMISSION VEHICLE STANDARD I (June 11, 1996), *available in* <<http://www.arb.ca.gov>> [hereinafter 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II].

<sup>483</sup> 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121, at 1.

<sup>484</sup> See Board Chairman's Letter, *supra* note 376, at attached schedule; 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121, at 1-2; 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 1; CALIFORNIA AIR RESOURCES BOARD, MAIL OUT #96-19: PUBLIC WORKSHOP TO DISCUSS PROPOSED REVISIONS TO THE LOW-EMISSION VEHICLE REGULATIONS 1-2 (June 11, 1996), *available in* <<http://www.arb.ca.gov>> [hereinafter MAIL OUT #96-19].

<sup>485</sup> See Board Chairman's Letter, *supra* note 376, at attached schedule.

<sup>486</sup> 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121.

<sup>487</sup> At the time, the CARB staff proposed that Type A-C HEVs with an all-electric range of at least 30 miles and an auxiliary power unit and fuel system that, considering combined exhaust, evaporative, and refueling emissions, would meet ULEV emission standards could receive partial ZEV credit. See 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121, at 2, 15-16.

<sup>488</sup> 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 1; 1995 PRELIMINARY DRAFT STAFF REPORT: EZEVS, *supra* note 121, at 6.

<sup>489</sup> See 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 1.

<sup>490</sup> See *id.*; Board Chairman's Letter, *supra* note 376, at attached schedule.

the LEV regulations and published a second preliminary draft staff report on June 11, 1996.<sup>491</sup> The third public workshop, on July 2, 1996, was scheduled to obtain public input on this revised preliminary draft proposal.<sup>492</sup> The June, 1996, revised preliminary draft staff report continues to propose an EZEV standard and allows vehicles meeting it to count, on a one-to-one basis, toward manufacturers' ZEV requirements, or earn ZEV credits; but drops entirely the proposed partial ZEV credits for certain HEVs.<sup>493</sup>

## 2. The Proposed EZEV Emission Standards

To establish the proposed EZEV emission standards for NO<sub>x</sub> and NMOG, the CARB staff, with the help of the California Energy Commission (CEC) staff, developed a range of EV-related emissions estimates using six different scenarios.<sup>494</sup> Using assumptions about the expected number of EVs operating in the South Coast Air Basin (SCAB) in the years 2000 and 2010; the average annual miles driven for these EVs; the times of day these EVs would be recharged; and their energy efficiency in kilowatt hours per mile (KWh/mi), the CEC staff estimated the NO<sub>x</sub> and ROG emission from SCAB and Ventura power plants attributable to EVs operating in the SCAB.<sup>495</sup> From this the CARB staff determined the new, proposed standards for emissions from EZEVs in the PC and LDT classes from 0–3750 pounds LVW for NO<sub>x</sub> as 0.02 g/mi and for NMOG as 0.004 g/mi.<sup>496</sup> In contrast, the existing exhaust emission certification standards for ULEVs in the same class for these pollutants are 0.2 g/mi for NO<sub>x</sub> and 0.040 g/mi for NMOG.<sup>497</sup> No separate HCHO standard was recommended by the staff, because formaldehyde emissions under the proposal are to be measured and counted within NMOG emissions from EZEVs.<sup>498</sup> Also, EZEVs with auxiliary power units operating on alternative fuels would be precluded from applying a RAF to the NMOG emission standard.<sup>499</sup>

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<sup>491</sup> See 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 1; MAIL OUT #96–19, *supra* note 484, at 1.

<sup>492</sup> See MAIL OUT #96–19, *supra* note 484, at 2.

<sup>493</sup> 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 1, 7.

<sup>494</sup> *Id.* at 8–14.

<sup>495</sup> *Id.* at 9, 14.

<sup>496</sup> See *id.* at 5.

<sup>497</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) (1996); table III–1, *infra* app. A.

<sup>498</sup> 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 4.

<sup>499</sup> See *id.* at app. A, 3–3.

The proposed EZEV emissions standard is a “combined exhaust, evaporative and refueling emission standard.”<sup>500</sup> Therefore, the CARB staff’s proposal also addresses CO, PM, evaporative, and refueling emissions.<sup>501</sup> The staff proposes to establish CO and PM standards that are ten times more stringent than the ULEV emissions standards for these pollutants.<sup>502</sup> The proposed certification standards for EZEVs in the PC and LDT classes from 0–3750 pounds LVW are 0.17 g/mi for CO and 0.004 g/mi for PM, whereas the certification standards for ULEVs in the same classes are 1.7 g/mi for CO and 0.04 g/mi for PM.<sup>503</sup> The rationale for making the EZEV CO and PM standards ten times more stringent flows from the fact that the proposed NO<sub>x</sub> and NMOG standards, based on the estimated EV-related power plant emissions, are one-tenth of the existing ULEV standards for NO<sub>x</sub> and NMOG.<sup>504</sup> The staff proposes developing evaporative and refueling emissions standards for EZEVs on a case-by-case basis, rather than developing complicated generic standards that might not apply to a particular EZEVs fuel system or the fuel it employs.<sup>505</sup> For example, an evaporative emissions standard might not be needed for EZEVs possessing closed fuel systems exhibiting no evaporative losses.<sup>506</sup> For EZEVs containing fuel systems that give off evaporative emissions the staff will convert these emissions into g/mi, combine them with the other emissions test results, and then compare the combined results to the EZEV emissions standards to determine compliance.<sup>507</sup> For refueling emissions the CARB staff predetermined, by using assumptions about ROG emissions from gasoline refueling and applying a conversion factor to obtain g/mi equivalent, that the emissions from existing gasoline refueling systems already exceed the NMOG emission standard proposed for EZEVs.<sup>508</sup> Since refueling emissions associated with alternative fuels are not well established, manufacturers will have to provide the CARB “proposed test procedures for determining refueling emissions from their systems and test data demonstrating compliance.”<sup>509</sup>

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<sup>500</sup> *Id.* at 4.

<sup>501</sup> *See id.*

<sup>502</sup> *See id.*

<sup>503</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(7); 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 5.

<sup>504</sup> *See* 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 4.

<sup>505</sup> *See id.* at 6–7.

<sup>506</sup> *See id.* at 6.

<sup>507</sup> *See id.*

<sup>508</sup> *See id.* at 7.

<sup>509</sup> 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 7.



### 3. Proposed Modifications to the Certification, Test Procedures, and In-Use Requirements

Under the CARB staff's proposal, EZEVs would be required to certify to the combined exhaust, evaporative, and refueling emissions standards discussed above for 100,000 miles.<sup>510</sup> However, EZEVs would be prohibited from exceeding the combined emissions standards for their entire useful life, regardless of mileage.<sup>511</sup> For now, in-use compliance with the emissions standards, under the staff's proposal, would be ensured through the requirements for EZEVs to contain on-board diagnostics systems and to be subject to in-use compliance testing for life.<sup>512</sup> Also, EZEVs would be subject to inspection and maintenance program requirements.<sup>513</sup> The staff's proposal suggests that in-use compliance for EZEVs might also be ensured if manufacturers were to provide comprehensive warranties for the emission control components.<sup>514</sup> The CARB staff also noted that accurately measuring the extremely low emissions from EZEVs might require revisions to the existing test procedures or even more sophisticated testing equipment, and pledged its intent to work with manufacturers to make required revisions to the test procedures.<sup>515</sup> Along these lines, the staff's revised preliminary draft staff report already proposes revisions to the test procedures for HEVs to more accurately measure their emissions.<sup>516</sup> The staff's proposed changes to existing certification and testing procedures include modifications to HEV and ZEV air conditioning loading testing; HEV and ZEV all-electric range testing; and limiting HEV dynamometer testing to electric chassis dynamometers.<sup>517</sup>

#### F. *The Third Biennial Review (March 1996) and the Memoranda of Agreements (MOAs)*

##### 1. Introduction

In general, the LEV regulations adopted by the CARB in 1990 would require large-volume manufacturers—those selling more than

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<sup>510</sup> See *id.*

<sup>511</sup> *Id.*

<sup>512</sup> *Id.* at 5, 7, app. A, at 3-6.

<sup>513</sup> *Id.* at 5.

<sup>514</sup> See 1996 PRELIMINARY DRAFT STAFF REPORT: EZEVS II, *supra* note 482, at 17.

<sup>515</sup> *Id.* at 6.

<sup>516</sup> *Id.*

<sup>517</sup> *Id.* at 21-27.

a total of 35,000 LDVs and MDVs in California per year—to ensure that at least two percent of their fleet of PCs and LDTs from 0–3750 LVW delivered for sale in California for the 1998 through 2000 model years are ZEVs.<sup>518</sup> This fixed-percentage requirement for large-volume manufacturers would increase to five percent of the new fleet for the 2001 through 2002 model years, and to ten percent for the 2003 and subsequent model years.<sup>519</sup> The affected large-volume automakers include GM, Ford, Chrysler, Honda, Nissan, Mazda, and Toyota.<sup>520</sup> Intermediate-volume manufacturers—those with average sales from 1989 to 1993, or projected first-time sales, of LDVs and MDVs in California between 3001 and 35,000 units—would become subject to the ten percent requirement beginning in the 2003 model year.<sup>521</sup> Small-volume manufacturers are entirely exempt from these requirements.<sup>522</sup> As the deadline for the fixed-percentage requirements grew nearer, large-volume automakers were concerned that the large-scale introduction of EVs, using primarily lead-acid batteries, in 1998 would not be cost-effective and “could ‘poison the well’ for future sales if consumer perceptions of low-range EVs and battery replacement needs . . . [were] negative.”<sup>523</sup>

In response to these concerns, at the close of the second biennial review the CARB directed the staff to look into a number of issues raised during the public hearing, and report back on any significant matters needing further consideration by the Board.<sup>524</sup> This resulted in an aggressive schedule of public workshops and other forums, from May through November, 1995, involving ZEV-related issues including: consumer marketability; advanced battery technologies; infrastructure and fleet issues; and the costs and benefits of ZEVs.<sup>525</sup> The CARB staff, auto manufacturers, environmental groups, electric utilities, business groups, and other interested persons participated in these ZEV-related public workshops.<sup>526</sup> Through this process a num-

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<sup>518</sup> See discussion *supra* Section III.A.3.; CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9); 1994 ZEV UPDATE, *supra* note 4, at 6.

<sup>519</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9).

<sup>520</sup> 1994 ZEV UPDATE, *supra* note 4, at 6; 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 15.

<sup>521</sup> CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)g.

<sup>522</sup> *Id.* at n.(9)f.

<sup>523</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 9.

<sup>524</sup> See *id.* at 4; see also discussion *supra* Section IV.H.

<sup>525</sup> See discussion *supra* Section IV.H. The schedule of public forums also involved Board hearings, including a public hearing on ZEVs during January, 1996. *Id.*; Board Chairman's Letter, *supra* note 376, at attached schedule.

<sup>526</sup> *Strock Lays Ground Rules for Review of 1998 ZEV Mandate*, 5 Cal. Env't Comp. Monitor (Landels, Ripley & Diamond) No. 27, at 359 (Nov. 27, 1995).

ber of interested parties, including the automakers, proffered proposals to modify the ZEV mandate for the staff's consideration.<sup>527</sup> At a public hearing in November, 1995, the CARB directed the staff to convene a public forum to consider these proposed modifications to the ZEV mandate and to solicit additional proposals.<sup>528</sup> Also, the CARB directed the staff to prepare a proposal modifying the mandate for the CARB's consideration by the next biennial review, the third, in March, 1996.<sup>529</sup> However, any modified program would have to be capable of attaining, at a minimum, the same emission reductions attributable to the ZEV mandate under the November, 1994 *California State Implementation Plan for Ozone* (SIP), or federal approval of the SIP would be jeopardized.<sup>530</sup> In this latter regard, the California Environmental Protection Agency (Cal. EPA) Secretary, James M. Strock, suggested the CARB should require a "clean air premium"—emissions reductions greater than those anticipated under the existing ZEV mandate relied on in the 1994 SIP—from automakers in return for any relaxation of the ZEV mandate.<sup>531</sup>

In response to the CARB's directive, the staff conducted a public forum on December 6, 1995, in which it presented three main alternative approaches to the existing ZEV regulations, "Concepts A, B, and C."<sup>532</sup> The Concept A approach would remove all existing requirements for ZEVs and rely on performance standards and market-

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<sup>527</sup> *Id.*; see also CALIFORNIA AIR RESOURCES BOARD, NOTICE OF PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE ZERO-EMISSION VEHICLE REQUIREMENTS FOR PASSENGER CARS AND LIGHT-DUTY TRUCKS 1-2 (Jan. 30, 1996), available in <<http://www.arb.ca.gov>> [hereinafter NOTICE OF PUBLIC HEARING: ZEV AMENDMENTS]. The CARB staff met with "the primary stakeholders" on October 24, 1995, to discuss implementation strategies to ensure the long-term success of the ZEV program, and to solicit proposals from them regarding how to modify the program. 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 7.

<sup>528</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 8.

<sup>529</sup> *Strock Lays Ground Rules*, *supra* note 526, at 360; 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at i.

<sup>530</sup> See *Strock Lays Ground Rules*, *supra* note 526, at 360; 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 1, 3.

<sup>531</sup> See *Strock Lays Ground Rules*, *supra* note 526, at 360-61. According to the CARB staff, even the revised SIP, which takes into account both existing regulatory programs for stationary and mobile sources and also new measures targeting further reductions from mobile sources, contains "so called 'black box' measures"—reasonable further progress shortfalls that will require CARB to come up with additional emissions reductions through "as yet unspecified measures." See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 1. Some of the new mobile source measures taken into account in the SIP include accelerated light-duty vehicle scrappage measures, and "measures targeting heavy-duty vehicles and off-road equipment." See *id.*

<sup>532</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 8.

based incentives to implement ZEVs in California.<sup>533</sup> The Concept B approach would delay fixed-percentage implementation until the 2004 model year, and would use a combination of market incentives, commitments from covered automakers, and regulatory requirements to ensure a “ramp-up” toward fixed-percentage requirements effective in the 2004 model year.<sup>534</sup> The Concept C approach would combine relaxed fixed-percentage requirements for ZEVs with market-based incentives.<sup>535</sup> A little over a week later, the staff presented these three concepts to the CARB at a public meeting, in which the Board listened to further comments from interested parties.<sup>536</sup> The next week, in a continuation of the CARB’s public meeting, the staff recommended and received approval for drafting proposed modifications to the ZEV mandate based on the Concept B approach.<sup>537</sup>

On January 30, 1996, the CARB published notice of the third biennial review and of the staff’s intent to propose modifications to the ZEV portion of the LEV regulations removing the fixed-percentage requirements for the 1998 through 2002 model years.<sup>538</sup> The proposed modifications, according to the public notice, would provide affected manufacturers more lead-time to develop and incorporate advanced-battery technologies in EVs and the “flexibility to determine the best time to introduce this new technology to the market.”<sup>539</sup> On February 9, 1996, the CARB staff released its *Staff Report: Initial Statement of Rulemaking; Proposed Amendments to the Zero-Emission Vehicle Requirements for Passenger Cars and Light-Duty Trucks*, which contains a narrative discussion of the proposed changes, including: the *Master Memorandum of Agreement* agreed to by the seven large-volume automakers; the reasons for the modifications; the economic and environmental impacts of the proposed regulatory amendments; and the text of the LEV regulations incorporating the proposed regulatory amendments.<sup>540</sup> The CARB considered the staff’s proposed amendments to the ZEV requirements and public comments about them in public hearings on March 28–29, 1996.<sup>541</sup> At the close of the public

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<sup>533</sup> See *id.*

<sup>534</sup> See *id.*

<sup>535</sup> See *id.*

<sup>536</sup> See *id.*

<sup>537</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 8–9.

<sup>538</sup> See NOTICE OF PUBLIC HEARING: ZEV AMENDMENTS, *supra* note 527, at 2.

<sup>539</sup> See *id.*

<sup>540</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 1–26, app. A, app. C.

<sup>541</sup> See CALIFORNIA AIR RESOURCES BOARD, NOTICE OF PUBLIC AVAILABILITY OF MODIFIED TEXT: PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE ZERO-EMISSION VE-

hearing the CARB adopted, in Resolution 96-12, the proposed regulatory amendments along with some additional modifications.<sup>542</sup> The Board directed the CARB Executive Officer to make the recent, additional modifications to the regulatory amendments available to the public for comment for at least fifteen days before formally adopting the final amendments, which was done on June 14, 1996.<sup>543</sup>

## 2. The Proposed Amendments to the ZEV Requirements

Two primary regulatory changes will take effect when the pending modifications become final. First, the fixed-percentage requirements for large-volume automakers for the 1998 through 2002 model years will be curtailed.<sup>544</sup> However, each large-volume manufacturer will be required to enter into a memorandum of agreement (MOA), designed to help ensure the long-term success of the ZEV program and avoid jeopardizing federal approval of the SIP, with the CARB.<sup>545</sup> Second, manufacturers producing qualified long-range ZEVs and advanced-battery-powered ZEVs for sale in California in model years 1996 through 2002 will be able to earn extra ZEV credits.<sup>546</sup> The requirements for ten percent ZEVs in the 2003 and subsequent model years for large- and intermediate-volume manufacturers, as well as the exemption for small-volume manufacturers, remain unchanged.<sup>547</sup> Also, the annual fleet average NMOG requirements, which were originally based upon an assumed production mix including ZEVs, will remain the same. The emission reductions that would have been realized by

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HICLE REQUIREMENTS FOR PASSENGER CARS AND LIGHT-DUTY TRUCKS 1 (June 14, 1996), available in <<http://www.arb.ca.gov>> [hereinafter FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS].

<sup>542</sup> See *id.* at 1-4, attachment A at 1-21.

<sup>543</sup> *Id.* at 4. The CARB's directive also requires the Executive Officer to consider the comments before taking final action, to make any appropriate changes to the modifications in light of the comments, and, if warranted, present any further modifications to the Board for consideration. *Id.* Also, California law requires the promulgating agency to respond to written comments regarding the modifications in the final action adopting the regulations. CAL. GOV'T. CODE § 11346.8(c) (West 1992).

<sup>544</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 10-11; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 (to be codified at CAL. CODE REGS. tit. 13 § 1960.1(g)(2) n.(9)).

<sup>545</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13-19, app. C, C-1 to C-12.

<sup>546</sup> *Id.* at 10-12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.1-2).

<sup>547</sup> See FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-6.

the 1998–2002 ZEVs will be made up through the manufacturers' proposed production of cleaner cars nationwide.<sup>548</sup>

a. *The Memoranda of Agreement (MOAs)*

In exchange for curtailment of the fixed-percentage requirements for ZEVs for model years 1998 through 2002, the seven large-volume manufacturers listed above agreed to enter into comprehensive MOAs with the CARB, based upon a *Master Memorandum of Agreement (Master MOA)*, that guarantees substantial commitments from all of the parties.<sup>549</sup> The MOAs require the automakers to produce cleaner LDVs nationwide; to produce and market ZEVs for sale in California per their individual, confidential business plans; to participate in a ZEV-related, advanced-technology development and demonstration project in partnership with the CARB; to provide comprehensive annual reports to the CARB Executive Officer; and to agree to pay steep liquidated damages for noncompliance with the foregoing requirements.<sup>550</sup> For its part, the CARB obligates itself in the MOAs to help ensure that the necessary infrastructure for ZEVs is developed; to help implement incentive programs for ZEVs; to help remove some of the institutional obstacles to the successful introduction of ZEVs; and to hold public biennial reviews of the ZEV program beginning in 1998.<sup>551</sup>

i. The Cleaner Cars Requirement

Under this provision of the MOAs, the automakers agree to produce and sell PCs and LDTs in all states, beginning in model year 2001, that meet exhaust emission standards equivalent to the exhaust emissions standards required under the California LEV regulations.<sup>552</sup> These cleaner cars will be produced and sold in all states, except those states that have already adopted the California LEV Program, three

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<sup>548</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13–19, app. B, B-1 to B-12.

<sup>549</sup> See *id.* at 13–19, app. C, C-1 to C-12.

<sup>550</sup> *Id.* at 13–19, app. C, C-1 to C-10.

<sup>551</sup> See *id.* at 16–17, app. C, at C-6 to C-7.

<sup>552</sup> See *id.* at 13, app. C, C-2 to C-3. This provision, proposed by the automakers, emanates from the auto manufacturers' proposal to the OTC to build a so-called "49 state car" in an effort to dissuade New York and Massachusetts from adopting California's ZEV mandate. See discussion *supra* Section III.G.; see also CALIFORNIA AIR RESOURCES BOARD, TRANSCRIPT OF BOARD MEETING 26 (Mar. 29, 1996), available in <<http://www.arb.ca.gov>> [hereinafter MARCH 29, 1996 BOARD HEARING TRANSCRIPT].

model years before the federal Tier II certification and in-use exhaust emission standards could become effective.<sup>553</sup> The requirement for the manufacturers to produce and sell California LEV-program-equivalent PCs and LDTs nationwide beginning in model year 2001 is an absolute one under this provision, the so-called “49 state program,” but how the CARB and the affected automakers ensure its fulfillment is contingent upon the final outcome of the EPA’s proposed voluntary national-low-emission-vehicle program (NLEV program).<sup>554</sup> This MOA provision is structured in a manner to ensure that manufacturers will voluntarily opt-in to the NLEV program if it turns out as expected.<sup>555</sup> In this event, manufacturers will be required to produce and deliver cars for sale in the other forty-nine states that meet annual fleet average NMOG values of 0.075 g/mi NMOG for PCs and LDTs from 0–3750 pounds LVW and 0.1 g/mi NMOG for LDTs from 3751–6000 pounds LVW.<sup>556</sup> These NLEV program PCs and LDTs will also have to meet the on-board diagnostics requirements of the California LEV regulations.<sup>557</sup> If, on the other hand, the final NLEV program does not turn out as anticipated, backstop provisions have been written into this provision to ensure equivalent emission reductions.<sup>558</sup> In this event, the automakers will either be required to produce and deliver for sale California LEVs nationwide—a “50-state” car—or, if that should fail, implement an alternative program, approved by the CARB Executive Officer under the MOAs.<sup>559</sup> Based on estimates of the number of out-of-state vehicles registered each year in California, their average age, and a number of other assumptions, the CARB staff projected that the emission reductions in the SCAB by 2010 resulting from the automakers’ implementation of the NLEV program would exceed the emission reductions that would have been realized by the 1998 through

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<sup>553</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13.

<sup>554</sup> See *id.* at 13–14, app. C, C-2 to C-3; MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 23–26. When the CARB staff and the automakers negotiated the Master MOA, and at the time of the Board’s hearing, the EPA’s proposed voluntary NLEV program was not expected to become a final rule until around May, 1996. See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13; MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 23.

<sup>555</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13, app. C, C-2 to C-3; MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 23–26.

<sup>556</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13, app. C, C-3.

<sup>557</sup> See *id.* at 13–14.

<sup>558</sup> See *id.* at 13, app. C, C-2 to C-3; MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 23–26.

<sup>559</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 13, app. C, C-3; MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 23–26.

2002 model year ZEV requirement in the SCAB by 2010.<sup>560</sup> The CARB staff presumed that the EPA will implement the federal Tier II emission standards beginning in model year 2004, so only projected emissions benefits in the SCAB from the early introduction of Tier II equivalent vehicles were figured into the calculations.<sup>561</sup>

## ii. The ZEV Production Requirement

During November, 1995, the affected manufacturers submitted confidential business plans to the CARB, outlining their anticipated ZEV production capabilities assuming consumer demand for them.<sup>562</sup> Under the MOAs, the automakers must submit biennial updates of these ZEV product plans beginning in 1997.<sup>563</sup> These confidential product plans must, to the extent feasible, identify “projections for model-type(s), vehicle features and specifications, production capacity, prospective battery suppliers, capital allocation, and identification of products that will meet the ZEV regulatory requirement in 2003.”<sup>564</sup> This ZEV production plans provision will help ensure the manufacturers’ commitment to “ramp-up” ZEV production and marketing to meet the model year 2003 ten percent requirement.<sup>565</sup> Also, the MOAs contain a provision requiring the manufacturers to permit CARB representatives biennial “on site review of activities and hardware related to [the] Manufacturer’s ZEV program.”<sup>566</sup>

## iii. The Advanced-Technology Development and Demonstration Requirement

Under this provision the automakers and the CARB commit to developing a long-term market for ZEVs in California through a “Technology Development Partnership.”<sup>567</sup> GM will commit to providing \$8.9 million to the USABC for advanced-battery research and development, and Ford and Chrysler will agree to contribute \$6.67 million and \$3.34 million, respectively.<sup>568</sup> Also, this provision requires

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<sup>560</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 17, app. B, B-1 to B-12.

<sup>561</sup> *Id.* at 17, app. B, B-5.

<sup>562</sup> *See id.* at app. C, C-3.

<sup>563</sup> *See id.*

<sup>564</sup> *Id.*

<sup>565</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 14, app. C, C-3.

<sup>566</sup> *Id.* at app. C, C-6.

<sup>567</sup> *See id.* at 14–16, app. C, C-3 to C-5.

<sup>568</sup> *Id.* at app. C, C-4 n.2.



each of the seven manufacturers, based on their average share of the California market, to produce a pro rata share of an initial total of 3750 advanced-battery-powered ZEVs for demonstration projects in California urban areas in model years 1998 through 2000.<sup>569</sup> These demonstration vehicles are to be placed in use for at least three years among California consumers—through sale, lease, or other form of transfer.<sup>570</sup> The manufacturers will be responsible for service and support of the demonstration vehicles for the three-year period, and the consumers will provide the manufacturers feedback.<sup>571</sup> The advanced batteries for the 1998 model year must possess a specific energy level of at least 40 w-hr/kg and at least 50 w-hr/kg for 1999 and subsequent model years.<sup>572</sup> However, this part of the MOAs includes incentives provisions that could reduce the total number of demonstration project ZEVs, while pushing even greater advances in battery technology.<sup>573</sup> For demonstration project purposes, manufacturers that produce ZEVs powered by advanced batteries with specific energy levels greater than 50 w-hr/kg will receive additional vehicle credits toward their model year production requirement.<sup>574</sup> ZEVs incorporating advanced batteries with 60 w-hr/kg specific energy levels will count as two ZEVs, and those with 90 w-hr/kg will count as three ZEVs toward the model year demonstration project requirement.<sup>575</sup> Also, this section of the MOA grants the manufacturers some flexibility by permitting them to suspend a demonstration for good cause or to seek an adjustment in the pro rata requirements from the CARB Executive Officer.<sup>576</sup>

#### iv. The Annual Reporting Requirement

Once the MOAs become effective, the affected manufacturers will be required to submit annual reports to the CARB Executive Officer,

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<sup>569</sup> *Id.* at 14–15. Each manufacturer's share of the total requirement—750 in the 1998 model year and 1500 each year in model years 1999 and 2000—appears in table 4 of the 1996 STAFF REPORT. *Id.*

<sup>570</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 15, app. C, C-4.

<sup>571</sup> *See id.* at 15, app. C, C-5.

<sup>572</sup> *Id.*

<sup>573</sup> *See id.* at 15–16, app. C, C-5.

<sup>574</sup> *Id.*

<sup>575</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 15–16, app. C, C-5. Advanced-battery-powered ZEVs with specific energy values between 50 and 60 and between 60 and 90 will receive additional partial credit for the demonstration projects, based on a linear interpolation between the values. *Id.*

<sup>576</sup> *See id.* at app. C, C-4 to C-5.

providing information about ZEVs, other than demonstration-project vehicles, placed in use in California and elsewhere in the United States; about advanced battery purchases or contributions to the USABC; and about the demonstration-project ZEVs, including consumer feedback.<sup>577</sup>

#### v. The Enforcement Provisions

The primary enforcement mechanism of the MOAs is the likelihood of the imposition of liquidated damages for noncompliance, as stipulated in the MOAs.<sup>578</sup> If a manufacturer breaches the MOA by failing to fulfill one of the commitments described in Sections V.F.2.a.(1)-(4) above, the CARB may assess predetermined liquidated damages, or a lesser amount determined appropriate by the CARB.<sup>579</sup> Also, the CARB may reinstate the fixed-percentage requirements for that manufacturer.<sup>580</sup> Any liquidated damages assessed by the CARB are to be put into an escrow account to fund projects that will help promote a long-term market for ZEVs.<sup>581</sup> For either a failure to submit ZEV product plans or to provide an annual report by the required date, a manufacturer could be compelled to pay as much as \$150,000 in liquidated damages—\$5,000 per violation per day up to a maximum of thirty days.<sup>582</sup> If GM, Ford, or Chrysler fail to fund the USABC as agreed under the MOA, the liquidated damages will be equivalent to the unpaid balance of the funding obligation.<sup>583</sup> If a manufacturer totally fails to implement the nationwide clean car program, the CARB may assess liquidated damages equivalent to that manufacturer's pro rata share of \$100,000,000.<sup>584</sup> If, on the other hand, a manufacturer simply fails to implement the nationwide clean car program on time and completely fails to offset the lost emission reduction benefits of the forty-nine state program, the CARB may assess liquidated damages of \$100,000 plus \$22,000 per ton of uncompensated emissions

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<sup>577</sup> See *id.* at app. C, C-6.

<sup>578</sup> See *id.* at 18. According to the CARB staff, the predetermined liquidated damages will fully compensate any damage caused by a manufacturer's noncompliance with the specified requirements; and "[t]he amounts established are sufficient to ensure that manufacturers will meet these requirements." *Id.*

<sup>579</sup> *Id.* at app. C, C-9 to C-10.

<sup>580</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at app. C, C-9 to C-10.

<sup>581</sup> *Id.* at app. C, C-9 to C-10.

<sup>582</sup> *Id.* at app. C, C-9.

<sup>583</sup> *Id.*

<sup>584</sup> *Id.*

offsets.<sup>585</sup> However, for a manufacturer that fails to implement the forty-nine state program on time, but completely offsets the emissions reduction benefit, the CARB may only assess liquidated damages of up to \$100,000.<sup>586</sup>

Any determination of noncompliance by a manufacturer will be initiated under the MOAs by the CARB Executive Officer, and the affected manufacturer may seek *de novo* review of the Executive Officer's final determination, first by the Board and thereafter by the Superior Court of California for Sacramento County.<sup>587</sup> The CARB Executive Officer initiates a possible determination of noncompliance, by sending the manufacturer a written notice of preliminary determination, including the reason for the determination and the supporting information.<sup>588</sup> Upon receipt of the notice, the manufacturer must notify the Executive Officer, within fifteen business days, of the following: (1) any contention that it has fully complied with the MOA; (2) details of its efforts to comply; and (3) any corrective action(s) taken or proposed.<sup>589</sup> Then, the Executive Officer must make a final determination regarding whether the manufacturer has breached a provision covered by part B of the agreement, and provide written notice of any breach finding to the manufacturer.<sup>590</sup> At this point, the Executive Officer has the discretion to waive or diminish the manufacturer's compliance obligation, and if the noncompliance was due to factors beyond the manufacturer's control, like storms, war, strikes, or labor disputes, it should not be determined to be a breach.<sup>591</sup> If the Executive Officer determines a breach occurred, the Executive Officer has the discretion to waive or lessen the applicable liquidated damages.<sup>592</sup> Upon receipt of the Executive Officer's determination of breach, the manufacturer has thirty business days to appeal to the Board for *de novo* review of the matter.<sup>593</sup>

#### vi. The CARB's Commitments

For its part, the CARB will obligate itself under the MOAs to a list of specific commitments that involve working with state and local

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<sup>585</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at app. C, C-9.

<sup>586</sup> *Id.*

<sup>587</sup> *Id.* at app. C, C-7.

<sup>588</sup> *Id.* at app. C, C-8.

<sup>589</sup> *Id.*

<sup>590</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at app. C, C-8.

<sup>591</sup> *Id.* at app. C, C-8 to C-9.

<sup>592</sup> *Id.* at app. C, C-8.

<sup>593</sup> See *id.*

government agencies, trade groups, and others to facilitate a market for ZEVs in California.<sup>594</sup> These commitments include facilitating the state's purchase or lease of ZEVs for fleet use; resolving ZEV insurance issues with the California Department of Insurance; working with state agencies to ensure adequate battery recycling capacity exists; working with local governments, utilities, and trade groups to facilitate the development of EV recharging infrastructure in both the public and private sectors; and generally assisting the development of incentive programs to spawn ZEV purchases.<sup>595</sup> Also, the CARB will be obligated to conduct public biennial reviews of the ZEV program beginning in 1998.<sup>596</sup> However, at the March 29, 1996 CARB hearing, some of the Board members urged annual updates of the ZEV program, and the CARB Executive Officer indicated that annual updates, in between the biennial reviews called for in the MOAs, were feasible and would be carried out.<sup>597</sup>

#### vii. Miscellaneous Provisions

After a MOA has been in effect for 180 days, a manufacturer that can prove that the CARB has, in effect, required the production or sale of ZEVs prior to the 2003 model year has the option of terminating the agreement.<sup>598</sup> Otherwise, the MOA will terminate at the close of model year 2002, except the provision permitting the CARB to pursue liquidated damages or regulatory action for a manufacturer's breach.<sup>599</sup> The MOAs will contain provisions that expressly apply California laws to their provisions and, excluding the procedures contained in the enforcement provision, they contain no provision for alternative dispute resolution.<sup>600</sup>

#### b. *The Expanded ZEV Credits*

The method for calculating ZEV credits, or debits, remains unchanged.<sup>601</sup> However, manufacturers may now count certain ZEVs produced and delivered for sale in California prior to the 2003 model

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<sup>594</sup> See *id.* at 16-17, app. C, C-6 to C-7.

<sup>595</sup> 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 16-17, app. C, C-6 to C-7.

<sup>596</sup> See *id.* at 18, app. C, C-7.

<sup>597</sup> See, e.g., MARCH 29, 1996 BOARD HEARING TRANSCRIPT, *supra* note 552, at 64-65, 72, 76-77.

<sup>598</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at app. C, C-10.

<sup>599</sup> See *id.*

<sup>600</sup> See *id.* at app. C, C-1 to C-12.

<sup>601</sup> See FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-6; see also discussion *supra* Section III.D.2.

year at either a two-to-one or a three-to-one ratio.<sup>602</sup> Also, under the proposed amendments ZEV credits earned prior to the 2003 model year will be treated as though earned in the 2003 model year, and they will not be discounted until the end of the 2004 model year.<sup>603</sup> The proposed multiple ZEV credit provisions, except for ZEVs produced in the 1996 and 1997 model years, are based on either vehicle range or incorporation of advanced-battery technology.<sup>604</sup>

Under the provisions for multiple ZEV credits based on range, any ZEV produced in the 1996 or 1997 model year, regardless of vehicle range, will be treated as two ZEVs.<sup>605</sup> ZEVs produced and delivered for sale in California in the 1996 and 1997 model year with a vehicle range of seventy miles or more will be treated as three ZEVs.<sup>606</sup> ZEVs produced in the 1998 and 1999 model years with a range of 100–129 miles will be counted as two, and those with a range of 130 miles or more will be treated as three ZEVs.<sup>607</sup> Then in the 2000 through 2002 model years, ZEVs will have to certify to a range of 140 miles or more to earn two credits, or to a range of 175 miles or more to earn three credits.<sup>608</sup> Under the proposed amendments to the ZEV program, the range for ZEVs will be determined under a revised all-electric-range test (AERT), which requires certification of ZEVs on both the Federal Urban Dynamometer Driving Schedule (UDDS) and also the Federal Highway Fuel Economy Driving Schedule (HFEDS).<sup>609</sup>

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<sup>602</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 11–13; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.1–2).

<sup>603</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a). Under the existing regulations, all ZEV credits earned prior to the 1998 model year are treated as though earned in the 1998 model year, and are discounted beginning in model year 2000. See CAL. CODE REGS. tit. 13 § 1960.1(g)(2) nn.(7)c–d & (9)a (1996).

<sup>604</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 11–12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-5 (to be codified at CAL. CODE REGS. tit. 13 § 1960.1(g)(2) n.(9)a.1–2) (proposed Mar. 28, 1996).

<sup>605</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 11; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.1) (proposed Mar. 28, 1996).

<sup>606</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 11; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.1) (proposed Mar. 28, 1996).

<sup>607</sup> See FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.1) (proposed Mar. 28, 1996).

<sup>608</sup> See *id.*

<sup>609</sup> See *id.* at 2, attachment A, A-5, 19–20. The newly revised, pending AERT is contained in the California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, which is incorporated by

Under the provisions for multiple credits for ZEVs with advanced batteries delivered for sale in California prior to the 2003 model year, any ZEV produced in model years 1996 through 1998 that uses an advanced battery will be counted as two ZEVs, regardless of the battery's specific energy.<sup>610</sup> Under the proposed amendments, the specific energy of a ZEV's battery will be determined using the USABC's 1996 "Constant Current Discharge Test Series" at the C/3 rate.<sup>611</sup> ZEVs produced for sale in California in the 1996 through 1998 model years with advanced batteries testing at forty or more watt hours per kilogram (w-hr/kg) of specific energy will be counted as three ZEVs.<sup>612</sup> Advanced-battery-powered ZEVs produced for sale in California in the 1999 and 2000 model years with a specific energy of 50 to 59 w-hr/kg will count as two ZEVs, and those with 60 or more w-hr/kg will count as three ZEVs.<sup>613</sup> In the 2001 and 2002 model years, advanced-battery-powered ZEVs will count as two if the specific energy is 60 or more w-hr/kg, and as three if the specific energy is 90 or more w-hr/kg.<sup>614</sup>

ZEVs may only earn multiple credits based on either long-range or incorporation of an advanced battery, not both, and multiple credits may not be used in the calculations for determining the annual fleet average NMOG.<sup>615</sup> Also, a manufacturer's pro rata share of ZEVs

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reference in CAL. CODE REGS. tit. 13, § 1960.1(k). *See id.* at A-5. As part of the proposed modifications to the AERT, the useful battery life light requirement, requiring an on-board light to illuminate the first time the battery system can not meet at least 75% of the vehicles certified range, will now be based on the range the vehicle is certified to under the UDDS. *See id.* at 3, 19-20.

<sup>610</sup> *See* 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.2) (proposed Mar. 28, 1996).

<sup>611</sup> *See* 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5, 20 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.2) (proposed Mar. 28, 1996).

<sup>612</sup> *See* 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.2) (proposed Mar. 28, 1996).

<sup>613</sup> *See* 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.2) (proposed Mar. 28, 1996).

<sup>614</sup> *See* 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 12; FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.2).

<sup>615</sup> FIRST FIFTEEN-DAY NOTICE: ZEV AMENDMENTS, *supra* note 541, at attachment A, A-4 to A-5 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n.(9)a.3-4).

produced to comply with the advanced-technology-demonstration projects are ineligible for the multiple credits.<sup>616</sup>

## VI. CONCLUSION

The initial California LEV regulations represent a compelling design for the startup of a long-term, technology-forcing, air pollution control program. The basic regulations contained just about the right mix of command and control requirements, softened by optional compliance methods, intermediate standards, exemptions, lengthy lead-times, and market-based incentives; and implementation oversight and regulatory review to effectively jump start the program and to help ensure its long-term success.

The technology-forcing fleet average NMOG standards and the ZEV production mandate motivated component suppliers, advanced-technology developers, and others to focus on technologies to meet the requirements. These requirements, coupled with potentially steep civil penalties for noncompliance, compelled the automakers to engage in research and development of vehicles, or emission control strategies for them, that they otherwise would probably not have undertaken. The fixed-percentage ZEV requirement, in particular, spawned unprecedented research and development of advanced batteries and EVs in the United States, Japan, and Europe.<sup>617</sup> In this country those efforts resulted in, among other things, a ground-up designed, limited-production EV for the 1997 model year, GM's EV1. In contrast, President Richard M. Nixon's program, launched in 1970, to foster domestic production of a "virtually pollution-free automobile" faded from view, after five years and about \$50 million in funding, without any significant results.<sup>618</sup> To help promote and sustain the technological developments necessary to meet the far-reaching requirements, though, the initial regulations provided flexible compliance options, market-based incentives, exemptions, intermediate compliance standards or waivers, and lengthy lead-times for compliance. The California LEV regulations, for the most part, are fuel and vehicle neutral, leaving it to the individual automakers to determine how to best use their resources to meet the emissions standards. Automakers choos-

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<sup>616</sup> See 1996 STAFF REPORT: ZEV RULEMAKING, *supra* note 24, at 11.

<sup>617</sup> See BRUCH, *supra* note 212, at 2-3, 5. The report notes that the United States and Japan lead the rest of the world in EV research and development because their automakers will suffer the most if they fail to meet the requirements of California's ZEV mandate. See *id.* at 5.

<sup>618</sup> See MOORE & MILLER, *supra* note 1, at 135.

ing to incorporate clean alternative fuels or the most efficient technologies in their compliance approach, or choosing to introduce compliant vehicles before the deadlines, will reap the rewards of marketable VECs, ZEV credits, or fleet average NMOG credits. The basic regulatory provisions, as well as recent adjustments, also recognize the differences in resources among manufacturers and their respective contributions to the vehicular pollution problems in the state, by distinguishing small-, intermediate-, and large-volume manufacturers and imposing varying compliance burdens on them. At the same time, all of the manufacturers receive the benefit of lengthy lead-times for compliance, various intermediate in-use exhaust emissions standards, and various waivers of certain in-use emissions standards, to help them meet the initial challenge of some of the technology-forcing standards. Nevertheless, the uncertainties associated with a far-reaching program demand more than predetermined options, waivers, and incentives.

To keep the uncertainties of LEV program under control, the Board and the staff committed to a continuous process of implementation oversight and regulatory review. This process, coupled with the CARB's willingness to adjust and change the basic program, has resulted in mid-course revisions that provide manufacturers more options and more time to comply with the program's requirements. Among the many adjustments, two new categories of vehicles, SULEVs and EZEVs, and corresponding emissions standards have recently been proposed that will expand the automakers' compliance options. Of the mid-course changes, the most significant, and controversial, has been the recent roll-back of the ZEV mandate to the 2003 model year. The bottom line going into the third biennial review, based on all of the information from the workshops and other sources, was that the unprecedented progress wrought by the ZEV requirements might wither on the vine if the mandate was premature. Rather than risk small short-term gains over long-term failure, the CARB delayed the ZEV mandate. Through the process, however, the CARB emerged with a binding partnering agreement that not only will promote the long-term success of this aspect of the program but also promises a long-term "clean air premium" for the state.

Through the MOAs, the large-volume automakers are now committed to working toward building consumer confidence in, and a market for, ZEVs instead of choring the refrain of "nonsense" to every stanza of mass production of ZEVs. For its part, the CARB has committed itself to concentrate more effort on the institutional barriers to con-



sumer acceptance of ZEVs, and to work for incentives to promote their ultimate purchase. Only time will tell, but the joint commitment between the seven automakers and the CARB, memorialized in the MOAs, will likely foster a sustainable, if not a growing, market for ZEVs in California in 2003 and beyond. A sustainable market will no doubt help push areas like the SCAB closer toward the required attainment of air quality standards. A growth market will accomplish this and even more, like reducing the inevitable economic impact and inconvenience that consumers in the worst ozone nonattainment areas will suffer, if current trends continue, from stringent control measures for conventional vehicles. On the other hand, draconian control measures like gasoline surcharges, gasoline rationing, fees for VMT, and mandatory no-drive days just might stir up consumer demand for ZEVs.

## APPENDIX A: TABLES

TABLE III-1.—1992 And Subsequent Model Year Passenger Car (PC) and Light-Duty Truck (LDT) Exhaust Emission Standards for TLEVs, LEVs, ULEVs, & ZEVs [grams per mile (g/mi)]<sup>a</sup>

| Vehicle Type | Loaded Vehicle Weight (lbs.) | Durability Vehicle Basis (mi) | Vehicle Emission Category | Non-Methane Organic Gases g/mi | Carbon Monoxide g/mi | Oxides of Nitrogen g/mi |
|--------------|------------------------------|-------------------------------|---------------------------|--------------------------------|----------------------|-------------------------|
| PCs and LDTs | All 0-3750                   | 50000                         | TLEV                      | 0.125 (0.188)                  | 3.4 (3.4)            | 0.4 (0.4)               |
|              |                              |                               | LEV                       | 0.075 (0.100)                  | 3.4 (3.4)            | 0.2 (0.3)               |
|              |                              |                               | ULEV                      | 0.040 (0.058)                  | 1.7 (2.6)            | 0.2 (0.3)               |
|              |                              |                               | ZEV                       | 0                              | 0                    | 0                       |
|              |                              | 100000                        | TLEV                      | 0.156                          | 4.2                  | 0.6                     |
|              |                              |                               | LEV                       | 0.090                          | 4.2                  | 0.3                     |
|              |                              |                               | ULEV                      | 0.055                          | 2.1                  | 0.3                     |
|              |                              |                               | ZEV                       | 0                              | 0                    | 0                       |
| LDTs         | 3751-5750                    | 50000                         | TLEV                      | 0.160 (0.238)                  | 4.4 (4.4)            | 0.7 (0.7)               |
|              |                              |                               | LEV                       | 0.100 (0.128)                  | 4.4 (4.4)            | 0.4 (0.5)               |
|              |                              |                               | ULEV                      | 0.050 (0.075)                  | 2.2 (3.3)            | 0.4 (0.5)               |
|              |                              | 100000                        | TLEV                      | 0.200                          | 5.5                  | 0.9                     |
|              |                              |                               | LEV                       | 0.130                          | 5.5                  | 0.5                     |
|              |                              |                               | ULEV                      | 0.070                          | 2.8                  | 0.5                     |

<sup>a</sup>CAL. CODE REGS. tit. 13, § 1960.1(g)(1) (1996); 1990 STAFF REPORT, *supra* note 18, app. A at A27; 1994 STAFF REPORT, *supra* note , at 2; CARB Letter, *supra* note 26, at 3. The standards in parentheses indicate the intermediate in-use compliance standards for 50,000 miles. CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n.(6) (1996). These intermediate standards, which are up to 30% less stringent, and waivers of the 100,000 mile in-use standards apply to TLEVs through the 1995 model year and to LEVs and ULEVs through the 1998 model year. CAL. CODE REGS. tit. 13, § 1960.1(g)(1) n. (6) (1996); 1990 STAFF REPORT, *supra* note 18, at 21.

TABLE III-2.—*Passenger Car (PC) and Light-Duty Truck (LDT) Fleet Average NMOG Exhaust Emission Requirements (g/mi)<sup>b</sup>*

| Vehicle Type | Loaded Vehicle Weight (lbs.) | Durability Vehicle Basis (mi) | Model Year | Fleet Average NMOG g/mi |
|--------------|------------------------------|-------------------------------|------------|-------------------------|
| PCs and LDTs | All<br>0-3750                | 50000                         | 1992*      | 0.390*                  |
|              |                              |                               | 1993*      | 0.334*                  |
|              |                              |                               | 1994       | 0.250                   |
|              |                              |                               | 1995       | 0.231                   |
|              |                              |                               | 1996       | 0.225                   |
|              |                              |                               | 1997       | 0.202                   |
|              |                              |                               | 1998       | 0.157                   |
|              |                              |                               | 1999       | 0.113                   |
|              |                              |                               | 2000       | 0.073                   |
|              |                              |                               | 2001       | 0.070                   |
|              |                              |                               | 2002       | 0.068                   |
|              |                              |                               |            | 2003 & after            |
| LDTs         | 3751-5750                    | 50000                         | 1992*      | 0.500*                  |
|              |                              |                               | 1993*      | 0.428*                  |
|              |                              |                               | 1994       | 0.320                   |
|              |                              |                               | 1995       | 0.295                   |
|              |                              |                               | 1996       | 0.287                   |
|              |                              |                               | 1997       | 0.260                   |
|              |                              |                               | 1998       | 0.205                   |
|              |                              |                               | 1999       | 0.150                   |
|              |                              |                               | 2000       | 0.099                   |
|              |                              |                               | 2001       | 0.098                   |
|              |                              |                               | 2002       | 0.095                   |
|              |                              |                               |            | 2003 & after            |

<sup>B</sup>CAL. CODE REGS. tit. 13, § 1960.1(g)(2)(1996); 1990 STAFF REPORT, *supra* note 18, app. A at A30. TABLE III-2 above does not depict the model year 2000, and later, special fleet average NMOG values for small volume manufacturers. In 2000 and subsequent model years, small volume manufacturers must meet fleet average NMOG values of 0.075 g/mi for passenger cars and light-duty trucks 0-3,750 lbs. LVW and 0.100 g/mi for light-duty trucks 3,751-5,750 lbs. LVW. CAL. CODE REGS. tit. 13, § 1960.1(g)(2) nn. (6)b-c (1996). The asterisks in table III-2 above indicate the fleet average g/mi NMOG available for determining emissions credits for manufacturers who produced and delivered vehicles certified for "phase-in" or other more stringent standards, including ZEVs, in the 1992 and 1993 model years. See CAL. CODE REGS. tit. 13, § 1960.1(g)(2) n. (8) (1996).

TABLE III-3.—*Medium-Duty Low-Emission Vehicle (LEV) and Ultra-Low-Emission Vehicle (ULEV) Implementation Schedule<sup>c</sup>*

| Model Year   | LEVs | ULEVs |
|--------------|------|-------|
| 1998         | 25%  | 2%    |
| 1999         | 50   | 2     |
| 2000         | 75   | 2     |
| 2001         | 95   | 5     |
| 2002         | 90   | 10    |
| 2003 & after | 85   | 15    |

<sup>c</sup>CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n. (10)a, b (1996).; 1990 STAFF REPORT, *supra* note 18, app. A at A39; CARB Letter, *supra* note 26, at 5.

TABLE III-4.—*Exhaust Emission Standards for Low-Emission Vehicles (LEVs) and Ultra-Low-Emission Vehicles (ULEVs) in the Medium-Duty Vehicle Weight Classes (g/mi)<sup>d</sup>*

| Test Weight (lbs.) | Durability Vehicle Basis (mi) | Vehicle Emission Category | Non-Methane Organic Gases (NMOG) (g/mi) | Carbon Monoxide (CO) (g/mi) | Oxides of Nitrogen (NO <sub>x</sub> ) (g/mi) | Particulates (PM) (g/mi) |
|--------------------|-------------------------------|---------------------------|---|-----------------------------|--|--------------------------|
| 0-3,750            | 50,000                        | LEV                       | 0.125 (0.188)                           | 3.4 (3.4)                   | 0.4 (0.4)                                    | n/a                      |
|                    |                               | ULEV                      | 0.075 (0.100)                           | 1.7 (2.6)                   | 0.2 (0.3)                                    | n/a                      |
|                    | 120,000                       | LEV                       | 0.180                                   | 5.0                         | 0.6  | 0.08                     |
|                    |                               | ULEV                      | 0.107                                   | 2.5                         | 0.3  | 0.04                     |
| 3,751-5,750        | 50,000                        | LEV                       | 0.160 (0.238)                           | 4.4 (4.4)                   | 0.7 (0.7)                                    | n/a                      |
|                    |                               | ULEV                      | 0.100 (0.128)                           | 2.2 (3.3)                   | 0.4 (0.5)                                    | n/a                      |
|                    | 120,000                       | LEV                       | 0.230                                   | 6.4                         | 1.0  | 0.10                     |
|                    |                               | ULEV                      | 0.143                                   | 3.2                         | 0.5  | 0.05                     |
| 5,751-8,500        | 50,000                        | LEV                       | 0.195 (0.293)                           | 5.0 (5.0)                   | 1.1 (1.1)                                    | n/a                      |
|                    |                               | ULEV                      | 0.117 (0.156)                           | 2.5 (3.8)                   | 0.6 (0.8)                                    | n/a                      |
|                    | 120,000                       | LEV                       | 0.280                                   | 7.3                         | 1.5  | 0.12                     |
|                    |                               | ULEV                      | 0.167                                   | 3.7                         | 0.8  | 0.06                     |
| 8,501-10,000       | 50,000                        | LEV                       | 0.230 (0.345)                           | 5.5 (5.5)                   | 1.3 (1.3)                                    | n/a                      |
|                    |                               | ULEV                      | 0.138 (0.184)                           | 2.8 (4.2)                   | 0.7 (1.0)                                    | n/a                      |
|                    | 120,000                       | LEV                       | 0.330                                   | 8.1                         | 1.8  | 0.12                     |
|                    |                               | ULEV                      | 0.197                                   | 4.1                         | 0.9  | 0.06                     |
| 10,001-14,000      | 50,000                        | LEV                       | 0.300 (0.450)                           | 7.0 (7.0)                   | 2.0 (2.0)                                    | n/a                      |
|                    |                               | ULEV                      | 0.180 (0.240)                           | 3.5 (5.3)                   | 1.0 (1.5)                                    | n/a                      |
|                    | 120,000                       | LEV                       | 0.430                                   | 10.3                        | 2.8  | 0.12                     |
|                    |                               | ULEV                      | 0.257                                   | 5.2                         | 1.4  | 0.06                     |

<sup>d</sup>CAL. CODE REGS. tit. 13, § 1960.1(h)(2) (1996); 1990 STAFF REPORT, *supra* note 18, app. A at A36. The 50,000 mile standards shown in parentheses represent the intermediate in-use compliance standards that apply to medium-duty LEVs and ULEVs through the 1999 model year. CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n. (9) (1996).

TABLE III-5.—*Exhaust Emission Standards for Engines Used in Incomplete Medium-Duty Low-Emission Vehicles and Ultra-Low-Emission Vehicles (g/brake horsepower-hour)<sup>e</sup>*

| Model Year          | Vehicle Emissions Category | Carbon Monoxide (CO) | Non-Methane Hydrocarbons and Oxides of Nitrogen (NMHC & NO <sub>x</sub> ) | Formaldehyde (HCHO) | Particulates (PM) |
|---------------------|----------------------------|----------------------|---|---------------------|-------------------|
| 1992 and subsequent | LEV                        | 14.4                 | 3.5   | 0.05                | 0.1               |
|                     | ULEV                       | 7.2                  | 2.5   | 0.025               | 0.05              |

<sup>e</sup>CAL. CODE REGS. tit. 13, § 1956.8(h) (1996). 1990 STAFF REPORT, *supra* note 18, app. A at A16.

TABLE III-6.—*Medium-Duty Tier 1, Low-Emission Vehicle (LEV), and Ultra-Low-Emission Vehicle (ULEV) Phase-In Requirements<sup>f</sup>*

| Model Year | % MDVs Certified to Title 13 CCR Section 1960.1(h)(1) or (h)(2) |     |      | % MDVs Certified to Title 13 CCR Section 1956.8(g) or (h) |     |      |
|------------|---|-----|------|---|-----|------|
|            | Tier 1  | LEV | ULEV | Tier 1  | LEV | ULEV |
| 1998       | 73  | 25  | 2    | 100   | 0   | 0    |
| 1999       | 48  | 50  | 2    | 100   | 0   | 0    |
| 2000       | 23  | 75  | 2    | 100   | 0   | 0    |
| 2001       | 0   | 80  | 20   | 100   | 0   | 0    |
| 2002       | 0   | 70  | 30   | 0   | 100 | 0    |
| 2003       | 0   | 60  | 40   | 0   | 100 | 0    |
| 2004 +     | 0   | 60  | 40   | 0   | 0   | 100  |

<sup>f</sup>See 1995 STAFF REPORT: LEV RULEMAKING, *supra* note 102, at 20; FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note , at 24–25 (to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2) n. (10)a) (adopted June 24, 1996 and forwarded to OAL on Aug. 9, 1996) [hereinafter FINAL REGULATION ORDER: LEV RULEMAKING]; Compare TABLE 3, *supra* at p. (showing the original requirement for only 5% MDV ULEVs in 2001, 10% in 2002, and 15% for 2003 and thereafter). The Tier I MDVs are the conventional MDVs certified to the exhaust emission standards required for new 1995 and subsequent model years. See CAL. CODE REGS. tit. 13, § 1960.1(h)(1) (1996).

TABLE III-7.—*Medium-Duty Low-Emission Vehicle (LEV), Ultra-Low-Emission Vehicle (ULEV), and Super-Ultra-Low-Emission Vehicle (SULEV) Exhaust Emission Standards<sup>g</sup>*

| Test Weight (lbs.) | Durability Vehicle Basis (mi) | Vehicle Emission Category | Non-Methane Organic Gases (NMOG) g/mi | Carbon Monoxide (CO) g/mi | Oxides of Nitrogen (NO <sub>x</sub> ) g/mi | Particulates (PM) g/mi |
|--------------------|-------------------------------|---------------------------|---------------------------------------|---------------------------|--|------------------------|
| 0-3,750            | 50,000                        | LEV                       | 0.125                                 | 3.4                       | 0.4  | n/a                    |
|                    |                               | ULEV                      | 0.075                                 | 1.7                       | 0.2  | n/a                    |
|                    | 120,000                       | LEV                       | 0.180                                 | 5.0                       | 0.6  | 0.08                   |
|                    |                               | ULEV                      | 0.107                                 | 2.5                       | 0.3  | 0.04                   |
| 3,751-5,750        | 50,000                        | LEV                       | 0.160                                 | 4.4                       | <b>0.4</b> (0.7)                           | n/a                    |
|                    |                               | ULEV                      | 0.100                                 | <del>4.4</del> (2.2)      | 0.4  | n/a                    |
|                    |                               | SULEV                     | 0.050                                 | 2.2                       | 0.2  | n/a                    |
|                    | 120,000                       | LEV                       | 0.230                                 | 6.4                       | <b>0.6</b> (1.0)                           | 0.10                   |
|                    |                               | ULEV                      | 0.143                                 | <del>6.4</del> (3.2)      | <b>0.6</b> (0.5)                           | 0.05                   |
|                    |                               | SULEV                     | 0.072                                 | 3.2                       | 0.3  | 0.05                   |
| 5,751-8,500        | 50,000                        | LEV                       | 0.195                                 | 5.0                       | <b>0.6</b> (1.1)                           | n/a                    |
|                    |                               | ULEV                      | 0.117                                 | <del>5.0</del> (2.5)      | 0.6  | n/a                    |
|                    |                               | SULEV                     | 0.059                                 | 2.5                       | 0.3  | n/a                    |
|                    | 120,000                       | LEV                       | 0.280                                 | 7.3                       | <b>0.9</b> (1.5)                           | 0.12                   |
|                    |                               | ULEV                      | 0.167                                 | <del>7.3</del> (3.7)      | <b>0.9</b> (0.8)                           | 0.06                   |
|                    |                               | SULEV                     | 0.084                                 | 3.7                       | 0.45                                       | 0.06                   |
| 8,501-10,000       | 50,000                        | LEV                       | 0.230                                 | 5.5                       | <b>0.7</b> (1.3)                           | n/a                    |
|                    |                               | ULEV                      | 0.138                                 | <del>5.5</del> (2.8)      | 0.7  | n/a                    |
|                    |                               | SULEV                     | 0.069                                 | 2.8                       | 0.35                                       | n/a                    |
|                    | 120,000                       | LEV                       | 0.330                                 | 8.1                       | <b>1.0</b> (1.8)                           | 0.12                   |
|                    |                               | ULEV                      | 0.197                                 | <del>8.1</del> (4.1)      | <b>1.0</b> (0.9)                           | 0.06                   |
|                    |                               | SULEV                     | 0.100                                 | 4.1                       | 0.5  | 0.06                   |
| 10,001-14,000      | 50,000                        | LEV                       | 0.300                                 | 7.0                       | <b>1.0</b> (2.0)                           | n/a                    |
|                    |                               | ULEV                      | 0.180                                 | <del>7.0</del> (3.5)      | 1.0  | n/a                    |
|                    |                               | SULEV                     | 0.09                                  | 3.5                       |  |                        |
|                    | 120,000                       | LEV                       | 0.430                                 | 10.3                      | <b>1.5</b> (2.8)                           | 0.12                   |
|                    |                               | ULEV                      | 0.257                                 | <del>10.3</del> (5.2)     | <b>1.5</b> (1.4)                           | 0.06                   |
|                    |                               | SULEV                     | 0.130                                 | 5.2                       | 0.7  | 0.06                   |

<sup>g</sup>See FINAL REGULATION ORDER: LEV RULEMAKING, *supra* note , at 18-19,(to be codified at CAL. CODE REGS. tit. 13, § 1960.1(h)(2)) (adopted June 24, 1996 and forwarded to OAL on Aug. 9, 1996); Compare TABLE 4, *supra* at p. (showing the original more lenient 50,000 and 120,000 mi. NO<sub>x</sub> standards for MDV LEVs, the more stringent original 50,000 and 120,000 mi. CO requirements for MDV ULEVs, and the slightly more stringent 120,000 mi. NO<sub>x</sub> standards for MDV ULEVs). The certification standards shown in strikeout and parentheses in table III-7 above are the standards that became obsolete on October 23, 1996 when the new standards, shown in highlight, went into effect.

**APPENDIX B: ACRONYMS LIST**

| <b>NAME OR DESCRIPTION</b>   | <b>ACRONYM</b>            |
|--|---------------------------|
| American Automobile Manufacturers Association                              | AAMA                      |
| Auxiliary Power Unit   | APU                       |
| Association of International Automobile Manufacturers, Inc.                | AIAM                      |
| California Air Resources Board   | CARB                      |
| California Air Resources Board Information System                          | ARBIS                     |
| California Energy Commission   | CEC                       |
| California Environmental Protection Agency                                 | Cal. EPA                  |
| California Low-Emission Vehicle and Clean Fuels Program                    | CLEV/CFP                  |
| California Office of Administrative Law                                    | OAL                       |
| Carbon Dioxide   | CO <sub>2</sub>           |
| Carbon Monoxide  | CO                        |
| Compressed Natural Gas   | CNG                       |
| Electrically Heated Catalyst   | EHC                       |
| Electric Power Research Institute  | EPRI                      |
| Electric vehicle(s)  | EV(s)                     |
| Equivalent Zero-emission Vehicle(s)  | EZEV(s)                   |
| Federal Clean Air Act  | CAA                       |
| Federal Clean Air Act Amendments   | CAAA                      |
| Federal Highway Fuel Economy Driving Schedule                              | HFEDS                     |
| Federal Implementation Plan  | FIP                       |
| Federal Motor Vehicle Safety Standards                                     | FMVSS                     |
| Federal Urban Dynamometer Driving Schedule                                 | UDDS                      |
| Formaldehyde   | HCHO                      |
| General Motors   | GM                        |
| Grams per Brake Horsepower-hour  | g/bhp-hr                  |
| Grams of Ozone per Gram NMOG   | g O <sub>3</sub> / g NMOG |
| Grams Per Mile   | g/mi                      |
| Gross Vehicle Weight   | GVW                       |
| Hybrid Electric Vehicle(s)   | HEV(s)                    |
| Hydrocarbons   | HC                        |
| Institute of Transportation Studies at the University of California, Davis | ITS-Davis                 |
| Kilowatt Hours Per Mile  | KWh/mi                    |
| Light-Duty Truck(s)  | LDT(s)                    |
| Light-Duty Vehicle(s)  | LDV(s)                    |
| Liquefied Petroleum Gas  | LPG                       |
| Loaded Vehicle Weight  | LVW                       |
| Long-Range Motor Vehicle Plan  | LRMVP                     |
| Low-Emission Vehicle(s)  | LEV(s)                    |
| Malfunction Indicator Light  | MIL                       |
| Massachusetts Department of Environmental Protection                       | DEP                       |
| Master Memorandum of Agreement   | Master MOA                |
| Maximum Incremental Reactivity   | MIR                       |

| <b>NAME OR DESCRIPTION</b>   | <b>ACRONYM</b>  |
|--|-----------------|
| American Automobile Manufacturers Association                      | AAMA            |
| Medium-Duty Vehicle(s)   | MDV(s)          |
| Memoranda of Agreement   | MOAs            |
| Memoranda of Understanding   | MOUs            |
| Methanol   | M85             |
| Motor Vehicle Manufacturers Association of the United States, Inc. | MVMA            |
| National Ambient Air Quality Standards                             | NAAQS           |
| National Highway Traffic Safety Administration                     | NHTSA           |
| National Low-Emission Vehicle                                      | NLEV            |
| Natural Resources Defense Council                                  | NRDC            |
| New Source Review  | NSR             |
| New York State Department of Environmental Conservation            | DEC             |
| Non-Methane Hydrocarbons   | NMHC            |
| Non-Methane Organic Gases  | NMOG            |
| Northeast Ozone Transport Region                                   | OTR             |
| Organic Material Hydrocarbon Equivalent                            | OMHCE           |
| Organic Material Non-Methane Hydrocarbon Equivalent                | OMNMHCE         |
| Ovonic Battery Company, Inc.                                       | OBC             |
| Oxides of Nitrogen   | NO <sub>x</sub> |
| Ozone Transport Commission   | OTC             |
| Particulate Matter (or Particulates)                               | PM              |
| Passenger Car(s)   | PC(s)           |
| Reactivity Adjustment Factor(s)                                    | RAF(s)          |
| Reactive Organic Gases   | ROG             |
| Reformulated Gasoline  | RFG             |
| Simplified Federal Urban Driving Schedule                          | SFUDS           |
| South Coast Air Basin  | SCAB            |
| South Coast Air Quality Management District                        | SCAQMD          |
| State Implementation Plan  | SIP             |
| Super-Low-Emission Vehicle(s)                                      | SLEV(s)         |
| Super-Ultra-Low-Emission Vehicle(s)                                | SULEV(s)        |
| Test Weight  | TW              |
| Transitional Low-Emission Vehicle(s)                               | TLEV(s)         |
| Ultra Low-Emission Vehicle(s)                                      | ULEV(s)         |
| United States Advanced Battery Consortium                          | USABC           |
| U.S. Department of Energy  | DOE             |
| U.S. Environmental Protection Agency                               | EPA             |
| Vehicle Equivalent Credit(s)                                       | VEC(s)          |
| Vehicle Equivalent Debit(s)  | VED(s)          |
| Vehicle Miles Traveled   | VMT             |
| Watt Hours per Kilogram  | w-hr/kg         |
| Western Propane Gas Association                                    | WPGA            |
| Zero-Emission Vehicle(s)   | ZEV(s)          |