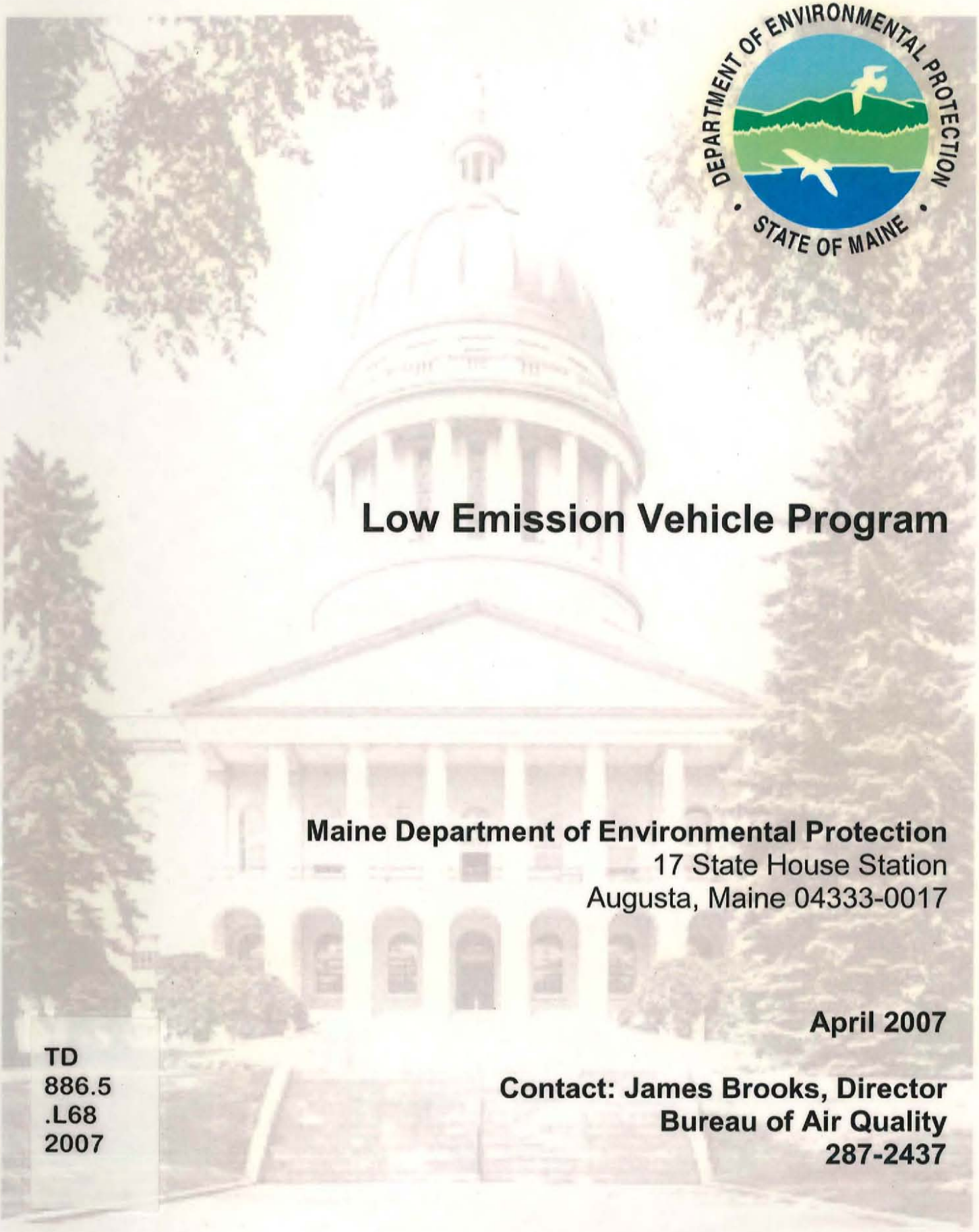

Low Emission Vehicle Program

Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

April 2007

Contact: James Brooks, Director
Bureau of Air Quality
287-2437

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

Memorandum

To: Senator John L. Martin and Representative Ted Koffman, Chairs of the Natural Resources Committee

From: James P. Brooks, Director of the Bureau of Air Quality Maine Department of Environmental Protection

Date: 4/26/2007

Re: 2007 Low Emission Vehicle Report

Enclosed please find copies of the 2007 Low Emission Vehicle Report prepared as required by 38 MRSA, §585-D. This report evaluates whether Maine should continue to implement and enforce the California Low Emission Vehicle standards for new motor vehicles. The report includes an evaluation of the benefits and costs of enforcing the California standards and the benefits and costs of adopting the federal standards.

If you have any questions regarding this report do not hesitate to contact the Bureau of Air Quality staff at (207) 287-2437.

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04769-2094
(207) 764-0477 FAX: (207) 760-3143

web site: www.maine.gov/dep

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I. Introduction

In 2005 the 123rd Maine Legislature amended 585-D *New Motor Vehicle Emission Standards* to require the Maine Department of Environmental Protection (DEP) to annually evaluate whether the state should continue to implement and enforce the California Low Emission Vehicle (LEV) standards for new motor vehicles or new motor vehicle engines. The evaluation shall include a review of the benefits and costs of enforcing the California standards and the benefits and costs of adopting the federal standards. This report addresses that requirement.

II. Background

A. California's Low Emission Vehicle (LEV) Program

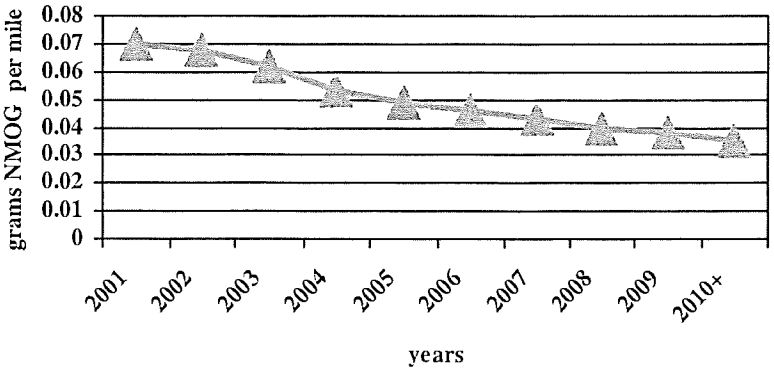
Emission standards for passenger cars were first established in California in 1966 and in 1968 the U.S. federal standards followed. In 1970 the Clean Air Act (Section 209) codified the authority of the State of California to establish emissions limits for motor vehicles, provided that such limits are in the aggregate at least as protective of public health as the federal standards. All new vehicles sold in the U.S. must meet vehicle emissions standards certified by either the federal government or the State of California. Today, California is the only state with the authority to set its own vehicle standards. However, Congress also recognized that other states with significant air quality issues needed to achieve emission reductions from motor vehicles to meet ambient air quality standards. Under Section 177 of the Clean Air Act Amendments of 1990, Congress granted states with air pollution problems the authority to adopt motor vehicle emissions standards that are *identical* to the California standards.

LEV I

In September 1990, the California Air Resources Board (CARB) adopted the Low Emission Vehicle (LEV I) regulations. California required each automobile manufacturer to phase-in (1994 through 2003) progressively cleaner passenger and light-duty vehicles. The starting program included emission certification categories from the least to most stringent emissions as follows: Transitional Low Emission Vehicle (TLEV), Low Emission Vehicle (LEV), Ultra Low Emission Vehicle (ULEV) which is 50% cleaner than the average new model, and Zero Emission Vehicle (ZEV). See Appendix A.

California's program establishes a declining fleet average for non-methane organic gas (NMOG) emissions. The fleet average NMOG requirement is reduced each year until 2010 when the requirement for passenger cars will be .035 grams per mile and .043 for heavier trucks. See Figure 1.

Figure 1
Fleet Average NMOG Requirements
for Light Duty Weight Class (0-3750 lbs.)



LEV II

In November 1998 CARB adopted new amendments known as LEV II, requiring further phased-in emission reductions from new passenger cars, light-duty trucks, and medium-duty vehicles for model years 2004 through 2010. The main elements are:

- Extending passenger car emissions standards to heavier sport utility vehicles and pickup trucks (with gross vehicle weight up to 8,500 pounds), which formerly had been regulated under less stringent emission standards; medium-duty vehicles (8500 to 14,000 lbs) are subject to less stringent emission standards;

- Eliminating the Transitional Low Emission Vehicle (TLEV) certification;

- Extending and phasing down the fleet-wide average emission standards during 2004-2010;

- Creating a new super-ultra low emission vehicle (SULEV) category for light-duty vehicles;

- Reducing NOx emission standards for the low and ultra-low emission vehicle categories (LEV, ULEV) 75% from the LEV I standards;

- Increasing emission control durability standards from 100,000 miles to 120,000 miles for passenger cars and light-duty trucks;

- Requiring up to an 80% reduction in evaporative emissions for passenger cars; and

- Creating partial zero-emission vehicle (PZEV) credits for vehicles that achieve near zero tailpipe emissions and zero evaporative emissions.

See Appendix B for Table 1, LEV II Exhaust Mass Emissions Standards.

Zero Emission Vehicle (ZEV) Mandate

In addition to the emission standards outlined above, the California LEV II program also revised the ZEV mandate of the original LEV program to allow manufacturers to fulfill a portion of the ZEV mandate with a variety of advanced automobile technologies besides battery electric vehicles:

- Advanced Technology Partial Low Emission Vehicles (AT PZEV) which include hybrid-electric vehicles;

- Partial Zero Emission Vehicles (PZEV) which are super low-emitting gasoline vehicles; and

- hydrogen fuel cell vehicles.

B. Federal "Tier 2" Vehicle Emission Program vs. California LEV II Program

The federal Tier 2 program requires manufacturers to certify individual vehicles to tailpipe and evaporative emissions standards and to meet a sales-weighted fleet-wide emissions average. However, the Tier 2 program differs from LEV II in that it requires manufacturers to meet a fleet wide average for nitrogen oxides (precursors of ground level ozone) rather than non-methane organic gases (NMOG). See Appendix C for full useful life exhaust mass emission standards. [1]

There are also differences in the evaporative emissions standards required under the federal and California programs. Table 3 shows that the LEV II program evaporative standards are more stringent than the Tier 2 evaporative standards.

Table 3
Evaporative Emissions Standards for LEV II and Tier 2

Vehicle Class	2-day/3-day diurnal + hot soak test standard in grams/test	
	California (LEVII)	Federal (Tier2)
Passenger cars	.65/.5	1.2/.95
Light duty trucks <6,000 lbs GVW	.85/.65	1.2/.95
Light duty trucks 6,000-8,500 lbs GVW	1.15/.9	1.5/1.2
Medium duty vehicles under 10,000 lbs. GVW	1.25/1.0	1.75/1.4

NESCAUM White Paper on the Emissions Benefits of the LEV II Program, Sept. 2003

The most significant difference between the programs is that the California LEV program includes an important component that requires a percentage of the fleet to be certified as meeting zero emissions (ZEV). The program has successfully introduced a variety of low-emission vehicle technologies, many of which may not have been commercially available without the ZEV requirements. The California ZEV program requires that all vehicles certified as PZEVs and AT PZEVs be certified to 150,000-mile durability standards instead of 120,000 mile standards as required for Tier 2, a benefit to the consumer as well as air quality.

In addition to the above evaporative standards, ZEV, AT PZEVs and PZEVs must meet a zero evaporative emission standard. Since PZEVs are expected to make up a significant percentage of the vehicle fleet, this ZEV requirement is likely to lead to additional

[1] Although emissions from diesel passenger vehicles have improved with advanced emission control devices and reduced sulfur content in the fuel, diesel vehicles still emit significant particulate and NOx emissions. Diesel *passenger* vehicles have met only federal Tier 1 standards and currently do not meet the Tier 2 or LEV II standards. Some auto manufacturers have indicated that diesel passenger cars will be certified as meeting both federal and California emission standards in 2008. Medium-duty diesel vehicles are certified in both programs. Some SUVs and trucks are certified to California emission standards and are offered for sale in Maine.

reductions in VOC and toxic emissions resulting in improved air quality and health benefits.

Greenhouse Gas Emission (GHG) Standards

Another difference between the California and federal program involves greenhouse gases. In late 2004, California adopted new standards requiring cars and light duty passenger vehicles to reduce GHG emissions that contribute to climate change. The standards begin with the 2009 model year and phase-in gradually over eight years, allowing changes to be made as part of the product improvement cycle. When phased in by model year 2016, the new vehicles will reduce GHG emissions by 30%. Eleven other states (Maine, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Maryland, Oregon, and Washington) adopted the California GHG emission standards for new vehicles. The Canadian government has a memorandum of agreement with the auto manufacturers to reduce GHG emissions from new vehicles. The federal Tier 2 program does not address GHG emissions from vehicles.

Unlike the federal program which will remain the same for at least a decade as required by the Clean Air Act, the California program will be dynamic and continue to be more stringent.

III. The Northeast Low Emission Vehicle History

In 1987 most states in the Northeast, including Maine, failed to attain the ozone standard and were directed by EPA to develop state implementation plans (SIPs). In addition, some major urban areas in the northeast were also in violation of the carbon monoxide (CO) standard. SIPs show how the state will achieve the federal ambient air quality standards. At that time, motor vehicles were estimated to contribute 75% of carbon monoxide and 50% of the region's ozone-forming volatile organic compounds (VOCs) and nitrogen oxides, the two primary precursor pollutants that when mixed with sunlight combine to form ground level ozone. Vehicles are a major source of high risk air toxics including benzene, 1, 3-butadiene and formaldehyde. Vehicles also emit particulate pollution (PM2.5). All of these pollutants pose serious health risks.

Therefore, the Northeast states commissioned a study by Michael Walsh to evaluate the federal motor vehicle emission control program and make recommendations for achieving further reductions from this source. The report issued by Northeast States for Consolidated Air Use Management (NESCAUM) in 1988 concluded that the Northeast states could reduce mobile source emissions through a number of key initiatives including: clean fuels, vehicle inspection and maintenance, vapor recovery programs and adoption of the California motor vehicle emission standards (pre-LEV).

In 1989, NESCAUM commissioned a study by Sierra Research to provide an in-depth assessment of the cost and benefits associated with adoption of the California motor vehicle standards in the Northeast. Like the Walsh study before it, the Sierra study concluded that the Northeast could achieve substantial emission reductions with adoption of the California Low Emission Vehicle (LEV) program.

The NESCAUM states commissioned a study by Pechan and Associates, Michael Walsh and Energy & Environmental Analysis, Inc. to assess the cost & benefits and implementation issues associated with adopting the LEV program. In conducting this study, the Northeast states worked very closely with USEPA, the California Air Resources Board (CARB), the automobile manufacturers and the country's most renowned automotive consultants in conducting the technical analyses. This study concluded that significant emission reductions could be achieved in a cost-effective manner through the adoption of the California LEV standards in Northeast states. Four Northeast states adopted the California Low Emission Vehicle program: Massachusetts (starting with model year 1996 motor vehicles); New York (starting with model year 1997), Vermont (starting with model year 1999), and Maine (starting with model year 2001).

In 2002, NESCAUM conducted a study comparing the emission reductions of the California LEV II program to the federal Tier 2 program. Both the federal Tier 2 program and the California LEV II program provide substantial reductions from new vehicle exhaust emissions (on the order of 90 percent or more) over the next two decades. However, the analysis conducted by Cambridge Systematics for NESCAUM found that California's standards continue to provide additional emissions reduction benefits over

and above what the federal program is expected to achieve.[2] Specifically, the analysis found additional reductions in light duty vehicle hydrocarbon (HC) emissions under the LEV II program compared to the federal Tier 2 program. Moreover, reductions of those HC emissions that are also considered toxic (e.g. benzene, formaldehyde and 1, 3-butadiene) provide additional benefits. Finally, the analysis determined that LEV II yields modest carbon dioxide reduction benefits (on the order of 3 percent in 2020) compared to Tier 2, primarily as a result of the advanced technology vehicle component of the California program.[3]

Following the *NESCAUM White Paper on the Emission Benefits of the LEV II Program*, dated September 2003, three NESCAUM states, Connecticut, New Jersey, and Rhode Island adopted the California LEV II program in 2004 and 2005. Pennsylvania adopted LEV II in 2006 and Maryland in 2007.

The adoption of California LEV II in CT, RI and NJ in 2005, Pennsylvania in 2006, and Maryland in 2007 provides the practical benefit of allowing the seamless movement of vehicles among auto dealers throughout the Northeast.

Washington and Oregon adopted LEV II in 2006 and Maryland has begun the legislative process for adoption of the California LEV program. The states of Texas, North Carolina, New Mexico and Arizona are considering adoption.

See Appendix D for a summary of the emissions reduction potential for the northeast states adopting the California (LEVII) program.

[2] Summary of NESCAUM Analysis Evaluating the NOx, HC, and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEVII) Standards, June 2005, pg.3. See Appendix D

[3] NESCAUM White Paper on the Emission Benefits of the LEV II Program, September, 2003, pg 4. It is important to note that calculated emissions benefits depend to a critical extent on assumptions made in the course of the analysis.

IV. Maine's Low Emission Vehicle Program

The Department of Environmental Protection is responsible for the significant challenge of protecting public health and the environment from the adverse impacts of air pollution. Despite the impressive progress made in developing and introducing clean vehicles and fuels, motor vehicles still contribute a significant portion of the emission inventory for ozone, fine particulate matter and air toxics. While per vehicle emissions have declined dramatically vehicle ownership and miles traveled continue to increase. Therefore, Maine adopted the California LEV program in 1993 to reduce emissions from the motor vehicle sector.

A. Regulatory History

- **Adoption of Chapter 127 *New Motor Vehicle Emission Standards* February 17, 1993**

In 1993, portions of the State of Maine exceeded both the state and federal ambient air quality standards for ozone. Mobile sources have been identified as the single greatest source of both volatile organic compounds (VOCs) and nitrogen oxides (NOx) emissions, precursors to ozone formation. In addition, mobile sources are significant emitters of air toxics. The 1990 Clean Air Act Amendments (CAAA) mandated that Maine's moderate nonattainment areas achieve a 15 percent reduction in VOCs by November 15, 1996, and that Maine implement a strategy for the long-term maintenance of air quality.

As part of the strategy Maine adopted DEP RegulationChapter 127, *New Motor Vehicle Emission Standards,* which requires that all 1996 and newer passenger cars and light-duty trucks be manufactured and certified to the more stringent California emission standards than those required by the federal government. These more stringent emission standards are necessary for the long term maintenance of air quality in the face of increased vehicle usage and economic development. The emission reductions resulting from this regulation were necessary to attain the state and federal ozone air quality standards.

- **Amended to Delay Program Implementation March 30, 1994**

Chapter 127 was amended to incorporate restrictions on the implementation of the Maine New Motor Vehicle Emissions Standards made by the 116th First Regular Session of the Maine Legislature. The effective date of the regulation and applicable dates were changed in response to the restrictions set forth in 38 M.R.S.A Section 585-D. Legislation stipulated that the effective date of the regulation was dependent on whether states in the northeast and the 13 state Ozone Transport Region also adopted similar rules.

- **Amended to Adopt LEV II Standards and Repeal ZEV**
  December 31, 2000

The December 2000 amendment of Chapter 127 reflected changes to the California Low Emission Vehicle Program that were made since the Maine program was adopted in 1993. The first major change to Chapter 127 was the adoption of the more stringent LEV II standards. The California Air Resources Board first adopted LEV standards in 1990 for model years 1994 through 2003. LEV II regulations applying to model years 2004 through 2010 represent continuing progress in emission reductions as the state's passenger vehicle fleet continues to grow and as vehicle miles traveled increases.

In addition, the Board amended Chapter 127 to repeal the Zero Emission Vehicle (ZEV) mandate which would have required, starting with model year 2003, that10 percent of new vehicles sold in Maine be ZEVs (sales of vehicles such as gasoline/electric hybrids and super clean gasoline powered vehicles can be counted in that calculation). This amendment was based on a 1997 study required by the Maine legislature (38 MRSA Section 585-D) of zero emission vehicle technology, price, performance, consumer acceptability, and implementation issues relating to use of those vehicles in the State.

DEP staff shared reservations expressed by the California Air Resources Board (CARB) regarding current lack of ZEV availability, market demand, and cost and incentives for ZEVs. CARB directed their staff to review the regulation and propose appropriate modifications to address these issues and assure successful penetration of ZEVs into the market. The DEP staff recommended that the Board of Environmental Protection repeal the current ZEV mandate and revisit the ZEV mandate after California completed its evaluation. The Board approved the recommendation.

- **Amendment to Incorporate More Stringent Light and Medium-Duty Vehicle Emission Standards and the Not-to Exceed- and EURO III European Stationary Cycle (ESC) Test Procedures**
  December 22, 2001

California incorporated EPA's federal Tier 2 standards that were more stringent for light and medium duty vehicles than the previously adopted LEV II standards. California also adopted EPA's more stringent standards for heavy-duty gasoline engines beginning with model year 2005. In December 2001, the Board of Environmental Protection adopted these standards, thereby assuring that Maine continued to receive only the cleanest vehicles available in every vehicle category.

- **Amendment to Adopt California's Heavy-Duty Diesel Engine Standards**
  December 28, 2005

This rulemaking was part of a multi-state initiative. At that time thirteen states had committed to adopting California's heavy-duty diesel emission standards to ensure that a significant portion of the domestic market for Heavy Duty Diesel Engines (HHHE) is

required to meet the more stringent emission standards and that states receive the associated significant emission reduction benefits.

Adoption of the 2007 California HDDE emission standards would aid the State in attaining and maintaining the National Ambient Air Quality Standard for ozone by reducing in-use emissions of air contaminants from HDDE vehicles

- **Amended for Provisional Adoption of ZEV December 28, 2004**

When California adopted the ZEV program in 1993, battery electric vehicles were virtually the only vehicles available that could meet the ZEV requirements. In April 2003 CARB finalized modifications to its ZEV program that better aligned the program requirements with the status of current technology development. Those modifications allow gasoline-electric hybrids and gasoline powered vehicles that meet the SULEV standard with zero evaporative emissions to meet up to 80% of the ZEV requirement. The ZEV percentage requirements remained at 10% but started in model year 2005, allowing manufacturers to earn and bank credits for vehicles produced prior to the 2005 model year.

The 2003 changes also included an "alternative compliance path" that allows AT PZEVs (gasoline-electric hybrids) to be used to meet the pure ZEV obligations, provided that the manufacturer meets a requirement for a specified number of fuel cell vehicles (250 fuel cell vehicles from 2001 to 2008). Many of these technologies have at least some qualities inherent to ZEVs, such as extremely low emissions, partial all-electric range, extended durability, or the use of an inherently durable non-combustion engine.

Based on the California Zero Emission Vehicle Program modifications, the Board of Environmental Protection found that California had addressed the concerns expressed in 2000 and adopted the ZEV requirements of the LEV II program.

- **Amended for ZEV Program to Take Effect July 21, 2005**

On December 2, 2004 the Board provisionally adopted the amendment to reinstate the Zero Emission Vehicle program pursuant to 38 MRSA Section 585-D, which states that "*any rule adopted by the board containing a zero-emission vehicle mandate is a major substantive rule pursuant to Title 5, chapter 375,subchapter II-A.*" Therefore, the rule could not go into effect until approved by the legislature.

On May 31, 2005 Governor John Baldacci signed into law LD 1465, "A Resolve, Regarding Legislative Review of Portions of Chapter 127: New Motor Vehicle Emission Standards, a Major Substantive Rule of the Bureau of Air Quality" (emergency). The Resolve authorized the final adoption of the ZEV program. However, at the Department's recommendation, the legislature amended the provisionally adopted Chapter 127 to include provisions to allow automobile manufacturers to establish credits

in Maine for placement of vehicles in California (proportional to the vehicle sales in Maine).

- **Amended to Adopt California Greenhouse Gas Emission Standards December 19, 2005**

The purpose of this rulemaking was to amend Chapter 127 to reflect changes to California's LEV II program that incorporated motor vehicle greenhouse gas (GHG) emission standards commencing with the 2009 model year for passenger cars, light duty trucks and medium-duty passenger vehicles, and maintain identical standards with California for all vehicle weight classes as required by Section 177 of the federal Clean Air Act.

The standards phase in beginning with 2009 model year through 2016, allowing changes to be made as part of the product improvement cycle. This ensures that all manufacturers can comply with the standards without resorting to weight reduction or altering their fleet mix.

Transportation is Maine's single largest and fastest growing source of greenhouse gases. Adoption of this regulation was the only currently available policy option that can substantially reduce emissions from this sector and help Maine meet its commitment to the Climate Action Plan to reduce greenhouse gas emissions.

B. Enforcement

Unlike the other states that adopted the California LEV program, Maine does not enforce the program through registration denial. In a registration denial program, a person can not register the vehicle without proof that the vehicle is certified to meet the California emission standards. Unlike the other northeast LEV states, Maine does not have a centralized registration system. Vehicles can be registered at the Bureau of Motor Vehicle Branch offices or at municipal offices (thus a decentralized registration system). Since vehicles can be registered by the municipalities, it was considered too cumbersome to administer a registration denial program.

The Department utilizes two enforcement methods to determine compliance with the LEV program. First, DEP staff conducts unannounced inspections of vehicles at Maine automobile dealerships. Staff review certificates of origins on all new vehicles at the dealership and, if necessary, look at the "under the hood" labels to verify compliance with California emission certification.

In addition, the Bureau of Motor Vehicles staff review each new titled vehicle for California certified emissions on the Manufacturers Certificate of Origin (MCO). This collaborative effort between agencies has been very successful in identifying non compliant vehicles and potential loss of sales to Maine dealerships for non LEV vehicles purchased out of state.

From October 2005 through December 2006 the Bureau of Motor Vehicles sent 49 copies of MCOs of potentially non-conforming titled vehicles of the 58,315 new vehicles titled in 2006. Of the 49 vehicles that were investigated:

a) 23 vehicles were determined to be compliant with California emissions.
b) 21 vehicles were purchased out-of-state with federal emissions certification or undetermined.
c) 5 vehicles were non-compliant vehicles traded into Maine from an out-of-state dealership and therefore illegally offered for sale in Maine.

The enforcement of those five violations took into account any economic benefit that was realized by the dealer, as well as a standard penalty.

C. Manufacturer Reports for 2005

In accordance with Chapter 127, Section 8 B (1), the auto manufacturers must report following the end of each model year the actual vehicles delivered for sale to Maine. For model year 2005 the actual vehicles delivered for sale are shown in Appendix E.

V. Cost to Administer the LEV Program

A. Cost to the State of Maine to Administer the LEV Program

In the context of our mobile source control program, the administrative workload of the LEV program is small. Less than 50% of one staff person's time is routinely involved in the program implementation, and much of that effort is directly related to management of the information submitted by the automobile manufacturers and the evaluation of changes made to California's program and any regulatory revisions needed to keep the program identical with California's as required under Section 177 of the Clean Air Act.

If Maine's LEV program was repealed, the Maine new vehicle emissions program would default to the federal vehicle emission program administered by the U.S. Environmental Protection Agency. Under this scenario there would be minimal department administration, essentially staff would refer all inquiries on the program to the EPA Region 1, Boston Office.

B. Cost Effectiveness of the LEV Program

Massachusetts Department of Environmental Protection reports annually to their legislature on the economic impacts and the cost effectiveness of implementation of the California LEV program. Their report states:

"Impact on Vehicle Cost

The costs of the California LEV II standards have been calculated by CARB and include the incremental costs of both exhaust and evaporative controls required on passenger cars, light-duty trucks and medium duty vehicles. The total costs include the cost of parts and internal corporate costs to automobile manufacturers.

The additional cost per vehicle varies depending upon the standard to which the vehicle is certified. CARB estimates the following vehicle price increases:

Retail price increase: $96 - $304
Average vehicle price increase: $215 ($190 for exhaust controls; $25 for evaporative controls)
Average percent increase in vehicle cost: 1% (based on an average vehicle cost of $19,000)

EPA estimates the additional retail cost for vehicles meeting the proposed Tier 2 emission standards to be $50-218. Therefore, the additional costs to Massachusetts' consumers for vehicles meeting LEV II standards vs. Tier 2 standards are negligible. In addition, the extended warranty on vehicles may result in lower repair costs to the consumer.

Cost Effectiveness

CARB estimates that the cost-effectiveness of LEV II standards relative to LEV I standards is on average $1.00 per pound of pollutants reduced. For comparison purposes, mobile source control measures usually are in the range of $5.00 per pound of emissions and stationary sources are in the range of up to $10.00 per pound of pollutants reduced."

VI. Benefits of the California LEV II Program

In 2006, the National Research Council (NRC) report entitled "*State and Federal Standards for Mobile Source Emissions*," found that California's approach to setting vehicle pollution standards continues to provide air quality benefits and innovation beyond the federal motor vehicle emission control program.

California's LEV II standards for evaporative and tailpipe VOC emissions are more stringent than those of the federal Tier 2 program.[4] Additional reductions in toxic vehicle emissions under LEV II are estimated at approximately 12 percent in 2020, compared to the federal program.[5] NESCAUM modeling of the LEV II program using the MOBILE6.2 model indicates that nearly 50 tons of NOx+VOC per day will be reduced in the seven Northeast LEV II states in 2025.[6]. This assumes no changes to the LEV program to further reduce emissions between now and 2025. In 2025 approximately 11 tons per day of VOCs will be reduced in our region with inclusion of the zero evaporative emission standards over and above the federal Tier 2 standards. Any additional hydrocarbon and NOx reductions achieved through the California LEV program will help Maine address the formidable challenge of attaining (and maintaining) new ozone and fine particle ambient air quality standards despite continued growth in vehicle miles traveled and other pollution-generating activities. See Appendix D for emission reduction achieved for light duty vehicles.

A significant added benefit of the California LEV program involves reductions of greenhouse gas emissions from new motor vehicles. The Maine Climate Action Plan calls for Maine to reduce greenhouse gas emissions (GHG) to 1990 levels by 2010 and 10% below that by 2020. The stake holder's process determined that per capita greenhouse gas emissions from motor vehicles in Maine exceed the national average and every other New England State. Moreover, projections for Maine and other Northeastern states have concluded that emissions from this sector will comprise most of the growth in overall GHG emissions in our region over the next decade.[7] In the Maine Climate Action Plan, adopting the California GHG emission standards for new passenger and light-duty vehicles was the number two overall recommendation to meet Maine's GHG reduction

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[4] Because of differences in the way each program structures its compliance requirements, it is difficult to make a straightforward comparison of the stringency of the LEV II standards compared to the Tier 2 standards. For example California requires manufacturers to comply with a fleet average for non-methane organic gas (NMOG) but not NOx and EPA requires manufacturers to comply with a fleet average for NOx but not hydrocarbons. In spite of these differences it is possible to assess relative program benefits using certain assumptions which, according to this analysis, suggest that LEV II provides additional emissions benefits over Tier 2.

[5] Summary of NESCAUM Analysis Evaluating NOx, HC and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEV II) Standards, page 6.

[6] Summary of NESCAUM Analysis Evaluating NOx, HC and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEV II) Standards, page 8.

[7] See NESCAAF, Reducing Greenhouse Gas Emissions from Light-Duty Motor Vehicles (Sept. 2004).

targets.[8] The LEV II program is the only currently available policy option that can substantially reduce emissions from this sector. The Northeast States for Consolidated Air Use Management (NESCAUM) projected overall GHG reductions throughout the region to be 18% by 2020 from adoption of the California GHG Low Emission Vehicle Program standards. Importantly the analyses done by NESCAUM and CARB suggest that these reductions can be achieved at a net savings to consumers from reduced fuel and vehicle maintenance costs.

Thirdly, Maine's program provides added benefits through its ZEV vehicle sales mandate. The ZEV mandate described in Section II results in the introduction of advanced technology vehicles with even lower emissions than those required of new conventional gasoline vehicles under either the California or federal program. Eligibility for ZEV credits requires SULEV emission certification as well as zero evaporative emissions and a 150,000 mile durability requirement. Not only does this benefit air quality but the extended warranty on vehicles may result in lower repair costs to the Maine consumer.

The 2005 report on the vehicles delivered for sale to Maine reported 26 percent of the new passenger vehicles met the more stringent near zero tailpipe emissions and zero evaporative standards. More importantly, resulting air quality improvements can result in potentially significant public health benefits.

[8] Maine Department of Environmental Protection, Maine Climate Action Plan 2004, A Report to the Joint Standing Committee on Natural Resources of the Maine Legislature Pursuant to PL 2003 Chapter 237, p. 3-4 (December 2004).

VII. Conclusion

The 2005 NESCAUM study concluded the LEV II program provides significant NOx, HC, and CO emission reductions over the federal Tier 2 program.[9] Unlike the federal program which will remain the same for at least a decade as required by the Clean Air Act, the California program will be dynamic and continue to become more stringent. Thus emission reductions achieved by the California program compared to federal Tier 2 will likely become greater as California adopts more stringent phases of the LEV program. In particular, risks associated with exposure to toxics such as benzene, formaldehyde, and 1, 3-butadiene will be significantly reduced by the California LEV II program.

The results of the NESCAUM analysis indicate that Northeast states derive air quality and public health benefits from adopting the California program in at least three areas:

- reducing ambient levels of priority airborne toxic pollutants
- attaining health-based air quality standards for ozone and fine particles
- meeting state and regional climate change objectives

[9] Summary of NESCAUM Analysis Evaluating the NOx, HC, and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEVII) Standards, June 2005.

Appendices

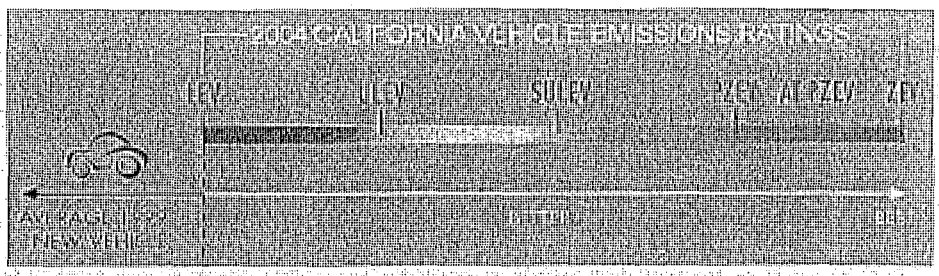
Fact Sheet

California Environmental Protection Agency
Air Resources Board

California Vehicle Emissions

A vehicle's emissions are the result of the combined attributes of fuel type, controls on the engine's operations, and maintenance throughout the life of the vehicle. All new vehicles sold in California must be certified to one of six California Air Resources Board (ARB) emissions ratings; however, the criteria to meet these ratings vary depending upon the weight of the vehicle. For example, heavier vehicles like trucks and SUVs, have less stringent criteria than smaller vehicles to receive the same emissions rating. This will phase out by 2008, when SUV size vehicles must match the more stringent criteria currently required for smaller cars. A vehicle's emissions rating is posted on the Vehicle Emissions Control Information Label found under the hood.

California's emissions ratings apply to all new vehicles sold in this state, and are the most stringent in the world.



LEV *(Low Emission Vehicle):* The least stringent emission standard for all new cars sold in California beyond 2004.

ULEV *(Ultra Low Emission Vehicle):* 50% cleaner than the average new 2003 model year vehicle.

SULEV *(Super Ultra Low Emission Vehicle):* 90% cleaner than the average new 2003 model year vehicle.

PZEV *(Partial Zero Emission Vehicle):* Meets SULEV tailpipe standards, has a 15-year / 150,000 mile warranty, and zero evaporative emissions[1].

AT PZEV *(Advanced Technology PZEV):* Meets PZEV standards and includes ZEV enabling technology.

ZEV *(Zero Emission Vehicle):* Zero tailpipe emissions, and 98% cleaner than the average new 2003 model year vehicle.

How Technologies Compare in Emissions

Gasoline Powered Vehicles: Gasoline powered vehicles have historically been considered very polluting, however, recent model years have achieved very stringent emissions standards. In 2004, 37 gas-powered vehicle models were certified to PZEV standards, and this number is expected to increase greatly in coming years. Gas-powered vehicles are able to achieve stringent standards because of advanced controls on engines and fuel systems that substantially reduce tailpipe emissions and virtually eliminate evaporative emissions.

Hybrid-Electric Cars: Hybrid vehicles will always produce fewer greenhouse gas emissions than a comparable pure gasoline powered vehicle. The overall emissions, however, will vary depending on the vehicle's "level of hybrid" (electrical storage capacity), and how advanced the engine

[1] *Evaporative emissions are fuel vapors that escape to the outside*

controls are. Each hybrid model must be judged individually, and may or may not have fewer smog-forming emissions than a gas-powered car.

Alternative Fueled Vehicles (AFVs): AFVs can operate on fuel other than gasoline or petroleum based diesel, such as electricity, ethanol, hydrogen (H_2), methanol, natural gas (CNG), biologically produced diesel (biodiesel), or propane (LPG). Alternative fuels are generally cleaner than gasoline, but adequate controls on the engine are necessary to ensure fewer overall emissions.

- ***Flex-fuel*** – A flexible fueled vehicle has a single fuel tank, fuel system, and engine. The vehicle is designed to run on unleaded gasoline and an alcohol fuel (usually ethanol) in any mixture. These engines have sensors to analyze the fuel mixture, and adjust the fuel injection and timing. Since fuel composition and engine controls vary widely from one car to the next, flex-fuel vehicles do not assure fewer emissions than dedicated gas-powered vehicles.

- ***Bi-fuel*** – A bi-fuel vehicle has two separate fuel systems, one for gasoline or diesel and another for LPG, CNG or H_2. Because LPG, CNG and H_2 are stored in pressurized tanks, they cannot be simply pumped into the gasoline tank. Like flex-fuel vehicles, bi-fuel vehicle emissions vary from car to car depending on engine controls and the fuel chosen – making them not necessarily cleaner than a dedicated gas vehicle.

Hydrogen Fuel Cell Vehicle (FCVs): All H_2 FCVs are zero emission. Currently, most H_2 is harvested from natural gas – the cleanest and most efficient method at this time. The source of H_2 is an integral part of the emissions considerations, but H_2 FCVs themselves are zero emission. Not all FCVs are zero emission, for example, if they use methanol such as in a direct methanol FCV, they produce some carbon monoxide emissions and potential other trace constituents.

Diesel: Vehicles run on diesel achieve better fuel economy and contribute less to greenhouse gas emissions. And although emissions from diesel vehicles are better controlled because of improved engines, new emission control devices and reduced sulfur content in the fuel, diesel vehicles still have significant particulate and oxides of nitrogen emissions. Diesels have met only federal Tier I standards to date, which are about 4.5 times dirtier than California's least stringent LEV standard.

Common Terms

AER	All Electric Range	**GHG**	Greenhouse Gas	**NOx**	Oxides of Nitrogen
AFV	Alternative Fuel Vehicles	**H_2**	Hydrogen	**OBD**	On Board Diagnostics
AT PZEV	Advanced Technology Partial Zero Emission Vehicle	**HC**	Hydrocarbon	**PbA**	Lead Acid (battery)
BEV or EV	Battery Electric Vehicle	**HEV**	Hybrid Electric Vehicle	**PC**	Passenger Car
CaFCP	California Fuel Cell Partnership	**HEV 20**	Hybrid EV with 20 Miles All Electric Range	**PEM**	Proton Exchange Membrane (fuel cell)
CBG	Cleaner Burning Gasoline	**LDT**	Light Duty Truck	**PPM**	Parts Per Million
CEV	City Electric Vehicle	**LEV**	Low Emission Vehicle	**PZEV**	Partial Zero Emission Vehicle
CNG	Compressed Natural Gas	**LEV II**	1998 amendments to LEV program	**SULEV**	Super Ultra Low Emission Vehicle
CO_2	Carbon Dioxide	**LPG**	Liquid Petroleum Gas (Propane)	**ULEV**	Ultra Low Emission Vehicle
E85	85% Ethanol (gas blend)	**MDV**	Medium Duty Vehicle	**UDDS**	Urban Dynamometer Driving Schedule
FCEV or FCV	Fuel Cell Electric Vehicle	**MeOH**	Methanol	**VMT**	Vehicle Miles Traveled
FE	Fuel Efficiency	**NEV**	Neighborhood Electric Vehicle	**ZEM**	Zero Emission Motorcycle
FFEV	Full Function Electric Vehicle	**NiMH**	Nickel Metal Hydride (battery)	**ZEB**	Zero Emission Bus
g/mile	Grams per Mile	**NMOG**	Non Methane Organic Gas	**ZEV**	Zero Emission Vehicle

Appendix B

New vehicles (less than 7,501 miles) can be certified to meet the California emission standards established for LEV, ULEV, SULEV or ZEV. Standards corresponding to each category are summarized in Table 1 below.

Table 1
LEV II Exhaust Mass Emission Standards for New 2004 and Subsequent Model Year Passenger Cars

Vehicle Type	Durability Vehicle (miles)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)
All passenger cars and light duty trucks 8,500 lbs. GVW or less	50,000	LEV	0.075	3.4	0.05
		LEV, option 1	0.075	3.4	0.07
		ULEV	0.040	3.4	0.05
	120,000	LEV	0.090	1.7	0.07
		LEV option 1	0.090	4.2	0.10
		ULEV	0.055	2.1	0.07
		SULEV	0.010	1.0	0.02
	150,000 (optional)	LEV	0.090	4.2	0.07
		LEV option 1	0.090	4.2	0.10
		ULEV	0.055	2.1	0.07
		SULEV	0.010	1.0	0.02

NESCAUM White Paper on the Emissions Benefits of the LEV II Program, September 2003

Appendix C

Emissions standards for individual vehicles are listed below in Table 2. The Tier 2 fleet-wide average NOx standard is .07 grams per mile. This corresponds to a Bin 5 vehicle, although manufacturers can certify vehicles in any bin as long as they meet the fleet wide average. [1]

Table 2
Tier 2 Full Useful Life Exhaust Mass Emission Standards

Bin #	NOx	NMOG	CO	HCHO
11*	.9	.280	7.3	0.032
10*	.6	0.156/0.230	4.2/6.4	0.018/0.027
9*	.3	0.90/0.180	4.2	0.018
8	0.20	0.125/0.156	4.2	0.018
7	0.15	0.090	4.2	0.018
6	0.10	0.090	4.2	0.018
5 (LEV)	0.07	0.090	4.2	0.018
4	0.04	0.070	2.1	0.011
3	0.03	0.055	2.1	0.011
2 (SULEV)	0.02	0.010	2.1	0.004
1 (ZEV)	0.00	0.000	0.0	0.000

NESCAUM White Paper on the Emissions Benefits of the LEV II Program, Sept. 2003

NOx are nitrogen oxides (precursor of ground-level ozone pollution)

NMOG are non-methane organic gases

CO is carbon monoxide

HCHO is formaldehyde

[1] NESCAUM White Paper on the Emissions Benefits of the LEV II Program, September 2003, pg 13.
* Bin 11 is only for medium duty passenger vehicles and will be deleted at the end of 2008. Bin 10 and higher NMOG, CO and HCHO values apply for certain vehicles and will be deleted at the end of 2006 or 2008 (depending on the vehicle type). Bin 9 and higher NMOG standards apply only to certain vehicles will be deleted at the end of 2006 or 2008 (depending on the vehicle).

NESCAUM
www.nescaum.org

The Clean Air Association of the Northeast States
101 Merrimac Street, 10th Floor Boston, MA 02114
Phone 617-259-2000 Fax 617-742-9162
Arthur N. Marin, Executive Director

Summary of NESCAUM Analysis Evaluating the NOx, HC, and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEV II) Standards June, 2005

I. Overview

This summary provides the results of modeling conducted by NESCAUM to evaluate the NOx, HC, and CO emissions reductions that will be realized in Northeast states adopting the California Low Emission Vehicle ("LEV II") program. The study is a follow-up to modeling conducted in 2002 to evaluate the HC, toxics, and CO_2 emissions reductions gained from adoption of the California LEV II program. The analysis itself was conducted by Cambridge Systematics, Inc., an independent consulting firm that, for more than 20 years, has conducted projects associated with the implementation of transportation and air quality planning initiatives.

The purpose of the analysis is to compare Tier 2 and LEV II light-duty vehicle emissions in different NESCAUM member states. The modeling results described in this summary provide an estimate of State Implementation Plan (SIP) credits that could be claimed from LEV II program adoption. In addition, the modeling conducted for this analysis addresses issues raised by the U.S. EPA about a prior NESCAUM analysis published in 2003.[1] The current analysis evaluates criteria pollutants but not other pollution reduced through adoption of the CA LEV program, such as greenhouse gas emissions.[2] This summary also provides the results of an evaluation - not using MOBILE6.2 - to assess the evaporative emission reductions achieved from the introduction of "zero evaporative" standards that are a part of the LEV II program. Section III summarizes the MOBILE6.2 modeling results, Section IV provides estimates for the VOC emission reductions that will result from introduction of zero evaporative emission standards in the Northeast, and Section V provides an overview of the method used to estimate the criteria pollutant reductions.

II. Background

Light-Duty Motor Vehicle Emissions Standards

All new vehicles sold in the U.S. are subject to emissions standards set by either the federal government or the State of California. California is the only state with the authority to set its own vehicle standards; other states may adopt either the California or the federal standards.[3] In the

[1] NESCAUM, "Comparing the Emissions Reductions of the LEV II Program to the Tier 2 Program," October, 2003.
[2] Reductions in GHG emissions that will be realized in the Northeast states through LEV II program adoption are summarized in "Quantifying the GHG Emission Reductions Achieved Through Adoption of the LEV II Program," NESCAUM, 2005
[3] The authority of other states to adopt California standards in lieu of federal standards was granted under Section 177 of the Clean Air Act Amendments of 1977.

1990s, several Northeast states (specifically, Maine, Massachusetts, New York and Vermont) adopted the California Low Emission Vehicle (LEV) program in lieu of federal standards. Three other Northeast states (Connecticut, New Jersey, and Rhode Island) adopted the LEV II program in 2004 and 2005.[4]

Air Quality Background

The substantial contribution of motor vehicles to ozone pollution is well established. Automobiles and other mobile sources emit hydrocarbons and nitrogen oxides (NOx), the two primary precursor pollutants that – when mixed in the atmosphere in the presence of sunlight – combine to form ozone. In fact, light-duty vehicles account for approximately one-third of all ozone precursor (NOx and HC) emissions in the Northeast. Light-duty vehicles also emit particulate ($PM_{2.5}$). Both ozone and fine particle pollution are associated with serious health impacts. In the case of ozone, documented health risks include decreased lung function and increased respiratory problems, and – with repeated exposure – long-term and potentially irreversible lung damage. Meanwhile, large-scale epidemiological studies of the health risks associated with fine particle pollution have produced convincing evidence for a host of adverse effects, including premature mortality, aggravation of respiratory and cardiovascular disease and increased incidence of asthma attacks, chronic bronchitis and hospital visits.

In the case of fine particles – which have emerged as a focus of air quality regulation and public health concern only in the last decade or so – the relative contribution of different source categories to ambient concentrations is less well understood. However, it is clear that light-duty vehicles emit primary $PM_{2.5}$ in addition to organic aerosols. Organic aerosols constitute a significant fraction of overall fine particle mass in many urban locales. Together with other sources of organic compounds – notably highway and nonroad diesel-powered engines – light duty vehicles are therefore likely to play at least some role in the formation of fine particle pollution in most urban areas. In this context, any additional hydrocarbon and NOx reductions achieved through the California LEV program will help states address the formidable challenge of attaining (and maintaining) new ozone and fine particle ambient air quality standards despite continued growth in vehicle miles traveled and other pollution-generating activities. More importantly, resulting air quality improvements will translate to potentially significant public health benefits, especially for the millions of citizens who live in urban areas of the Northeast that frequently experience unhealthy concentrations of ozone and fine particle pollution.

NESCAUM 2003 LEV II and Tier 2 Analysis

In 2002, NESCAUM evaluated the LEV II program and estimated the amount of hydrocarbon (HC), toxics and carbon dioxide (CO_2) emission reductions that would be achieved in states adopting the LEV II program. Following the publication of the results, EPA provided comments and noted areas for further analysis or revision. Specifically, EPA commented on the need to: 1)

[4] Another state in the Northeast - Pennsylvania - adopted the LEV II program in 2006.

include LDT3 and LDT4 vehicles in the modeling; 2) use bin mix assumptions included in an EPA 2002 guidance document;[5] and 3) evaluate the emissions reductions achieved in states that recently adopted LEV II. At the time EPA issued its 2002 guidance document, the NESCAUM modeling of LEV II emissions was already underway, and NESCAUM did not change the assumptions in the evaluation to conform to the EPA guidance. This follow-up analysis re-evaluates the LEV II and Tier 2 program benefits using the EPA guidance for MOBILE6.2 (see Attachment A for the EPA guidance document).

III. Results: NOx, HC, and CO Emission Reductions

This section summarizes the NESCAUM modeling results using the EPA MOBILE6.2 model and the June, 2002 EPA guidance entitled "Modeling Alternative NLEV Implementation and Adoption of California Standards in MOBILE6." Results for early adopting LEV II states (New York, Massachusetts, Vermont, and Maine) are presented separately from recently adopting LEV II states (New Jersey, Connecticut, and Rhode Island) since the date of program implementation impacts emissions reductions.

Both the federal Tier 2 program and the California LEV II program will provide substantial further reductions in new vehicle exhaust emissions (on the order of 90 percent or more) over the next two decades. However, the analysis conducted by Cambridge Systematics for NESCAUM finds that California's standards provide additional emissions reduction benefits over and above what the federal program is expected to achieve. Specifically, the analysis finds additional reductions in light duty vehicle emissions of 31 tons per day of NOx+VOC in 2020 for early adopting states (MA, NY, VT, and ME) and reductions of 17 tons per day of NOx+VOC for newly adopting states (CT, NJ, and RI) under the LEV II program compared to the federal Tier 2 program. Reduced formation of secondary organic aerosol is likely an additional benefit of the LEV II program, although this has not been quantified in this study.

Tables 1 and 2 summarize the annual NOx, VOC, and CO emissions reductions that will be realized in the Northeast LEV states between 2015 and 2025. Table 1 provides reductions for the early adopting LEV states and Table 2 provides reductions for recently adopting states. The emissions reductions are presented for all light-duty vehicles (passenger cars and light-duty trucks 1, 2, 3, and 4).

[5] EPA, "Modeling Alternative NLEV Implementation and Adoption of California Standards In MOBILE6," June, 2002. NESCAUM assumed that most vehicles would be certified in bin 5 in the earlier analysis, and the EPA guidance document assumes somewhat of a different mix of vehicles.

Table 1: Emissions Reductions Achieved in Early Adopting LEV States

Calendar Year	NOx Reduced (% light duty emissions)	NOx Reduced (tons per day)	CO Reduced (% light duty emissions)	CO Reduced (tons per day)	VOC Reduced (% light duty emissions)	VOC Reduced (tons per day)
2015	11.4%	18.8	.2%	5.3	6.3%	11.4
2020	14.7%	19.3	.4%	11.8	7.6%	12.1
2025	16.4%	20.1	.9%	25.1	8.4%	13.4

Table 2: Emissions Reductions Achieved in Recently Adopting LEV States

Calendar Year	NOx Reduced (% light duty emissions)	NOx Reduced (tons per day)	CO Reduced (% light duty emissions)	CO Reduced (tons per day)	VOC Reduced (% light duty emissions)	VOC Reduced (tons per day)
2015	4.5%	4.9	1.5%	23.5	2.2%	2.6
2020	10.8%	8.1	3.0%	44.8	4.8%	4.5
2025	15.2%	9.7	3.7%	54.7	6.9%	6.0

The results above show that in 2025, more than 49 tons of smog-forming pollutants (NOx + VOC) will be reduced per day in the seven Northeast LEV states as a result of adoption of the LEV II program.

Discussion:

Several assumptions specific to the Northeast vehicle fleets evaluated were made in this analysis. First, different LEV II program implementation dates for the states are used. For example, Massachusetts first implemented the LEV program in 1994 and other states will implement the program in 2009. Since fleet turnover affects total fleet emissions, the analysis is specific to the different implementation dates assumed. Second, the analysis assumed that I/M programs are in place for a substantial fraction of the fleet evaluated. Last, fleet mixes for the Northeast states were also used in the analysis.

It is also important to note the results are reported in terms of tons reduced for light-duty vehicles and as a percent of the emissions difference between a Tier 2 fleet and a LEV II fleet. Heavy-duty vehicle emissions were not included in calculating percent reductions from the fleet. If emissions reduced are reported as a percent of total emissions from all motor vehicles - including heavy-duty vehicles - the percent reductions would be lower. Heavy-duty vehicle emissions are not included since light-duty vehicle emissions comprise roughly one third of the ozone forming pollutant inventory in the Northeast, and thus merit a stand alone analysis.

IV. Additional Analysis Using EMFAC Assumptions for "Zero" Evaporative Standards

The MOBILE model does not include an assumption for differences in evaporative emissions between near zero evaporative standards (standards for LEV, ULEV, and SULEVs) and for zero evaporative standards (standards for PZEVs, AT PZEVs, and ZEVs). The LEV program sets different certification standards for these different types of vehicles. The standards are summarized in Table 3.

Table 3: Comparison of Evaporative Standards (3-day diurnal + hot soak emissions: g/test)

Vehicle Class	LEV II "near zero" evap standards	LEV II "zero" evap standards
LDV	.5	.35
LDT1 and LDT2	.65	.5
LDT3 and LDT4	.9	.75

Unlike the federal program, the LEV II program requires a set percentage of vehicles sold to be zero emission vehicles ("ZEVs") or their equivalent (ZEVs and their equivalent are referred to as advanced technology vehicles in this summary). These advanced technology vehicles must meet the more stringent evaporative emission standards shown in column three of Table 3 labeled "LEV II zero evap standards." The requirement in 2006 is that 10 percent of passenger cars and LDT1s sold be zero emission vehicles, or their equivalent. This percentage requirement increases gradually until 2018, when it is fully implemented. In 2018, the requirement is 16 percent of combined passenger car, LDT1, and LDT2 sales are to be advanced technology vehicles. A flexible credit mechanism is available to manufacturers to facilitate compliance with the advanced technology vehicle requirement. As part of this compliance mechanism, up to 6 percent of the 10 percent ZEV requirement can be met with PZEV sales, however a PZEV does not receive the same amount of credit as a ZEV. Each PZEV sold receives 1/5 of a ZEV credit. Thus, five PZEVs must be sold to equal one ZEV. Assuming that at least 30 percent of the passenger car, LDT1, and LDT2 sales will be sold and will meet the more stringent evaporative emissions, the zero evaporative requirement will have a positive impact on air quality in the Northeast.[6]

To estimate the additional benefits that will be realized in the Northeast LEV II states from the zero evaporative standard, NESCAUM adjusted the MOBILE6.2 evaporative emission factors to reflect the emissions benefit of the more stringent zero evaporative standards. Since many PZEVs and some AT PZEVs will be powered by gasoline engines, deterioration in emissions over time is expected. To account for this, NESCAUM used lifetime average evaporative

[6] If full volume manufacturers meet 6% of the ZEV requirement with PZEVs, then 30% of passenger cars and LDT1s sold in 2006 will need to be PZEVs. The number of PZEVs required increases in later years.

emission factors from EMFAC for PZEVs and AT PZEVs. Differences between LEV II and Tier 2 program VOC emissions for the seven Northeast LEV states - adjusted to include the more stringent evaporative emissions standards - are presented in Table 4. Columns 2 and 4 show the additional total VOC emissions reduced with LEV program adoption in the early and recent adopting LEV states using the EPA 2002 guidance method. Columns three and five show the additional total VOC emissions reduced with LEV program adoption in the early and recent adopting LEV states - including additional VOC reductions from the zero evaporative standards.

Table 4: VOC Emissions with Default and "Adjusted" Evaporative Emissions

	Early Adopting States		Recently Adopting States	
	MOBILE6 no "zero" evap (%VOC reduction from Tier 2)	**With "zero" evap (% VOC reduction from Tier 2)**	**MOBILE6 - no "zero" evap (% VOC reduction from Tier 2)**	**With "zero" evap (% VOC reduction from Tier 2)**
2015	6.3%	10.2%	2.2%	6.2%
2020	7.6%	12.1%	4.8%	9.5%
2025	8.4%	13.1%	6.9%	11.7%
Tons per day reduced in 2025	13.4	21.0	6.0	10.1

The additional evaporative emissions reductions that will likely be realized as a result of the zero evaporative emission standards will equal an additional 11.6 VOC tons per day reduced in 2025 in the seven states.

V. Overview of Method to Estimate Emission Reductions

Estimates were developed for HC, CO, and NOx emissions reductions achieved by the adoption of the LEV II program in early adopting states (New York, Massachusetts, Maine, and Vermont) and recently adopting states (New Jersey, Connecticut and Rhode Island) relative to emissions under the Tier 2 program. Passenger cars and light-duty trucks (vehicles weighing less than 8,500 lbs) were included in the analysis. Assumptions about vehicle emissions and fleet characteristics under the federal base case and the California LEV II program were input to MOBILE6.2, EPA's most recent mobile source emission factor model, in accordance with EPA's technical guidance issued in June of 2002. The resulting emission factors were then combined with estimates of future light-duty vehicle travel in the seven states to predict future emission levels for projection years through 2025.

Early-adopting states were assumed to implement LEV-II beginning at the same time as Massachusetts (2004), and late-adopting states at the same time as New Jersey (2009). EPA

input files were adjusted to account for state specific sales mix. State specific I&M program parameters were used for Massachusetts and New Jersey, again representing early-adopting and late-adopting states, respectively. Emissions are expressed as a percent (and in tons) of additional reduction over and above emissions reduced from implementation of the Tier 2 program - in other words:

$$\frac{\text{(Tier 2 Fleet Emissions - LEV II Fleet Emissions)}}{\text{Tier 2 Fleet Emissions}}$$

MOBILE6.2 Inputs

Where available, state-specific data were used for inputs that would have a potentially significant impact on the results, such as inspection and maintenance (I/M) programs. Emission factors were developed separately for two regions, representing early-adopting and late-adopting states. State-specific inputs for Massachusetts and New Jersey were used for fuel, temperature, I/M program, and vehicle age distribution parameters. Emission factors were developed for these regions both with and without I/M programs, since some areas in the Northeast do not have I/M programs. No-I/M emission factors were applied to the VMT from these areas. Different phase-in schedules for the Tier 2 and/or LEV II programs were developed for the early versus late adopting states.

With the exception of these inputs, national defaults embedded in MOBILE6.2 were used for other model parameters. The use of defaults rather than state-specific assumptions in these instances is unlikely to create a significant difference in the relative benefits calculated for the LEV II versus Tier 2 programs.

To calculate total emissions, emission factors were combined with estimates of vehicle-miles of travel (VMT) for each region analyzed. Since consistent VMT forecasts were not available from every state, VMT baseline estimates for 2004 and forecasts through 2020 were obtained for each state from the Highway Performance Monitoring System (HPMS). The impact on the difference in emissions for LEV II versus Tier 2 resulting from the use of HPMS rather than state-derived forecasts was determined to be small. For New York State, VMT estimates for downstate (I/M program) and upstate (no I/M program) were obtained from the Department of Environmental Conservation (NYDEC) and these proportions were applied to the total VMT projections from HPMS. Forecasts of total VMT were allocated to different vehicle types based on EPA forecasts which account for the growing percentage of light trucks in the light-duty vehicle fleet.[7]

[7] The methodology for allocating Massachusetts VMT by vehicle class is the same as used in the 1999 study by Cambridge Systematics for NESCAUM of the benefits of the CA LEV II program.

Pursuant to the revised EPA guidance it was assumed that evaporative emissions for all LEV and PZEV vehicles were equivalent to those under Tier 2. Subsequent analysis was performed to compare HC emissions assuming a reduction in evaporative emissions from PZEV vehicles. "Zero" evaporative emission standards are more stringent than near zero (LEV II) evaporative standards (as seen in Table 3) for vehicles that are not eligible for ZEV credit. With deterioration over the life of the vehicle factored in, the EMFAC model assumes that evaporative emissions from vehicles subject to the PZEV and AT PZEV evaporative emissions standards are approximately 30 percent lower over the life of the vehicle, when compared to LEV vehicles meeting the less stringent "near zero" evaporative emission standards.

In the additional analysis of "zero evaporative" emissions standards, post-processing adjustments of MOBILE6.2 output were made to account for the zero evaporative standards. To do this, evaporative emissions outputs for LEV II vehicles were obtained by model year. For LEV II advanced technology vehicles, evaporative emissions were then reduced in proportion to the estimated lifetime average evaporative emissions rate found in the California EMFAC model.

VI. Conclusions

The LEV II program provides significant NOx, HC, and CO emission reductions over the Tier 2 program. Specifically, modeling conducted using the MOBILE6.2 model indicates that nearly 50 tons of NOx+VOC per day will be reduced in the seven Northeast LEV II states in 2025 with adoption of LEV II. This assumes that the LEV program stringency will not increase between now and 2025. In addition, approximately 11 tons per day of VOC in 2025 will be reduced in our region from adoption of the zero evaporative emission standards.

Appendix E

Maine 2005 Sales Report:

Table 4
2005 Passenger Cars

Name	LEV/LEVII	ULEV/ULEVII	PZEV
American Honda Motor Co., Inc.	426	982	545
American Suzuki Motor Corporation		81	
Aston Martin	3	1	
BMW Group	64	20	2
DaimlerChrysler	529	1064	221
Ford Motor Company	1755	743	1164
General Motors	4002	2439	570
Hyundai America	620	251	578
Jaguar	7	4	
Kia Motors Corporation	47	33	42
Land Rover North America, Inc.	4		
Mazda Motor Corporation	180	82	149
Mercedes-Benz	62	105	
Mitsubishi Motors R&D of America, Inc.	44	81	57
Nissan Motor Co., Ltd.	247	261	911
Porsche Cars North America Inc.	16		
Subaru of America, Inc.	1526	112	230
Toyota Motor Sales, U.S.A., Inc.	623	2143	1886
Volvo Cars Of North America, LLC	14	235	60
VW Group (Audi, VW, Rolls Royce, Lamborghini)	175	254	270
TOTAL	10344	8891	6685

Table 5
2005 Light Duty Truck I

NAME	LEV/LEVII	ULEV/ULEVII	PZEV
American Honda Motor Co., Inc.	653		
American Suzuki Motor Corporation		18	
Aston Martin			
BMW Group			
DaimlerChrysler	89		
Ford Motor Company	148	136	77
General Motors		74	
Hyundai America		68	
Jaguar			
Kia Motors Corporation	3		

Land Rover North America, Inc.			
Mazda Motor Corporation	30	1	
Mercedes-Benz			
Mitsubishi Motors R&D of America, Inc.		8	
Nissan Motor Co., Ltd.			
Porsche Cars North America Inc.			
Subaru of America, Inc.			
Toyota Motor Sales, U.S.A., Inc.	56	513	
Volvo Cars Of North America, LLC			
VW Group (Audi, VW, Rolls Royce, Lamborghini)	43		
TOTAL	1022	818	77

Table 6
2005 Light Duty Truck 2

NAME	LEV	LEVII	ULEV	ULEVII	SULEV	PZEV
American Honda Motor Co., Inc.				912		
American Suzuki Motor Corporation		27				
Aston Martin						
BMW Group	8			16		
DaimlerChrysler		3647	1042			
Ford Motor Company		1888	1252			
General Motors		2117	1241	98		
Hyundai America	482		10			
Jaguar						
Kia Motors Corporation	232					
Land Rover North America, Inc.						
Mazda Motor Corporation		260	30			
Mercedes-Benz						
Mitsubishi Motors R&D of America, Inc.		55	50			
Nissan Motor Co., Ltd.	5	833	86			
Porsche Cars North America Inc.			1		11	
Subaru of America, Inc.						899
Toyota Motor Sales, U.S.A., Inc.	96	1013		2025		
Volvo Cars Of North America, LLC				262		
VW Group (Audi, VW, Rolls Royce, Lamborghini)						
TOTAL	823	9840	3712	3313	11	899

Table 7 demonstrates that 26% of the vehicles delivered to Maine in 2005 were partial zero emission vehicles (PZEVs) with near zero emissions, zero evaporative emissions and a 15year/150,000 mile warranty.

Table 7
Summary of LEV Certified Vehicles Delivered to Maine in 2005

	LEV/LEVII	ULEV/ULEVII	SULEV	PZEV	% PZEV
Passenger Cars	10344	8891		6685	26
Light Duty Truck 1	1022	818		77	4
Light Duty Truck 2	10663	7025	11	899	5
TOTAL	22029	16734	11	7661	16