ADOPTING THE CALIFORNIA LOW EMISSION VEHICLE PROGRAM IN THE NORTHEAST STATES

- AN EVALUATION-

EXECUTIVE SUMMARY

Northeast States for Coordinated Air Use Management
(NESCAUM)

September 1991

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EXECUTIVE SUMMARY

Significant reductions in volatile organic compounds (VOCs), oxides of nitrogen (NOx) and carbon monoxide (CO) emissions will be needed to bring all areas on the Northeast into attainment with the National Ambient Air Quality Standards (NAAQS). The analysis contained in this report illustrate that adoption and implementation of the California Low Emission Vehicle (LEV) Program in the NESCAUM states will produce substantial emission reductions from the motor vehicle fleet beyond those projected for the future Federal Motor Vehicle Control Program.

Motor vehicles currently contribute approximately 50 percent of all volatile organic compounds and oxides of nitrogen emitted in the NESCAUM region during the summer ozone season and 75 percent of all carbon monoxide emitted on a typical winter day when exceedances of the NAAQS for CO are most prevalent. Motor vehicles also emit significant amounts of non-federally regulated toxic pollutants into the ambient air.

The results from the regional ozone modeling for Northeast transport (ROMNET) project provide further evidence of the extent of the ozone nonattainment problem in the Northeast and highlight the difficulties in bringing all areas of the NESCAUM region into attainment with the ozone NAAQS of .12 parts per million. The ROMNET project, was initiated by EPA, in conjunction with state and local air quality agencies in the Northeast, to assist with the challenge of developing effective and equitable control programs to attain the ozone standard. Initial results indicate that future attainment of the ozone health standard throughout the Northeast corridor will be difficult to achieve even with the implementation of extremely aggressive VOC and NOx control programs.

The Clean Air Act Amendments of 1990 (CAAA) contain several mandatory programs designed to reduce motor vehicle emissions including: the design, manufacture and certification of new vehicles to lower tailpipe and evaporative emission standards; enhanced inspection and maintenance programs to reduce in-use emissions; the use of less polluting gasoline and alternative fuels; and the implementation of transportation control measures to reduce the number of vehicle miles travelled.

Under Section 177 of the CAAA of 1990, other states retain the authority granted by Congress in the 1977 Amendments to the Clean Air Act, to adopt and enforce new vehicle standards which differ from the Federal standards as long as such standards are identical to the California standards and are adopted at least two years prior to the commencement of a model year.

California has responded to its ozone nonattainment problem with a

long-term plan of new VOC and NOx control initiatives designed to achieve significant reductions in emissions of these and other pollutants from current levels. To further reduce motor vehicle emissions, the California Air Resources Board (CARB) has established stringent new Low Emission Vehicle (LEV) standards. Under this program, four new categories of vehicles certifying to increasingly stringent emission standards will be introduced over the next decade: transitional low emission vehicles (TLEVs), low emission vehicles (LEVs), ultra-low emission vehicles (ULEVs) and zero emission vehicles (ZEVs). Compliance with the TLEV, LEV, and ULEV standards will be achieved through a combination of advanced vehicle emission control technology and reformulated gasoline or other clean burning fuels. ZEVs are defined as vehicles with no direct exhaust or evaporative emissions; only battery-powered electric vehicles are expected to be capable of certifying to this standard in the near term.

Beginning in Model Year 1994, vehicle manufacturers will be required to meet progressively more stringent fleet average non-methane organic gas (NMOG) standards. Manufacturers will be allowed to meet the fleet average standard by certifying vehicles to any combination of TLEV, LEV, ULEV, ZEV or conventional vehicle standards, as long as their sales-weighted NMOG emissions do not exceed the prescribed fleet average in a given year. The California LEV program includes a banking and trading component which permits manufacturers to earn marketable credits and offset poor vehicle sales or overly optimistic sales projections for a certain model year by utilizing credits previously earned by that manufacturer or a competitor.

The U.S. EPA's MOBILE4.1 emission factor model was used to estimate composite light-duty vehicle emission rates for the future Federal motor vehicle fleet and the LEV fleet. These emission rates were used in conjunction with light-duty vehicle travel estimates to project exhaust emissions of VOCs, NOx, CO and three air toxic compounds from the motor vehicle fleet in the years 2000, 2005, 2010, and 2015. MOBILE4.1 is not capable of estimating future year evaporative emissions. Based on current information, it is anticipated that EPA and CARB will adopt comparable evaporative emission control requirements which will result in exhaust emissions dominating the mobile source inventory after the year 2000.

Emissions from the Tier I future Federal motor vehicle fleet were estimated using emission factors provide by EPA. To determine the potential range of emission benefits which result from the implementation of the California Low Emission Vehicle program in the Northeast, two alternative modeling scenarios were analyzed. Alternative A, which is based on CARB's methodology for generating emission factors for low emission vehicles, assumes that zero mile emission levels and in-use exhaust deterioration factors for TLEVs, LEVs, and ULEVs will be reduced in proportion to the reduction in the standards. Alternative B is based on EPA's methodology for modeling emissions from future California certified motor vehicles. Alternative B assigns identical zero mile emission levels to

the future California vehicles as those used in Alternative A, but assumes that these vehicles will experience the same deterioration rates as future Federal vehicles, regardless of the certification standard.

For both Low Emission Vehicle scenarios and the Federal Tier I base case, only exhaust emission factors vary. Other variables such as growth in vehicle miles travelled, vehicle speeds, fleet turnover and in-use fuels are held constant for all cases and scenarios. The carbon monoxide analysis assumes that oxygenated fuels will be used statewide during the winter months in Connecticut, Massachusetts, New Jersey, New York and Rhode Island. This study assumes that the EPA will fully implement the mandates of the CAAA according to the schedule prescribed in the Act and that CARB's program will remain essentially static through the study period.

Potentially significant additional benefits are likely to accrue under the LEV program as a result of advanced on-board diagnostics, warranty recall and the fact that ZEVs have no evaporative emissions. These beneficial program elements are not directly accounted for in the modeling conducted for this analysis due to the uncertainties associated with quantifying the actual benefits of these features of the California LEV program. The projected emission benefits discussed below do not include the impact of enhanced inspection and maintenance programs. An analysis and discussion of the additional benefits of this control strategy is included in the report.

Emission benefits accrue incrementally as new Federal or California Low Emission Vehicles replace older, higher polluting vehicles in the fleet; the difference in fleet emissions under the two programs increases with time. By the year 2015, VOC emissions from light-duty vehicles in the NESCAUM region are predicted to be from 23 to 61 percent lower under the LEV program than the Federal program on a typical summer day, depending on the assumptions used to model LEV fleet emissions. NOx emissions reductions are projected in the range of 26 to 41 percent. Winter day CO emissions are predicted to be 10 to 33 percent lower under the LEV program than the Federal program. Toxic emission benefits were calculated for 1,3-butadiene, benzene and formaldehyde. By the year 2015, 1,3-butadiene emissions are projected to decrease by 23 to 66 percent under the LEV program, benzene emissions by 23 to 64 percent and formaldehyde emissions by 22 to 65 percent.

The results of this analysis indicate that total emissions from motor vehicles will decrease under both programs from the year 2000 through the year 2005. After this time, however, emission from the Tier I Federal fleet will begin to rise again as the increase in vehicle miles travelled begin to offset the emission standards benefits. Under the LEV program, fleetwide emissions continue to decline through the year 2015.

The emission control costs for the LEV program was calculated at $180 per ton using the Alternative A modeling assumptions and $500 per ton using the Alternative B assumptions when hydrocarbons, oxides of nitrogen, carbon monoxide and toxics benefits are included. Program cost effectiveness for hydrocarbon and oxides of nitrogen control only, is estimated at $1,800 per ton under Alternative A and $3,900 per ton under Alternative B. The per vehicle cost increase is estimated at $70 for TLEVs, $170 for LEVs and ULEVs.

Table E.1

California Low Emission Vehicle Program

50,000 Mile Certification Standards for Passenger Cars (in grams per mile)

Category	NMOG	CO	NO_x
Federal Tier 1	0.250	3.4	0.4
TLEV	0.125	3.4	0.4
LEV	0.075	3.4	0.2
ULEV	0.040	1.7	0.2
ZEV	0.000	0.0	0.0

Table E.2

Category Implementation Rates Used to Calculate Fleet Average Standards for Passenger Cars

Model Year	0.39	Fed Tier 1 0.25	TLEV 0.125	LEV 0.075	ULEV 0.04	ZEV 0	Fleet Avg. Standard
1994	10%	80%	10%				0.250
1995		85%	15%				0.231
1996		80%	20%				0.225
1997		73%		25%	2%		0.202
1998		48%		48%	2%	2%	0.157
1999		23%		73%	2%	2%	0.113
2000				96%	2%	2%	0.073
2001				90%	5%	5%	0.070
2002				85%	10%	5%	0.068
2003				75%	15%	10%	0.062

Table E.3

Light-Duty Motor Vehicle Emission Projections
NESCAUM State Totals
(VOCs and NO_x in tons per summer day/CO in tons per winter day)

	Federal	CA LEV			
		Alternative A		Alternative B	
	tons per day	tons per day	% reduction from federal	tons per day	% reduction from federal
2000					
VOCs	457	438	4.2	446	2.4
NOx	558	541	3.0	543	2.7
CO	10,057	9948	1.1	9979	0.8
2005					
VOCs	385	278	27.8	336	12.7
NOx	495	403	18.6	428	13.5
CO	9632	8389	12.9	9116	5.4
2010					
VOCs	393	197	49.9	316	19.6
NOx	495	331	33.1	386	22.0
CO	10,004	7483	25.2	9180	8.2
2015					
VOCs	419	156	62.8	322	23.2
NOx	524	308	41.2	387	26.1
CO	10,621	7101	33.1	9610	9.5

Motor Vehicle Toxic Emission Projections
NESCAUM State Total - 2015
Alternative A
(in tons)

Compound	Federal	CA LEV	% Reduction
Benzene	3278	1179	64%
1,3-butadiene	385	131	66%
Formaldehyde	1093	384	65%