ANALYSIS OF NATIONAL LOW EMISSION VEHICLE PROGRAM BENEFITS

DRAFT REPORT

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ACRONYMS AND ABBREVIATIONS

AMS	Area and Mobile Source Subsystem
CAA	Clean Air Act
CO	carbon monoxide
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FTP	Federal test procedure
GVWR	Gross Vehicle Weight Rating
HC	hydrocarbon
HDDVs	heavy-duty diesel vehicles
HDGVs	heavy-duty gasoline vehicles
HDVs	heavy-duty vehicles
HPMS	Highway Performance Monitoring System
I/M	inspection and maintenance
IRS	Internal Revenue Service
LDDTs	light-duty diesel trucks
LDDVs	light-duty diesel vehicles
LDGTs	light-duty gasoline trucks
LDGVs	light-duty gasoline vehicles
LDTs	light-duty trucks
LDVs	light-duty vehicles
LEV	low-emission vehicle
NMOG	nonmethane organic gas
NO_x	oxides of nitrogen
OMS	Office of Mobile Sources
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
RIA	Regulatory Impact Analysis
RVP	Reid vapor pressure
SIPs	State Implementation Plans
TIUS	*Truck Inventory and Use Survey*
TLEV	transitional low emission vehicle
ULEV	ultra-low emission vehicle
VMT	vehicle miles traveled
ZEV	zero emission vehicle

CHAPTER I
INTRODUCTION

On December 19, 1994, the U.S. Environmental Protection Agency (EPA) announced its final determination that reduction of new motor vehicle emissions throughout the Northeast Ozone Transport Region (OTR) is necessary to mitigate the effects of air pollution transport, and to bring nonattainment areas in the OTR into attainment (including maintenance) of the national ambient air quality standard for tropospheric ozone (smog). Through this determination, EPA promulgated a rule under Sections 184 and 110 of the Clean Air Act (CAA) that requires emission reductions from new motor vehicles in the OTR to be equivalent to the reductions that would be achieved by the Ozone Transport Commission (OTC)-Low-Emission Vehicle (LEV) program. This rule was reversed by the U.S. Court of Appeals for the District of Columbia in March, 1997.

During the OTC LEV process, EPA, with the extensive involvement of the states, auto manufacturers, and other interested parties, began to develop a voluntary National LEV program. Under this program, auto manufacturers would agree to comply with tailpipe emission standards which are more stringent than EPA can mandate prior to MY2004 if EPA and the OTC States agree to certain conditions. Because neither EPA nor the States could mandate such a program, it can become effective only upon agreement of a variety of parties.

This report is a supporting document for a Regulatory Impact Analysis (RIA) for a National LEV program. It provides estimates of emission reductions. This report compares and contrasts two potential motor vehicle emission control scenarios: (1) continuation of the Federal Motor Vehicle Emission Control Program with Tier I exhaust emission standards in all States except in the OTR States, where a California (CAL-LEV) program has been adopted; and (2) a national LEV in all States. A sensitivity analysis is also presented that examines the emissions for a scenario where all Northeast OTR States adopt the CAL-LEV program.

The emission benefit calculations and comparisons utilized in this study are presented in Chapter II. The same modeling assumptions used for previous LEV analyses are used in this study whereever possible in order to facilitate comparison between these analyses.

CHAPTER II
EMISSION BENEFITS OF THE NATIONAL LEV PROGRAM

This chapter presents estimates of highway vehicle emissions both inside the OTR and nationally as would be expected to occur under two cases: Case A: a National LEV Case with national LEV in all States and Case B: a Base Case California LEV program only in the six OTR States that have adopted programs, and Tier I exhaust standards elsewhere. In both cases, the State-adopted programs were applied in New York, Massachusetts, and Connecticut. However, in the National LEV Case, the LEV programs for these three States were replaced by the national LEV program beginning with the 1999 model year start of the national LEV program. California was not included in either of these cases. Emission estimates are presented for the two severe ozone nonattainment area attainment dates – the years 2005 and 2007 – and a year when full benefits of the national LEV program are observed – 2015.

Modeling methods that are common to both modeling cases are presented in the first section of this chapter. This is followed by descriptions of the modeling assumptions specific to the two modeled cases. Results are presented after the modeling methods discussions.

A. ASSUMPTIONS COMMON TO BOTH CASES

1. Vehicle Miles Traveled (VMT)

VMT growth rates were developed using national VMT projections from the MOBILE4.1 Fuel Consumption Model (EPA, 1991) and State-level Bureau of Economic Analysis population projections (BEA, 1990). The MOBILE4.1 Fuel Consumption Model estimates national VMT through the year 2020. The following methodology was used to calculate State-specific VMT growth rates. First, the 1990 national VMT estimate from the MOBILE4 fuel consumption model was allocated to States based on their 1990 population. Next, the projection year national VMT estimate from the MOBILE4 fuel consumption model was allocated to States based on their estimated projection year population. Finally, State-specific VMT average annual growth rates were calculated using the following formula:

$$AAGR_{BYPY} = \left[\left(\frac{VMT_{PY}}{VMT_{BY}} \right)^{\frac{1}{PY-BY}} - 1 \right] * 100$$

where:

$AAGR_{BYPY}$ = average annual VMT growth rate from the base year to the projection year (percent)
VMT_{PY} = VMT in the projection year
VMT_{BY} = VMT in the base year

State-specific VMT growth rates are listed in Table II-1.

Table II-1
VMT Growth Rates by State

State	Annually Compounded VMT Growth Rate Percentages from 1990 to: 2005	2007	2015
Alabama	1.8	1.8	1.8
Alaska	2.1	2.0	1.9
Arizona	3.1	3.0	2.7
Arkansas	2.0	2.0	1.9
Colorado	2.7	2.6	2.4
Connecticut	2.2	2.2	2.1
Delaware	2.7	2.6	2.4
District of Columbia	1.8	1.8	1.8
Florida	2.9	2.8	2.6
Georgia	2.5	2.4	2.3
Hawaii	2.8	2.8	2.5
Idaho	2.1	2.1	2.0
Illinois	2.1	2.1	2.0
Indiana	2.1	2.0	2.0
Iowa	2.0	2.0	1.9
Kansas	2.0	1.9	1.9
Kentucky	1.9	1.9	1.8
Louisiana	1.6	1.6	1.6
Maine	2.2	2.2	2.1
Maryland	2.4	2.4	2.2
Massachusetts	2.2	2.2	2.1
Michigan	2.0	2.0	1.9
Minnesota	2.2	2.2	2.0
Mississippi	1.9	1.9	1.8
Missouri	2.0	2.0	1.9
Montana	1.8	1.8	1.8
Nebraska	2.0	2.0	1.9
Nevada	3.5	3.4	3.0
New Hampshire	2.6	2.6	2.4

Table II-1 (continued)

State	Annually Compounded VMT Growth Rate Percentages from 1990 to: 2005	2007	2015
New Jersey	2.3	2.3	2.2
New Mexico	2.5	2.4	2.3
New York	1.9	1.8	1.8
North Carolina	2.2	2.2	2.1
North Dakota	1.9	1.9	1.9
Ohio	1.9	1.9	1.8
Oklahoma	1.9	1.9	1.8
Oregon	2.4	2.3	2.2
Pennsylvania	2.0	1.9	1.9
Rhode Island	2.2	2.2	2.1
South Carolina	2.1	2.1	2.0
South Dakota	2.0	1.9	1.9
Tennessee	2.3	2.3	2.1
Texas	2.1	2.1	2.0
Utah	2.7	2.6	2.4
Vermont	2.4	2.3	2.2
Virginia	2.6	2.6	2.4
Washington	2.6	2.5	2.3
West Virginia	1.6	1.6	1.7
Wisconsin	2.1	2.0	2.0
Wyoming	1.6	1.6	1.6
National Average	2.2	2.2	2.1

The VMT data, used as the base VMT that were grown to the projection years, were the 1990 VMT data developed for the 1990 Regional Interim Emission Inventory (EPA, 1993). The primary sources of data used in developing this VMT data base were the Highway Performance Monitoring System (HPMS) areawide data base (FHWA, 1992a) and the Bureau of the Census *Truck Inventory and Use Survey* (TIUS) (BOC, 1990). Travel data from the MOBILE4.1 Fuel Consumption Model were used to divide light-duty vehicle VMT into its gasoline and diesel components. The VMT were classified by six vehicle types: light-duty gasoline vehicles (LDGVs), light-duty gasoline trucks (LDGTs), heavy-duty gasoline vehicles (HDGVs), light-duty diesel vehicles (LDDVs), light-duty diesel trucks (LDDTs), and heavy-duty diesel vehicles (HDDVs). The final VMT data base was at the county/vehicle type/roadway type level.

2. MOBILE Model Inputs

All motor vehicle emission factors used in this analysis were calculated using EPA's MOBILE5a emission factor model (EPA, 1994a). The criteria pollutants modeled were nonmethane organic gas (NMOG), oxides of nitrogen (NO_x), and carbon monoxide (CO).

a. Vehicle Speeds

Each of the 12 Area and Mobile Source Subsystem (AMS) roadway classifications was assigned a speed by vehicle type. The speeds modeled were derived from the average overall speed output from the HPMS 1990 impact analysis (FHWA, 1992b). To determine the actual speeds to use in modeling the emission factors, HPMS vehicle types were chosen to represent the speeds for each of the vehicle types modeled in this analysis as follows:

- Passenger cars – used for light-duty vehicles (LDVs);
- Pickup trucks and vans – used for light-duty trucks (LDTs); and
- Multi-trailer trucks with five or more axles – used for heavy-duty vehicles (HDVs).

The number of speeds modeled was then reduced by rounding the HPMS speeds to the nearest 5 miles per hour. Local speeds, which were not included in the HPMS impact analysis output, were assumed to be the same as minor collector speeds for rural roads and collector speeds for urban roads. Table II-2 lists the average speeds used for each roadway type/vehicle type combination.

b. Temperature

A single temperature condition was used in modeling all of the emission factors for this analysis. The average daily minimum temperature modeled was 75°F and the average daily maximum temperature modeled was 95°F. These temperatures are representative of typical ozone season or July temperatures in most parts of the country.

c. Reid Vapor Pressure (RVP)

Phase II RVP limits were modeled for all areas. In areas with a 9.0 psi Phase II RVP limit, 8.7 psi was the modeled RVP, allowing for a 0.3 psi margin of safety. In areas

Table II-2
Average Speeds by Road Type and Vehicle Type
(miles per hour)

	Rural						Urban					
	Interstate	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local	Interstate	Other Freeways & Expressways	Principal Arterial	Minor Arterial	Collector	Local
LDV	60	45	40	35	30	30	45	45	20	20	20	20
LDT	55	45	40	35	30	30	45	45	20	20	20	20
HDV	40	35	30	25	25	25	35	35	15	15	15	15

where reformulated gasoline was modeled, the MOBILE5a model overrides the input RVP values with appropriate RVP values for reformulated gasoline.

d. Registration Distribution

The registration distributions modeled were representative of the composition of the vehicle fleet in the projection years. EPA's Dynamic Registration Preprocessor to MOBILE5a (EPA, 1994b) was used to convert the MOBILE5a default national registration distribution to distributions for 2005, 2007, and 2015. Only the LDV registration distribution is affected by this model. Registration distributions for the remaining vehicle types represent national 1990 distributions.

e. Operating Mode

All emission factors were modeled using the Federal test procedure (FTP) operating mode. Under this operating mode, 20.6 percent of VMT is assumed to accumulate in the cold-start mode, 27.3 percent of VMT is assumed to accumulate in the hot-start mode, and 52.1 percent of VMT is assumed to accumulate in the stabilized mode.

3. Inspection and Maintenance (I/M) Programs

Enhanced and basic I/M programs were modeled in the counties that are either required to have such a program under the CAA or that have formally chosen to adopt such a program. Table II-3 lists the counties where an enhanced I/M program was modeled. The same set of model inputs was used to model the enhanced I/M program in each of these counties. The program modeled was based on EPA's enhanced I/M performance standard. The specifics of this program as modeled for this analysis are shown in Table II-4. Although the status of many States' I/M programs is changing due to changes in EPA's I/M policy, the modeling here represents I/M coverage based on EPA's I/M rulemaking published in the *Federal Register* on November 5, 1992 (57FR52950, 1992). This is also consistent with the assumptions made for the OTC-LEV RIA.

Using up-to-date I/M program information would have reduced the number of counties where maximum LEV credits were granted. This would occur because it appears that some counties within the OTR, where enhanced I/M programs were required under the November 5, 1992 I/M Program Requirements, will either not have I/M programs, or have ones that do not meet the enhanced I/M performance standard. Proposed revisions to the November 5, 1992 I/M rule allow States more flexibility in designing programs as long as they meet EPA's performance standard. Many States are currently in the process of studying alternative I/M program designs, and because it is unclear how well these programs will do in identifying excess emissions from LEV technology vehicles, it was decided to retain the previous assumptions about I/M program effectiveness until the States and EPA evaluate new program designs.

4. Reformulated Gasoline

Federal reformulated gasoline was modeled in the counties in the OTR that are listed in the *Federal Register* notice detailing the final rulemaking on reformulated gasoline

(59FR7716, 1994). In addition to these counties, reformulated gasoline was also modeled in Orange and Putnam Counties in New York (both are in ozone nonattainment areas).

Table II-3
Counties Modeled with Enhanced I/M

State/County	State/County	State/County	State/County
Alaska	Indiana	Nevada	New York (cont.)
Anchorage Ed	Lake Co	Clark Co	Orange Co
Colorado	Porter Co	New Hampshire	Orleans Co
Adams Co	Louisiana	Hillsborough Co	Oswego Co
Arapahoe Co	Ascension Par	Merrimack Co	Putnam Co
Boulder Co	East Baton Rouge Par	Rockingham Co	Queens Co
Denver Co	Iberville Par	Strafford Co	Rensselaer Co
Douglas Co	Livingston Par	New Jersey	Richmond Co
Jefferson Co	Pointe Coupee Par	Atlantic Co	Rockland Co
Connecticut	West Baton Rouge Par	Bergen Co	Saratoga Co
Fairfield Co	Maine	Burlington Co	Schenectady Co
Hartford Co	Androscoggin Co	Camden Co	Suffolk Co
Litchfield Co	Cumberland Co	Cape May Co	Tioga Co
Middlesex Co	Kennebec Co	Cumberland Co	Warren Co
New Haven Co	Knox Co	Essex Co	Washington Co
New London Co	Lincoln Co	Gloucester Co	Wayne Co
Tolland Co	Sagadahoc Co	Hudson Co	Westchester Co
Windham Co	York Co	Hunterdon Co	Pennsylvania
Delaware	Maryland	Mercer Co	Allegheny Co
Kent Co	Allegany Co	Middlesex Co	Beaver Co
New Castle Co	Anne Arundel Co	Monmouth Co	Berks Co
District of Columbia	Baltimore Co	Morris Co	Blair Co
Washington	Calvert Co	Ocean Co	Bucks Co
Georgia	Carroll Co	Passaic Co	Cambria Co
Cherokee Co	Cecil Co	Salem Co	Centre Co
Clayton Co	Charles Co	Somerset Co	Chester Co
Cobb Co	Frederick Co	Sussex Co	Cumberland Co
Coweta Co	Harford Co	Union Co	Dauphin Co
De Kalb Co	Howard Co	Warren Co	Delaware Co
Douglas Co	Montgomery Co	New York	Erie Co
Fayette Co	Prince Georges Co	Albany Co	Lackawanna Co
Forsyth Co	Washington Co	Bronx Co	Lancaster Co
Fulton Co	Baltimore	Broome Co	Lebanon Co
Gwinnett Co	Massachusetts	Dutchess Co	Lehigh Co
Henry Co	Barnstable Co	Erie Co	Luzerne Co
Paulding Co	Berkshire Co	Greene Co	Lycoming Co
Rockdale Co	Bristol Co	Herkimer Co	Mercer Co
Illinois	Dukes Co	Kings Co	Montgomery Co
Cook Co	Essex Co	Livingston Co	Northampton Co
Du Page Co	Franklin Co	Madison Co	Philadelphia Co
Grundy Co	Hampden Co	Monroe Co	Washington Co
Kane Co	Hampshire Co	Montgomery Co	Westmoreland Co
Kendall Co	Middlesex Co	Nassau Co	York Co
Lake Co	Nantucket Co	New York Co	
McHenry Co	Norfolk Co	Niagara Co	
Will Co	Plymouth Co	Oneida Co	
	Suffolk Co	Onondaga Co	
	Worcester Co	Ontario Co	

Table II-3 (continued)

State/County	State/County	State/County	State/County
Rhode Island	Utah	Virginia	Washington
Bristol Co	Utah Co	Arlington Co	King Co
Kent Co	Vermont	Fairfax Co	Pierce Co
Newport Co	Chittenden Co	Loudoun Co	Snohomish Co
Providence Co	Grand Isle Co	Prince William Co	Spokane Co
Washington Co		Stafford Co	Wisconsin
Texas		Alexandria	Kenosha Co
Brazoria Co		Fairfax	Milwaukee Co
Chambers Co		Falls Church	Ozaukee Co
El Paso Co			Racine Co
Fort Bend Co			Washington Co
Galveston Co			Waukesha Co
Hardin Co			
Harris Co			
Jefferson Co			
Liberty Co			
Montgomery Co			
Orange Co			
Waller Co			

Table II-4
Enhanced I/M Program Modeling Assumptions

	Enhanced I/M Program Characteristics	
I/M Program:		
Start year:	1983	1983
Pre-1981 MYR stringency rate:	20%	20%
Model years covered:	1968 - 2020	1986 - 2020
Waiver rate (pre-1981):	3%	3%
Waiver rate (1981 and newer):	3%	3%
Compliance rate:	96%	96%
Inspection type:	Centralized	Centralized
Inspection frequency:	Annual	Annual
Vehicle types covered:	LDGV, LDGT 1 & 2	LDGV, LDGT 1 & 2
1981 & later MYR test type:	2500/Idle	Transient
Hydrocarbon (HC)/CO/NO_x cutpoints (g/mi)		0.80/20.0/2.0
Anti-tampering Program:		
Start year:	1983	
Model years covered:	1984 - 2020	
Vehicle types covered:	LDGV, LDGT 1 & 2	
Inspection type:	Centralized	
Inspection frequency:	Annual	
Compliance rate:	96.0%	
Tampering inspections performed:	Air pump system, catalyst, fuel inlet restrictor	
Evaporative System Pressure Test:		
Start year:	1983	
Model years covered:	1983-2020	
Vehicle types covered:	LDGV, LDGT 1 & 2	
Inspection type:	Centralized	
Inspection frequency:	Annual	
Compliance rate:	96%	
Functional Purge Test:		
Start year:	1983	
Model years covered:	1986 - 2020	
Vehicle types covered:	LDGV, LDGT 1 & 2	
Inspection type:	Centralized	
Inspection frequency:	Annual	
Compliance rate:	96%	

NOTE: The start year indicates the calendar year that the testing is to begin, while the model years covered indicate which model year vehicles are to be included in the program. Although no area had an IM240 program in place in 1983, 1983 is specified as the program start year for the enhanced I/M program performance standard. The enhanced I/M performance standard is used to calculate the emission benefit that enhanced I/M programs must achieve in areas with existing I/M programs.

Although only portions of some counties are required to implement a reformulated gasoline program, these entire counties were modeled as having reformulated gasoline.

The final rulemaking for reformulated gasoline includes a reduction requirement for NO_x emissions in Phase 2 of the program. The MOBILE5a model does not include any NO_x benefits from reformulated gasoline. Therefore, the MOBILE5a NO_x emission factors were reduced to reflect this requirement. Based on conversations with Office of Mobile Sources (OMS) staff about the possible emission benefits of this NO_x requirement, the NO_x reductions from reformulated gasoline were modeled as follows: 1986 and later LDGVs should receive a 6 percent NO_x reduction, while older model year LDGVs should get no NO_x reduction; 1990 and later model year LDGTs should get a 6 percent reduction in NO_x emissions from reformulated gasoline, while earlier model year LDGTs should get no benefit; and HDGVs should get no NO_x benefit from reformulated gasoline.

5. Permanent Migration Effects

Both cases were modeled to include the effects of permanent migration (i.e., people who change their State of residence). This was done to account for the difference that would occur in the composition of the vehicle fleet inside and outside the OTR with the implementation of the different LEV programs. To estimate the effects of migration on emissions inside and outside the OTR, estimates of the amount of in-migration and out-migration occurring relative to the OTR were based on Internal Revenue Service (IRS) 1991 to 1992 data (IRS, 1994). These data show the changes in residence by State that occurred between these 2 years. From these IRS files, EPA estimated the number of people who had moved out of the OTR and the number who had moved into the OTR during these 2 years. The percentage change in exemptions listed on IRS tax returns was used as a surrogate for the percentage change in number of vehicles. In other words, the percentage of the number of exemptions listed with a change of residence into the OTR from 1991 to 1992 was used as the percentage of vehicles newly registered in the OTR, and similarly for the percentage moving out of the OTR. This analysis was only targeted at determining the effects of migration on the OTR, without separately analyzing the effects of vehicles moving into or out of Massachusetts or New York. EPA's analysis showed an in-migration rate of 0.877 percent and an out-migration rate of 1.556 percent per year. The cumulative effect of migration was estimated by EPA as 6.45 percent of the 2005 vehicle fleet in the OTR made up of vehicles from outside the OTR.

A similar calculation was performed for this analysis to determine the fraction of the fleet outside the OTR made up of vehicles from the OTR. Using EPA's methodology, it was estimated that the annual in-migration rate (to States outside the OTR) from Massachusetts and New York was 0.18 percent, from Connecticut was 0.04 percent, from New Jersey, Rhode Island, and Vermont was 0.07 percent, and from the remaining OTR States was 0.21 percent. The annual out-migration rate from States outside the OTR to OTR States was 1.56 percent. The cumulative effect of migration from OTR States to States outside the OTR is as follows: 1.39 percent of the vehicle fleet in States outside of the OTR are vehicles from New York or Massachusetts, 0.28 percent are vehicles from Connecticut, 0.50 percent are vehicles from Rhode Island, New Jersey, and Vermont, and 1.67 percent are vehicles from the remaining OTR States.

In order to incorporate the effects of permanent migration on vehicle emissions, all emission factors were first calculated ignoring the effects of migration. The emission factors representing States inside the OTR were multiplied by 0.9355 and were weighted with the corresponding emission factors from outside the OTR, multiplied by 0.0645. Emission factors were matched by I/M program, reformulated gas program, and RVP. Emissions inside the OTR were then calculated using this adjusted set of emission factors. A similar procedure was performed to calculate emissions outside the OTR incorporating effects of migration from the OTR. Emission factors representative of the area outside the OTR were multiplied by 0.9614 and weighted with 0.0139 multiplied by the Massachusetts/New York factors, 0.0028 multiplied by the Connecticut factors, 0.0052 multiplied by the Rhode Island/New Jersey/Vermont factors, and 0.0167 multiplied by the OTR factors. This analysis assumes that migrant vehicles that have moved into an enhanced I/M area in the OTR from an area with no I/M program or a basic I/M program would receive full benefits of the enhanced I/M program, as though the vehicle had always been subject to enhanced I/M, and vice versa. In actuality, EPA has found that this would not necessarily occur until the vehicle had passed two cycles of enhanced I/M inspections. Thus, actual emissions in the OTR may be slightly higher than are calculated here, and emissions outside the OTR may be slightly lower than calculated here.

B. NATIONAL LEV CASE MODELING ASSUMPTIONS (CASE A)

The National LEV Case is representative of the emission benefits that would occur with the adoption of a national LEV program in all States. Massachusetts, New York, and Connecticut are assumed to proceed with their State-adopted LEV programs until the start of the national LEV program (in 1999), which would then replace these State LEV programs. The start date of the Massachusetts and New York LEV programs is 1996 while the start date of the Connecticut LEV program is 1998.

The national LEV program includes a provision for early adoption of LEV program vehicles in the OTR. The implementation schedule for the OTR States (excluding Massachusetts, New York, and Connecticut) is shown in Table II-5. In States outside of the OTR, all new cars and light-duty trucks sold, starting with the 2001 model year, would be LEV category vehicles. The implementation schedule for Massachusetts and New York for the National LEV case is shown in Tables II-6a (for LDGVs and LDGT1as up to 3,750 pounds loaded vehicle weight) and II-6b (for LDGT1bs over 3,750 pounds loaded vehicle weight). The implementation schedule for Connecticut for LDGVs and LDGT1as is the same as Table II-6a and the implementation schedule for LDGT1bs is the same as Table II-6b, except that 1996 and 1997 model year vehicle sales would be 100 percent Tier I vehicles.

C. BASE CASE MODELING ASSUMPTIONS (CASE B)

The Base Case is representative of the emissions that would occur with the adoption of OTC-LEV programs in States that have adopted a program as of July 1997. The States that have adopted a program as of this date are Massachusetts, New York, Connecticut, Rhode Island, New Jersey, and Vermont. The Federal Tier I tailpipe standards were modeled for States outside of the OTR and the remaining OTR States that did not adopt an OTC-LEV program.

Table II-5
Implementation Schedule for the National LEV Program in the OTR (Excluding Massachusetts, New York, and Connecticut)

	Implementation Rate (Percent)		
Model Year	**Federal Tier I**	**TLEV**	**LEV**
1999	30	40	30
2000	0	40	60
2001 and later	0	0	100

NOTE: Implementation schedule applies to all LDGVs and LDGT1s (up to 6,000 lb GVWR).

Table II-6a
Implementation Schedule for the National LEV Program in Massachusetts, New York, and Connecticut*

	Implementation Rate (Percent)					
			Intermediate		Intermediate	
Model Year	**Federal Tier I**	**TLEV**	**LEV**	**LEV**	**ULEV**	**ULEV**
1996	80	20	0	0	0	0
1997	73	0	25	0	2	0
1998	47	0	0	51	0	2
1999	30	40	0	30	0	0
2000	0	40	0	60	0	0
2001 and later	0	0	0	100	0	0

NOTES: Implementation schedule applies to all LDGVs and LDGT1as (up to 3,750 pounds loaded vehicle weight).
*The Connecticut LEV program begins with the 1998 model year.

Table II-6b
Implementation Schedule for the National LEV Program in Massachusetts, New York, and Connecticut*

	Implementation Rate (Percent)					
			Intermediate		Intermediate	
Model Year	**Federal Tier I**	**TLEV**	**LEV**	**LEV**	**ULEV**	**ULEV**
1996	80	20	0	0	0	0
1997	73	0	25	0	2	0
1998	48	0	50	0	0	2
1999	30	40	0	30	0	0
2000	0	40	0	60	0	0
2001 and later	0	0	0	100	0	0

NOTES: Implementation schedule applies to all LDGT1bs (greater than 3,750 pounds loaded vehicle weight).
*The Connecticut LEV program begins with the 1998 model year.

1. Implementation Schedules for Massachusetts, New York, Connecticut, Rhode Island, New Jersey, and Vermont

Massachusetts, New York, Connecticut, Rhode Island, New Jersey, and Vermont were modeled with their own LEV programs in the Base Case because these States have already adopted regulations to implement an LEV program. Therefore, their existing programs would be expected to proceed with or without approval of the OTC-LEV petition or the adoption of a national LEV program. The zero emission vehicle (ZEV) sales mandate was not included in the modeling. The LEV modeling for Massachusetts and New York follows the OTC-LEV program implementation schedule, with a program start date of 1996. The modeling for Connecticut uses a start date of 1998, and the remaining three States use a start date of 1999.

The LEV program implementation schedules for Massachusetts and New York are shown in Table II-7 for LDGVs and LDTG1as and in Table II-8 for LDGT1bs. The Connecticut implementation schedule for LDGVs and LDGT1as is the same as that shown for Massachusetts and New York in Table II-7 and for LDGT1bs is the same as that shown for Massachusetts and New York in Table II-8, with the exception that the 1996 and 1997 model years would be 100 percent Tier I vehicles in both tables. Similarly, the LEV implementation schedule for Rhode Island, New Jersey, and Vermont are shown in Table II-7 for LDGVs and LDGT1as and in Table II-8 for LDGT1bs, with the exception that the 1996, 1997, and 1998 model years would be 100 percent Tier I vehicles.

These LEV programs apply only to LDGVs and LDGTs that would be included in the MOBILE5a LDGT1 category. The LDGT1 category includes light-duty trucks up to 6,000 lb Gross Vehicle Weight Rating (GVWR) and a loaded vehicle weight of up to 5,750 pounds. Implementation schedules and emission rates vary within the LDGT1 class of trucks, with LDGT1s of up to 3,750 pounds loaded vehicle weight (LDGT1as) following the schedule and standards of LDGVs, while LDGT1s of greater than 3,750 pounds loaded vehicle weight (LDGT1bs) follow a slightly different implementation schedule, and have different emission standards.

2. LEV Credits

Nonattainment areas cannot claim credits in their State Implementation Plans (SIPs) for the maximum benefits of the LEV program without an *appropriate* I/M program. The requirements of an *appropriate* I/M program are described in a memo produced by EPA's Office of Mobile Sources entitled "Emission Reduction Credits for California Low Emission Vehicles" (Lorang, 1994). In accordance with this guidance, the MOBILE5a input files were set up so that the *appropriate* I/M credits flag for the LEV program was turned on in areas with an enhanced I/M program. In all areas without an enhanced I/M program, this *appropriate* I/M credits flag for the LEV program was set so that the minimum LEV credit would be modeled in these areas.

D. SENSITIVITY CASE MODELING ASSUMPTIONS (CASE C)

The sensitivity of the Base Case to the effects of having the remaining seven OTC States adopt an OTC-LEV program was evaluated. In this case, the remaining seven OTC

States were assumed to adopt the OTC-LEV program implementation schedule as shown in Tables II-7 and II-8, but with a start date of 2000. Therefore, for model years

Table II-7
Base Case LEV Program Implementation Schedule for LDGVs and LDGT1as in Massachusetts and New York

	Implementation Rate (Percent)					
Model Year	Federal Tier I	TLEV	Inter-mediate LEV*	LEV	Inter-mediate ULEV*	ULEV
1996	80	20	0	0	0	0
1997	73	0	25	0	2	0
1998	47	0	0	51	0	2
1999	22	0	0	76	0	2
2000	0	0	0	94	0	6
2001	0	0	0	86	0	14
2002	0	0	0	80	0	20
2003 and later	0	0	0	63	0	37

NOTE: *The California LEV program includes intermediate compliance standards for transitional low emission vehicles (TLEVs), LEVs, and ultra-low emission vehicles (ULEVs) that are less stringent than the final TLEV, LEV, and ULEV standards. The LEV program emission factors calculated with the MOBILE5a model include the effect of these less stringent standards. LDGT1as are light-duty trucks of up to 3,750 pounds loaded vehicle weight and up to 6,000 pounds GVWR. Connecticut follows this schedule beginning in model year 1998, with 100 percent Tier I vehicles prior to 1998. New Jersey, Rhode Island, and Vermont follow this schedule beginning in model year 1999, with 100 percent Tier I vehicles prior to 1999.

Table II-8
Base Case LEV Program Implementation Schedule for LDGT1bs in Massachusetts and New York

	Implementation Rate (Percent)					
Model Year	Federal Tier I	TLEV	Inter-mediate LEV*	LEV	Inter-mediate ULEV*	ULEV
1996	80	20	0	0	0	0
1997	73	0	25	0	2	0
1998	48	0	50	0	0	2
1999	23	0	0	75	0	2
2000	0	0	0	98	0	2
2001	0	0	0	95	0	5
2002	0	0	0	90	0	10
2003 and later	0	0	0	85	0	15

NOTE: *The California LEV program includes intermediate compliance standards for TLEVs, LEVs, and ULEVs that are less stringent than the final TLEV, LEV, and ULEV standards. The LEV program emission factors calculated with the MOBILE5a model include the effect of these less stringent standards. LDGT1bs are light-duty trucks of more than 3,750 pounds loaded vehicle weight and up to 5,750 pounds loaded vehicle weight and up to 6,000 pounds GVWR. Connecticut follows this schedule beginning in model year 1998, with 100 percent Tier I vehicles prior to 1998. New Jersey, Rhode Island, and Vermont follow this schedule beginning in model year 1999, with 100 percent Tier I vehicles prior to 1999.

prior to 2000, 100 percent Tier I vehicles were modeled in these States. As in the Base Case, States outside the OTC were modeled with Tier I vehicles only.

E. RESULTS

The criteria pollutant emissions from these analyses are summarized in Table II-9. By 2015, a year when the full benefits of the LEV program should be realized, a national LEV program would reduce highway vehicle NMOG emissions nationally by 8 percent and national NO_x emissions by 10 percent compared with Case B (continuation of current northeast State-adopted California LEV programs). When the national LEV program 49-State highway vehicle emissions are compared with emissions under Case C, which represents a situation where all Northeast OTR States adopt the California LEV program, emission differences are 6 percent for NMOG and 8 percent for NO_x.

Table II-9
Highway Vehicle Emissions Summary, 2005, 2007, and 2015

			Ozone Season Weekday Emissions (tons/day)		
Year	**Pollutant**	**Region**	**Case A**	**Case B**	**Case C**
2005	NMOG	OTR Total	1,499	1,573	1,507
		National Total	12,046	12,396	12,325
	NO_x	OTR Total	2,403	2,526	2,409
		National Total	14,863	15,401	15,275
	CO	OTR Total	11,744	12,721	11,913
		National Total	89,807	94,461	93,579
2007	NMOG	OTR Total	1,366	1,480	1,377
		National Total	11,858	12,373	12,262
	NO_x	OTR Total	2,226	2,427	2,246
		National Total	14,654	15,464	15,273
	CO	OTR Total	10,943	12,352	11,192
		National Total	89,495	96,105	94,845
2015	NMOG	OTR Total	1,148	1,386	1,169
		National Total	12,111	13,141	12,909
	NO_x	OTR Total	1,899	2,367	1,970
		National Total	15,084	16,783	16,364
	CO	OTR Total	9,650	12,363	10,094
		National Total	94,460	106,852	104,415

NOTES: Case A includes NLEV starting in 1999 in the OTC States and NLEV starting in 2001 outside the OTC. NY, MA, and CT have their own LEV programs until 1999, at which point they join the NLEV program.
Case B includes CA LEV (as modeled in the RIA for CT) in States that have adopted a program as of now, with the indicated start dates: NY -- 1996, MA -- 1996, CT -- 1998, RI - 1999, NJ -- 1999, and VT -- 1999. Tier I is modeled in all other States.
Case C is the same as Case B, but with the remaining OTC States starting a CA LEV program in 2000 (as modeled in the RIA for CT).
California is not included in any of the cases.

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TECHNICAL REPORT ABSTRACT

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DOES THIS REPORT CONTAIN CONFIDENTIAL BUSINESS INFORMATION

YES_____ NO_____X_____

REPORT ABSTRACT - Include a brief (200 words or less) factual summary of the scope and nature of the work performed and referenced in the report.

On December 19, 1994, the U.S. Environmental Protection Agency (EPA) announced its final determination that reduction of new motor vehicle emissions throughout the Northeast Ozone Transport Region (OTR) is necessary to mitigate the effects of air pollution transport, and to bring nonattainment areas in the OTR into attainment (including maintenance) of the national ambient air quality standard for tropospheric ozone (smog). Through this determination, EPA promulgated a rule under Sections 184 and 110 of the Clean Air Act (CAA) that requires emission reductions from new motor vehicles in the OTR to be equivalent to the reductions that would be achieved by the Ozone Transport Commission (OTC)-Low-Emission Vehicle (LEV) program.

States would be relieved of their obligations under this requirement if EPA were to find that all automakers had opted into a LEV equivalent new motor vehicle control program deemed acceptable by EPA through rulemaking. EPA believes that such a program, which would be far better than the OTC-LEV, could be agreed upon and adopted in the near future. (Because neither EPA nor the States could mandate such a program, it can become effective only upon agreement of a variety of parties.)

This report is a supporting document for a Regulatory Impact Analysis (RIA) for a LEV program to be implemented nationwide. It provides estimates of emission reductions. This report compares and contrasts two potential motor vehicle emission control scenarios: (1) continuation of the Federal Motor Vehicle Emission Control Program with Tier I exhaust emission standards in all States except in the OTR States, where a CAL-LEV program has been adopted; and (2) a national LEV in all States. A sensitivity analysis is also presented

that examines the emissions for a scenario where all Northeast OTR States adopt the CAL-LEV program.

The emission benefit calculations and comparisons utilized in this study are presented in Chapter II.

KEY WORDS/DESCRIPTORS - Select the scientific or engineering terms that identify the major concept of the research and are sufficiently specific and precise to be used as index entries for cataloging.

motor vehicles; regulatory analysis