Environment Canada Environnement Canada

Fleet Average NO_x Emission Performance of 2008 Model Year Light-Duty Vehicles, Light-Duty Trucks and Medium-Duty Passenger Vehicles

In relation to the

On-Road Vehicle and Engine Emission Regulations

under the

Canadian Environmental Protection Act, 1999

Transportation Division

Environment Canada

December 2010

Canada

Disclaimer

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1 Purpose

The purpose of this report is to summarize the fleet average NO_x emission performance of individual companies and the overall Canadian fleet for the 2008 model year (MY) based on data submitted by companies in their end of model year reports; furthermore, it is also to report on the effectiveness of the Canadian fleet average NO_x emission program in achieving the environmental performance objectives.

2 Introduction

On January 1, 2004, the *On-Road Vehicle and Engine Emission Regulations* (hereafter referred to as the "Regulations") came into effect under the *Canadian Environmental Protection Act, 1999* (CEPA 1999). These Regulations introduced more stringent national emission standards for on-road vehicles and engines. The Regulations align Canada's emission standards for light-duty vehicles, light-duty trucks, medium-duty passenger vehicles, heavy-duty vehicles, heavy-duty engines and motorcycles with those of the U.S. Environmental Protection Agency (EPA) through incorporation by reference to the U.S. Code of Federal Regulations (CFR).

The Regulations also establish fleet average NO_x standards for light-duty vehicles[(i)] (LDV), light light-duty trucks[(ii)] (LLDT), heavy light-duty trucks[(iii)] (HLDT) and medium-duty passenger vehicles[(iv)] (MDPV). Each new LDV, LLDT, HLDT and MDPV is required to be certified to one of the bins presented in Table 1, for which there are specific emission standards for NO_x and other pollutants. A company's choice of bin to which individual vehicle models are certified in a given model year is limited by the obligation to comply with the fleet average NO_x standards associated with that model year. Table 2 presents the fleet average NO_x standards for a company's fleet of LDV and LLDT and its fleet of HLDT and MDPV.

[(i)] Light-duty vehicles generally consist of passenger cars.

[(ii)] Light light-duty trucks generally consist of vans, sport utility vehicles and pick-up trucks having a gross vehicle weight rating (GVWR) of 2 722 kg (6 000 pounds) or less.

[(iii)] Heavy light-duty trucks generally comprise vans, sport utility vehicles and pick-up trucks having a GVWR of more than 2 722 kg (6 000 pounds) and up to 3 856 kg (8 500 pounds).

[(iv)] Medium-duty passenger vehicles generally consist of heavier passenger-type vehicles, such as vans and sport utility vehicles having a GVWR greater than 3 856 kg (8 500 pounds) and less than 4 536 kg (10 000 pounds).

Table 1: LDV, LLDT, HLDT and MDPV Full Useful Life Exhaust Emission Standards (grams/mile)

Bin Number	NO_x	NMOG	CO	Formaldehyde	PM
11	0.9	0.28	7.3	0.032	0.12
10	0.6	0.156/0.230	4.2/6.4	0.018/0.027	0.08
9	0.3	0.090/0.180	4.2	0.018	0.06
8	0.20	0.125/0.156	4.2	0.018	0.02
7	0.15	0.09	4.2	0.018	0.02
6	0.10	0.09	4.2	0.018	0.01
5	0.07	0.09	4.2	0.018	0.01
4	0.04	0.07	2.1	0.011	0.01
3	0.03	0.055	2.1	0.011	0.01
2	0.02	0.01	2.1	0.004	0.01
1	0.00	0.00	0.0	0.000	0.00

Notes: 1) The equivalent limits in units of grams/km are obtained by multiplying the grams/mile value by 0.621.

2) Bin 11 is only for MDPV and is available up to and including the 2008 model year. Bins 9 and 10 are only available for the 2004 to 2006 model years for LDV and LLDT, and up to and including the 2008 model year for HLDT and MDPV. Bins 8 through 10 contain additional temporary, less stringent standards for certain pollutants and for certain vehicles.

3) Beginning in the 2009 model year, applicable standards are limited to bins 1 to 8 for all categories.

Table 2: Fleet Average NO_x Standards (grams/mile)

Model Year	LDV/LLDT	HLDT/MDPV
2004	0.25	0.53
2005	0.19	0.43
2006	0.13	0.33
2007	0.07	0.20
2008	0.07	0.14
2009	0.07	

Note: A company's combined fleet of LDV, LLDT, HLDT and MDPV of the 2009 and later model years will be subject to a single fleet average NO_x standard of 0.07 grams/mile.

A company's fleet average NO_x value is the weighted average based on the number of vehicles certified to each bin. The emission bins, fleet average NO_x standards, and methods of calculating fleet average NO_x values are aligned with those of the U.S. EPA; however, there are differences in the structure of the NO_x averaging program in Canada, which is designed to recognize vehicles that are sold concurrently in Canada and the U.S. The regulatory requirements are structured to deliver fleet average emissions comparable to those of the U.S. while minimizing

the regulatory burden on companies and enabling the marketing of vehicles in Canada independently from the U.S.

The Regulations require that all companies submit a report to the Minister of the Environment no later than May 1 after the end of each model year. The end of model year report must contain detailed information concerning the company's fleets and/or groups of vehicles, including information related to:

- statements of allowable elections made by the company in complying with the fleet average NO_x requirements of the Regulations;
- average NO_x value(s) achieved;
- values used in calculating a fleet average NO_x value;
- calculation of NO_x emission credits and/or deficits;
- balance of credits or deficits; and
- credit transfers to or from the company.

For more information regarding the calculation of fleet average NO_x values and NO_x emission credits/deficits please refer to the Regulations which can be found on the Environment Canada CEPA Registry at www.ec.gc.ca/CEPARegistry/regulations/. Reports for prior model years (2004-2007, inclusive) can also be found on the CEPA Registry.

3 Company Fleet Average NO_x Emission Performance for the 2008 Model Year

3.1 Scope of Company Reports

Table 3 presents a summary of the companies that submitted a fleet average NO_x report for the 2008 model year in accordance with the requirements of the Regulations, including the vehicle makes and the number of test groups covered by the reports.

Table 3: Scope of Company Reports

Company	Makes	Number of Test Groups[1]
Aston Martin Lagonda Limited	Aston Martin	2
BMW Group Canada	BMW, Mini, Rolls-Royce	17
Chrysler Canada Inc.	Chrysler, Dodge, Jeep	24
Ferrari North America, Inc.	Ferrari	2
Ford Motor Company of Canada, Limited	Ford, Lincoln, Mercury	33
General Motors of Canada Limited	Buick, Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab, Saturn	43
Honda Canada Inc.	Acura, Honda	16
Hyundai Auto Canada Corp.	Hyundai	13
Jaguar (Jaguar Land Rover Canada ULC)	Jaguar	4
Kia Canada Inc.	Kia	12
Land Rover (Jaguar Land Rover Canada ULC)	Land Rover	4
Lotus Cars Limited	Lotus	1
Maserati North America, Inc.	Maserati	1
Mazda Canada Inc.	Mazda	18
Mercedes-Benz Canada Inc.	Mercedes, Smart, Maybach	15
Mitsubishi Motor Sales of Canada, Inc.	Mitsubishi	8
Nissan Canada Inc.	Infiniti, Nissan	20
Porsche Cars Canada, Ltd.	Porsche	7
Subaru Canada, Inc.	Subaru	6
Suzuki Canada Inc.	Suzuki	4
Toyota Canada Inc.	Lexus, Toyota	23
Volkswagen Group	Audi, Bentley, Lamborghini, Volkswagen	19
Volvo Cars of Canada Corp.	Volvo	6

[1]*A test group is the basic classification unit that comprises LDV, LLDT, HLDT or MDPV having similar exhaust emission performances and that share all of the features described in section 1827, subchapter C, part 86 of the CFR.*

A total of 23 companies submitted reports for the 2008 model year covering a total of 288 test groups. It should be noted that certain test groups were common between companies that shared vehicle platforms and/or powertrains. As a result, the sum of all the test groups listed in Table 3 above will exceed the afore-mentioned total.

3.2 Distribution of LDV, LLDT and HLDT/MDPV

Table 4 summarizes the LDV, LLDT and HLDT/MDPV distribution of the Canadian fleet for the 2008 model year.

Table 4: Distribution of Canadian Fleet

Vehicle Class	Total Number of Vehicles	Percentage of Total Fleet
LDV	839 242	55
LLDT	438 005	28
HLDT/MDPV	268 542	17
Total	**1 545 789**	

A total of 1 277 247 LDV/LLDT and 268 542 HLDT/MDPV were reported for the 2008 model year, for a combined total of 1 545 789 vehicles. The overall Canadian fleet for the 2008 model year was comprised of 55% LDV, 28% LLDT and 17% HLDT/MDPV compared to a 59% LDV, 27% LLDT and 13% HLDT/MDPV fleet distribution from the 2007 model year. There was a slight change in the distribution from light-duty vehicles and light light-duty trucks to heavy light-duty trucks and medium-duty passenger vehicles in the 2008 model year.

3.3 Company Fleet Average NO_x Values

Tables 5 and 6 summarize the total number of vehicles and average NO_x values for each company's fleets of LDV/LLDT and HLDT/MDPV respectively.

Table 5: Summary of Company Average NO_x Values for the LDV/LLDT Fleet
Fleet Average NO_x Standard = 0.07 grams/mile
Maximum NO_x = 0.2 grams/mile (Bin 8)

Company	Total Number of Vehicles	Average NO_x Value (grams/mile)
Aston Martin Lagonda Limited	56	0.070
BMW Group Canada	25 474	0.070000
Chrysler Canada Inc.	119 522	0.0807837
Ferrari North America, Inc.	116	0.0700
Ford Motor Company of Canada, Limited	152 822	0.0657647
General Motors of Canada Limited	242 663	0.0700000
Honda Canada Inc.	183 164	0.0694486
Hyundai Auto Canada Corp.	80 169	0.070000
Jaguar (Jaguar Land Rover Canada ULC)	393	0.0700
Kia Canada Inc.	36 528	0.070000
Land Rover (Jaguar Land Rover Canada ULC)	1 844	0.07000
Lotus Cars Limited	39	0.070
Maserati North America, Inc.	154	0.0700
Mazda Canada Inc.	85 019	0.070000
Mercedes-Benz Canada Inc.	18 220	0.070274
Mitsubishi Motor Sales of Canada, Inc.	18 808	0.070000
Nissan Canada Inc.	76 732	0.070000
Porsche Cars Canada, Ltd.	1 172	0.07000
Subaru Canada, Inc.	20 232	0.070000
Suzuki Canada Inc.	13 331	0.069548
Toyota Canada Inc.	152 320	0.0673348
Volkswagen Group	42 111	0.070000
Volvo Cars of Canada Corp.	6 358	0.07000

Note: Fleet average NO_x values are rounded to the same number of significant figures that are contained in the total number of vehicles in a company's fleet.

Table 6: Summary of Company Average NO_x Values for the HLDT/MDPV Fleet
Fleet Average NO_x Standard = 0.14 grams/mile
Maximum NO_x = 0.9 grams/mile (Bin 11)

Company	Total Number of Vehicles	Average NO_x Value (grams/mile)
BMW Group Canada	4 072	0.1124
Chrysler Canada Inc.	98 120	0.11685
Ford Motor Company of Canada, Limited	53 413	0.17748
General Motors of Canada Limited	82 299	0.091495
Honda Canada Inc.	4 500	0.07000
Land Rover (Jaguar Land Rover Canada ULC)	1 722	0.07000
Mercedes-Benz Canada, Inc.	5 374	0.4219
Nissan Canada Inc.	3 485	0.07000
Porsche Cars Canada, Ltd.	1 229	0.07000
Toyota Canada Inc.	12 328	0.065250
Volkswagen Group	2 000	0.07000

Note: Fleet average NO_x values are rounded to the same number of significant figures that are contained in the total number of vehicles in a company's fleet.

The company average NO_x values ranged from 0.0657647 grams/mile to 0.0807837 grams/mile for the fleet of LDV/LLDT and 0.065250 grams/mile to 0.4219 grams/mile for the fleet of HLDT/MDPV. The calculated average NO_x values of two out of twenty-three companies' LDV/LLDT fleets are above the average NO_x standard of 0.07 grams/mile. The calculated average NO_x values of two out of eleven companies' HLDT/MDPV fleets are above the average NO_x standard of 0.14 grams/mile.

Average NO_x values above the applicable average NO_x standard for a given fleet can be attributed to the following factors:

1. The company elects to exclude from mandatory compliance with the fleet average NO_x standard its group of U.S.-certified vehicles that are sold in Canada and the U.S. This exclusion is allowed because the objective of the fleet averaging provisions is to achieve an overall Canadian vehicle fleet emission performance comparable to that of the U.S., while minimizing the regulatory burden on companies. An analysis[(v)] conducted by Environment Canada indicated that, even under extreme scenarios, the variations between the Canadian and U.S. fleet averages are expected to be small.

2. The fleet includes a substantial number of diesel-fuelled vehicles. It is recognized that achieving low NO_x levels represents a greater technical challenge for diesel-fuelled vehicles. Diesel engines, however, typically produce lower emissions of non-methane organic gases (NMOG), carbon monoxide (CO) and carbon dioxide (CO_2) relative to comparable gasoline-fuelled vehicles.

3. The average NO_x value of only one of the fleets (LDV/LLDT or HLDT/MDPV) is above the average NO_x standard. A company can average values from the LDV/LLDT and

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[(v)] *Scenario Analysis: Fleet Average NO_x Emissions in Canada*. Transportation Systems Branch, Environment Canada, November, 2002.

HLDT/MDPV fleets to satisfy the requirements of the average NO_x emission program in Canada.

4. A company obtained NO_x emission credits by achieving better than average NO_x values in previous model years. A company can carry forward NO_x emission credits to offset a deficit in a subsequent model year.

3.4 NO_x Emission Credits/Deficits for the 2008 Model Year

Table 7 summarizes the NO_x emission credits/deficits obtained by each company for the 2008 model year. Companies that elected to exclude their group of vehicles from compliance with the fleet average NO_x standard (and that did not report credits) or those companies whose fleet average was equal to the standard are assigned "0" credits/deficits. "N/A" is used to represent companies that did not report vehicles for a particular fleet.

Table 7: NO_x Emission Credits/Deficits for the 2008 Model Year (vehicle-grams/mile)

Company	LDV/LLDT[1]	HLDT/MDPV[1]	Total 2008 MY Credits[1]
Aston Martin Lagonda Limited	0[4]	N/A	0
BMW Group Canada	0[4]	112	112
Chrysler Canada Inc.	-1 289	2 271	982
Ferrari North America, Inc.	0[2]	N/A	0
Ford Motor Company of Canada, Limited	647	-2 002	-1 355
General Motors of Canada Limited	0[4]	3 992	3 992
Honda Canada Inc.	101	315	416
Hyundai Auto Canada Corp.	0[4]	N/A	0
Jaguar (Jaguar Land Rover Canada ULC)	0[4]	N/A	0
Kia Canada Inc.	0[4]	N/A	0
Land Rover (Jaguar Land Rover Canada ULC)	0[4]	121	121
Lotus Cars Limited	0[2]	N/A	0
Maserati North America, Inc.	0[2]	N/A	0
Mazda Canada Inc.	0[4]	N/A	0
Mercedes-Benz Canada Inc.	0[3]	0[2]	0
Mitsubishi Motor Sales of Canada, Inc.	0[2]	N/A	0
Nissan Canada Inc.	0[3]	244	244
Porsche Cars Canada, Ltd.	0[4]	86	86
Subaru Canada, Inc.	0[4]	N/A	0
Suzuki Canada Inc.	6	N/A	6
Toyota Canada Inc.	406	922	1 328
Volkswagen Group	0[3]	0[2]	0
Volvo Cars of Canada Corp.	0[4]	N/A	0
Total	**-129**	**6 061**	**5 932**

[1]NO_x emission credits/deficits are rounded to the nearest whole number. A negative sign (-) indicates a deficit.

[2]The company elected to exclude their entire fleet, which is sold concurrently in Canada and the U.S., from compliance with the fleet average NO_x standard pursuant to subsection 31(1) of the Regulations.

[3]The company elected to exclude only parts of their fleet that satisfied the election from compliance with the fleet average NO_x standard pursuant to subsection 31(1) of the Regulations. However, the average NO_x value for their group of vehicles not subject to the election was at or below the applicable average NO_x standard and therefore did not incur a deficit.

[4]The company reported a fleet average NO_x value that is equal to the fleet average NOx standard.

A total of 5 932 credits were generated by companies for the 2008 model year. A total of fourteen companies, which did not elect to exclude their entire fleet from compliance with the fleet average NO_x standard, reported a fleet average NO_x value for LDV/LLDT that is equal to the fleet average NO_x standard (i.e. those denoted as footnote 3 or 4 in the preceding table). Only one company incurred an overall deficit with respect to their combined 2008 model year fleets.

3.5 End of Model Year Balance of NO_x Emission Credits/Deficits

Table 8 shows all activities relating to credits/deficits for the 2008 model year.

Table 8: End of Model Year Balance of NO_x Emission Credits/Deficits (vehicle-grams/mile)

Company	Initial Balance[1] (2007 MY)	Total 2008 MY Credits[1]	Credits Transferred[1]	End of Model Year Balance[1]
Aston Martin Lagonda Limited	0	0	0	0
BMW Group Canada	801	112	0	913
Chrysler Canada Inc.	40 493	982	-455[2]	41 020
Ferrari North America, Inc.	0	0	0	0
Ford Motor Company of Canada, Limited	39 087	-1 355	0	37 732
General Motors of Canada Limited	71 882	3 992	0	75 874
Honda Canada Inc.	19 559	416	0	19 975
Hyundai Auto Canada Corp.	3 163	0	0	3 163
Jaguar (Jaguar Land Rover Canada ULC)	126	0	0	126
Kia Canada Inc.	4 721	0	0	4 721
Land Rover (Jaguar Land Rover Canada ULC)	832	121	0	953
Lotus Cars Limited	0	0	0	0
Maserati North America, Inc.	0	0	0	0
Mazda Canada Inc.	14 878	0	0	14 878
Mercedes-Benz Canada Inc.	0	0	0	0
Mitsubishi Motor Sales of Canada, Inc.	-379	0	455[2]	76
Nissan Canada Inc.	18 610	244	0	18 854
Porsche Cars Canada, Ltd.	370	86	0	456
Subaru Canada, Inc.	2 606	0	0	2 606
Suzuki Canada Inc.	1 249	6	0	1 255
Toyota Canada Inc.	24 677	1 328	0	26 005
Volkswagen Group	0	0	0	0
Volvo Cars of Canada Corp.	3 538	0	0	3 538
Total	**246 213**	**5 932**		**252 145**

[1]NO_x emission credits/deficits are rounded to the nearest whole number. A negative sign (-) indicates a deficit.

[2]A transfer of 455 credits was made from Chrysler Canada Inc. to Mitsubishi Motor Sales of Canada, Inc.

None of the companies reported a negative balance at the end of the 2008 model year. Of the three companies that reported LDV/LLDT and/or HLDT/MDPV fleet average NO_x values above the respective standards, two used credits earned or their credit balance from previous years to offset the deficits incurred. The third company elected to exclude part of their LDV/LLDT fleet and all of their HLDT/MDPV fleet from compliance pursuant to the Regulations. As a result, they maintained a balance of zero credits for the 2008 model year.

3.6 Distribution of Bins and Fleet Average NO_x Values

Table 9 summarizes the distribution of vehicles by NO_x standard (bin) and calculated average NO_x values for each of the LDV/LLDT and HLDT/MDPV fleets for the 2008 model year.

Table 9: Distribution of Vehicles by NO_x Standard (Bin)

Bin Number	NO_x Standard (grams/mile)	LDV/LLDT		HLDT/MDPV	
		Total Number of Vehicles in "Bin"	Percentage of Vehicles in "Bin"	Total Number of Vehicles in "Bin"	Percentage of Vehicles in "Bin"
11	0.9	N/A	N/A	0	0.00
10	0.6	N/A	N/A	11 084	4.13
9	0.3	N/A	N/A	0	0.00
8	0.20	16 376	1.28	65 725	24.47
7	0.15	0	0.00	0	0.00
6	0.10	0	0.00	0	0.00
5	0.07	1 224 113	95.84	186 481	69.44
4	0.04	22 394	1.75	3 788	1.41
3	0.03	12 344	0.97	1 464	0.55
2	0.02	2 020	0.16	0	0.00
1	0.00	0	0.00	0	0.00
Total		**1 277 247**		**268 542**	
Canada Fleet Average NO_x Value (grams/mile)		**0.07010463**		**0.122550**	
Fleet Average NO_x Standard (grams/mile)		**0.07**		**0.14**	

For the 2008 model year, approximately 99% of the LDV/LLDT fleet and 71% of the HLDT/MDPV fleet were certified to a bin at or below the applicable fleet average NO_x standard.

The average NO_x value for the LDV/LLDT fleet was 0.07010463 grams/mile, which is 0.15% above the applicable fleet average NO_x standard of 0.07 grams/mile. The average NO_x value for the HLDT/MDPV fleet was 0.122550 grams/mile, which is 12% below the applicable fleet average NO_x standard of 0.14 grams/mile.

Figures 1a and 1b depict the changing distribution of LDV/LLDT and HLDT/MDPV fleets by NO_x standard (bin) across the 2004 to 2008 model years. In addition, figures 2a and 2b present this information on a percentage basis to facilitate year to year comparison within each fleet.

Figure 1a: Distribution of LDV/LLDT by NO_x Standard (Bin) in Number of Vehicles

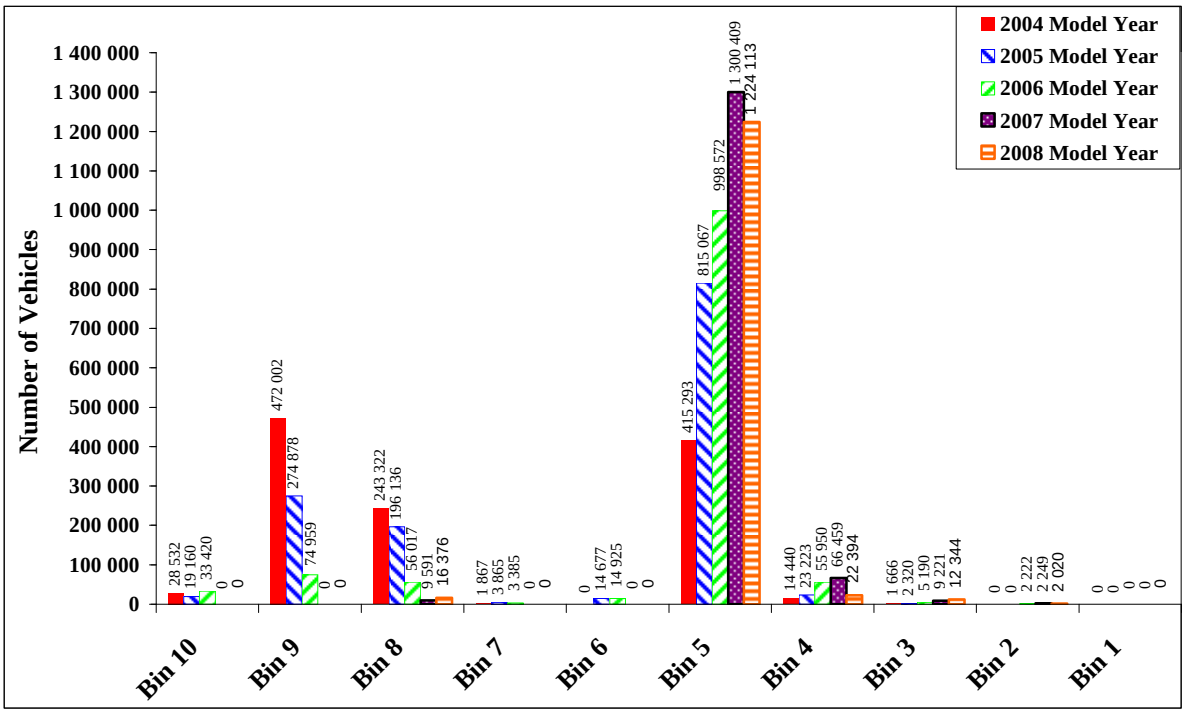


Figure 1b: Distribution of HLDT/MDPV by NO_x Standard (Bin) in Number of Vehicles

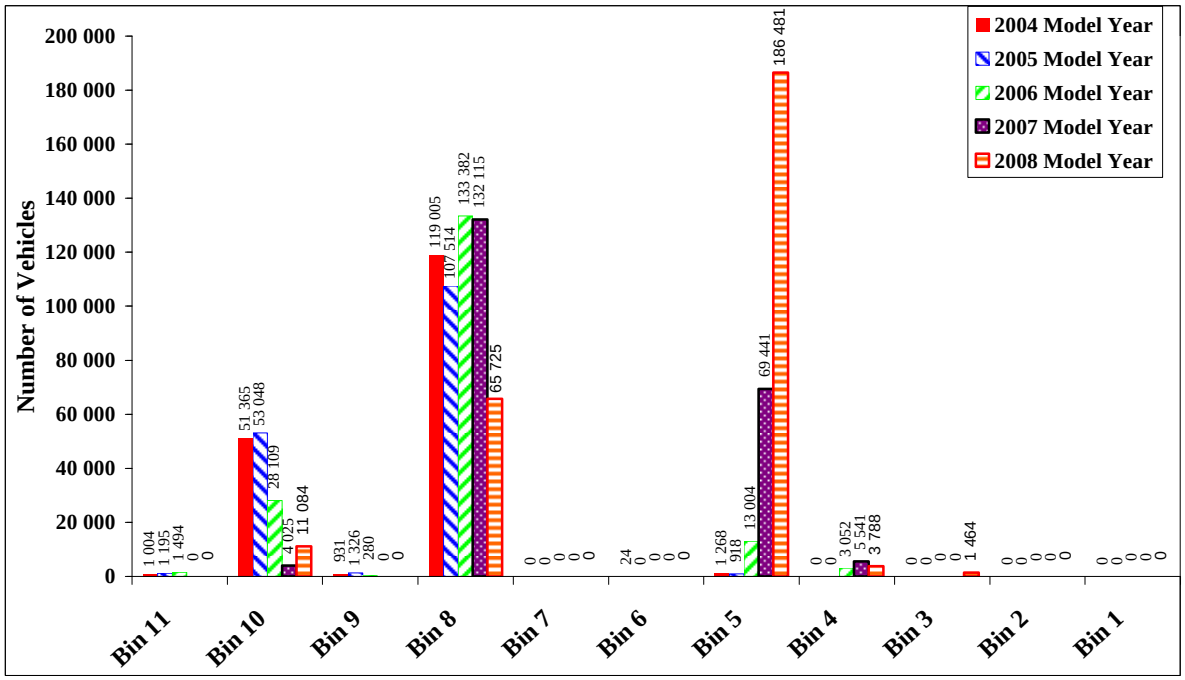


Figure 2a: Distribution of LDV/LLDT by NO_x Standard (Bin) in Percentage of Vehicles Relative to the Fleet

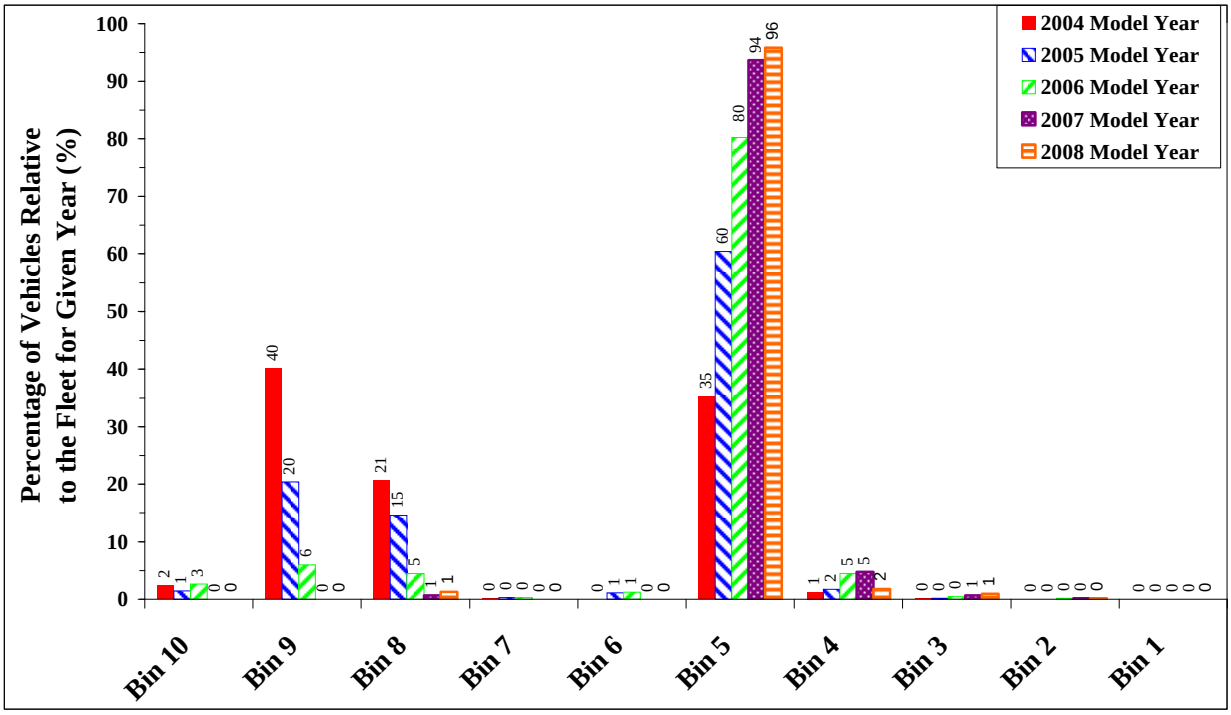
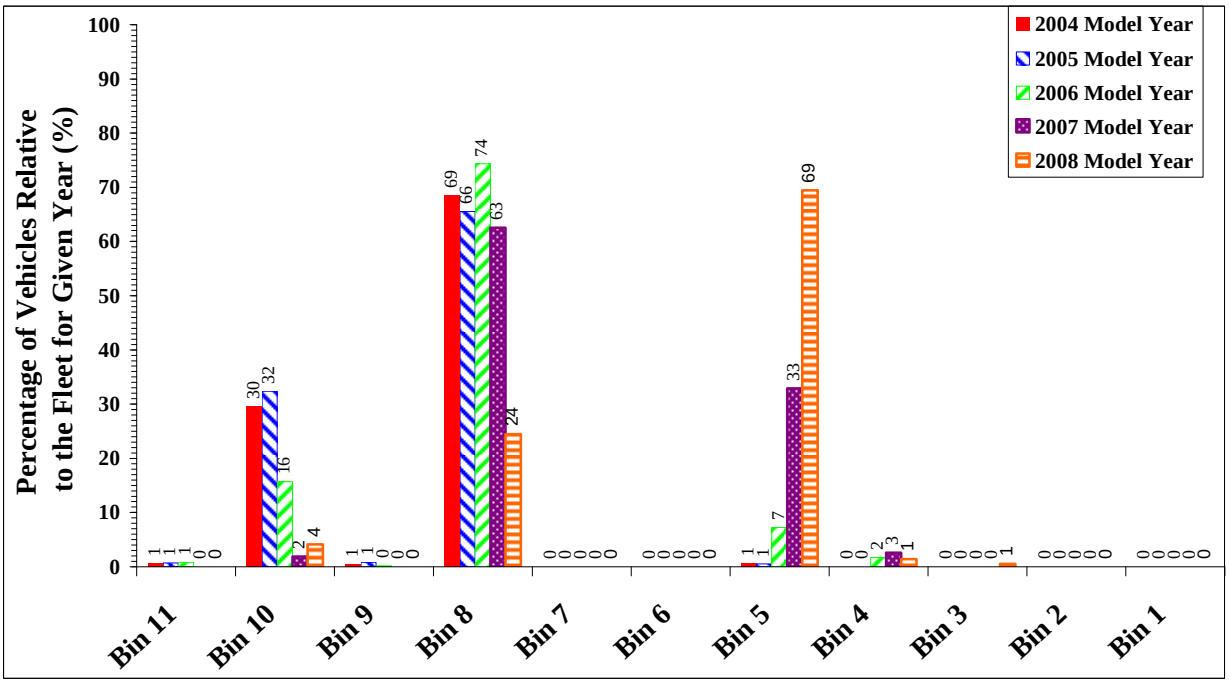


Figure 2b: Distribution of HLDT/MDPV by NO_x Standard (Bin) in Percentage of Vehicles Relative to the Fleet



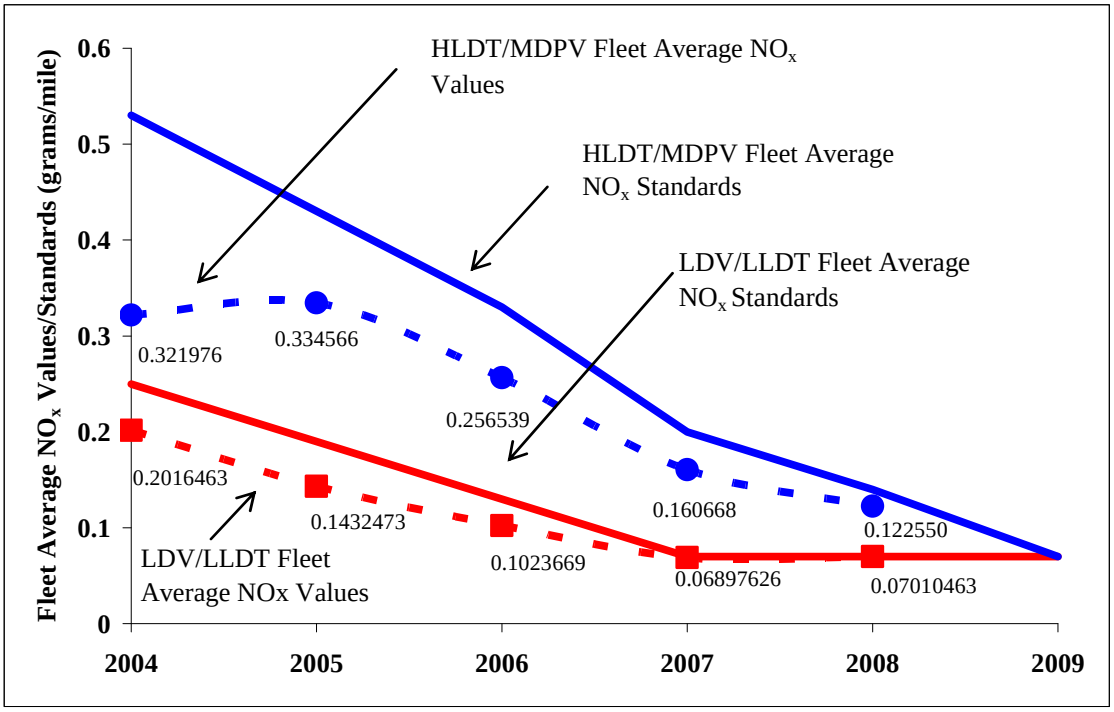
The percentage of LDV/LLDT certified to bin 5 or better increased from 36% of the fleet for the 2004 model year to 62% for the 2005 model year, to 85% for the 2006 model year, and to 99% for the 2007 and 2008 model years. While the portion of the LDV/LLDT certified to bin 5 increased for the 2008 model year compared to 2007 (96% versus 94%), the portion of the fleet certified to bin 4 or better decreased to approximately 3% versus 6% in 2007. As for the remaining portion of the fleet (i.e. certified to bin 6 and above), it increased slightly in 2008. These factors contributed to the slight increase in the overall LDV/LLDT fleet average NO_x value.

The percentage of HLDT/MDPV certified to bin 5 or better increased from less than 1% for the 2004 and 2005 model years to 9% for the 2006 model year, to 36% for the 2007 and to 71% for the 2008 model year.

3.7 Fleet Average NO_x Values Trend

Figure 3 presents the average NO_x values trend relative to the standard since 2004 for both the LDV/LLDT and HLDT/MDPV fleets.

Figure 3: Fleet Average NO_x Values and Standards



The average NO_x value for the fleet of LDV/LLDT steadily improved from 2004 to 2007, with an average NO_x value slightly below the phased-in standard of 0.07 grams/mile for the 2007 model year (bin 5). For the 2008 model year, the fleet average NO_x value increased slightly to

0.07010463 grams/mile. As for the average NO_x value for the fleet of HLDT/MDPV, it remained below the applicable fleet average NO_x standard for the fifth consecutive year.

It should be noted that the fleet average NO_x standards for both LDV/LLDT and HLDT/MDPV converge to a final combined fleet average NO_x standard of 0.07 grams/mile (bin 5) beginning in the 2009 model year.

4 Conclusions

This is the fifth year that companies were subject to the fleet average NO_x requirements under the Regulations. A total of 23 companies submitted reports for a total of 288 test groups comprising 1 545 789 vehicles manufactured or imported for the purpose of sale in Canada.

The average NO_x value for the entire Canadian LDV/LLDT fleet is 0.07010463 grams/mile compared to a fleet average NO_x standard of 0.07 grams/mile. The average NO_x value for the entire Canadian HLDT/MDPV fleet is 0.122550 grams/mile compared to a fleet average NO_x standard of 0.14 grams/mile. While the LDV/LLDT average NO_x value is 0.15% above the applicable standard, all companies have complied with the fleet averaging provisions of the Regulations based on their reports.

Overall, the average NO_x value for the combined fleets of LDV/LLDT and HLDT/MDPV continues to decrease which is consistent with the environmental performance objectives of the Regulations.

www.**ec.gc.ca**

Additional information can be obtained at:

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