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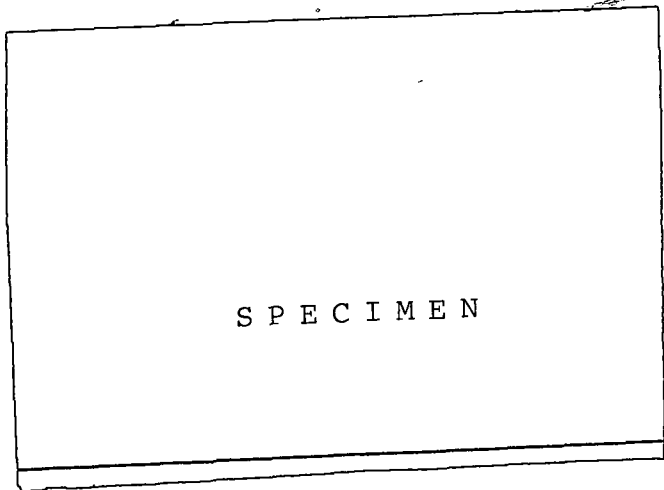
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Canada's Motor Vehicle Pollution Control Program

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Policy and Planning
Report EPS 2-AP-74-1

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Air Pollution
Control Directorate
June 1974

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**CANADA'S MOTOR VEHICLE POLLUTION
CONTROL PROGRAM**

Mobile Sources Division
Abatement and Compliance Branch
Air Pollution Control Directorate

Report EPS 2-AP-74-1

June 1974

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ABSTRACT

The Federal Government, recognizing the need to improve the quality of our air, has launched a program to eliminate the motor vehicle as a significant source of air pollution in Canada. This report presents a general discussion of current government steps taken towards accomplishing this goal. Data and methodology now available for assessing and monitoring the Canadian automotive emission problem are summarized and evaluated, areas for further research are designated, and arguments are presented for the immediate need for stringent government action.

RÉSUMÉ

Après avoir reconnu la nécessité d'améliorer la qualité de notre air, le gouvernement fédéral a lancé un programme afin d'éliminer les véhicules automobiles comme source importante de pollution atmosphérique du Canada. Le présent rapport porte, en termes généraux, sur les mesures qui sont prises à l'heure actuelle par le gouvernement pour atteindre ce but. Il résume et évalue les données et la méthodologie maintenant disponibles pour évaluer et contrôler le problème des gaz d'échappement, indique des domaines où il faut poursuivre les recherches et présente les arguments sur la nécessité d'une action gouvernementale rigoureuse.

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1 INTRODUCTION

With the passage of the Motor Vehicle Safety Regulations the Federal Government initiated a program to combat air pollution from all new motor vehicles manufactured in or imported into Canada, starting with the 1971 model year. The Ministry of Transport was made responsible for the administration of these regulations, and the Department of the Environment was designated to carry out the required compliance testing. Within the Department of the Environment, these activities are carried out by the Mobile Sources Division, which is responsible for monitoring the various programs and conducting surveys and studies, and by the Emission Testing Laboratory, which provides the technical support for Mobile Sources Division programs.

The goal of the federal program is to reduce wherever feasible the air pollution caused by motor vehicles. This is being accomplished in three principal ways: monitoring new motor vehicles for compliance with current standards, assessing the contribution of the motor vehicle to the total air pollution burden, and finally developing federal legislation, and encouraging provincial legislation, for the control and abatement of air pollution from this source. Current programs directed towards accomplishing this goal are discussed in this report. Appendix I contains press releases outlining official policy on control of air pollution from motor vehicles. The Motor Vehicle Safety Regulations, promulgated in the Canada Gazette in November 1970 and amended in July 1974, are reproduced in Appendix II. In Appendix III are found Environment Canada's policy statements on automobile emissions.

2 COMPLIANCE MONITORING PROGRAM

2.1 General

The compliance monitoring program ensures that all new motor vehicles offered for sale in Canada conform to current emission standards as certified by the manufacturers. At the beginning of a model year the Ministry of Transport selects a representative sample of all the makes and models of motor vehicles imported into or made in Canada. This sample is then thoroughly tested for compliance with the emission standards by the Department of the Environment.

Test procedures permit an estimation of the deterioration of the emission control systems during the lifetime of the motor vehicle. With these known deterioration factors the emission level determined at 4000 miles after engine break-in may be related to that at 50 000 miles. These extrapolated results are used to determine whether the vehicle complies with emissions standards.

The Emission Testing Laboratory was established in March 1972 and was able to begin emission testing of 1972 model year vehicles by June 1972. The 1973 model year program started in November 1972, and included 4000 mile emission test vehicles and 50 000 mile durability test vehicles. Comparability of results with those of the United States Environmental Protection Agency (EPA) is assured through the annual testing of a carefully maintained laboratory vehicle at EPA and several other nongovernment laboratories. The accuracy of the instruments is checked every 4 months by the Gas Cross Reference Service provided by Scott Research Limited.

2.2 Test Procedures

The test procedures are designed to measure the amount of pollutants emitted by a vehicle during actual use. Certain parameters are carefully controlled to ensure repeatability and comparability of test results.

Before starting the testing, the motor vehicle is preconditioned for at least 12 h at a temperature between 60 and 86 °F. At the end of this period the vehicle is moved onto a chassis dynamometer. This machine simulates actual driving conditions by permitting the vehicle engine to rotate the rear wheels at speeds of up to 70 mph. Road friction and air resistance are simulated by a variable power absorber unit, and the acceleration and deceleration of the vehicle are closely matched by a set of inertia fly-wheels. The emission test consists of starting the vehicle and driving it for 23 min through a nonrepetitive sequence of accelerations and decelerations at speeds varying from 0 to 60 mph. This sequence simulates a typical 7 1/2 mile trip in city traffic.

During the entire 23 min test the exhaust gases are diluted with filtered ambient air and accurately metered. A small sample of this mixture is continuously taken and stored for analysis, a separate sample of filtered ambient air is also taken during the test to determine the amount of the background pollutants. These samples are then analyzed by a sensitive electronic instrumentation system capable of measuring carbon monoxide, hydrocarbons, and nitrogen oxide concentrations as low as 10 ppm in air. The concentrations of carbon monoxide, hydrocarbons, and nitrogen oxides are recorded automatically from the ambient air sample and from the dilute exhaust gas sample. The weight of each pollutant emitted by the motor vehicle is then calculated in grams per vehicle mile of travel and checked for compliance with the emission standards prescribed in the Motor Vehicle Safety Regulations.

A separate test is conducted to determine the amount of hydrocarbons lost by evaporation from the fuel system of the motor vehicle resulting from leakage and changes in temperature. The evaporative losses are collected separately from the carburetor, filler cap, and fuel tank vent line by means of tubing, fittings, desiccator, and a dried preweighed activated-charcoal cannister. The difference in weight of the cannister before and after the test is used to calculate the fuel vapor losses, which are checked for compliance.

The present standardized test procedures are too time consuming and expensive for testing in-use vehicles. Therefore, a short dynamometer test is being developed to duplicate, if possible, the accuracy of the present 23 min test. To date five modes (idle, 1500 and 2000 rpm, and 30 and 60 mph) appear to provide reasonable diagnostic information. The idle mode alone appears effective in isolating gross pollutants.

A sealed shed, which completely encloses a test vehicle, is being evaluated as a possible substitute for the present unsatisfactory 24 h evaporative emission test in the compliance sequence. Evaluation of the shed using a known concentration of hydrocarbons has resulted in excellent correlation at low concentrations but small losses occur at high concentrations. However, emission values obtained when using the shed are complicated by background levels of hydrocarbon emissions from paint and tires on new vehicles.

3 ASSESSING THE CONTRIBUTION OF THE MOTOR VEHICLE TO THE AIR POLLUTION BURDEN IN CANADA

3 1 General

Until recently, this assessment was based almost entirely on United States and European studies because of the lack of Canadian data. The situation is now being corrected through the initiation of a number of programs which involve in-depth studies supported by comprehensive Canadian emission results.

3 2 Cold Weather Program

This program was initiated in November 1972 to determine the effects of our Canadian climate on emissions in the temperature range from -10 to 60 °F, as this information is practically nonexistent. The program consists of the daily conditioning, and 23 min emission test at ambient temperatures, of a fleet of nine vehicles, with 25% of the tests conducted at baseline conditions (68 - 86 °F) on a rotational basis for comparison. Data from more than 100 tests indicate that emission levels increase substantially as temperature decreases. For example, at -10 °F levels can be as much as 150% higher and at 20 °F, 100% higher than baseline results. Complementing this program, the Alberta Motor Association has conducted emission tests at idle on several thousand vehicles in Edmonton during the 1972/73 winter. These computerized results are being correlated with the data obtained in the in-house program.

3 3 Government Motor Vehicle Fleet Program

To develop Canadian data on the effects on emissions of age, mileage, and maintenance, from both a compliance and an environmental standpoint, a number of fleet programs have been planned involving private, government, and commercial vehicles. Initially, emphasis will be on testing a fleet selected from several government departments in proportion to sales volume of various makes and models in Canada. Certain vehicles unsuitable for government use will be purchased by the Ministry of Transport as is the current practice in the compliance program. Approximately 70 vehicles will be introduced into the program annually, and emissions will be tested at 0 miles and at each 4000 mile interval throughout their lifetimes. Mileage accumulation and maintenance will be the responsibility of the individual departments.

3 4 Motor Vehicle Air Pollutant Inventory

This study will determine the total weight of the three principal pollutants caused by the motor vehicle in Canada. Figures representing emission rates, fuel economy, and total tonnage for Canadian automobiles have been developed from analysis of information published by the United States Environmental Protection Agency, Statistics Canada, and the Ontario Ministry of the Environment.

This high priority study will be a continuing one. Data are being evaluated from statistics-gathering agencies, from technical studies in several countries and Canadian provinces, and

from the cold weather and compliance testing programs at the Emission Testing Laboratory. Results will be updated as new information becomes available from sources such as the government motor vehicle fleet program. Present indications are that exhaust emissions from the average automobile are higher in Canada than in the United States. Future work will concentrate on the heavily populated urban areas in Canada and will eventually incorporate all transportation modes.

3 5 The Motor Vehicle and Air Quality

Air pollution caused by motor vehicles is being viewed with rising concern by many countries throughout the world. In the United States and Japan, particularly, this problem has received a great deal of attention with the resulting passage of increasingly more stringent emission control regulations. In Canada the total road vehicle population is small in comparison with the United States but is increasing at a substantial rate. As in other countries this results in the concentration of large numbers in relatively few urban centers. Thus we find an automobile pollution problem which differs little from cities of equivalent size and climatology in the United States.

Some argue that Canada is different from the United States, that we do not have the same degree of automobile pollution as New York, Chicago, or Los Angeles, and therefore, that our emission standards should be different. Although this argument appears reasonable, other factors must be considered which are less favorable in Canada than in the U.S. Exhaust emissions increase substantially at low temperatures. Driving patterns are affected by snow covered roads, and winter driving conditions cause cars and emission control systems to deteriorate faster. Our studies to date have indicated higher emission factors in Canada than in the United States and higher maintenance requirements which are being generally ignored by the motoring public. One such study carried out in Montreal showed that about 70% of the vehicles checked lacked adequate maintenance. In Ontario, the Head of the Provincial Automotive Emission Control Section has estimated that mandatory corrective engine tune-ups might improve air emissions by from 20 to 30%. All these factors appear to argue against a less stringent approach in Canada.

In Canada our control philosophy is one of protecting and conserving the quality of air. We are committed to an anti-degradation policy for our unpolluted areas. Besides an 'acceptable' air quality objective that provides for adequate protection of both health and welfare, we have a 'desirable' air quality objective - a long-term goal - that provides for the continuing development of control technology. Man should be able to enjoy his environment, not just receive adequate protection. Thus we prefer the application of 'best practicable technology' and do not rely solely on the assimilative capacity of the atmosphere.

Because an acceptable method of correlating motor vehicle emissions to air quality has not been found, a study has been initiated to determine the relationship between emission standards and air quality in selected urban areas. Correlation should be possible through computer modeling when sufficient data from air monitoring stations are available.

4 CONTROL AND ABATEMENT OF AIR POLLUTION FROM MOTOR VEHICLES

4 1 General

To improve the quality of our air, we must anticipate pollution problems and take preventative action. Otherwise, a prohibitive length of time would be necessary to obtain evidence that an air quality problem exists, to prove that these observed levels are harmful through comprehensive medical studies, and then to institute effective abatement measures such as more stringent emission standards, compulsory use of alternate fuels and power sources, and drastic changes in traffic systems and transportation generally.

4 2 Emission Standards

Recognizing that motor vehicles are responsible for approximately 75% of the total man-made carbon monoxide, 65% of the total hydrocarbons, and 53% of the total nitrogen oxides emitted into the atmosphere in Canada, the Federal Government amended the 1971 regulations, requiring as of 1 January, 1973, a reduction of at least 25% in the average nitrogen oxides emissions actually measured from current vehicles.

In an effort to prevent the total vehicle emissions from increasing again in the early 1980's with the growth of the vehicle population, Environment Canada in conjunction with the Ministry of Transport announced proposed amendments to the Motor Vehicle Safety Regulations regarding emissions for 1975 passenger vehicles. The numerical values proposed for 1975 are:

carbon monoxide	25.0 g per vehicle mile
hydrocarbons	2.0 g per vehicle mile
nitrogen oxides	3.1 g per vehicle mile

Our Mobile Sources Division has completed an extensive study of the effect of motor vehicle emission standards on the total emissions from motor vehicles. The results of this study show that if we maintain the emission standards at the 1973 levels, we can expect a continuing decline in total emissions until about 1979 as the percentage of vehicles with emission control systems gradually increases. Furthermore, maintaining the 1973 standard will result in a renewed increase in total emissions beginning around 1979/80. Adoption of progressively more stringent standards, however, will result in a continuing decrease in total emissions throughout the next decade.

These progressively more stringent standards are required if we are to both achieve and maintain that better quality of air and life. Our objective is to preserve, restore, and enhance the quality of the overall environment in Canada. This is why we must take preventive measures now, we must not wait until the problem is once again upon us and then spend another decade trying to control it.

4 3 Emission Control Technology

New concepts in emission control systems, alternate power plants such as turbine, diesel, and electric, and alternate fuels such as propane, natural gas, and hydrogen are being evaluated.

continuously through literature research and laboratory testing. Current laboratory support includes the testing to 50 000 miles of a motor vehicle equipped with a Wankel engine and the evaluation of two vehicles modified for propane as an alternative to gasoline for limited use in fleet vehicles.

Occasionally, emission control devices developed by inventors are tested by the laboratory to assess their potential for meeting the proposed 1975 standards. Normally, this testing is done only at the request of the Department of Industry, Trade and Commerce to determine whether assistance is warranted under the industrial incentives program. Approximately 12 - 15 proposals are received each year with tests carried out on three or four of the most promising devices. To date none of these devices have been successful. However, technical experts in both the Mobile Sources Division and Emission Testing Laboratory will continue to examine carefully all proposals received.

4 4 Annual Vehicle Inspections

Although the control of emissions from in-use motor vehicles is outside federal jurisdiction, the dramatic increase in emissions from badly maintained vehicles is of great concern to the Department. In this respect, a comprehensive review and evaluation of all compulsory emission inspection systems used in Canada, the United States, and several European countries are in progress, and will be published shortly. The Mobile Sources Division intends to recommend guidelines for provincial and municipal motor vehicle inspection programs. These programs will be coordinated with the Ministry of Transport's feasibility study on annual safety inspections. The Emission Testing Laboratory support consists of emission testing to determine effects of maintenance and evaluation of test equipment which could be used in these inspections.

5 FUTURE PLANS

It is expected that the current progress in automobile technology will result in the development of emission control systems and power sources leading eventually to the marketing of very low-pollution motor vehicles. We are under no illusions about the complexity of the problem and the difficulties industry faces in carrying out the task before it. On the other hand much has already been accomplished.

Even after we have lowered new-car emissions as far as is feasible some cities and regions will still require additional controls on vehicular use. The Federal Government will continue to monitor the success and cost efficiency of retrofit controls on individual cars and the various mileage reduction plans proposed in the United States and other countries. With the information gathered we will be able to advise provincial and regional officials on the most appropriate control plan for their areas.

APPENDIX I

NEWS RELEASES

MOTOR VEHICLE SAFETY ACT

ENVIRONMENT CANADA - NEWS RELEASE, NO. 78-71, DECEMBER 15, 1971

TRANSPORT MINISTER JAMIESON AND ENVIRONMENT MINISTER DAVIS ANNOUNCE PROPOSED AMENDMENTS TO FURTHER REDUCE EXHAUST EMISSIONS FROM MOTOR VEHICLES

OTTAWA - Transport Minister Don Jamieson and Environment Minister Jack Davis jointly announced today proposed amendments to the Motor Vehicle Safety Regulations, aimed at protecting public health by preventing further deterioration of the urban environment

The proposals provide more stringent requirements concerning emissions into the atmosphere from new gasoline powered motor vehicles to be manufactured commencing in 1973, 1975, and 1976

The Ministry of Transport invites vehicle manufacturers, vehicle importers, petroleum companies, and other interested parties to submit representations on the proposals

Mr Jamieson and Mr Davis pointed out that motor vehicles have been responsible for approximately 90% of the total man-made carbon monoxide, 60% of the total hydrocarbons, and nearly 50% of the total nitrogen oxides emitted into the urban atmosphere Under the new proposals, existing Regulations of the Motor Vehicle Safety Act would be amended to require on January 1, 1973, a reduction of at least 25% in the average nitrogen oxide emissions actually measured from current vehicles By January 1, 1975, regulations would be amended to require a reduction of at least 90% in the carbon monoxide and hydrocarbon emissions allowable under the Canadian standards of January 1, 1971 A further amendment proposed would require on January 1, 1976, a reduction of at least 90% from the average emissions of oxides of nitrogen actually measured during the first half of 1971 The proposed emission requirements are compared with current values in the attached table

The Ministers noted that all motor vehicles to which the proposed future emission standards are applicable must meet these requirements throughout their useful life For enforcement purposes, the "useful life" will be considered to be 50 000 miles

Mr Jamieson and Mr Davis stated that carbon monoxide causes toxic effects at high concentrations by interfering with the oxygen transport in the blood supply Hydrocarbons and nitrogen oxides, while toxic in large concentrations, also interact in the presence of sunlight to produce photochemical smog The Ministers reported that these contaminant emissions from gasoline powered cars and trucks in urban areas had been increasing rapidly up to 1968 Due to vehicle design modifications and government regulations the total emissions from all motor vehicles have started to decline since 1968 and this trend is likely to continue to 1980 because of the steady increase in the percentage of vehicles with emission control systems and the scrapping of older uncontrolled vehicles The Ministers stated that the proposed regulations for 1975 and 1976 will prevent the total vehicle emissions from again increasing with the growth of the vehicle population in the early 1980's

The Ministers stated that the exhaust emission proposals were being announced now to allow the motor vehicle and petroleum industries the needed lead time to intensify their research, production retooling, and plan modifications to meet these objectives for 1973, 1975, and 1976

The Ministers said the proposed exhaust emission amendments had been submitted to the Provincial Ministers responsible for motor vehicle administration and environmental affairs for their consideration. Mr. Jamieson stated that the new proposed emission regulations would be printed in Part I of the Canada Gazette toward the end of the month.

SUMMARY OF CURRENT AND PROPOSED CANADIAN EMISSION CONTROL REQUIREMENTS - PASSENGER CARS AND LIGHT TRUCKS (UNDER 6000 lbs, g v w)*

Pollutant	Actual	Proposed			
	1972	1973	1974	1975	1976
Carbon monoxide (g/mile)	39 0	39 0	39 0	3 4	3 4
Hydrocarbons (g/mile)	3 4	3 4	3 4	0 41	0 41
Hydrocarbon evaporation (g/mile)	2	2	2	2	2
Nitrogen oxides (g/mile)	NR	3 0	3 0	3 0	0 4

* Abbreviations NR, no requirement, g v w, gross vehicle weight

FACT SHEET TO ACCOMPANY NEWS RELEASE, NO 78-71, DECEMBER 15, 1971 EMISSIONS FROM NEW MOTOR VEHICLES FOR 1973, 1975, AND 1976

1 It is estimated that the motor vehicle is responsible for approximately 60% of the total urban air pollution. Large quantities of carbon monoxide, hydrocarbons, and nitrogen oxides are emitted to the atmosphere.

2 Carbon monoxide causes toxic effects at high concentrations by interfering with the oxygen transport in the blood supply. Hydrocarbons and nitrogen oxides, while toxic in large concentrations, also interact in the presence of sunlight to produce photochemical smog.

3 As the motor vehicle is likely to be the principal mode of transportation for the citizens of Canada for the foreseeable future, it is imperative that progressively more stringent emission standards be enforced to protect the public health.

4 Although current Canadian emission regulations, now in force, and those proposed for 1973, 1975, and 1976 are based upon U.S. Standards, they are considered to be entirely appropriate as Canadian National Standards.

5 Street-level concentration of carbon monoxide in Canadian cities sometimes exceed the threshold limits set for industrial workers. Photochemical pollutants have now been reported in Toronto and air pollution damage has occurred to agricultural crops in Southern Ontario. This situation undoubtedly exists in other parts of Canada.

6 Various studies and surveys conducted in the United States have shown that the increase in urban pollution attributable to motor vehicles is directly related to the increase in vehicle population.

7 Contaminant emissions in the U.S. increased from 1945 to 1966 with the increase in vehicle population, then halted in 1967. From 1968 to 1980 emissions are declining due to the steady increase in the percentage of vehicles with emissions control systems and to the scrapping of older uncontrolled vehicles. It is predicted that emissions will again begin to increase with the growth of the vehicle population in the early 1980's unless further measures are taken now.

8 Canadian emission standards are developed in cooperation with United States authorities in the Environmental Protection Agency. It is generally recognized that there is a need to maintain Canadian standards similar to those in the United States due to our close proximity, to pollution problems common to all North American urban areas, and most importantly due to the existence of the Canada/United States auto pact which involves the free movements of thousands of new vehicles across the border.

9 Current technological progress in both emission control systems and power plants indicates that these proposed 1973, 1975, and 1976 standards are achievable.

10 The proposed amendment for 1973 for nitrogen oxides will require a reduction of 25% compared with the levels emitted by light duty vehicles manufactured during the first half of 1971. This will limit the emission of nitrogen oxides to 3 grams per vehicle mile.

11 The proposed amendment for 1975 will require a reduction of at least 90% from emissions allowable under the present standards of January 1, 1971. The hydrocarbons and carbon monoxide content of the exhaust emissions from a gasoline powered vehicle engine shall not exceed

- (a) 0.41 gram per vehicle mile in the case of hydrocarbons by the approved true mass measurement 'cold' and 'hot' start test procedure for a light duty vehicle, and
- (b) in the case of carbon monoxide, 3.4 grams per vehicle mile

12 The proposed amendment for 1976 will require not more than 0.4 gram of nitrogen oxide per vehicle mile

13 Early publication of future government intentions to revise motor vehicle emission standards will allow industry to intensify its effort to develop basic new technology and will provide the needed lead time required for production retooling

14 The provinces depend on the federal government to enforce emission standards at the point of manufacture, distribution, and importation. Such proposed amendments could be promulgated by the provinces through similar legislation directed to vehicles in use. Currently, the Provinces of Ontario and British Columbia have such legislation

15 The Ministry of Transport consulted on these proposed amendments with the Departments of Environment, Energy, Mines and Resources, Industry, Trade and Commerce, Consumer and Corporate Affairs, and National Health and Welfare

ALBERTA MOTOR ASSOCIATION – NEWS RELEASE FROM THE PUBLIC INFORMATION OFFICE, EDMONTON, NOVEMBER 10, 1972

The automobile's role in air pollution is declining steadily according to statistics released today by the Alberta Motor Association

In a report covering the results of the emission testing program carried out during the summer months, the A M A 's research indicates a steadily declining percentage of pollutants being emitted with each new model year

The program, "Count Down to Clean Air", consisted of mobile emission testing units, which travelled throughout the province and measured the amount of hydrocarbons and carbon monoxide being emitted by private passenger vehicles and was the first public testing of this type to be conducted in Canada

Computerized results of the emission testing showed that in general, the newer the car, the less pollutants emitted. The research program also showed a wide variance in emissions between different automobiles of the same model year with tune-ups lowering emission levels by 100% and in some cases even more. Vehicles which were found to be emitting an excessive amount of carbon monoxide and hydrocarbons were as follows

	Excessive HC, CO, or both	Excessive CO	Excessive HC
1967	76 8%	40 1%	64 5%
1968	73 3%	39 9%	59 8%
1969	65 1%	31 6%	53 8%
1970	66 5%	52 1%	43 4%
1971	52 2%	42 1%	34 8%
1972	44 0%	32 5%	30 3%

At the same time, the A M A announced that the emission testing program will be continued through the winter months in cooperation with the Federal Government Department of the Environment

The purpose of the winter test is to acquire Canadian data on the effect of sub zero temperatures on automobile emissions. The mobile test unit will be available to measure emissions at no charge for both A M A members and the driving public at large. The results of the winter phase of the

program will be processed and reported to Environment Canada on a monthly basis commencing immediately

The cost of the Winter Emission Testing program will be borne jointly by Environment Canada and the A M A

INFORMATION FROM ALBERTA MOTOR ASSOCIATION

The following chart shows a comparison of the years 1967-1972 of three major automobile makes

The figures cover only eight cylinder models and show the percentage of vehicles tested which were found to be emitting excessive amounts of hydrocarbons and carbon monoxide

Eight cylinder model	Percentage of vehicles emitting excesses					
	1967		1968		1969	
	CO	HC	CO	HC	CO	HC
Chev	41 9	72 0	39 7	62 8	38 0	66 1
Dodge	41 4	70 7	42 8	53 5	22 7	43 1
Ford	37 5	55 6	44 5	58 1	40 6	56 2
	1970		1971		1972	
Chev	54 5	47 2	25 0	21 1	13 4	21 6
Dodge	65 2	34 7	68 7	56 2	43 4	30 4
Ford	64 7	45 5	43 4	31 5	38 7	40 8

As can be readily seen, there is an overall decline in the amount of pollutants being emitted by the newer model cars. Tests have also shown that regardless of the model year, an improperly tuned car will still emit an excessive amount of hydrocarbons and carbon monoxide. The decline is especially noticeable in hydrocarbon output in all models. Conversely, some models as early as 1953 were found to be within 1972 standards after being properly tuned and adjusted.

AVERAGE CO EMISSIONS FOR ALL MAKES AND ENGINE SIZES

Year	%	Year	%
1967	6.25	1970	5.14
1968	6.24	1971	4.38
1969	5.68	1972	3.62

In most instances, excessive carbon monoxide readings can be corrected by a simple carburetor adjustment. Excessive hydrocarbon emission is most often indicative of a fault in the ignition system.

TRANSPORT CANADA - NEWS RELEASE, NO 121/73, JULY 19, 1973

MINISTERS OF TRANSPORT AND ENVIRONMENT ANNOUNCE 1975 AUTOMOBILE EXHAUST EMISSION STANDARDS

OTTAWA - Proposed amendments to the Motor Vehicle Safety Act Regulations aimed at protecting public health by further reducing automobile exhaust emissions which are a major source of air pollution were announced jointly today by Transport Minister Jean Marchand and Environment Minister Jack Davis

The changes in Canadian Standards for 1975 will result in reductions in emissions of unburned hydrocarbons and carbon monoxide. The Ministers explained that the quality of life of the Canadian public was paramount in making the decision and that the ambient levels of these noxious gases are of some concern at present in Canadian urban areas.

The 1973 Canadian Motor Vehicle Exhaust Emission Standards have resulted in a reduction in exhaust emissions for new motor vehicles of about 70%, as compared with the pre-1966 uncontrolled automobile engines. Mr. Marchand and Mr. Davis stressed that the new Standards, to become effective January 1, 1975, will result in an estimated further 5% reduction in exhaust emissions without incurring additional cost to purchasers over and above those related to the production changes which the North American automobile manufacturers make themselves, without any reduction in automobile performance or fuel economy, and without the need for catalytic converters.

Canadian automobile emission standards for 1975 will be more stringent than those currently in effect but less stringent than the U.S. National Standards for 1975. To meet the U.S. Standards it will be necessary for manufacturers to add catalytic converters to the exhaust systems of many of their models. These new automotive anti-pollution devices, which could cost in excess of \$50.00 each, will not be required to meet the Canadian Standards. Otherwise, Canadian automobiles will have similar engine equipment to those which will be marketed in the U.S.

The 1975 Canadian Automobile Exhaust Emission Standards can be met by the use of such devices as early fuel evaporation, electronic ignitions, and improved carburetors. All these modifications have proven performance records.

Mr. Marchand stated that the proposed 1975 Automobile Exhaust Emission Standards will be officially published in the Canada Gazette in the near future.

The 1975 Canadian Automobile Exhaust Emission Standards are compared with the 1973 Canadian Standards and the 1975 U.S. National Standards in the table

EMISSION CONTROL REQUIREMENTS FOR PASSENGER CARS

	1973	1975	1975
Emissions, g/mile	Canadian Standard	Canadian Standard	U S National Standard
Hydrocarbons	3 4	2 0	1 5
Carbon monoxide	39 0	25 0	15 0

ENVIRONMENT CANADA - NEWS RELEASE, NO 122/73, NOVEMBER 29, 1973

**TAKING POLLUTION CONTROL DEVICES OFF WON'T SOLVE GAS MILEAGE PROBLEMS,
MINISTER SAYS**

OTTAWA - Removing the emission control device from your automobile, even if it were legal, is no way to improve gasoline mileage, Environment Minister Jack Davis said today. In fact, the end result could be higher fuel consumption.

Mr. Davis said that studies have shown that the average increase in fuel consumption caused by emission controls since their first introduction in 1968 has been 8%.

"This can only be offset by modifications involving not only the emission controls but other engine systems," said Mr. Davis. "The modifications could be done by a well-trained mechanic for \$250. If an untrained person tackled the job, the result could be disastrous from a mileage point of view."

"We must keep in mind the loads imposed by other devices," said Mr. Davis. "Air conditioning, for instance, cuts fuel economy an average of 9%, automatic transmissions, 6%."

Increased weight of cars was also cited by Mr. Davis as a significant factor. "Our studies show that when the weight of 1973 vehicles was raised from 3000 to 3500 lb, fuel consumption increased 14%. Raise it another 500 lb and your fuel consumption will have gone up by a total of 30%."

The Minister said automobile manufacturers are planning improvements in engine performance that will improve the gasoline mileage for 1975 automobiles by between 10 and 20% thus bringing their fuel performance back to 1968 levels.

"The best way for a car owner to improve his gas mileage is to make sure that his car is properly maintained", said Davis. "A poorly tuned car may be only 90% efficient."

"The real answer, of course, is a small car. You can cut your use of fuel in half by getting your horsepower down. Smaller cars and fewer gadgets can work wonders in this regard", the Minister said.

APPENDIX II

EXTRACTS FROM THE CANADA GAZETTE

MOTOR VEHICLE SAFETY REGULATIONS

SCHEDULE E - MOTOR VEHICLE SAFETY REGULATIONS, NOVEMBER 1970

Definitions

1100 In this Schedule,

"crankcase emissions" means air pollutant emitted into the atmosphere through any opening in the crankcase,

"evaporative emissions" means any hydrocarbon component of motor gasoline emitted into the atmosphere from the fuel tank or carburetor of a vehicle,

"exhaust emissions" means air pollutant emitted into the atmosphere from any opening downstream from the exhaust port of a vehicle engine,

"gross vehicle weight" means the manufacturer's gross weight rating for a vehicle,

"heavy duty vehicle" means a passenger car or any vehicle having a gross vehicle weight of 6,000 pounds or less but does not include an off-road utility vehicle,

"off road utility vehicle" means a vehicle having a gross vehicle weight of 6,000 pounds or less designed for carrying persons, property or a work performing structure and which incorporates special features for off-road operation including four-wheel drive,

"opacity" means the fraction of a beam of light, expressed as a percentage, that fails to penetrate the exhaust emission,

"system or device" means any modification of a vehicle or vehicle engine that prevents or lessens the emission of air pollutant to the atmosphere, and

"vehicle engine" means an engine of 50 cubic inches or more capacity, and includes the exhaust emissions system but does not include the engine of an off-road utility vehicle

General

1101 (1) A system or device

(a) shall not cause emission into the atmosphere of any air pollutant that would not be emitted into the atmosphere during the operation of the vehicle or vehicle engine if it were not equipped with the system or device, and

(b) shall not result in any unsafe condition endangering persons or property

(2) Compliance with the requirements of this Schedule shall be demonstrated by approved test methods, and in the case of a heavy duty vehicle such requirements shall be those applicable at the time of the engine

(3) A system or device shall be deemed to meet the requirements of this Schedule if it is of the same construction, in all respects material to compliance with this Schedule, as a system or device that meets such requirements when tested in accordance with subsection (2)

Crankcase Emissions

1102 The crankcase of a gasoline powered vehicle engine shall be constructed in such manner and be capable of being maintained in such condition that crankcase emissions are not discharged into the atmosphere

Exhaust Emissions

1103 The hydrocarbon and carbon monoxide content of the exhaust emissions from a gasoline powered vehicle engine shall not exceed

- (a) in the case of hydrocarbons ,
 - (i) 2.2 grams per vehicle mile as determined by the approved theoretical flow rate method for a light duty vehicle , and
 - (ii) 275 parts per million by volume for a heavy duty vehicle, and
- (b) in the case of carbon monoxide ,
 - (i) 23 grams per vehicle mile as determined by the approved theoretical flow rate method for a light duty vehicle , and
 - (ii) 1.5 per cent by volume for a heavy duty vehicle

Opacity

1104 The opacity of the exhaust emissions of a diesel powered heavy duty vehicle engine shall not exceed

- (a) 40 per cent during acceleration, and
- (b) 20 per cent during lugging

Evaporative Emissions

1105 The evaporative emissions from a gasoline powered light duty vehicle shall not exceed 6 grams of hydrocarbons

MOTOR VEHICLE SAFETY REGULATIONS, AMENDMENT

His Excellency the Governor General in Council, on the recommendation of the Minister of Transport, pursuant to sections 4 and 7 of the Motor Vehicle Safety Act, is pleased hereby to amend the Motor Vehicle Safety Regulations made by Order in Council P C 1970-1944 of the 6th November 1970, as amended, in accordance with the schedule hereto, effective January 1, 1975

Schedule

1 (1) Section 2 of the Motor Vehicle Safety Regulations is amended by adding thereto, immediately after the definition "gross vehicle weight rating", the following definitions

"heavy duty vehicle" means

- (a) a bus,
- (b) a chassis-cab,
- (c) a multipurpose passenger vehicle, or
- (d) a truck

having a gross vehicle weight rating of more than 6000 pounds (272 6 kg) but does not include a passenger car,"

(2) Section 2 of the said Regulations is further amended by adding thereto, immediately after the definition "inspector", the following definition

"leaded gasoline" means gasoline that contains more than

- (a) 0 06 grams of lead per Imperial gallon (0 013 grams per litre), or
- (b) 0 006 grams of phosphorous per Imperial gallon (0 0013 grams per litre),"

(3) Section 2 of the said Regulations is further amended by adding, thereto, immediately after the definition "leaded gasoline" the following definition

"light duty vehicle" means

- (a) a passenger car, or
- (b) any other vehicle having a gross vehicle weight rating of 6000 pounds (2721 6 kg) or less

but does not include an off-road utility vehicle,"

(4) Section 2 of the said Regulations is further amended by adding thereto, immediately after the definition "truck" the following definition

"unleaded gasoline" means gasoline that contains not more than

- (a) 0 06 grams of lead per Imperial gallon (0 013 grams per litre), or
- (b) 0 006 grams of phosphorous per Imperial gallon (0 0013 grams per litre),"

2 The definitions "heavy duty vehicle" and "light duty vehicle" in section 1100 of Schedule E to the said Regulations are revoked

3 Section 1101 of Schedule E to the said Regulations is amended by adding thereto the following subsection

(5) Every vehicle provided with an emission control device the performance of which will be impaired by the use of leaded gasoline shall have

(a) a warning to that effect that is visible to the operator of the vehicle,

(b) a warning to that effect that is

(i) immediately adjacent to the gasoline tank filler inlet, and

(ii) in both official languages, and

(c) a gasoline tank filler inlet that

(i) allows the insertion of a nozzle spout terminal end that has an outside diameter not greater than 0 84 inches (2 134 centimeters),

(ii) has a restriction preventing the insertion of a nozzle spout terminal end that has an outside diameter greater than 0 93 inches (2 362 centimeters), and

(iii) is designed to pass not more than 700 cc of gasoline into the tank when introduction of gasoline is attempted from a nozzle referred to in subparagraph (ii) "

4 Section 1103 of Schedule E to the said Regulations is revoked and the following substituted therefor

"1103 (1) The hydrocarbon, carbon monoxide and oxides of nitrogen content of the exhaust emissions from gasoline powered or diesel powered vehicle engines, when subjected to approved test methods, shall,

(a) in the case of a light duty vehicle, not exceed per vehicle mile (1 61 kilometers)

(i) 2 grams of hydrocarbons,

(ii) 25 grams of carbon monoxide, and

(iii) 3 1 grams of oxides of nitrogen, or

(b) in the case of a heavy duty vehicle, not exceed per brake horsepower-hour (2 684 megajoules)

(i) 16 grams of hydrocarbons combined with oxides of nitrogen, and

(ii) 40 grams of carbon monoxide

(2) Every catalytic emission control device fitted on a light duty vehicle shall be designed to meet the requirements set out in subsection (1), when subjected to approved test methods, or the vehicle shall be equipped with an audible or visual warning signal, or both, to alert the operator of the vehicle of the need for maintenance of the catalytic device

- (3) The warning signal referred to in subsection (2) shall be activated
 - (a) at a preset time or mileage, at the option of the manufacturer, or
 - (b) upon failure of the catalytic device ''

5 Section 1104 of Schedule E to the said Regulations is revoked and the following substituted therefor

- ''1104 The opacity of the exhaust emissions from a diesel-powered heavy duty vehicle engine shall not exceed
- (a) 20 per cent during engine acceleration,
 - (b) 15 per cent during engine lugging, and
 - (c) 50 per cent during peak conditions of engine acceleration and engine lugging ''

6 Section 1105 of Schedule E to the said Regulations is revoked and the following substituted therefor

- ''1105 The evaporative emissions from a gasoline-powered light duty vehicle having an engine displacement of 50 cubic inches (819 35 cubic centimetres) or more shall not exceed 2 grams of hydrocarbons when subjected to approved test methods ''

APPENDIX III

**ENVIRONMENT CANADA'S POLICIES AND PROGRAMS ON AUTOMOBILE EMISSIONS AND
RELATED PROGRAMS**

**ENVIRONMENT CANADA'S POLICIES AND PROGRAMS ON AUTOMOBILE
EMISSIONS AND RELATED TOPICS, APRIL 23, 1974**

EXHAUST EMISSION REGULATIONS - NEW MOTOR VEHICLES

The Federal Government exercises control over the exhaust emission levels of new motor vehicles through the Motor Vehicle Safety Act which is administered by the Road and Motor Vehicle Traffic Safety Branch of the Ministry of Transport Environment Canada, through the Mobile Sources Division, Abatement and Compliance Branch, Air Pollution Control Directorate, provides M O T with an emission testing facility and advises them on attainable and desirable emission control levels for new motor vehicles. The long term goal of this emission control program is to reduce new car emissions to a degree that will eliminate the automobile as a significant source of air pollution. Present control levels are at about 68% and a proposal to go to 72% control in 1975 has been Gazetted. No change is contemplated for 1976.

Regulations based on weights of tailpipe emissions per mile travelled follow the policy of controlling actual emissions rather than legislating the existence of particular control hardware. The choice of competing control methods is thus left to the automotive industry operating within economic and other market constraints.

EXHAUST EMISSION REGULATIONS - IN-USE VEHICLES

Because of federal-provincial jurisdictional constraints, the Motor Vehicle Safety Act has been designed to stop at the distributor level. The control of emission levels from vehicles in dealers' and consumers' hands (in-use vehicles) is solely a provincial responsibility. Several provinces already have legislation forbidding the sale of a non-complying new car and other provinces are working on similar legislation which should adequately control vehicle emissions at the dealers' level.

In the consumer area (in-use vehicles) Environment Canada is encouraging each province to enact legislation designed to ensure that every vehicle continues to perform at the emission control level specified in the federal regulation for its particular model year. A deterrent to tampering with the emission control system would be one aspect of this program.

A vehicle in good operating condition and properly tuned will be emitting at its lowest level. Unfortunately, because of administrative problems, a simple requirement that a current "tune-up certificate" be presented prior to annual licensing has not been found to be effective in practice. It is also recognized that the 23-minute dynamometer test, on which the federal emission standards are based, is not practical for a comprehensive inspection program for private cars.

Accordingly, in recent years, considerable resources have been devoted to finding a quick test which would indicate, with a high degree of accuracy, whether or not a vehicle could pass the federal

dynamometer test. While a short test has not been found which correlates well with results on the federal test, nevertheless, the manufacturers' warrant the emission performance of each vehicle for 50 000 miles provided that the vehicle is tuned to their specifications. Experience has shown that, when properly adjusted, the vehicles will generally meet this warranty. It is recommended therefore, that legislation requiring an in-use inspection program be based on the manufacturers' specifications for the idle engine speed and the carbon monoxide concentration in the exhaust at that speed. A more detailed description of this in-use inspection program is available.

OTHER VEHICLE EMISSION ABATEMENT PROGRAMS

The total daily emissions from vehicles within a given metropolitan area is simply the average emissions per vehicle mile multiplied by the total vehicle miles travelled (VMT) for a typical day. Reducing the size of either parameter will produce a corresponding reduction in total emissions.

Significant reductions in VMT cannot be accomplished without large stresses and strains, occasionally beneficial, in life styles (e.g. mass transit). Such reductions, however, yield immediate and perceivable side benefits (less noise, savings in travel time and energy) as well as important reductions in total emissions. Reductions in the average emissions of individual in-use vehicles, while they don't affect life styles very much, do incur direct costs to the consumer for generally unperceived (to him) benefits. This cost is considerably less, however, when lower emissions are incorporated into the design of the vehicle, as new vehicle standards, than when attempts are made to "retrofit" emission controls on in-use vehicles.

The question of retrofitting raises other issues as well. In general, every retrofit program proposed thus far has a very poor cost/benefit ratio for emissions reduction. In the U.S. retrofit of private vehicles is being seriously considered only for geographical areas which cannot otherwise meet their air quality targets. This approach is not recommended today for any location in Canada. In any event, Environment Canada are continuing to monitor developments in retrofitting. Applications to commercial fleets, e.g. delivery trucks, buses, are being investigated and may prove to be both practical and effective under certain circumstances.

"TAMPERING" WITH EXHAUST EMISSION CONTROL DEVICES

As a result of the "energy crisis" and the erroneous belief that emission controls are exacting a heavy fuel penalty, there has been much recent discussion about removing the control devices to get better fuel economy. Environment Canada's Mobile Sources staff have concluded that there is little to be gained in regard to fuel economy by removing these devices. It is, therefore, recommended that all means, including legislation, be used to discourage consumers and others from tampering with emission controls. Specifically, government and industry tests have shown that the average fuel economy loss due to emission controls between 1967 and 1973 models is in the order of 8 to 13%. Because much of the control is accomplished by internal engine modifications only half of that loss may in theory be countered

by a well trained mechanic by removing devices and other adjustments. In tests done by the U S E P A , their own mechanics achieved a modest improvement but "corner garage" mechanics got a small net loss in fuel economy when attempting to "tamper" with the same vehicles and the car owner was billed for the result.

Although it has been proven that tampering is generally not beneficial to the car owner, the current popular opinion is to the contrary and therefore an anti-tampering law would be useful as a deterrent. In framing such a law, an important consideration is that a law which simply makes tampering illegal is not sufficient. It is possible for a knowledgeable person to invest time and money in engine modifications to maximize performance without increasing emissions. Since catalytic converters will become available with the 1975 models an obvious example would be the voluntary retrofit of a converter, at considerable expense, with subsequent removal of some engine controls to gain improved performance, particularly fuel economy.

With the above in mind the approach recommended to an anti-tampering law would be to prohibit the modifying, from manufacturer's specifications, of a car's engine or its emission control system in such a manner that the emissions to the atmosphere of any pollutant are increased. This approach would be an effective deterrent to tampering with emission controls while still allowing some latitude to the individual who wishes to improve his engine's performance.

FUEL-SAVING DEVICES

The "energy crisis" has brought with it a new wave of "miracle" carburetors and other gasoline saving devices. Even before the fall of '73 many of the older devices were resurrected and presented to the Mobile Sources Division on the mistaken assumption that they would automatically guarantee reduced emissions. This has not proven to be the case. In the past two years, over a dozen of these devices have been investigated by the Mobile Sources Division. Not one has lived up to the inventor's claims. Those which indicated an improvement in emissions or fuel economy were invariably too complex or otherwise unsuitable for mass production as an add-on. The Mobile Sources Division will continue to evaluate each device referred to it by the Department of Industry, Trade and Commerce. At the present time, therefore, it is recommended that the only device that should be promoted for fuel savings is an engine "tune-up".

**ADDENDUM TO ENVIRONMENT CANADA'S POLICY PAPER ON AUTOMOTIVE EMISSIONS
ABATEMENT CATALYTIC CONVERTERS, MAY 1, 1974**

There has been considerable public interest in "catalytic converters" scheduled for use on some automobiles in 1975 and beyond. Concern has centered on their requirement for unleaded fuel which is presently priced at 3¢ more per gallon than regular grades. Their effectiveness and maintenance requirements have also been questioned.

The following facts are relevant to this subject:

(1) The "oxidation" catalyst is an effective control device for motor vehicle emissions. When fitted to an otherwise uncontrolled engine, it can, when air is pumped into the exhaust system, produce very low emission levels (98 - 99% control) or, with only a lean carburetor setting (no "added" oxygen), it can still get 80 to 90% control.

(2) Without the air pump (no added oxygen) the system is remarkably stable. An overload due to a misfiring will simply pass through, since there will be only sufficient oxygen to convert a fraction of it, and the catalyst returns to normal effectiveness when the exhaust stream returns to normal.

(3) Both the Canadian and the U.S. 1975 emission standards (75 - 80% control) can be met with only engine modifications but on many models the penalties in fuel economy and driveability are large. The catalytic converter will be used, therefore, to meet the 1975 standards on many models since it is simply a matter of decontrolling the 1974 engine and throwing the whole control load on the catalyst as a downstream control device. Fuel penalties and driveability problems are thus avoided.

(4) A car with a catalyst must use unleaded fuel to prevent "poisoning" the catalyst. The catalyst can "recover" from a tank of leaded fuel used only occasionally in emergencies. A vehicle with a poisoned catalyst will produce emissions similar to an uncontrolled pre-1968 engine.

(5) Some manufacturers have stated that the use of unleaded fuel results in lower maintenance requirements and lower emissions. Even where no catalyst is used these manufacturers are insisting that the purchaser use only unleaded fuel for optimum engine performance and minimum emissions.

(6) To prevent the accidental use of leaded fuel in cars requiring unleaded, the Federal Ministry of Transport has proposed a regulation requiring small diameter tank filler necks on such cars. It is estimated that about 50% of the 1975 models sold in Canada will be equipped with these small tank filler necks.

In a letter to provincial environment ministers dated November 5, 1973, the federal environment minister noted that there was some danger of lead-fouling of emission control systems on

1975 model vehicles through either the inadvertent or the willful use of leaded fuel in vehicles designed for unleaded. The federal regulation requiring small tank filler necks on such cars should prevent the *inadvertent* use of the wrong fuel by the owner. However, if the current 3¢/gallon extra cost for unleaded fuel remains there will be an incentive for the *willful* use of leaded fuel by some owners. Since provinces have the authority to control vehicles in use there may well develop a requirement for provincial initiative to prevent the willful poisoning of emission control systems which would lead to increased motor vehicle air pollution. Should this prove to be the case it is recommended that provinces consider enacting suitable legislation to prevent tampering with vehicle tank filler necks and fuel pump dispensing nozzles.