SUBMISSIONS TO TRANSPORT CANADA

REGARDING

REVISIONS TO LIGHT DUTY MOTOR

VEHICLE EMISSION STANDARDS

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I. INTRODUCTION

The Canadian Environmental Law Association (CELA), founded in 1970, is a public interest environmental law group. Since 1980, CELA has focused both its casework and law reform efforts in the area of toxic chemicals, hazardous wastes, and pesticides. In May 1983, CELA presented a brief to Environment Canada in relation to the proposed phase down of lead in gasoline (see attached). CELA's position was that Environment Canada should enact a lead-free standard to be put into effect as soon as possible. The rationale for advocating the phase down of lead in gasoline is similar to our contention that reductions to the carbon monoxide (CO), hydrocarbons (HC) and oxides of nitrogen (NOx) motor vehicle emission standards should be enacted as soon as possible.

The Canadian Environmental Law Research Foundation (CELRF), is an independent research organization which carries out studies in environmental law matters, in particular with respect to the problems posed by toxic chemicals. CELRF is presently engaged in a study of toxic and oxidant air pollution which crosses the international border.

In March 1984, CELRF presented a brief to the Sub-Committee on Acid Rain on nitrogen oxides emissions from motor vehicles as a contributor of oxidant air pollution (see attached). At that time CELRF recommended that the standard for NOx be changed from 3.1 to 1.0 grams per vehicle mile.

The discussion that follows deals with: evidence of adverse health and environmental impacts of the three contaminants under consideration; the existing regulatory framework for the control of motor vehicle emissions; the proposals for regulatory change; and our recommendations.

II. EFFECTS OF MOTOR VEHICLE EMISSIONS

Motor vehicle emissions contribute to numerous human health and environmental problems in Canada. It is our premise that many of these problems are of immediate concern, are related at least in part to the existing emission standards and would improve with a tightening of the standards.

The emission standards address three classes of pollutants: carbon monoxide, oxides of nitrogen and hydrocarbons. These three classes are responsible for environmental problems alone and when combined and transformed into secondary pollutants such as photochemical oxidants or acid deposition. In addition, there are other pollutants of concern not addressed by the LDV emission standards, including diesel particulate exhaust containing cancer-causing polycyclic aromatic hydrocarbons ("PAH") and lead emissions (which are controlled through fuel content regulations).

For each of the three pollutants, there are numerous sources contributing to ambient concentrations, with the single most important source for each on a national basis being the light duty vehicle (LDV): 23.2% of hydrocarbon emissions, 45.1% for carbon monoxide and 20.4% (24.7% in Eastern Canada) for NOx.[1] Thus it is our view that reducing emissions from motor vehicles is an important step toward improved Canadian air quality but it is notthe only step which needs to be taken in achieving long-term environmental quality.

We will briefly discuss the effects associated with motor vehicle emissions.

A. Carbon Moxoxide. The primary concern with carbon monoxide (CO) emissions is their impacts on human health, particularly with regard to sensitive populations. The primary route of human exposure to CO is through inhalation. CO acts by binding with haemoglobin in the blood thereby reducing the amount of oxygen in the blood and inhibiting the release of oxygen to tissues.[2] Although there are many factors affecting the amount of CO in the body following exposure, "exposure to even very low concentrations of CO can result in a significant reduction in the oxygen-carrying capacity of the blood".[3]

Because of the way CO acts in the body, several groups have been identified as sensitive populations, or those at risk from low-level ambient exposure to CO. Groups at most risk are: those with cardiovascular disease (at greatest risk),[4] those with respiratory disease[5] and fetuses[6].

National ambient air quality objectives (NAAQO) have been set for carbon monoxide. The maximum acceptable level is 31 ppm for a one-hour concentration and 13 ppm for an eight-hour concentration; and the maximum tolerable level for CO is 20 ppm for an eight-hour concentration.[7] The ambient objectives in Ontario (and most provinces) are the same as the federal "acceptable" objectives.[8]

Pollutants for which NAAQOs have been set are regularly monitored in Canadian urban areas by the National Air Pollution Surveillance (NAPS) Network. The latest report of the NAPS network[9] shows that the national objectives are exceeded in several Canadian cities, including Calgary, Regina and Toronto, where the acceptable level was exceeded 144 times and the tolerable objective was exceeded 41 times in that year. This is a matter of considerable public concern, especially with regard to the sensitive populations identified above.

The trend in emissions has been steady over the late 1970s[10] and is expected to decrease until 1985, then increase to 4.6 million tonnes by 2000[11] in the absence of new motor vehicle emission controls. However, "adoption of the U.S. emission standard will reduce the LDV emissions to about 2.2 million tonnes (roughly 50% of status quo level) in the year 2000 and reduce the overall emissions of CO from the transportation sector in that year by about 30%."[12]

B. Oxides of Nitrogen ("NOx")

1. Effects of NOx

NOx emissions are of concern because they can directly affect human health and vegetation and because they also can indirectly affect health and the environment by contributing to the formation of photochemical oxidants and acid rain.

Health effects of NOx relate primarily to damage to respiratory tissue and increase in susceptibility to respiratory infection.[13] Most studies have looked at effects resulting from short-term exposure and there is little data on long-term human exposure to NOx.[14] However, animal studies where the animals were exposed to concentrations likely to be found in ambient air showed these levels to be "associated with decrease in resistance to bacterial infection"[15] and other studies indicate "serious, irreversible health effects" associated with long-term exposure.[16] These studies in the absence of other data, should alert us to the potential human effect of NOx exposure, particularly with regard to those people most sensitive to respiratory impairment.

NOx is also thought to have adverse effects on sensitive plant species by causing foliar injury, reducing growth or producing physiological and biochemical changes. Much is unknown about the impact of NOx on vegetation, but studies of both long-term and short-term exposures indicate that "the extent of injury was greatest when NO_2 levels were high, even for short time periods".[17] This finding suggests that short-term peaks may be more important than annual average concentrations in considering vegetation damage. Short-term human exposure to nitrogen dioxide may also be a greater cause of concern than annual average exposures. A recent study by U.S. EPA showed that adverse health effects were noted in school children in Akron, Ohio who were exposed to levels of nitrogen dioxide and sulphur dioxide below their respective quality standards.[18]

National Ambient Air Quality Objectives (NAAQOs) have been established for NO_2 only. The acceptable levels are 0.05 ppm annual mean, 0.11 ppm for 24 hours and 0.21 ppm for one hour. NAPS data indicates generally acceptable annual means in Canadian cities but a number of exceedances of the 24 hour limit in Edmonton (50), Calgary (28), and Toronto (35) in 1982.[19]

NOx emissions from light-duty vehicles, in the absence of changes to the motor vehicle emission standards, are expected to remain constant to the year 2000.[20] If the standards are changed to those now in place in the U.S., NOx emissions from LDVs are expected to drop 45%, reducing total national NOx emissions by 8%.[21]

2. Relationship of NOx to Acid Rain

One area of concern with NOx emissions is their relationship to damage caused by acid rain. Although rates of formation remain unknown, it is believed that approximately 35% of all acid deposition is accounted for by nitrate deposition. This means that approximately 9% of all acid deposition is accounted for by NOx emissions from light-duty vehicles.[22]

Generally speaking, most nitrogen deposited to an ecosystem during the growing season is retained by the soil and plants and thus does not contribute to long-term acidification of surface waters.[23] However, nitrate accumulation in the snow pack does contribute to pH depression in surface waters during the spring snow-melt.[24] Coming in the spring, the pH depression has important effects on aquatic organisms because it occurs at critical life stages.

The importance of nitrate to episodic aquatic impacts makes its control an important goal. Although it is difficult to estimate the quantitative relationship, it has been predicted that "(r)eduction of NOx emissions should lead to reduction in the formation and deposition of nitric acid."[25] Because NOx, as opposed to sulphate, is transformed into acid and deposited relatively close to source , Canadian NOx emissions appear to be directly responsible for nitrate acidification in Canada. This is an opportunity for Canadians alone to effectively control one part of our "acid rain" problem.

NOx also contributes to the formation of photochemical oxidants which is discussed below.

C. Hydrocarbons

Although it is "generally agreed that hydrocarbons as a class do not present a direct health hazard,"[26] some individual hydrocarbons found in motor vehicle emissions may present a health hazard and reactive species of hydrocarbons are involved in the formation of photochemical oxidants (discussed below).

Perhaps the hydrocarbon of most concern for health is benzene. Benzene has received most attention in occupational exposure settings. However, the U.S. EPA has "single(d) out benzene as present in ambient air at levels representing a risk for leukemia, pancytopenia and chromosomal aberrations".[27] The significance of this finding for the setting of emission standards is in the fact that in Canada "(b)y far the largest source of environmental emissions is associated with vehicular exhaust gases (80 to 85%)".[28]

D. Photochemical Oxidants

Oxidants (including ozone) are a group of substances which form in the atmosphere from reactive precursor emissions in the presence of sunlight. In Canada, "photochemical oxidant pollution is an issue of immediate concern"[29] because it is responsible for millions of dollars worth of damage to vegetation and harm to health and materials. The emissions contributing to the formation of ozone and other oxidants are NOx and reactive hydrocarbons and the single most important source of both is motor vehicles.

The oxidant or "smog" problem was originally thought to be only an urban problem with emissions coming only from local sources. In recent years, however, numerous studies have identified a rural smog problem -- high ozone levels in urban plumes downwind of large cities and the occurrence of "regional ozone episodes" where high levels are experienced simultaneously in locations separated by hundreds of kilometres.[30]

There are three areas of Canada now recognized as facing the threat of major vegetation damage due to ozone: Vancouver and the Lower Fraser Valley, the area from Windsor to Quebec City close to the Great Lakes/St. Lawrence River, and the Maritime provinces. Data on air quality in Canada shows the routine exceedance of both the acceptable and tolerable national ambient air quality objectives for ozone. For example, in urban areas in 1980, there were 156, 151 and 279 exceedances of the "acceptable" level in Toronto, Montreal and Vancouver respectively with 10 exceedances of the tolerable level in Vancouver.[31] In the same year there were 600, 522 and 136 exceedances of the acceptable level and 12, 6 and 8 exceedances of the tolerable level in southwestern, west central and central Ontario respectively.[32] The mean growing season concentrations of ozone are above threshold values for effects on forests and crops in Ontario and British Columbia and close to but below the threshold in the Maritimes.[33]

This regular incidence of high ozone levels in rural areas of Ontario translates into extensive foliar damage and yield losses to agricultural crops. It has been estimated that if the ambient objective for ozone could be met in all parts of Ontario "the value of the extra crop production to farmers could amount to as much as $23 million per year with a more likely average of about $15 million per year (in 1980 $)".[34] There is little information on effects on crops and forests in other areas of Canada, however, large agricultural and forest areas of southern Canada are in areas subject to long-range transported air pollutants including ozone[35] and the potential for damage is great.

Other effects of ambient ozone levels are less certain. With regard to health effects, ozone is "the most irritant gas known"[36] and effects relate to decreased respiratory function and increased susceptibility to bacterial infection.[37] Sensitive populations appear to be people with chronic respiratory disease, particularly asthmatics, young children and people engaging in physical activity.[38]

Health effects have been found at ambient levels found in Canada. In fact, the U.S. EPA has noted that exposure to ambient levels of 0.05 to 0.06 ppm (i.e., below the Canadian acceptable objective) "may well be associated with some increased health risk".[39]

Ozone control should receive high priority in Canada. However, because of the complexity of oxidant formation, the exact relationship between precursor emission reduction and ozone reduction is unknown. There is a great deal of controversy over the value of controlling hydrocarbons alone, NOx alone or both. Part of the controversy is due to the fact that the ozone concentration depends on the <u>ratio</u> of hydrocarbon (HC) to NOx and at constant HC concentrations, a decrease in NOx can lead to an increase in ozone concentrations under certain circumstances. It is now recognized that this occurs in urban areas close to the emission source for single-day episodes, but with a better understanding of rural ozone problems, it appears that availability of NOx downwind is the limiting factor in ozone production.[40] For multi-day episodes, there is a general feeling that controlling HC alone "will have less impact on ozone maximums within an urban area and even less impact downwind".[41] Thus, it would seem that control of <u>both</u> HC and NOx are necessary to effective ozone control. Because light duty vehicles are important contributors to both reactive HC and NOx emissions, further controls are an essential part of an oxidant control strategy.

The situation is further complicated by the contribution to Canadian ozone levels by long-range transported emissions from the United States. U.S. emissions are the primary source of ozone in the Maritimes, are important in Southwestern Ontario and irrelevant in the Vancouver area. In regional episodes in southern Ontario and Quebec (which usually extend to New York State), U.S. emissions are significant but so too are urban Canadian emissions. Both Toronto and Montreal create emission plumes causing elevated ozone levels downwind and air masses moving over Montreal have often passed over Ontario.[42] It is expected that reductions of both HC and NOx should reduce ozone levels downwind of the urban area.[43] Thus, even recognizing the U.S. contribution, reducing Canadian precursor emissions from LDVs will have an impact on ozone concentrations in Canada, perhaps to the extent of reducing peak concentrations and mitigating the worst effects.

E. Lead

Lead is not regulated in respect of its concentration in vehicle exhaust but in respect of the amount which can be added to gasoline. However, lead is an important environmental pollutant and is directly related to the setting of LDV emission standards because any decision to go to the U.S. standards will require use of the three-way catalytic converter and widespread use of unleaded gasoline. Lead's serious health impacts and the proportion of exposure due to vehicle emissions are additional compelling reasons to lower our current standards.

Toxic effects due to lead exposure are well-known. It is only in recent years, however, that adverse health effects have been associated with chronic exposure to very low lead levels. These effects include neurological damage affecting intelligence, motor activity and behaviour.[44] Children and fetuses are particularly susceptible to lead effects because they absorb lead at a much higher rate than adults do.

In Canada, by far the largest source of atmospheric lead emissions is use of gasoline by on-road and off-road motor vehicles -- 63% of total emissions.[45] The Department of National Health and Welfare, after reviewing several studies, concluded that lead in gasoline contributes significantly to blood lead concentrations and for this reason the lead content of gasoline should be reduced.[46]

Environment Canada is moving to reduce the lead content of gasoline by 60% by January of 1987. Although this will improve environmental lead levels, other jurisdictions (U.K. and U.S.) are phasing out lead completely. The Canadian situation will be greatly improved by the required use of unleaded gasoline due to the required use of catalyst technology to control LDV emissions.

III THE EXISTING REGULATORY SCHEME

A. Canada

The control of automobile exhaust emissions is dealt with under the authority of the Motor Vehicle Safety Act.[47]

Sections 4 and 7 of the Act empower the Governor in Council to make regulations affecting domestic manufacturers and importers of motor vehicles. "Safety standards" may be prescribed for motor vehicles. The definition of "safety standards" is important. It reads:

> "Safety Standards" means standards regulating the design, identification, construction or functioning of motor vehicles and their components for the purpose of protecting persons against personal injury, impairment of health or death". (emphasis added) [48]

The Motor Vehicle Safety Regulations, passed in 1974, impose limitations on emissions from certain types of new motor vehicles manufactured or imported into Canada after 1971. The regulations specify maximum permissible levels of hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx) in exhaust emissions from light duty motor vehicles. The current levels are 2.0 HC, 25 CO and 3.1 NOx grams per mile. The Regulations also set standards for losses of HC to the air as a result of the evaporation of fuel, prohibit crank case emissions and specify how emission systems are to comply with the standards. These controls do not make it illegal to operate vehicles with emissions beyond those permitted by the regulations. Rather they are directed at manufacturers, exporters and importers of such vehicles. It is up to the provinces to set maintenance requirements and to enforce them.

The federal Clean Air Act,[49] sets National Ambient Air Quality Objectives for CO, oxidants (ozone) and nitrogen dioxide. In addition, regulations made pursuant to the Clean Air Act, limit the amount of lead in gasoline. The Act provides for regulation of fuel additives if their presence "in a greater concentration than that prescribed would result in a significant contribution to air pollution ..."[50] Air pollution is defined as:

> "a condition of the ambient air, arising wholly or partly from the presence therein of one or more air contaminants, that endangers the health, safety or welfare of persons, that interferes with normal enjoyment of life or property, that endangers the health of animal life or that causes damage to plant life or to property". (emphasis added)[51]

B. United States

In the United States the regulation of the automobile exhaust emissions of HC, CO and NOx as well as lead in gasoline are dealt with under the Clean Air Act. Title II of the Clean Air Act governs mobile source control.

The regulation of vehicle exhausts goes back more than 20 years. In 1960 legislation was passed directing the Surgeon General to study the problem of motor vehicle exhaust and effects on human health. Subsequently the Clean Air Act, the first strong step taken by the U.S. federal government against air pollution, was enacted in 1963 and an amendment in 1965 entitled the Motor Vehicle Pollution Control Act[52] required the setting of standards for controlling the emissions of pollutants from cars. The Act was to apply only to new motor vehicles and required that regulations be established with "appropriate consideration to technological feasibility and economic standards". In 1970, the Clean Air Act was significantly amended. The new amendments sought to reduce HC, CO and NOx levels by 90% of their uncontrolled levels. Section 202 directs the Administrator to establish emission standards for pollutants from new motor vehicles which "cause or contribute to air pollution which endangers the public health or welfare".[53] The former requirement to consider "technological feasibility and economic standards" was repealed.

In order to meet these targets, the motor vehicle emission standards were set at .41 gpm for HC, 3.4 CO and .4 NOx to be met by 1975 for HC and CO and 1976 for NOx. The 1970 amendments were quite unique because they were "technology forcing" in that they tried to anticipate or force automotive pollution technology. They reflected not only an overwhelming concern for the adverse health consequences of motor vehicle pollution, but demonstrated a note of confidence in the capacity of the automobile industry to meet technological challenges. While emissions were considerably reduced, it became evident that meeting these goals, even with a one or two year extension was impossible. Therefore in 1977 new amendments to the Clean Air Act were passed postponing the timing of the reductions in emissions. The .41 gpm HC standard was to come into place in 1980, the 3.4 gpm standard for CO to be in place by 1981 and a new standard of 1 gpm for NOx was to be in place by 1981. The NOx standard was revised upward from .41 to 1 gpm, with .4 stated to be a research objective. While the NOx and HC standard went into effect as scheduled, the CO standard was waived from 3.4 to 7.0 gpm for certain cars from 1981 to 1983. However as of model year 1983, the 3.4 standard has been in place.

IV THE FEDERAL GOVERNMENT'S PROPOSED NEW REGULATIONS

A. Overview

The government has been proposing changes to the auto emission standards since October 1978, in the case of NOx, and 1982 in the case of HC and CO. In September 1982, notice was given that a Socio-Economic Impact Analysis (SEIA) would be prepared on the promulgation of emission standards of 2.0 HC, 7 CO and 1.0 NOx g/mile. These standards are similar to the U.S. standards, with the exception of the CO standard, which is proposed to be 7 gpm rather than the current U.S. standard of 3.4 gpm. There would seem to be no rationale for not lowering the 7.0 proposed CO standard to the current U.S. standard of 3.4. Indeed all the arguments put forward in the SEIA lead to the conclusion that identical standards should be implemented.

It is our submission that the proposed standards for HC and NOx and 3.4 gpm CO should be put in place as soon as possible. Emission control technology is available, therefore we believe that the recommendations of the Sub-Committee on Acid Rain to implement the more stringent standards for the 1986 model year should be followed.[54]

It is also our submission that the language of the <u>Motor Vehicle Safety Act</u> is preventive in nature, and does not envision a situation where "dead bodies" have to be produced. As discussed above, the legal test for the promulgation of "safety standards" is "for the purpose of protecting persons against personal injury, impairment of health or death". The test in the U.S. <u>Clean Air Act</u> for establishing emission standards is whether the pollutants "cause or contribute to air pollution which endangers the public health or welfare". The similarity in the two tests is the precautionary language and the fact that the emphasis is on impacts to 'human health'. This is in contrast to the much broader language found in our <u>Clean Air Act</u> which provides for regulation of contaminants that endanger either human health, animal health or that causes damage to plant life or to property. It is submitted that this test which applies to lead emissions, should also be used to regulate the other automobile emissions. However this would require an amendment to the Motor Vehicle Safety Act (MVSA), or the more logical placement of the motor vehicle emission sections of the MVSA under the Clean Air Act.

As we have noted in our submissions regarding the amendment of the leaded gasoline regulations, the U.S. leaded gasoline standard was challenged by members of the refining and lead industries.[55] However, the courts in upholding the standard clearly rejected the idea that actual harm must preclude regulation. It is submitted that the decision has considerable significance for the regulation of pollution risks generally in the absence of complete knowledge. Future danger, rather than existing harm, is decisive. This is very similar to the situation regarding the health impacts of HC, NOx and CO.

Indeed, in the Ethyl decision, the court concluded that regulation was permissible if airborne and other sources created an aggregate lead danger. The court held that:

> "The administrator may regulate lead additives under section 211 (c)(1)(A) when he determines, based on his assessment of risks as developed by consideration of all the evidence available to him, and guided by the policy judgement inherent in the statute, that lead automobile emissions significantly increase the total human exposure to lead so as to cause a significant risk of harm to the public health."[56]

It is our contention that this rationale should also apply to the regulation of motor vehicle exhaust emissions.

B. Socio-Economic Impact Analysis (SEIA)

Since 1978, the federal government has required all new federal regulations in the areas of health, safety and fairness that would have a significant effect on the Canadian economy be subject to socio-economic impact analysis. While the analysis may cover the use of several different methods, including cost-benefit, cost-effectiveness and risk-benefit analysis, the Treasury Board has stated its preference for cost-benefit analysis. However, it has become increasingly evident that quantifying the benefits of regulating toxic chemicals is a very difficult task. As a result, as can be seen in the SEIA on automobile exhaust emissions, a partial cost-benefit analysis was attempted, with monetary values not attached to a number of benefits. As well a cost-effectiveness analysis of the various regulatory options was undertaken.

While we believe that the SEIA exercise is useful in generally identifying the costs and benefits associated with regulation, we maintain that it cannot and should not be used for making final decisions. A 1980 U.S. congressional subcommittee report outlined several problems with institutionalizing reliance on these instruments in government regulation-making. These problems included:

(i) because it is easier to quantify the costs of regulation than its benefits, there has been a general tendency to overstate costs and understate benefits;

(ii) while it is usually easier to estimate costs than benefits, particularly in dollar terms; there are many problems associated with cost quantification including: agency dependence on industry data that overestimates compliance costs; failure to reduce cost estimates that might come from recognition of economies of scale; and failure to reduce cost estimates that come from industry's ability to learn over time to comply more effectively with controls;

(iii) the state of the art in quantifying benefits is primitive, as reflected in difficulties in determining how many lives will be saved; how much pain and suffering averted and risk of environmental harm reduced. There are also difficulties in applying dollar values to items that lack a market value (eg. human life) or of adjusting cost-benefit estimates over the time during which they accrue; and

(iv) cost-benefit analysis is incapable of dealing with questions of equity, i.e., that costs and benefits are often borne by different groups of people within society.[57]

Beside the above cited difficulties in using cost-benefit analysis as a final decision-making instrument, it seems clear in Canada that SEIA, as a non-statutory directive, cannot be used to override a clear statutory mandate to protect human health from the dangers posed by toxic chemicals, in this case motor vehicle exhaust emissions. While the U.S. Clean Air Act has been widely recognized as a legislative command to provide the benefits associated with cleaner air without explicit balancing of associated costs, the same can be said of both the Canadian Clean Air Act and the Motor Vehicle Safety Act and regulations.

The SEIA[58] prepared in this case, however, does clearly show that the cost of putting in place emission control equipment is minimal weighed against present adverse health effects and environmental impact of the three contaminants and the "secondary pollutants" formed by various reactions of these substances in the atmosphere.

V. CONCLUSIONS

CELA and CELRF contend that clear benefits to public health and the environment can be achieved by decreasing HC, CO and NOx emissions from LDVs. Maintaining the present standards will continue a situation where ambient air quality objectives are regularly exceeded in many parts of Canada. Adverse environmental and health effects are now being experienced which relate directly to LDV emissions, making their control imperative.

It is our submission that a preventive approach should be taken in relation to the regulation of toxic chemicals. This is also supported by the language of the Motor Vehicle Safety Act. We should move to eliminate the "double standard" in Canadian and U.S. auto emission requirements and ensure that we do not needlessly expose the Canadian public to higher levels of contaminants.

We therefore recommend that the present U.S. standards of .41 HC, 3.4 CO and 1.0 NOx gpm be put in place for the 1986 model year.

VI. NOTES

1. Pilorusso Research Associates Incorporated, "Analysis of Proposed Revision to Canadian Light Duty Motor Vehicle Emissions Standards", prepared for Environmental Protection Service, Report IP-16, August 1984, Table 4.6, p. 56; Environmental Protection Service, "Air Pollution Emissions and Control: Light Duty Vehicles", EPS 2/TS/4, July 1984, Tables 1, 2 and 3.

2. R. J. Kolomeychuk, K.L. Yeager, J. M. Spiegel, The Environmental Application Group Limited and A. Yassi, "Effects of Automotive Emissions", prepared for Environmental Protection Service, Report IP-7, January 1984, hereinafter cited as "Effects", pp. 4-5.

3. Ibid.

4. CO reduces oxygen available to the heart and forces the heart to work harder to compensate for lack of oxygen to other tissues - "Effects", supra, note 2, p. 4-7; CO can also aggravate angina pectoris - "Effects", p. 4-11; but there is controversy over whether it increases the risk of heart attack - "Effects", pp. 4-15-16.

5. CO aggravates a pre-existing condition and may affect the work capacity of healthy individuals - "Effects", supra, note 2, p. 4-18.

6. CO can "interfere with fetal tissue oxygenation during important developmental stages ..." and it is thought this affects birth weight and learning ability - "Effects", supra, note 2, p. 4-23.

7. Ambient Air Quality Objectives, S.O.R./74-325 and S.O.R. 78-74.

8. Ambient Air Quality Criteria, R.R.O. 1980, Reg. 296.

9. Environmental Protection Service, "National Air Pollution Surveillance Annual Summary for 1982", EPS 5-EP-83-13, November 1983, pp. 70-71.

10. Environmental Protection Service, "Urban Air Quality Trends in Canada, 1970-79", EPS 5-AP-81-14, November 1981, p. 28.

11. EPS 2/TS/4, *supra*, note 1, p. 10

12. *Ibid*.

13. "Effects", *supra*, note 2, p. 4-32.

14. *Ibid*.

15. "Effects", *supra*, note 2, p. 4-33.

16. *Ibid*., see Table 4.2-13.

17. "Effects", *supra*, note 2, p. 4-99.

18. U.S. EPA, *Air Pollution and Health Effects in Children Residing in Akron, Ohio*, Project Summary (March, 1981), cited in Michael Walsh, "Issue Paper on Automobile Emissions", 14 U. of Toledo Law Review (1983) at 332.

19. NAPS, *supra*, note 9, p. 72.

20. EPS 2/TS/4, *supra*, note 1, p. 8

21. *Ibid*.

22. Environmental Protection Service, "The Atmosphere Pathway for Oxides of Nitrogen", EPS 2/TS/2, May 1984, p. 7.

23. Environmental Protection Service, "Effects of Nitrate on the Acidification of the Aquatic System", EPS 2/TS/1, April 1984, p. 5.

24. *Ibid*.; U.S.-Canada Memorandum of Intent on Transboundary Air Pollution, Work Group I, Impact Assessment, "Final Report", February 1983, p. 3-7.

25. EPS 2/TS/2, *supra*, note 22, p. 9.

26. "Effects", *supra*, note 2, p. 4-82.

27. *Ibid*., p.4-83.

28. Environmental Health Directorate, Health and Welfare Canada, "Benzene: Human Health Implications of Benzene at Levels Found in the Canadian Environment and Workplace", No. 79-EHD-40, March 1979, p. 41.

29. Environmental Protection Service, "Light Duty Vehicle Emission and the Oxidants Issue in Canada," EPS 2/TS/3, May 1984, p. 10.

30. Environmental Protection Service, "Initial Assessment Report on Photochemical Oxidant Air Pollutants in Canada - Final Report", April 1984, p. 2.28.

31. *Ibid*., Table 3.3.

32. *Ibid*.

33. EPS 2/TS/3, *supra*, note 29, p. 1.

34. S. N. Linzon, R. G. Pearson, J. A. Donnan, F. N. Durham, "Ozone Effects on Crops in Ontario and Related Monetary Values", Ontario MOE ARB-13-84-Phyto, January 1984, p. 44.

35. EPS, *supra*, note 30, pp. 5.43, 5.48.

36. *Ibid*., p. 5.23.

37. Ibid., pp. 5.22-3; also see "Effects", *supra*, note 2, section 4.2.4.

38. "Effects", *supra*, note 2, p. 4-69.

39. *Ibid*.

40. EPS 2/TS/3, *supra*, note 29, p. 7.

41. *Ibid*.

42. *Ibid*., p. 6.

43. *Ibid*., pp. 7-8.

44. See, e.g., H.L. Needleman, "Studies in Children Exposed to Low Levels of Lead", U.S. EPA, December 1981; U.S. House of Representatives, *Lead in Gasoline: Public Health Dangers*. Hearings before a Subcommittee of the Committee on Government Operations, April 14, 1982.

45. Environmental Protection Service, "National Inventory of Sources and Emissions of Lead (1978)", EPS 3-EP-83-6, November 1983, Table 1.

46. Health and Welfare Canada, "Human Exposure to Environmental Lead", November 1982.

47. R.S.C. 1970, c. 26 (1st Supp.) as amended.

48. Ibid. at 2(1).

49. S.C. 1970-71-72, c. 47.

50. Ibid., at s.2(1)(b).

51. Ibid., s.2(1)(b).

52. The entire Act was enacted as 101(8) of the Clean Air Act Amendments of 1965, Pub. L. No. 89-272, 79 Stat. 992 (current version at 42 U.S.C. 7521 et seq.).

53. Clean Air Act Amendments of 1970, Pub. L. No. 91-604, 84 stat. 1676.

54. House of Commons Sub-Committee on Acid Rain, Time Lost (Ottawa; 1984) at 1.

55. Ethyl Corp. v. EPA, 541 F.2d 1 (D.C. Cir), cert. denied, No. 426 U.S. 941 (1976).

56. Ibid., at 29.

57. United States House of Representatives. Cost-Benefit Analysis: Wonder Tool or Mirage? Report together with Minority Views by the Subcommittee on Oversight and Investigations of the Committee on Interstate and Foreign Commerce, 96th Cong., 2nd Sess. (Dec. 1980) at 25.

58. While the document referred to supra note 1 states that it was done in accordance with chapter 490, Appendix E of Treasury Board Canada's Administrative Policy Manual and that it met "the requirements for Socio-Economic Impact Analyses", Transport Canada does not appear to be treating it as the SEIA in this matter. This means that more than two years after the announcement in the February 20, 1982 Canada Gazette, Part I that a SEIA would be prepared, the document has not been completed. This may unfortunately lead to further delays in promulgating new standards.