CLEAN AIR 2000

ACTION PLAN FOR AIR QUALITY MANAGEMENT IN THE COLOMBO METROPOLITAN AREA

Preparation of this Action Plan was supported by:

The World Bank
United Nations Development Programme
Norwegian Agency for Development Co-operation
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Natural Resources and Environmental Policy Project of
the United States Agency for International Development (NAREPP-USAID)
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METROPOLITAN ENVIRONMENTAL IMPROVEMENT PROGRAMME
MINISTRY OF POLICY PLANNING AND IMPLEMENTATION
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BATTARAMULLA, SRI LANKA

October 1992

FOREWORD

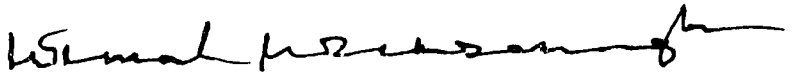
Good air quality is essential for human health and the health of the environment as a whole. Polluted air can seriously affect the quality of life, can damage historic buildings, and kill sensitive plant life and in the long term it would adversely affect natural conditions. The two major global issues-- *greenhouse effect and ozone layer depletion*-- are a result of unlimited man-made emissions. In Sri Lanka, the major source of air pollution is from energy consumption. Pollution from mobile sources predominate stationary sources. Again much of the pollution caused by the transport sector is from buses, trucks and lorries. The National Environmental Act (NEA) as amended in 1988 provides the legal framework for air pollution control. This section of the Act deals extensively with the control of air pollutants from both stationary and mobile sources.

Recognizing the growing problem of air pollution in the Colombo area, the Metropolitan Environmental Improvement Programme (MEIP) has developed the Strategy and Action Plan - ***Clean Air 2000***. This Action Plan is the outcome of a Short-course conducted in July 1992. This has been prepared in consultation with Ministries and Agencies whose activities influence air quality and has been considered by the National Environmental Steering Committee (NESC).

The CA2AP combines policy and strategic measures that will be introduced to the overall policy-making framework. Early action in the area of air pollution will prevent it from reaching critical proportions that soil erosion, water pollution and deforestation have reached in this country. While the short-term benefits of air pollution control may not be immediately visible, the long-term benefits, together with the health benefits and the consequent savings for the individual and the country, are undeniable. Apart from providing the basis for the first real attempt to reduce automotive air pollution in the CMA, CA2AP is also expected to stimulate future multi-lateral investment initiatives in the areas of energy conservation, cleaner fuels and air pollution control technologies.

On the recommendation of His Excellency Ranasinghe Premadasa, in his capacity as the Minister of Policy Planning and Implementation, the Cabinet of Ministers approved the implementation of this Action Plan on February 17, 1993. The Cabinet also appointed an Implementation Committee under the chairmanship of Secretary, Ministry of Environment and Parliamentary Affairs and directed that this Plan be the framework for future international assistance in the area of air quality management.

This Action Plan is an accompanying document of the National Environmental Action Plan (NEAP) and its publication is timely. I strongly seek the support and co-operation of concerned agencies in its full implementation. I congratulate the MEIP for developing this Action Plan. I also express my sincere gratitude to the World Bank, United Nations Development Programme, Norwegian Agency for International Development, Japan International Co-operation Agency and the Government of China for extending assistance in developing this Plan.



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This Action Plan is the outcome of the Short-course on Air Quality Management held between July 6 and 10, 1992, organized by the Metropolitan Environmental Improvement Programme-Colombo of the Ministry of Policy Planning and Implementation and sponsored by the World Bank, the United Nations Development Programme (UNDP), Norwegian Agency for Development Co-operation (NORAD), Japan International Co-operation Agency (JICA), the Natural Resources and Environmental Policy Project of the United States Agency for International Development (NAREPP-USAID) and the People's Republic of China.

Those associated with the formulation of this Action Plan is given below. The ***Clean Air 2000 - Action Plan*** was subsequently approved by the National Environmental Steering Committee, at its meeting no. 16 held on October 8, 1992 under the chairmanship of Secretary, Ministry of Policy Planning and Implementation. The NESC also appointed an Implementing Committee to monitor the progress of the Action Plan.

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LIST OF ABBREVIATIONS

2S	Two Stroke Engines
4S	Four Stroke Engines
CAMP	Colombo Air Quality Monitoring Programme
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
CISIR	Ceylon Institute of Scientific and Industrial Research
CMA	Colombo Metropolitan Area
CMC	Colombo Municipal Council
CMT	Commissioner of Motor Traffic
CO	Carbon Monoxide
CPC	Ceylon Petroleum Corporation
EIA	Environmental Impact Assessment
EPL	Environmental Protection License [Scheme]
FD	Fine Dust
GOSL	Government of Sri Lanka
HC	Hydrocarbons
Hr	Hour
I/M	Inspection and Maintenance
Km	Kilometre
M	Metre
MEPA	Ministry of Environment and Parliamentary Affairs
MEIP	Metropolitan Environmental Improvement Programme
Mg	Milligrams
MIST	Ministry of Industries, Science and Technology
MoF	Ministry of Finance
MPG	Miles per Gallon
MT	Metric Ton
MTH	Ministry of Transport and Highways
MW	Mega Watts
NBRO	National Building Research Organization
NEAP	National Environmental Action Plan
NESC	National Environmental Steering Committee
NO_X	Oxides of Nitrogen
NPC	National Programme Co-ordinator
Pb	Lead
S	Sulphur
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
TEL	Tetra Ethyl Lead
TOE	Tonnes of Oil Equivalent
TSP	Total Suspended Particulate
TSPC	Transport Studies and Planning Centre
UDA	Urban Development Authority
Yr	Year

GENERAL

1. Air pollution worldwide is rapidly approaching dangerous proportions. The Global Climate Convention, an international treaty recently signed by world leaders, calls for the reduction of greenhouse gases through the formulation of appropriate national and international strategies. An increasing awareness of the critical problems related to air pollution and the emission of greenhouse gases has led to global attention focusing on the formulation and implementation of policies for air quality management and the development of innovative technology for air pollution control.

2. Air pollution is the chief by-product of energy conversion. Principal primary energy sources in Sri Lanka include: (a) biomass (71 percent); (b) hydroelectricity (10 percent); and (c) petroleum (19 percent). Biomass, the dominant fuel, is not traded, except for urban cooking fuel and fuelwood consumed by industry. High rainfall and the hilly topography of the southwest provide Sri Lanka with excellent hydropower potential, and hydro capacity expanded nearly threefold in the period 1977 to 1988. All oil is imported. The first five year *National Environmental Action Plan (NEAP)*[1/], published in 1991 has identified the following as the principal environmental issues in the energy sector:

a. Biomass, which includes fuelwood and agricultural residues and is mainly used for household cooking and industry, constitutes 71 percent of primary energy, but contributes only about 40 percent of usable energy. Biomass fuel consumption is growing at about 1.4 percent per year, i.e., at approximately the overall population growth rate, and biomass is expected to remain the dominant fuel in the medium term. To relieve additional pressure on forests, biomass fuel conservation measures are essential;

b. Consumption of electricity grew by 5.8 percent annually from 1980 to 1990, and predicted annual power system growth from 1991 to the year 2000, which is expected to be driven by industrial growth, is 7.3 percent. There is no regular monitoring of emissions from Sri Lanka's three existing oil-fired thermal plants, nor has Sri Lanka enacted emission standards for thermal plants. To promote an environmentally beneficial mix of power sources and improved commercial energy efficiency, integrated energy planning and industrial energy conservation measures are needed. In light of plans to invest US$1 billion in the 1990s toward development of a mixed commercial power system with roughly equal hydro and thermal capacities by the year 2007, GOSL capacity to assess, monitor and mitigate potential adverse environmental impacts of hydro and thermal power plants needs strengthening;

c. Inefficient combustion of petroleum in motor vehicles is a primary cause of growing air pollution in the Colombo area. To prevent adverse health and economic impacts, initial steps to develop incentives and regulations to reduce air emissions need to be taken.

1/ The NEAP evolved from the CEA published National Conservation Strategy-Action Plan (1990) and the World Bank sponsored Environmental Management for Sri Lanka - An Action Plan (1991).

BASIS FOR CLEAN AIR 2000

3. The NEAP spells out interventions required in the next few years to arrest and reverse the process of environmental degradation (including air pollution) caused by the energy sector. *Clean Air 2000* is an action plan which was the outcome of the Short-course on Air Quality Management conducted by the Metropolitan Environmental Improvement Programme (MEIP)-Colombo. This action plan supplements the NEAP, by focusing specifically on air quality management for the Colombo Metropolian Area (CMA). The ***Clean Air 2000 - Action Plan*** also builds on the recommendations made by the Inter-Agency Committee on the Vehicular Air Pollution (para 26) and details a time-bound approach.

4. The ensuing paragraphs aptly describe the present conditions and trends and efforts required to mitigate air pollution. This Action Plan combines policy and strategic measures that will be introduced into the overall policy making framework. Early action in the area of air pollution will prevent it from reaching the drastic proportions that soil erosion, water pollution and deforestation have reached in this country. While the short-term benefits of air pollution control may not be immediately visible the long-term benefits, together with the health benefits and the consequent savings for the individual and the country, are undeniable. Apart from providing the basis for the first real attempt to reduce automotive air pollution in the CMA, ***Clean Air 2000 - Action Plan*** is also expected to stimulate future multi-lateral investment initiatives in the areas of energy conservation, cleaner fuels and air pollution control technologies.

5. Considering the past intensity and future trends of development the CMA, as shown in figure 1, is chosen as the target region. CMA which includes the Capital City is the dominant hub of both economic activity and urban life in Sri Lanka. The present population is approximately 2.1 million and is expected to grow to 2.5 million by the year 2000. The region also accounts for 70 percent of all industrialization and 50 percent of vehicles plying on Sri Lankan roads.

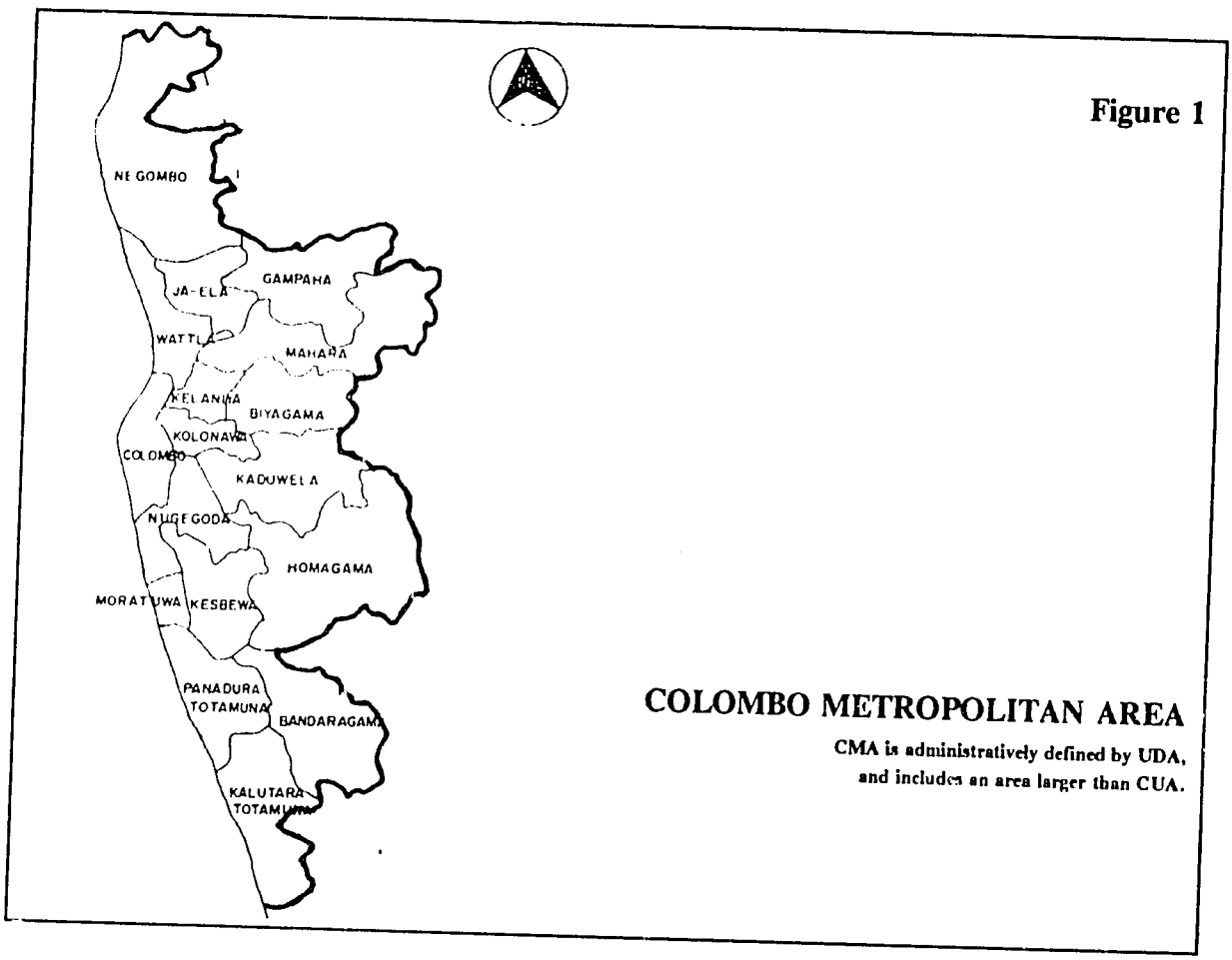

Figure 1

COLOMBO METROPOLITAN AREA

CMA is administratively defined by UDA, and includes an area larger than CUA.

TRENDS AND CONDITIONS

Sources

6. The sources of air pollution in Sri Lanka, as everywhere, are stationary and mobile sources. National energy consumption for 1991 is given in table 1[2/] and illustrated in figures 2 and 3[3/]. Sectoral fuel use in the CMA is given in figures 4 and 5. A detailed analysis of the CMA situation follows.

[2/] a. National Energy consumption data for different fuel uses was obtained from the Sri Lanka Energy Balance and Energy Data, published annually by the Ceylon Electricity Board.

b. Consumption data specific to the CMA was compiled from the 1991 CPC sales data.

[3/] Conversion factors:

		TOE
Petrol	1Mt	1.09
Kerosene	1Mt	1.05
Diesel	1Mt	1.05
Fuel Oil	1Mt	0.98
Firewood	1Mt	0.38

1 TOE = 41.84 Giga Joules

TABLE 1
ENERGY CONSUMPTION BY SECTOR ('000 Mt)

SECTOR		AUTO DIESEL	SUP DIESEL	HEAVY DIESEL	PETROL	KEROSENE	FUR OIL	FUEL-WOOD[4/]
Transport	National	537.975	20.132		159.336			
	CMA	162.14	9.7929		71.62			
	CMA %	30.13	48.64		44.95			
Industry	National			32.151		2.8	199.7	*1450.72
	CMA			4.313		2.24	160.81	412[a]
	CMA %			13.41		80	80.5	28.39
Household	National					152.5		*8560
	CMA					33.35		945[b]
	CMA %					21.86		11
Commercial and Power	National			*0.378			*1.165	* 32
	CMA			0.378			1.165	8[c]
	CMA %			100			100	25

* Estimates made from 1990 Energy Balance

Source: Sri Lanka Energy Balance and Data 1990
Ceylon Petroleum Corporation
Metropolitan Environmental Improvement Programme
"Energy Status of Sri Lanka" - Prof K K Y W Perera

4/ Assumptions:-

a. Composition of industries consuming fuelwood in CMA is as follows:

- Coconut Oil	=	23.00
- Tobacco Processing	=	19.00
- Bakery (60% of all)	=	200.00
- Bricks or Tiles (50% of all)	=	170.00
TOTAL		412.00

b. Computation of household fuelwood consumption for CMA

$$\text{Annual per capita household fuelwood consumption} = \frac{\text{Total National Fuel Wood Consumed}}{\text{National Population x \% of Fuelwood Users}}$$

$$= \frac{8560 \text{ Mt}}{17 \text{ million} \times 93\%} = 5.41 \times 10^{-04} \text{ Mt/person}$$

Population using fuelwood in CMA = 80.5 %
Population in 1991 = 2.1 million
Population using fuelwood in CMA = $2.1 \times 10^{6} \times 80.5 \times 5.41 \times 10^{-04}$
= 945 Mt

c. Commercial fuelwood use in CMA = 25% of the National commercial fuelwood consumption

NATIONAL SECTORAL ENERGY CONSUMPTION - 1991 IN TOE (%)

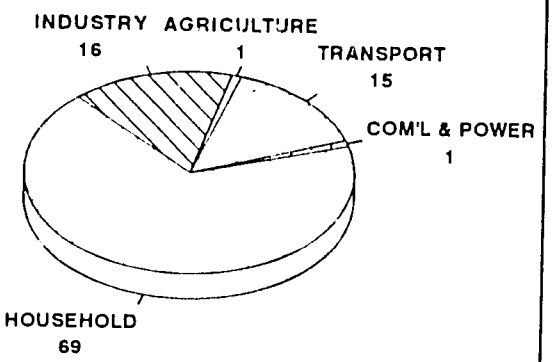

Figure 2

GROSS NATIONAL ENERGY CONSUMPTION - 1991 IN TOE (%)

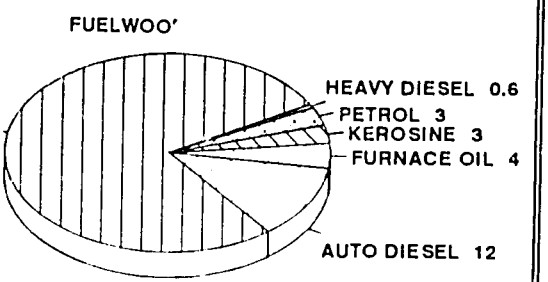

Figure 3

CMA SECTORAL ENERGY CONSUMPTION - 1991 IN TOE (%)

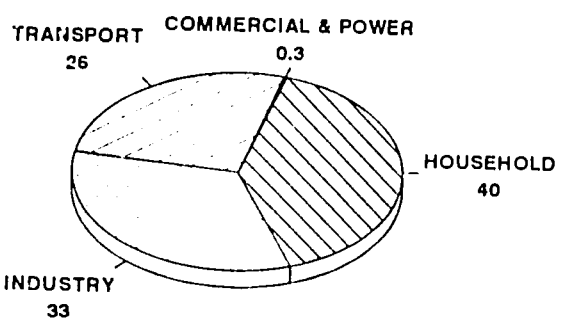

Figure 4

GROSS CMA ENERGY CONSUMPTION - 1991 IN TOE (%)

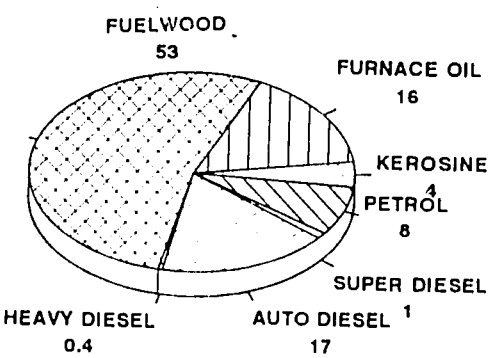

Figure 5

7. Of the *stationary sources*, the primary energy consumer--the domestic sector (household) using wood, electricity, kerosene and gas for domestic lighting and cooking--consume nearly 69 percent of the total national energy. In the CMA, households account for nearly 40 percent of energy consumption as shown in figure 4. Nearly, 80 percent of the households use fuelwood as the principal cooking fuel and the balance use gas, electricity and kerosene[5/]. Apart from the domestic health impacts of fuelwood and kerosene burning, the air pollution is localized to the neighbourhood.

8. The energy consumed by industrial processes in the CMA is 32 percent. Recent investigations indicate that industrial emissions are from the operation of boilers and the resulting air pollution is localized. Overall, water pollution predominates air pollution in the industrial sector.

9. Sri Lanka's electricity generation, largely hydro, includes two diesel generating units with a total capacity of 260 MW located in the CMA. No large thermal power plants have been built as yet. Consequently, air pollution from power generation remains low. However, plans are afoot to construct additional diesel and coal-fired power plants before 2000. The siting of these and industrial plants will be preceded by Environmental Impact Assessments (EIAs).

10. The *mobile source* of air pollution, the transport sector, accounts for 15 percent of Sri Lanka's energy consumption. Of the total fuel used, 91.3 percent of diesel and 87.5 percent of petrol is consumed by this sector. The share of transport sector in the CMA is 26 percent. The registered vehicle population in Sri Lanka increased 3-fold in the last decade from 300,000 in 1980 to over 900,000 in 1991 although approximately 200,000 vehicles are estimated to be off the road. Of these vehicles, over 50 percent are registered in the CMA and an additional 10 percent commuting to Colombo daily from the neighbouring regions. About 50 percent of these motor vehicles are motor cycles, 25 percent light trucks, lorries and land vehicles, 20 percent cars, and 5 percent buses. The vehicle population is expected to double by the year 2000. The projected vehicle population is given in Table 2.

TABLE 2
Projected Vehicle Population For CUA

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Passenger Cars	64408	68238	72368	76824	81636	86834	92456	98538	105124	112262	120002
Bus	15925	16424	16934	17456	17988	18532	19680	20310	20910	20980	21693
Light Goods Vehicles	48115	49428	46303	50776	52162	53586	55047	58092	59677	61306	62978
Heavy Goods Vehicles	744	744	744	744	744	744	744	744	744	744	744
Motorcycle 4S	94016	108118	123255	139278	155991	173150	190465	207607	224215	239910	254305
Motorcycle 2S	62677	72079	82170	92852	103994	115433	126977	138405	149477	159940	169537
TOTAL	285884	315030	341774	377930	412515	448279	485369	523696	560147	595142	629259

5/ Census of Population and Housing - 1981

11. Fuel used by the transport sector is primarily petrol or auto diesel, refined by the Ceylon Petroleum Corporation (CPC) from imported crude oil. Specifications for sulphur content in diesel is between 0.1 and 1.1 percent. The present level, however, is 0.8 percent. There is no sulphur in petrol. Although the specifications for lead addition, in the form of Tetra Ethyl Lead (TEL), is 0.45 grams per litre, lead is presently added at the rate of 0.24 grams per litre (average) or 160 tons per year. The octane rating is 90 and 93 for the two grades of gasoline.

EMISSION INVENTORY

12. An emission inventory is usually derived almost entirely from published statistics on fuel consumption, automobile registration, industrial production, population and other significant indicators representative of the area, and offers estimations of emissions. A simple emission inventory usually provides only a gross appraisal of total annual emissions without geographical and seasonal estimates. An emission inventory which accounts for the air pollutant sources, their related emission rates, and their location, is an essential element in the development of emission control strategy. Further, emission data may also be used in estimating present as well as projected pollutant concentrations in the air, in the design of sampling programmes, as a guide to planning activities and in almost all aspects of air pollution control programmes.

13. Emissions from petroleum products in the CMA, is estimated in table 3[6]/. No emission control was assumed. This inventorization covers the major air pollutants, suspended particulate matter (SPM), sulphur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO) and hydrocarbons (HC). The inventorization excludes pollution caused by fuelwood consumption due to the non-availability of reliable emission factors for domestic biomass fuels.

14. Computing motor vehicle emissions involves factors such as the vehicle population, vehicle type, estimations of kilometres driven per vehicle per year, and the estimated rate of each pollutant by the vehicle category (grams per kilometre driven) in the following formula[7]/:

Number of vehicles x grams/km x km/year x tons/grams = tons/year

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[6]/ The inventorization for industry, power generation, commercial and household sectors have been computed using the energy consumption data given in table 1 and the emission factors given in the Rapid Assessment of Sources of Air Pollution (WHO, 1982), along with USEPA's Air Pollutant Emission Factors (EPA, AP-42, 1976). Certain factors were normalized for Sri Lankan conditions.

[7]/ The assumptions made and the emission factors used for the computation of vehicular emissions are given in annex 1.

15. For fuel related pollutants such as lead and sulphur the estimations are carried out on the basis of each constituent in a volume of fuel and combined with the fuel efficiency of the vehicle according to the following formula[8]/:

grams/gal x gal/mile x mile/km x tons/grams = tons/year

TABLE 3
ESTIMATED EMISSION FROM PETROLEUM COMBUSTION SOURCES
(Tons/Year and Percent)

SOURCES	SPM	SO_2	NO_X	HC	CO
Transport	3,453	455	5,928	38,364	199,736
%	88.23	4.34	81.55	99.78	99.9
Industry	358.42	9,791.15	1,243.56	68.59	97.98
%	9.16	93.54	17.1	<1	<1
Power & Commercial	1.603	107.38	20.358	0.19	1.0179
%	<1	<1	<1	<1	<1
Household	100.05	113.39	76.7	13.34	8.3375
%	2.55	<1	<1	<1	<1
TOTAL	3,913	10,467	7,268	38,446	199,843

16. Transport sector is the biggest contributor of pollutants to the environment. The emissions from other sectors are fairly low, except in the case of sulphur dioxide where the industrial sector accounts for nearly 93 percent of the total emissions. It is very evident from the available statistics therefore, that air pollution in the CMA is caused by automotive emissions and should be the main target of policies and actions.

ENVIRONMENTAL AND HEALTH IMPACTS

17. The known effects of common air pollutants in excessive concentrations are numerous and cause varying afflictions. Sulphur dioxide, for instance, causes aggravation of respiratory diseases, including asthma, chronic bronchitis, emphysema, reduced lung function, irritation of eyes and respiratory tract as well as increased mortality. Oxides of nitrogen cause the aggravation of respiratory illnesses. Carbon monoxide is responsible for some reduced tolerance for exercise, impairment of mental function and foetal development, and death at high levels. Lead accumulates in body organs causing anaemia and damage to the kidney and central nervous system.

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[8]/ Please see footnote 7.

AIR QUALITY MONITORING AND STANDARDS

18. Air quality monitoring is in its infancy in Sri Lanka. Emission monitoring is minimal and is limited to ensuing conformity to the Environmental Protection Licensing (EPL) Scheme. Comprehensive emission monitoring has been, and still is, hampered by the unavailability of appropriate equipment for stack monitoring.

19. The Central Environmental Authority (CEA), the Ceylon Institute for Scientific and Industrial Research (CISIR) and the National Building Research Organization (NBRO) are now monitoring ambient air quality in the city of Colombo. The first major effort to monitor air quality began in early 1989 when the NBRO initiated its three-year Colombo Air Quality Monitoring Programme (CAMP). Phase I involved the preliminary assessment of Colombo city air quality through determination of the sulphation rate, a measure of the concentration of sulphur compounds like sulphur dioxide, sulphur trioxide, and hydrogen sulphide, and dust fall, a measure of the total settleable dust in the atmosphere. Completion of this phase has led to the identification of specific locations for year-long monitoring, for which data will soon be available. Locations showing adverse air quality will be monitored in Phase II [1992-93] to measure SPM, lead, CO, SO_2 and NO_2.

20. The CISIR has carried out a survey of major traffic junctions in the city of Colombo, measuring traffic density and pollutant emissions. Concentrations of fine dust (FD) and total suspended particulate (TSP) were determined using 8 hour sampling periods, while SO_2, CO, total hydrocarbons (THC) and lead (Pb) were measured using 3 hour sampling periods. Data obtained from this study was used to calculate the respective pollutant averages given below. These values therefore represent prevailing air quality in Colombo in dry weather periods.

TSP	466.2×10^{-3}	mg/m^3	(8 hr)
SO_2	10.14×10^{-3}	mg/m^3	(3 hr)
THC	3.9	ppm	(3 hr)
Pb	0.38×10^{-3}	mg/m^3	(8 hr)
CO	4746.0×10^{-3}	mg/m^3	(3 hr)

21. Similarly, the CEA too has carried out air quality monitoring, selecting six traffic intersections or road junctions in the Colombo city, for monitoring of CO, NO_2, SO_2, and THC. This was conducted during peak traffic hours in the morning and evening over a period of seven months. CO and NO_2 were measured for 15 minutes and extrapolated to 1 hour averages by using a factor 0.92 taken from Shell Engineering and Associates Inc., Columbia, Missouri, USA. The CEA has, with technical assistance from the Royal Netherlands Government, proposed standards for the main air pollutants in Sri Lanka. These are summarized as follows:

TABLE 4
PROPOSED STANDARDS FOR MAIN AIR POLLUTANTS IN SRI LANKA[9]

POLLUTANT	AVERAGE CONCENTRATION IN mg/m³[10]			
	1-hr	8-hr	24-hr	1-yr
Carbon Monoxide (CO)	40	10	--	--
Nitrogen Dioxide (NO_2)	0.40	--	0.15	--
Sulphur Dioxide (SO_2)	0.35	--	0.10	--
Suspended Particulate Matter (SPM)	--	--	0.30	0.1
Ozone (O_3)	0.2	--	--	--
Lead	--	--	--	0.001

22. The adjusted 1 hour values for pollutant levels indicate higher values than the draft standards prescribed by the CEA. Precise and reliable judgements, however, can only be made if year-long monitoring is conducted in accordance with standard air quality monitoring specifications and practices.

LEGAL AND INSTITUTIONAL FRAMEWORK

23. The National Environmental Act (NEA) of 1980 as amended in 1988 prohibited pollution discharge into the environment. Sections 23J and K prohibit emission of pollutants into the atmosphere. The National Environmental (Protection and Quality) Regulations of 1990 now prohibit the discharge of wastes into the environment. Discharge standards have been prescribed for liquid wastes and the Sri Lanka Standards Institution (SLSI) has prescribed emission standards for sulphuric acid plants. These regulations do not, however, address vehicular air pollution.

24. Though the NEA gives the CEA the mandate to regulate and control air pollution, little has been achieved in this area due to the lack of relevant regulations. While the Motor Traffic Act considers visible emissions an offence, it is not rigorously enforced. The impending amendments to the Motor Traffic Act will give greater authority to the Department of Motor Traffic and the Police Department to control vehicular emissions. The need for expertise and equipment is actively felt.

9/ These Standards have been developed by the CEA with the Technical Assistance from the bkh Consulting Engineering, Delft, The Netherlands.

10/ Conversion Factors:

CO	-	1 ppm	=	1.15 mg/m³
NO_2	-	1 ppm	=	1.88 mg/m³
SO_2	-	1 ppm	=	2.6 mg/m³
O_3	-	1 ppm	=	1.96 mg/m³

25. The resources available within the CEA, the Police Department and the Department of Motor Traffic are primarily for the enforcement of legal provisions of the respective laws. In the past, lack of information on the economic and environmental costs and remedies of air pollution has inhibited voluntary public response to enforcement and has impeded the implementation of existing laws as well as the development of further regulations. An increase in awareness has led to the recognition of the need for increased regulatory control and policy initiation and has, among other factors, made possible the formulation of ***Clean Air 2000 - Action Plan***.

26. The growing problem of vehicular air pollution was first recognized in 1987, when His Excellency the President, as the Hon Prime Minister and Minister of Local Government, Housing and Construction appointed a Committee of Experts to draw up plans to combat vehicular air pollution. This inter-agency group, after a careful study of the situation, made 20 recommendations covering:

a. Establishing monitoring and testing methods;
b. Stronger enforcement measures;
c. Legal instruments;
d. Enhancing institutional capacities;
e. Granting incentives for importation of fuel-efficient automobile components;
f. Promoting public awareness; and
g. Introduction of alternative fuel sources for vehicles.

GOALS

27. Having identified the transport sector as being the primary source of air pollution in the CMA, the immediate priority then becomes the reduction of vehicular emissions.

28. While vehicular emissions are considered to be the most immediate concern, emissions from stationary sources are considered to be the next level priority. The use of EIA and EPL Scheme would ensure that new stationary sources would conform to national standards, thereby limiting its impact on the environment.

29. Possible target levels of reduction by the year 2000 for each pollutant using different options are given in table 5. Key assumptions made in estimating these target levels are given in para 30 and in Annex 1.

30. Key assumptions made in these projections include:

- no emission control exists in base year 1990;
- 20 percent of all vehicles registered in Sri Lanka are off the road, and that 50 percent of the remaining vehicles are operating in the CMA;
- the average km per year per vehicle is calculated based on engine efficiencies and fuel consumption amounts by class of vehicle;
- auto diesel and petrol contain 0.8 percent sulphur and 0.45 grams/litre lead respectively;

- annual growth rates for motor cars will be 7 percent by the year 2000 as compared to the present level of 5.9 percent;
- annual growth rate for buses will be 3.5 percent by the year 2000 as compared to the present level of 3.1 percent;
- annual growth rates for motor cycles will decrease from 15 percent to 5 percent by the year 2000;
- annual growth rates for light and heavy trucks will remain the same;
- the vehicle population would have doubled by the year 2000; and
- there will be no major changes in fuel prices.

31. Reduction in air pollution associated with the various strategies have, therefore, been calculated using these key assumptions, the experiences of strategies used in other countries and the methodology described above, and is shown in table 5. Focusing on particulate emissions first, it can be seen that vehicle inspection and maintenance (I/M) programmes can begin to reduce particulate emissions significantly from the levels to which they are otherwise expected to rise by the year 2000. Further, reducing the sulphur and lead content of diesel fuel and gasoline, respectively, will lower sulphur and lead emissions dramatically. Requiring (or effectively encouraging) a portion of the urban vans to shift from diesel to gasoline engines and tightening requirements on two stroke motorcycles will have a major impact on the remaining particulate emissions, lowering them almost to today's levels. If disparities in price between petrol and diesel are decreased and appropriately equated, less diesel fuel will be used and sulphur emissions will decline; since more gasoline will be consumed, lead levels will actually increase slightly. In both these latter cases, emissions will remain below today's levels. An additional measure which would further reduce particulate emissions is the conversion of buses to compressed natural gas. While this will only have a modest effect on total emissions throughout the region, it is estimated that it would have a significant effect on some of the densely populated, high bus-use urban areas. A gradual tightening of new vehicle standards would also lower emissions and as more and more vehicles are phased in this impact will rise over time in the period beyond the year 2000.

32. Looking to gaseous emissions, table 5 illustrates that I/M would also have a significant impact on HC and CO emissions. Tight motorcycle standards, by either reducing or cleaning up two stroke engines, would have an additional benefit for HC. The conversion of selected diesel vans to petrol fuel would actually increase CO and HC emissions somewhat but these increases would be more than offset by the introduction of tighter new vehicle standards.

TABLE 5
SEQUENTIAL STEPS IN CONTROL STRATEGY

		SULPHUR	LEAD	PARTICULATE	CO	HC	NO_x
Base 1990	Tons/Yr	455	79	3,450	188,736	38,364	5,928
	%	100	100	100	100	100	100
Projected 2000 (No controls)	Tons/Yr	452	126	4,418	340,001	78,207	16,940
	%	99	159	128	170	204	286
I/M	Tons/Yr	429	120	4,197	260,095	58,876	16,940
	%	94	151	122	130	153	286
0.15 Pb/.3S	Tons/Yr	163	40	4,197	260,095	58,876	16,940
	%	36	50	122	130	153	286
Diesel Shift	Tons/Yr	147	46	3,779	299,704	63,885	17,204
	%	32	58	110	150	167	290
Motorcycle Standards	Tons/Yr	147	47	2,942	298,974	61,109	17,760
	%	32	60	85	150	159	300
Car/Truck Standards	Tons/Yr	147	47	2,617	116,351	28,710	3,607
	%	32	60	76	58	75	61
Railway Shift	Tons/Yr	123	47	2,326	110,656	27,948	3,485
	%	27	60	67	55	73	59

TARGETS

33. The objective of this Action Plan involves the reduction of all pollutants of concern to Colombo. Hence, based on a review of the available air quality data, of the available practical control options and the calculations described above, it has been concluded that the following reductions from 1990 levels should be targeted for the year 2000:

PARTICULATE	40%
CARBON MONOXIDE	40%
OXIDES OF NITROGEN	30%
LEAD	30%
OXIDES OF SULPHUR	75%
HYDROCARBONS	20%

34. The Action Plan describes various steps that can be taken to reduce air pollution emissions from motor vehicles. Specific elements of the Action Plan designed to address each pollutant is outlined in the subsequent pages and is based on the consensus reached at different consultation sessions during the Short-course on Air Quality Management held in Colombo from July 6 to 10, 1992.

1 VEHICLE INSPECTION AND MAINTENANCE (I/M)

ISSUE:

In Sri Lanka, vehicles in use have consistently been found to emit pollutants well in excess of their design capabilities. Causes include poor maintenance, deliberate tampering or misfuelling in a (usually futile) attempt to improve performance or fuel economy, and poor vehicle durability. Experience further suggests that all vehicles perform better after being maintained and adjusted.

At present there are no comprehensive vehicle inspection and maintenance (I/M) regulations in Colombo. The benefits to be gained from a more rigorous and structured I/M programme are numerous. not costly and could possibly result in a net saving for the individual consumer and the public.

Measures to promote awareness among motorists and fleet owners on the benefits of regular vehicle maintenance is an important element in the successful implementation of the I/M programme. Further measures to be gradually undertaken are outlined below and include introducing smoke meters, initiating voluntary inspection, and tightening inspection standards.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Introduce Smoke Meters to Police	1992-93	CEA/Police/CMT
b. Develop, construct and operate Vehicle Testing Centre for I/M Program; Promote private sector participation in I/M Program	1993-94	CMT
c. Demonstrate the actual cost and pollution reduction resulting from engine tune-up	1993	CPC
d. Promote Awareness among motorists and fleet owners on the benefits of regular vehicle maintenance	1992 onwards	CEA/CMT
e. Initiate Voluntary Inspections	1995-96	Police/CMT
f. Tighten Inspection Standards	1996-97	Police/CMT

2 FUEL REFORMULATION, PRICING AND FLEET MIX

ISSUE:

The transport sector acounting for 15 percent of Sri Lanka's energy consumption uses 91.3 percent of diesel and 87.5 percent of petrol. With the projected growth rates of this sector the fuel consumption will also increase correspondingly. The Ceylon Petroleum Corporation, which is the only manufacturer of petroleum products imports crude oil from oil producing nations and refines them locally. At present, sulphur content and lead content is maintained between 0.1 and 1.1 percent in diesel and at 0.24 grams per litre (average) or 160 tons per year in petrol respectively. The octane rating is 90 and 93 for two grades of gasoline.

Addition of lead to gasoline is done at the marketing stage. This is done to achieve a high octane number to prevent vehicles from knocking. Sulphur is present to a greater or lesser degree in all crude oils and, as a result of the distillation process, some sulphur compounds which boil in the same range are present in streams used for diesel fuel blending. During combustion in the engines they burn to form acidic by-products (sulphur dioxides, trioxides). The gases will have an influence on exhaust odour, while the sulphates will contribute to particulate.

Solving the lead problem involves merely not adding lead to gasoline. However, as a result of such a transition, the gasoline must be further refined at the refinery to achieve the same octane level, or other less harmful additives will need to be substituted. Reducing lead in petrol will extend spark plug life and increase the interval necessary for oil changes. In addition, exhaust system and muffler life will be extended. Over the life of a vehicle, therefore, the cost to the consumer of switching completely to unleaded petrol should be virtually nil or even a net saving. It is important to note, however, that refineries are unlikely to phase out lead unless national economic balance permits.

The technology for reducing the sulphur levels in diesel fuel is well understood - essentially additional hydro-desulphurization at the refinery. It has been estimated that low sulphur fuel can increase the price of diesel fuel by a small amount. Partially offsetting this increased price is the increased engine durability which is likely to occur since the acids which form in the lubricating oil as a result of the sulphur in the fuel are a significant cause of engine wear.

Actions proposed under this section include, initially, the undertaking of a study to survey the demand for unleaded gasoline and subsequently the freezing of total lead addition to gasoline and reducing lead additives to 0.15 grams per litre, while ensuring that the total mass addition is maintained at or below present levels. Also recommended is the gradual expansion of hydrosulphurization capacity, resources permitting.

With the present pricing policies, which subsidises diesel fuel, it has been found that there is a greater shift towards the importation of diesel vehicles since 1990. Hence the Action Plan incooperates a component to discourage the shift to diesel vehicles by analyzing the diesel fleet make-up and the possible use of alternative pricing structure to achieve a lower diesel share with minimal social cost, and eventually implementing this alternative pricing structure.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
LEAD IN PETROL		
a. Survey the demand for unleaded gasoline and implement findings in stages. If viable, achieve 30% target of unleaded gasoline by 2000.	1993	CPC
b. Freeze total lead addition to gasoline at present levels of 160 tons per year regardless of increses in volume of demand	1992	CPC
c. Reduce lead additives to 0.15 grams per litre, while ensuring that the total mass addition is maintained at or below present levels	1995	CPC
d. Conduct a study on the economic feasibility and the needs for oxygenates	1994	CPC
REDUCE DIESEL PROPORTION OF VEHICLE MIX		
e. Analyze diesel fleet make-up	1993-94	TSPC
f. Analyze alternative pricing structure to achieve lower diesel share with minimal social cost, while protecting public transport and carriage of goods and services	1994-95	MoF/TSPC/CPC
g. Start to phase in revised pricing structure	1995-96	MTH/CPC
h. Complete phase-in	1998-99	MTH/CPC
SULPHUR IN DIESEL FUEL		
i. Expand hydrodesulfurization capacity (lower average to 0.5S) to enable island-wide supply if refinery economics permit and the availability of gasoline	1995-96	CPC
j. Further expand Hydrosulfurization (Lower average to 0.3S)	1998-99	CPC

3 EMISSION INVENTORY AND MONITORING

ISSUE:

Ad hoc studies have been done in the past to inventorize emission from mobile and stationary sources and status of ambient air quality. Emissions from petroleum combustion sources have been estimated from petroleum consumption data and emission factors as shown in table 3. The CEA, NBRO and CISIR have also conducted air quality monitoring programmes in and around the city of Colombo but have not completed any comprehensive emission inventorization.

At present, monitoring is done on a need basis and not on a regular basis. Hence emission and monitoring data is not published periodically. The Transport Statistics in Sri Lanka publishes annual statistics related to the transportation sector but is insufficient to develop a reliable database. Inventorizing also needs to incorporate various other statistics like meteorological, geographical, population and health data which are crucial elements of the emission inventory.

The Action Plan suggests measures that have to be taken to achieve this objective and these are outlined below.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Inventorize mobile and stationary sources of air pollution as given above	1992 continuous	CEA/CISIR/ NBRO/CEB
b. Document in the publication TRANSPORT STATISTICS IN SRI LANKA, the annual pollution load estimations from the transport sector	1993 onwards	TSPC
c. Expand the present monitoring programme to cover the Colombo Metropolitan Area and annually publish trend data	1993	NBRO/CISIR/ CEA
d. Establish reliable and acceptable monitoring systems and co-ordinate the present monitoring activitie of CEA, NBRO and CISIR and establish a central database with publication of annual trend data	1994	CEA
e. Upgrade laboratory and data processing facilities at CISIR, NBRO and CEA	1992-93	MEPA/MEIP

4	STANDARD SETTING

ISSUE:

So far, no air quality standards for commercial energy generation and utilization have been developed in Sri Lanka. This task may have to be embarked upon soon in view of the provisions in the legislation. Section 23 J of the National Environmental (Amendment) Act of 1988 stipulates that discharge or emission of waste into the atmosphere should be in accordance with standards and criteria prescribed under the Act. Further, Section 23 K prescribes the actions (bringing of waste, gaseous emissions from stationary and mobile sources, etc.,) that may be considered to contravene the provisions of the Act and also spells out the penalties in the event of an offence.

There are two types of air quality standards - emission and ambient. Emission standards prescribe the levels to be maintained at the polluting source, and is often based on the features and characteristics and the sensitivity of the location of the source. Ambient standards usually specify permissible concentrations of pollutants in a particular area at any given time. The main criteria that are considered while developing such standards are their ability to protect public health, eco-systems property and economic values to desired levels.

Developing national Ambient Air Quality Standards requires an intensive monitoring programme and a reliable database. The development of this programme has also been recommended in the Action Plan. Also proposed in the Action Plan is the formulation and implementation of various standards for stationary and mobile sources of air pollution.

RECOMMENDED ACTION	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Formulate ambient standards beginning with Colombo Metropolis	1992-93	CEA
MOTOR VEHICLES		
b. Formulate standards for emissions from vehicles, beginning with standards for 2-stroke motor cycles	1993-94	CEA/CMT/Police
c. Formulate engine specification standards for import of vehicles based on combustion efficiency, power, fuel efficiency, etc. E.g. Require imported vehicles to meet standards (for the given model) in the export country	1994-95	CMT
d. Conduct a study on the feasibility on the use of alternate fuels for public transport	1994	TSPC
INDUSTRIAL UNITS AND POWER PLANTS		
e. Study the economic, social and environmental costs of introducing pollution control equipment in existing power plants and industrial units to achieve pollution reduction by 30% in 1995, and 70% in 1998.	1992-93	MIST/CEA/CEB
f. Set emission and operating standards, based on the above	1994	CEA
g. Phase-in pollution control limits in individual units	1995	MIST/CEA
h. Complete phase-in	1998	MIST/CEA/CEB
i. Formulate emission standards for new industrial facilities and proposed power plants	1993	CEA

5 INSTITUTIONAL FRAMEWORK AND REGULATORY COMPLIANCE

ISSUE:

The National Environmental Act of 1980 as amended in 1988 prohibits pollution discharge into the environment. Sections 23J and K prohibit the discharge of wastes into the environment. Vehicular pollution, however, has not been addressed in the existing regulations.

The CEA is charged with establishing and enforcing pollution laws through regulatory instruments, which, in the case of vehicular pollution, is the Motor Traffic Act, the principal legislative document with vehicular pollution. The enforcement of this Act is carried out by the Department of Motor Traffic and the Police Department.

The appropriate delegation of institutional responsibility is central to the successful implementation of **Clean Air 2000 - Action Plan**. The existing institutions dealing with urban air pollution control will be called upon to play varying roles ranging from policy-making to air quality monitoring, together with enforcing laws, ensuring regulatory compliance and undertaking research and development of technology for air pollution control. The functional linkages between the many institutions dealing with environmental management have been studied and the importance of their coordination duly noted. The National Environmental Steering Commitee, as the multi-agency policy-making grouping, will provide the opportunity for these different institutions to interact throughout the implementation of this Action Plan. This Committee will also interface with support from external agencies.

Actions proposed include the establishment of an institutional framework, outlined below, to manage air pollution in the Colombo Metropolitan Area. Also proposed are related institutional changes which are described in detail below.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Establish the following institutional framework: MEPA - International co-operation and environmental policy; Co-ordination of the implementation of **Clean Air 2000** with CEA assistance; NESC - Inter-ministerial and cross-sectoral policy initiatives; Monitoring of implementation of **Clean Air 2000**; CMT - Vehicle I/M activities, through delegated authority to Provincial Councils; CEA - Standard setting for all sources, regulatory compliance for stationary sources, central database for air quality status and trends; Traffic Police - Enforcement of regulatory compliance for mobile sources; NBRO and CISIR - Ambient air quality and source emission monitoring, technology development and modelling; MEIP of MPPI - Co-ordination and monitoring of the implementation of **Clean Air 2000** through NESC.	1992	NESC
b. Expedite the enactment of regulations under the Motor Traffic Act, to include engine condition as a criterion for the issuing of a Fitness Certificate for the purpose of obtaining a Revenue License. This should be linked to 1 and 2.	1992	CMT/ Traffic Police
c. Enact/strengthen regulations under the Motor Traffic Act to make belching of smoke by vehicles a punishable offence.	1992	CMT/Traffic Police (thro' delegation)
d. Develop the infrastructure and facilities for regular smoke and pollution checks.	1993-2000	CMT
e. Begin enforcing the above	1993	Traffic Police

INSTITUTIONAL FRAMEWORK AND REGULATORY COMPLIANCE (contd...)		
RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
f. Strengthen Police Department (Traffic) through appropriate training programmes to enhance their capacities to strictly enforce the above	1993-1996	Traffic Police
g. Develop capacities at the CEA to serve as a referral laboratory 1992 onwards	1992-1993	CEA
h. Strengthen laboratory facilities and capabilities at the CISIR, NBRO and CEA to monitor ambient air and source emissions	1992-94	NBRO/CISIR/ CEA/MEIP
i. Require CISIR to undertake research on developing appropriate technologies for air pollution control	1993	CISIR
j. Require NBRO to develop air quality monitoring and modelling systems	1994	NBRO
k. Enact legislation to require imported vehicles to meet the standards (for the given model year) in the export country	1995	CMT/Police

6 ECONOMIC INSTRUMENTS

ISSUE:

Lack of information on the economic and environmental costs related to air pollution has been the primary reason behind the relatively scarce use of economic instruments in this area. Increased awareness of the costs of vehicular pollution and the options available using economic instruments has led, recently, to the innovative use of these tools.

Actions proposed inlcude, for the present, the introduction of higher penalities for belching vehicles and lower duties for importation of essential spare parts required for vehicle inspection and maintenance and for the immediate future, the study of differential annual licensing fee for a pricing mechanism for diesel-powered buses and trucks, diesel-powered cars and petrol-powered vehicles and the review of the possible use of different forms of duty and taxes for importation of new and reconditioned vehicles linked to polluting potential.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Introduce higher penalties for belching vehicles	1992	CMT/Police
b. Lower duty for importation of essential spare parts required for Vehicle I/M	1993	MoF
c. Study differential annual licesing fee for a pricing mechanism (taxes, duties, etc.,) for diesel-powered buses and trucks, diesel-powered cars and petrol-powered vehicles	1994	MTH/MoF
d. Implement recommendations of above, if acceptable	1995 onwards	MTH/MoF
e. Review and rationalize duty and taxes for importation of new and reconditioned vehicles linked to polluting potential	1996	MTH/MoF

7 TRANSPORTATION PLANNING AND TRAFFIC MANAGEMENT

ISSUE:

With the rapid increase, in the past few decades, of the population of Colombo and its surrounding urban areas, the number of vehicles on the road have also greatly increased lending to growing traffic congestion problems. With this vast increase in the number of vehicles on the road, the total road network length has not changed, the result of which is a growth in the number and length of trips, worsening traffic congestion. Congestion results in falling traffic speeds and consequently leads to the deterioration of ambient air quality. The growing phenomenon of urban sprawl is an important factor in increased traffic congestion. The linkages between urban growth and transport should therefore be a central element of a rational urban development strategy.

Actions proposed include the undertaking of a study incorporating landuse and locational factors in metropolitan transport planning, and the implementation of an already completed study on improving traffic flow and improved transportation planning.

RECOMMENDED ACTIONS	IMPLEMENT'G PRIORITY	IMPLEMENT'G AGENCY
a. Implement the study recommendations already completed on improving city traffic flow and improved transportation planning	1992-2000	MTH
b. Study and incorporate landuse and locational factors in Metropolitan transport planning	1992-2000	MTH/UDA/ CMC/WPC/ TSPC
c. Conduct a comprehensive study to investigate a long-term air pollution management program covering the Action Plan components	1993-94	CEA

ANNEX I

KEY ASSUMPTIONS:

EMISSION FACTORS

Vehicle Mode	Number 1990	Km/Yr/Vehicle	Emission Factors (g/Km) CO	HC	NOx	Particulate	Sulfur %	Lead% Emitted	MPG
Passenger Cars	54408	15000	62	8.3	2	0	0.95	0.75	19
2Stroke MC	62677	7451	32	1.2	0.2	1.3	0.95	0.75	49
4Stroke MC	94016	7451	31	8.2	1	0	0.95	0.75	37.7
Taxis	10000	50000	62	8.3	2	0	0.95	0.75	19
Buses	15925	54000	12.4	3.7	9.4	1.5	0.95	0.75	5
Lorries									
Light	48115	25114	1.9	0.7	1.4	1	0.95	0.75	16.3
Heavy	744	38000	12.4	3.7	9.4	1.5	0.95	0.75	5

Fuels

Lead in Petrol	0.45	g/litre
S in Petrol	0	
S in Diesel	0.8	%

Key:
- Km/Yr/Vehicle - Kilometre per Year per Vehicle
- g/Km - grams per kilometre
- MPG - Miles per Gallon
- 4S - 4 Stroke Engines
- 2S - 2 Stroke Engines

COLOMBO VEHICLE POPULATION

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Passenger Cars	64408	68238	72368	76824	81636	86834	92456	98538	105124	112262	120002
Bus	15925	16424	16934	17456	17988	18532	19680	20310	20910	20980	21693
Light Goods Vehicles	4811..	49428	46303	50776	52162	53586	55047	58092	59677	61306	62978
Heavy Goods Vehicles	744	744	744	744	744	744	744	744	744	744	744
Motorcycle 4S	94016	108118	123255	139278	155991	173150	190465	207607	224215	239910	254305
Motorcycle 2S	62677	72079	82170	92852	103994	115433	126977	138405	149477	159940	169537
Motorcycle	156693	180197	205424	232129	259985	288583	317442	346011	373692	399851	423842
TOTAL	285884	315030	341774	377930	412515	448279	485369	523696	560147	595142	629259

ANNUAL GROWTH RATES

CAR	5.9%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9 %	7.0%
BUS	3.1%	3.1%	3.1%	3.1%	3.1%	3.0%	3.1%	3.2%	3.3%	3.4%	3.5%
LIGHT TRUCK	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
MOTORCYCLE	15.0%	14.0%	13.0%	12.0%	11.0%	10.0%	9.0%	8.0%	7.0%	6.0%	5.0%
HEAVY TRUCK	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

PERCENTAGE OF POPULATION BY VEHICLE CATEGORY

Passenger Car	22.5%	21.7%	20.9%	20.3%	19.7%	19.3%	10.0%	18.8%	18.8%	18.9%	19.1%
Goods Vehicle	17.1%	15.9%	14.9%	13.9%	13.1%	12.4%	11.8%	11.2%	10.8%	10.4%	10.1%
2S Motor Cycle	32.9%	34.3%	35.6%	36.7%	37.7%	38.5%	39.2%	39.7%	40.1%	40.3%	40.4%
4S Motor Cycle	21.9%	22.9%	23.7%	24.5%	25.1%	25.7%	26.1%	26.5%	26.7%	26.9%	26.9%
Buses	5.6%	5.2%	4.9%	4.6%	4.3%	4.1%	3.9%	3.8%	3.6%	3.5%	3.4%
	1	1	1	1	1	1	1	1	1	1	1

TOTAL NATIONAL VEHICLE POPULATION BY CLASS OF VEHICLE

CLASS OF VEHICLE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990*
CARS	114443	119826	124830	129630	134110	140570	146811	139027	145987	154176	128815
TAXIS	6430	6430	6827	7223	7620	8017	8413	8810	9207	9603	10000
MOTORCYCLES	79803	96851	107545	121840	138632	161373	187717	213441	240869	307392	313386
BUSES	20752	23092	26172	30438	34681	38309	40214	37064	37977	38603	31850
LIGHT TRUCKS	56461	64137	70390	78426	86430	94589	101298	102049	107052	112390	96230
HEAVY TRUCKS	1609	1666	1680	1688	1702	1717	1754	1800	1817	1841	1489
LORRIES	58070	65803	72070	80114	88132	96306	103052	103849	108869	114231	97718
TOTAL	279498	312002	337444	369245	403175	444575	486207	502191	542909	624005	581769

PERCENTAGE OF POPULATION BY VEHICLE CATEGORY

CLASS OF VEHICLE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
CARS	40.9%	38.4%	37.0%	35.1%	33.3%	31.6%	30.2%	27.7%	26.9%	24.7%	22.1%
TAXIS	2.3%	2.1%	2.0%	2.0%	1.9%	1.8%	1.7%	1.8%	1.7%	1.5%	1.7%
MOTORCYCLES	28.6%	31.0%	31.9%	33.0%	34.4%	36.3%	38.6%	42.5%	44.4%	49.3%	53.9%
BUSES	7.4%	7.4%	7.8%	8.2%	8.6%	8.6%	8.3%	7.4%	7.0%	6.2%	5.5%
LIGHT TRUCKS	20.2%	20.6%	20.9%	21.2%	21.4%	21.3%	20.8%	20.3%	19.7%	18.0%	16.5%
HEAVY TRUCKS	0.6%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
LORRIES	20.8%	21.1%	21.4%	21.7%	21.9%	21.7%	21.2%	20.7%	20.1%	18.3%	16.8%

ANNUAL GROWTH RATES

CARS	4.7%	4.2%	3.8%	3.5%	4.8%	4.4%	5.3%	5.0%	5.6%	5.9%
TAXIS	0.0%	6.2%	5.8%	5.5%	5.2%	4.9%	4.7%	4.5%	4.3%	4.1%
MOTORCYCLES	21.4%	11.0%	13.3%	13.8%	16.4%	16.3%	13.7%	12.9%	27.6%	27.4%
BUSES	11.3%	13.3%	16.3%	13.9%	10.5%	5.0%	7.8%	2.5%	1.6%	3.1%
LIGHT TRUCKS	13.6%	9.7%	11.4%	10.2%	9.4%	7.1%	0.7%	4.9%	5.0%	2.7%
HEAVY TRUCKS	3.5%	0.8%	0.5%	0.8%	0.9%	2.2%	2.6%	0.9%	1.3%	0.0%
LORRIES	13.3%	9.5%	11.2%	10.0%	9.3%	7.0%	0.8%	4.8%	4.9%	2.7%

* Figure after deducting the 200,000 vehicles considered to be off the road.

NATIONAL ENVIRONMENTAL STEERING COMMITTEE

Composition of the Committee

Mr R Paskaralingam, Secretary Ministry of Policy Planning and Implementation	-	Chairman
Dr D Nesiah, Secretary Ministry of Environment and Parliamentary Affairs	-	Co-Chairman
Mr A R M Jayawardena, Secretary Ministry of Transport and Highways	-	Member
Mr A S Jayawardena, Secretary Ministry of Industries, Science and Technology	-	Member
Mr W D Ailapperuma, Secretary Ministry of Housing and Construction	-	Member
Mr N V K K Weragoda, Secretary Ministry of Fisheries and Aquatic Resources	-	Member
Mr Dixon Nilaweera, Secretary Ministry of Agricultural Development and Research	-	Member
Mr Ackiel Mohamed, Secretary Ministry of Power and Energy	-	Member
Mr D G Premachandra, Secretary Ministry of Lands, Irrigation and Mahaweli Development	-	Member
Mr M N Junaid, Secretary Ministry of Public Administration, Provincial Councils and Home Affairs	-	Member
Mr S A Jinadasa, Addl Secretary to the President and Addl Director, Urban Programme Unit	-	Member
Dr V Ambalavanar, Addl Secretary to the President and Director General National Building Research Organization	-	Member
Dr Lloyd Fernando, Addl Secretary/PPI & Director General of National Planning	-	Member
Mr V K Nanayakkara, Secretary to the Minister of Environment	-	Member
Mr Raja Kuruppu, Secretary to the Minister of State for Finance	-	Member
Mr G K Amaratunga, Chairman Central Environmental Authority	-	Member
Mr S W P Bulankulame, Chairman Urban Development Authority	-	Member
Mr Lakshman R Watawala, Director General Greater Colombo Economic Commission	-	Member
Mr Ranjit Fernando, General Manager National Development Bank	-	Member
Mr P Illangovan, National Programme Co-ordinator for Metropolitan Environmental Improvement Programme	-	Secretary