

Vision

Clean Air for a Healthy Nation

Mission

Maintain air quality at desirable levels by minimising emission of harmful air pollutants resulting from all human activities through an effective stakeholder participatory mechanism



Air Resource Management Centre
No: 980/4 A, Wickramasinghe Place,
Ethul Kotte, Kotte, Sri Lanka.
Tel: +94 112 888 248
E-mail: eeconga@yahoo.com

CLEAN AIR 2025

An Action Plan for Air Quality Management



Ministry of Mahaweli Development & Environment

May 2016

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Maintain air quality at desirable levels by minimising emission of harmful air pollutants resulting from all human activities through an effective stakeholder participatory mechanism

Compiled and Edited by

Mr.Anura Jayatilake
Mr.R.N.R.Jayarathna

Contributed by

Dr.D.S.Jayaweera
Dr A.G.T.Sugathapala
Dr.R.L.Wijemuni
Dr.M.M.S.S.B.Yalegama
Mr.A.W.Disanayake
Mr.H.D.S.Premasiri
Ms Janani Palliyaguru
Ms Gayani Galabada Arachchi
Mr.Sampath Ranasinghe
Mr.Ruwan Weerasooriya
Mr Nanda Senarathna
Ms Kasuni Anuranga
Ms Upamili Jayasumana

Secretariat

Air Resource Management Centre
Ministry of Mahaweli Development & Environment
No 980/4A, Wickramasinghe Place,
Ethul Kotte.

FOREWORD

Studies shows that more than 800,000 people die prematurely every year due to illnesses caused by outdoor air pollution worldwide. More than 150,000 of these deaths are recorded in South Asia alone. Root cause for variety of illnesses happened to be air pollution. These illnesses include cancers, respiratory diseases such as bronchial asthma, chronic bronchitis and cardio vascular diseases such as heart attacks and hypertension.

In Sri Lanka air pollution is an increasing problem due to rapid expansion in the industrial and commercial sectors and expanding living standards of the population following the country's economic growth. Expansion of major urban centres, rapid increase in the usage of motor vehicles and economic activities resulting more and more usage of fossil fuel has aggravated this issue.

In Colombo City alone the transport sector itself is contributing around 55-60% to the air pollution. The thermal power plants and other industrial activities established within the Colombo Metropolitan Area (CMA) have a direct linkage to this issue. The situation of Kandy City located in a valley has a significant air pollution issue which needs special attention. Other cities such as Kurunegala, Nuwara Eliya, Anuradhapura, Galle also has to be looked carefully due to increasing vehicle population and industrial development activities taking place in the country.

Indoor air pollution is another area of major concern due to high level of biomass use in domestic cooking in poorly ventilated sub-urban and rural kitchens and other related activities in household such as smoking, use of perfumes and scents, mosquito coils. Further air quality in new development initiatives i.e. underground shopping centres, underground parking, tunnelling etc also have to be carefully looked into. In addition open burning of waste consisting of plastics and polythene also pose a greater threat to public health mainly to young children, pregnant and feeding mothers who will be exposed to these pollutants mainly dioxins and furans which are classified as persistent organic pollutants.

In present scenario, Air quality monitoring in the country is generally weak. In the densely populated and rapidly urbanizing Colombo City there is only one station consistently monitoring air quality. Air quality monitoring in other regional cities such as Kandy, Anuradhapura, Puttalam and Kurunegala is very limited and most often ad hoc. Further, indoor air quality monitoring is virtually non existing in Sri Lanka.

The overall vision of Clean Air 2025 is to reduce urban, industrial and indoor air pollution and maintain air quality at desirable levels minimising emission of harmful air pollutants. This is to be achieved through an effective stakeholder participatory mechanism and ensuring source identification, quantification and monitoring of harmful air pollutants along with an appropriate regulatory framework. Further it recognises the need for research and development and capacity building in air quality management (AQM) assisted by sub-regional, regional and global linkages. Also important is raising public awareness on air pollution, its health and other impacts and actions taken to address related issues.

AirMAC as the main coordinating institution of all the AQM activities in Sri Lanka, has the enormous responsibility of carrying forward the tasks identified in this Action Plan and monitoring the progress. Further this document needs reviewing on a regular basis to incorporate latest developments and world trends in AQM.

Udaya R. Seneviratne
Secretary

Ministry of Mahaweli Development and Environment

Action plan for Air Quality Management

Objectives

- To develop and establish a national multi-stakeholder platform for formulation and coordination of all air quality improvement and management programs
- To ensure source identification, quantification, monitoring and reduction of harmful air pollutants through implementation of identified programmes in association with all stakeholders
- To formulate, strengthen and implement an appropriate regulatory framework for ensuring effective air quality management
- To undertake research and development and capacity building programs for Air Quality Management
- To establish linkages with sub-regional, regional and global air quality management initiatives
- To create public awareness on air pollution, its health and other impacts and actions taken to address related issues
- To ensure adequate financial resources through formal and innovative financing mechanisms for air quality management

TARGETS (COLOMBO FORT)

Pollutants	Annual Average (2015)	Target
PM ₁₀	63 µg/m ³	50 µg/m ³
SO ₂	0.007ppm (Max. 01hr average (0.135ppm))	Further reduce
NO ₂	0.018ppm (Max. 01hr average 0.085ppm)	Further reduce

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2. The National Environmental Amendment Act No 53 2000
3. The National Environmental (Protection and Quality) Regulations, 1990
4. Regulations on National ambient air quality standards for Sri Lanka, gazetted under the National Environmental Act No 47 of 1980
5. The Environmental Impact Assessment (EIA)/ IEE regulation, 1993 gazetted under the National Environmental Act No 47 of 1980
6. Clean Air 2000 Action Plan prepared under Metropolitan Environment Improvement Project (MEIP)
7. Clean Air 2015 Action Plan prepared by AirMAC

ABRAVATIONS

AirMAC	Air Resource Management Centre
BOI	Board of Investment
CEA	Central Environment Authority
CMC	Colombo Municipal Council
CPC	Ceylon Petroleum Cooperation
CARP	Council for Agricultural Research Policy
CPA	Centre for Policy Alternatives
DMT	Department of Motor Traffic
DoA	Department of Agriculture
DoA	Department of Archaeology
ERD	Department of External Resources
GSMB	Geographical Survey & Mining Bureau
IOC	Indian Oil Company
ITI	Industrial Technology Institute
KMC	Kandy Municipal Council
LA	Local Authorities
MoMD&E	Ministry of Mahaweli Development and Environment
MOT	Ministry of Transport
MOF	Ministry of Finance
MoM&WD	Ministry of Megapolis and Western Development
MoPC&LG	Ministry of Provincial Council and Local Government
MOI	Ministry of Industries
MOH	Ministry of Health
MoPRD	Ministry of Petroleum Resources Development
MoP&RE	Ministry of Power & Renewable Energy
MoS&T	Ministry of Science & Technology
MET	Department of Metrology
MoNP&EA	Ministry of National Policies and Economic Affairs
MoS,T&R	Ministry of Science, Technology and Research
NBRO	National Building Research Organization
NCPC	National Cleaner Production Centre
NPD	National Planning Department
NSF	National Science Foundation
PRDA	Provincial Road Development Authority
RDA	Road Development Authority
SEA	Sustainable Energy Authority
SACEP	South Asia Co-operative Environment Programme
UDA	Urban Development Authority
UNEP	United Nations Environment Programme
VET Fund	Vehicle Emission Testing Fund

1. AIR POLLUTION IN SRI LANKA

1.1 INTRODUCTION

Air is an essential basic need of all of living beings. Since air is abundantly available, in the past it was not treated as a resource in the same manner as land and water. However, air pollution has now been identified as a growing problem in Sri Lanka as in most other countries in the world. This is mainly due to rapid motorization and industrialization. Rapid motorization has led to large increase in vehicle fleet from 1991 to 2015. The active vehicle population in Sri Lanka amounts to 3,660,685 at the end of year 2015, out of which 45% is motor cycles and 14% three wheelers. Also the general trends in energy consumption show increase in petroleum consumption compared with other renewable sources such as bio-fuels and hydropower.

The atmospheric pollution has been highest in the Greater Colombo area, where a significant proportion of the country's population resides, and most of the industrialization has occurred. The transport sector is contributing about 60% to the air pollution especially in the Greater Colombo Area. Due to its topography, Kandy City (located in a valley) has been revealed to have worse air quality than Colombo. The air quality levels in other major urban centres such as Kurunegala, Anuradhapura, Nuwara Eliya, Galle etc are also should be carefully examined due to increased number of vehicles and establishment of industrial activities in these urban centres and periphery.

Air quality in certain urban areas has deteriorated to such an extent that the human health is being threatened. Intensive use of petroleum products, especially gasoline-driven vehicles has made the control of air pollution difficult. Diesel and gasoline combusted in vehicles are major sources of air pollution, releasing a number of pollutants into the air which then build up to harmful levels in cities with high-density traffic. These pollutants mainly consisting of carbon monoxide, nitrogen oxides, hydrocarbons, and lead have reduced the quality of life in these cities.

Further, the rapid economic development and associated higher levels of energy consumption also caused significant levels of air pollution in the cities. The impact of this is aggravated by the fact that the development of industrial and residential areas are completely unplanned within most of these cities with housing is located by the side of industrial installations and vice versa. These haphazard development activities have exposed the population in these cities to increased risk of air pollution not only from burning fossil fuels but also from industrial accidents.

Air pollution can occur from both from stationary as well as mobile sources. Major stationary sources are those in the industrial and domestic sectors. Even to date fuel-wood dominates as the cooking fuel in Sri Lanka with more than 75% of the households using it as the fuel. Other energy sources used for cooking in the domestic sector are liquefied petroleum gas (LPG), electricity and kerosene. Further industrial installations also use energy sources such as fuelwood, gas, diesel and fuel oil to fulfil their energy requirements. All these result in localized air pollution, which in turn affects the local population.

Air quality monitoring in Sri Lanka has focused mainly to the Colombo City where most of the economic and urbanization activities are centred. Air quality monitoring in other regional cities such as Kandy, Anuradhapura, Puttalam, Kurunegala etc. are very limited or has been carried out for specific reasons , research purposes etc.

Recent studies reveal that indoor air quality, open burning of waste and related impacts needs more and more attention. Indoor air quality monitoring is very limited when compared with the urban (ambient) air quality monitoring in Sri Lanka. Even though Lead has been eliminated from gasoline in 2003, presence of Lead in paints is still a cause for indoor air pollution. In addition, the use of biomass for cooking in poorly ventilated kitchens, open burning of waste/plastics and polythene at household level continues to be a major factor in domestic and indoor air pollution.

1.2 INDUSTRY SECTOR

Within the last decade industrial activity in Sri Lanka has grown at a relatively rapid pace. Most of the manufacturing sector industries are concentrated in Kandy, Gampaha and Colombo districts. Air pollution due to industrial sources has proportionately increased with the expansion of the industrial sector. Air pollutants from these industries include suspended particulate matter (SPM), carbon dioxide, oxides of sulphur and nitrogen.

Air pollution problem arises in Sri Lanka from industrial activities mainly due to unavailability of air pollution control measures and disregarding environmental problems at the planning stage. Most industries, which were established prior to 1980, use outdated technology without proper pollution control measures incorporated. Many of these industries do not have the resources to adopt new technology or pollution control equipment and lack physical space for installation of pollution control devices.

Commonly used fuels in the Industrial sector include electricity, furnace oil, diesel, firewood and coal used in power plants. Emission of Carbon dioxide occurs in various industrial processes including cement and lime manufacture, petroleum refining and handling, power generation and activated carbon manufacture.

The air pollutants from industries can be categorized into two types -emissions associated with processing of raw materials (eg cement dust, lead particulates from lead smelting furnaces, acid fumes and mist from acid processing plants) and emissions from energy generation processes (i.e. in furnaces and boilers). While urban industries are mostly confined to fossil fuel, agro-industry and certain manufacturing industries in rural areas mostly use biomass based sources of energy.

1.3 TRANSPORT SECTOR-VEHICULAR EMISSIONS

Emissions of Carbon monoxide (CO), hydrocarbons (HCs) and oxides of nitrogen (NO_x) from mobile sources have an adverse impact on human health. In addition to their direct impacts, they are precursors to the formation of secondary pollutants (e.g. photochemical smog and acid rain) which again impact public health and the environment. Reactions of NO_x and HCs with hydroxyl radicals in the presence of ultraviolet light lead to the formation of Ozone (O₃, a principal component of photochemical smog) in the lower atmosphere. The majority of urban NO_x emissions in the United States are from mobile sources and data from the eastern United States indicate that nearly 30 - 40% of acid rain is due to nitric acid. Carbon monoxide, like ozone and NO_x, is also a respiratory irritant regulated as a criteria pollutant by the United States Environmental Protection Agency (USEPA). Most often, smoke particulates also contain toxic materials that are very harmful to the public health and increase mortality.

Automobile exhaust is identified as a major source of air pollution in Sri Lanka. Rapidly increasing vehicle population and fuel consumption, particularly diesel, high proportion of old and reconditioned vehicle usage in transportation and poor vehicle maintenance, usage of cheaper oil to reduce cost and high rate of urbanization are contributing factors to high pollution levels in Sri Lanka.

However usage of electric and hybrid vehicles in recent years has contributed to maintain urban air quality levels within reasonable levels even with the increasing number of vehicles on the road. Still urban air quality levels in our major cities mainly Colombo is above the gazetted ambient air quality level. Therefore measurement of these constituents in automobile exhaust is important in urban air quality control, human health impact assessment and environment pollution assessment.

Existing evidence has shown that the urban environment of Colombo is heavily contaminated with vehicular emissions. Many studies undertaken by regulatory agencies and researchers clearly indicate that inefficient combustion of petroleum fuels in motor vehicles is the primary cause of growing air pollution in Colombo, the largest metropolitan area with nearly 50% of the vehicle population is concentrated and 30% of the nation's human population dwells.

The observed lead (Pb) (till 2003), total suspended particulates (TSP), sulphur dioxide (SO₂), and ozone (O₃) levels are significantly higher than the levels recommended by the World Health Organization (WHO) and the Central Environmental Authority (CEA) of Sri Lanka. It has been found that among the major sectors contributing emissions of air pollutants to the atmosphere from petroleum-derived combustion sources (transport, industry, power and domestic) approximately 75% of SPM, NO_x, HC, CO originates from the transport sector.

1.4 DOMESTIC SECTOR AIR POLLUTANTS

In developing countries like Sri Lanka indoor pollution comes mainly from burning of biomass fuels such as wood and agricultural waste used in domestic cooking. Indoor air pollution due to usage of various building materials, biomass and other fossil fuels such as kerosene, LPG and diesel constitutes many elements. They are nitrogen dioxide, carbon monoxide, radon, formaldehyde, asbestos, mercury, man-made mineral fibres and volatile organic compounds, and health damaging organisms such as bacteria. Domestic air pollution problem is aggravated when there is no proper ventilation in the cooking environment.

In addition open burning of solid waste has also contributed to our domestic air pollutants mainly in the surrounding area. The burning of household waste which consists of plastics and polythene in our waste stream has huge impact on the health conditions of the house hold mainly young children, pregnant and feeding mothers.

Burning of plastics and polythene at lower temperatures (normal heat of waste burning at household level is around 200-400C) at household level emit dioxins and furans which are persistent organic pollutants indentified under the Stockholm (POPs) Convention.

1.5 ACCIDENTAL FIRES, FOREST FIRES AND SAND STORMS

In Sri Lanka accidental fires and forest fires are rare, and there are hardly any sandstorms. Forest fires occur occasionally, and it does not contribute much to the air pollution, other than the volume of carbon dioxide, unburned hydrocarbons and other particulate matter released from combustion. However during dry weather periods accidental forest fires are occurred due to human activities.

1.6 EMISSIONS OF POWER PLANTS

Emissions from thermal power generation significantly contribute to air pollution in Sri Lanka as furnace oil and diesel used for power generation have more than 10,000 PPM of Sulphur. The fuel mix for electricity generation in the country has undergone a very dramatic change. While over 95 % of the country's electricity requirements in 1995 were obtained from hydroelectric schemes.

The scenario has rapidly changed during the last decade due to increasing demand and limited hydropower resources. Thermal power plants have taken over the generation of around 50-60 % of the national electricity requirement.

To meet the expected doubling of power requirements, the government's preferred option is the installation of more fossil fuel power plants. Establishment of coal fired power plant in Norochhole, Puttalam adds 900 MW to the national grid. Another power plant is in the pipeline to be established in Sampur, Trincomalee.

1.7 INDICATORS OF AIR POLLUTION

Dust/Soot is the major source of air pollution in Sri Lanka. As identified by the Central Environmental Authority (CEA), major contributor to dust pollution is mobile and point sources. In addition, resuspension of dust particles due to poor maintenance of roads has aggravated the dust pollution especially in the urban areas.

Annual average of ambient PM-10 level in Colombo over the years have remained within the range 72-82 $\mu\text{g}/\text{m}^3$ peaking in 2001 . These values, however, consistently exceeded WHO latest guideline of 20 $\mu\text{g}/\text{m}^3$ for PM-10 and barely complied with WHO interim-1 target of 70 $\mu\text{g}/\text{m}^3$ showed an unhealthy situation in relation to the particulate pollution in the Colombo City.

However after the implementation of the Vehicle Emission Testing Programme in 2008, the ambient PM-10 level in Colombo has been decreased within the range of 62-65 $\mu\text{g}/\text{m}^3$ and even with the increased number of vehicles.

Despite high SO₂ emissions from industrial activities, especially thermal power plants within CMR and emissions from diesel vehicles, 01hr average of SO₂ has exceeded from time to time but fell within the annual USEPA limit of 80 $\mu\text{g}/\text{m}^3$.

Sri Lanka does not have an annual standard for SO₂. NO₂ concentration levels in the Colombo City over the past years have also shown the same pattern trend as with SO₂. Sri Lanka does not have an annual standard for NO₂ too.

2. INTERVENTIONS IN AIR POLLUTION CONTROL

Sri Lanka has taken important policy interventions in mitigating air pollution in the past, through establishment of necessary legal and regulatory mechanisms, institutional strengthening and carrying out necessary capacity development activities.

2.1 NATIONAL ENVIRONMENTAL ACT AND ESTABLISHMENT OF CENTRAL ENVIRONMENTAL AUTHORITY

The National Environmental Act (NEA) No 47 was enacted as a overriding legislation for the protection, conservation and management of the environment of Sri Lanka. The Central Environmental Authority was established in 1981 to implement the provisions of the NEA. The National Environmental Act (NEA) was amended in 1988 under to incorporate provisions for the discharge of pollutants into the environment including emission of pollutants into the atmosphere.

Under the National Environmental (Protection and Quality) Regulations of 1990 prohibits the discharge of wastes into the environment. Discharge standards have been prescribed by the CEA for liquid wastes and the Sri Lanka Standards Institution (SLSI) has prescribed emission standards for sulphuric acid plants.

In 1993, the Environmental Impact Assessment (EIA) regulations gazetted under the NEA ensured that any new project undertaken under the prescribed list undergoes a complete EIA or an Initial Environmental Examination (IEE) before a licence is issued for implementation.

In December 1994, a national ambient air quality standard for Sri Lanka was gazetted under the National Environmental Act. These regulations do not, however, address vehicular air pollution. However, Central Environmental Authority in 2000, 2003, 2007, 2014 gazetted regulations under the NEA included provisions for vehicular emission standards for the vehicles in use, and vehicle imports, and fuel quality standards.

2.2 CLEAN AIR 2000 ACTION PLAN

Under the Metropolitan Environment Programme (MEIP), Clean Air 2000 Action Plan was prepared to restore the gradually deteriorating air quality of Colombo Metropolitan Area. Clean Air 2000- Action Plan called upon existing institutions dealing with urban air pollution control, to play different roles ranging from policy making to air quality monitoring, together with enforcing laws, ensuring regulatory compliance and undertaking research and development on technology for air pollution control. It allowed the establishment of functional linkages between many institutions dealing with environmental management.

Actions proposed included the establishment of an institutional framework encompassing relevant institutions such as the Ministry of Environment, Commissioner of Motor Traffic (CMT), Central Environmental Authority (CEA), Traffic Police, National Building Research Organisation (NBRO) and Industrial Technology Institute (ITI) to manage air pollution in Sri Lanka

Though the implementation of Clean Air 2000 programme has been slow, the actions on gazetting of regulations for vehicular emissions standards, fuel quality standards were carried out under this plan.

2.2.1 Provision of Cleaner Fuel

Based on the recommendations following actions were carried out to provide cleaner fuel.

- Leaded gasoline was phased out on July 01, 2002 and unleaded gasoline was introduced through-out the island.
- Phasing out 10,000 ppm sulphur diesel and in 2003 3,000 ppm sulphur diesel was introduced island wide



2.2.2 Vehicular Emission/Fuel Standards

- Regulations gazetted by Central Environmental Authority under the NEA on June 30, 2003 included the following
 - Vehicular exhaust emission standards for vehicles already in use
 - Fuel standards for gasoline, diesel and super diesel
 - Vehicular exhaust emission standards for importation of vehicles

2.2.3 Other Interventions

- Introducing automated air quality monitoring,
- Promotion of gas conversion kits that allow vehicles to use Liquid Petroleum gas in petrol vehicles
- Fiscal instrument was applied in the form of increasing annual road tax for diesel vehicles in order to restrict the growth of diesel vehicles.

2.2.4 Clean Air 2007 Action Plan

During this period Clean Air 2000 Action Plan was updated as Clean Air 2007 Action Plan incorporating new challenges i.e. emissions from two stroke three wheelers, stationary sources, air quality monitoring etc.

2.3 ESTABLISHMENT OF AIR RESOURCES MANAGEMENT CENTRE (AIRMAC)

A Fundamental right case (FR Case No 859) Environmental lawyer Mr. Lalanath M de Silva Vs. Ministry of Environment, urging the Supreme Court to rule that citizens have a fundamental right to a healthy environment. Sri Lanka's constitution guarantees a right to life, but Colombo's air is so polluted that breathing it damages peoples' lungs. Furthermore he asserted that Sri Lanka's government is violating Sri Lankans' right to life by failing to implement adequate air quality standards.

Supreme Court directed then Ministry of Environment to gazette Emission Standards. Ministry Gazetted Mobile Air Emission, Fuel and Vehicle Specification Standards for Importation in 2000, June (No 1137/35) under NEA. However there was no mechanism to implement the gazetted regulation to fulfil the above legal requirements.



To facilitate Air Quality Management (AQM) programs in Colombo and the country, the Air Resource Management Centre (AirMAC) was formed in July 2001 under then Ministry of Forestry and Environment.

Since then, AirMAC has been instrumental in improving stakeholder participation in the country. It is functioning as the single institution to handle all aspects of air pollution in the country.

The key partners of the Air Resource Management Centre include. Ministries of Environment, Finance and Planning, Transport; Departments of Motor Traffic (DMT), Traffic Police, Meteorology; Central Environmental Authority(CEA), Colombo Municipal Council (CMC), Ceylon Petroleum Corporation (CPC), Industrial Technological Institute (ITI), National Building Research Organization (NBRO), Atomic Energy Authority (AEA), National Engineering Research and Development Centre (NERD), National Science Foundation (NSF), Universities, Sri Lanka Automobile Association, Chambers of Commerce and Industries.

2.3.1 Mission of Air Resources Management Centre (Airmac)

The mission of the Air Resource Management Centre is to provide leadership to manage the air resources by mitigating the air pollution in order to improve the health of the public and quality of environment as a whole. The thrust areas identified for the Air Resource Management Centre to operate included.

- a) Policy co-ordination
- b) Ambient air quality monitoring
- c) Emission monitoring and modelling
- d) Standards setting
- e) Public sensitization programme
- f) Capacity building and training
- g) Research and information

2.3.2 Objectives of the Air Resource Management Centre (AirMAC)

The objectives of the AirMAC are

- a) Development of an effective co-ordination mechanism
- b) Development of air resources related policies and programmes
- c) Integration of air pollution abatement programmes implemented in the island
- d) Nationwide ambient air quality monitoring
- e) Implementation of effective point source and mobile emission monitoring
- f) Planning and development of air resources management projects and programmes
- g) Institutional strengthening, training, capacity building of related staff of air resources management
- h) Development of air resources research programme
- i) Establishment of air resources information centre for dissemination of air resources information

Following the establishment of the AirMAC all the activities related to air quality management were coordinated and carried out by it through stakeholder consultation and participations.

2.4 CLEAN AIR INITIATIVE PROGRAMME (CAIP)

The Government of Sri Lanka obtained grant support from the United States Asia Environmental Partnership (USAEP) to strengthen the institutional framework for air quality management in Sri Lanka. This programme mainly focused on urban air pollution control and controlling vehicular emissions. There was a necessity to develop a national programme to monitor and control vehicular emission to maintain and protect the quality of our air quality in our cities.

2.4.1 Background and Stakeholder Consultation

All the relevant information on fundamentals of vehicle emissions, emission testing equipment and methodologies, and local as well as international status were summarized. Through regular stakeholder meetings and considerations of the representatives of all the relevant organisations and their views were taken in to account before finalizing activities and recommendations.

The experience of similar programmes in other countries was shared through consultation of relevant literature and experts, especially foreign consultants. Further, contributions of many experts were obtained for the preparation of documents and awareness & training material.

2.4.2 Awareness and Training Programmes



Awareness programmes for different target groups were devised. This included awareness among school children through teachers training workshops, awareness among bus drivers through number of workshops throughout the country, preparation of video programmes, newspaper articles and radio & TV programmes.

With the assistance of an international consultant a number of training, pilot vehicle testing and awareness workshops were conducted for technicians on vehicle emission testing and vehicle repairs for emission reduction. Similar workshops were conducted for examiners of Department of Motor Traffic and motor traffic police officers on implementation of vehicle emission testing programme. Further technical officers from selected technical colleges were trained as trainers for future technician training programmes.

2.5 URBAN AIR QUALITY MANAGEMENT PROJECT

As a follow up to CAIP, The government of Sri Lanka obtained assistance from the World Bank to strengthen the institutional and policy framework for urban air quality management in Colombo. The overall objective of the proposed activity was to help the development of institutions and policies needed to reverse the deterioration of air quality in Colombo and its accompanying health effects. This programme further supported to carry out background work for the implementation of the Vehicular Emission Testing Programme

2.5.1 Pilot Vehicle Testing.

The pilot vehicle inspection and maintenance (I/M) programme was carried out in two phases. The first phase was undertaken during a period of approximately two weeks to establish emission standards or "cut points", which included measurements of smoke opacity for sample populations of approximately 70 heavy-duty trucks, 70 heavy-duty buses, and 70 light-duty vehicles (dual purpose vehicles & motor cars). In addition measurements of smoke opacity together with exhaust HC and CO concentrations were performed on sample population of approximately 70 three-wheelers and 70 motor cycles. In the case of dual-purpose vehicles, around 30 vehicles were tested on chassis dynamometer at the Open University.

During phase two, the emission standards established during Phase 1 have been applied to a further sample of these types of vehicles over a period of approximately two weeks. Motorcycles and three-wheelers having emissions that exceeded the established standards received on-site adjustments and then re-tested. These activities were fully supported by the corresponding motor industries.

Vehicles that still failed after this service were required to undergo further repairs off-site, and then required to present for a follow-up test. Diesel vehicles with smoke exceeding the established standard were required to undergo repairs off-site, and then presented for a follow-up test. Emission reductions and repair costs were tabulated, and used to fine-tune the recommendations for a full-scale vehicle I/M programme.

The testing was carried out at number of different locations to have a better representative sample of vehicles. During the testing programme, at least two police officers and two examiners were present. This was essential both for the operation of the programme and to deal with any security and legal problems.

In addition to emission testing, a number of training workshops were carried out for training of technicians, examiners and police officers. There were two workshops for technicians, one on emission testing and required maintenance of diesel vehicles and the other on emission testing and associated repair of two stroke two and three wheelers.

The other work shop was conducted for examiners of Department of motor traffic and for Traffic police officers on implementation of vehicle emission testing, inspection & maintenance programme.

2.6 IMPLEMENTATION OF VEHICLE EMISSION TESTING PROGRAMME

After careful study, stakeholder consultations, capacity assessment and training of various stakeholders, it was decided to start vehicle emission testing program as a public private partnership. After open tender procedure, two private sector companies namely Cleanco Lanka Ltd and Laugh Ecosri Pvt Ltd were selected to implement the program in 2005. The two companies established fixed and mobile emission testing facilities island-wide. By 2016, there are 388 emission testing centres operated by both companies.

2.6.1 Sri Lanka Vehicle Emission Testing Trust Fund (SLVET)

To implement the Vehicle Emission Testing Programme, the SLVET Fund was established as a separate project office of the Department of Motor Traffic. Its role is proper implementation and monitoring of the VET program and co-ordination and facilitation of its implementation. The monitoring and auditing of the VET programme was done by the AirMAC.

2.6.2 Implementation of the Sri Lanka Vehicle Emission Testing Program

The awareness creation prior to implementation was started during the period 2006-2008. 17 district and divisional secretariat officers (excluding North and East due to security situation), traffic police officers, technical officers were trained during the period. In addition 2007/2008 period a public awareness campaign was also carried out to educate the public about the emission testing procedures.



In June 2008, the pilot vehicle testing programme was started in the Western province and since this was successful, programme was extended to Southern, Central, North Central, Sabaragamuwa, Uva and North Western Provinces and finally in 2011 July, programme was implemented in Eastern Province. By June 2013, the programme was implemented island wide including Northern Province.



Table 1: VET Center Distribution as at, March 2016

	Province	District	Total	Province Wise
1	Western	Colombo	25	69
2		Gampaha	25	
3		Kaluthara	19	
4	Central	Kandy	19	32
5		Matale	9	
6		Nuwara Eliya	4	
7	Southern	Galle	20	44
8		Matara	20	
9		Hambantota	4	
10	Northern	Jaffna	16	30
11		Vavuniya	3	
12		Kilinochchi	3	
13		Mannar	4	
14		Mullaitivu	4	
15	Eastern	Ampara	18	33
16		Batticaloa	5	
17		Trincomalee	10	
18	North Central	Anuradhapura	29	41
19		Polonnaruwa	12	
20	Uva	Badulla	21	39
21		Monaragala	18	
22	Sabaragamuwa	Kegalle	7	25
23		Rathnapura	18	
24	North Western	Puttalam	19	71
25		Kurunegala	52	
		Total		384

Table 2: Test conducted by the VET contractors in islandwide in 2015

Vehicle Class	Pass				Fail				Total Fail %
	Initial	%	Retest	%	Initial	%	Retest	%	
Motor Cycle	1,650,298	38.13%	246,446	5.69%	268,132	6.2%	63,769	1.47%	7.67%
Tricycle	691,456	15.98%	128,060	2.96%	137,464	3.2%	32,367	0.75%	3.92%
Motor Car	367,608	8.49%	29,153	0.67%	36,718	0.8%	15,958	0.37%	1.22%
Dual Purpose	283,886	6.56%	33,125	0.77%	36,814	0.9%	6,612	0.15%	1.00%
Motor Lorry	191,135	4.42%	21,052	0.49%	23,985	0.6%	4,777	0.11%	0.66%
Motor Coach	45,799	1.06%	4,856	0.11%	5,483	0.1%	962	0.02%	0.15%
Omnibus	184	0.00%	16	0.00%	18	0.0%	2	0.00%	0.00%
M/Lorry(Prime Mover)	1,298	0.03%	62	0.00%	73	0.0%	8	0.00%	0.00%
Land Vehicle	574	0.01%	52	0.00%	66	0.0%	11	0.00%	0.00%
Total Test	3232238	74.68%	462822	10.69%	508753	11.75%	124466	2.88%	15%
	3695060		85%		633219		15%		
	4,328,279								

2.6.3 Monitoring of Vehicle Emission Testing Programme

Vehicle Emission Testing Programme is continuously monitored by the Air Resources Management Centre (AirMAC) under the Ministry of Environment. The AirMAC monitoring carried out in three ways

1. Testing Centre Inspection Programme

Testing Centre Inspection Programme audit is carried out by AirMAC with the assistance of officials from Central Environment Authority (CEA), Department of Motor Traffic (DMT), Department of Measurement, Units and Standards Setting (MUSSD). The centre locations adhere to the correct testing procedures, record keeping, and transmitting reports to VET office, technical capacities of centre personnel etc are inspected during this process.

Any violations to testing procedures are reported to VET fund office and corrective measures are recommended. Even closing down of testing centre is also done if gross violations, malpractices are found. Findings of these inspections are discussed during VET progress review meeting with relevant stakeholders and corrective measures are taken and are being implemented.



2. Road side Emission Testing Programme

Road side Emission Testing Programme is carried out by AirMAC officials with the help of Traffic Police, Department of Motor Traffic (DMT), and Technicians from Orugodawatte Technical Training Institute. The emissions of vehicles are checked on the road and any vehicle even CTB buses that exceed the emission standards are asked to repair their vehicles.



Those emission certificates issued are cancelled and those vehicle owners are asked to present them to closest Office of the Department of Motor Traffic for emission testing. They are given sufficient time to correct and repair such vehicles.

There is a process to cross check on who issued the certificates, the centre, the technician, the machine. If continuous errors/ incorrect certificates are found corrective action are taken for such centres, technicians, and machines etc.

3 Smoky vehicle Spotter Programme

Smoky vehicle Spotter Programme is carried out by AirMAC officials with the Department of Motor Traffic (DMT)/VET office. The officers are trained to identify smoky vehicles by visual inspection of vehicles on the road.



The identified high emitting vehicles are photographed and times spotted are recorded. Owners of these identified smoky vehicles are informed by the VET office to present their vehicles to the DMT offices for emission inspection within a stipulated time.

If the vehicles are not reported as notified, actions are taken by the Commissioner General of Motor Traffic under the Motor Traffic Act. It is important to note that up to date all the vehicles identified has reported to closest DMT offices after making necessary repairs for their vehicles

2.6.4 Impact of VET Programme to Urban Air Quality

The Vehicle Emission Testing program has a direct impact on urban air quality. As an example the PM-10 values at Colombo Fort Air Quality Monitoring Station was around 72-74 /ppm prior to implementation of the VET Program. However the PM-10 values were improved since July 2008 and now it is around 62-64 ppm range.

The smoky vehicles are rarely seen on the roads. Vehicle owners try to maintain their vehicles within the specified standards as continuous monitoring is carried out by the DMT and the AirMAC.

2.7 CONTROL AND BAN OF TWO STROKE THREE WHEELERS

After several studies on the impact of emission created due to two stroke three wheelers the Government in 2007 decided to control and ban the use and importation of two stroke three wheelers. Based on the above decision following controls were implemented.

- a) *Importation of three wheelers powered by two-Stroke petrol engines was prohibited with effect from 01.01.2008*
- b) *Importation of spare parts for such engines was prohibited with effect from 01.01.2011*
- c) *A grace period of six (06) months was granted for registration of three wheelers powered by two-stroke engines imported prior to 01.01.2008*
- d) *The Commissioner of Motor Traffic suspended registration of two stroke three-wheelers with effect from 01.07.2008*



A study carried out by The AirMAC in 2015 revealed that there are around 144,000 two stroke three wheelers running in the country. According to the survey, it is identified that by 2020 majority of the three wheelers will be out of the road due to lack of spare parts. However, this will depend on enforcement of regulations and controlling illegal smuggling of spare parts.

2.8 CLEAN AIR 2015 ACTION PLAN

In 2007, a FR case was filed in the Supreme Court for the non implementation of the Sri Lanka Vehicle Emission Testing Program. During the hearing of the FR Case, the Supreme Court directed the Ministry of Environment and the AirMAC to update the Clean Air 2007 Action Plan and prepare action Plan up to 2015.

Accordingly CLEAN AIR 2015 Action Plan was prepared by the AirMAC after wider stakeholder consultation and submitted to the Supreme Court. The CA 2015 AP included new targets for emission standards, fuel quality, ambient air quality monitoring, and standards for stationary emissions

2.9 STATIONARY EMISSION STANDARDS

The National Environmental Act (NEA) was amended in 1988 incorporating provisions for the discharge of pollutants into the environment including emission of pollutants into the atmosphere. In addition, National Environmental (Protection and Quality) Regulations of 1990 prohibits the discharge of wastes into the environment.

Discharge standards have been prescribed by the CEA for liquid wastes, but emission standards, for source emissions, and other stationary sources was a necessity due to establishment of thermal power plants and other similar industries.

Enactment of EIA regulations under the NEA was gazetted in 1993. All the prescribed project has to undergo a complete EIA or an Initial Environmental Examination (IEE) before a licence is issued under the NEA for implementation.



The thermal power plants/coal power plants were prescribed projects under these regulations and emission standards for these sources have to be established for effective enforcement of the regulation.

The Central Environmental Authority with AirMAC initiated a process to prepare source emission standards with the participation of relevant stakeholders, and industry experts. These standards were discussed with wider stakeholder participation.

It is expected that these standards will be gazetted during the period 2016. However, until the gazetting the standards, CEA is in the process of implementing interim standards in line with the proposed standards.

2.10 PARTICIPATION IN INTERNATIONAL CONFERENCES

Capacity building and awareness has been identified as a key component in the implementation of successful air quality management programme. In this regard exposure to international conferences and seminars to obtain knowledge and expertise was carried out since the initiation of the AirMAC.

2.10.1 Better Air Quality Conference (BAQ Asia)

The BAQ conference is the flagship event of Clean Air Initiative (CAI)-Asia. This biennial event brings leading experts, policy and decision makers together to network, learn and share experiences on air quality management. Policy makers, practitioners and industry leaders meet at BAQ to network, innovate, learn and share experiences.

Past BAQs have proven to leverage change influence policies, initiate new projects and programs across Asia and not the least establish innovative partnerships. Past BAQs have proven to influence policies, initiate new projects and establish partnerships. AirMAC stakeholders continued to participate in BAQ Asia since its first conference in Hong Kong 2002.

Clean Air Sri Lanka is a stakeholder organisation of the AirMAC and it is the Sri Lanka member of CAI Asia. Clean Air Sri Lanka continued to have its own exhibition stall at all BAQ Asia Conferences.

2.10.2 BAQ 2014 and 8th EST Forum, Colombo, Sri Lanka, November 2014

The "Integrated Conference of BAQ 2014 and Intergovernmental 8th Regional EST Forum in Asia" was co-organized by the Ministry of Transport of Sri Lanka, The Ministry of Environment and Renewable Energy of Sri Lanka, Ministry of Environment of Japan, United Nations Centre for Regional Development, and Clean Air Asia, in partnership with the Asian Development Bank, World Bank and the German International Cooperation.



The Theme of the Conference was "*Next Generation Solutions for Clean Air and Sustainable Transport? Towards a Liveable Society in Asia*"

The Integrated Conference of BAQ 2014 and Intergovernmental 8th Regional EST Forum in Asia became another milestone in the fight against air pollution. With more than 1000 delegates participating in the joint conference, it was indeed has become another milestone in the fight against air pollution and the quest for more sustainable cities and livelihoods for citizens across Asia.



Many of the delegates left with a sense of new purpose and also being equipped with the newest knowledge and learning - and new solutions - for better air quality across Asia. The solutions were as wide ranging as the problems we face - the challenges of poor air quality, climate change and negative health impacts. (www.baq2014.org)

2.10.3 The Kong Ha Award -2014

In 2008, the Clean Air Asia Partnership established the Kong Ha Award for Excellence in Air Quality Management to honour the memory of the late Kong Ha, who served as the chairperson of the Clean Air Initiative for Asian Cities (Clean Air Asia) from December 2004 to April 2007.

During BAQ 2014 Dr B M S Batagoda (first Director of AirMAC) of Sri Lanka was honoured with this award for pioneering work on air quality management in Sri Lanka.

2.11 FUEL QUALITY ROAD MAP

Due to increasing number of vehicles, establishment of thermal power plants there was a necessity to have much more cleaner fuel for our vehicles and industry. Identifying the need to develop a fuel quality road map, in 2012, the Cabinet of Minister appointed a Cabinet Sub Committee to develop a Road Map and Technical Committee was appointed to assist the Cabinet Sub Committee. The Technical Committee which was co-chaired by Secretaries of Environment and Petroleum Resources and consisted of all the relevant stakeholders.

The Road Map prepared included the following key components

- a) Provision of cleaner fuel for vehicles in parallel with Euro Standards
- b) Provision of cleaner fuel for the industry, power plants etc
- c) Promotion of alternative fuel/biofuels for transport
- d) Modernisation of Existing oil refinery and or development of state of the art new oil refinery
- e) Establishment of laboratory facilities for testing of fuels
- f) Electrification of Railways

Based on the above road map 10ppm sulphur diesel was provided island wide replacing 500 ppm sulphur diesel from July 2014. It is expected to provide 350ppm sulphur diesel as normal diesel to be provided islandwide by year 2020 replacing the present 3000 ppm sulphur normal diesel.

The finalised fuel quality road map is to be submitted to the Cabinet for approval within 2016

2.12 REVISION OF VEHICULAR EMISSION STANDARDS

Sri Lanka Vehicle Emission Standards were gazetted in 2003 under the National Environmental Act No 47 of 1980. Sri Lanka Vehicle Emission Testing Programme was started in mid 2008 in the Western Province and subsequently the Program was implemented island wide since 2013. After the implementation of the VET programme island wide there was a greater necessity to have more stringent emission standard to remove high emitting vehicles from the road for the betterment of the urban air quality.

After a careful study of the vehicle fleet, the emission levels of the failed vehicles and to be failed vehicles new emission standards were gazetted under the NEA in later part of 2014.(No 1887/20) However, the implementation of these standards is yet to be a reality. It is expected that by July 2016, these standards will come into force.

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 EXTRAORDINARY

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 No. 1887/20 - WEDNESDAY, NOVEMBER 05, 2014

(A) Petrol Vehicles

Type of Vehicle	Emission Standards		Remarks
	Carbon Monoxide CO (%V/V)	Hydrocarbon HC (ppm V/V)	
Petrol Vehicles other than Motor Cycles and Motor Tricycles	3.0	1000	Both Idling and 2500 RPM/no load
Petrol Motor Cycles	4.0	6000	Both Idling and 2500 RPM/no load
Petrol Motor Tricycles	4.0	6000	Both Idling and 2500 RPM/no load

(B) Diesel Vehicles

Type of Vehicle	Emission Standards /K Factor (m) based on Smoke Opacity	Remarks
Diesel Vehicles	4.0	On Snap Acceleration

2.13 OTHER ACHIEVEMENTS

User perception survey on Non-motorized transport system in Sri Lanka

This survey was carried out by Clean Air Sri Lanka with the financial support from GEF/SGP UNDP Sri Lanka. This survey report is one of the products of the project titled Reducing Greenhouse Gas (GHG) Emissions from Urban Areas in Colombo by Promoting Environmentally Sustainable Transport and Sustainable Energy Systems which is funded by Global Environmental Facility/ Small Grants Programme (GEF/SGP UNDP), Sri Lanka

The research was carried out to assess the user perception of NMT in Colombo city and suburb areas. It was carried out in four (04) areas in Colombo covering three (03) Municipal Councils namely Colombo, Sri Jayewardenepura Kotte and Kaduwela. A questionnaire was developed to collect information on vehicle ownership, travel behaviour, purpose of the trips, perception on NMT Infrastructure facilities, pedestrian and cyclist facilities and exposure to air pollution, preference on NMT Infrastructure facilities and socio-economic profile.

3. CURRENT ISSUES AND PROGRAMMES

The current issues and programmes associated with air quality management can be grouped in to the following areas as suggested during stakeholder consultations.

- a) Institutionalize and Coordination Of All Air Quality Improvement And Management Activities*
- b) Management of Air Emissions from Transportation sector*
- c) Management of Air Emissions from Stationary sources*
- d) Management of Indoor Air Quality*
- e) Management of Unethical & Unintentional practices*
- f) Implementation of Cleaner technologies, Fuels and processes*
- g) Implementation of Air quality monitoring Programmes*
- h) Awareness, Education, Information and Knowledge Management for Air Quality*
- i) Research and development and Impact Assessment OF AIR Pollution*
- j) Development Of Human Resources for effective AQM*
- k) Participation and Collaboration In Regional/Global Clean Air Initiatives*
- l) Development of a Sustainable Financing Mechanism*

3.1 INSTITUTIONALIZE AND COORDINATION OF ALL AIR QUALITY IMPROVEMENT AND MANAGEMENT ACTIVITIES

Different aspects of air quality management such as source monitoring and vehicle emissions are vested with several institutions. Further, emission reduction requires participation of many agencies since the activities are complementary. For instance, Ministry of Transport cannot achieve emission reduction targets without clean fuel being available for the users in the local market.

Therefore coordination of AQM programmes becomes difficult when institutions operate individually.

3.2 MANAGEMENT OF EMISSIONS FROM TRANSPORT SECTOR

3.2.1 Development of Sri Lanka Vehicle Emission Testing (SLVET) Programme

Sri Lanka Vehicle Emission Testing (SLVET) Programme was initiated in 2008 to control emission from vehicles. The Vehicle Emission Standards were gazetted in 2003 and recently updated in 2014. SLVET Programme has to be upgraded to a higher level by incorporating new technologies in emission testing i.e chassis dynamometer testing, etc.

There is a greater necessity to carry out intensive training of garage technicians, monitoring officers, traffic police, and other necessary infrastructure. Awareness creation on driving habits of vehicle drivers and vehicle users is also a greater need to control vehicular emissions .

3.2.2 Promotion of Environmental Friendly Transport Modes

Promotion of environmentally friendly transport modes and cleaner transport practices such as walking, cycling, and promotion of water transportation is also required in proper management of emissions of transport sector. Development of dedicated bicycle lanes or use of such facilities by other purposes have forced bicycle riders to opt for alternative travelling modes which are generally based on fossil fuels. .

3.2.3 Traffic Management

Urban traffic congestion, particularly in the rapidly growing major metropolitan areas is imposing increasing economic and environmental costs. Traditional methods of curtailing congestion such as expansion and improvements of roads are typically short-lived and are constrained by increasingly tight fiscal, physical and environmental constraints. However, demand side options, particularly pricing offer a more promising long-term solution

3.3 MANAGEMENT OF EMISSIONS FROM STATIONARY SOURCES

It is necessary to control pollution from high polluting (HP) industries and stationary sources and these needs to be properly identified both in terms of the types of pollutants and their quantities of emissions. Also the benchmark for such HP industries for improved emissions needs to be established in order to plan AQM activities in this sector.

Management of Emissions from thermal power plants

Hydropower domination in the electricity generation sector has been gradually diminishing due to the limitation in economically exploitable hydropower resources remaining in the country. As a result, the use of thermal power fired by fossil fuels has been on the rise during the last 10 years to meet rapidly increasing electricity demand.

A significant proportion of these thermal plants are based on furnace oil, diesel and coal which has a high content of Sulphur. This has resulted in rapidly increasing emissions in the power sector.

3.4 MANAGEMENT OF INDOOR AIR QUALITY

3.4.1 Data and Research Findings and Activities on Indoor Air Pollution

Research findings in the field of indoor air pollution in Sri Lanka need to be properly compiled and kept in a database. These need to be accessible to public and to researchers in particular, in order to ensure that the related activities progress smoothly without any duplication and efficient use of available resources. Such a database is not available at present and establishment of it requires urgent attention.

3.4.2 Awareness Creation among General Public

People tend to believe their home environments are the safest in terms of air pollution. But the research finding emerged in the recent past have shown that indoor air in Sri Lanka is much more polluted than air in outdoors. This is mainly due to inefficient cooking stoves, mosquito coils and other burning induced indoor air pollution. This causes significant life time health risk to the general public leading them to air pollution related morbidity and mortality.

3.4.3 Implementation of National Action Plan on Indoor Air Quality Management

There is an ongoing exercise by Ministry of Health to identify the multiple sources of air pollution in Sri Lanka and necessary mitigation activities, in the form of a National Action Plan on Indoor Air Pollution. There should be immediate action to implement the recommendations.

3.5 MANEGEMENT OF UNETHICAL & UNINTENTIONAL PRACTICES

Uncontrolled combustion of clinical and municipal waste, constructions craps, agricultural residues etc. in an open yard or in barrels results in incomplete combustion, and as a result, harmful air pollutants (Dioxins, Furans, etc.) are released directly into the ambient air without passing through an adequate stack, duct or chimney.

3.5.1 Burning and Plastics and Polythene at Household

Dioxin, Furans are generated when plastics/ polythene is burnt at low temperatures below 1200 OC. These are harmful gases identified as Persistent Organic Pollutant, falls under the Stockholm Convention which has already signed by Sri Lanka. These gasses cause cancer, growth defect, affects DNA, affects immune and reproductive systems and huge impact on young children, youth, pregnant & feeding mothers.

Normal temperature at domestic waste burning is around 200/400 OC. Our wastes consist of plastics and polythene and therefore in domestic waste burning, dioxin & furans are generated.

3.5.2 Health Issues

These pollutants, such as fine particulates, PAHs (Polycyclic Aromatic Hydrocarbons), heavy metals, and dioxins have been linked to such significant health impacts as decreased lung function, neurological disorders, cancer, and heart attacks and other non communicable diseases.

According to the World Health Organization, about 3.7 million people die prematurely from outdoor air pollution. Those most at risk are children, the elderly and people with chronic respiratory problems.

3.5.3 Management Measures

If such a large source of air pollutants is not taken into account, the air pollution countermeasures put in place may not be effective in controlling air pollution. Therefore, there is a strong need to identify contribution of open burning to the total level of air pollutants in Sri Lanka.

It is also important to identify the sources and their relative significance in order to introduce regulations to control open burning. In this regard there is a strong need to introduce measures to control open burning in Sri Lanka through guidelines and standards.

3.6 IMPLEMENTATION OF CLEANER TECHNOLOGIES, FUELS AND PROCESSES

The availability of fuel with a higher percentage of polluting material such as Sulphur in the market leads to consumption of these fuels by the users and it is necessary to implement the fuel quality road map developed to provide cleaner fuels in the country. There is a greater need to establish mechanism to promote hybrid vehicles in public transportation.

Promotion of electric vehicles and supportive infrastructure to facilitate these practices are essential for cleaner urban environment and air quality. More research is needed in the promotion of bio-fuel, in the transport sector.

Use of fossil fuel/ bio mass for industries

Deficit of traditional sources such as wood fuel / biomass in certain tea growing and other areas has led to some industries to shift into more conveniently and widely available fossil fuels such as diesel and furnace oil. However due to increasing cost of furnace oil and diesel there is an increase in the usage of fuel wood/biomass for power generation in the industrial sector and this need to be streamlined with proper guidelines, and standards.

3.7 IMPLEMENTATION OF AIR QUALITY MONITORING PROGRAMME

It is always important to verify the effectiveness of different actions taken from time to time with the intention of improving air quality. Such verification helps to take appropriate corrective measures where necessary and modify those actions to achieve the final objective of improved air quality in the environment.

This can only be carried out with the development of a comprehensive database of air quality before and after adopting different measures. There is an urgent requirement to implement a comprehensive air quality monitoring programme covering the major cities and suburbs.

3.8 AWARENESS, EDUCATION, INFORMATION AND KNOWLEDGE MANAGEMENT FOR AIR QUALITY

General public seems to be unaware of the extent of the air pollution in the country and its injurious health effects that could be either acute or chronic. Further they are not enlightened on the social and economic impacts caused by pollution of their local environment.

Morbidity (disease incidence) and mortality (deaths) attributed to air pollution and its socio-economic costs are currently unavailable not only to the officials but also to the researchers. This results in difficulties in assessing the correlation between the emissions of pollutants and the actual health impacts.

Poor knowledge on health and economic benefits of air quality mitigation options makes it extremely difficult to justify the cost-benefit of air pollution mitigation activities to the political leadership, other policymakers and the general public, making its implementation inefficient if not impossible

Regular forums are important in terms of sharing experience of researchers and other professionals engaged in air pollution related activities and improving public awareness on the current research and their findings. There is no mechanism for sustainable financial support to conduct such forums to present these findings on a regular basis.

3.9 RESEARCH AND DEVELOPMENT AND IMPACT ASSESSMENT OF AIR POLLUTION

In order to assess the impact of air pollution from different sources it is paramount that a suitable air quality model is identified for Sri Lanka incorporating relevant emission inventory and meteorological data.

Development of fuel quality testing facilities

Independent fuel quality measurement is an important aspect of the implementation and monitoring of fuel quality standards. In the absence of such a laboratory which is capital intensive, Sri Lanka may have to make use of other laboratories in the region for this purpose.

Research on air quality and health effects

Absence of comprehensive epidemiological research on air quality and health effects also hinders effective public awareness programmes which need to be backed by research outcomes.

3.10 DEVELOPMENT OF HUMAN RESOURCES FOR EFFECTIVE AIR QUALITY MANAGEMENT

Implementation of proper Air Quality Management Programmes requires individuals with multitude of capacities with multidisciplinary exposure. These skills include those in areas such as project formulation, identification of best practices, stakeholder co-ordination, implementation and marketing programs among stakeholders and beneficiaries.

Lack of trained staff with such background and exposure has negatively affected effective implementation of AQM programmes

3.11 PARTICIPATION AND COLLABORATION IN REGIONAL/ GLOBAL CLEAN AIR INITIATIVES

It has been found that Sri Lanka's participation in regional and global initiatives on AQM or related activities is often not active and inconsistent. However during the past decade Sri Lanka participation in activities of Clean Air Initiatives in Asia's activities is encouraging. Better Air Quality Conferences (BAQ Asia) in 2006 (Indonesia), 2008 (Bangkok), 2010 (Singapore), 2012 (Hong Kong) and Environmental Sustainable Transport Forums have seen more active Sri Lanka participation both from the Government and Private Sector.

In 2014, Sri Lanka hosted BAQ 2014 and 8th EST Forum in Colombo. However there is a greater need to give priority to Sri Lanka participation in these international events to obtain more exposure and technology to develop the AQM sector in the country..

3.12 DEVELOPMENT OF A SUSTAINABLE FINANCING MECHANISM

One of the major constraints in implementing AQM programmes is the resource limitations. This needs to draw special attention in seeking alternative forms of funding which requires properly crafted project proposals that could attract the interest of funding agencies. Absence of capacity to draw up such funding proposals is therefore a serious concern.

Lack of awareness among key policy makers on status of Air Quality and importance of its control has resulted in AQM activities receiving a low priority in resource allocation. Even when adverse impacts of air pollution and the responsible polluters are identified and they are made to pay for the damage there is no proper mechanism to collect the associated revenue.

4. CLEAN AIR ACTION PLAN 2025

The main objectives of the Clean Air Action Plan 2025 are the following

- *To develop and establish a national multi-stakeholder platform for formulation and coordination of all air quality improvement and management programs.*
- *To ensure source identification, quantification, monitoring and reduction of harmful air pollutants through implementation of identified programmes in association with all stakeholders.*
- *To implement and strengthen regulatory framework for ensuring effective air quality management.*
- *To undertake research and development and capacity building programs for Air Quality Management.*
- *To establish linkages with sub-regional, regional and global air quality management initiatives.*
- *To create public awareness on air pollution, its impacts and actions taken to address related issues.*
- *To ensure adequate financial resources through formal and innovative financing mechanisms for air quality management*

These objectives are achieved by addressing the issues identified in Chapter 4 through various strategies and time bound actions. The overall responsibility of implementing the Clean Air Action Plan lies with Air Resources Management Centre (AirMAC).

4.1 INSTITUTIONALIZE THE COORDINATION OF AIR QUALITY MANAGEMENT ACTIVITIES

AirMAC was established in 2001 informally as an outcome of Clean Air 2000 with the participation of relevant stakeholders in air quality management.

- Ministry of Mahaweli Development & Environment (M/MD&E)
- Ministries of Transport, Civil Aviation, Urban Development, Industries, Finance, Health, Provincial Councils, Local Government
- Central Environmental Authority (CEA)
- Department of National Planning
- Department of Police - Traffic Police Division
- Department of Motor Traffic (DMT), Vehicle Emission Testing Trust Fund
- National Building Research Organisation (NBRO)
- Industrial Technology Institute (ITI)
- Universities
- Provincial Environmental Authorities (eg Provincial Environmental Authority- North-Western province and Waste Management Authority-Western Province)
- Colombo Municipal Council (CMC)

At present the AirMAC is managed by a steering committee representing above stakeholder institutions with the chairmanship rotated on a regular basis among the member institutions. Unavailability of a formal structure has hindered progress on AQM programmes in many different ways and therefore this issue needs to be immediately addressed.

Strategies

- Establishment of a strong structured mechanism to enable stakeholder participation

Recommended Action

- Establish a Cabinet Appointed Steering committee for Air Resource Management to implement the actions the Clean Air 2025 Action Plan.

Time Duration

- By 2016

4.2 EFFECTIVE MANAGEMENT OF AIR EMISSION FROM TRANSPORT SECTOR

The Urban Air Quality has a direct linkage with the pollutants and emission from transport. Improvement of public and goods transportation systems both road and railways has been key ingredients to maintain the urban air quality levels within acceptable standards. Strategies to further improve the ongoing programs on vehicular emissions testing and traffic management are also important in controlling urban air quality management.

Strategies

- Effective affordable and customer friendly public transport system
- Establish green freight transport system.
- Improvement of effectiveness of VET programme
- Traffic management

Recommended Action

- Introduce Mass public transportation (BRT/MRT) systems
- Improve quality and efficiency of railway transport system.
- Use train for freight transport
- Relocation of freight & container yards closer to express way entry points & railway
- Review of ongoing VET programme & develop guidelines to effect corrective measures
- Construction of flyovers & underground tunnels to reduce traffic congestions
- Introduce regulation, market based instruments, guidelines for public parking and improve facilities for public parking proper efficient traffic planning system
- promotion of driving habits

Time Duration

- 2016-2025

4.3 EFFECTIVE MANAGEMENT OF AIR EMISSIONS FROM STATIONARY SOURCES

There is an urgent need to develop capacity for measurement and monitoring of stationary source emissions according to standards and procedures. This would fill the gap of information about correlation between ambient air quality standards and source emission standards.

It will also improve resources and expertise for the local industry to adopt the standards. There is also need to implement these control technologies existing industries.

Strategies:

- Strengthening the existing capacities of agencies
- Harmonization of ambient air quality standards and stationary source emission standards
- Stepwise approach in implementation
- Mitigation air pollution from small scale and traditional existing industries

Recommended Action

- Strengthening capacity of CEA and other related agencies in emission measuring and monitoring
- Develop suitable projects / proposal/TAP(technical assistance programmes) for implementing related activities
- Collect baseline data on air emissions of stationary sources (key industries initially) and identify gaps in baseline data.
- Preparation of an implementation road map
- Awareness creation and capacity building among stakeholders including industrialist on source emission standards
- Introduce recognition and rewarding mechanism for pollution minimized industries
- Policy interventions (Tax concession/ financial assistance) for energy efficient equipment, etc.,
- Financial assistance/technical assistance/incentives for emission control, testing and standards implementation

Time Duration

" 2016-2025

4.4 INDOOR AIR QUALITY MANAGEMENT

Indoor Air Quality Management has been identified as a area where great attention is needed in air quality management. Many health related issues are associated to indoor air pollution.

However there is a vacuum in baseline data and information, data on indoor air pollution due to use of biomass for cooking and cooking practices. It is also necessary to focus attention on indoor air quality in building design, construction, maintenance and use

Strategies:

- Conduct studies to generate baseline data
- Awareness creation on the methods to reduce indoor air pollution due to biomass use
- Improving building design, construction and maintenance through building regulations and guidelines

Recommended Action

- Carry out baseline surveys
- Develop guidelines on how to control indoor air quality management
- Identify different types of buildings / locations that the guideline should be applied
- Conduct pilot scale indoor air pollution studies for major cities
- Conduct exposure studies on health impact assessment
- Conduct awareness programmes on methods to reduce indoor air pollution
- Review the existing building regulations and incorporate indoor air quality guidelines

Time Duration

" 2016-2018

4.5 MANAGEMENT OF UNETHICAL & UNINTENTIONAL PRACTICES

It has been identified that air pollution due to unethical and unintentional practices have an impact on air quality management both at urban and households. These pollution is occurred mainly due to open burning of solid waste, plastics and polythene, including e- waste, and construction/activities.

Strategies:

- Develop a series of guideline and regulation in order to control / Minimize open burning
- Awareness creation
- Mitigate air pollution from construction activities/transportation of debris/ construction materials

Recommended Action

- Establish a inter agency subcommittee
- prepare guidelines, standards and an action plan
- Conduct awareness programs on harmful effects of emissions from open burning of waste

Time Duration

- 2016-2018

4.6 CLEANER TECHNOLOGIES FUELS AND PRACTICES

In air quality management, cleaner fuels technologies and practices have a direct impact. There is a necessity to develop sustainable fiscal policy on cleaner fuels, technologies and other related areas and to make availability of quality fuel and of alternative cleaner fuel.

Strategies:

- Implement the fuel quality road map which includes fiscal policies, fuel quality standards for, transport, industry & power, fuel Quality maintenance and Promotion of alternative cleaner fuel
- Promoting cleaner technology
- Guidelines on evaporative emissions during transportation of fuel , from fuel stations, servicing, and fuel tanks

Recommended Action

- Encourage to use green vehicles with energy efficiency
- Provide infrastructure for Electric /Hybrid vehicles.
- Promote electric vehicle for public transport.
- Implementation of fuel quality road map
- Periodic review of vehicular emissions standard
- Promote solar energy for electric vehicles
- Upgrade existing oil refinery
- Establish and maintain independent accredited fuel quality test laboratories.
- Promoting new investments on cleaner alternative fuel processing facilities through incentives.
- Awareness creations

Time Duration

- 2016-2025

4.7 AIR QUALITY MONITORING

There is an urgent requirement to establish comprehensive Air Quality Monitoring System for Sri Lanka. It will provide comprehensive data base to verify the effectiveness of the measures taken in air quality management. It is also needed to establish information system on ambient air quality and to collect data from trans boundary air pollution

Strategies

- Develop Island wide Air Quality Monitoring Mechanism
- Establish nationwide ambient air quality monitoring network for air quality monitoring
- Disseminate information on ambient air quality through establishment of information system
- Strengthen Trans boundary air pollution monitoring under the Male Declaration

Recommended Action

- Develop a comprehensive proposal for ERD for Technical Assistant Programme
- Carry out stocktaking of present air quality monitoring
- Develop comprehensive proposal for island- wide Ambient Air Quality Monitoring Network including locations frequencies, Methodologies and parameters and resources required and also including training and capacity building
- Strengthen existing facilities and capacities in trans boundary monitoring
- Implementation of a nation wise air quality monitoring mechanism

Time Duration

- 2016-2020

4.8 AWARENESS, EDUCATION, INFORMATION AND KNOWLEDGE MANAGEMENT FOR AIR QUALITY

Create awareness among general public on air pollution and its social, environmental, economic and health impacts

Strategy:

- Enhance general awareness regarding air pollution and its related effects among the general public

Recommended Action

- Conduct cross-sectional KAP (Knowledge, Attitude and Practices) sample survey on air pollution and its adverse effects.
- Conduct awareness programmes targeting school children, teachers, policemen, vehicle owners and drivers and advocacy programmes for policy makers
- Review and revise the school curriculum and training programs of public health staff to include the air pollution related issues

Time Duration

- On going

4.9 RESEARCH, DEVELOPMENT FOSTERED AND IMPACT ASSESSMENT OF AIR POLLUTION

There is a greater requirement to promote incorporation of research finding for decision making an policy interventions in air quality management. It is necessary to collect data on impacts of air pollution and prevention measures

Strategies

- Mechanism to identify the priorities in air pollution related research
- Impact assessment of air pollution prevention strategies

Recommended Action

- Identify the priorities in air pollution related research through steering committee on AQM
- strengthening the established research groups and institutes
- Introduce IAQ studies for post graduate studies of medicine
- Impact assessment of identified health aspects
- Cost benefits analysis of proposed prevention strategies.
- Development of polices/policy briefs based on the research findings
- Pilot project on air quality data and impact of health issues in selected towns.

Time Duration

- 2016-2025

4.10 DEVELOPMENT OF INFORMATION KNOWLEDGEBASE & HUMAN RESOURCES FOR EFFECTIVE AQM

It is necessary to enhance the capability of the officials who are engaged in air quality management and also to enhance the information knowledge based on air quality

Strategies:

- Implementation of comprehensive HRD program
- Encouraging research & development especially on local issues
- Create platforms to share the research findings (symposium, web based discussion forum, press releases) and compilation of published research
- Dissemination of air quality monitoring data and interpretation to public

Recommended Action

- Develop HRD Plan to fill gap and market it based on capacity assessment on thematic areas.
- Use SIDA, USEPA, AIT and JICA for advanced Air Quality Management certificate courses
- AQM modules in postgraduate programmes in environmental sciences
- Establish a Top to bottom information system / Knowledge base
- Identify the present under graduate and post graduate programme on air quality and fill the gaps
- Organize bi-annual symposium and compilation of research reports/publications.
- Maintain an active web based forum which discuss at least one important issue per month.
- Publishing timely updated air quality monitoring index
- Training programme for media personal about air quality issues/air quality management with giving relevant certificate
- Measure air quality data in key cities and disseminate among other institutions and public

Time Duration

- On going

4.11 GLOBAL PARTICIPATION AND COLLABORATION FOR AQM

For better and effective management of sustainable air quality management programme, it should provide opportunities to obtain technical, educational and financial benefits through regional and international networks by sharing experience and resources.

Strategies:

- Share Sri Lanka experience in air quality management
- share the experience of other countries and seek networking opportunities

Recommended Action

- Enhanced participation in CAI-Asia, Clean Air Training Network (CATNET) and APTI, USEPA, UNEP, USAID/World Bank Initiatives and other.
- Initiate Collaborative programme with AIT /UNDP-GEF ,
- Coordinate Male Declaration secretariat(UNEP/SACEP)
- Coordinate with UNCCRD on EST

Time Duration

- On going

4.12 DEVELOPMENT OF A SUSTAINABLE FINANCING MECHANISM

Obtain necessary funds to implement Air Quality Management programmes

Strategies:

- Awareness through promotion campaign on status of air quality and the importance and priority of Air Quality Management
- Make provisions to financial assistance from VET fund and other funding sources
- Public-Private partnerships
- Establish market based mechanisms for managing AQM

Recommended Action

- Identify priority projects and conduct awareness programmes to key policy makers
- Identify priority projects to be submitted to Vehicle Emission Testing Trust Fund
- Develop capacity of a selected group to write appealing project proposals
- Presenting attractive and appealing project proposals to foreign and local funding agencies
- Identify business models that could apply to promote public-private partnership mechanism to co-op up with air quality management related activities and take action to implement
- Introducing load-based tax systems for high polluting activities

Time Duration

- On going

5. MONITORING AND REVIEW

The overall responsibility of the implementation of the Action Plan lies with AirMAC under the general direction of its Steering Committee appointed by the Ministry of Mahaweli Development and Environment.

While the institutions responsible for carrying out specific actions have been identified for each of the tasks from the list given below, the overall coordination is carried out by AirMAC.

- Ministry of Mahaweli Development & Environment (M/MD&E)
- Ministries of Transport, Civil Aviation, Urban Development, Industries, Finance, Health, Provincial Councils, Local Government
- Central Environmental Authority (CEA)
- Department of National Planning
- Department of Police - Traffic Police Division
- Department of Motor Traffic (DMT), Vehicle Emission Testing Trust Fund
- National Building Research Organisation (NBRO)
- Industrial Technology Institute (ITI)
- Universities
- Provincial Environmental Authorities (eg Provincial Environmental Authority- North-western province and Waste Management Authority-Western Province)
- Colombo Municipal Council (CMC)

In the process of coordination AirMAC will also monitor the progress of these actions according to an agreed time schedule of implementation along with interim targets for each of the actions. The Action Plan will be reviewed every two years to include the most updated policies of the government and the latest advancements in technology and other areas as well as world trends.

Appendix 1 – SCHEDULE OF PROPOSED INTERVENTIONS

Clean Air 2025 Action Plan

1. Institutional framework for strategic management and coordination of AQM

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget-Mn.
Necessity of formal and structural strong stakeholder linkage (network) to provide sharing platform to coordinate and implementation of air quality management strategies by covering all key areas represented.	Strong structured mechanism to enable stakeholder participation.	<ol style="list-style-type: none"> 1. Review priority needs and define a flexible co-ordinating structure through stakeholder consultative workshops. 2. Establish a cabinet appointed steering committee for air resource management to carry out the Clean Air 2025 Action Plan. <ol style="list-style-type: none"> a. Thematic Working Groups(TWG) <ol style="list-style-type: none"> i. Technical Expert Committee for Stationary Source Emission Standards. ii. Emission Inventory/ Database Management System iii. Indoor Air Quality iv. Air Quality Modelling & Gap Filling b. Technical Expert Committee <ol style="list-style-type: none"> i. Monitoring/Awareness/Advocacy ii. Policies/Land use/Transport Planning iii. Technology/R&D/Impact 3. Establish technical committee to assist steering committee for air quality, fuel quality and open burning. 4. Establish a suitable institutional(AirMAC) mechanism as appropriate based on 1, 2 & 3 above 	2016 - 2017	AirMAC MoMD&E MoT MoNP&EA CEA, RDA, UDA	<ol style="list-style-type: none"> 1. Refined structure 2. Number of partner institutions 3. key areas represented 	<ol style="list-style-type: none"> 1. Strong stakeholder linkage with sharing platform for all key areas on air quality management represented. 2. Suitable institutional mechanism established (AirMAC) 	1.0 Mn

2. Effective management of Air emissions from Transportation sector

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget - Rs.
To develop customer friendly public transport system	Effective affordable and customer friendly public transport system	<ol style="list-style-type: none"> 1. BRT and/or dedicated only bus lane to be introduced to congested urban roads 2. Introduce friendly systematic bus time tables and minimizing the unnecessary waiting time at bus stops 3. Improve the quality of bus stops/stands 4. Intensives for luxury bus services 5. Introduce proper efficient traffic planning system 6. Introduce an effective road maintenance program. 7. Introduce and encourage widespread use of international standards for road furniture 8. Introduce legislation to safeguard road users. 9. Improve quality and efficiency of railway transport system. 10. Studies/Activities on field transport 	2016-2025	MoMD&E MoT MoF RDA PRDA MoM&WD	<ol style="list-style-type: none"> 1. Percentage of increasing commuters using public transport 2. Percentage of reduction of private vehicles entering city limits 3. Improved high quality bus stops/ Road furniture 	<ol style="list-style-type: none"> 1. Increased use of public transport 2. No of smart cities by 2025 	100 Mn & private sector
To develop environmental friendly freight transport system	Establish green freight transport system.	<ol style="list-style-type: none"> 1. Use train for freight transport 2. Improve road rail linkages 3. Relocation of freight & container yards closer to express way entry points & railway links 	2016-2025	MoT RDA MoMD&E	<p>Establish train schedule for freight transport</p> <p>Developed Land use plans available</p>	<ol style="list-style-type: none"> 1. Existing railway system enhancing with relevant infrastructure 2. Available environment friendly freight transport system 	1000 Mn & private sector
To improve VET programme	Improvement of effectiveness of VET programme	<ol style="list-style-type: none"> 1. Review of ongoing VET programme & develop guidelines to effect corrective measures 2. Introduce chassis dynamometer test for vehicle test 	2016-2020	AirMAC VET Fund DMT CEA MoF	<ol style="list-style-type: none"> 1. No of accredited VET centres 2. Number of trained technicians 	<ol style="list-style-type: none"> 1. Effective VET program 2. 100% of vehicles obtaining 	100 Mn & 1000 Mn by private sector

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget - Rs.
		3. Establish accreditation system for VET testing centres 4. Selection of new entities to carryout emission testing 5. Strengthen the activities of VET programme by training of technicians of garages and technicians of VET centres 6. Publish Vehicle emission test data of vehicles 7. Institutionalize of Sri Lanka VET Fund. 8. Establish emission database system			3. Vehicle emission data index 4. VET fund to function as independent cooperation	VET certificate 3. New contractor selected	
To reduce heavy traffic Congestion	Traffic management	1. Construction of flyovers & underground tunnels to reduce traffic congestions 2. Introduce tax system for private vehicle to enter vehicles to city limits in peak hours. 3. Development of the environmental friendly defensive driving curricular (Training through driving schools) 4. Introduce public parking <ol style="list-style-type: none"> Multi story parking Time limitations(for Road side parking bays) Locate close to the Marketplaces, bus terminals & railway stations 5. Reduce entering of heavy vehicles to the city limits in the peak time 6. Develop a mechanism to locate container yards out of the city limits and use trains to transport goods from port to yard.(preferably closer to highway entry/exists 7. Introduce affordable economically viable systematic train system for goods transportation among major cities. 8. Introduce congestion road pricing scheme	ongoing	MoT DMT MoM&WD RDA MoPC&LG (CMC, KMC)	1. Travel time 2. Establish Tax System/ Introduce city entry fee 3. Environment friendly driving certificate. 4. Public parking yards 5. Train schedule to transport goods 6. Congested road pricing scheme 7. No of container yards relocated. 8. No of new fly overs & tunnels	1.Reduced Traffic congestion 2.Reduced travel time	500 Mn & private Sector

3. Effective management of Air Emissions from Stationary Sources

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
To develop capacity for measurement and monitoring stationary source emissions according to standard procedures and methods	Strengthening the existing capacities	<ol style="list-style-type: none"> 1. Preparation of specifications for required emission measuring equipment (Setup should be through CEA) 2. Facilitate capacity building of CEA and other identified organizations 3. Preparation of criteria for registration of testing laboratories 4. Registration of testing laboratories 5. Strength – CEA monitoring capacity 6. Develop suitable project proposal/TAP(technical assistance programmes) for implementing related activities 	2016-2018	AirMAC, MoMD&E CEA ITI, NBRO, Universities	<ol style="list-style-type: none"> 1.Prepared specifications for measuring equipment 2.No of registered laboratories 3.No of capacity building programmes conducted. 4. Proposal submission to NPD/ERD for approval 	<ol style="list-style-type: none"> 1.Well-equipped standard accredited testing laboratories for source emission monitoring, 2.Capacity built in related agencies 	10 Mn
To fill the gap of information about correlation between ambient air quality standards and Source emission standard.	Harmonization of ambient air quality standards and stationary source emission standards	<ol style="list-style-type: none"> 1. Collect baseline data on air emissions of stationary sources (key industries initially) and identify gaps in baseline data. 2. Improve the data collection mechanism to fill-up data gaps identified. 3. Introduce both dispersion and receptor modelling for air emissions to identify the correlation of stationary source emissions and ambient air quality 	2016-2018	AirMAC coordinate with CEA ITI NBRO VET Fund Universities	<ol style="list-style-type: none"> 1. Availability of compiled baseline data bank 2. Availability of applicable receptor and dispersion models 	<ol style="list-style-type: none"> 1.Harmonized emission standards gazetted 	5 Mn annually (15 Mn)
To improve resources and expertise for the local industry to adopt the Standards.	Stepwise approach in implementation	<ol style="list-style-type: none"> 1. Preparation of implementation road map 2. Preparation of code of practice including methods and criteria 3. Awareness among stakeholders including industrializing on source emission standards 4. Prepare and provide guidelines and information materials for industrialists. 	2016-2020	AirMAC MoMD&E CEA MoI BOI NCPV VET Fund SEA UDA MoPC&LG	<ol style="list-style-type: none"> 1. Availability of code of practice 2. No. of awareness programs conducted 3. Availability of guidelines and information materials 4. Existence of mechanism to recognise and reward pollution minimizing 	<ol style="list-style-type: none"> 1. Fully implemented Stationary Source Emission Standards 2.No of industries with ISO certification 	25 Mn (5 Mn annually)

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
		5. Introduce regulations to appoint qualified trained officer responsible for environment (at least category A high polluting industries initially) 6. Introduce recognition and rewarding mechanism for pollution minimized industries			industries. 5. Annual rewarding scheme for AQM	on Environment	
To implementation of control technology to some existing industries	Mitigation air pollution from small scale and traditional existing industries	1. Appoint expert committee for investigate, study the available best efficient and affordable technology for air emission control including energy efficient processes and equipment and make recommendation with solutions for identified practical problems for implementation. 2. Policy interventions (Tax concession/ financial assistance) for energy efficient equipment, etc., 3. Financial assistance/technical assistance/incentives for emission control, testing and standards implementation	2016-2025	AirMAC MoMD&E MoF CEA MoI BOI NCPC SEA Universities	1. Percentage of existing small scale and traditional industries that have reduced emissions below the emission standards. 2. Expert committee appointed. 3. Policy intervention (Tax concession) 4. Establish a special revolving fund to support these interventions. 5. Special loan scheme for SMI sector	1.50% reduction of air pollution loads from small scale & traditional industries by 2025 2.2.50 % of existing industries converted to clean energy efficiency process	1000 Mn (Initial capital for the revolving fund) 50 Mn (5 Mn annually)

4. Indoor Air Quality Management

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To generate baseline data	Conduct studies to generate baseline data	<ol style="list-style-type: none"> 1. Carry out literature survey 2. Identify the pollutants found in indoors (CO₂, PM, SO₂) 3. Identify other parameters that should be included in guidelines 4. Identify different types of buildings / locations that the guideline should be applied 5. Conduct island wide sample survey 6. Include indoor air pollution component to Kandy air pollution study 7. Conduct pilot indoor air quality study in Colombo area 8. Conduct exposure study on health impact assessment 	2016-2018	AirMAC, CEA, SEA, MoE, NBRO, Universities, VET Fund, MoI, MoM&WD, UDA, LAs,	<ol style="list-style-type: none"> 1. Literature survey report on Indoor Air Quality 2. Indoor air pollutant index. 3. Pilot study on indoor air quality 4. Study report of health impact assessment 	<ol style="list-style-type: none"> 1. Baseline data on indoor air quality available for decision making 2. Guidelines, standards & regulations for indoor air quality management 	15 Mn
To minimize indoor air pollution due to use of biomass for cooking	Awareness creation on the methods to reduce indoor air pollution due to biomass use	<ol style="list-style-type: none"> 1. Conduct awareness programmes on methods to reduce indoor air pollution <ol style="list-style-type: none"> 1. Improved cooking stoves/ Efficient cooking methods 2. Improved the kitchen ventilation etc., 3. Behaviour changes 	2016-2018	AirMAC, CEA, SEA, MoMD&E, NBRO, Universities, VET Fund, MoH, UDA, LAs	1.No. of awareness programmes	1. Reduced indoor air pollution in rural households	
To focus attention on indoor air quality in building design, construction, maintenance and use	Improving building design, construction and maintenance through building regulations and guidelines	<ol style="list-style-type: none"> 1. Strict implementation of existing building regulations 2. Review existing regulations 3. Develop indoor air quality guidelines 4. Incorporate indoor air quality guidelines to building regulations 	2016-2018	AirMAC, CEA, SEA, MoMD&E, NBRO, Universities, VET Fund, MoI, UDA, LAs	1.Indoor air quality guidelines in place	1. More awareness related on indoor air pollution	

5. Management of Unethical & Unintentional Practices

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To minimize air pollution due to open burning including e- waste	Develop a series of guideline and regulation in order to control / Minimize open burning.	1.Establish a inter agency subcommittee 2. prepare guidelines & standards and action plan	2016-2018	AirMAC CEA UDA, LAs MoM&WD MoH	1.Developed guideline, standards & regulations	1.Reduced open burning	3 Mn
	Awareness creation	Conduct awareness programs on harmful effects of emissions from open burning of waste	2016-2018	AirMAC CEA UDA ,LAs MoM&WD MoH	1.No. of awareness programs	1.Reduced open burning	15 Mn
To minimize air pollution from construction activities	Mitigate air pollution from construction activities/transportation of debris/ construction materials	1. prepare standards, guidelines & regulations 2. develop implementation action plan 3. awareness creations	2016-2018	GSMB AirMAC CEA UDA ,LAs MoM&WD MoH	1.Prepared standards, guidelines & regulations 2. Prepared action plan	1.Air pollution due to construction activities reduced	10 Mn

6. Cleaner Technologies, Fuels and Processes

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To develop sustainable fiscal policy on cleaner fuels, technologies and other related areas	Review fiscal policies on fuels and technologies on a scientific basis	<ol style="list-style-type: none"> 1. Sustain current price ratio between diesel and petrol 2. Encourage to use green vehicles with energy efficiency 3. Review of vehicular emissions standard 4. Introduction & importation of euro engine standards 5. Encourage to use bio-fuel and alternative fuel 6. Manage the infrastructure for Electric /Hybrid vehicles. 7. Promote electric vehicle for public transport. 8. Promote solar energy for electric vehicles 	On going	AirMAC, SEA, VET Fund, MoP&RE MoF MoMD&E, MoNP&EA MoT CEA	<ol style="list-style-type: none"> 1. Percentage of energy efficient green vehicles in the vehicle fleet 2. Percentage of alternative cleaner fuel used 3. No of electric vehicles for public transport 4. No of charging points 	1.Reduce air pollution by Increasing use of cleaner fuels and technologies	100 Mn & private sector
To make availability of quality fuel	Develop fuel quality standards for, transport, industry & power	<ol style="list-style-type: none"> 1. Preparation of standards for fuel quality for industrial and power sector 2. Review of existing fuel quality standards for transport sector 3. Introducing stringent fuel quality and emission standards for strategic/sensitive /vulnerable areas. 	2016-2020	CEA AirMAC MoPRD CPC IOC MoF	1.Fuel quality standards in place for transport, industry and power	1. Improved quality of fossil fuel.	25 Mn
	Fuel Quality maintenance	<ol style="list-style-type: none"> 1. Upgrade existing refinery 2. Establish and maintain independent accredited fuel quality test laboratories 	2016-2025	MoMD&E MoPRD AirMAC, VET Fund, MoM&WD MoF	<ol style="list-style-type: none"> 1. Upgraded refinery 2. Existence of accredited laboratories 	1. Improved quality of fossil fuel.	2500 Mn
To make availability of alternative cleaner fuel	Promotion of alternative cleaner fuel	<ol style="list-style-type: none"> 1. Promoting new investments on cleaner alternative fuel processing facilities through incentives 	ongoing	MoP&RE SEA	1. Ratio of alternative fuel used to fossil fuel	1.Reduced air pollutant emissions	5 Mn annually

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To increase availability of clean technology	Promoting cleaner technology	<ol style="list-style-type: none"> 1. Financial assistance, support, Tax concessions for energy efficient technologies. Ex: low engine capacity(less than 1.8L) Hybrid vehicles, Electric Vehicle, Charged by Solar Power. 2. Promote energy efficiency through eco labelling alternative clean technology 3. Financial assistance/incentives for renewable energy sources 	On going	MoF MoP&RE SEA	<ol style="list-style-type: none"> 1. Percentage of low emission vehicles 2. Percentage of energy coming from renewable sources 	1.Percentage of new inventions & practices in Cleaner technologies	5 Mn annually
To control Evaporative emissions	Guidelines on evaporative emissions during transportation of fuel , from fuel stations, servicing, and fuel tanks	<ol style="list-style-type: none"> 1. Introduce guideline 2. Awareness creations 3. Introduce precautionary measures and protective equipment to existing infrastructure 	2016-2020	AirMAC CPC IOC, MoPRD	1.Guideline prepared	1.Control emissions by evaporation	10 Mn + private sector

7. Air Quality Monitoring

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To establish comprehensive Air Quality Monitoring System for Sri Lanka	Develop Island wide Air Quality Monitoring Mechanism	Develop a comprehensive proposal for ERD for Technical Assistant Programme(TAP)	2016	CEA, AirMAC MoF NPD ERD	1.Project proposals	1.Comprehensive Technical Assistant Programme (TAP)	1 Mn
To establish comprehensive data base to verify the effectiveness of the measures taken.	Establish nationwide ambient air quality monitoring network for air quality monitoring	<ol style="list-style-type: none"> 1. Carry out stocktaking of present air quality monitoring 2. Establish a database of all AQM studies 3. Develop comprehensive proposal for island- wide Ambient Air Quality Monitoring Network <ol style="list-style-type: none"> a) Number of stations/ locations, b) Monitoring frequency (Continuous, time to time, random) c) Monitoring Methodologies and parameters. d) Resource requirement (equipment and personal) 4. Infrastructure development <ol style="list-style-type: none"> a) Site selection b) Land accusation/rental c) Equipment /facility purchasing/preparation d) Training and awareness 5. Start Monitoring and collect data 	2016-2020	CEA, AirMAC MoMD&E NBRO VET Fund	1.Existence of a ambient air quality monitoring network	1.Availability of comprehensive ambient air quality data base	500 Mn with private sector
To establish information system on ambient air quality	Disseminate information on ambient air quality through establishment of information system to analysis	<ol style="list-style-type: none"> 1. Gather data, analyse and disseminate information on ambient air quality through steering committee appointed by AirMac 2. Analyse data and make recommendations 3. Conduct research on incorporation of pollutant parameters such as ultra-fine 	2016-2017	AirMAC, CEA, VET Fund, NBRO	1.Air quality information	1.Readily available information on air quality	20 Mn

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
		particles in ambient air quality standards. (Submit proposal within 1 year)					
To establish data collection of trans boundary air pollution	Strengthen Trans boundary air pollution monitoring mechanism under the Male Declaration	<ol style="list-style-type: none"> 1. Strengthen capacity of existing station in Anuradhapura 2. Establish at least one additional monitoring station 3. Incorporate these monitoring activities to proposed air quality monitoring mechanism 	2016-2020	AirMAC CEA SACEP UNEP	1.Existence of trans boundary pollution monitoring mechanism	1.Availability of trans boundary air pollution data	30 Mn

8. Awareness, Education, Information and Knowledge Management for Air Quality

Objectives	Strategies	Actions	Time Frame	Agency	Indicators	Outcome	Budget
To create awareness among general public on air pollution and its social, environmental, economic and health impacts	Enhance general awareness regarding air pollution and its related effects among the general public	<ol style="list-style-type: none"> 1. Conduct cross-sectional KAP (Knowledge, Attitude and Practices) sample survey on air pollution and its adverse effects. 2. Design and implement comprehensive media strategy based on the survey. 3. Conduct awareness programmes targeting school children, teachers, policemen, vehicle owners and drivers. 4. Advocacy programmes for policy makers 5. Inclusion of air pollution related questions to driving license examination 6. Review and revise the school curriculum and training programs of public health staff to include the air pollution related issues 7. Development of IEC (Information, Education & Communication) material on air pollution and effects (environmental, health and social) 	On going	AirMAC, CEA, SEA MoMD&E NBRO, Universities, VET Fund , MoH	<ol style="list-style-type: none"> 1. Report of cross sectional KAP sample survey 2. No. of awareness programs 3. No. Of advocacy programs for policy makers 4. Driver awareness programme 5. Public health staff awareness programmes 6. Selected Sector awareness ie. traffic police, 3W drivers, motorcyclists 	Increased awareness among general public about air pollution issues	5 Mn annually

9. Research, Development fostered and Impact Assessment of Air Pollution

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
To promote incorporation of research finding for decision making policy interventions	Mechanism to identify the priorities in air pollution related research established	<ol style="list-style-type: none"> 1. Identify the priorities in air pollution related research through steering committee on ARM <ol style="list-style-type: none"> a. Development of emission factors according to Sri Lankan context b. Availability of a updated emission inventory c. Practicing of dispersion and receptor modelling d. Development of a Air Quality Index to aware general public easily. e. Indoor air quality f. Non combustion emissions from vehicles other sources 2. strengthening the established research groups and institutes 3. Promote research on impact on health, agricultural, environmental , archaeological structures and material 4. Include Air Quality Management on NSF priority areas 5. Introduce IAQ studies for post graduate studies of medicine 	On going	AirMAC, MoS&T Universities, CAE, NBRO VET Fund MoH DoA MET DoA CRAP	<ol style="list-style-type: none"> 1. Number of research groups and institutes identified and strengthened 2. Completed research projects relevant to each identified area and number of publications and abstracts 3. Annual allocation for research through the relevant agencies dedicated to air pollution based research. 4. Feedback from researchers on addressed constraints. 	1.Availability of research findings to support decision making process and policies	3 Mn annually
To collect data on impacts of air pollution and prevention measures	Impact assessment of air pollution prevention strategies	<ol style="list-style-type: none"> 1. Impact assessment of identified health aspects 2. Impact assessment of identified environmental aspects 3. Cost benefits analysis of proposed prevention strategies. 4. development of polices/policy 	2016-2025	AirMAC, MoH CPA CEA	Availability of data on impacts of air pollution and prevention measures	1. Health and environmental impacts of air pollution established.	2 Mn annually

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget
		briefs based on the research findings 5. Strengthening the routing data collection mechanism to facilitate air quality related research 6. Compile the air pollution impact studies in post graduate / MD level 7. Pilot project on air quality data and impact of health issues in selected towns.				2. Costs and benefits of prevention measures established.	

10. Development of Information Knowledgebase & Human Resources for Effective AQM

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
To enhance the capability of the officials who are engage in air quality management to measure comprehensive program of AQM	<ol style="list-style-type: none"> 1. Implementation of comprehensive HRD programme 2. Training and exposure visits (local and overseas), 3. Knowledge sharing 4. Encouraging research & development especially on local issues 5. Develop 20-30 targeted needs and places for tanning /exposure 	<ol style="list-style-type: none"> 1. Develop HRD Plan to fill gap and market it based on capacity assessment on thematic areas. 2. Use SIDA, USEPA, AIT and JICA for advanced Air Quality Management certificate courses 3. Participate in BAQ and other international forums and encourage publications and presentations. . 4. AQM modules in postgraduate programmes in environmental sciences. 5. Start a diploma/master's programme in AQM at an appropriate local universities 6. Targeted exposure(issue based) 7. Establish a Top to bottom information system / Knowledge base 8. Identify the present under graduate and post graduate programme on air quality and fill the gaps 9. Determine special areas to study of graduate level and post graduate for relevant agencies. 	Continuous	AirMAC, MoMD&E, CEA, VET Fund	<ol style="list-style-type: none"> 1. No. of Sri Lankan participants in international forums 2. No. of persons trained on AQM 3. No. of local postgraduate programmes with AQM modules 4. No. of AQM related Masters/ Ph.D research conducted. 	1. A team of officials with knowledge and skills in air quality management	Donor funding as far as possible and 1.5 Mn annually
To enhance the information knowledge based on air quality	<ol style="list-style-type: none"> 1. Platform to share the research findings (symposium, web based discussion forum) and compilation of published research 2. Regular press release/newspapers articles and the press conferences 	<ol style="list-style-type: none"> 1. Organize bi-annual symposium and compilation of research reports/publications. 2. Maintain an active web based forum which discuss at least one important issue per month. 3. Hold press conferences to disseminate important statistics on air quality. 	Continuous	AirMAC, MoMD&E, CEA, VET Fund	<ol style="list-style-type: none"> 1. No. of papers presented at annual research symposiums. 2. No. of press conferences conducted. 	1. Accessible, comprehensive and up-to-date information on air quality management & related	Donors & Private sponsorships and 2 Mn annually

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
	based on the research findings 3. Dissemination of air quality monitoring data and interpretation to public	4. Publishing timely updated air quality monitoring index 5. Paper article publish on air quality 6. Prepare the curriculum for training programmes. 7. Training programme for media personal about air quality issues/air quality management with giving relevant certificate 8. Measure air quality data in key cities and disseminate among other institutions and public 9. Create database to get all air quality data.			3. Published air quality index, data	issues.	

11. Global Participation & Collaboration for AQM

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
To create opportunities to obtain technical, educational and financial benefits through regional and international networks by sharing experience and resources.	<ol style="list-style-type: none"> 1. Share Sri Lanka experience in air quality management 2. Share the experience of other countries and seek networking opportunities 	<ol style="list-style-type: none"> 1. Identify relevant institutions to network and actively work towards establishing formal linkages 2. Enhanced participation in CAI-Asia, Clean Air Training Network (CATNET) and APTI, USEPA, UNEP, USAID/World Bank Initiatives and other. 3. Participation in Asia PROECO Programme by EU, AIT and BAQ 4. Initiate Collaborative programme with AIT /UNDP-GEF 5. Coordinate with UNEP Chemicals & Waste branch 6. Coordinate Male Declaration secretariat (UNEP/SACEP) 7. Collaboration with UNEP Cleaner Fuels & Vehicles Programme 8. Coordinate with UNCCRD on EST 	Continuous	AirMAC Together with stakeholder agencies	<ol style="list-style-type: none"> 1. Number of Sri Lankans participated in training/research activities 2. Number of joint programmes conducted through networks 3. Number of best management practices shared 	1. Technical, educational and financial benefits gained through regional and international networks.	Donor support & 1.5 M annually

12. Sustainable Financing Mechanism for AQM

Objectives	Strategies	Actions	Time Frame	Agency	KPI	Outcome	Budget -Rs.
To establish sustainable financing Mechanism for AQM	Awareness through promotion campaign on status of air quality and the importance and priority of Air Quality Management.	<ol style="list-style-type: none"> 1. Identify priority projects through a stakeholder meeting. 2. Conduct awareness programmes to key policy makers especially to those who are involved in resource/financial allocation. 	Continues	AirMAC stakeholders	1.No. of stakeholder meetings/ no of awareness programmes	1.No of trained people /policy makers	1 Mn annually
	Make provisions to financial assistance from VET fund	<ol style="list-style-type: none"> 1. Develop a suitable format to submit project proposals to VET Fund (with guidelines) 2. Identify priority projects to be submitted to VET before March every year through stakeholder meeting. 		AirMAC VET fund CEA NBRO Universities	1.No. of priority project proposals that received funding	1.Fund allocations for priority projects	0.2 Mn annually
	Obtaining financial assistance from different agencies	<ol style="list-style-type: none"> 1. Develop capacity of a selected group to write appealing project proposals 2. Identify interests of different funding agencies and make funding requests accordingly 3. Presenting attractive and appealing project proposals to foreign and local funding agencies 4. Obtain funding from GEF/SGP 		Air MAC & other stakeholders	<ol style="list-style-type: none"> 1.No. of trained group for write proposals 2.No of attractive project proposals 	<ol style="list-style-type: none"> 1.No. of project proposals 2.No of funds available 	1.0 Mn annually
	Public-Private partnerships	<ol style="list-style-type: none"> 1. Identify business models that could apply to promote public-private partnership mechanism co-op up with air quality management related activities and take action to implement 2. Outsourcing Air Quality Monitoring 		AirMAC	No. of suitable business models, guidelines & standards	No of Implemented business models , guidelines, standards & regulations implemented	2.0 Mn 2016/2017
	Establish market base mechanisms for managing AQM	<ol style="list-style-type: none"> 1. Introducing load-based tax systems for high polluting activities. 		AirMAC MoMD&E CEA SEA	Market base instruments available	Market base instruments implemented	

Appendix 11

List of Participants

No	Name	Institute
1	Prof. Amal S. Kumarage	Senior Professor Department of Transport and Logistics Management, Faculty of Engineering, University of Moratuwa.
2	Dr. A. G. T. Sugathapala	Senior Lecturer Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa.
3	Archt. Dr. Indrika Rajapaksha	Senior Lecturer Department of Architecture, Faculty of Architect, University of Moratuwa.
4	Dr. D. G. G. Parakrama Karunarathne	Senior Lecturer Department of Chemical & Process Engineering, Faculty of Engineering, University of Peradeniya.
5	Dr. D. S. Jayaweera	Director Clean Air Sri Lanka 908/1, Pannipitiya Road, Battaramulla.
6	Dr. Ruwan Wijemuni	Chief Medical Officer Colombo Municipal Council Town Hall, Colombo 07.
7	Dr. Ananda Malawathanthri	Country Representative IUCN Sri Lanka Country Office, 53, Horton Place, Colombo 07.
8	Dr. Inoka Suraweera	Consultant, Community Physician, Environment & Occupational Health Unit Ministry of Health & Ingenious Medicine "Suwasiripaya" , Colombo 10.
9	Dr. Sugath Yalegama	Director (Planning and Development) Ministry of Policy Planning & Economic Affairs "Miloda"(Old Times Building), Colombo 01.
10	Dr. B.M.S. Batagoda	Ministry of Power and Renewable Energy 72, Ananda Coomarswamy Mw, Colombo 07
11	Dr. Sumal Nandasena	Consultant National Institute of Health Science No: 28, Nagoda, Kalutara.
12	Mr. Anura Jayathilaka	Director (ARM&IR) Ministry of Mahaweli Development & Environment "Sampathpaya", Battaramulla.
13	Mr. Ajith Silva	Director/Planning Ministry of Mahaweli Development & Environment "Sampathpaya", Battaramulla.
14	Eng. (Mrs.)W.R.L. Hiranthi Jansz	AD /Air Resource Management Unit Center Environment Authority 104, Denzil Kobbekaduwa Mawatha, Battaramulla.
15	Mr. R. N. R. Jayarathne	Senior Public Relation Officer Industrial Technology Institute No: 363, Bauddhaloka Mawatha, Colombo 07.

- 16 Ms. Shireen Samarasuriya National Coordinator
GEF/SGP Sri Lanka
UNDP, 202-204, Bauddhaloka Mawatha,
Colombo 07
- 17 Mr. M. F. A. Mubarak Director- Environment
Department of National Planning
1st Floor, The Secretariat, Colombo 01.
- 18 Mrs. Anoja Herath Director (Agriculture Development)
Ministry of Agriculture
"Govijana Mandiraya", Battaramulla.
- 19 Ms. B. L. D. Balasuriya Director(Education)
Ministry of Education
"Isurupaya", Battaramulla.
- 20 Mr. A. M. R. J. K. Jayasinghe Senior Assistant Secretary (Admin)
Ministry of Transport & Civil Aviation
No. 1, DR Wijewardana Mw, Colombo 10.
- 21 Mr. D. D. L. Darmapriya Addl. Secretary
Ministry of Transport & Civil Aviation
No. 1, DR Wijewardana Mw, Colombo 10.
- 22 Mrs. D. M. J. K. Dissanayaka AD(Planning)
Ministry of Petroleum
80, Sir Ernest de Silva Mawatha, Colombo 07.
- 23 Mr. H. D. S. Premasiri Senior Scientist
National Building Research Organization
No: 1/99, Jawatta Road, Colombo 05.
- 24 Ms. W. H. S. P. Soysa Lecturer
National Institute of Education
21, High-level Rd, Maharagama.
- 25 Mr. J. J. Shanthasiri Senior Scientific Officer
National Science Foundation
47/5, Maitland Place, Colombo 07.
- 26 Mrs. M. C. Senevirathne Quality Manager(Life Sciences Division)
Sri Lanka Atomic Energy Board
60/460, Baseline Road, Orugodawatta,
Wellampitiya.
- 27 Mr. K. M. T. B. Ganegoda Senior Civil Engineer
Sri Lanka Ports Authority
No. 19, Chaithya Road, Colombo 01.
- 28 Mr. Sajith Wickckramanayake Chief Mechanical Engineer (Maintenance)
Sri Lanka Transport Board
No.200. Kirula Road, Colombo 5.
- 29 Mr. Dhanushka De Silva Environmental Compliance & Planning Manager
Environment Strategy and compliance unit
Sri Lankan Airlines Ltd.,
Bandaranayaka International Airport, Katunayaka.
- 30 Mrs. W. P. P. Wijesinghe Deputy Director (Environment)
Urban Development Authority
Sethsiripaya, Battaramulla.
- 31 Mr. A. W. Dissanayaka Project Director
Vehicular Emission Testing Program
Department of Motor Traffic, Narahenpita.
- 32 Mr. Hudson U. de Silva Director
Environment & Social Development
Road Development Authority
Sethsiripaya, Battaramulla.

- 33 Mrs. Lumbini Kiriella
Legal Officer
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 34 Mrs. Janani Palliyaguru
Assistant Director (ARM&IR)
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 35 Mr. Sanjeewa Bandaranayaka
DGM/Finance & Administration
People's Leasing & Finance PLC
1161, Maradana Road, Colombo 08.
- 36 Mr. Sampath Ranasinghe
Project Manager
Biomass Energy Project, UNFAO
Sri Lanka Sustainable Energy Authority, BMICH,
Colombo 07.
- 37 Mr. R. M. Ariyamanjula
Deputy Manager Technical Support & Cooperate
Affairs
Ceylon Petroleum Corporation
609, Dr Danister de Silva Mawatha, Colombo 09.
- 38 Mr. Parakrama Dissanayaka
Senior Director
Civil Aviation Authority
No 4, Hunupitiya Road, Colombo 02.
- 39 Mr. R. K. D. Alwis
Director/General Manager
CleanCo Lanka Limited.
334, T.B. Jaya Mawatha, Colombo 10.
- 40 Mr. D. A. Jayasinghearachchi
Deputy Director
Department of Meteorology
383, Bauddhaloka Mawatha, Colombo 07.
- 41 Mrs. Sujeewa S Guruge
Assistant Commissioner
Department of Motor Traffic
341, Alvitigala Mw, Colombo 5, Narahenpita.
- 42 Ms. Kalika Kumarasinghe
Research Engineer
Industrial Technology Institute
No: 363, Bauddhaloka Mawatha, Colombo 07.
- 43 Mr. Damayantha Darmasiriwardene
Chief Executive Officer Eco Sri
LAUGFS Eco Sri (Pvt) Ltd
No. 14, R A De Mel Mawatha, Colombo 04.
- 44 Mr. T. R. Miskin
Inspector of Police
Traffic Police
Traffic Police Head quarters, Mihidu MW,
Colombo 10.
- 45 Mr. Ruwan Weerasooriya
Assistant Director
Vehicular Emission Testing Program
Department of Motor Traffic, Narahenpita
- 46 Mr. Gamini Gamage
Additional Secretary
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 47 Mr. Sujith Rathnayake
Enior Environmental Management Officer
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 48 Mr. Gemunu Wijeratne
Chairman
Sri Lanka Private Bus Owners Association
No 06, Nawala Road, Nugegoda.
- 49 Mr. K. K. Hewavitharana
Deputy Chief Engineer(Motive Power),
Sub Department,
Sri Lanka Railways
No 575, Baseline Road, Colombo 9.

- 50 Mr. T. R. R. Palli
Secretary
Three Wheel Association
19/4, KAMAL Road, Kollupitiya.
- 51 G.A.D.R.Gayani
Assistant Director
Air Resource Management & International Relations
Ministry of Mahaweli Development & Environment
Development Officer(Env)
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 52 Mr. Nanda Senarathna
Development Officer (Env)
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 53 Ms. Kasuni Anuranga
Development Officer (Env)
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.
- 54 Ms. Upamali Jayasumana
Program Assistant
Ministry of Mahaweli Development & Environment
"Sampathpaya", Battaramulla.