

Senarath, Mrs. Chandralatha “An Overview Of Air Pollution And Respiratory Illnesses In Sri Lanka” in Martin J. Bunch, V. Madha Suresh and T. Vasantha Kumaran, eds., *Proceedings of the Third International Conference on Environment and Health, Chennai, India, 15-17 December, 2003*. Chennai: Department of Geography, University of Madras and Faculty of Environmental Studies, York University. Pages 489 – 501.

AN OVERVIEW OF AIR POLLUTION AND RESPIRATORY ILLNESSES IN SRI LANKA

Mrs. Chandralatha Senarath (BSc. Hons, PGDE.Merit, MEd)
Senior Lecturer, Nilwala College of Education, Wilpita, Akuressa, Sri Lanka,
csenerath@yahoo.com.au

Abstract

The development of science and technology leads to environmental problems in both developed and developing countries. Air pollution is one of these problems. In Sri Lanka the impact of air pollutants on human health has become a major issue. Therefore it is important to investigate the effects and the controlling measures of air pollution.

Through this overview I will illustrate the major air pollutants and their sources, and then show the health effects of air pollution and do an investigation on the air pollution scenario in Sri Lanka, to know the current situation of respiratory illnesses related to air pollution. Then to find the control measures taken by the regulatory authorities to abate air pollution.

By visiting the Central Environmental Authority, Urban Development Authority and Public Health Bureau, I was able to collect relevant facts through discussions and interviews with the people who concern about Air pollution and using some reference materials. By observation of the places where air pollutants can be seen, I was able to find some ways that air pollutants are released

- *There have been famous air pollution episodes in the past.*
- *Air pollutants can be classified as suspended particulate matter, gasses and vaporous.*
- *In Sri Lanka automobile exhaust is one of the major causes of air pollution.*
- *In Sri Lanka since 1995, diseases of the respiratory system ranked as the second leading cause of hospitalization.*
- *Respiratory diseases ranked within the first five leading causes of death in all age groups except 15 – 24 and 25 – 49 years.*
- *The figures of hospitalization and hospital deaths from 1995 – 2001 show that ASTHMA has become a major respiratory disease.*

.....

Introduction

Air pollution is an undesirable change in the physical, chemical or biological characteristics of air, which will adversely affect plants, animals, human beings and inanimate objects.

The development of science and technology leads to environmental problems in both developed and developing countries. Air pollution is one of these environmental problems.

Air pollution, both indoors and outdoors, is a major environmental health problem affecting both developed and developing countries alike. It comes from sources of dust, gases and smoke and is generated mainly by human activities but also naturally. Green house effect, Ozone layer depletion and Acid rain are global effects of Air pollution.

In Sri Lanka the impact of air pollutants on human health has become a major issue. Therefore it is important to investigate the effect and the control measures of air pollution.

Objectives

1. To categorize the major air pollutants and their sources.
2. To investigate the health effects of air pollution.
3. To investigate the air pollution scenario in Sri Lanka.
4. To understand the current situation of respiratory illnesses in Sri Lanka related to air pollution.
5. To find control measures taken by the regulatory authorities to abate air pollution.

Methodology

Data were collected:

- By visiting the Central Environmental Authority, Family Health Bureau.
- Through discussions and interviews with the people who are concerned about air pollution and its health effects.
- Using reference materials.

Findings

The major findings of the study are:

- (1) Air pollutants can be classified as suspended particulate matter, gases and vapours that are present in the atmosphere in abnormally high concentrations. The main components of suspended particulate matter are coarse particles such as soil and mineral ash or fine particles found in wood smoke or coming from engine exhausts. Gaseous air pollutants are principally oxides of Nitrogen, Ozone, Carbon monoxide, Sulphur dioxide, Ammonia and Volatile organic compounds.

- (2) Air pollutants sources and health effects can be tabulized as mentioned below.

<i>Air Pollutants</i>	<i>Sources</i>	Health Effects
Carbon monoxide	Product of incomplete Combustion of organic matter	* Symptoms of Co (Carbon monoxide) poisoning are: Dizziness, Headache, General fatigue. * Blocks the uptake of Oxygen by blood by forming carboxyhaemoglobin. This affects respiration and function of brain and heart.
Sulphur oxides	* Burning of fossil fuels * Automobile exhaust	* Irritation of the mucous membrane

Nitrogen oxides	<ul style="list-style-type: none"> * Industrial process * Automobile exhaust * Industrial furnaces 	<ul style="list-style-type: none"> * Aggravate existing conditions especially bronchitis * Causes wheezing, shortness of breath and coughing * Irritates mucous lining of nose and throat, coughing, choking, headache, lung inflammation such as bronchitis or pneumonia
(S P M) Suspended particulate matter	<ul style="list-style-type: none"> * Automobile exhaust fumes. * Industry – smoke, mining and construction * Agricultural activities * Indoor cooking using firewood * Burning of organic matter 	<ul style="list-style-type: none"> * Aggravates heart and lung conditions * Irritates nose, throat * Particles less than five microns can pass through the lungs causing inflammation and scar to Lung tissue
Heavy metals, Pb (Lead)	<ul style="list-style-type: none"> * Motor vehicle exhaust * Industry 	<ul style="list-style-type: none"> * Accumulate in bones where It replaces Calcium *Lead intoxication will lead to brain damage * Low level of chronic exposure to Pb leads to permanent retardation in children

(3) In Sri Lanka, 69% of the Domestic sector and 17% of the Industrial sector cause air pollution. Power generation, Open burning of domestic and industrial refuse can be mentioned as other stationary sources. The mobile source, the transport sector causes air pollution of 12.5%.

Air pollution in Sri Lanka is primarily due to the combustion of commercial energy. Transport sector is the biggest contributor of pollutants to the environment. Emissions from other sectors being fairly low except Sulphur dioxide. Carbon monoxide is the largest pollutant. Industrial sector accounts for nearly half of the total emission of SO₂ (Sulphur dioxide).

Among urban areas, Colombo, the capital of Sri Lanka is highly polluted due to:

- High traffic congestion during peak hours.
- Higher vehicle population.
- Low priority for vehicle maintenance and fuel efficiency.
- Improper releasing of harmful air pollutants from the factories in the metropolitan area.

- (4) According to a finding of WHO (Air pollution is an important risk factor for acute respiratory infections, which are responsible for nearly a third of all childhood deaths) it is understood that air pollution effects the human respiratory system.

Table 1 shows the data of hospitalization and hospital deaths related to the respiratory system, which are taken from a major children's hospital in Sri Lanka. This indicates 'ASTHMA' and 'ACCUTE BRONCHIOLITIS' have taken a major place of hospitalization.

Table 2 shows since 1995 diseases of the respiratory system ranked as the second leading cause of hospitalization. And according to Graph 1, the number of hospitalizations has increased annually, although a slight decrease is shown in 2001.

Analyzing the figures of hospitalization and hospital deaths of selected diseases from 1995 – 2001, it is obvious that there is a marked increased of ASTHMA. (Refer table – 3).

According to the Annual Health Bulletin 2001 respiratory diseases ranked within the first five leading causes of death in all age group except 15 – 24 and 25 – 49 years. (Refer table 4).

Table 5 and Graph 2 show the diseases of respiratory system ranked the 6th and 7th leading cause of death from 1995- 2001.

- (5) In Sri Lanka, the National Environmental Steering Committee, Central Environmental Authority (CEA), Police and Ceylon Petroleum Corporation (CPC) are the authorities that are concerned about air pollution. These authorities have taken control measures to abate air pollution. Some of them are mentioned below.

- In 1992 the National Environmental Steering Committee approved “Clean Air 2000”. This was the first step taken in Sri Lanka to address this problem in the Colombo Metropolitan Area in 1992. In March 1993, “Clean Air 2000” came into effect. It proposed 50 actions, but very few could be implemented.
- Formulate a National Policy on air quality management. This was formulated to implement the actions specified in “Clean Air 2000”.
- Formulate ambient air quality standards. This was formulated by Central Environmental Authority and issued in the gazette in December 1994 under the National Environment Act as the National Environmental Regulations 1994.
- Air Emission Standards. - This also comes under the National Environmental Act. Emission limits for motor vehicles coming under this Air Emission Standards.
- Establish a reliable and acceptable monitoring system. Monitoring was done at three stations such as two stationary stations and one mobile station. They have selected Colombo Railway Station as one station. The

Analyzed results are published in a weekly News Paper using Air Quality Index and Colour Code for the awareness of the public. (Refer- chart 1)

- Motor Traffic Act. – Any examiner or authorized officer can stop a motor vehicle on a highway if he has reasonable grounds to believe that the vehicle is not in a fit condition.
- Ceylon Petroleum Corporation regulates the type of fuel being brought into the country. And it has phased out the Leaded Gasoline completely.

Conclusions and Suggestions

- Automobile exhaust is one of the major causes of air pollution.
- Through this overview it is understood the respiratory diseases in Sri Lanka have become a major health problem and this issue will be suitable for further studies.
- Strengthen the control measures to abate the Air Pollution.
- Take necessary steps to minimize traffic congestion and to conduct suitable programmes to make public aware.
- Minimize the using of artificial materials such as polythene, plastics in day today activities.
- Enhancement of recycling processes of artificial materials.

References:

1. State of the Environment in Sri Lanka, A National Report prepared for the South Asian Association for the Regional Cooperation. Ministry of Environment and Natural Resources. (Jan 2002)
2. Annual Health Bulletin (1997)
3. Annual Health Bulletin (1998)
4. Annual Health Bulletin (1999)
5. Annual Health Bulletin (2000)
6. Annual Health Bulletin (2001)
7. Pollution and its impacts on the environment. Published by the Open University of Sri Lanka (2000).

Diseases of respiratory system [J00-J99]

Table-1

		2001 Disch.	Deaths	2002 Disch.	Deaths	2003 (1qr)
J20	Acute Bronchitis	63	-	60	-	30
J21	Acute Bronchiolitis	803	2	1940	1	568
J30-J39	Other Diseases of the upper respiratory tract	415	-	338	-	160
J40-J44	Bronchitis, Emphysema & other Chronic obstructive pulmonary diseases.	30	-	34	1	4
J45-J46	Asthma	1068	1	2004	-	530
J47	Bronchiectasis	2	-	2	-	10
J22 J60-J98	Other Disease of the respiratory system	5222	15	11942	11	4538

Table - 2

Leading Causes of Hospitalization, 1995 - 2001

Disease and ICD (10th Revision) code	2001		2000		1999		1998		1997 ¹		1996 ²		1995 ³	
	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
Traumatic injuries (S00-T19)	1	13.4	1	14.6	1	14.1	1	13.4	1	13.0	1	12.7	1	10.2
Diseases of the respiratory system excluding diseases of upper the respiratory tract, pneumonia, and influenza	2	8.1	2	9.6	2	9.9	2	10.0	2	10.1	2	10.2	2	10.0
Symptoms, signs and abnormal clinical and laboratory findings (R00-R99)	3	5.5	4	5.8	4	5.9	4	6.2	3	6.4	3	6.7	3	8.4
Diseases of the gastro-intestinal tract (K20-K92)	4	5.0	5	5.4	5	5.3	6	5.3	6	5.2	6	5.0	6	4.3
Viral diseases (A80-B34)	5	4.6	3	6.8	3	6.3	3	7.2	4	5.6	4	5.9	5	4.3
Intestinal infectious diseases (A00-A09)	6	4.0	6	4.1	6	4.9	5	5.5	5	5.6	5	5.2	4	4.4
Direct and indirect obstetric causes ⁵ (O10-O46, O48-O75, O81-O99, Z35)	7	3.3	7	3.6	9	3.3	9	3.0	10	2.9	10	2.9	11	2.5
Diseases of the urinary system (N00-N39)	8	3.2	8	3.5	7	3.5	7	3.6	8	3.4	8	3.6	8	3.6
Diseases of the musculoskeletal system and connective tissue	9	2.9	9	3.3	8	3.4	8	3.5	7	3.6	7	3.8	7	4.0
Diseases of the skin and subcutaneous tissue (L00-L99)	10	2.7	10	3.1	10	3.0	10	3.0	9	2.9	9	3.2	9	3.4
Hypertensive diseases (I10-I15)	11	2.3	11	2.4	11	2.3	11	2.3			11	2.3		
Diseases of the upper respiratory tract Malaria (B50-B54)														
Other injuries and early complications of trauma (T33-T35, T66-T79, T90-T98)													10	2.9

Source: Medical Statistics Unit

Excludes:

- ¹ Ampara District
- ² Kilinochchi and Mullaitivu Districts
- ³ Jaffna, Kilinochchi, Mullaitivu and Ampara Districts
- ⁴ Polonnaruwa District
- ⁵ Single spontaneous delivery, false labour and those admitted and discharged before delivery.

Hospitalization – Diseases of the respiratory system

Graph-1

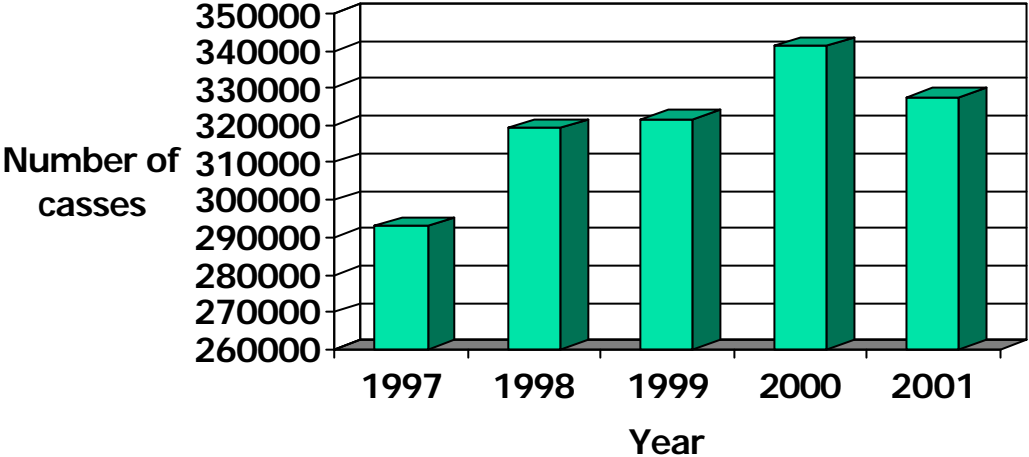


Table - 3.

Trends in Hospitalization and Hospital Deaths of Selected Diseases, 1975 - 2001

Disease and ICD Code	Cases per 100,000 Population					Deaths per 100,000 Population								
	1975	1980	1985	1990 ¹	1995 ²	2000	2001	1975	1980	1985	1990 ¹	1995 ²	2000	2001
Intestinal infectious diseases (A00-A09)	969.8	955.4	849.1	837.5	676.1	347.4	857.4	18.6	10.3	7.3	3.0	1.0	1.0	1.9
Tuberculosis (A15-A19)	114.1	76.2	74.0	86.8	54.0	60.7	66.3	8.3	4.3	3.9	3.5	3.1	3.0	7.3
Diphtheria (A36)	2.3	0.3	0.1	-	-	-	-	0.3	0.0	0.0	0.0	-	-	-
Whooping cough (A37)	9.9	3.7	3.4	1.9	1.0	1.1	0.3	0.1	0.0	0.0	0.0	0.0	-	-
Septicaemia (A40, A41)	6.7	8.3	9.9	8.5	5.5	13.6	16.3	1.7	3.7	5.4	4.7	1.4	6.3	11.6
Rabies (A82)	1.3	0.9	0.7	1.7	0.9	0.8	1.6	0.3	0.1	0.2	0.3	0.5	0.5	0.5
Measles (B05)	37.0	34.1	59.3	27.6	1.5	90.7	3.3	0.0	0.1	0.1	0.0	-	0.0	0.0
Viral hepatitis (B15-B19)	109.8	31.7	41.9	40.9	38.7	26.3	22.5	1.4	0.4	0.4	0.4	0.1	0.1	0.2
Malaria (B50-B54)	800.3	344.5	437.1	678.9	262.2	304.1	148.4	0.9	0.2	0.2	0.5	0.2	0.6	0.8
Helminthiasis (B76, B77, B79, B80)	230.5	207.4	112.0	37.9	17.3	10.1	8.4	1.6	0.5	0.4	0.1	0.1	-	-
Diabetes mellitus (E10-E14)	95.5	65.6	86.6	87.5	78.6	204.8	245.1	4.7	1.8	2.0	2.0	3.8	3.7	7.0
Nutritional deficiencies (E40-E46, E50-E56)	197.7	134.4	109.2	24.8	7.3	15.9	17.9	10.4	1.3	1.3	0.4	0.1	0.1	0.1
Anemias (D50-D64)	430.8	394.8	277.5	154.9	134.6	98.9	89.2	9.4	3.3	2.2	1.0	0.9	0.7	1.0
Hypertensive disease (I10-I15)	121.6	182.7	186.8	200.7	326.7	428.3	471.3	6.0	4.9	4.5	3.6	3.1	3.3	6.2
Ischaemic heart disease (I20-I25)	76.4	117.3	163.9	163.2	263.3	313.2	342.2	7.6	12.5	15.9	15.1	16.8	18.6	37.5
Asthma (J45)	353.6	396.6	395.0	554.7	779.3	894.8	953.5	1.4	1.2	1.6	2.0	3.7	4.4	8.7
Diseases of the liver (K70-K76)	38.5 ³	32.3	41.1	64.3	68.9	121.7	136.1	3.8	3.3	3.9	6.4	8.2	14.1	30.2
Abortions ⁴ (O00-C08)	829.4	869.5	811.3	846.2	832.8	788.2	850.4	1.1	0.3	0.3	0.3	0.2	0.2	5.6

Excludes:

¹ Northern and Eastern Provinces² Jaffna, Kilinochchi, Mullaitivu and Ampara districts³ cirrhosis of the liver only⁴ Rate per 100,000 females of the reproductive age group

Source: Medical Statistics Unit

Table - 4

Deaths and Rates for the Five Leading Causes of Death in Each Age Group, 1996

Age and Cause of Death	Number	Rate	Age and Cause of Death	Number	Rate
Under 1 Year			15 - 24 Years		
All causes	5,879	1979.2	All causes	9,500	278.8
* Conditions originating in the perinatal period	4,138	1393.1	* Homicides and injury purposely inflicted by others	3,897	114.4
* Symptoms, signs and ill-defined conditions	374	125.9	* Other violence	1,615	47.4
* Diseases of the respiratory system excluding diseases of the upper respiratory tract	265	89.2	* Suicides and self-inflicted injury	1,449	42.5
* Diseases of the pulmonary circulation and other forms of heart disease	200	67.3	* Other accidents including late effects	650	19.1
* Other bacterial diseases	165	55.5	* Symptoms, signs and ill-defined conditions	380	11.2
Other Causes	737	248.1	Other causes	1,509	44.3
1 - 4 Years			25 - 49 Years		
All causes	1,237	94.0	All causes	25,851	391.7
* Symptoms, signs and ill-defined conditions	232	17.6	* Homicides and injury purposely inflicted by others	6,681	101.2
* Diseases of the respiratory system excluding diseases of the upper respiratory tract	135	10.3	* Suicides and self-inflicted injury	2,707	41.0
* Other accidents including late effects	112	8.5	* Symptoms, signs and ill-defined conditions	2,250	34.1
* Diseases of the nervous system	104	7.9	* Diseases of the pulmonary circulation and other forms of heart diseases	2,011	30.5
* Diseases of the pulmonary circulation and other forms of heart diseases	101	7.7	* Diseases of the gastro-intestinal tract	1,781	27.0
Other causes	553	42.0	Other causes	10,421	157.9
5 - 14 Years			50 and above		
All causes	1,914	50.4	All causes	77,780	2682.3
* Symptoms, signs and ill-defined conditions	279	7.4	* Symptoms, signs and ill-defined conditions	33,962	1171.2
* Other accidents including late effects	252	6.6	* Diseases of the pulmonary circulation and other forms of heart diseases	8,669	299.0
* Diseases of the respiratory system excluding diseases of the upper respiratory tract	140	3.7	* Diseases of the nervous system	4,893	168.7
* Diseases of the pulmonary circulation and other forms of heart diseases	125	3.3	* Diseases of the respiratory system excluding diseases of the upper respiratory tract	4,638	159.9
* Congenital anomalies	97	2.6	* Ischaemic heart disease	3,749	129.3
Other Causes	1,021	26.9	Other causes	21,869	754.2

Source: Medical Statistics Unit

Based on Registrar General's mortality statistics

The two digit rubrics of the Basic Tabulation List of the ICD 9, was used in selecting the leading causes of death. Rate per 100,000 population of the respective age groups.

Table-5 Leading Causes of Hospital Deaths, 1995 - 2001

Disease and ICD (10th Revision) code	2001		2000		1999		1998		1997 ²		1996 ³		1995 ⁴	
	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
Ischaemic heart disease (I20-I25)	1	8.5	1	10.6	1	10.0	1	9.5	1	9.7	1	10.6	1	10.6
Diseases of the gastro-intestinal tract (K20-K92)	2	8.0	2	9.3	2	9.3	2	9.4	2	9.1	3	8.6	3	8.6
Cerebrovascular disease (I60-I69)	3	7.1	3	9.0	3	9.1	4	8.6	3	9.1	2	9.6	2	10.6
Pulmonary heart disease and diseases of the pulmonary circulation (I26-I51)	4	6.7	4	8.6	4	8.0	3	8.8	4	8.1	4	8.2	4	8.1
Neoplasms (C00-D48)	5	6.4	5	7.5	5	7.4	5	6.7	6	6.5	5	8.1	5	7.3
Diseases of the respiratory system, excluding diseases of upper respiratory tract, pneumonia and influenza (J20-J22) (J40-J98)	6	5.3	6	6.5	6	6.8	7	6.1	7	5.9	7	5.7	7	5.7
Toxic effects of pesticides (T00)	7	4.1	7	5.4	7	5.7	6	6.7	5	6.6	6	6.3	6	6.0
Symptoms, signs and abnormal clinical and laboratory findings (R00-R99)	8	3.7	8	4.8	8	5.0	8	4.6	8	5.1	9	4.5	11	3.2
Traumatic injuries (S00-T19)	9	3.2	10	4.0	9	4.5	11	3.8	11	3.8	11	3.4		
Zoonotic and other bacterial diseases (A20-A49)	10	3.1	9	7.3			9	4.4	9	4.3	8	5.0	8	4.3
Diseases of the urinary system (N00-N59)	11	2.8			10	3.7								
Pneumonia (J12-J18)			11	3.6	11	3.6	10	4.4	10	3.8				
Disorders related to short gestation, low birth weight, slow fetal growth and fetal malnutrition (P05-P07)											10	3.8	10	3.3

¹ Includes deaths reported from the Cancer Hospital (not analysed by site and type of neoplasm).

Exclude-

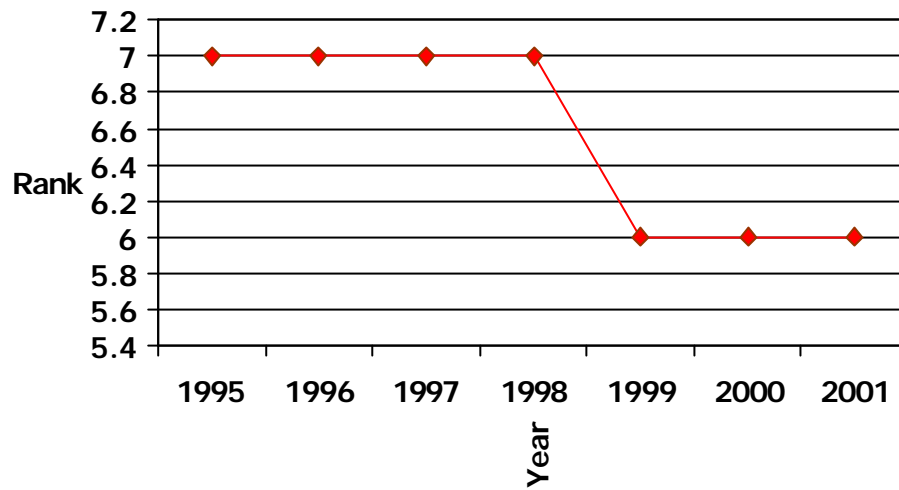
² Ampara District

³ Kilinochchi, Mullaitivu and Ampara Districts

⁴ Polonnaruwa District

Source: Medical Statistics Unit

Hospital Deaths- Diseases of the respiratory system Graph-2





The Air We Breathe Chart-1

[Location Railway Station, Colombo Fort]

Sri Lanka Air Quality Index (SLAQI) & Colour Code

Carbon Monoxide (CO)	SLAQI = 15
Sulper Dioxide (SO ₂)	SLAQI = 44
Nitrogen Dioxide (NO ₂)	SLAQI = 32
Particular Matter (PM ₁₀)	SLAQI = 49



