

Impacts of Air Pollution in Sri Lanka

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Abstract— Air pollution is a significant threat to health and the environment for the whole world. When Technology development, air pollution is increased rapidly in all over the world. The air pollution of the atmosphere causes many kinds of weather and climate changes, also depletion of the ozone layer and rising global warming too. In this research paper discussed air pollution in Sri Lanka, the impact of air pollution and how it is affected by environmental pollution. Finally, the suggestions for air pollution impacts and what are the necessary steps for reducing or decrease air pollution are discussed here.

Index Terms –Air pollution, Air quality index, Environment, Health, Pollutants,

1 INTRODUCTION

The atmosphere is the collection of gasses. The structure of the atmosphere can be divided into five parts [1].

- Troposphere – 0km to 12km
- Stratosphere – 12km to 50km
- Mesosphere – 50km to 80km
- Thermosphere – 80km to 700km
- Exosphere – 700km to 10,00 km

Nitrogen is the most abundant gas in the atmosphere; it is 78%, 20.9% Oxygen contains in the atmosphere, and 0.90% argon gases, 0.03%, carbon dioxide contained in the atmosphere. Rest of 0.17% are other gases [2].

Mainly energy is transferred in the atmosphere in three ways. They are,

- Conduction – Happens through the interactions of adjacent atoms.
- Convection – Movement of whole masses of air.
- Radiation – The IR region of the spectrum is caused by electromagnetic radiation.

Air pollution is releasing the pollutants into the air, and it is given harmful effects to the human health and whole planet, before the invention of the fire no man makes air pollution. Sri Lanka faces a rapid rise in air pollution today. Because of the air quality problems are increase day by day and give harmful effects to the human and the environment.

2 AIR POLLUTANTS

When harmful or excessive quantities of substances are adding to the earth's atmosphere, air pollution occurs. These pollutants cannot be visible because they come from different sources. There are mainly two types of air pollutants, primary and secondary pollutants.

Primary Pollutants

The air born particles that are emitted directly from identifiable sources called primary pollutants. Mainly air pollution sources can be categorized, anthropogenic and natural. The anthropogenic sources are combustion process, chemical process, nuclear or atomic process, roasting heating, and refining process, mining, quarrying, and farming process. Natural sources are volcanoes, breaking seas, fire, blowing dust, bacteria, and virus.

Secondary Pollutants

Secondary pollutants are formed in the atmosphere from reactions taking place between Primary pollutants.

3 AIR POLLUTION TYPES

3.1. Indoor Air pollution

Many houses in developing countries have no closable windows. They are making outdoor and indoor air quality significantly different. Cooking is mainly done by firewood or charcoal, thus making outdoor considerably better than inside. Changing lifestyles, place of work and home improvement falls into another category of indoor air quality. In Sri Lanka, most people spend 80%-90% of their times indoors. Elderly groups, pregnant ladies and infants spend even more time indoors. Children also spent most of the time with their mother during cooking. Impact on children is exacerbated due to, small airways - more susceptible to inflammation. Lungs are not fully developed – breath faster. Breathe more air per body mass than adults.

Factors Influencing Indoor Air Quality

There are five main factors that influence indoor air quality [3].

- 1) The rate of exchange of air with air from outdoors.

At higher exchange rates pollutants inside a structure are removed. If the ambient outside air has lower pollutants' concentration, high exchange rate helps lower the indoor pollutant level. Increasing the exchange rate can bring contaminants to the building if the outside pollutant concentration is raised. Pollutants emitted from sources within the building at a low exchange rate can contribute to high levels of indoor air pollutants.

- 2) The concentration of pollutants in outdoors.

The concentration of pollutants in outdoors is a function of the removal process, such as dilution, filtration, and destruction.

Dilution is a function of the air exchange rate and ambient air quality. Gaseous and particulate may also be removed from indoor by deposition on the surface.

Filtration systems are part of many ventilation systems. As air conditioning systems circulate air, it passes through a filter which removes some of the particulate matter.

Removal efficiency depends on particle size. Besides, some restive gasses like NO_2 and SO_2 readily absorbs on the interior surface.

- 3) The rates of emissions of indoor source.

Indoor sources are building materials (glues, adhesives), Combustion sources (natural gas or kerosene emits NO and CO_2), Furnishing, Pets. The emission of organic gasses is higher with increased temperature and humidity but usually decreases with the structure's age.

- 4) The rate of infiltration from soil gas

The pressure drop in soil support for the radon gas to enter through the cracks in the building's foundation. The infiltration rate depends on the soil type, building structure, and pressure difference between the soil and the building.

- 5) The rate of removal in the indoor environment.

The Fig. 1 is representing the main factors effect o indoor air quality.

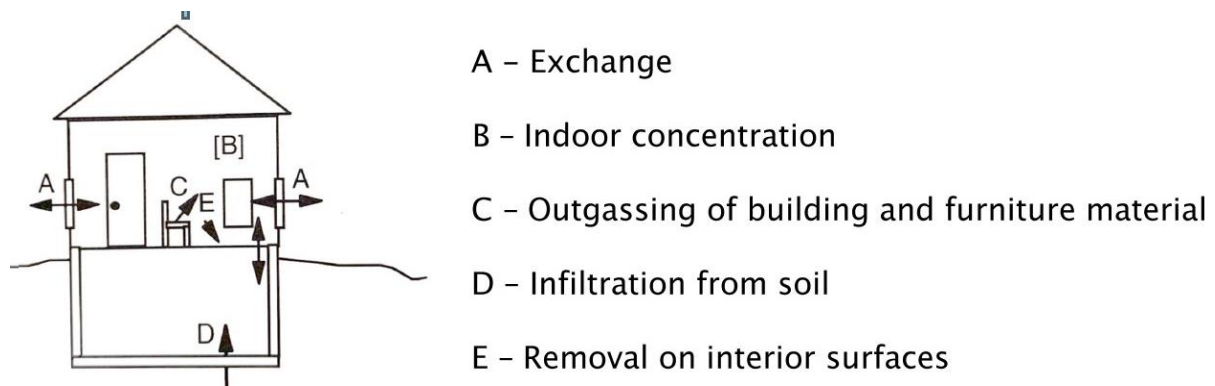


Fig. 1. Factors effect on indoor air quality

Indoor Air Pollutants

Indoor air pollutants and sources are, [3].

- Environmental tobacco smoke – sources are cigarette and waterpipe smoking. It is classified as class A carcinogen by US EPA along with benzene & Asbestos. Also, it is the single largest non-occupational source of exposure. The greatest course of air pollution health effects of active smoking is included.
- Asbestos – banned in developed countries. Air pollution sources are Deteriorating, damaged, or disturbed insulation, fireproofing acoustical materials, and floor tiles. It is all over in our indoors. Asbestos was in cigarette filters, brake pads, light switches, and insulating pads. Now have on the roof, ceiling, floor tiles, pipelines, and soundproofing materials.
- Formaldehyde – most common sources are Furniture made with pressed wood products, urea-formaldehyde foam insulation, environmental tobacco smoke, glues.
- Volatile organic compounds – sources are, Paint, paint stripper, solvent aerosol sprays.
- Radon – it is a product of the radioactive decay of its parent, Uranium. it is half-life 3.8 days. it is colorless, and generally it can be considered as inert. it does not sorb, hydrolyze, oxidize, or precipitate. Thus, the movement through the ground is not inhibited by chemical interaction with the soil. Most common sources are, Building materials and well water.
- Respirable particles – sources are, Kerosene heaters, wood stoves, fireplaces and, environmental tobacco smoke.
- Biological pollutants – sources are Cockroaches rodents and other pests, Dust mite, Pet dander, droppings and body parts of Bacteria, Fungi.

3.2. Outdoor Air Pollution

There are several types of outdoor Air pollution. Mainly, emissions from transportation, power generation, industrialization, population, and urbanization [4, 5].

4 AIR QUALITY INDEX (AQI)

It tells how clean or polluted air, and what associated health effects might be a concern for us. AQI focuses on health effects within a few hours or days after inhaling contaminated air. AQI's mission is to help understand what local air quality is for human health. To identify them more accessible and to follow, AQI divides into six categories [3]. They are given in the Table 1.

Table 1. Air Quality Index (AQI)

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 - 50	Good	Green
51 - 100	Moderate	Yellow
101 - 150	Unhealthy for Sensitive Groups	Orange
151 - 200	Unhealthy	Red
201 - 300	Very Unhealthy	Purple
301 - 500	Hazardous	Maroon

5 EFFECTS OF AIR POLLUTION

Because of the indoor air pollution, several of health outcomes coming from respiratory systems, lung cancers, and low birth weight, bronchitis, and susceptibility to viral infection. Nitrogen Oxides (NO_x), Carbon monoxide (CO), Sulphur Oxides (SO₂), or Volatile Organic Carbon (VOC) is directly affected by human health.

- Acid rains - When the gases of NO_x, CO₂ and SO₂ react with the water in the atmosphere causes for the acid rain. Effects of acid rains are Kills micro-organisms, Poisons plants, Damage metals and limestone and kills fish.
- Climate Changes – All the climate changes, like more extreme weather, rising sea levels, acid rains, heat-related deaths and warmer temperatures lead because of the greenhouse gases.
- Unbalancing of carbon cycle - Human activities are leading to a gradual increase in the atmospheric CO₂ and it is affected for the CO₂ cycle. Deforestation, oil, and coal combustion increase the Carbon dioxide levels CO₂ is a greenhouse gas.
- Unbalancing of nitrogen cycle – Nitrogen Oxides and Oxygen react with each other and formed nitrogen oxide gas (N₂O). Also, it releases by, kerosene heaters, UV-vented gas stoves and heaters, environmental tobacco smoke. It is greenhouse gas and it reacts with the ozone layer and broken down it. Because of that different kind of skin cancers are formed.
- Global Warming – it is gradually increasing the over temperature of the atmosphere because of the increasing level of CO₂, CH₄, CFCs and other pollutants. Because of the global warming,
 - The temperature goes up of the earth's surface
 - Melting the glaciers and increase the sea levels
 - Change the patterns of the rain
 - Increase the flood because of the rain

- Also affected to the ocean surges.
- Radio Activity - It can be polluting the different air forms. Mainly Natural and Anthropogenic. It is hard to clean the environment once; it gets polluted.
- Depletion of The Ozone Layer – Mainly Halocarbon, Refrigerants, Solvents, Propellants, and Foams blowing agents (CFC, HCFC) are responsible for the depletion of the ozone layer.
- Hazardous air pollutants – Mercury, lead, dioxins, and benzene are the most hazardous air pollutants. Benzene is affected for the lung irritation, skin and eye irritation in the short term and blood disorders in the long term. Dioxins contain in food but, the small amount contains in the air. It can be affected for the liver and nervous, endocrine systems and immune for long term. A large amount of lead is affected for the kidneys and children's brains. Sources are lead-based paint, contaminated soil, dust and drinking water. And, mercury can damage the central nervous system.
- Vegetation – Sulphur Oxides (SO₂), Nitrogen Oxides (NO_x) and chemical compounds of hydrogen and chlorine is directly impact on vegetation.

6 MINIMIZE THE AIR POLLUTION

Traditional Sri Lankan housing architecture provided designs with ample air circulation and thermal comfort to the houses. Proper architectural knowledge and environmental compatibility made the structures more livable and pleasant for the human being. Control strategies depend on the pollutant type.

Control of Indoor Air Pollutants

- Avoid air stagnation
- Avoid bringing harmful odors makers or items into the building
- Integrate indoor air quality into your purchasing decisions
- But only the required quantity, do not store volatiles
- Do not smoke and discourage others to smoke
- Choose on chemical method for pest control
- Dispose garbage promptly and properly
- Do not block air vents
- Ensure combustion appliances are properly vented and receive enough supply of air
- Do not idle the car inside the garage

7 CONCLUSION

In this research paper, air pollution, effects of the air pollution and few suggestions to prevent air pollution is covered. Controlling the air is helps not only humans, it also helps to protect environment too. Sri Lanka has moderate air pollution index. If Sri Lanka air pollution going to good, it will be a great opportunity to save the thousands of aliveness and environment. Also, it will be affected to the Sri Lanka's economy.

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