

Pollution and Effects on Community Health

Review Article

Road Traffic is The Major Source of Pollution in Big Cities

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Abstract

The vehicles that drive through cities each day are one of the main causes of urban pollution. In Europe, road traffic is estimated to generate almost 40% of nitrogen oxide emissions. Traffic is also a significant source of PM₁₀ and PM_{2,5} particles and lead emissions. The energy consumed by residential, commercial and government buildings generate a large volume of suspended particular matter, rising to almost 60% in the case of PM_{2,5} particles. Residential, commercial and institutional buildings are also a major source of carbon monoxide (CO), black carbon emissions. Most big cities in the world are surrounded by industrial areas occupied by polluting businesses that also contribute to the deterioration of air quality in urban areas. In addition to the gasses generated by fossil fuels burning industry is responsible for releasing heavy metals, such as nickel and arsenic. Tackling noise and air pollution requires stronger collaboration across all levels of governmental, municipal, scientific and technical organizations. Our task should be the movement towards healthier, quieter and more livable cities.

Keywords: Noise; Traffic; Air; Pollution; City-greenery; Mitigation; Suburb; Slum

Introduction

Historically, in the early centuries of civilization, the rate of urbanization was slow and gradual. But little by little, especially beginning from the middle of the 20th century, it began to grow and little by little. It became the most dramatic after 2000s, mainly in developing countries of south-east Asia and Latin America [1,2]. Today, the world is becoming increasingly urbanized. From 2007 more than half of the world's population lived in cities. But as it is predicted it will go up to 60 percent by 2030 [3]. The rapid urbanization is resulting in uncontrolled number of light vehicles, growing number of slums, inadequate and overburdened infrastructure and such services as waste collection, road and transport infrastructure development etc. All these adverse factors increased air and noise pollution levels and deteriorated ecological sustainability of big cities [4]. Municipal authorities and urbanists

occurred unready for these processes and could not keep pace with times. The results are uncontrolled development of cities and their suburbs [5,6].

Cities are the centers of economic growth of countries contributing about 60 per cent of global GDP, but they also account for about 70 per cent of global carbon emissions and over 60 per cent of resource use [7]. Excessive noise levels in most big cities of the world contribute to physical and psychological burden on people. Air pollution has always been considered as main source of big cities' pollution, but in the last decades due to the uncontrolled rates of city traffic growth aroused the problem of noise pollution which is not only overtook rates of air pollution but sometimes surpassed it. Today noise pollution is a constantly growing problem in big cities of the world.

Thou trees have always been an important part of human settlements throughout the whole human history, only lately their value for urban dwellers became accordingly considered [8]. Urban forests and other green spaces are closely related to landscape architecture and park development and must be done together with professionals of these fields as urban forestry includes activities carried out in the city center, suburb areas and in the interface space with rural areas. As many parks and other green spaces are in the cities as better are their citizens protected from air and noise pollution. Well-developed green spaces in big cities act as natural air filters and buffers. Trees and other green spaces absorb air and noise pollution, improving the microclimate of the city and at the same time natural resources quality including soil and water. Foresters and ecologists know well that leaves absorb the greater part of noise coming onto their surface and reflect into the air the remained part. Trees infiltrate the air from hazardous gases and microbes. But unfortunately, in the process of infiltration trees suffer themselves too. Especially dangerous for them are fluorine, phosphorus, fluorine-hydrogen, chlorines, nitrogen dioxide. These gases getting into the leaves violate the processes of breathing and photosynthesis. Especially suffer trees with thin leaves in summertime when air temperature is above 30°C and more and air humidity is under 50%. Our recommendation is to implant in big city parks, squares and along the sidewalks trees and bushes heaving thick leaves, better with glossy surface which reflect most part of sun rays and suffer less than trees heaving thin leaves [9].

The Problems of Pollution in Big Cities and Megapolises

Air pollution

There are different kind of pollution in the world, but the major pollution in big cities are air and noise pollutions. Cities are the centers of economic growth of countries contributing about 60 per cent of global GDP, but they also account for about 70 per cent of global carbon emissions and over 60 per cent of resource use. Excessive noise levels in most big cities of the world contribute to physical and psychological burden on people. Air pollution has always been considered as main source of big cities' pollution. From hazardous substances the most dangerous are: Carbon Oxides(CO), Nitrogen Oxides(NO₂), Hydrocarbons(HMVOC);Sulfur Dioxide (SO₂), Particular Matters(PM₁₀ and PM₂₅), Soot(BC), and Ammonia(NH₂).Combustion gases of concern include: Carbon Monoxide, Carbon Dioxide, Sulfur dioxide and Nitrogen Oxides.

Carbon Monoxide

Carbon Monoxide (CO) is a colorless, highly poisonous, odorless, flammable gas that is slightly less dense than air.

The most common source of carbon monoxide is the partial combustion of carbon containing compounds, when sufficient oxygen or heat is present to produce carbon dioxide. It is important in production of many compounds, including drugs, fragrances and fuels. Upon emission into the atmosphere, carbon monoxide affects several processes that contribute to climate change. Several thousand people go to hospital emergency rooms every year to be treated for carbon monoxide poisoning [10]. It is known that carbon monoxide had been used for genocide during the Holocaust at some extermination camps in Germany during World War II.

Carbon Dioxide

Carbon Dioxide (CO₂) in the air is transparent to visible light but absorbs infrared radiation, acting as greenhouse gas [35,36]. Burning fossil fuels are the primary cause of increased CO₂ concentrations and global warming and climate change. About half of excess CO₂ emissions to the atmosphere are absorbed by land and ocean. Carbon dioxide content in fresh air varies between 0.036% and 0.041% depending on the location [11]. There are few studies of the health effects of long-term continuous CO₂ exposure on humans and animals at levels below 1%. Poor ventilation is one of the main causes of excessive CO₂ concentrations in closed spaces. Carbon dioxide is natural and harmless in small quantities, but as levels rise it can affect productivity and sleep. High levels are directly correlated to low productivity and high sick leave making this a crucial concern in offices, schools and home environments. It is revealed in restlessness, drowsiness, increased heart rate and blood pressure, sweating and headache

Nitrogen Oxides (NO_x)

Nitrogen is one of the elements contained in fossil fuel. Their presence in the atmosphere is directly related to the burning of fossil fuels, such as in road vehicles. Long exposure to high concentrations of NO_x can lead to long problems and inflammation of the airways. Furthermore, NO_x is also contributes to the formation of tropospheric ozone.

Sulfur Dioxide (SO₂)

Is a gaseous air pollutant composed of sulfur and oxygen. SO₂ is formed when sulfur-containing fuel such as coal, oil, or diesel is burned. Sulfur dioxide causes a range of harmful effects on lungs, as the EPA, besides it causes wheezing, shortness of breath and chest tightness, especially during exercise or physical activity; continued exposure at high levels increases respiratory symptoms and reduces ability of lungs to function; short exposure make it difficult for people with asthma to breathe when they are active outdoors; rapid breathing during exercise through the mouth; increased risk of hospital admissions or emergency room visits, especially among children, older adults and people with asthma [12].

Particular Matters (PM10 and PM2.5)

PM₁₀ is particulate matter of 10 micrometers or less in diameter. PM_{2.5} is particulate matter of 2.5 micrometers or less in diameter. Synonyms of particular matters are: dust, inhalable particles, respirable particles, smoke and mist. PM are important constituents of the atmosphere [13]. The sources of PM can be natural or man-made sources. There are a number of natural sources that inject million tons of PM into the atmosphere. They include volcanic eruptions, wind and dust storms, forest fires, salt spray, debris, reactions between gaseous emissions and soil erosion. Man-made activities such as fuel combustion, industrial processes, Steel industry, petroleum foundries, cement, glass manufacturing industry, mining operations, fly-ash emissions from power plants, burning of coal and agricultural refuse. All these substances contribute to PM in the atmosphere.

Soot (BC)

Soot (BC) is a impure carbon particle resulting from the combustion of hydrocarbons. Soot as an airborne contaminant has many different sources like coal burning, internal-combustion engines, power-plant boilers, ship boilers, central steam-heat boilers, local field burning, house fires, fireplaces. Soot, particularly diesel exhaust pollution accounts for one quarter of total hazardous pollution in the air. Among these diesel emission components a particular matter has been a serious concern for human health due to its direct and broad impact on the respiratory organs. It is associated with lung cancer, influenza, asthma and increased mortality rate. Recent scientific studies show that these diseases more closely linked with fine particles (PM_{2.5}) and ultra-fine particles (PM_{0.1}) than with (PM₁₀) particles as believed before.

Ammonia (NH3)

Ammonia is a compound of nitrogen and hydrogen with chemical formula NH₃. It is a colorless gas with distinct pungent smell. Ammonia even at dilute concentrations is highly toxic to aquatic animals and for this reason it is classified as dangerous for the environment. Atmospheric ammonia plays a key role in the formation of fine particulate matter. Ammonia is a constituent of tobacco smoke. In humans, inhaling ammonia in high concentrations can be fatal. Exposure to ammonia can cause headaches, impaired memory, seizures, and coma as it is neurotoxic by nature [14].

Ozone(O3)

Tropospheric ozone can cause serious damage to plant life. But it is also harmful to human health. Ozone is a secondary pollutant. It is formed as a result of a photochemical reaction between nitrogen oxides (NOx) and volatile compounds (VOC). which is triggered by sunlight. In other words, pollutants from cars or industry are released into the atmosphere and as they circulate through the air, transformed into other

substances, such as ozone. Ozone causes smog and can cause breathing difficulties.

Volatile Organic Compounds (VOCs) are another pollutant that is released when fossil fuels are burned. However, two of the main sources of VOCs are solvents and paints and the companies that manufacture these products are significant contributors to this form of pollution. For people they can cause a range of problems from breathing difficulties to dizziness, or a lack of concentration.

Noise pollution

The problem of noise pollution has always been ignored until recently in the world [15-16]. But due to the accelerated rates of automobilization and connected with it adverse air and noise problems made scientists and city municipalities to pay due attention to these problems. Noise pollution is the dangerously growing problem of city pollution especially in all big cities of the world. Many people may not even be aware of its adverse impacts on their health [17,18]. Noise pollution is a major problem both for human health and animals as well as the environment. Long-term exposure to noise pollution can induce a variety of adverse health impacts like increasing annoyance, sleep disturbance, negative effects on cardiovascular and metabolic system, as well as cognitive impairment in children. Millions of people in big cities suffer from chronic high annoyance and sleep disturbance. It is estimated that school children suffer reading impairment as a result of aircraft noise living in the neighborhood of big airports [19]. Despite the fact that noise pollution is one of the major public health problem in most big cities of the world, there has always been and continued a tendency to underestimate it making major accent on air pollution.

European Court of Auditors (ECA) report on air and noise pollution that they cause 12,000 premature deaths and 48,000 new cases of ischemic heart Diseases, contributing to learning disabilities in children, causes sleep deprivation and costs Europeans an estimated 40 billion euro per year. Noise pollution is the dangerously growing problem of city pollution especially in all big cities of the world. Long-term exposure to noise pollution can induce a variety of adverse health impacts like increasing annoyance, sleep disturbance, negative effects on cardiovascular and metabolic system, as well as cognitive impairment in children. Millions of people in big cities suffer from chronic high annoyance and sleep disturbance [21, 22]. It is estimated that school children suffer reading impairment as a result of aircraft noise living in the neighborhood of big airport. Despite the fact that noise pollution is one of the major public health problems in most big cities of the world. There has always been and continued a tendency to underestimate it making major accent on air pollution. It's high time to change this tendency.

The most common health problem from noise pollution is noise induced hearing disease, sleep disturbances and

stress. These health problems can affect all age group of people, especially children [23]. Many children living near noisy airports or streets have been found to suffer from stress and other problems such as impairments in memory, attention level and reading skill. Noise pollution also impacts the health and well-being of wildlife. Animals use sound for a variety of reasons, including navigation, finding food, attracting mates and avoid predators. Noise pollution makes it difficult for them to accomplish these tasks which affects their ability to survive. Children often participate in recreational activities that can harm their hearing. These activities include attending music concerts, especially pop and rock concerts, sporting events where crowds of audience cry and shout loudly. Small children play with noisy toys and video games in computers, play their own music players. All these of noise adversely effect on children. Many of them suffer from noise-induced hearing loss. Noise pollution can often harm children's physical and psychological health.

Conclusions

Accelerated rates of urbanization in the world generate a lot of health and other adverse problems for city dwellers which are getting more and more difficult for municipal authorities to solve. The desire of people to live in cities is understandable by some reasons like finding a job, giving their children good education and so on. But it raises many problems for old native dwellers living there before as well as for newcomers too. Cities are getting dangerously overcrowded with traffic and people. This continued process is mostly observed in countries of south-east Asia and Latin America where in some of them live 20 million people and even more with suburbs. The most of big cities have growing number of light and other vehicles, crowds of people in the streets, insanitary condition and a lot of slums in the suburbs full of trash and stink substances which are the souse of bacterium and different infectious diseases that spread in the world. It is enough to see the downstream of the river Nile which is extremely dirty and people including children are swimming and bathing there. What can be done in this situation? Unfortunately scientists don't have effective measures until now to stop urbanization rates and growing rates of transport traffic gems. Our recommendations are the following: to decrease further building construction, especially skyscrapers; to increase city greenery instead of building new houses: city greenery must include big and small parks, pocket and vertical greenery on buildings and roofs; making ponds where it is possible; implanting trees, bushes and half-bushes along the streets. These measures will help to increase the total space of city greenery and mitigate adverse effects from air and noise pollution. It will help citizens to breathe additional fresh air and defend their homes from extra noise pollution. From technical means: it is necessary to regulate city traffic

especially on the crossroads to avoid traffic jams; to choose the most optimal traffic routs in the cities according to the present day demands and convenience for traffic and people; such type of transport as motorcycles and scooters must be strictly banned as producers of the most terrible loud noise and exhaustion of great amount of the most toxic gases that adversely impact on people; decrease transport speed in the central and over-crowded parts of the city to 30 km/h; to use zero emission buses, refuse collecting trucks and municipal vans; to develop infrastructure for safe cycling and available public bike fleet; gradual transition from internal-combustion vehicles working on fossil fuel to electric cars.

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