iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34082

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

Case Study on Anthropogenic Air Pollution in Nagpur City

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Abstract: Air pollution is a very serious problem worldwide. Anthropogenic air pollution is mostly related to the combustion of various types of fuels. Air pollutant levels remain too high and air quality problems are still not solved. The presence of pollutants in the air has a harmful effect on the human health and the environment. Good air quality is a prerequisite for our good health and well-being. Nagpur city is located in Maharashtra state of central India. Business hub and increased industrialization in study area is affecting the environment adversely. n. Changing life style of corporate community and their effects on other population enhancing the contamination of environment.

I. INTRODUCTION

Air pollution is both global and national problem as air pollutants released in a particular country can migrate through to the atmosphere and pollute the air else-where. We breathe from the moment of birth to our death .Breathing is of vital and constant importance for almost any living being on Earth, not just for us. The poor air quality affects all of us. It damages our health and the environment causing severe losses. The air we breathe comprises various pollutants.

The atmosphere consists of gases with various densities. Dry air is composed of about 78% nitrogen, 21% oxygen and 1% argon. The atmosphere also comprises some water vapours, which, for example, take 0.1% to 4% of the troposphere. In addition, there are thousands of other gases and particles released into the atmosphere from natural and/or anthropogenic sources. The composition of the air is constantly changing. Some substances in it are highly active, i.e. they tend to interact with other substances, forming new ones. As a result, “secondary” pollutants may form, which could be very harmful to human health and the environment.

The thermal radiation of the sun, in its turn, acts as a catalyst that facilitates and accelerates chemical reactions.

Air pollution is a significant risk factor for human health in India and around the world. A study on air pollution as a global disease-related problem has shown that it is among the top ten health risk factors worldwide.

Not all substances in the air are considered pollutants. Air pollution is defined as the presence of certain pollutants in the air at levels that have a harmful effect on human health and the environment. The legislation addresses only the air pollution caused by sources of anthropogenic origin. However, not all sources of pollution are anthropogenic. There are many natural phenomena, which also cause air pollution, such as the volcanic eruptions, dust storms and forest fires.

The anthropogenic air pollution is related to the combustion of different types of fossil fuels (solid, liquid, gaseous), as well as to the activity of metallurgical and chemical plants. In this regard, some 20 billion tonnes of CO2, 150 million tonnes of SO2, up to 53 million tonnes of NOx, millions of tonnes of fluorinated substances, Hg, freons and other toxic environmental pollutants are released into the Earth’s atmosphere on yearly basis. The main anthropogenic pollutants are CO2 and CO, various hydrocarbons, Sulphur and nitrogen oxides, heavy metals, various aerosols, photochemical oxidants, O3, CH4, etc.

The sources of harmful substances released into the air are classified in various categories: thermal power plants, domestic combustion, industrial combustion processes, non-combustible production processes, mining and processing of fossil fuels, use of solvents, road transport, other types of transport, waste treatment and disposal, agriculture, natural sources. Each of these sources releases specific pollutants, namely: SOX, NxOy, non-methane vola-tile organic compounds (NMVOCs), CH4, NH3, CO, Hg, Cd, Pb, polycyclic aromatic hydrocarbons (PAHs), dioxins and furans (DF).

Nagpur, 30 June 2020: Nagpur’s clean air plan does not contain information on the sources of air pollution, according to a new independent analysis released today by the Council on Energy, Environment and Water (CEEW) and Urban Emissions. In contrast, Chandrapur’s plan is among the five plans in Maharashtra that contain emissions sources information. The analysis highlights identification, mapping and estimation of source contributions as a crucial step in prioritizing air pollution mitigation efforts, targeting appropriate emission sources and having maximum on-ground impact. The analysis also states that Nagpur’s clean air plan lacks a legal mandate for implementation.

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India's National Clean Air Programme (NCAP) recommended 102 cities, including Nagpur, to create city-specific clean air plans as a primary mitigation measure for reducing particulate concentration by 20% to 30% by 2024. Currently, over 80 per cent of the actions mentioned in Nagpur's plan involve overseeing, planning, proposing, preparing, investigating, identifying, ensuring, banning, initiating, launching, planning, restricting and promoting. This implies that only 20% of the interventions call for on-ground pollution control measures. Also, 38 per cent of Nagpur's action strategies are directed at the transport sector and 20 per cent target industries. While not entirely budgeted, Nagpur's plan does estimate financial requirements for certain activities. "During the lockdown, the only real-time monitoring station in Nagpur reported a 30 per cent decline in PM2.5 concentrations. However, to tackle air pollution in the city in the long-term, a single monitoring station for a city with over 2 million population is insufficient. The Maharashtra pollution control board and the Nagpur municipal corporation must collectively prioritize the setting up of more monitoring stations and creating trackable indicators to oversee the progress of implementation of this plan," said Tanushree Ganguly, a researcher at CEEW and a co-author of the study. The CEEW-Urban Emissions analysis also finds that Nagpur's city plan lists 66 measures across 17 different agencies. While the state pollution control board (SPCB) is responsible for only 20% of all actions in Nagpur, the urban local bodies (ULB) and state transport department share the burden of almost 60% of the actions. Moreover, 34% of actions fall under multiple agencies. Further, independent estimates suggest that 21% of the pollution in Nagpur could originate outside city limits. However, the plan does not include any measures to ensure regional coordination. "With over 30% of the activities shared across multiple agencies, fragmentation of accountability is a key impediment. Hence, it is crucial to delineate specific tasks for each action point among participating agencies," said Kurinji Selvaraj, a researcher at CEEW and a co-author of the study.

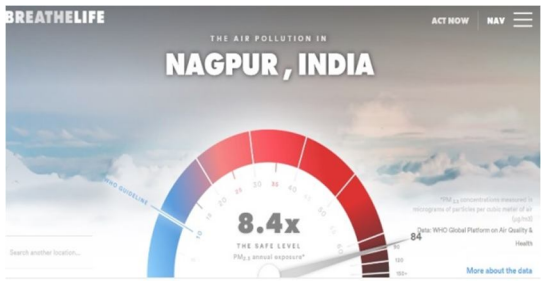
II. PARTICULATE MATTER (PM)

Is the air pollutant that causes the greatest damage to human health. Dust particles ,whether natural or of anthropogenic origin, once airborne, take part in various chemical reactions and increase air pollution. Significant efforts have been made in the last decades to purify the air, and yet air in Europe continues to be harmful to our health and the environment. Dust and ozone air pollution pose a serious risk to public health, impair the quality of life and life expectancy. Different pollutants have different sources and effects. They are so light and mobile in the air that can penetrate not only deep into human lungs, but also into human blood. While some particles get airborne from the ground, others, such as the Sulphur dioxide, nitrogen oxides, ammonia, etc. result from chemical reactions. According to a study of the World Health Organization (WHO), particulate matter (PM2.5, i.e. particles of less than 2.5 microns in diameter), pollution can be hazardous to human health. Another study made by the WHO, "Review of evidence on health aspects of air pollution", states that the long-term exposure to particulate matter can cause respiratory disease, atherosclerosis and adverse birth outcomes. The WHO study further claims a relationship between the particulate matter pollution and the retarded development of the nervous system, diabetes, and increased mortality rate from respiratory and cardiovascular diseases. The different chemical composition of the particulates can also affect the global climate by warming or cooling the planet. The elemental carbon is one of the major components of the black carbon, which in turn is the most commonly met compound of the PM. It results from the incomplete combustion of fossil fuels and firewood. In particular, black carbon emissions in urban areas are most frequently caused by the motor vehicles' diesel engines. In addition to adverse effects on the human health, the carbon in the particulate matter contributes to the climate changes by absorbing the solar energy, thus warming up the atmosphere.

The harmful effect of particulate matter pollution increases highly in the presence of Sulphur dioxide in the air. The short-term exposure to 500 ìg/m3 particular matter and Sulphur dioxide increases the overall mortality rate of the population, while the exposure to twice lower levels of the particular matter and Sulphur increases the level of general morbidity and deterioration of the pulmonary function.

1) Data collected on 30 April, 2021 ($PM_{2.5}$)

2) Ranking Of Countries Based On Air Pollution Levels (Some Examples Are Shown In The Image Above)



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ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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III. WHO AIR QUALITY

1) Particulate matter (PM)
2) Guideline values
3) Fine particulate matter ($PM_{2.5}$)
a) 10 µg/m^3 annual mean
b) 25 µg/m^3 24-hour mean

4) *Coarse Particulate Matter (PM_{10})*
a) 20 µg/m^3 annual mean
b) 50 µg/m^3 24-hour mean

In addition to guideline values, the *WHO air quality guidelines* provide interim targets for concentrations of PM_{10} and $PM_{2.5}$ aimed at promoting a gradual shift from high to lower concentrations.

If these interim targets were to be achieved, significant reductions in risks for acute and chronic health effects from air pollution can be expected. Achieving the guideline values, however, should be the ultimate objective.

The effects of PM on health occur at levels of exposure currently being experienced by many people both in urban and rural areas and in developed and developing countries – although exposures in many fast-developing cities today are often far higher than in developed cities of comparable size.

"*WHO air quality guidelines*" estimate that reducing annual average fine particulate matter ($PM_{2.5}$) concentrations from levels of 35 µg/m^3, common in many developing cities, to the WHO guideline level of 10 µg/m^3, could reduce air pollution-related deaths by around 15%. However, even in the European Union, where PM concentrations in many cities do comply with guideline levels, it is estimated that average life expectancy is 8.6 months lower than it would otherwise be, due to PM exposures from human sources.

In low- and middle- income countries, exposure to pollutants in and around homes from the household combustion of polluting fuels on open fires or traditional stoves for cooking, heating and lighting further increases the risk for air pollution-related diseases, including acute lower respiratory infections, cardiovascular disease, chronic obstructive pulmonary disease and lung cancer.

There are serious risks to health not only from exposure to PM, but also from exposure to ozone (O_3), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2). As with PM, concentrations are often highest largely in the urban areas of low- and middle-income countries. Ozone is a major factor in asthma morbidity and mortality, while nitrogen dioxide and sulfur dioxide also can play a role in asthma, bronchial symptoms, lung inflammation and reduced lung function.

THE PM LEVELS IN NAGPUR EXCEED THE WHO STANDARDS	
PARTICULATE MATTER (PM 2.5)	PARTICULATE MATTER (PM10)
WHO recommended: 10 µg/m^3	WHO recommended :20 µg/m^3
annual Nagpur limit ; 10 µg/m^3	annual Nagpur ; 20 µg/m^3
NAGPUR : 38.1 µg/m^3	NAGPUR : 72 µg/m^3

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IV. CONCLUSION

1) Nagpur has a four new air quality monitoring station. The locations as finalized by the Maharashtra pollution control board (MPCB) are TOWN HALL IN MAHAL, MEDICAL SQUARE ,VNIT and LAXMINAGAR INSTITUTE OF TECHNOLOGY.

2) The critical air pollutant will not necessarily be SPM; hence, information on other pollutants is also required for proper presentation of air quality through the AQI. The green Nagpur may not stay as green if the polluting sources are not controlled. Since the maximum ground level concentration of NO2 from the Industrial sources is found much closer to the Central Pollution Control Board (CPCB) standard limits.

Various measures are suggested to control air pollution from industries in Nagpur:

a) Shifting of Industries from non- conforming zones.
b) Switching over to clean technologies.
c) Using clean fuels.
d) Installation of Pollution control Devices.
e) Development of green belt around the industries.

V. SUGGESTIONS

A. Implementation of the emission norms as well as fuel quality in Accordance with the road map proposed by the Auto Fuel Policy.
B. Switching over to clean alternate fuels like CNG, LPG & Bio-fuels.
C. Augmentation in Public Transport system.
D. Better traffic management Implementation of fiscal measures, etc.

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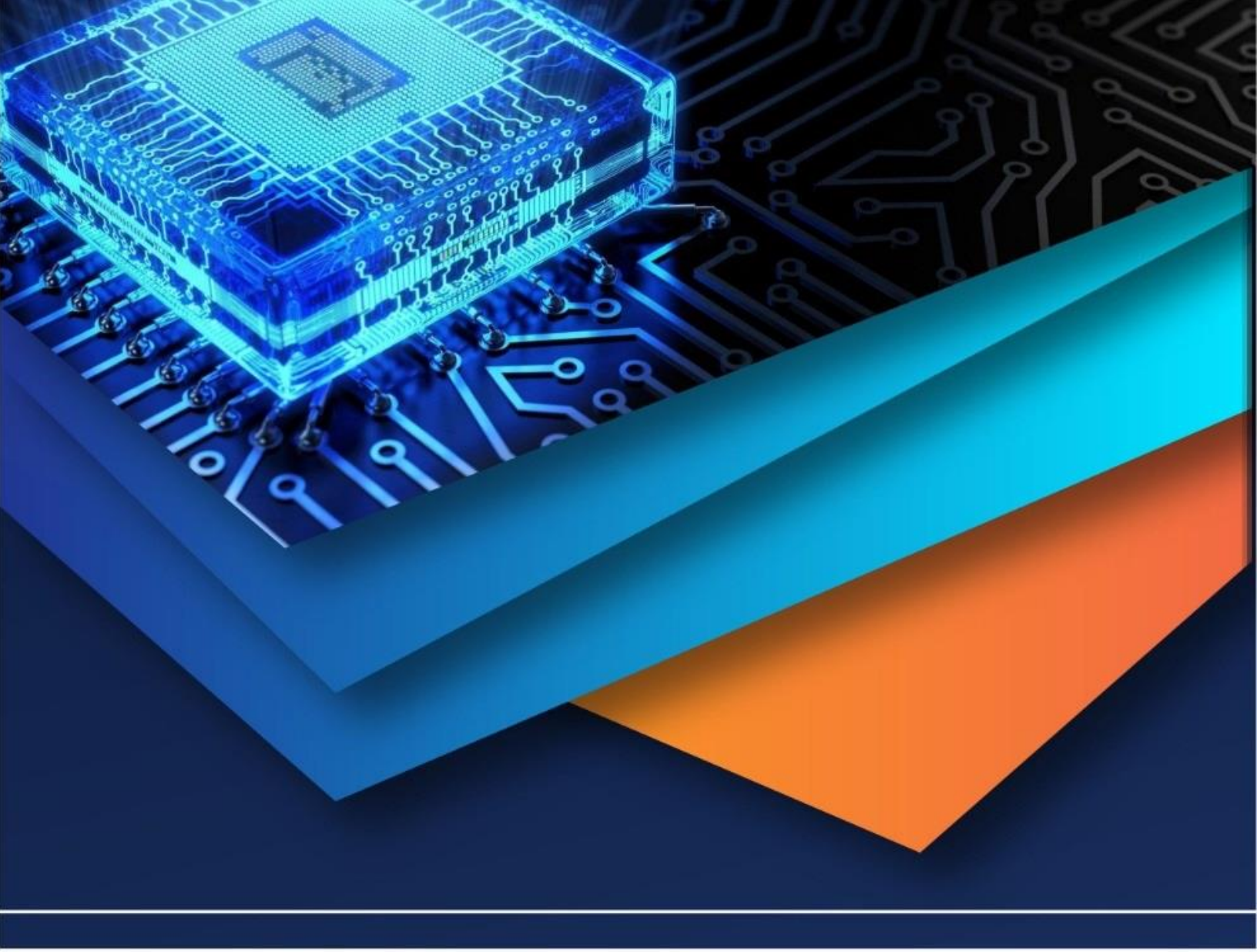

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