



Quality of air and human health with references to urban and rural areas in Morena district, M.P.

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DOI: <https://doi.org/10.66856/chemistry.2026.10.2.10039>

Abstract

India is currently facing a public health emergency due to severe air pollution. This study analyses how industrial growth and the release of toxic micro-particles have compromised the Air Quality Index (AQI), leading to a rise in life-threatening respiratory conditions. The research highlights the socio-economic consequences of this decline, including the destabilization of natural resources and altered lifestyles for Indian citizens. By accessing data from both urban and rural sectors, this paper identifies why current government and private sector initiatives have failed to reverse the alarming trends of global warming and environmental degradation. The findings emphasize the immediate need for improved evaluation of health impacts related to particulate concentration.

Keywords: Air Pollution by industries, urban and rural areas of india, clean air, clean fuel, green technologies, policy implementations, human health's

Introduction

The term 'Resources' is basic needs for the living beings. Human beings are interconnected with resources, technologies, development, but a sustainable development is necessary for the growth of human beings, and other living beings. If natural resources will be finished survival of human beings is in danger zone. Indiscriminate exploitation of resources has led to global warming, depletion of ozone layer, worst condition of environment which produces pollution like air pollution and land degradation. An equitable distribution of resources has become essential for a sustained quality of global peace. Air pollution is one of the major problems Infront of local, State, and central government. As we need a sustainable development without disturbing the surrounding environment of region. As increasing the air pollution, the temperature of the earth increasing regularly, climate change also changes due this pollution. After the multiple studies and analysis of observed data shows the the condition will be worst, respiratory track should be effective, and the air become toxic due to continuous increasing the presence of pollutant gases in environment. Increasing the population along with the lack or sufficient sources (natural resources) also effect the life cycle on earth. Due to lack of controlling resources, daily monitoring, unwanted activities shouldn't ban or fine the condition should be worsened in future of Indian cities. These all pollutants may cause the harmful effect on human health such as cardiovascular and respiratory disease, Neurological impairments, increased risk of preterm birth and even mortality and morbidity. Multiple research projects, various collection of data of different region, locations, help us to know about the pollution levels should be varies in different areas, with respect to collection of sampling time, places, and climatic condition and temperature of this region.

Literature review

This paper reviews the Air Quality Analysis at following locations in India: Morena. Morena is a district which is surrounded by industrial and commercial zones and rapid increase in urbanization results in increase gaseous pollutants SO₂, NO₂, SPM and RSPM. Concentration of SO₂ was monitored at 4 locations of Morena by using high volume air sampler (Envirotech APM 415 and 411) and collection of samples by the help of leaves. The average ambient air concentration of SO₂ was found below the permissible limits of NAAQS at all the sites. Comparatively somewhat higher concentration of SO₂ was observed during these months. A health survey was also carried out which showed the symptoms were developed such as sore throat, shortness of breath, skin irritation, wheezing, sneezing, chest tightness, nausea etc. As a survey proceed on different ages of people and the categories are (aged 10 to 60 years) was carried out to find health problems due to vehicular pollution between the months of April-2025 to october-2025 (winter). Average concentration of SO₂ at residential urban areas was found 11.800 µg/m³ which is less as compared to other sites and the health effects are minimum because this area is not so congested, and traffic is less. At commercial area Banmore average concentration of SO₂ was found 13.300 µg/m³ which is higher than that of rural and urban area of Morena and may be because this area is highly congested as compared to other sites because it is the commercial and industrial area of Morena. Sometimes it is rushing area due to heavy loader, public and personal transport. as compared to the rural area of Morena district. The average concentration of SO₂ at Railway Station and bus stand were found to be highest i.e.19.30 and 10.16µg/m³ respectively because these locations are highly congested and have heavy traffic area Kishore and Deswal 192 The average ambient air concentration of SO₂ was found below the permissible limits of NAAQS of CPCB at all the sites. Comparatively somewhat higher concentration of SO₂ was observed during April 2025 to sept-2025. In this study, an assessment of people (aged 10 to 60 years)

suffering from health problems due to vehicular pollution between the months of April 2025 to oct-2025 after diwali showing these symptoms (sneezing, sore throat, shortness of breath, wheezing, chest tightness, skin irritation, nausea etc.) was developed. The people in were mainly suffering from sneezing and skin irritation which may be due to the heavy emissions from Tempos. These vehicles are mainly run by diesel fuel and in most cases, are not frequently serviced. Wheezing is rare in all areas, but traders in Morena Railway station, showed the highest complaints. Shortness of breath and skin irritation is mainly shown by the tempo drivers and other people in Morena Railway station. Since this is a commercial area of Morena. The percentage of people affected by sneezing, sore throat and shortness of breath was the highest in Railway Station and Housing Board Colony. Because Tempos, Buses, Trucks, Trains and privet cars are more common, and they are not well maintained. Shortness of breath is very common in these areas. The health effects in Collector office were found more this may be because this is in condensed area, and the fleet of traffic is found less in this area. The people were mainly affected by skin irritation; this may be because the spent most of their time with their vehicles which are not well maintained.

Table 1: Effects of the automobile emission on the people in the study area

Complaint	A.B road	Railway Station	Barokhar vali mata	Gandhi Colony	Total
Sneezing	16	29	34	687	21.7%
Sore Throat	14	29	26	877	19.2%
Shortness of Breath	16	23	18	562	15.5%
Wheezing	4	1	4	211	2.7%
Chest Tightness	13	16	21	757	14.2%
Skin irritation	15	14	15	1054	14.2%
Nausea	12	17	19	452	13.0%

The data obtained from monitoring of ambient air at ten locations within the study area are used to calculate the AQI for each season during the study period. Throughout the study period PM2.5 was found to be maximum of 31.45 at railway colony on 2025-06-05. AQI (Air Quality Index) is helps to indicate the quality of air in area particular reason affected is air quality index value is high and the people facing different health problems.

AQI range	Air Quality	Health Impact
0-50	Good	Air is clean and safe
51-100	Satisfactory	Minor effect of sensitive people
101-200	Moderate	May cause discomfort for most people
301-400	Very Poor	May cause respiratory illness
401-500	Severe	Serious health issues; everyone may feel discomfort

Above data indicates that how AQI helps to identify the affected area. This study identifies the potential sources of air pollution. The data obtained from monitoring of ambient air at ten locations within the study area are used to calculate the AQI for each season during the study period.

Table 2: Parameters (Pollutants) in mg/m3 Monsoon, 2025

NO ₂	SO ₂	PM10	PM2.5	AQI
23.05	20.02	81.29	31.45	81.29
23.12	19.30	80.36	30.26	80.20
22.16	19.96	78.16	29.45	80.10
20.65	18.52	70.10	28.52	78.12
19.62	17.2	69.25	28.36	70.10
17.2	16.02	60.21	27.15	69.21
16.14	10.40	60.32	26.41	60.42
15.2	10.16	60.38	19.56	60.38

The above data is taken in monsoon period time from June-august 2025. According to above data it seems that in the starting time of monsoon the air quality index, PM2.5, PM10 shows that air quality is poorer than mid and end of monsoon.

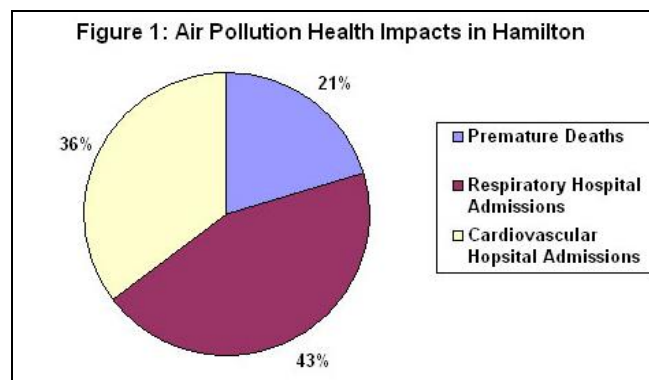
Source Apportionment of Morena to Air Pollution

Source	%Contribution
Construction	22-23.1
Road dust	14.5-29.0
Waste burning	10.5-24.4
Vehicles	8.7-20.5
Diesel Generator	6.8-12.3

The above data is helping to increase the pollution day by day. Tiny particles (called particulate matter or PM) get dispersed in the atmosphere and carried with the wind getting concentrated in the hotspots deteriorating the local air quality. Therefore small places becoming a main spot of presence of micropollutants in environment which effect the air day by day.

Health impacts of air pollution in rural areas

Health impact of air pollution depends on the pollutant type (Table 2), its concentration in the air, length of exposure, other pollutants in the air, and individual susceptibility. Different people are affected by air pollution in different ways.



Due to bad air people can't take breath properly, air pollution becomes a major problem in today's life cycle. Life cycle is going to disturb regularly. By the of above figure a worst condition of urban area's population. It tells

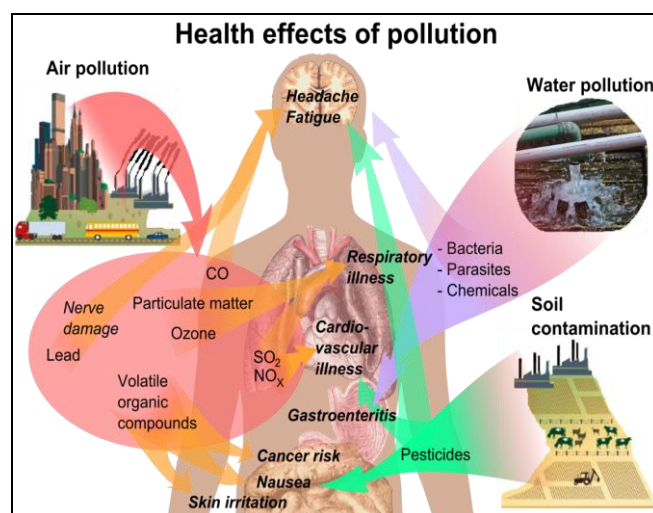
about how medical emergency is increasing day by day and patient of lungs cancer is increasing regularly.



Materials and methods: The study was conducted for a period of seven months (April to October). At each site 8 hrs sampling were done to collect the sample. Three sampling sites selected for ambient air monitoring are Railway colony, A. B Road and Bus stand. Monitored parameters were PM10, PM2.5, SO2 and NOx. HVS (APM 460) was used for air sampling, and all the parameters were analyzed as per CPCB guidelines. Air quality index values are divided into six ranges. Air pollution index (API) was calculated by, airnow.gov/index.cfm?action=resources.cocm_aqi_cacl website

$$AQI = \frac{1}{3} [PM_{2.5} / sPM_{2.5} + PM_{10} / sPM_{10} + SO_2 / sSO_2 + NO_x / sNO_x] \times 100$$

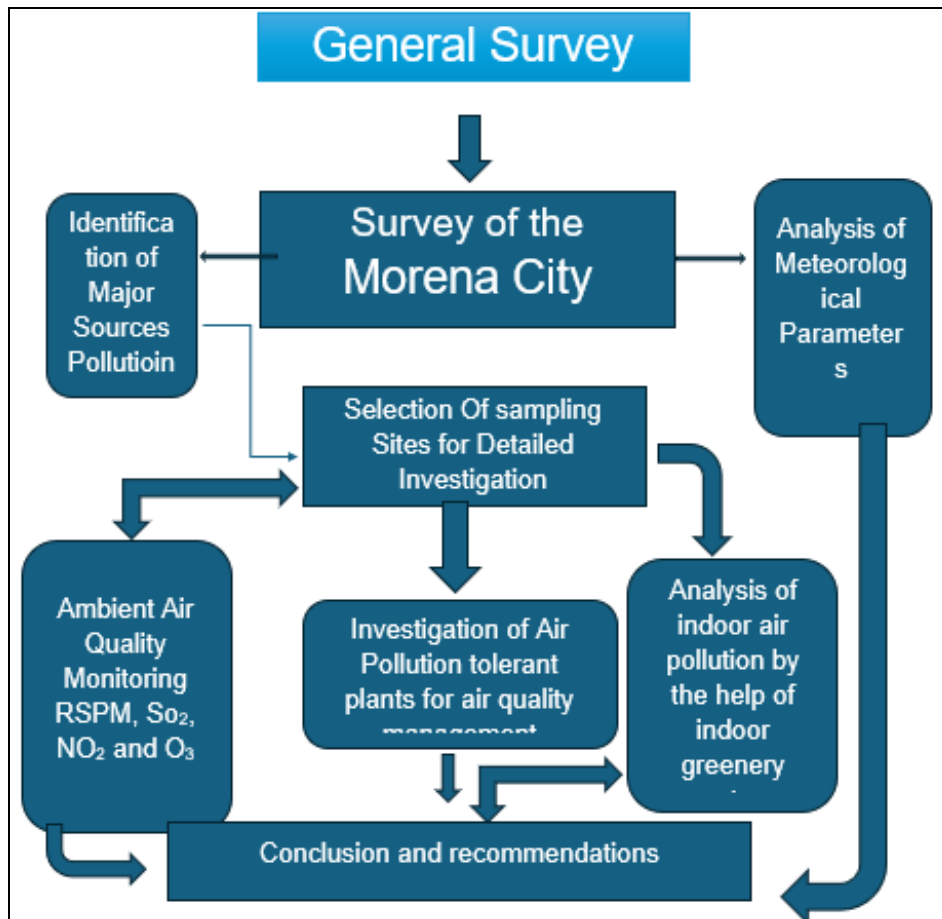
Where sPM10, sSOx and sNOx represent the new ambient air quality standards as prescribed by the Central Pollution Control Board of India. Environmental tests yield the actual quantities of pollutants like PM2.5, PM10, {SO}, and {NO}. To calculate the Air Quality Index (AQI), these raw pollutant concentrations are individually converted into index numbers. The highest of these individual pollutant scores then becomes the official, total AQI for the area. A greater AQI reading directly indicates higher levels of air contamination and a more severe threat to health. The AQI uses a five-step classification system to describe the air's condition and the related health risks.



Pollutant	Health Impact
Tobacco smoke	Tobacco smoke generates a wide range of harmful chemicals and is a major cause of ill health, as it is known to cause cancer, not only to the smoker but affecting passive smokers too, ranging from burning sensation in the eyes or nose, and throat irritation, to cancer, bronchitis, severe asthma, and a decrease in lung function.
Biological pollutants	These are mostly allergens that can cause asthma, hay fever, and other allergic diseases.
Volatile organic compounds	Volatile compounds can cause irritation of the eye, nose and throat. In severe cases there may be headaches, nausea, and loss of coordination. In the longer run, some of them are suspected to cause damage to the liver and other parts of the body.
Formaldehyde	Exposure causes irritation to the eyes, nose and may cause allergies in some people
Lead	Prolonged exposure can cause damage to the nervous system, digestive problems, and in some cases cause cancer. It is especially hazardous to small children.
Radon	A radioactive gas that can accumulate inside the house, it originates from the rocks and soil under the house and its level is dominated by the outdoor air and also to some extent the other gases being emitted indoors. Exposure to this gas increases the risk of lung cancer.
Ozone	Exposure to this gas makes our eyes itch, burn, and water and it has also been associated with increase in respiratory disorders such as asthma. It lowers our resistance to colds and pneumonia.
Oxides of nitrogen	This gas can make children susceptible to respiratory diseases in the winters.
Carbon monoxide (CO)	CO combines with haemoglobin to lessen the amount of oxygen that enters our blood through our lungs. The binding with other haeme proteins causes changes in the function of the affected organs such as the brain and the cardiovascular system, and also the developing foetus. It can impair our concentration, slow our reflexes, and make us confused and sleepy.
Sulphur dioxide. (SO2)	Sulphur Dioxide in the air is caused due to the rise in combustion of fossil fuels. It can oxidize and form sulphuric acid mist. SO2 in the air leads to diseases of the lung and other lung disorders such as wheezing and shortness of breath. Long-term effects are more difficult to ascertain as SO2 exposure is often combined with that of SPM.
Suspended Particulate Matter (SPM)	SPM consists of dust, fumes, mist and smoke. Lead is of major concern, others being nickel, arsenic, and those present in diesel exhaust. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems. The importance of SPM as a major pollutant needs special emphasis as a) it affects more people globally than any other pollutant on a continuing basis; b) there is more monitoring data available on this than any other pollutant; and c) more epidemiological evidence has been collected on the exposure to this than to any other pollutant.

Result and Conclusion

An analysis of the data (Table 1, Figs. 2 and 3) highlights a clear distinction between particulate and gaseous pollution during the study. Sulphur Dioxide {SO₂} and Nitrogen Oxides were found to be compliant with the standard at every site during the sampling period. However, particulate contamination presented a severe issue. All samples for both were recorded to be higher than the mandated safety limits in monsoon and reached its maximum point at Railway station and Bus stand Road in September and October, with a low at rural areas in May.



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