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Increasing Road Network Causing Air Pollution in Rajasthan

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ABSTRACT: Air pollution is one of the major environmental problems. It can cause serious health consequences such as cancer, heart disease and high mortality rates. The people of Rajasthan contribute significantly to air pollution in urban and rural areas or areas. The first largest state in India, Rajasthan, the subject of this concept, is one of the most polluted areas in the country. Severe air pollution of concern particles and high hydrocarbons. The height of the Rajasthan industry is a major source of air pollution compared to the rest of India. This project provides an analysis of the practice of fixed respiratory tract (PM10) and fixed particle matter (PM2.5) throughout the city of Rajasthan, India. Filtering of air particles compares with national standards for air quality of last year's data. Prices for PM10 and PM2.5 were lower during the rainy season compared to the summer winter. The ARIMA Season Model (SARIMA) time analysis is used for air analysis and pollution forecasting. The data collection for PM10 and PM2.5 is well integrated. Cross-model validation was performed using residual analysis. The remainder of the difference between the observed value and the predicted number of PM10 is not significant at that time in few years. In this project data collection and data analysis should be done on the basis of the Indian standard.

KEYWORDS: road, network, air, pollution, Rajasthan, mortality, standard

I. INTRODUCTION

If the city's municipal bodies manage to keep roads clean from dust and silt, it will easily bring down levels of air pollution drastically, experts have said.

"Even when there is no stubble burning in northern India during this time of the year and there's no fog like in the winters, the city's air quality was categorised as 'moderate', which may cause breathing discomfort among people with lungs, asthma and heart diseases," they added. "Air pollution is taking toll on the health of people. The major contributors are increasing number of vehicles, frequent traffic congestions, industries emitting pollution and road dust. There is a need for taking measures to reduce the sources of air pollution for ensuring that people get fresh or less polluted air to breathe," said Dr Narrottam Sharma, chief medical health officer (CMHO), Jaipur.[5,6,7] Based on the high level of PM2.5 concentration, IQAir, a Swiss air quality technology company, slotted Jaipur at the 70th place in the list of world's most polluted cities recently. A Rajasthan State Pollution Control Board official said that road dust and burning of municipal waste and biomass burning in summer are the major causes of air pollution. The contributors of air pollution in summer are different from those in winter. In summer, 66% of concentration of PM2.5 in the air is due to road dust (36%) and biomass burning (30%). This was mentioned in a report issued by IIT Kanpur, released in 2019 on pollution in Jaipur.

A coordinated effort of all the departments are required by different government agencies such as Jaipur Development Authority, Rajasthan Housing Board, Jaipur Municipal Corporation, National Highway Authority, Public Works Department and state forest department as per their jurisdictions in bringing down the air pollution level. The IIT-Kanpur, report found that some of the stretches with very high silt load mentioned in the study were found to be in Badi Chaupad, Yadgaar crossroad, Agra road, Triven crossroad, Jaipur-Kishangarh highway and Pradhan Guest House.

Jaipur being the capital of Rajasthan is the focus of the socio-economic and political life of the state. It is the 10th largest city and one of the fastest growing cities in India. It is the center of both traditional and modern industries and is a very popular tourist destination for cultural heritage and historic architecture. It witnessed fast growth both physical and demographic i.e. with 2011 population at 30.73 lakhs, the city is likely to attain a population of 64.95 lakhs by the year 2025 with 5.3% annual growth rate. Jaipur City forms part of the famous "Golden Triangle", "Golden Quadrilateral" and "Delhi Mumbai Industrial Corridor". For the purpose we have taken the boundary of the Jaipur

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Development Authority as the study area. Pollution Survey Analysis : This survey is carried out at 10 locations in the study area. In this survey ambient air quality data is collected at each location for 24 hours on a working day. In air pollution survey data pertaining to particulate matters (PM10, PM2.5), SO2, NO2, O3, Lead, CO, Ammonia, Benzopyrene, Benzene, Arsenic and Nickel are collected.

Factors Escalating Vehicular Emission 1. Road Infrastructure 2. Personalized Transport 3. Public Transport 4. Traffic 5. Vehicle and Fuel Efficiency Road Infrastructure: Jaipur has a total road network of around 1500 km. Approximately 34 per cent of the roads are two lane roads. Although 52% of the roads surveyed are 4 lane, parking and encroachments on carriageway has led to underutilization of the road capacity. Due to spatial disparity in growth, traffic movement is from periphery to the core city. The radial roads especially in the periphery are inadequate, with the absence of more circumferential roads connecting the radial roadway system

The average annual growth rate of vehicles in Jaipur is around 8.4%. Increase in the number of registered vehicles on the limited road space has led to overcrowding and congestion on roads. Jaipur district has a total number of 2423648 motor vehicles registered till the year 2016, of which two wheelers and cars constitute 73.18 per cent and 13.76 per cent respectively. The bus system both public and private is inadequate in terms of comfort and frequency. They always operate at crush capacity. The available buses per lakh population are around 30 which is less than desirable (50 per lakh). Due to in-efficient rationalization of routes, public transit routes are unregulated with too many buses in one route causing confusion and congestion. Jaipur Metro is also at very initial stage and does not provide proper connectivity and mobility

Traffic: Traffic volumes are very high in the Walled City vicinity, Jhotwara, RajaPark, Sodala, Sindhi Camp etc. Volume Capacity Ratio is found to be more than 1 during the peak periods sometimes. The average speed in the commercial areas of the city is 16 km per hour during peak hours. Volume Capacity Ratio in the range of 0.75-0.90 represents traffic operations approaching unstable flow of heavy congestion and characterized by restrictions in maneuverability. Vehicle and Fuel Efficiency : Auto Industry has had the capability of making BS4 vehicles since 2010, but lack of proper BS4 fuel prevented it from selling such vehicles nationwide. The exhaust emissions for BS-III two-wheelers direct that the petrol-powered engine should have carbon monoxide and Hydrocarbon + Nitrous Oxide emission restricted to 1.00 g/km. For a vehicle to be BS-IV compliant it must have an emission not more than 0.75 g/km of CO and HC+Nox respectively. Solutions : 1. Moving People Rather Than Vehicles 2. Integrating Land Use And Urban Transportation 3. Priorities To Non-Motorized Transport 4. Switching To More Efficient Fuel and Vehicles 5. Promoting Hybrid Vehicles Moving People Rather Than Vehicles: Promotion of public transport will ideally reduce the traffic congestion on the streets by discouraging the use of personal vehicles. One important factor which can help in this regard is the provision of dedicated bus lanes, which will greatly improve the speed of the bus traffic and may help in turning people to use public transport by establishing it as a faster mode of travel. Integrating Land Use And Urban Transportation: While most of the economic activities are located in the Walled City area, the residential colonies have grown in the western and southern parts, which are far from the main centre of activities. This imbalance in the location of jobs and residences over space coupled with inadequacy of public transport system generates huge volumes of intermediate and personalized traffic especially on arterial roads. Priorities To Non-Motorized Transport: Footpaths should be made in residential streets and on major roads with commercial activities and the existing footpaths should be redeemed from encroachments and obstructions. Besides road space should be demarcated exclusively for movement by pedestrian and cyclists. Better Fuel And Vehicles • BS-VI should be implemented soon • Battery Driven Vehicles and Hybrid Vehicles should be promoted • e-Rickshaws should be made more popular • Fleet Modernization Policy should be implemented with vigor which will help reducing vehicular emission by 25% according to an estimate[2,3,4]

DISCUSSION

Urban pollution has increased due to expanding cities, more traffic, demographic growth, rapid economic development, industrialization, and increasing levels of energy consumption (CPCB,2010). The biggest environmental health risk is poor air quality, which is thought to be responsible for 4.2 million premature deaths annually worldwide (WHO, 2019). The cause of this death is exposure to small particulate matter (PM2.5) with a diameter of 2.5 microns or less, which is linked to cancer, cardiovascular, and respiratory diseases (WHO, 2019) (Lelieveld, 2015).

In addition to its negative effects on health, air pollution also results in enormous economic losses, especially when it comes to the costs associated with the medical care that must be given to people who are affected.(Lancet, 2019)

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According to a report published by a U.S. research group, air pollution is anticipated to shorten the life expectancy of approximately 40% of Indians by more than nine years.

The paper created by the Energy Policy Institute at the University of Chicago claims that more than 480 million people who reside in the broad regions of central, eastern, and northern India, including the nation's capital, New Delhi, face considerably high pollution levels (EPIC).

In Rajasthan, air pollution is the second-largest risk factor for early mortality (2016, state level disease burden estimates by IHME, ICMR, PHFI). Due to the lockdown, PM2.5 levels have been on average lower this year, however this hasn't been able to stop the winter spike: In year's overall PM2.5 average (up until December 20) has been predictably lower than last year, partly due to the unheard-of economic disruption caused by the monsoon and summer lockout. However, the resumption of the economy and the arrival of the winter, which traps pollution, caused PM2.5 levels to increase starting in October. The weekly average of PM2.5 increased seven times in Jaipur from the respective cleanest week. (cseindia.org, 2019)

A. Air Pollution

According to Indian Standards Institution IS 4167, 1996, "the presence in ambient atmosphere of substances, generally resulting from human activity, present in sufficient concentrations, present for a sufficient period of time, and under circumstances that interfere significantly with the comfort, health, or welfare of persons or with the full use or enjoyment of property." Numerous gaseous inorganic pollutants enter the atmosphere as a result of human activity. The biosphere's main component, the atmosphere, is a dynamic system that is constantly absorbing different gases from both natural and man-made sources.

There are two types of pollution sources: stationary sources and moving sources. Automobiles are the main mobile causes of air pollution, whereas industries are the main fixed sources.

B. Ingredients of Air Pollution[1,2]

1. Sulphur oxides (SOX): Coal and petroleum both contain sulphur compounds, and burning them releases sulphur dioxide. H2SO4 is created by further oxidising SO2, typically with the aid of a catalyst like NO2. When breathed in, damages our mucous membranes.
2. Nitrogen oxides (NOX): These vehicle pollutants can irritate the lungs and erode the body's resistance to respiratory illnesses like pneumonia and influenza. Additionally, they contribute to the creation of particulate matter and ozone.
3. Carbon Monoxide (CO): When fossil fuels like gasoline are burned, an odourless, colourless gas is created. Nearly two thirds of this pollutant come from cars and trucks. CO prevents oxygen from reaching the brain, heart, and other crucial body organs when it is inhaled. People with chronic conditions and new-borns are particularly vulnerable to the effects of CO.
4. Photochemical Oxides (Ozone): The main component of urban smog, is produced when sunlight reacts with hydrocarbons and nitrogen oxides, two pollutants emitted during the combustion of automotive fuel. Ozone may be advantageous in the high atmosphere, but it can irritate the respiratory system at ground level, leading to coughing, choking, and diminished lung capacity.
5. Volatile Organic Compounds (VOCs): Methane is a very potent greenhouse gas that raises the earth's temperature. Other hydrocarbons, or volatile organic compounds (VOCs), are important greenhouse gases due to their role in ozone production and their ability to prolong the atmospheric lifetime of methane. The probable carcinogens benzene, toluene, and xylene are aromatic VOCs that can lead to leukaemia in people who are exposed to them over an extended period of time.
6. Particulate Matter (PM): Road Dust, emissions from vehicles and factories, include PM2.5, it enters the respiratory system when breathed through the nose or mouth depends on its size; smaller particles enter the body more deeply than larger ones.

C. Air Quality Standard

A regulatory body or organisation adopts and upholds certain standards. Each standard ought to have its own definition and set of threshold values, which ought to be adequately justified (Molina, Molina, Slott & Kolbe, (December 2004). Due to a number of variables, including technical advancements, economic situations, and epidemiological studies on the effects of local air pollution, air quality standards may vary between nations. Countries including India, China, and

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the United States use the National Ambient Air Quality Standards (NAAQS, 2009). On the other hand, limit values are predetermined.

1. Vehicular Emission: The term "disease of prosperity" has been used to describe the air pollution brought on by vehicles. Automotive emissions have prompted extensive research and development. In fact, the burning of fossil fuels and the by-products that result greatly contribute to anthropogenic air pollution, which is especially severe in urban areas (Upadhyay, 2018). About 30% of all registered vehicles in the state of Rajasthan are in the Jaipur region. The Jaipur district has 446 vehicles per 1,000 people, which is significantly more than the regional average of 243 vehicles per 1,000 people. More than 70% of all registered vehicles are two-wheelers (CSE, 2019).
2. Factors Escalating Vehicular Emission

a. Road Infrastructure
b. Personalized Transport
c. Public Transport
d. Traffic
e. Vehicle and Fuel Efficiency

II. LITERATURE REVIEW

The perception of commuters regarding air pollution must be gathered in order to understand how they alter their choices, those who reside in large cities are more likely to recognise air pollution as a serious threat to their health (Badland et. al., 2009).

According to the results of a similar study conducted in California, those who are more concerned about the purity of the air check it more regularly. When working and exercising outside, people with respiratory conditions like asthma were shown to be more inclined to check the air quality(Veloz, 2019). An exposure analysis was carried out in Delhi utilising six different modes of transportation, walking and utilising auto rickshaws provides the highest exposure. Without any appropriate pollution control measures the elevated exposure to PM2.5 levels pose serious short- and long-term health concerns to Delhi residents.[3,4,5] An integrated and intelligent transportation systems is essential & to inform commuters on how to reduce exposure levels and their effects on their health (Maji, 2019). Mehrdad and Alistair Woodward et. al, investigated through their studies that choosing the cleanest route from an air pollution standpoint is crucial when active commuters plan their routes and get benefit from knowing the level of air pollution, especially those who frequently walk or cycle the same route. (M.Rafiepourgatabi, 2019) In India, the consequences of emissions from different forms of transportation were assessed byPandey, Apoorva, Venkataraman, & Chandra(2014). When compared to other forms of transportation, study concluded that on-road mobility contributed over 97 percent of the expected emissions in India.

(Goel, 2015) studies the impact of air pollutants exposure on different modes and investigated that travelling in auto rickshaw leads to 30% higher exposure rate than in an off-road location. Also, inside air-conditioned cars and metro carriages, the exposure rate is the lowest. The exposure of cyclists to ultrafine particles was evaluated along commuter routes. Reis and Oroz, (2019)did study on the factors that the overall concentration of UFP on the road influenced by traffic, construction sites, and the presence of bicycle infrastructure along the route, influences the percentage of particles that actually come into contact with the cyclist due to their relative position on the road.

(Xu, 2017), investigated both long-term, short-term temporal variation where the ratio of PM2.5 and PM10 reaches the maximum in winter because of stable atmospheric conditions. There are apparent night-day differences of daily variation of the ratio, which increases at night in all seasons in consequence of temperature inversion and declines in the daytime with a moderate rise in the afternoon.

(Suthar, 2018), calculated the amount of air pollutants produced by DG sets used in Jaipur City, India's wedding gardens, malls, and retail centres. The quantity of fuel a DG set uses, how long it has been in service, and how often it is maintained all affect how much air pollution it emits. The solid particles that make up the fumes from diesel engines cause serious disease as well as oncological problems when they are present in the air.

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III. JAIPUR PROFILE

1. Rajasthan's capital city, Jaipur, is the center of the state's socioeconomic and political activity.
2. It is the tenth largest city and one of the fastest growing cities in India.
3. It is the hub of both conventional and modern industry and a tourist attraction for its historical architecture and cultural heritage. It witnessed fast growth both physical and demographical.
4. Current Population of Jaipur in 2019, 40.67 lakh. Sex Ratio in Jaipur, 909 females per 1,000 males.
5. Jaipur City forms part of the famous “Golden Triangle”, “Golden Quadrilateral” and “Delhi Mumbai Industrial Corridor”.

A. Need of The Present Study

Jaipur is one of the highly polluted cities in Rajasthan, India. Emission level, measured in terms of annual mean value of PM10, PM2.5 has consistently been higher than the specified limits by NAAQS and much higher than WHO benchmark. High level of air pollution contributed by growing traffic is a major challenge to the sustainability of city transportation system.[6,7,8]

B. Choosing A Site

State capital of Rajasthan, Jaipur, is situated 435 metres above sea level at 26°55′10″N and 75°47′16″E. The city's population has surpassed 4.1 million as per the latest recent data. The city is surrounded by the Nahargarh Hills to the north and Jhalana to the east. All around the city, there are isolated, erratic hillocks. The city of Jaipur is located in a semi-arid region. In order to track ambient air quality in Jaipur, three Continuous Ambient Air Quality Monitoring Stations are located at the Police Commissionerate (M.I. Road), the Regional Science Centre (Shastri Nagar), and the Psychiatric Centre (Adarsh Nagar) shown in figure 2.

Figure 2: CAAQMS Stations in Jaipur.

These stations continually record meteorological data such as temperature, humidity levels, wind speed, wind direction, pressure, and sun irradiation in addition to particulate matter (PM10 and PM2.5), gaseous pollutants such as SO2, NOx, O3, CO, VOC, and NH3, and other pollutants. Furthermore, as part of the National Air Quality Monitoring Program, the State Board installed 9 manual units at the following locations: (CPCB)

1. RSPCB Office, Jhalana Dongari,
2. RIICO Office MIA, Jaipur
3. PHD Office, Ajmeri Gate
4. Office of the District Educational Officer, Chandpole
5. RSPCB, RO, Vidyadhar Nagar
6. VKIA, Jaipur (Road no.-6)
7. Nagar Nigam Office, Mansarovar, Jaipur
8. RIICO Office, Baees Godam Ind. Area, Jaipur
9. RIICO Office, Sitapura Industrial Area, Jaipur

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C. Air Quality of Jaipur[9,10]

Hourly and daily data were downloaded in the form of a CSV file from the CPCB portal, which provides real-time air quality data in its online dashboard from all the continuous monitors, in order to choose a survey selection site. PM2.5 was considered for this investigation because to its prevalence and significant health risk that is linked to long-term health impacts. For the purpose of choosing the study site, the retrieved data are examined in two steps:

1. Hourly ambient air quality level for April 2019

For the month of April 2019, the hourly PM2.5 data from each of the three continuous monitoring stations were retrieved. A line diagram is constructed to determine the highest concentration of areas with bad air quality, and it is discovered that the Police Commissionerate in Jaipur is the monitoring station with the highest monthly air quality index (CPCB, 2019).

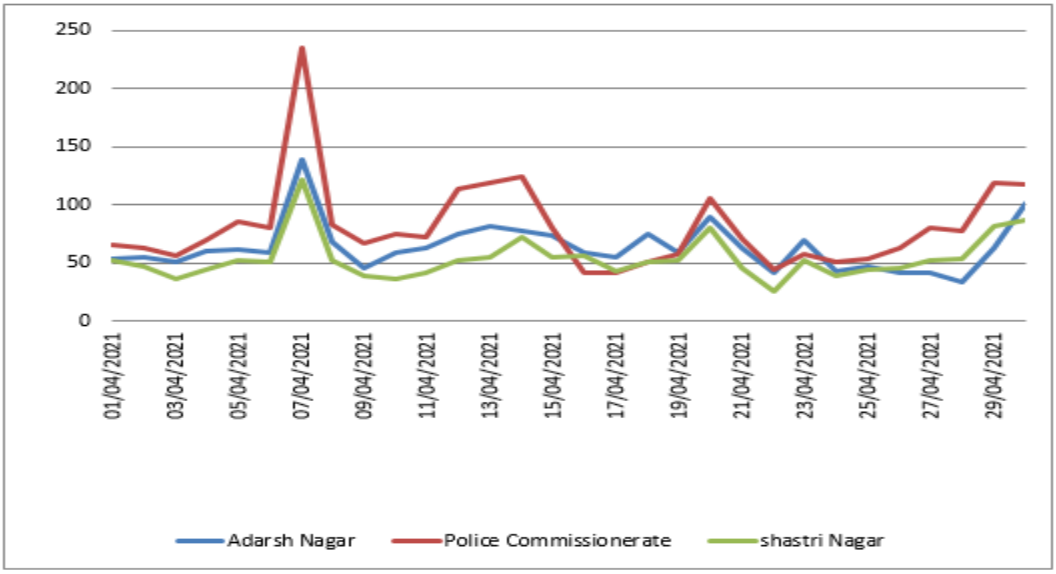

Figure 3: Hourly PM2.5 (µg/m³) analysis (April 2021)

2. Annual ambient air quality level from March 2019 to March 2019

The Police Commissionerate in Jaipur is considered to be a crucial place for this study, it may be inferred from the data gathered. However, since concentration levels vary with weather season variation, the same might not apply to the remaining months. PM2.5 data for three monitoring stations from March 2019 to March 2019 is downloaded to determine which station has the highest concentration level on any given day (CPCB, 2019).

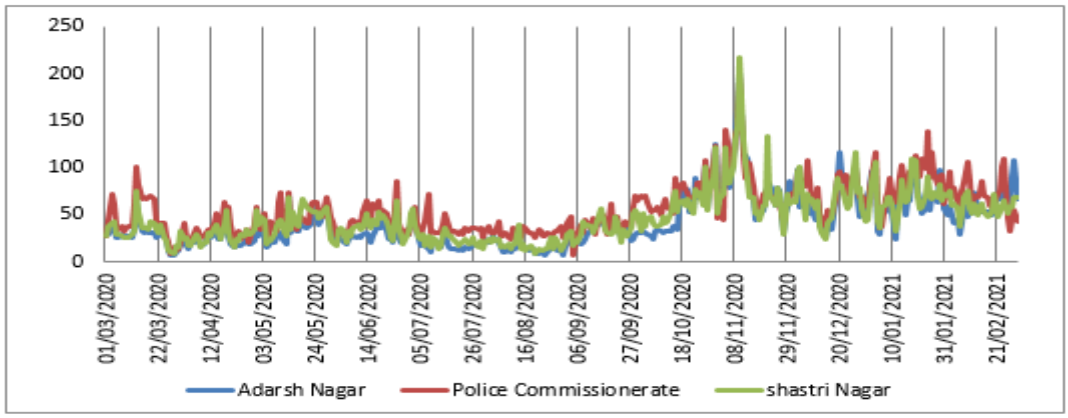

Figure 4: Severity of yearly air pollution (in Adarsh Nagar, Police Commissionerate & Shastri Nagar)

After analyzing throughout the year, the concentration at Police Commissionerate in Jaipur is the highest among all 3 stations.[11,12,13]

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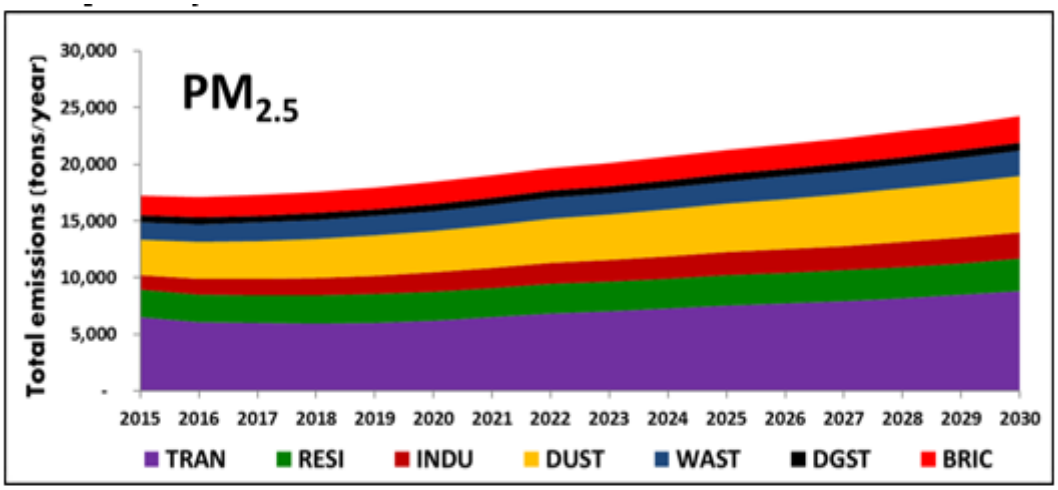
The state of the city in terms of air pollution is not very encouraging according to the issued World Health Organization (WHO) report on pollution. 500 new non-commercial vehicles, including two-wheelers and four-wheelers, are registered in Jaipur each day, according to the regional transport office (RTO). (TOI, 2014); (Urban Emissions.info, 2015).



TRAN = transport emissions; RESI = residential emissions; INDU = industrial emissions; DUST = dust emissions; WAST = open waste burning emissions; DGST = diesel generator set emissions; BRIC = brick kiln emissions (Urban Emissions.info, 2015).

Figure 5: Total PM2.5 Emissions by Sector 2015-2030

Urban Emissions.info, 2015 compiled an emissions inventory for the Jaipur region for based on the available local activity and fuel consumption estimates. The figure given below represents the various sectors responsible for increase of fine Particulate Matter (PM) with size fraction less than 2.5 µm, for year 2015 and projected to 2030 (Fig 5).

Comparing Hourly variations in Jaipur from 1 June 2019 to 1 July 2019 with CPCB 2019 standards and guideline values prescribed by WHO for parameters of Particulate Matters PM2.5 and PM10.

- PM2.5(µg/m³)

WHO Guideline values states that the annual mean concentration of Fine particulate matter (PM2.5) should not exceed 5 µg/m3, while 24-hour average exposures should not exceed 25 µg/m3 (WHO global air quality guidelines, 2019).

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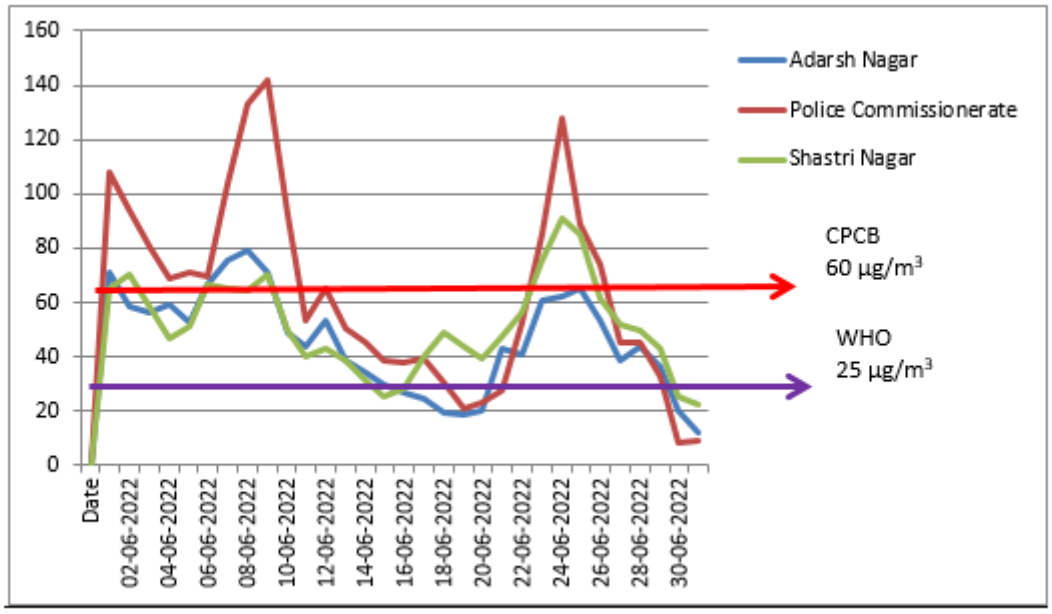

Figure 6: Comparison of PM2.5 content in June-July 2022

- *PM10(µg/m³)*

As per the WHO guidelines the annual average for Coarse particulate matter (PM10) is 15 µg/m³ and 24-Hour mean is 50 µg/m³, whereas according to CPCB it should not increase 100 µg/m³ hourly exposure (WHO global air quality guidelines, 2021).

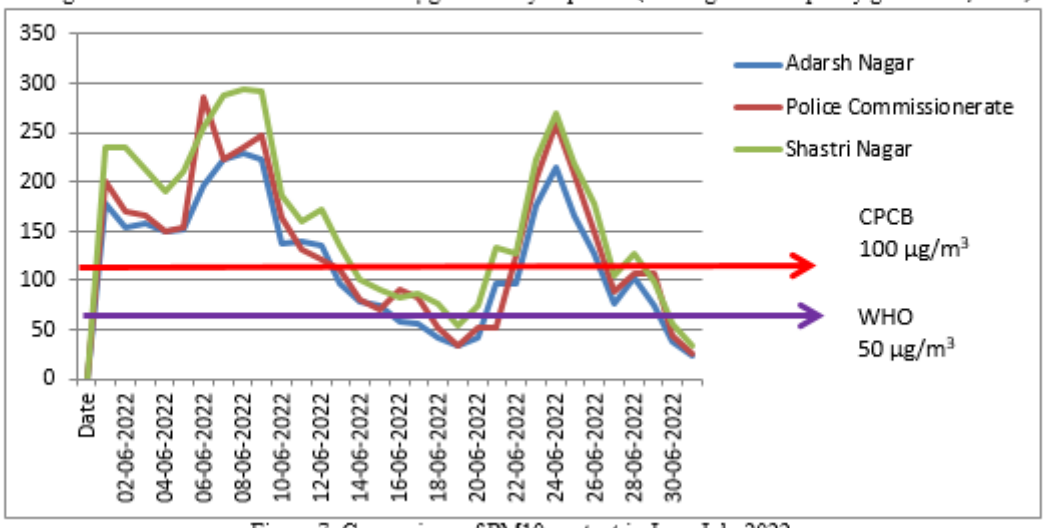

Figure 7: Comparison of PM10 content in June-July 2022

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The top four contributors to PM10 emissions are road dust (71%), industries (8%), vehicles (8%) and construction (4%); these are based on annual emissions. Seasonal and daily emissions could be highly variable.

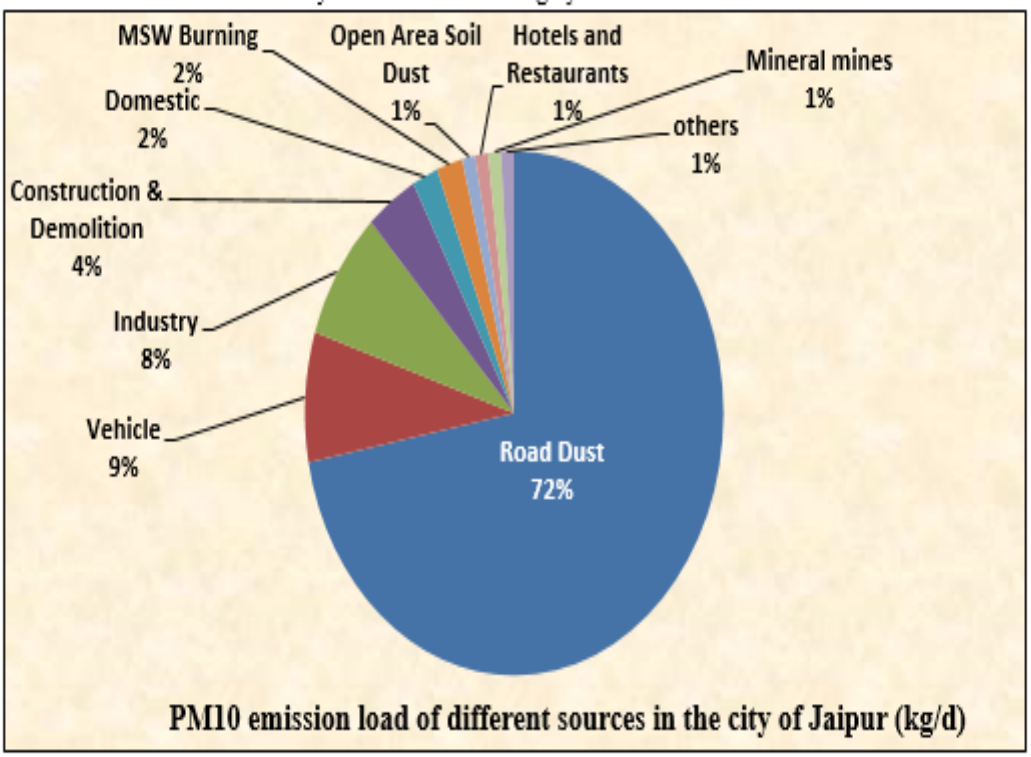

Figure 8: Category Wise PM10 Emissions from All Sources

Road dust (46 percent), automobiles (20 percent), industry (19 percent), and home fuel combustion (5 percent) are the top four sources of PM2.5 pollutants, according to annual emissions. Daily and seasonal emissions may vary greatly.

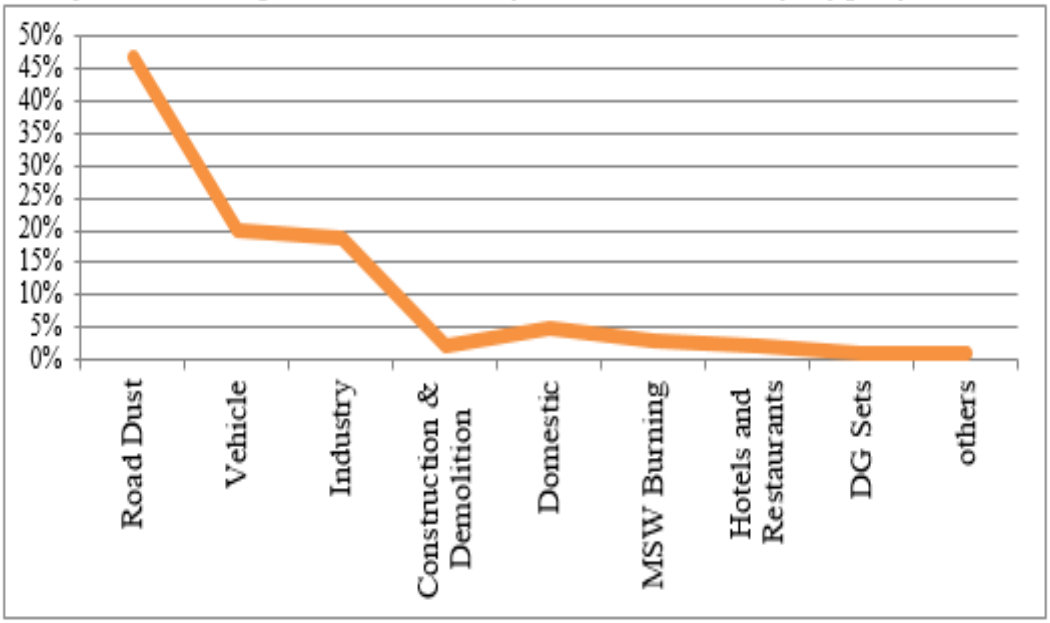

Figure 9: Category Wise PM2.5 Emissions from All Sources

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• Moving People Rather than Vehicles	Encouraging Public Transport and car pools.
• Integrating Land Use and Urban Transportation	Introducing BRTS effectively and efficiently.
• Priorities to Non-Motorized Transport	Constructing footpaths and cycle tracks.
• Switching to More Efficient Fuel	Introduction of cleaner fuels (e.g. CNG)
• Introduction of electric and hybrid vehicles	Less gas and oil required. Eco-friendly
• Implementation of BS VI engines	Equipped with fuel infusion resulting in better throttle response & fuel efficiency.

IV. RESULTS

Udaipur, a mineral-rich district, houses a number of mineral- and stone-based industries – many of which are major sources of air pollution. In fact, due to its high air pollution levels, Udaipur has been listed as a 'non-attainment city' by the National Clean Air Programme (NCAP) launched in 2019 by the Union Ministry of Environment, Forest and Climate Change.

An assessment by New Delhi-based think tank Centre for Science and Environment (CSE) has identified fugitive emissions from these industries and road dust as the key triggers for air pollution in the district. CSE has now gone ahead to also offer a roadmap for cleaning up Udaipur's air.

A workshop titled "Improving Environmental Performance of Industries in Udaipur" was conducted jointly here today by CSE and the Rajasthan State Pollution Control Board (RSPCB) to lay down this roadmap. The focus of the roadmap is on improving environmental performance of industries and providing better infrastructure in the industrial areas.

The workshop brought together key players, including representatives from the Rajasthan State Industrial Development and Investment Corporation (RIICO), the District Industries Centre (DIC), industries, consultancies and industrial associations.

As per data provided by the RSPCB, there are approximately 1,207 industries in Udaipur, out of which 885have been identified as 'air polluting' industries; 446 are industries that are responsible for fugitive emissions; and 439 are 'fuel-consuming' industries.

Of the 446 fugitive emission industries, 366 are mineral-grinding units,while 80 are stone crushers. Says Nivit Yadav, programme director, industrial pollution, CSE: "These sectors, operating in large numbers, generate huge amounts of dust and emissionsand need to comply with strict environmental guidelines to reduce their emissions. The dust from

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these sectors has often been a big concern for the nearby residential areas -- therefore, this sector needs priority focus." [14,15,16]

Speaking at the workshop, Sharad Saksena, regional officer, RSPCB, Udaipur, said: "The RSPCB and industry should work together to ensure implementation of guidelines on the ground. Mere installation of air pollution control devices is not enough to curb air pollution….it also demands a strong mindset towards pollution control."
Yadav mentions that in 2019, CSE conducted a study to assess industrial air pollution in major districts in Rajasthan. "We found that industries in Udaipurwere largely using coal, wood or liquid fuel.The particulate matter pollution load from these fuel-consuming industries was 148 tonne per annum; the sulphur dioxide load was 200 tonne per annum,while the nitrogen oxide load was 162 tonne per annum.The pollution load in Udaipur compared with other non-attainment cities like Jaipur and Alwar was lower.However, considering the growth in number of industries in Udaipur in near future, it is recommended that industries in the city should shift towards cleaner fuel."

The situation has improved since then, as per the RSPCB. Parth Kumar, programmemanager, industrial pollution, CSE says: "Following the RSPCB's drive on increased use of biomass, the situation has improved; some industries have shifted to using biomass and other clean fuels. In the longer run, all industries should use cleaner fuels with appropriate air pollution control devices."

Shreya Verma, deputy programme manager with CSE's industrial pollution unit, adds: "For sustainable growth of industries, it is important that industries take initiatives and adopt pollution control measures at the individual level."
What CSE and RSPCB recommend

Fugitive emissions: All mineral grinding and stone crusher units should follow and ensure the implementation of guidelines outlined by the RSPCB.The RSPCB should ensure the installation and working of well-maintained pollution control equipment in all industries. Consent to operate should be withheld if an industry is not complying with the guidelines.

Infrastructure in industrial areas:

- Condition of roads:Condition of roads in industrial areas is unsatisfactory.It should beensured that all roads and sidewalks are repaired and paved. Industrial areas should have blacktopped metaled roads, includingthe pavement of road shoulders.It is important to ensure good quality cement concrete roads that can bear heavy vehicle movement for longer periods.Regular cleaning of roadsis also critical.
- Green areas: It is important to develop and maintain green areas, gardens and parks in industrial areas.Plantations can be done on sidewalks to minimise dust generation.
- Use of cleaner fuels:
- Industries should shift to cleaner fuels (biomass-based),and install proper air pollution control devices.
- A time-bound plan, based on a natural gas feasibility study,is needed to provide access to cleanfuel (PNG) in the city.

Yadavsays: "To achieve the NCAP objective of clean air, industries with fugitive emissions must follow the guidelines outlined by RSPCB for the respective sectors, and their implementation should be ensured by the Board. There is also an urgent need to improve industrial infrastructure like road conditions, as poor infrastructure causes road emissions which eventually contribute to the city's air pollution."[17,18,19]

V. CONCLUSION

The present study highlights that the air pollution become a major problem for the Jaipur city during last decade. This study reveals that both the particulate pollutants, PM 10 and PM2.5 are mostly above permissible limits at study site It is observed that there is no gradual increasing or decreasing trend in the studied air pollutants i.e. PM10 and PM2.5. From Figure 4, it can be observed that there is drastic increase in PM2.5 in winters as compared to summer season. The year 2019 in winters had seen worst Air Quality Index for PM2.5 when compared to previous years.(Mandowara, 2019) A. Findings and Recommendations • Expanding air quality monitoring network enables better understanding of air quality • Understanding pollution sources • Road dust One of the main sources of PM10 and PM2.5 emissions, soil and road dust emissions consistently contribute to ambient air concentration. To lessen the emissions of dust on main roadways, the following control measures are advised: ? Create paved roads from unpaved ones and keep them free of potholes. ? Application of truck loading regulations; installation of suitable truck enclosures and gravel paving on all

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haul routes. ? Increase plantation and green space. Greening efforts should be made in public spaces, community spaces, schools, and housing societies. • Vehicular pollution Solutions that can be followed to reduce the impact of automobile emission as vehicles play a significant role in increasing the percentage of pollutants.[20]

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