Air Pollution in Gwalior Region and Its Effects On Human's Health

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Abstract-: *Air pollution causes various health troubles in the urban areas. recently, the air pollution level in Gwalior has undergone several transformations in terms of the stages of pollutants and the manage measures taken to decrease them. This study presented an evidence -based approaching into the status of air pollution in Gwalior and its effects on health and control measures. As per WHO 2016 explained that Gwalior is a high level of most air polluted city in INDIA and second in world level. Out of 20 cities within the world with dirtiest air, 13 are from India Automobiles are the major contributors in air pollution, before rapid industrialization; urbanization has resulted in the appearance of industrial centers without a corresponding expansion in civic value and pollution manage mechanism. polluted air quality has both extreme and persistent effects on human health. In all cities like Gwalior has an air pollution level exceed according to World Health Organization (WHO).*
Keywords: *Air Pollution, Pollutants, So_x, No_x, Human health.*

I. INTRODUCTION

Human activities due to the fact preindustrial time have resulted in huge enhance in air pollution. Air pollutants are substances which after causes in the atmosphere negatively affect the human health, animals, plants, or microbial existence; harm substances, or hold up with the normal activities of life. India is the one of the major developing country and its economic expansion over the past decades has been one of the strongest in the world history. Such an economic development increases with the use of fossil fuels and automobile discharges. These pollutants have an effect on human health which are source of many diseases. several government organizations present concentration of each contaminant levels in ambient air periodically. ordinary citizen may not recognize the data and to interpret how the quality of air is. An air quality index is one of the significant tools presented for investigating and representing air quality position uniformly. Air pollution is a serious and global difficulty that causes bad impact on human health. Madhya Pradesh mainly in Gwalior has severe air pollution problems, with rapidly increased suspended particulates matter at approximate 2 times as high as the WHO standards in metro cities. The Air Quality Index in Table 1 shows a measure to assess the relative change in the ambient air concentrations.

Table 1. AQI Proposed for India (Sharma et al., 2003)

S. No	Index	Category	SO_2 (24 hr avg.) ($\mu g/m^3$)	NO_2 (1- hr avg.) ($\mu g/m^3$)	SPM (24-hr avg.) ($\mu g/m^3$)	PM_{10} (24-hr avg.) ($\mu g/m^3$)
1	0 – 100	Good	0 – 80	0 – 80	0 – 200	0 – 100
2	101 – 200	Moderate	81 – 367	81 – 180	201 – 260	101 – 150
3	201 – 300	Poor	367 – 786	181 – 564	261 – 400	151 – 350
4	301 – 400	Very Poor	787 – 1572	565 – 1272	401 – 800	351 – 420
5	401 – 500	Severe	>1572	>1272	>800	>420

The value given in Table 1 are used to compute the AQI

II. MAJOR POLLUTANTS PRESENT IN AIR

In Madhya Pradesh Particular in Gwalior the problem of air pollution has assumed serious proportions, which depends on fossil fuels, private motor vehicles for transport, incompetent utilize of energy in buildings, and employ of biomass for food preparation and heating are factors believed to have contributed to this alarming increase in pollution levels. Sulphur dioxides (SO_2) produced from Industrial resources. Nitrogen oxides (NO_x) are formed mainly by the burning of fossil fuels and Ozone (O_3) increased by transportation mainly. It may cause serious heart and lungs diseases. This is the indication of risk about human health and respiratory system also.

III. AIR QUALITY STANDARD IN GWALIOR

The Gwalior has the highest particulate stuff in India at 329 mi-crograms per cubic metre was depend on Central Pollution Control Board (CPCB) 2012 report on 'national ambient air quality status and trends'. But because then there has been a vast enhancement in the situation. The current statistics explain that the foreign particle in the city stands at 141 micrograms per cubic metre. before this year, the CPCB data exposed Gwalior highest the list of polluted Indian cities in terms of particulate matter. The statistics explained that beside the allowable limit of 60 micrograms per cubic metre, particulate matter in Gwalior was 329 micrograms per cubic metre more than five times of the permissible limit. Only 12% of people living in cities that report air quality comply with WHO guideline levels.

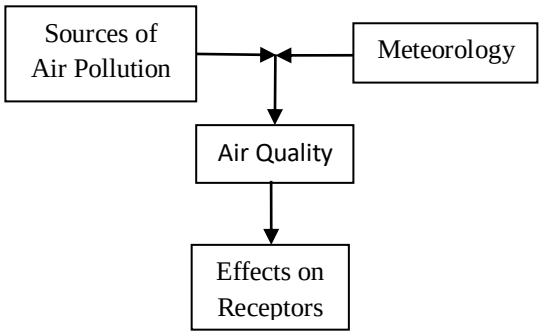


Figure 1: Air Pollution Based On System Approach

The chemical contamination of the pre-industrial (i.e., before the 18th century), natural global atmosphere is compared to current compositions in Table 1:

Table 2. Atmospheric Chemical Compositions

Gas	Symbol	% by volume (Current Atmosphere)	ppm (Natural Atmosphere)	ppm (Current Atmosphere)
Nitrogen	N_2	78.1	-	-
Oxygen	O_2	20.9	-	-
Argon	Ar	0.92	-	-
Neon	Ne	-	18.2	-
Helium	He	-	5.2	-
Krypton	Kr	-	1.14	-
Xenon	Xe	-	0.09	-
Carbon dioxide	CO_2	-	280.0	370.7[3]
Methane	CH_4	-	0.750	1.77[4]
Nitrous oxide	N_2O	-	0.270	0.318[5]
Water Vapor	H_2O	Variable(0.004 to 4)		

All human made (anthropogenic) discharges into the air can be called air pollution, since they modify the chemical composition of the natural environment. The augment in the worldwide concentrations of greenhouse gases CO2 , CH4 , and N2 O (shown in Table 1), known as air pollution with this approach, although the concentrations have not found to be toxic for humans and the ecosystem. single can treat this approach and only believe anthropogenic discharges of dangerous chemicals as air pollution. though, this developed approach has some disadvantages. Firstly, one has to define what "harmful" means. "Harmful" might denote an undesirable effect on the health of living things, an undesirable effect on anthropogenic or ordinary non-living structures, or a decrease in the air's visibility. Also, a chemical that does not source of any short-term harmful effects may build up in the atmosphere and create a long-term harmful causes.

For example, anthropogenic discharges of chlorofluorocarbons (CFCs) were formerly considered secure since they are inert in the lowest component of the atmosphere called the troposphere. However, once these elements enter the stratosphere, ultraviolet radiation can exchange them into extremely reactive species that can have a disturbing effect on stratospheric ozone. Similarly, anthropogenic CO2 releases from combustion processes were considered secure since they are not poisonous, but the long-term addition of CO2 in the atmosphere may direct to a weather transform, which might then be dangerous to humans and the environment.

The main intention of the air quality standards is to offered a source for protecting public health from the unfavorable effects of air pollution and for eliminating, or decreasing to a smallest amount, those air contaminants that are known or likely to be hazardous to human health and well-being.

IV. WHO Report of 2016

A recent statement of the World Health Organization has exposed Gwalior is the most polluted city in India in terms of air pollution. The details also suggests that the Indian population living outside Kashmir and the Himalayan belt are exposed to air pollution beyond the WHO safe limits. Meanwhile, Gwalior, known as the most polluted city in the world, doesn't feature in the list of cities with highest air pollution levels.

The researchers arranged air pollution records for their observe from nearly 3,000 cities globally among 2008 and 2015. measuring between Indian cities on stages of particulate matter PM10 and the more harmful PM2.5, Delhi features in the top lists in India. In provisions of pollution stages, Delhi ranks fourth in PM10 list and fifth in the PM2.5 list.

WHO prescribed safe limits PM2.5 and PM10 are 10 microgrammes per cubic metre and 20 microgrammes per cubic metre, respectively. On the other hand, India's prescribed limits for the same are 20 microgrammes per cubic metre and 60 microgrammes per cubic metre, respectively.

PM2.5 (WHO prescribed Safe level — 10 microgrammes per cubic metre)

- Gwalior-176
- Allahabad-170
- Patna-149
- Raipur-144
- Delhi-122
- Ludhiana-122
- Kanpur-115
- Khanna-114
- Lucknow-113
- Firozabad-113

India's cities with highest air pollution

PM10 (WHO prescribed Safe level — 20 microgrammes per cubic metre)

- Gwalior-329
- Allahabad-317
- Raipur-268
- Delhi-229
- Ludhiana-228
- Kanpur-215
- Khanna-213
- Firozabad-212
- Lucknow-211

- Amritsar-202

The study based on a pollution model that at least 92 percent of the global population lives in places that have air pollution levels that exceed whose safe or acceptable limits. The statement depend on a WHO air quality model also highlights areas in countries that go above WHO limits.

According to WHO, air pollution (indoor and outdoor) is responsible for at least 6.5 million deaths. It discovered that at approximately 90 percent of the deaths happened by air-pollution connected ailments are reported from low- and middle-income countries with approximately about 66 percent happening in South-East Asia and the Western Pacific. The important causes of air pollution comprise incompetent vehicles and other resources of fuel consuming transports, burning of devastate scraps, pollution from fossil-fuel powered power plants, and other dirty industries. even though, the statement adds not all air pollution is the doing of human activities and that air quality can also be decreased by dust storms releasing particulate matter in the air. Such phenomenon is seen more in arid areas or those close to deserts.

V. Results and Discussion

In Gwalior the total number of vehicles registered up to 2016 is 440000. Thus there is a great increase of vehicles on the roads of the city. The augment in the amount of vehicles on the roads of Gwalior resulted in an augment in the concentration of air pollution in and around the Gwalior city. Table 3 show the number of vehicles that has been registered up to 2016 in the city.

Zones selected for study of pollutions in Gwalior city -:

1. Thatipur
2. Golekamandir
3. Railway station
4. Lashkar

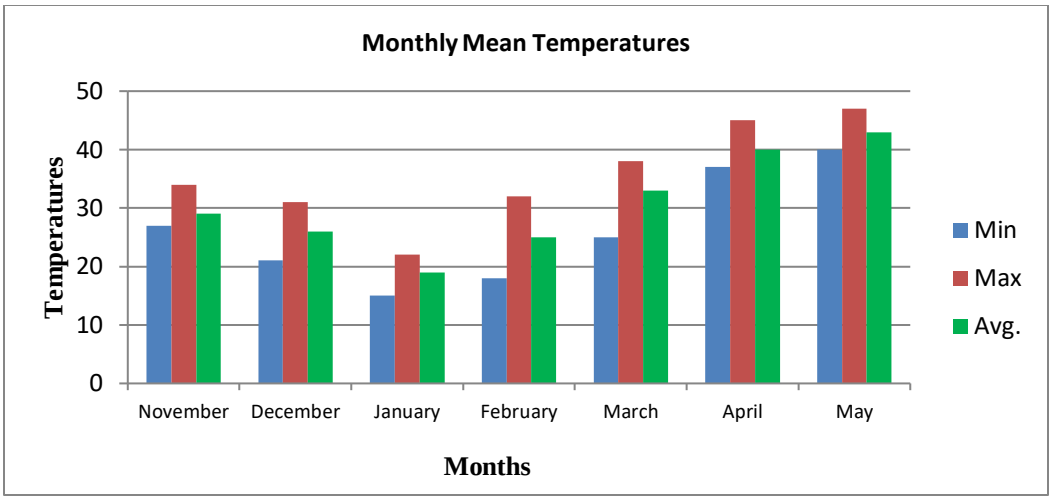
Table 3: Registered vehicles in Gwalior city

Years	No. of. Vehicle registered	No. of vehicle added
Previous	190000	0
2011-2012	280000	40000
2012-2013	285000	5000
2013-2014	330000	45000
2014-2015	380000	50000
2015-2016	440000	60000

Temperature and its vertical distribution affect the concentration of pollutants through atmospheric stability and by the rate of chemical reaction in the atmosphere. In the present study it has been observed that the months which experienced higher temperatures there was lesser concentration of NOx. Monthly minimum, maximum and average temperature from November 2016 to May 2017 is shown in Table 4.

Table 4: Monthly Mean Temperatures in 2016-17

Month	Temperatures		
	Min	Max	Avg.
November	27	34	29
December	21	31	26
January	15	22	19
February	18	32	25
March	25	38	33
April	37	45	40
May	40	47	43

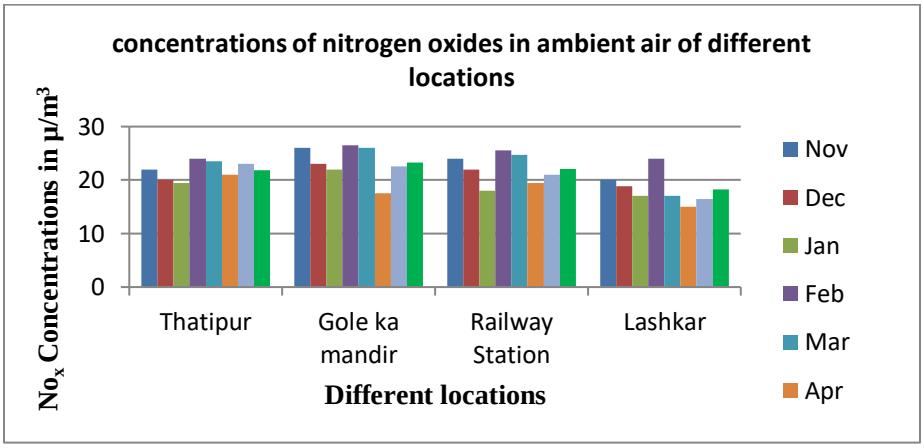


Graph 1: Monthly mean Temperatures

After selection of sampling site, monitoring of NO2, was done. The summarized data of average concentration of NO2 at Thatipur, Railway station, Gola kamandir and Lashkar for the study period have been represented graphically in graphs.

Table 5: Average concentrations of nitrogen oxides in ambient air of different locations

Location	No_2 values in Gwalior Year 2016-17							
	Nov	Dec	Jan	Feb	Mar	Apr	May	Average
Thatipur	22	20	19.5	24	23.5	21	23	21.8
Golekamandir	26	23	22	26.5	26	17.5	22.5	23.3
Railway Station	24	22	18	25.5	24.7	19.5	21	22.1
Lashkar	20	18.9	17	24	17	15	16.5	18.3

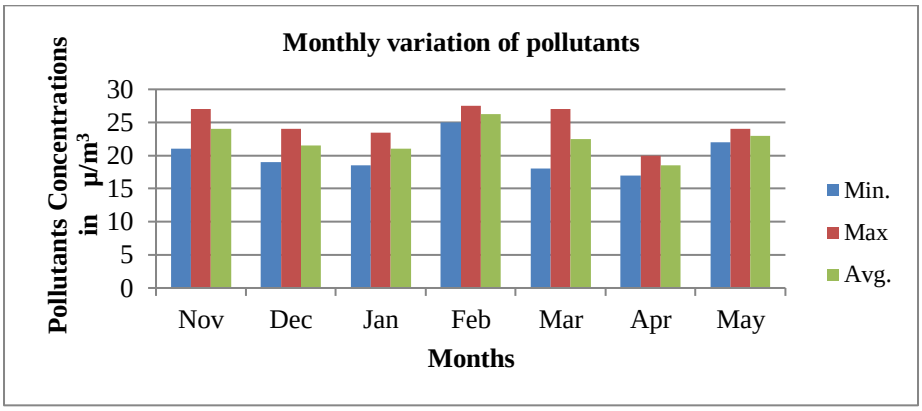


Graph 2: Monthly mean Temperatures

From the average data it was concluded that Gola Ka Mandir and Railway Station sampling sites showed higher concentrations of NOx in all the months as compared to Lashkar and Thatipur sites. The average concentrations of nitrogen dioxide during these months were recorded 21.8, 23.3 22.1, 18.3 µg/m^3, respectively monthly variation of NO_2 Graph showed low values during April at all the selected locations. Whereas high values were observed in the months of February.

Table 6: Monthly variation of pollutants

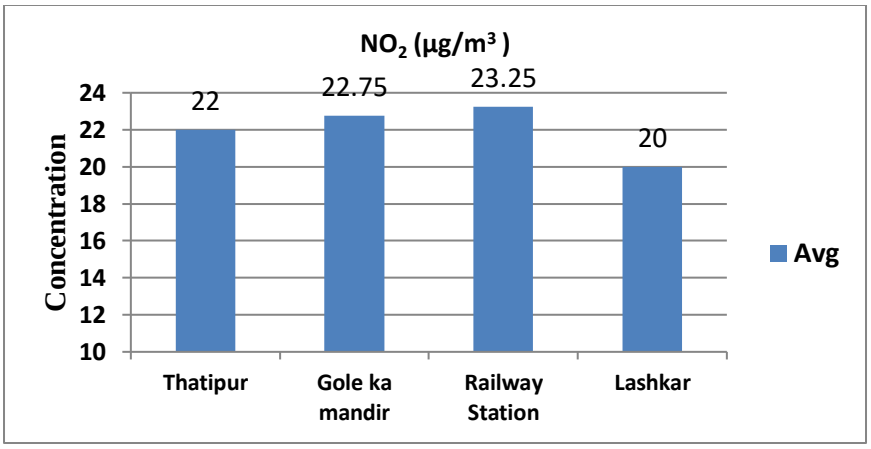
	Concentration µg/m^3 (2016-17)		
Months	**Min.**	**Max**	**Avg.**
November	21	27	24
December	19	24	21.5
January	18.5	23.5	21
February	25	27.5	26.25
March	18	27	22.5
April	17	20	18.5
May	22	24	23



Graph 3: Monthly variation of pollutants

Table 7: Location wise variations of Nitrogen dioxide

	Concentration µg/m^3 (2016-17)		
Locations	**Min.**	**Max**	**Avg.**
Thatipur	19	25	22
Golekamandir	18.5	27.5	22.75
Railway Station	20.5	26	23.25
Lashkar	15.5	24.5	20



Graph 4: Average concentration (µg/m³) of Sulphur dioxide (SO2) at different locations of Gwalior City

Table 8. Effects of automobile emissions on the respondents at Thatipur, Railway Station, Gola kaMandir, and Lashkar

Number of People affected by:							
Respondent	Sneezing (T,R,G,L)	Sore Throat (T,R,G,L)	Shortness of breath (T,R,G,L)	Wheezing (T,R,G,L)	Chest Tightness (T,R,G,L)	Skin irritation (T,R,G,L,)	Nausea (T,R,G,L)
Driver (private/personal)	(2,7,8,2)	(2,8,5,1)	(1,6,5,0)	(1,1,1,0)	(1,4,3,1)	(1,6,3,2)	(1,7,5,0)
Conductor	(0,4,7,1)	(1,3,4,1)	(1,5,4,0)	(1,1,1,0)	(1,4,3,1)	(1,6,3,2)	(1,7,5,0)
Commuter	(1,4,4,1)	(1,5,4,1)	(2,6,4,0)	(1,0,0,0)	(1,7,6,0)	(1,2,2,1)	(1,5,6,1)
Traders	(4,3,3,0)	(3,4,2,1)	(3.,1,2,0)	(1,0,0,1)	(1,0,0,0)	(2,0,0,1)	(2,0,0,0)
Student	(4,6,6,1)	(3,5,3,0)	(3,1,2,2)	(0,0,0,0)	(3,1,1,2)	(2,1,2,1)	(1,0,1,0)
Office workers	(2,1,2,0)	(1,1,3,1)	(2,1,0,1)	(0,0,0,1)	(1,0,2,1)	(1,0,0,1)	(1,0,0,1)
Market women	(3,1,1,0)	(1,2,2,1)	(2,1,0,0)	(0,0,1,0)	(2,0,1,1)	(2,0,1,0)	(1,0,0,0)
Street hawkers	(1,2,1,0)	(1,1,1,1)	(1,1,0,1)	(0,0,0,0)	(1,0,2,0)	(2,1,1,1)	(2,0,0,0)
Residents	(1,1,1,1)	(1,0,2,1)	(1,1,1,1)	(0,0,1,0)	(2,0,1,2)	(2,0,1,1)	(1,0,1,1)
Total	(18,29,34,6)	(14,29,26,8)	(16,23,18,5)	(4,1,4,2)	(13,16,21,7)	(15,14,15,10)	(12,17,19,4)

Key: T-Thatipur, R- Railway station, G – Gola kamandir, K - Kampoo

Table 9. Distribution of the respondents in the study areas

Respondent	Thatipur		Railway Station		Gola kamandir		Lashkar		Total
	M	F	M	F	M	F	M	F	
Driver(Private/ Personal)	15	4	18	3	21	4	11	1	77
Conductor	11	-	10	-	15	-	7	-	43
Commuter	9	7	12	5	11	5	7	3	59
Traders	17	-	10	-	13	-	5	-	45
Student	15	12	13	10	18	11	12	9	100
Office workers	5	1	3	2	7	1	3	-	22

Market Women	-	3	-	1	-	1	-	-	5
Street hawkers	3	-	7	-	4	-	1	-	15
Residents	7	2	3	1	7	5	6	3	34
Total	82	29	76	22	96	27	52	16	400

Key: M- Male, F – Female

Table 10. Effects of the automobile emission on the respondents in the study area

Complaint	Thatipur	Railway Station	Gola kamandir	Lashkar	Total
Sneezing	18	29	34	6	87(21.7%)
Sore Throat	14	29	26	8	77(19.2%)
Shortness of breath	16	23	18	5	62(15.5%)
Wheezing	4	1	4	2	11(2.7%)
Chest Tightness	13	16	21	7	57(14.2%)
Skin irritation	15	14	15	10	54(13.5%)
Nausea	12	17	19	4	52(13.0%)

VI. Conclusion

We found that the air standard in Gwalior is worst by the world health organization (WHO) report. The major factor towards this is vehicular pollution but we can't ignore the participation of industry, urbanization and rough roads in the air quality status of Madhya Pradesh mainly in Gwalior. In Madhya Pradesh need to generate an action plan for air quality management besides Madhya Pradesh whole India faces similar problems of poor air quality are being experienced. production of crops is also affected by the ecological conditions among which air quality plays a leading role. Air pollutants cause inimical effects on physiology and metabolism of plants due to their oxidizing potential Air pollution is a serious environmental concerns all around the surroundings. Over the last few decades, the strengthen procedure of industrialization and urbanization,coupled with fast population growth has resulted in sever environmentaldegradation. In particular, dangerous pollutants for example SO2,Nitrogen Dioxide (NO2), Ozone (O3), Total Suspended Particles Matter etc, are emitted and these contaminants still go beyond air quality guidelines recommended by the WHO, 2005. Particulate andgaseous emissions of pollutants from industries and auto exhaust areresponsible for rising discomfort, increasing airborne diseases, decreasingproductivity and weakening of creative and educational patrimony urban center.

India is not an exemption, where greater part of the population is exposed to deprived air quality. India deals through the similar challenges of both strengthening its economy and protecting its surroundings. Air quality has depreciated in large cities in India. The major foundations of air pollution comprise road dust re-suspension, diesel combustion, construction actions, biomass burning, certain contribution fromgasoline which has polluted cities.

The governmental efforts alone are not enough. Participation of the society is crucial so that you make a obvious impact within the decrease of contamination. The utilization of communal transport requirements to be encouraged More repeated checking of Pollution Under Control Certificates requires to be commenced by the public authorities to make sure that vehicles are discharging gases within allowable limits. People require to be knowledgeable to switch-off their motor vehicles when to come at traffic intersections. Moreover, the "upstream" factors responsible for pollution also need to be addressed. The growing influx of travelers can be decreased by rising and generating job opening in the peripheral and housing areas.

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