A

Minor Project Report

On

“Air Pollution Decrease in Indian Cities During Lockdown”

In Partial fulfilment of the requirement for the award of the degree

Bachelor of Technology in Chemical Engineering (2019-23)

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CANDIDATE'S DECLARATION

We hereby declare that the project report – "Air Pollution decrease in Indian cities during lockdown" which is being submitted for "minor project – 2 (170602) 6th semester in "MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (MP) is our genuine work done under the guidance of prof. Anish P. Jacob, Dept. of chemical engineering, "Madhav Institute of Technology & Science ", Gwalior.

Date: 15/04/2022

Place: Gwalior

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Guided by

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ABSTRACT:

Air pollution always is a big threat for India which has increased a lot in many parts of India in last decade with serious consequences for human health and many more. The government of India respond to the covid pandemic by imposing lockdown which led to delay in industrial sector and transportation sector etc. a short-term advantage of this was the reduction of air pollution across cities. This project report studies the impact of imposing 68-day lockdown on air pollution in India by comparing pollutant concentration data from cities by comparing the time during lockdown with the previous year and National ambient air quality standards (pollution control board). The primary objective of this report is to analyses the positive changes in air quality come during lockdown .

Abbreviation and key words:

1 NAAQS (National ambient air quality index)

2 DALYs (Disability adjusted life year)

3 NCAP (National clean air programme)

4 Air pollution

5 covid- 19

6 lockdown

7 non-attainment cities

8 Air pollutants

9 AQI (air quality index)

10 Indian cities

Literature review:

This project report is made after the study of journals and other source. which are mention below.

AUTHORS	YEAR	TITLE	CONCLUSION
Central pollution control board	23 SEPTEMBER 2020	National ambient air quality status & trends 2019	Cpcb launch national ambient air quality monitoring programme to collect, gather and circulate air quality information.
Purnamita Dasgupta, Kavitha Srikanth	4 November 2020	Reduce air pollution during covid -19 learnings for sustainability from Indian cities	One examining air pollution of different cities in covid period it came to know that air quality is improved.
Sonal Kumari, Anita Lakhani, K. Maharaj Kumari	28 September 2020	Covid -19 and air pollution in Indian cities : worlds most polluted cities	It shows that the primary and secondary pollutant concentration in air is decreased in lockdown. Better management of industries and transport can improve air quality
Ritwik nigam, Kanvi Pandya, Alvarinho J. Luis, Raja Sengupta Mahender Kotha	20 October 2020	Positive effects of covid-19 lockdown on air quality of industrial cities (Ankleshwar and Vapi) of Western India	Show positive effects of lock down on industrial cities Ankleshwar and vapi

Contents

1 introduction:

1.1 why good air quality is important?

Ans for breathing better quality of air is important for humans, plant and animals. a person inhales 14, 000[1] litre of air on an average therefore polluted air may be a cause of quality of life. hence clean air is a basic need of a society.

1.2Air pollution – it is defined as presence of air pollutant in the atmosphere (prevention and control of pollution) Act, 1981.

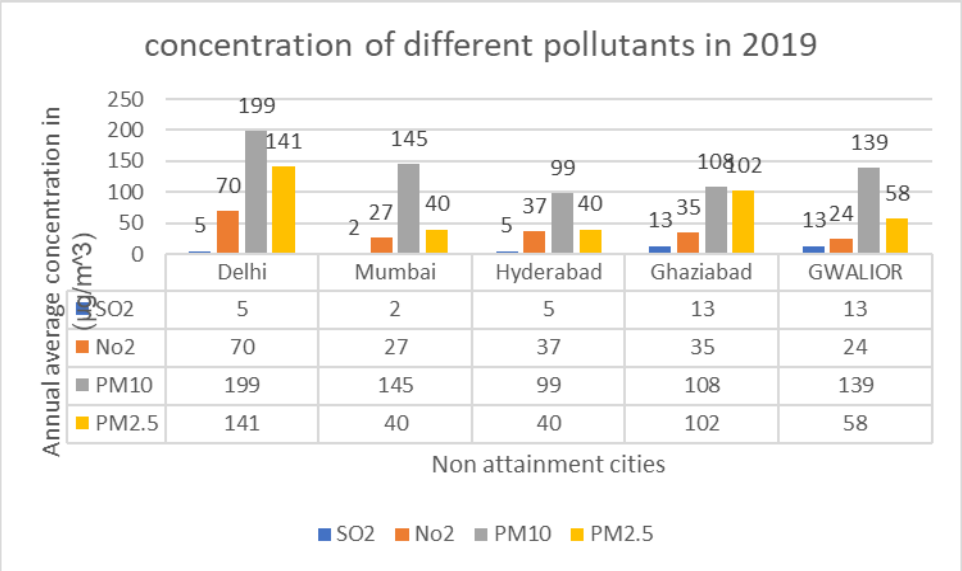
> Air pollutant means any solid, liquid or gaseous substance which is present in such a concentration which may affect the human beings or other living creature, plants and property of environment.

The COVID -19 pandemic has explained the dependency of human lives on the nature. Due to the lockdown enforces by the Indian government quality of air is improved in several cities of India for a short period of time. [2]The disability adjusted life year (DALYs) (a statistical data type) suggest that a death of 1.24 million could be due to air pollution in year 2017 for India. Early estimates suggest that the reduced air pollution during lock down could have prevented up to 0.65 million annual deaths for India. Noticeably improvement in air quality had a positive sign for persons.

[1] https://cpcb.nic.in/upload/NAAQS_2019.pdf
[2] https://www.who.int/data/gho/indicator-metadata-registry/imr-details/158

2 AIR QUALITY IN DIFFERENT CITIES: A graph is plot for annual average concentration (µg/m^3) for 5 different cities for the year 2019.

[3]



- Results

1 pm10 is dominant in all cities.

2 Delhi is having highest concentration of pm10.

3 noticeable effect of pm2.5 in all cities.

4 NO2 has also highest concentration in Delhi.

5 slight effect of SO2

Mathematical form

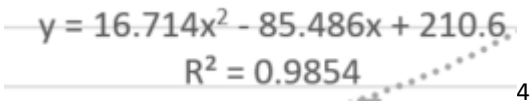
1 with respect to so2 - $y = 2.1429X^2 + 14.257x - 11.6$

$R^2 = 0.8128$

2 For NO2 = $Y = 4.5X^2 - 19.7X + 48.2$

$R^2 = 0.6501$

3 PM10



4 PM2.5

y = 22x + 10.2

[3] https://cpcb.nic.in/upload/NAAQS_2019.pdf chapter 7 table 7.2.

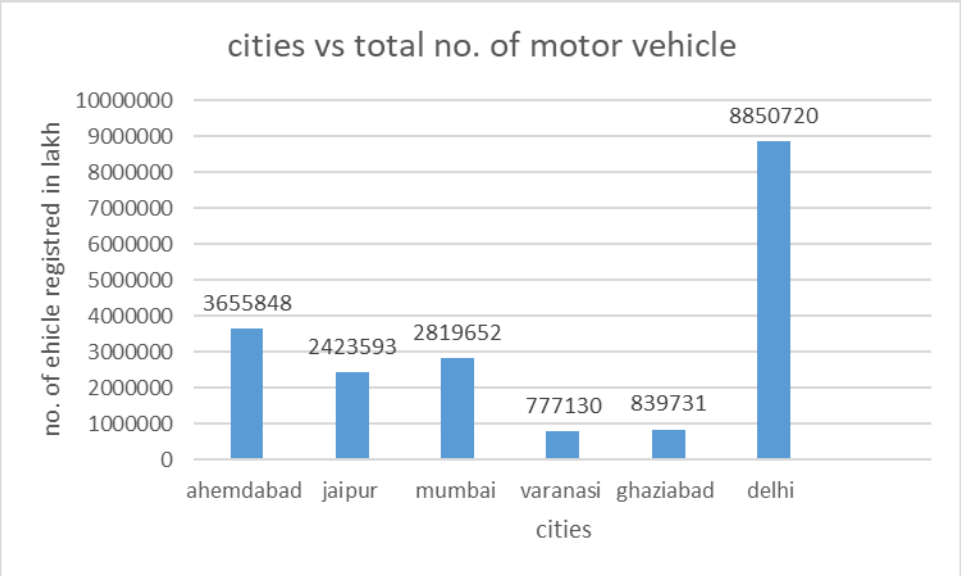
https://www.sciencedirect.com/science/article/pii/S2589791820300220 table 1

R^2 = 0.619 .

Government of India has categorised these cities as non- attainment cities. cities where the NAAQS limit has over crossed.

3 SOCIO – ECONOMIC FACTORS - study of socio – economic factor data which were collected for the mention cities to examine how economic activity is associated with the air pollution

A graph is plot based on economic activities and total no. of registred vehicle of different cities to show decrese in air pollution during lockdown



RESULTS

1 DELHI has highest no. of registred vehicle hence maximum reduction in air pollution during covid 19

2 Ahemdabad OCCUPIES 2ND position

3 mumbai and jaipur show incresed economic activities .

4 ghaziabad as industral area has increased no. of vehicle

5 varanasi economic activity is incresed also .

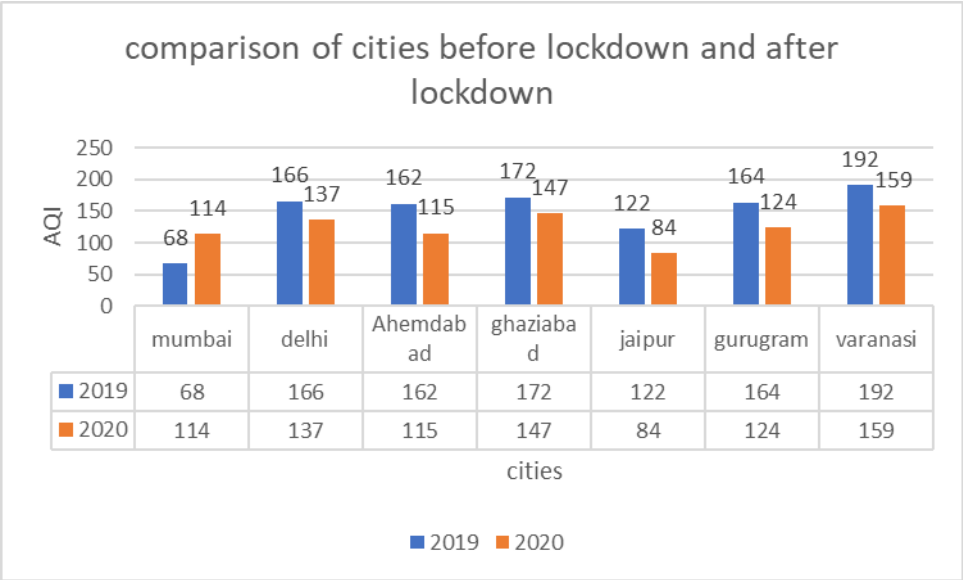
Mathematical form -

$$y = 801471x^2 - 5E+06x + 9E+06$$
$$R^2 = 0.6596$$

https://www.sciencedirect.com/science/article/pii/S2589791820300220 table 1

4 Comparison of AQI (air quality index of cities from between 24march – 31 may 2019 and 24 march to 31 may 2020)

[4]



RESULT - Clearly shown by graph the reduction in air pollution during lockdown.

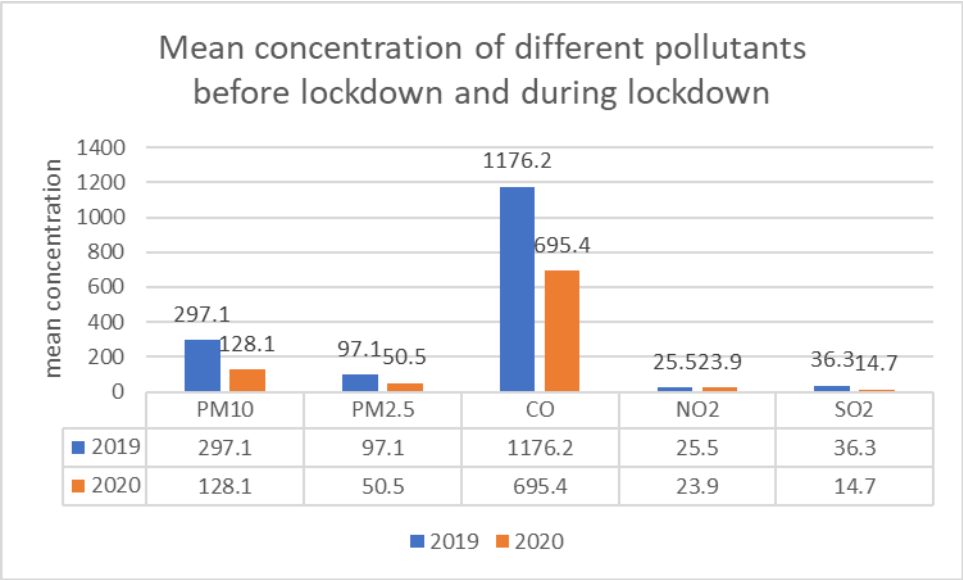
Mathematical equation – for 2019 – $y = 89.676x^{0.3818}$

For 2020 – $y = 117.4x^{0.0413}$

[4] https://aaqr.org/articles/aaqr-20-05-covid-0262 table 1

5 Ghaziabad –

The IQ Air report, 2019 state that the Ghaziabad was the most polluted city in 2019 (annual $PM_{2.5}$ mean 110.2 µg/m^3). Hence the effect of lockdown on various pollutant concentration is analysed. [5]The mean concentration of various pollutants is plot by graph of time 24march to 31 may 2019 to 24 march to 31 may 2020

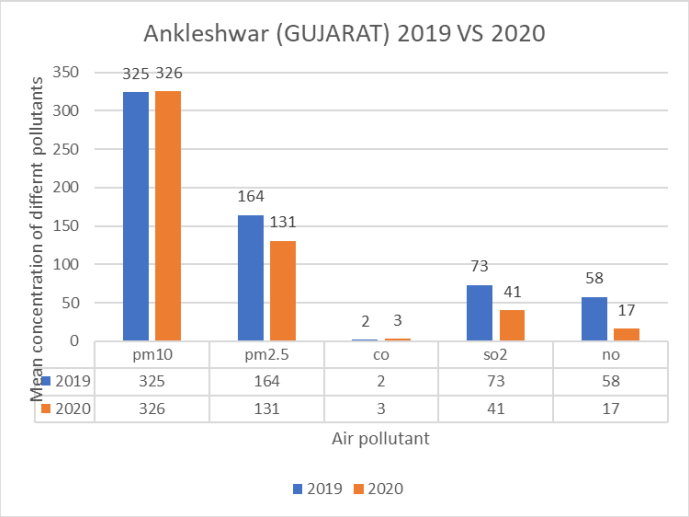


- Co the dominant pollutant in the city in both years.
- Pm10 level decrease as reduction in construction and industrial activities.
- PM10 (µG/m^3) , PM2.5 (µg/m^3) , CO (ppb) , NO_2(ppb) , SO_2(ppb)
- Mathematical Equation
- For 2019 – y = 59.32x + 504.4 linear
- For 2020 – y=25.34x + 258.4 (linear)
-

https://aaqr.org/articles/aaqr-20-05-covid-0262 table 3

6Ankleshwar and Vapi : Ankleshwar is located in Bharuch district in Gujrat and vapi is located under the Valsad district of Gujrat are polluted due to major industrial activities. In ankleshwar there are 2000 industries with over 1500 chemical plants producing, paints and pesticides where as in vapi 70% are chemical plants , other industries are packaging , paper , plastics and rubber .

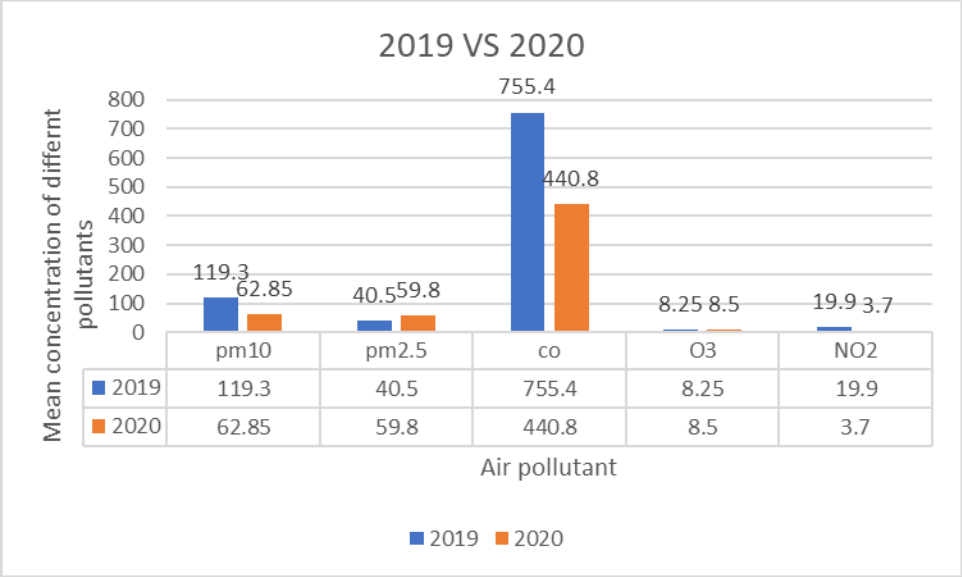
- [6]A graph is plotted for mean concentration of various air pollutants for ankleshwar



- Significant reduction in all pollutants, all pollutants are in µg/m^3 and CO in mg/m^3
- Equation 2019 y=- 62.5x + 311.9
- For 2020= Y = -70.8x + 316

[7]Similar graph is for vapi

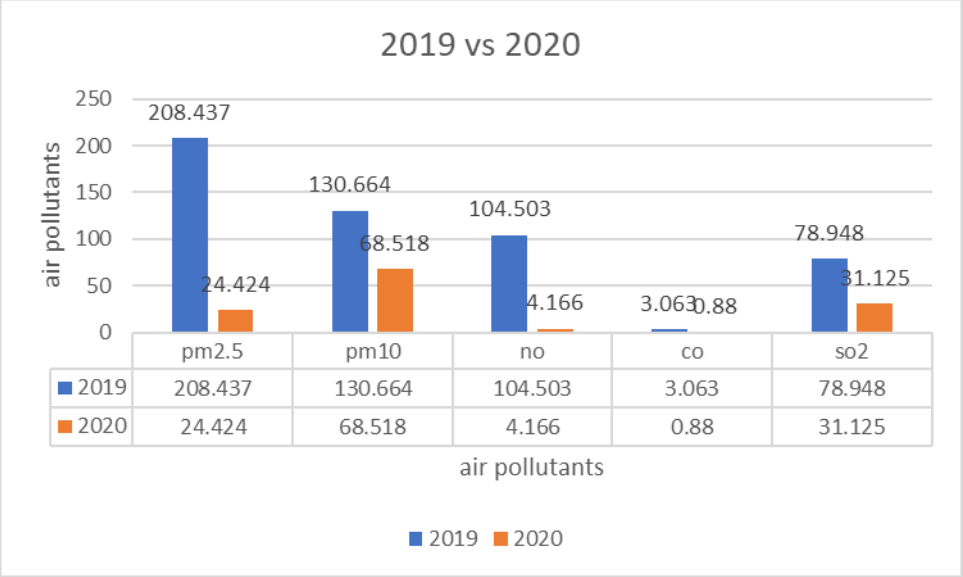
[6] https://www.nature.com/articles/s41598-021-83393-9/tables/3
[7] https://www.nature.com/articles/s41598-021-83393-9/tables/3



- All concentration are in µg/m^3 and CO is in mg/m^3
- Mathematical Equation 2019 – y = -20.62x + 166.45
- 2020 – y = -9.5x + 54.3

7 Patiala – city with maximum reduction in air pollution level. Patiala located in southern eastern Punjab, north- western India on indo – gangetic plain. Has maximum level of reduction in pollutants than any other city.

[8]As explained by the graph



- Graph is plotted for 24 march – 31 may 2019 and 24 march – 31 may 2020.CO is again dominant pollutant in both years which is decrease due to reduction in vehicle movement.
- Mathematical Equation 2019 – y = -20.62x + 166.45
- 2020 – y = -9.5x + 54.3
-

12 https://aaqr.org/articles/aaqr-20-05-covid-0262 table4

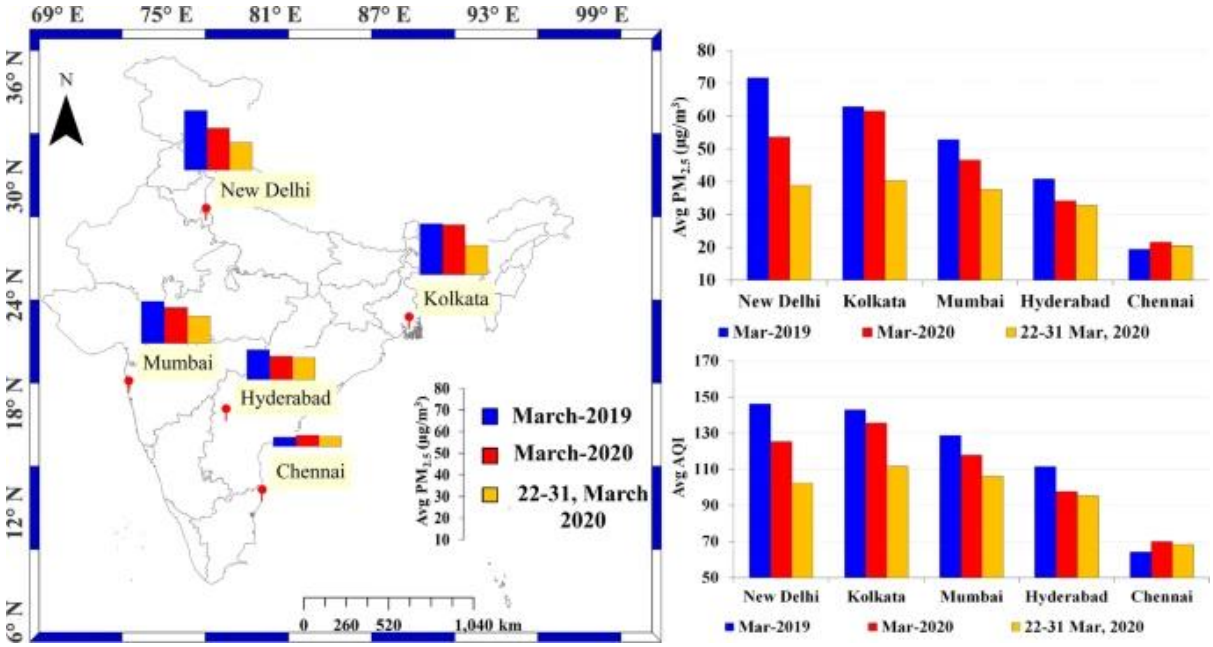
Left panel shows locations of five US Embassy (Delhi, Kolkata, Mumbai, Hyderabad, and Chennai) along with variations of average $PM_{2.5}$ during March 2019 (blue bar), March 2020 (red bar), and average during 22–31 March 2020. The lower right panel shows the average AQI over New Delhi, Kolkata, Mumbai, Hyderabad, and Chennai for different periods. In general, $PM_{2.5}$ and AQI are reduced during lockdown (22–31 March 2020) compared with March 2019 and March 2020, except in Chennai

$PM_{2.5}$ data

The US embassies are located in five major metropolitan cities in India, New Delhi (30 million), Mumbai (25 million), Hyderabad (12.91 million), Kolkata (15.6 million), and Chennai (10.96 million) (Fig. 1); in the bracket, the populations are given as per the latest census. We have studied two primary air quality parameters ($PM_{2.5}$ particulate matter with a particle size of 2.5-micron diameter and Air Quality Index-AQI) which are monitored by each respective US embassies at five locations. Data are taken from the US Environmental Protection Agency (EPA) through AirNow portal (https://www.airnow.gov/index.cfm?action=airnow.global_summary). The EPA claims to provide better quality of data.

NO_2 data

We have considered tropospheric NO_2, one of the major pollutants which is highly dependent on the local sources because of its short residential time in the atmosphere. We have considered tropospheric NO_2 data from the Ozone Monitoring Instrument (OMI). OMI is part of the NASA A-train satellite missions, which measures the concentration of various trace gases in the atmosphere. We have used OMI version 3 data which has a 1-day temporal and 0.25°×0.25° spatial resolutions. The details of the data are discussed by Krotkov et al. (2019).



8 conclusion –

The lockdown step proves to be an effective method to improve atmosphere in Indian cities. as it reduces the causes of air pollution. also this report shows that the CO, PM_{10} , $PM_{2.5,}$ NO_2 are the primary air pollutants which shows decrease pattern in cities and secondary pollutants show both decreasing and increasing behaviour . overall, 44 %– 40 % reduction was in primary pollutants in 2020 as compare to 2019. This explain that while focusing on economic growth we have to be environment friendly . therefore, moving on renewable source for electricity generation and clean fuels for transportation should be on the priority basis. therefore government of India in January 2019 launched NATIONAL CLEAN AIR PROGRAMME (NCAP) .

Objective: to reduce $PM_{2.5}$ pollution by 20 –30%
at the year of 2024 in 122 cities. Therefore, proper city management plans should be prepared by the government boards for public health management.

REFRENCES

1 https://cpcb.nic.in/upload/NAAQS_2019.pdf

3 https://www.sciencedirect.com/science/article/pii/S2589791820300220

4 https://aaqr.org/articles/aaqr-20-05-covid-0262

5 https://www.nature.com/articles/s41598-021-83393-9

6 https://www.airnow.gov/international/us-embassies-and-consulates/