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Analysis of Traffic Related Environment Pollution in Indian Cities: Need of the Hour

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Abstract - **Urbanisation has led to rapid motorization and un-sustainable growth of transport infrastructure in developing countries like India. This increase in urban sprawl and heavy dependency on automobiles has caused high levels of air pollution. The emissions from road transport are partially responsible for ozone depletion, acid deposition and other climatic changes. In present scenario, the exhaust emissions of road traffic cause a lot of concern about the effects of air quality in urban areas on human health and the production of ozone in the troposphere. Central and State Governments have taken many corrective measures to reduce vehicle emissions. However, the development of scientific methods and rigorous emissions inventory is critical. Therefore, an attempt has been made to explore traffic control strategies to reduce emissions from road transport have been made. For the present study, pollutants are monitored outside for 24 hours (4-hourly sampling of gaseous pollutants like NO_X and SO_X and 8-hourly sampling of particulate matter) with frequency of two times a week in Jalandhar region in order to have 104 observations per year. The analysis of the data shows that the increase in the Respirable Suspended Particulate Matter (RSPM) with every passing year and being almost double than the permissible limit. It has been observed that with no or less public transport, more loads has come down on private vehicles and auto rickshaws which lead to increase in traffic congestion and pollution. Hence, it is suggested to implement new strategies and an increase in public transport in order to reduce vehicular emissions.**
Keywords: **Air Pollution, Emissions, RSPM, NO_X and SO_X**

I. INTRODUCTION

In developing countries like India, air pollution has reached an alarmingly high level and has begun to mark itself worldwide as scientific facts in the form of increased health related problems such as respiratory diseases, risk of developing cancer and other serious ailments. Most cities have exceeded the National Ambient Air Quality (NAAQ) standards. Particulate matter (PM) is a major concern in Indian cities and 60 out of 62 metropolitan cities have exceeded World Health Organization (WHO) standards (Punjab Pollution Control Board, 2017).

About 80% premature deaths are recorded due to ischemic heart disease and strokes, 14% of deaths from chronic obstructive pulmonary disease or infections of the lower respiratory tract; the remaining 6% of deaths are due to lung cancer which occurs due to air pollution and exposure to small particulate matter of size 10 microns or less than that, which causes cardiovascular and respiratory disease and cancers (Pandey *et al*., 2006, World Health Organisation, 2012).

Road transport has now become the main source of air pollution in India. Road transport system is in direct relationship with air pollution in a city. Two-wheelers and cars subscribed 78 percent and 11 percent of pollution load respectively in cities of India (Mahendra and Krishnamurthy., 2005). Emissions from vehicles depend on vehicle speed, vehicle-km, age of vehicle, and emission rate. Twenty percent of poorly maintained vehicles produce about 60 percent of vehicular pollution in India (Pundir, 2001).

Transportation has also been the fastest-growing source of GHG emissions. From the pre-industrial era (i.e., ending about 1750) to 2015, concentrations of the greenhouse gases (CO_2, CH_4, and N_2O) have increased globally by 44 percent, 162 percent, and 21 percent, respectively (IPCC 2014, 2016). The greenhouse gas (GHG) emissions primarily come from burning fossil fuel for all modes of transportation (vehicles, ships, trains, and planes) (Environmental Protection Agency, 2017). In addition to GHG emissions, transposition also makes contributions to important air pollutants (68.4 percent CO, 60 percent VOCs, 49.1 percent NO_X, 5.5 percent particulates and 1.3 percent SO_X) (Boulter, 2009). Moreover, NOx is not only a primary air pollutant, but also accounted for the production of free radicals in troposphere, which can promptly react with VOCs and lead to a large variety of secondary air pollutants that could be much more hazardous to the public health than the primary air pollutants in urban environments (Wayne RP, 2000; Jacobson MZ, 2002; Girard JE, 2009).

Main causes for the shocking increase in vehicular emissions have been the exponential growth in the number of motor vehicles; inadequate public transport and inept management; haphazard urban development; obsolete vehicular technology; laxity in traffic enforcement; and an increase in freight moved over roads (The World Bank, 2005; Badami, 2005; Pucher *et al.,* 2007). The direct impact of the most prominent congestion is an increase in travel times (a decrease in the average travel speed, which increases the average emissions per mile of travel at low speeds (Beevers and Carslaw, 2005). This increased emission rate is due to both increased engine loads of high accelerated pace of movement during an unstable traffic and to the long operating time per unit distance at slower travel speeds (Barth and Boriboonsomsin, 2008). It has also been found that moderate reductions in travel time from the high speeds excessively can reduce emission rates per mile of travel. In other words, the effect on emission rate due to congestion varies depending on congestion levels (Farzaneh et. al., 2010). Greenwood et al. have found increase in emission rates with acceleration intensity and frequency however impact varies with travel speed and facility (Greenwood *et al.*, 2007). Research shows that the total vehicle emissions increases in the bottleneck site after the improvement of traffic flow due to the induced demand which can be seen by using microscopic traffic simulation (Anderson *et al.*,1996; Affum *et al.*, 2003; Noland and Stathopoulos, 2003; Noland and Quddus, 2006).

II. METHODOLOGY

In Punjab, Air Quality Index (AQI) nowadays is already falling in poor quality zone at 285. It is intimated that the moderate limit if air quality index is between 101 to 220 although the satisfactory limit is up to 100 due to phenomenal increase in vehicular population (Indian Express Report, 2017). This arises the need to study the Pollutants are monitored outside for 24 hours (4-hourly sampling of gaseous pollutants like NO_x and SO_x and 8-hourly sampling of particulate matter) with frequency of two times a week in Jalandhar, Punjab in order to have 104 observations per year.

The sample station is placed such that it has free exposure and should be kept away from large buildings which may interfere in free air circulation. It should be located at the height between 1.5 m to 15 m above the ground. The sample is preserved and sends to the laboratory for analyzing. The sites selected for study purpose are commercial areas and have rush of road transportation. Pollution data analysis for the period of 2013-2017 (5 years) in Jalandhar region has been done in the present study as in Jalandhar, the air quality index (AQI) rating is found to be the worst in Punjab, making it the most polluted city. This arises the need to go into detail study and monitoring of pollutions at various locations in Jalandhar region. The locations selected for the present study are: PWSS/Regional Office, Focal Point, and G.K./Maltex Malsters, Jalandhar.

III. RESULTS AND DISCUSSION

Pollution data collected from various sites in Jalandhar region is discussed as below: (Air Ambient Quality Standards, Punjab Pollution Control Board (PPCB), 2017)

Regional Office: In Regional Office region, the quantity of RSPM has lowered from 154 μg/m^3 in 2013 to 146 μg/m^3 in 2017, but it is still almost double than the permissible limit, which is 60 μg/m^3. The quantities of NO_X and SO_X have been around 25 μg/m^3 and 13 μg/m^3 over the past few years and are within the permissible limit of 40 μg/m^3 and 50 μg/m^3 respectively.

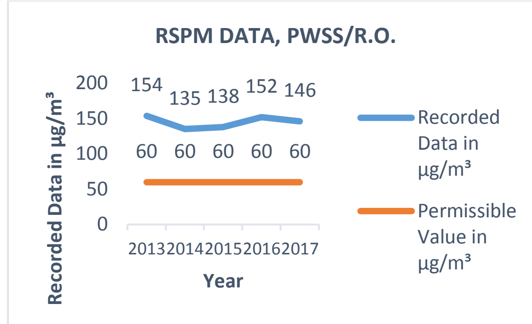

Fig. 1 RSPM data of PWSS/R.O., Jalandhar

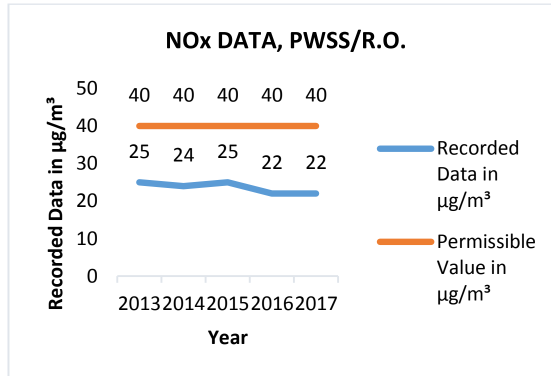

Fig. 2 NO_X data of PWSS/R.O., Jalandhar

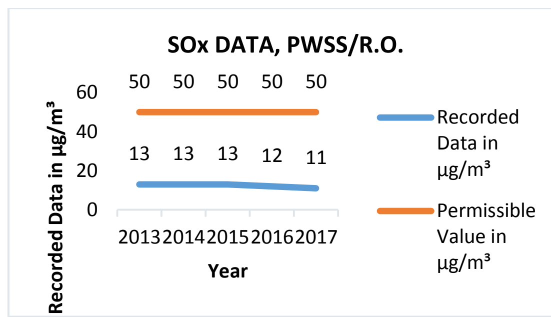

Fig. 3 SO_X data of PWSS/R.O., Jalandhar

Focal Point: In Focal Point region, the quantity of RSPM has significantly increased from 170 μg/m^3 in 2013 to 204 μg/m^3 in 2017 and more than twice the permissible limit of 60 μg/m^3. The reason for the increase of RSPM is considerable increase in vehicles. The quantities of NO_X and SO_X has been in the range of 24-28 μg/m^3 and 13-14 μg/m^3 over the past few years and is within the permissible limit of 40 μg/m^3 and 50 μg/m^3 respectively.

G.K./ Maltex Malster: In G.K./ Maltex Malster, the quantity of RSPM has decreased abruptly from 195 μg/m^3 in 2012 to 177 μg/m^3 in 2013 and then 136 μg/m^3 in 2017 but is still twice than the permissible limit of 60 μg/m^3. The quantities of NO_x and SOx have been around 28 μg/m^3 and 14 μg/m^3 over the past few years and are within the permissible limit of 40 μg/m^3 and 50 μg/m^3 respectively. It has been observed that, although the quantities of NO_X and SO_X are still less than permissible value, these have been further lowered in the year 2017 and found to be 22 μg/m^3 and 12 μg/m^3.

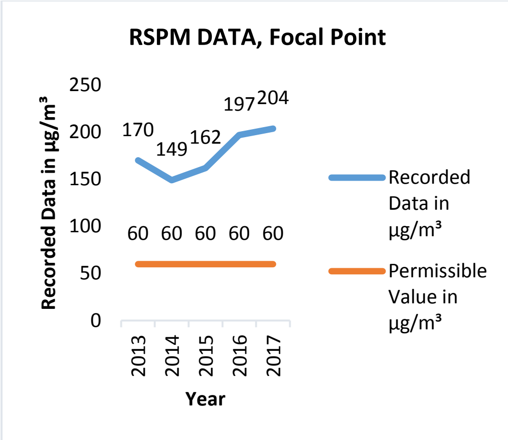

Fig. 4 RSPM data of Focal Point, Jalandhar

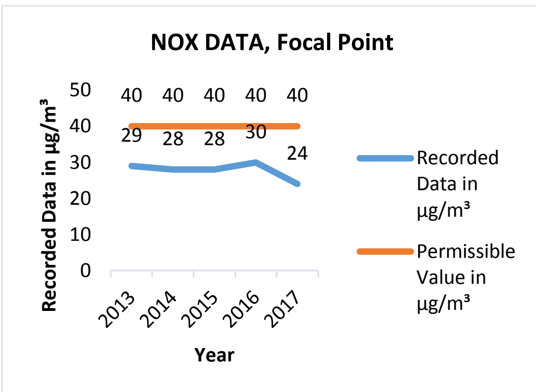

Fig. 5 NO_x data of Focal Point, Jalandhar

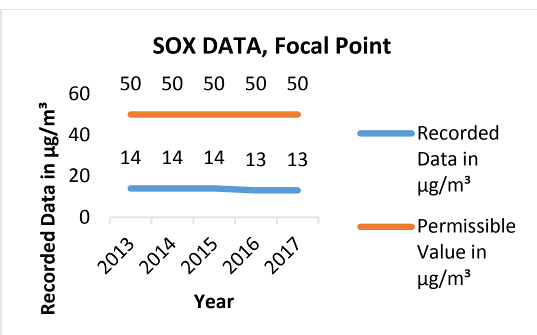

Fig. 6 SOx data of Focal Point, Jalandhar

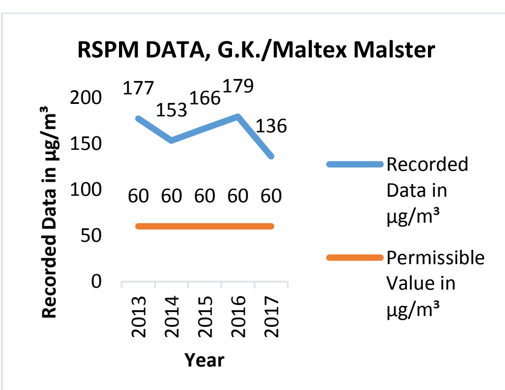

Fig. 7 RSPM data of G.K./Maltex Malster, Jalandhar

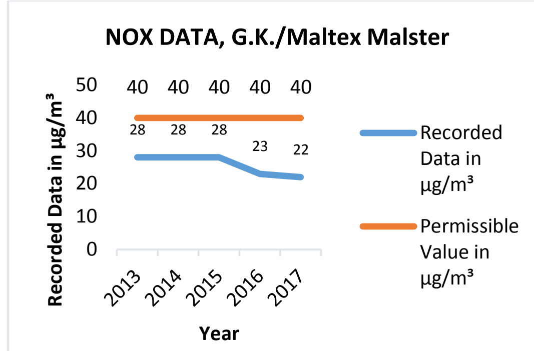

Fig. 8 NO_X data of G.K./Maltex Malster, Jalandhar

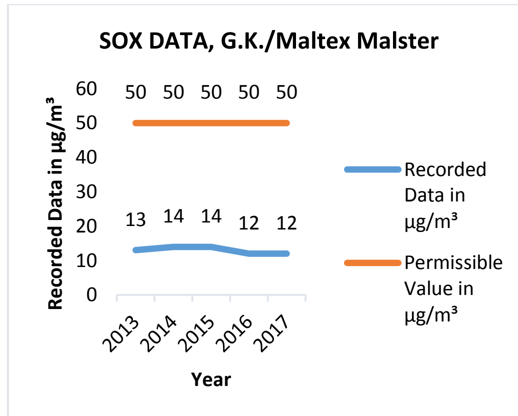

Fig. 9 SO_X data of G.K./Maltex Malster, Jalandhar

IV. CONCLUSION

The study analyzed the pollution of last 5 years from 2013 to 2017 to draw the conclusion that there is urgent need of implementing new strategies in the road transportation to minimize the emissions from vehicles. As this region is rapidly growing, it is resulting in increasing demand of public and passenger transport and hence the tremendous increase in number of motor vehicles. The increases in traffic as well as inadequate infrastructure facilities are responsible for the highest of pollutants and greenhouse gas emissions in the city. With the growing air pollution and greenhouse gas emissions from the transport sector in the cities, and a clear message that the regulatory bodies will have to take a big leap, especially in terms of traffic management in cities. They will have to implement radical solutions ranging from technical and social policy, within a short period of time to achieve long-term gains. This study focuses on emission outlook in the transport sector in Jalandhar, which could effectively lead to the improvement of urban air quality management.

V. SUGGESTIONS

It has been observed from the present study that there is immediate need of adopting traffic pollution mitigation strategies. have been suggested in order to curb the pollution emitting from the vehicles. These pollution control strategies have been very successfully implemented in various developed and developing countries and can be successfully implemented in India as well (Sengupta, 2017). In retrospect, the author has suggested some of the following such strategies.

1. Use of Compressed natural gas (CNG) (methane stored at high pressure) can be used in place of gasoline (petrol), diesel fuel and propane/LPG. CNG combustion produces fewer undesirable gases than the fuels mentioned above. It is safer than other fuels in the event of a spill, because natural gas is lighter than air and disperses quickly when released.
2. Increase in use of Public Transportation: With no public transport available in the Jalandhar city, the traffic infrastructure has taken a toll by around 10 lakh private vehicles on the city roads every day.
3. Earlier, around 8,000 people used to travel in the city through city bus service buses every day. With no bus service to move inside the city, most of the load has now come down on the private vehicles and the auto rickshaws hence further leading to the increase in traffic congestion and pollution in the city.
4. Road space rationing: such as the even-odd license plate policy, yellow label car policy, end-number policy can be implemented. These techniques have been successfully implemented in Beijing.
5. Road pricing (also road user charges) are direct charges levied for the use of roads, including road tolls, distance or time-based fees, charges designed to discourage use of certain classes of vehicle, fuel sources or more polluting vehicles. Examples of pollution pricing schemes include the London low emission zone and the discontinued Ecopass in Milan (Adler *et al*., 2015).
6. Accelerating the scrapping of so-called “yellow tag” motor vehicles, meaning older, highly polluting cars and trucks. China has already used this technique. More than a third of these vehicles that were on the road in 2012 are to be scrapped by the end of 2015. Such a program has been successful in Dongguan, Guangdong Province, China.

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