Air Pollution and Tourism Management

Alka S. Grover, Meenu Wats, Aanchal Wats, and Adwiteya Grover

***Abstract*—Tourism in itself is a significant contributor to greenhouse emission, transport pollution, degradation of land, addition of solid and sewage waste and colossal ill effects on health of indigenous people. The tourist thus, though a pivotal attraction to the economy, simultaneously becomes its destructor. The study concerning PM 2.5 and PM 10 along with humidity level was conducted in early winter of 2015 to July, 2016 in and around new Delhi, a heritage city attracting innumerable tourist. the Present study has given a clear indication of correlation of both outdoor as well as indoor air pollution viz-a-viz human health. Both tourists and local residents frequent tourist places exposing themselves to particulate matter increasing their vulnerability to respiratory irritations (38%), headaches (24%), asthma (19%), irritable behavior (12%), Irritable Bowel Syndromes (9%). This fact is also supported by a data study projected by W.H.O. that attributes every 8th death in the world to air pollution. This paper deals with the aforesaid aspects, shortfalls in the enviro-legal framework of india embodied in the Air (Prevention and Control of Pollution) Act, 1981 and its execution to suggest methods to improve or remedy the situation have also been explored.**

***Index Terms*—Air pollution, tourism, environment, India, particulate matter**

I. Introduction

India being a developing country and an emerging economy has ancient cultural heritage attracts a huge number of tourists, on the other hand, tourism itself is a significant contributor to greenhouse gas emissions, transport pollution and waste generation. This paper deals with the evaluation of air pollution and its impact on human health as well as to explore the implementation of air pollution laws and suggested how to avoid pollution due to tourism and tourists from pollution. According to WHO, Delhi the capital of India was named as the worst for PM2.5 particles out of 1600 cities around the world with the value of 153 micrograms per cubic metre [1]. The study concerning PM 2.5 and PM 10 along with the humidity levels was conducted in the early winter of 2015 to June 2016 in and around the areas of Delhi. PM refers to the particulate matter consisting of solid particles and liquid droplets in the air. It is formed from the chemical reaction in the atmosphere and through fuel combustion like motor vehicles, industrial facilities, residential fireplaces, wood stoves and agricultural burning [2].

Tourism world over has been recognized as a major contributor of economy. It holds 4th largest industry contributing to world's economy and for a developing nation like India tourism is one of the major service sectors, growing with leaps and bounds by every passing year and has risen in its contribution from 2.2% (2014) to estimated 7.6% (2015) to nation's GDP [3]. Tourism upholds both negative and positive impact on nation's economy. The ill effects of it are addition of pollution, overutilization of resources like energy and food, undesirable social and cultural changes, adverse impact on environment and ecology, depletion of valuable resources like fuel and water, threat to the wildlife owing to the disturbances in their habitats, degradation of land, addition of solid and sewage waste etc and over all is that it coasts the health of localities or indigenous people along with visitors. Increasing tourism means increasing air pollution which gives us instantaneous repercussions like poor visibility leading to more accidents, poor productivity of plants, higher concentration of PM2.5UM hampers respiratory and circulatory efficiencies of animals, higher troposphere ozone, a strong oxidizing agent, decline plants productivity along with their premature deaths. Oxides of nitrogen and sulphur, main pollutants from vehicular pollution, deteriorate water and soil chemistry. Excessive nitrogen depositions pose threat to the very existence of aquatic ecosystems by accelerating eutrophication. In general too air quality in most of the cities is deteriorating at an alarming rate, primarily due to increasing vehicular fleet [4]. Ground level Ozone, a secondary pollutant and one of the green house gases, if inhaled can lead to asthma, chest pain, coughing, throat irritation, congestion etc. The ill effects of ozone are worst during hot summer days while the particulate contamination is equally dangerous in all seasons [5], [6].

Delhi, the medieval capital of the country has today grown into a sprawling metropolis which today serves not only as the center of political activity of the country but also the center of trade and commerce in the Northern half of the country making it an island of opportunity which attracts many a migrants from distant parts of the country. Most recently the city has been battling the problem of pollution which has exacerbated since the late 1990's owing to the increase in vehicular traffic and rapid industrialization. According to government agencies Delhi's air pollution will impact tourism and is trying to make great efforts to make the city pollution free [7].

II. Methodology

The air sampling was undertaken in 500 units including tourist resorts and residential flats using Indoor Air Quality Monitor, IAQ 3007R, air sampler for PM 25 and PM 5, RH

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(relative humidity), temperature and CO_2 levels:

The internal pump gets on for about 35 seconds and the values are updated every second in this process.

The unit of PM10 and PM2.5 in this mode is "ug/m3"

The unit of CO_2 in this mode is "ppm"

RH is in percentage.

Temperature is in ℃.

The data (Fig. 1, Fig. 2) was collected at different times of the day inside and outside the units and the average value was calculated. The second round of study was performed in the same weather and in the same week of the month in the outskirts of the city. The data, for the present study on the status of health of both tourists and the local residents was collected by direct interview, cross questioning and questionnaires, was collected from the heritage city- New Delhi. The sample size was of 200 subjects (50 tourists and 150 locals). The symptoms of these diseases were also confirmed from the prescriptions of some of them who were taking some medical advice along with medication. Some generalized symptoms given by the subjects were correlated with medical terms. Local doctors were also visited to inquire about the common ailments, the local residents were reporting.

Data

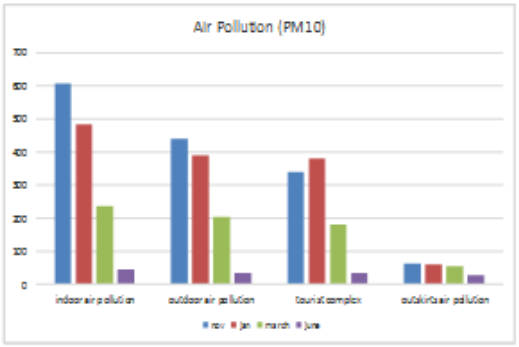

Fig. 1. Air pollution (PM10).

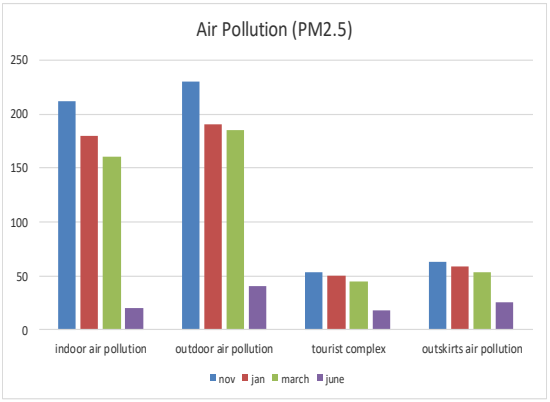

Fig. 2. Air pollution (PM2.5).

The average of CO_2 has been found from 400-700 ppm whereas RH has been found to vary from 58%-70%.

III. Results and Discussion

The air pollution data in the capital city Delhi and its satellite towns reveals that PM2.5 and PM10 is much higher than the prescribed limit by WHO in the months of November to April whereas for the months of May to June average comes down tremendously showing that the rain brings down the particulate matter resulting in cleaner air. It is in agreement with the Air Quality Index (AQI) as per the Union Earth Science Ministry's SAFAR index [8].

AQI values and the corresponding ambient concentrations associated with health impacts are as following is shown in Table I [9].

Present study has given a clear cut indication of correlation of both outdoor as well as indoor air pollution viz-a-viz human health. Both the tourists the local residents of frequently visited tourist's places are vulnerable to health disorders.

TABLE I: AQI Values and the Corresponding Ambient Concentrations Associated with Health Impacts

AQI (Category range)	PM10 (24 hr)	PM2.5 (24 hr)	Associated Health Impacts
Good (0-50)	0-50	0-30	Minimal impact.
Satisfactory (51-100)	51-100	31-60	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101-200)	101-250	61-90	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201-300)	251-350	91-120	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease.
Very poor (301-400)	351-430	121-250	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401-500)	430+	250+	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/ heart disease. The health impact may be experienced even during light physical activity.

The most common discomforts have been found to be respiratory irritations (38%), headaches (24%), asthma (19%), irritating behavior (12%), Irritable Bowel Syndromes - IBS (9%) (Fig. 3) and some times more than one symptoms have also been found among the people exposed to particulate and chemical air pollution. The rising death rate due to air pollution particularly indoor has been supported by Smith *et al.* [10]. Indoor pollution is a repercussion but due to more time spend indoor (> 80%), especially by elders and small children, health problems are found in enhanced proportion in these vulnerable age groups by Devlin *et al.* [11].

Symptoms of health discomfort were found more (23%) due to indoor pollution than outdoor (9%) [11]. Growing trend of personal transport mode in general has raised air pollution levels to alarming levels in India and it is related to

the type of fuel used in them. Residential complexes and tourists places were also surveyed for the types of vehicles used on the basis of nature of fuel used. It was found that the places where more of diesel based vehicles were in use, the people complained of breathing discomfort (19%) than the one having more of petrol based vehicles (8%). Such results may be correlated with the findings of Shrivastava et.al.[12] who also found more particulate pollution of diesel based vehicles than petrol ones (Fig. 4).

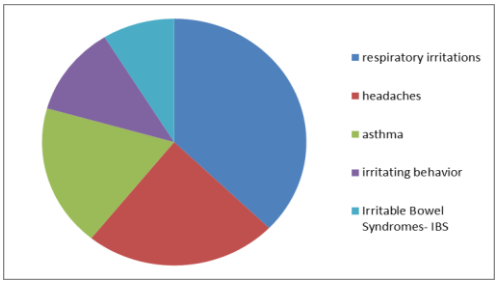

Fig. 3. Health discomforts due to indoor air pollution.

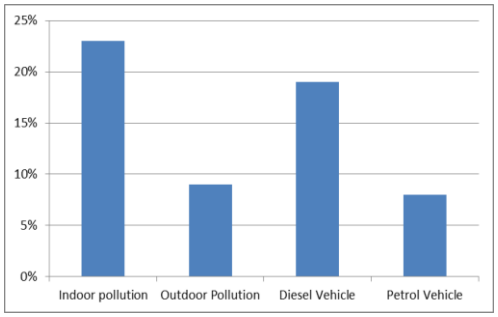

Fig. 4. Comparison of health problems with respect to location and type of fuel used in localities.

The health issues were more prominent in elders (18%) and children (9%) than middle aged people (Fig. 5). This can be attributed to more time spend by these both age groups indoor. The same has been reported by the Rizwan [13] and the report of Central Pollution Control Board, Ministry of Environment and Health [14] which too reports occurrence of 1.7 times more respiratory symptoms of one or more types, 1.5 and 1.7 times more patients of upper and lower respiratory symptoms as compared to the one under controlled conditions.

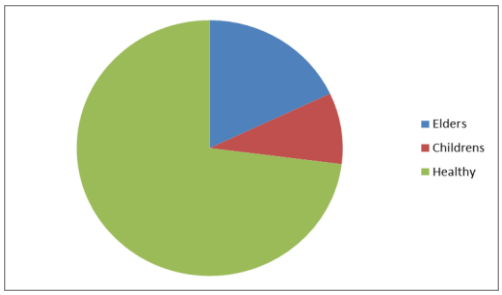

Fig. 5. Comparison for health problems with respect to age of occupants.

IV. Legal Study on Air Pollution Laws

As a safeguard to the increasing human threat to natural resources, the Indian legislation introduced a slew of legislations which would be meant to regulate the usage of these resources. In the year 1981 the Indian Parliament passed the Air (Prevention and Control of Pollution) Act (herein referred to as the air Act) which till date remains the sole legislation to deal with Air pollution however it must be understood that the purpose for which the act was enacted has still not been realized owing partly due to lack of implementation and partly due to the flaws in the liability regime. This part of the paper explores the flaws in the act and suggests certain measures which can improve the current situation of pollution.

The preamble to the act makes it clear that it was enacted to implement the decisions taken at the UN conference on the human environment 1972 [15] where it was decided to take measures to preserve the natural environment which included the quality of air and control of air pollution [16]. The Air act led to the constitution of two federal statutory bodies at the central and the provincial level known as Central Pollution Control Boards [‘CPCB’] [17] and the State Pollution Control Boards [‘SPCB’] [18], serving as an advisory body to the government and regulating the air pollution.

Post the economic liberalization era in the 1990’s, India has witnessed a surge in vehicular traffic having a deleterious impact on the air quality. It is impertinent to mention here that the standards for vehicular emissions are set by an inter-governmental committees headed by the Ministry of Road Transport and Highways [‘MoRTH’] [19]. This means that the CPCB and the SPCB’s play only a minor role in the control of pollution caused by vehicular traffic.

The Air act is primarily based on the principle ‘polluter pays’ and also employs an element of absolute liability i.e. a person is held liable even if the act is not attributable to the person concerned.

Section 22 of the Act prohibits industries from emitting any air pollutant in excess of standards laid down by the SPCB. The act gives the SPCB’s the power to investigate the pollution levels at industrial plants and if they are found to be in excess of the limits, the person in charge of the premises would be under a legal obligation to inform the SPCB’s immediately [20]. An amendment to the act in 1987 also empowered the SPCB’s and CPCB’s to ensure the closure of industrial plants and stoppage or regulation of the supply of electricity, water or any other service [21].

In case a person fails to comply with the above mentioned regulations imposed, the person shall be subject to imprisonment which shall not be less than one and a half years which may extend up to six years [22]. The Act also empowers the SPCB’s to further impose a fine which may amount to Rs.5000 a day if the person further fails to comply with the directions of the boards. Apart from the Air Act, instances of air pollution can also be prosecuted under the Indian Penal Code (IPC) [23]. Section 268 [24] defines public nuisance and Section 278 [25] makes the act of voluntarily vitiating the atmosphere and making it noxious to the health of the persons, an offence punishable under the fine.

It must however be noticed that the Act merely empowers the SPCB’s and CPCB’s the power to initiate the proceedings against the person found guilty however the punishments mentioned above can be imposed only by a court of law.

Even though the act prima facie seems to be a strong law empowering to impose punishments on offenders however

the state of pollution in the cities is testimony to the fact that the law has failed to achieve the objectives of the act. This has been so due to the issues in the law which have been mentioned below:

1) The primary problem in the law is the lack of enforcement power with the SPCB's and CPCB's. The act empowers them to temporarily close the industrial plants however it must be construed that a temporarily closure may be good for the environment in the short run but it may also lead to other problems such as unemployment, wastage of resources and economic losses. Judicial interpretation of the term 'directions' in the act has been interpreted to exclude levy of fines [26]. This means that the boards are left with almost no enforcement power.
2) Criminal litigation might not be the solution to the problem of air pollution as the courts in India are known for being slow taking many years for the courts to deliver its verdict. An apt example would be the case of Uttar Pradesh Pollution Control Board v Mohan Meakins Ltd [27] where the matter was decided 17 years after it was filed by the SPCB.

The establishment of a National Green Tribunal pursuant to an enactment has helped. Recent orders passed to ban diesel vehicles enroute to Rohtang Pass – an extremely popular tourist destination about 14000 ft above sea level has helped curb the menace of pollution. Similarly attempts to regulate tourist inflow at Taj Mahal and few other destinations as a serious attempts by the Tribunal.

V. Conclusion

The data and observation of the study clearly indicate a direct correlation between type, extent and exposure time of air particulate pollutant. The worst hit targets are elderly and children owing to their more indoor time spent along with feeble immune system. Indoor levels of pollution are definitely higher than outdoor, primarily due to our modern life style and architectural plans of today' buildings.

It becomes evident after reading the provisions of law that reform is sorely needed in order to make reduction of air pollution a reality. The government of India set up a committee in the year 2014 in order to propose improvements in the air pollution laws, Apart from certain recommendations to control vehicular traffic the committee did not address the issues related to the liability regime. In order to improve the air quality in India it becomes pertinent to empower the pollution control boards by giving them the power to enforce punishments rather than the courts handling punishments.

During the study it was concluded that the sources of major pollution is vehicular pollution, agricultural burning, construction material and the data collected suggests that during the stubble burning months and in the developing construction sites as well as the construction area of the city air pollution was the highest whereas values were much lower at the outskirts of the city. The data of the tourist complexes in the heart of the city was compared with those outside the city and it was found that the later was within the tolerable limits and it is suggested that the tourist complexes should be developed outside the vicinity of the city.

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