

Automobile Pollution in India and its Human Impact

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Summary

Automobiles are a 'necessary evil', while they have made living easy and convenient, they have also made human life more complicated and vulnerable to both toxic emissions and an increased risk of accidents. Urban people are most affected and amongst the worst sufferers are traffic policemen who are particularly close to the fumes of automobile exhaust. Studies made in Jaipur, India, indicate that there is high rate of occurrence of respiratory, digestive, ocular and skin problems amongst the traffic policemen and a significant number of them become victims of lung disorders in the very first few months of their posting to a traffic department. Traffic policemen everywhere should wear 'pollution masks' for their own safety and to arouse public awareness of the risk of automobile pollution.

Introduction

With the cultural and technological revolution came the automobile, totalling 53 million in the 1950s, automobiles now exceed 500 million. About 19 million vehicles are added each year to the global total. Automobiles have come to mankind as a mixed blessing. While they enable mankind to conquer distances, and they provide a quick means of transport, they have also caused blatant destruction of the human environment, poisoned the atmosphere, and made human beings vulnerable to several diseases, road accidents and fatalities. They are also a major consumer of oxygen. The most affected group of people are the urban inhabitants, the city dwellers, drivers, hawkers, vendors, shopkeepers and residents in the busy city area. But perhaps the worst sufferers are the traffic policemen, who remain close to the fumes of vehicle exhaust, and must inhale large quantities of their toxic pollutants every day, while on duty. Roughly a man breathes 22,000 times, and inhales 16 kg of air, daily.

The Indian Scenario

Automobile exhaust emissions contribute significantly to air pollution. In India production of vehicles increased from 210,000 pa in the 1970s to over 1,050,000 pa in the 1980s. This sudden increase in the number of vehicles has caused tremendous damage to the environment and has increased the intensity of air pollution in most of the big cities in the country. In the City of Bombay, for example, there are 400,000 vehicles and these are responsible for about 90 percent of the air pollution in this metropolis. The problem of vehicular pollution is increasing in almost all cities in India. Cities like Delhi, Calcutta, Ahmedabad, Madras, Jaipur, Hyderabad, Kanpur, Nagpur, Lucknow, Agra, Ambala and Chandigarh are the worst affected by automobile pollution (Table 1).

Pollution levels in Delhi and Calcutta are at a greater level than that recommended by the World Health Organisation (WHO). The incidence of respiratory diseases in these cities is 12 times the national average and, 30 percent of their populations suffer from respiratory diseases due to vehicular air pollution. According to one estimate (by the Department of Environment, Government of India), on average a million vehicles (diesel and petrol) spew from their exhaust daily, 250 t of carbon monoxide (CO), 400 t of hydrocarbons (HC), 6 t of sulphur dioxide (SO₂), 600 kg of lead (Pb), and large quantities of Suspended Particulate

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Table 1 Level of air pollution in some important Indian cities (average of 24 hours). 90 percent of this pollution is contributed by the automobiles (Source: NCERT,1988).

| City | SO ₂ | NO _x µg m ⁻³ | SPM |
|-----------|-----------------|---------------------------------------|--------|
| Agra | 15.50 | — | 308.00 |
| Ahmedabad | 41.57 | 25.67 | 249.27 |
| Bombay | 38.34 | 19.88 | 190.6 |
| Calcutta | 53.26 | 26.76 | 430.58 |
| Delhi | 31.14 | 31.06 | 400.88 |
| Madras | 13.32 | 12.6 | 143.34 |
| Jaipur | 7.98 | 11.94 | 301.74 |
| Hyderabad | 21.8 | 9.54 | 248.66 |
| Kanpur | 15.4 | 14.28 | 326.34 |
| Nagpur | 10.62 | 14.96 | 209.78 |

Matter (SPM) which may comprise as much as 945 µg m⁻³ of the ambient air. Diesel vehicles give out black unpleasant smoke but their emissions are relatively less toxic.

Automobile Emission Characteristics

Automobiles are mobile polluters and petrol vehicles are the worst. The highest emission rates occur during motor idling, deceleration and at slower speeds (Table 2). Road intersections, especially those that are traffic light controlled, and sharp turns in cities slow down the traffic and enhance the pollution emission rates. During idling and at slow speeds the greatest emission is of carbon monoxide and hydrocarbons. Ozone, the principal ingredient of urban smog, is formed when energy from sunlight causes hydrocarbons to react with nitrogen oxides (NO_x). Sulphur dioxide (SO₂), Lead (Pb), and the Suspended Particulate Matter (SPM) are the other toxic pollutants from automobiles, all of which make the urban environment particularly unpleasant for the city dwellers (Table 3).

Table 2 Emission rates of toxic gases depending upon mode of vehicle operation (Source: Legarra,1970).

| Operating mode | CO | Hydrocarbons | NO _x |
|----------------|-----------|--------------|-----------------|
| Idling | Very high | High | Low |
| Deceleration | Very high | High | Very low |
| Low speed | Moderate | Moderate | Low |
| Acceleration | Low | Low | High |
| High speed | Very low | Very low | Very high |
| Uniform speed | Minimum | Minimum | Minimum |

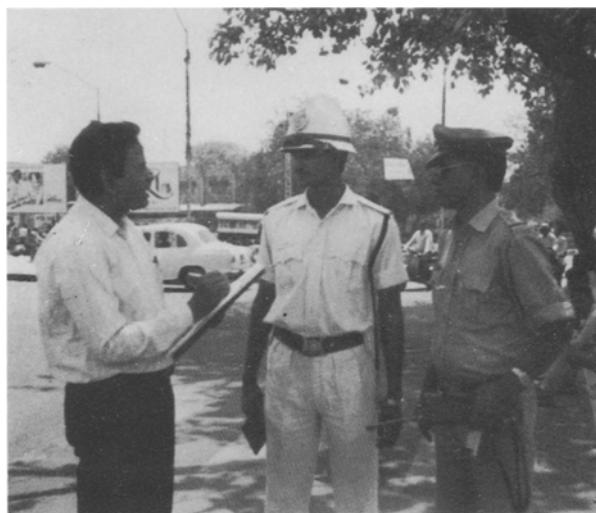


Fig. 1 The author Dr R.K. Sinha interviewing a traffic policeman, near Rambogh Circle, Jaipur, India.

Jaipur Pollution Study

The traffic police constables of Jaipur were selected in order to assess the impact of automobile pollution because they are the people who are most closely and constantly exposed to the automobile emissions everyday. One hundred traffic police constables were interviewed (Fig.1) during the busy traffic hours (8–11 am and 4–7 pm) in the more traffic congested areas of Jaipur City (such as, Ajmeri Gate, Sanganeri Gate, Bari Chauper, Chhoti Chauper, Chandpole, Johri Bazar, M.I. Road, Tonk Road, Rambagh Circle and Narain Singh Circle). They were interviewed using a questionnaire framed on various health problems emanating from automobile pollution. To verify the statements given by the traffic policemen and to provide further authenticity to the results, the police doctor and doctors at SMS General Hospital, Jaipur, in charge of chest, respiratory, gastro-intestinal and cardiac diseases were also interviewed and relevant information collected.

Table 3 Petrol and diesel vehicle emissions as a percentage of total air pollution, by different pollutants (Source: partly after Anon., 1984).

| Vehicles | CO | Hydrocarbons | NO _x | SO ₂ | SPM |
|---------------------------|------|--------------|-----------------|-----------------|-----|
| <i>Petrol</i> | | | | | |
| Small cars | 38.1 | 16.6 | 16.6 | 0.7 | 7.2 |
| Scooters/M.bicycles | 0.3 | 0.4 | * | * | 0.1 |
| Heavy vehicles 12.4 | 2.7 | 2.9 | 0.1 | 0.9 | |
| <i>Diesel</i> | | | | | |
| Cars/jeeps/tempos | * | * | 0.1 | * | + |
| Mini buses | * | * | 0.1 | * | + |
| Trucks/large buses | 0.9 | 11.2 | 13.4 | 1.2 | + |
| <i>Total contribution</i> | 51.7 | 30.9 | 33.1 | 2.0 | |

(* Less than 0.05 percent ^{+30 to 50 times that of petrol vehicles)}

There are about 250,000 automobiles of various categories (both petrol and diesel) operating in Jaipur City. Petrol vehicles comprise about 65 percent of the total (Table 4).

The traffic in Jaipur has been steadily increasing at a rate of about 14 percent pa. Jaipur, being a city of international tourist interest is known as the 'Pink City' and is becoming more congested daily. The level of vehicular pollution is increasing at an alarming rate and a "dark zone of black smoke" hanging above the ground has become a common sight during the late evening and early morning hours (Sinha, 1993). In a random check made by the Department of Environment, Government of Rajasthan (India), the level of lead, carbon monoxide, sulphur dioxide, hydrocarbons, nitrogen oxides and particulate matter (over a period of 24 hours) in the ambient air of Jaipur City was found to be above the limits specified by the World Health Organisation (Table 5).

Table 4 Registered vehicles in Jaipur City, India, in 1990 (Source: Motor Vehicle Department, Government of Rajasthan, Jaipur, India).

| Category of vehicle | Percentage |
|---------------------------------------|------------|
| Two wheelers (scooters/motorbicycles) | 53.30 |
| Three wheelers (autorickshaws) | 1.87 |
| Private cars/taxis | 11.72 |
| Tempos | 5.61 |
| Jeeps | 4.60 |
| Mini buses | 4.37 |
| Trucks and government city buses | 9.55 |
| Tractors | 1.00 |
| Miscellaneous | 7.98 |
| | 100.00 |

Traffic policemen stand mostly on intersections and crossings and these are 'high pollution zones' in the cities, with high levels of carbon monoxide and hydrocarbons emitted during the idling of vehicles on red traffic lights. Sulphur dioxide emission is also significant in these localities.

The study revealed that almost all traffic police interviewed (94 out of 100) suffered from various degrees of physical disorder. They made complaints of eye irritation, itching skin, blocked noses, tiredness, fatigue, coughs, loss of appetite, 'burning' sensations and 'tenderness' pains in their stomachs. Complaints of respiratory difficulties and problems related to digestion were very common. However, the most startling revelation was the high incidence of 'tuberculosis' (lung disorders) amongst the traffic policemen, especially the young persons between the ages of 20 and 30 (Table 6).

About 78 policemen out of the 100 complained of eye problems – irritation and burning sensations, redness and watering. A few of them (14 out of 100) complained of vision problems which had developed since they had been shifted to the traffic

Table 5 Level of pollutants in the ambient air of Jaipur City (average period of 24 hours). 90 percent of this pollution is probably contributed by automobiles (Source: DOE, 1985, Government of Rajasthan, Jaipur, India).

| Pollutant | Value in $\mu\text{g m}^{-3}$ |
|------------------------------------|-------------------------------|
| Lead | 1.82 |
| Carbon monoxide (CO) | 10.61 |
| Hydrocarbon | 8.94 |
| Sulphur dioxide (SO ₂) | 7.98 |
| Nitrogen oxides (NO _x) | 11.94 |
| Suspended Particulate Matter (SPM) | 301.74 |

Table 6 Health problems of the traffic policemen in Jaipur City thought to be due to constant inhalation of automobile pollutants.

| Most common complain | Complaints out of 100 |
|---|-----------------------|
| Breathing difficulty and respiratory problems | 84 |
| Eye problems | 78 |
| Loss of appetite and digestion problem | 66 |
| Attack of 'tuberculosis' | 55 |
| Fatigue | 100 |
| Skin problems | 58 |

department. Cross-checking with the police doctor confirmed the higher incidence of cataract and other eye problems among the traffic policemen. Doctors' experience showed that several traffic policemen after serving for about a year complained of poor vision in one of their eyes.

A large number of the police (84 out of 100) suffered from various degrees of respiratory problem, like coughs, difficulty in breathing, blocked noses, breathlessness following a little strain, formation of black sputum, etc. Some complained of frequent asthmatic attacks and mild pains in the chest. They showed greater vulnerability to lung diseases.

About 55 percent of Jaipur traffic policemen had a history of 'tuberculosis' and this was confirmed by the police doctors. The study revealed 55 cases of TB history out of 100 persons studied. Complaints of chest pains were common, which the doctor said was the first stage of TB, and many of the police seemed to contract the disease in their very first posting as traffic constables and within a period of six months to one year. Earlier such policemen had no complaint of TB when their posting had been at a different place in the police department. In advanced stages, the policemen suffering from TB were referred to the SMS Hospital in Jaipur. Nine such cases were recorded from the hospital.

Yet another startling discovery was that 66 out of 100 policemen complained that after they had been posted to the traffic department they started to lose their appetite and interest in food. They complained that after their return from duty in the evening they did not feel hungry even when they had not eaten for several hours. Their stomach appeared to be full and swollen.

This undoubtedly leads to a suspicion that

automobile emissions could affect the liver and other organs of digestion in the human body. The doctor observed that such complaints were frequent and traffic policemen needed digestive tonics more frequently than other police personnel. Further studies need to be made before reaching any definite conclusions, but experimental studies made at the All India Institute of Medical Sciences, New Delhi, on animals, show that the liver is susceptible to automobile exhaust. The inhibitory effects of automobile exhausts on the secretion of digestive juices would also appear to be likely.

Fatigue was felt unanimously. While this may be due to hard work and heavy duty, the impact of auto-exhaust on the body physiology cannot be ruled out. Policemen complained that ever since they were transferred to the traffic department their body strength had dwindled.

58 out of 100 traffic policemen complained of itching and a 'burning sensation' on their skin especially when they were on duty. Many complained of small eruptions in their skin when they first took up traffic duty.

Conclusions

Like other metropolitan cities of India, the 'Pink City', Jaipur, is reeling under the stress of vehicular pollution. The incidences of hypertension, respiratory, ocular, and cardiac diseases in Jaipur are increasing. Problems like tuberculosis, loss of appetite, poor vision, and impairment of digestion amongst the traffic police appear to be attributable to automobile pollution. The high rate of occurrence of these problems amongst the traffic policemen, persons who generally lead a disciplined life, take regular exercise and eat prescribed foods, are unlikely to be due to reasons other than constant inhalation of toxic gases from automobile exhaust.

Human beings can adapt biologically and psychologically to environmental change. This 'ecological adaptation' was noted in the present study (Sinha, 1991; 1993). Almost all of the traffic police reported that they had experienced the trauma and hazards of vehicular pollution more acutely and severely in the beginning of their appointment. As they continued in their job they became adjusted and the severity of their problems decreased with time.

It is recommended that the traffic police should be given pollution masks to wear during their duty hours to safeguard their health. The masks would also arouse public awareness with regard to automobile pollution. Vehicular pollution should be constantly monitored on important road junctions and levels of pollution then displayed on huge boards to make both the public and the automobile drivers more aware of the hazards involved.

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