Air Pollution: Indian Scenario.

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ABSTRACT

Environmental litigation has increased over the last several decades. Claims against not only polluters, but the Agencies involved in the control and regulation of pollution have been proposed. This paper examines the knowledge that the forensic and medical communities may require in future litigation involving air pollution in India.

(Keywords: environmental litigation, legal claims, writ, petition, legal damages, forensics)

INTRODUCTION

Litigation and claims have increased across all fields, from consumer goods to the health field. No field is exempt from these litigations. This Increase may be due to following reasons:

- Media Related: Increasing publicity of negligent suits and awards.
- Social Causes: Increasing awareness about consumer rights.

A writ Petition was filed by Shri M.C. Mehta, Advocate, as a public interest litigation regarding pollution caused to the Taj Mahal in Agra [1]. In view of the increasing litigation for the assessment of damages, the day may not be far away when compensation claims against the agencies responsible for pollution control may be lodged by the citizens and the forensic community may have to assist the administration of justice. One such example of 1982 litigation for disease caused by pollution was asbestos litigation against Johns-Manville, which mined virtually all of the asbestos used in the United States. This litigation mushroomed to over 16,000 claims.[2]

Knowledge of these upcoming litigations and dealing on with the related medico-legal concepts needs a substantive understanding of the health hazards arising, especially from air pollutants, and also the knowledge of preventive measures taken by regulatory agencies to deal with these polluting elements. This problem is nearing its acute stage in developed parts of our country especially metropolitan cities where modernization has brought its own negative side-effects with it.

Health hazards due to complex problems of air pollution in metropolitan cities are very well-recognized. Vehicular emissions are one of the main sources of air pollution. Rising income, the increasing necessity for personal mobility, and inadequate availability of mass transportation facility has resulted in a rapid increase in automobile ownership. Motor vehicles emit carbon monoxide, nitrogen oxide, sulphur dioxide and other toxic substances such as total suspended particulate matter (SPM) and lead. Health effects of air pollution range anywhere from minor irritation of the eyes and the upper respiratory system to chronic respiratory disease, heart disease, lung cancer, and death.

A compelling reason for controlling air pollutants such as suspended particulate matter (SPM), respirable particulate matters (RPM), or sulphur dioxide (SO2) is their damaging effect on human health. These effects include mortality (i.e., premature death) as well as morbidity (i.e., increases in the incidence of chronic heart and lung disease). According to the World Health Organization (WHO), 4 to 8% of deaths that occur annually in the world are related to air pollution.Of all air pollution constituents, the WHO has identified SPM as the most sinister in terms of its effect on health.[3]

Central Pollution Control Board is executing a nation-wide program of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). The network consists of three hundred and thirty two (332) operating stations covering one hundred and twenty one (121) cities/towns in twenty five (25) states and four (4) Union Territories of the country.

Under N.A.M.P., four air pollutants *viz*., Sulphur Dioxide (SO_2), Oxides of Nitrogen as NO_2, Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM / PM_{10}) have been identified for regular monitoring at all the locations.

Various pollutants found in the air include: (1) Oxides of Sulphur, (2) Oxides of Nitrogen, (3) Suspended Particulate Matter, (4) Respirable Suspended Particulate Matter, (5) Carbon Monoxide, (6) Lead, (7) Ozone, (8) Benzene, (9) and Hydrocarbons.

1. **Oxides of Sulphur** (SOx) occur in ambient air in the form of Sulphur Dioxide (SO_2) and Sulphur Trioxide (SO_3). It has been observed that out of the SOx in the ambient air, the percentage of SO_2 may be more than 95 % while the remaining 5 % or less may be in the form of SO_3. The major anthropogenic sources of SO_2 in the atmosphere are burning of fossil fuels for industrial and domestic purposes as well as their use in industrial processes, viz., petroleum, chemical, metallurgical and mineral based industries. The harmful health effects of the SO_2 include irritation of eyes and respiratory system, increased mucous production, cough and shortness of breath.

2. **Oxides of Nitrogen:** The Oxides of Nitrogen (NOx) are formed during the combustion processes mainly because of oxidation of atmospheric nitrogen and to a lesser degree by oxidation of organic nitrogen in fuels. The transport and industrial sectors are the major sources of NOx which causes irritation of the pulmonary tract and affect the functioning of lungs. Higher concentrations can even result in the narrowing of the air passage. Combines with oxygen to form ozone, which causes progressive lung damage.

3. **Suspended Particulate Matter**: These are fine particles of soot, dust, etc. They are found in ambient air due to the combined effect of various natural factors. In the case of Delhi, presence of extensively large arid and semi arid regions in north-west, loss of moisture from top soil strata, etc. and anthropogenic factors, (i.e., extensive urbanization and construction activities, increasing vehicular population, captive and domestic power generation) are some of the major contributors to SPM in ambient air. High SPM levels cause respiratory diseases and reduce visibility. While the human nostrils filter out 99% of the inhaled large and medium sized particles, the rest may enter the wind pipe and lungs where some inhaled particles cling to the protective mucous.

   The SPM is not homogeneous. It has a number of constituents. As a result, it is measured and characterized in various ways: (i) TSP (Total suspended particulates) with particle diameters < 50-100 µm is the fraction sampled with high-volume samplers. (ii) PM: Inhalable particles having a diameter <10 µm penetrates through the nose, by breathing. (iii) Thoracic particles: are approximately equal to PM particles. (iv) PM: 'Fine fraction' with a diameter <2.5 µm penetrates to the lungs; and (v) Black smoke: a measure of the blackness of a particle sample gives a relative value for the soot content of the sample [4].

4. **Respirable Suspended Particulate Matter:** RSPM are the suspended particulates, which are less than 10 micrometers in diameter (PM10) and tend to pose a great health hazard as these particles can be easily inhaled and can get accumulated in the alveoli (tiny air sacs in the lungs) which slows down the exchange of Oxygen and Carbon Dioxide in the blood. The finer the particles, the longer is their propensity to remain air borne. The diverse sources of RSPM are fuel combustion in industries, power plants, industrial furnaces and boilers, diesel generating sets, and motor vehicles. The other sources are refuse and agricultural residue, refuse burning, solid waste disposal, construction activities, and traffic/road dusts.

5. **Carbon Monoxide**: Carbon Monoxide is produced as a result of incomplete combustion of fuel. Vehicles and industries are major sources of CO emissions. Due to its high affinity for hemoglobin, Carbon Monoxide displaces Oxygen, leading to

progressive Oxygen starvation and severe health effects. Impairs oxygen-carrying capacity of blood. Affects central nervous system, high blood pressure, heart disease. In greater concentration, the effect of Carbon Monoxide could sometimes even be fatal. More than 3% concentration by volume in respired air can lead to sudden death.

6. **Lead**: Lead (Pb) and some of its chemical compounds are virtually ubiquitous in the environment. Lead comes into the atmosphere, mostly through vehicular exhaust. Lead exposure is of great concern from the health point of view as it does not spare any organ in the body and can cause kidney damage in children as well as in adults.

7. **Ozone:** Ozone (O_3) at the ground level is a secondary pollutant, formed by reaction of Oxides of Nitrogen and Hydrocarbons in the presence of sunlight. The major harmful effects on human health include eye, nose & throat irritation and reduced resistance to colds. It can also aggravate asthma and bronchitis.

8. **Benzene:** The major sources of benzene (C_6H_6) are anthropogenic in nature. It exists in the environment in vapor form. The presence of benzene in petrol and industrial solvents results in wide spread emissions into the environment. According to the reports, benzene is a known human carcinogen and can damage both bone marrow and the immune system.

9. **Hydrocarbons:** Hydrocarbons (C_XH_X) can consist of fine particles of un-combusted liquid fuel. Hydrocarbons may be carcinogenic and some of the compounds are strong irritants of the eyes, nose and throat.

Under the National Ambient Air Quality Monitoring (NAAQM) network three criteria air pollutants, namely, SPM, SO_2 and NO_2 have been identified for regular monitoring at 290 stations spread across the country. Ambient air quality standards have also been laid down with respect to these pollutants. Values are different depending on the area whether industrial or residential or areas with high traffic density like traffic intersection [5].

Levels of pollutants in air are monitored regularly and found to be increasing. Seeing this various steps taken to reduce the amount of pollution by all the states but special mention here is the steps taken by Delhi which showed a marked improvement.

Table 1: Pollution Levels.

Pollution level	Annual Mean Concentration Range (µg/m 3)				
	Industrial (I)			Residential (R)	
	SO_2 & NO_2	RSPM	SPM	SO_2, NO_2, RSPM	SPM
Low (L)	0-40	0-60	0-180	0-30	0-70
Moderate (M)	40-80	60-120	180-360	30-60	70-140
High (H)	80-120	120-180	360-540	60-90	140-210
Critical (C)	>120	>180	>540	>90	>210

Table 2: Value of Pollutant Major Cities During 2001 [5].

STATE / CITY	SO_2		NO_2		RSPM		SPM	
AREA CLASS	I	R	I	R	I	R	I	R
Delhi	L	L	L	M	C	C	H	C
Bangalore	L	L	L	L	H	C	L	H
Mumbai	L	L	L	L	M	H	M	C
Chennai	L	L	L	L	M	H	L	M
Kolkata	L	L	H	H	H	C	M	C
Chandigarh	L	L	L	L	H	C	-	-
Pondicherry	L	L	L	L	L	M	-	-

STEPS TAKEN BY DELHI STATE FOR PREVENTING FURTHER POLLUTION:

1. Under the supervision of Hon'ble Supreme Court, 15 Common effluent Treatment Plants (CETP) to cover 21 industrial areas are being set up to treat 165 MLD effluent. In the year 2000, closure orders were passed to 338 defaulting units in Mangolpuri Industrial Area.

2. All the operational Sewage Treatment Plants are being monitored quarterly and reports with comments and suggestions are being sent to Delhi Jal Board.

3. 44 major hospitals were visited with the official of DPCC, SRISHTI an NGO and Centre of Occupational & Environment Health and LNJP hospital. During the visit waste management practices of the various hospitals were assessed.

4. Identifying and sealing of the water polluting units not having effluent treatment plants as per the orders of Supreme Court in 'Maily Yamuna' case. Approximately 3288 units were closed under the case including units closed in the previous year.

5. Monitoring air and noise pollution regularly. 10 source and ambient air monitoring were undertaken in different units. Thermal Power Stations situated in Delhi were monitored twice. Continuous Ambient air monitoring stations was established at Maharana Pratap I.S.B.T from April to November.

6. Actively participated in Anti-cracker campaign demonstrations were given in different school to give the students firsthand experience.

In addition to this, Delhi also took vehicular regulation seriously and these results were encouraging too.

Emission Norms of Vehicles [6]: In 1996, Emission norms made stringent as compared to 1991.

In 1998, Emission norms for catalytic converter fitted vehicle made stringent and hot start replaced by Cold start test which gives fewer emissions.

In 2000, Euro-I equivalent norms for all types of vehicles except passenger vehicles which are EURO-II equivalent.

In 2001, CNG/LPG norms finalized.

Other Measures: In 1996, Govt. vehicle to run CNG/Catalytic Converter.

In 1998, 15 years old commercial vehicle banned and pre-mix 2T oil in retail outlets.

In 2000, buses more than 8 years out were phased out, replacement of pre-1990 autos/taxis with vehicle on clean fuels and conversion of post 1990 autos to CNG initiated. Also fuel testing laboratory established.

In 2001, all taxis/autos and buses to run on CNG.

In 2002, introduction of mass transport concept by increasing the number of buses in the city for public transport from 6600 to 10,000 [7].

By following the above mentioned measures Delhi witnessed a great deal of change in the atmospheric values of air pollutants (Table 3).

Table 3: Changes in Air Pollutants.

Pollutant (in µg/m^3)	2000			2001			2002			2003			2004		
	R	I	TI	R	I	TI	R	I	TI	R	I	TI	R	I	TI
SO_2	17	13	18	14	13	15	11	13	10	10	9	9	10	10	8
NO_2	31	36	59	23	29	67	33	35	75	38	36	94	40	42	89
SPM	310	433	430	311	358	476	384	451	533	314	352	509	330	339	500
RSPM	-	-	191	120	150	190	139	167	270	127	140	244	131	135	224
CO	4686			4183			3258			2831			2581		

R- Residential Area, I- Industrial Area, TI – Traffic Intersection (Source: Central Pollution Control Board, New Delhi) [5]

This table shows the values of Sulfur Dioxide levels have gone down tremendously because of persistent efforts of phasing out old commercial vehicles, introduction of unleaded petrol and low sulfur diesel, extensive use of CNG based vehicles, and increase in forest cover. Carbon monoxide level too has come down tremendously. Level of RSPM has come down especially in industrial area after strict implementation of new policies regarding control of pollution. However, Nitrogen Dioxide levels have begun to rise while SPM and RSPM levels remain critically high. The main source of high levels of SPM and NO_2 in air is the vehicular emission [8].

CONCLUSION

As the population continues to grow, the demand for motorized vehicles will increase, as well. The increasing number of vehicles on the road will emit thousands of tons of pollutants into the atmosphere each year, affecting not only local air quality, but the entire globe. The lesson to be taken from a study of numerous policies implemented by the City of Delhi regarding vehicular emissions, closing industrial establishment in residential areas, using efficient fuel, strict check on taxis and buses, supporting mass transportation and introducing Metrorail, can be seen in the reduced pollution levels, although there still there is a long way to go. Increasing green cover is another important measure which will further help in cleaning air of many pollutants. Other solutions have been considered, which hopefully once active, will reduce the amount of vehicular emissions released each year.

Disease and deformity caused by air pollution is no doubt not a natural phenomenon to be ignored but if people themselves try to help reducing this increase in pollution then health hazards due to this will itself be constrained. Litigation by itself is no answer to this but we are likely to face such situations in the near future when victims will be filing claims for their disease and deformity from regulatory agencies responsible for the control of the pollution. In such a situation, forensic medicine experts may have an additional work load in assisting the courts for such claims.

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