10 URBAN ENVIRONMENT

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> Great cities are planned and grow without any regard for the fact that they are parasites on the countryside, which must somehow supply food, water, air, and degrade huge quantities of wastes.
>
> —*Eugene Odum*

Six to seven million people are added annually to urban India. At the beginning of this millennium, 285 million Indians lived in its nearly 4400 towns and cities (Census 2001). It is estimated to rise to 550 million by the year 2021 and 800 million by 2041 when it will surpass China. At that point urban India will be larger than the total population of Europe (NIUA 2000).

Economic growth is both a driving cause as well as the chief outcome of any urbanization process. India is among the ten most industrialized nations of the world. At 8.5 per cent (2003–4) India stands next only to China in terms of per annum GDP growth. In the last decade India's average growth rate was 6.3 per cent (1994–2004) and it aspires to achieve 8 per cent plus growth rate in the coming decade (Table 10.1).

Table 10.1
GDP Growth Rates of India in the Last Decade

Year	GDP growth rate
1994–5	7.3
1995–6	7.3
1996–7	7.8
1997–8	4.8
1998–9	6.5
1999–2000	6.1
2000–1	4.4
2001–2	5.8
2002–3	4.0
2003–4	8.5

Source: National Accounts Statistics 2005, Central Statistical Organisation[1]

Much of this boom has been experienced in the larger urban areas, where majority of the industrial production is concentrated. Cities act as engines of economic growth, contributing to 60 per cent of the national income. After India embarked upon economic reforms in 1991, the percentage of poverty fell from 36 per cent in 1993 to 26 per cent in 2000. This new found prosperity has not only led to a greater collective demand for a variety of goods, but also that traditional lifestyles have been altered in pursuit of an increasingly 'modern' way of living.

Per capita urban energy consumption has been increasing in the recent years. Demand for packaged consumer goods has increased several folds even in rural areas. These developments pose a serious threat to fast depleting natural resources that act both as factors of production, as well as dumping grounds for wastes generated.

Urbanization in India is characterized by unplanned and uncontrolled growth leading to urban sprawl. Land use planning and the pattern of development, relationship between residential areas and industrial, commercial and office complexes have a considerable impact on the environment (Singh and Steinberg 1996). Most of all, appropriate infrastructure provision has not kept pace with economic growth. Consequently, the environment of urban areas, particularly of larger cities, has been deteriorating rapidly. ULBs in India are faced with a plethora of issues that directly impact their capacity to manage municipal service delivery

Views expressed in the chapter are of the authors.

[1] *http://mospi.nic.in/3_macro_agg_const.pdf*

while simultaneously addressing environmental concerns. These include:

- multiplicity of organizations;
- inadequate resource mobilization;
- lack of capability to adopt proper corporate planning;
- lack of information and information systems; and
- inadequate monitoring of policy implementation.

Where the municipalities are struggling to provide basic amenities to citizens, issues of environmental pollution or hazard management are not accorded priority till matters reach the proportions of a crisis.

We explore impact of waste generation by us—people and industry—and emissions from urban transport on the quality of the water we consume and air we breathe and the inadequacy of ULBs when faced with the consequences of negligence of green issues, which are a part and parcel of contemporary civic existence.

Status of the Urban Environment

Water and Waste Water[2]

Although 89 per cent of the urban population has access to water supply, the average availability is less than four hours a day, and in some areas water is supplied only for one hour on alternate days (ADB 1997). The per capita water supply ranges from a low of 9 lpcd to a high of 584 lpcd across urban India (CPCB 2000). The poor quality of transmission and distribution networks results in higher operating costs and physical losses ranging between 25 per cent to over 50 per cent. Low pressure and intermittent supply leads to the contamination in the distribution network. This also has direct impact on system efficiency, especially administrative losses. International experience shows that administrative losses could be two to three times the physical losses (World Bank 1999). Hence, a vicious cycle of unsatisfactory service standards caused by low tariff structures resulting in poor resource positions of ULBs and poor maintenance and service continues (GoI 2002).

A survey of 241 class 2 towns in 17 states of India undertaken by the Central Pollution Control Board indicates that 90 per cent of the water supplied is polluted (CPCB 2000). Absence of technically qualified personnel and inadequate laboratory facilities for the periodic analysis of water are identified as the reasons behind the substandard quality of water supplied. About 30.5 million Disability-Adjusted Life Years (DALYs) are lost annually owing to poor quality of drinking water and the absence of sanitation facilities. The financial loss in terms of productivity has been quantified at Rs 360 billion annually (MoUD 2000). Table 10.2 shows the situation in four metro cities studied in 1996–7.

Table 10.2
Parameters of Water Supply in Four Indian Cities (1996–7)

Parameter	Ahmedabad[a]	Bangalore	Hyderabad	Pune
Per capita supply, municipal (lpd)	130	139	127	263
Per capita supply, all sources (lpd)	178	177	147	263
Hours of supply per day	1–1.5	1–2	1.5–2	2–4
Area of MC covered (per cent)	84	85	90	100
Connections per million	713	728	895	710
Percentage households metred	3	n.a.	95	54

Note: [a]Municipal corporation excludes outgrowth areas.
Source: AMA (1998)

On the basis of the quantity of water supplied per capita in litres per day, the class 1 cities can be divided into 4 categories: low (<100), normal (101–200), high (201–300), and very high (>300). Thirty-seven per cent cities fall in the 'low' category, that is, they are receiving water supply less than 100 litres per capita per day (CPCB 2000). Most of the ULBs do not have adequate infrastructure facilities such as required capacities for treatment of raw water, adequate testing facilities and technical manpower for operation and maintenance.

Although 75 to 81 per cent of the urban households in India have sanitation facilities, an increase of 64 per cent since 1991, only 72 of 4400 towns in the country have partial sewerage facilities and 17 have some form of primary treatment facilities before disposal. Of the 229 class 1 cities, 160 have sewerage systems for more than 75 per cent of the population and 92 cities for more than 50 per cent of the population. While the waste generation in class 1 cities has more than doubled from 1978 to 1995, the treatment capacity has decreased from 39 per cent to 24 per cent during the same period. Of the total wastewater generated in the metropolitan cities, barely 30 per cent is treated before disposal. Untreated water finds its way into water systems such as rivers, lakes, groundwater, and coastal waters (GOI 2002). In 118 cities, it is discharged indirectly into rivers, lakes, ponds or creeks, while in 63 cities it is used for agriculture. This lack of adequate sewerage network and proper sanitation facilities leads to degradation of the environment in the catchment of the natural drains, which has a detrimental effect on the quality of life of the inhabitants, besides polluting the water bodies. It is estimated that 75 to 80 per cent of the water pollution by volume is caused by domestic sewage (TERI 2003).

[2] For a comprehensive coverage on delivery of water and waste water, please see Chapter 7 of the report.

Solid Waste[3]

The growth of Municipal Solid Waste (MSW) has outpaced population growth in recent years as a result of changing lifestyles, food habits, and rising living standards (GOI 2002). About 48 million tonnes of solid waste are generated in the urban areas everyday, an eight-fold increase since independence (CPCB 2000a). Of this not more than 72 per cent is collected daily, which leads to accumulation and decomposition of the waste in public places with adverse effects on public health. The increase in non-degradable waste is alarming; the production and consumption of plastic has increased more than 70 times between 1960 and 1995.

ULBs have the massive challenge of managing this MSW, a function which they are completely inadequate to execute. Despite the notification of the MSW Rules 2000, most of the municipalities have not met their provisions. With the poor implementation of the 74th CAA and the failure to provide financial autonomy to municipalities, their overall financial health is precarious[4]. This is compounded by the inability of the local bodies to recover user charges from the generators of MSW. A lacuna in the provisions of MSW Rules itself is that it does not clearly specify role and responsibilities of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs).

Seventy per cent of Indian cities have inadequate waste transportation facilities resulting in littering during collection and transportation. The landfill sites too are seldom managed in an environmentally acceptable manner and are prone to groundwater contamination because of leachate production (TERI 2003). These sites are sources of livelihoods for the urban poor like rag pickers who often locate their residences in proximity to these sites, living in and exacerbating unhygienic environmental conditions and suffering from an array of physical and mental health problems. Landfill workers have significantly higher incidence of respiratory symptoms, and they suffer more often from diarrhoea, fungal and other skin infections, transient loss of memory, and depression (Ray 2004).

The municipal effort towards solid waste management has been minimal because deficiencies in it do not translate to immediate public reaction. Private sector participation in solid waste management has been negligible so far because the government has not defined and formulated a policy framework and guidelines for private investment in the sector. The urban local bodies impose no specific tax to run the services related to management of solid waste. This means that the marginal cost to households for managing the solid waste generated, more often than not, is zero.

Health Care Waste

While initiatives by the state government and health care facilities are picking up, the level of compliance with Biomedical Waste Management (BMW) Rules is still low. Originally, health care facilities had to comply with the Rules within a range of 1.5 to 4.5 years based on the type and size of the health care facility, and population size in the locality—all health care facilities had to comply with the Rules in a phased manner by the end of 2002. Actual implementation has been poor. The High Powered Committee (HPC) on hazardous waste, commenting on status of biomedical waste management in the country, noted that barring a few exceptions, in some of the larger institutions in a few cities, the management of hospital wastes has been a neglected issue. The situation is worse in smaller cities and towns, where a large number of hospitals and nursing homes lack adequate segregation of infectious wastes and dump their medical waste along with municipal waste. Studies thus indicate that about 0.1–1.5 kg per bed per day of health care waste (HCW) is generated in the country with wide variations across cities, hospitals, and urban health centres.

Approximately 25 per cent of this waste generated is hazardous but no definite figure has been arrived at. The High Powered Committee on hazardous waste management cited estimates ranging from 0.4 to 0.5 kg of infectious waste generated per bed per day, while estimates of the Health Ministry put the figure at 0.25 kg per bed per day (CPCB 2001). Going merely by the increase in the number of hospital beds in the country since 1997, and assuming an average waste generation of 1 kg per bed per day, total HCW generated in India increased from about 890 tonnes to 920 tonnes per day between 1997 and 2002[5]. Assuming that 25 per cent of this waste is infectious in nature, about 230 tonnes of BMW was generated daily in 2002. This constitutes only 0.14 per cent of the total municipal waste generated in the country. Clearly, the problem is not one of quantity but of the nature of the waste generated. Segregation is the key to safe management of biomedical waste.

A survey of 120 health care facilities in West Bengal, Gujarat, Punjab, Tamil Nadu, Haryana, Delhi, and UP

[3] For a comprehensive study of Solid Waste Management in urban India, please see Chapter 8. Only the principal concerns of SWM affecting environment and living conditions of people are highlighted here.

[4] The 74th CAA redefined the role, powers, functions and financial authority of urban local bodies (ULBs). A three-tier structure of urban local governance has been put in place in various states with the implementation of the Act. The urban local bodies are classified into Nagar Panchayats, Municipal Councils and Municipal Corporations. Further, the 74th Amendment entrusts these local bodies with the responsibility of provision of basic services such as water supply, sanitation and solid waste management in their cities (Box 3.1).

[5] The number of hospital beds went up from 8.9 lakh in 1997 to 9.2 lakh in 2002 as reported in the *Statistical Abstract of India 2003*. The number for 2002 may be an underestimation since the reported number of hospitals declined from 2001 to 2002 due to exclusion of Community Health Centres and non-reporting of the data.

undertaken under the Revised National Tuberculosis Control Programme, in urban and rural areas found that about 42 per cent of the health care workers in these facilities did not have knowledge about classification and segregation of biomedical waste. The survey also revealed the gross inadequacy of equipment such as needle destroyers, especially in rural areas (63 per cent of health care workers in rural areas and 34 per cent in urban areas reported non-availability of needle destroyers). Open dumping or burning of biomedical waste was reported as a common practice (CPCB 2001). Evaluations of Common Waste Treatment Facilities (CWTFs) point out several disturbing issues (MPCB 2004) related to collection, transportation, and treatment of HCW discussed in following sections.

Collection

Bio-Medical Waste (BMW) is not segregated at the source properly. Because of the lack of training, intention, and regulatory control, all waste generated in medical institutes including other solid waste is classified as BMW. Non-incinerable /autoclavable waste is not sent to the waste disposal facility. This waste often reaches the recycling market without any treatment. A CWTF generally charges the generators either on a per kilo or per bed basis. In case of the per bed charge, facilities do not undertake appropriate waste segregation. However, where the charge is based on weight, the waste received from hospitals is observed to be reduced considerably, indicating that hospitals may be disposing waste in an unscientific manner.

Transportation

The number of vehicles available for waste collection falls short of the requirement. Further, appropriately designed collection vehicles are rarely used. Transporters do not regularly collect BMW from all hospitals, particularly the smaller ones. Transporters do not maintain records of the waste collected from individual operators on a category and weight basis.

Treatment

Handling and storage of waste before treatment is inadequate. Most facilities lack technical support to address operational problems. Records of incinerator operation including temperature, waste received and treated, time of operation and fuel consumption are not maintained at the site. Majority of BMW incinerators installed earlier did not meet the specification of the 1998 Rules. Incinerators are found to be operating improperly—in most cases the required temperatures are not achieved. Functioning is also impaired due to lack of proper segregation of waste. In many of these facilities there are no alternative disposal technologies such as autoclaving/hydroclaving/microwaving for waste that should not be incinerated for example, chlorinated plastics. The common facilities are often not equipped to manage all steps in waste management. For instance, some have only incineration facilities with no proper arrangement for ash disposal. Scrubbed water and floor washings are not adequately treated.

Air Pollution

The processes of urbanization and industrialization are intimately related in an urban environment. The high density of population and industries in the cities lead to vehicular, domestic, and industrial emissions affecting adversely the environment and health of the citizens. In India, the situation is particularly bad. More than 90 per cent of the national monitoring stations have recorded particulate concentrations exceeding the WHO recommended guidelines (TERI 2003).

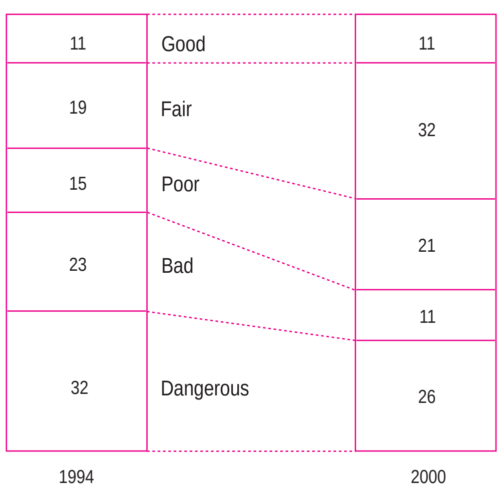

Fig. 10.1 Smaller Fraction of Cities with Dangerous or Bad Air

The health effects of pollutants depend upon the concentration, exposure duration and the individual's susceptibility. There are important connections between air pollution and diseases, and the cost that they impose on the society. It thus becomes important to study the impact of vehicular emissions on human health. Such studies for estimating the health costs on account of vehicular emissions have not been conducted in India till date. A study conducted by Carter Brandon and Kirsten Hommann in 1995 for World Bank on the economy-wide cost of environmental degradation in India, studied 1991–2 data from 36 cities in the country and found that the annual health costs due to ambient air pollution levels far exceed the WHO guidelines which range between US$517 and US$2102 (MoPNG 2002).

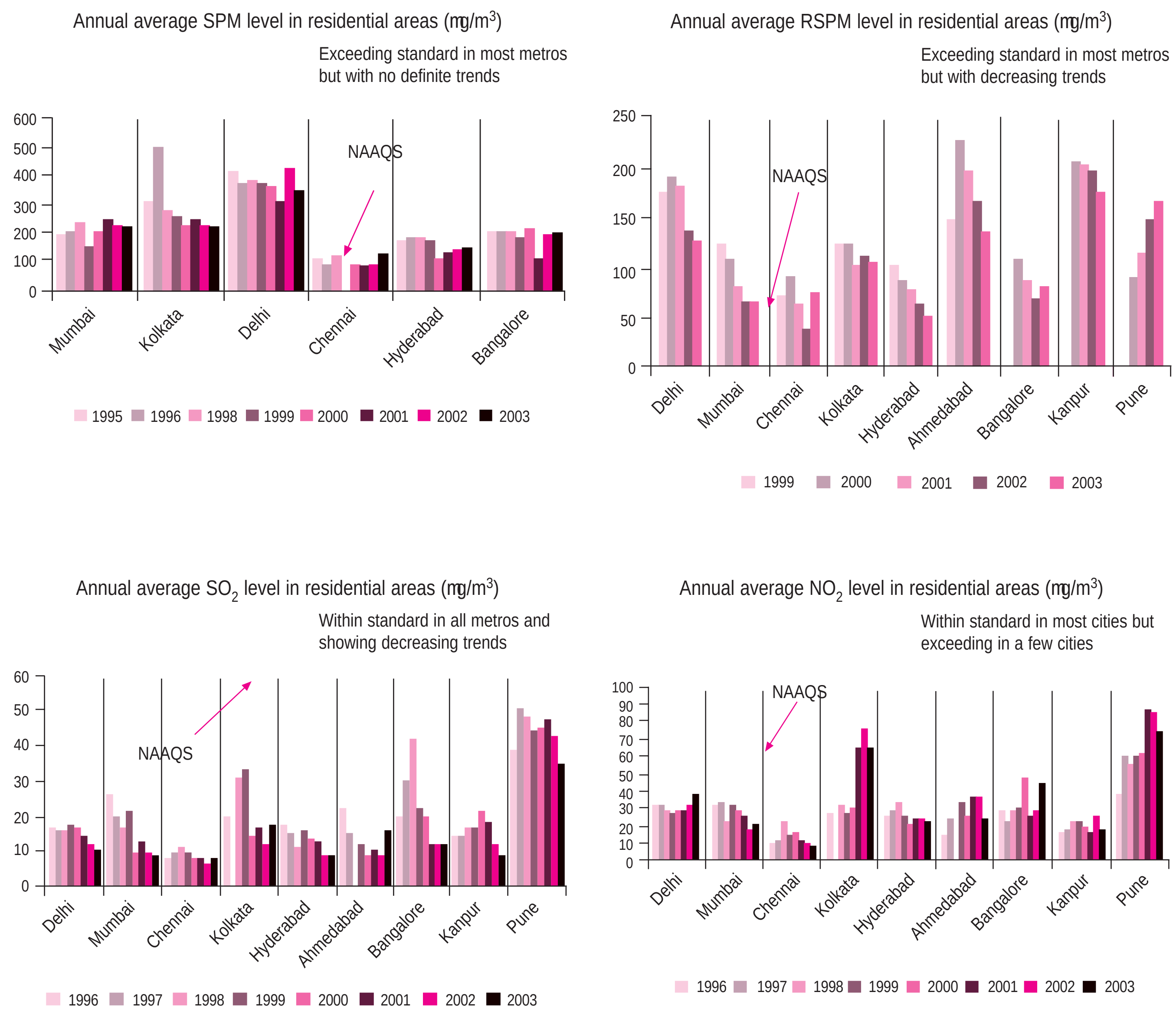

Fig. 10.2 SO_x and No_x in Air

Source: CPCB (various years)

The Energy and Resources Institute (TERI 1998) estimated the incidence of mortality and morbidity in different groups in India due to exposure to PM10 and translated these impacts into economic values. The results indicated 2.5 million premature deaths and total morbidity and mortality costs of Rs 88,500 crore to Rs 4,25,000 crore annually.

Serious efforts are underway to reduce air pollution (Figure 10.1; Box 10.1). The results of these efforts are now visible. Air quality was rated dangerous or bad in 34 out of 62 Indian cities in 1994. The percentage of cities with 'dangerous' air has since come down from 32 per cent in 1994 to 26 per cent in 2000 (Figure 10.2). In the same period, the percentage of cities with 'bad' air fell from 23 per cent to 11 per cent. This shows that the air quality is improving in the worst categories but on the other hand the percentage of cities with 'poor' air increased from 15 per cent to 21 per cent, which is a clear indication that sustained efforts are required to achieve substantial improvement in the air quality of India (TERI 2003).

Urban transportation

Urban transport is one of the largest causes of air pollution in Indian cities adversely affecting the health of the people and their quality of life. Due to lack of integrated land-use and transport planning in most of cities, today we witness a plethora of personalized modes, and a scarcity of public transport modes.

Box 10.1

Delhi Breathes Clean Air Now

Delhi, in terms of air pollution, was ranked fourth among the 41 most polluted cities in the world, in the 1990s. The annual average levels of suspended particulate matter increased to 411 $\mu g/m^3$ during 1995, which is nearly three times the National Ambient Air Quality Standard (NAAQS) of 140 $\mu g/m^3$ for residential areas as notified by the Ministry of Environment, Government of India. The annual average levels of CO also increased to 5587 $\mu g/m^3$ as against the NAAQS of 2000 $\mu g/m^3$ for the residential areas. Vehicles, thermal power plants and large as well as small-scale industrial units in Delhi were the major sources of these pollutants at that time. The quantum of pollutants has reduced substantially in the last decade despite growth in motorized vehicles (Table B10.1.1).

Table B10.1.1

Delhi Air Quality Data ($\mu g/m^3$) Averaged for all the Stations

Year	SO_2	NO_x	SPM	RSPM
1995	23.5	47.2	410.6	–
1996	17.3	39.7	402.4	–
1997	16.3	34.2	335.7	–
1998	15.4	33.9	362.9	–
1999	17.5	35.7	352.1	–
2000	15.2	39.9	380.9	159.0
2001	12.9	36.9	345.5	127.9
2002	11.3	37.3	426.5	164.9
2003	9.6	45.2	352.3	147.4
2004	9.6	48.3	359.9	141.2

Source: CPCB (various years)

The Delhi Transport Corporation, the only public utility managing public transport in the city, which had a fleet of over 5500 buses contributed heavily towards the air pollution load of the city as most of the buses were old and poorly maintained. More importantly, all public transport was based on diesel or petrol. Low average speeds, frequent stops at traffic intersections, long idling times, etc. were the order of the day. On the other hand, air pollution load was increased by the fuel combustion of both large and small-scale industries, which mainly included thermal power plants in the large-scale category. Also, significant pollution was also caused by a large number of Diesel Generating (DG) Sets, which were installed in various commercial and industrial establishments.

The turnaround came when the Supreme Court in July 1998 directed, among other things, the replacement of all pre-1990 auto-rickshaws and retrofitting all the post-1990 auto-rickshaws and taxis with devices running on clean fuels. In addition to this, the Supreme Court also directed the withdrawal of buses which were more than eight years old and conversion of the rest of the city's bus fleet to CNG based vehicles and setting up of more CNG filling stations. Besides, more stringent emission norms were implemented in Delhi on the recommendations of the Environment Pollution (Prevention & Control) Authority (EPCA), set up by the Ministry of Environment and Forests. Apart from this, Delhi Pollution Control Committee directed several industrial units to install pollution control devices, which were found to be polluting according to the Air (Prevention and Control of Pollution) Act, 1981 and the Supreme Court, in 1996, and passed orders to close down 1328 polluting units, following it up with orders to move such units out of Delhi.

The coordinated measures for affecting the switchover were put in place by the Government of Delhi through multipronged action as different agencies were responsible for ensuring the environment friendliness of public transportation namely Delhi Transport Corporation (DTC), Indraprastha Gas Ltd. (IGL), Department of Transport, and Department of Environment. The fight against air pollution in the capital finally started yielding results in 2001. Statistics have shown that not only has the rising trend in pollution level been checked, but the level of various pollutants in the ambient air is also coming down. Figure 10.2 and Table B10.1.1 show a significant improvement in the overall air quality of the city as compared to the other metropolises. The concentration of CO in Delhi has fallen by 32 per cent and that of SO_2 level has fallen by 39 per cent from 1997 to 2002. Despite the phenomenal growth in vehicular population, the levels of NO_2 have remained more or less constant, which can be attributed to the phasing out of old commercial vehicles and implementation of Euro-I and subsequently Euro-II norms for petrol and diesel driven private vehicles. The results show that Delhi has undoubtedly proved to be a proud example to be emulated by other metropolises (DPCC 2005).

Private passenger vehicles are in high demand in the urban areas and the car ownership is growing rapidly at over 10 per cent per annum. The total number of motor vehicles has increased from 0.3 million in 1951 to 67 million in 2003. Also, a drastic increase in the number of two-wheelers has been observed, increasing from 8 per cent in 1951 to 70.9 per cent in 2003, whereas the share of public transport has severely declined especially the share of buses which declined from 11 per cent to 1.1 per cent during the same period (MoRTH 2005). A major cause of concern is that even though the vehicle ownership rates are much lower in India as compared to the developed countries, the traffic congestion is very severe. The congestion results in crawling traffic, an increasing accident rate, fuel wastage, and environmental pollution.

Paucity of funds has led to poor delivery of services and, thus, giving a poor image to public transport. Those who cannot afford personalized vehicles suffer even more, both, at the hands of poor public transport service and externalities imposed by private vehicle users. The waning use of cheaper non-motorized modes like cycling and walking have become extremely risky, since these modes have to share the same right of way with motorized modes. This is reflected in the accident rates going up from 160,000 in 1981 to over 390,000 in 2001 and fatalities going up from 28,400 to over 80,000 respectively.

Vehicles have been found to emit large quantities of carbon monoxide, hydrocarbons, nitrogen oxides, and other toxic substances including fine particles. Old and in-use private vehicles with old technology (for example, two and three wheelers with 2-stroke engines) constituted a significant portion of the total fleet and emissions from these vehicles were very high. Impact of the quality of fuel and the level of vehicle technology on the quality of the air can be easily observed. Various studies on the concentration of pollutants in the ambient air have revealed that the contribution of auto exhaust to carbon monoxide, nitrogen oxide and particulate matter (both SPM as well as Respirable Suspended Particulate Matter [RSPM]) levels is fairly high. For most of the cities, SPM exceeds the national standards (Figure 10.2).

The scenario in the recent years is found to be changing for the better. This is as a result of efforts of the government to impose stricter emission norms, phasing out of lead in petrol and reducing sulphur content in diesel (Box 10.2). These efforts which started in mega cities are now also being implemented in other cities all over the country.

Government Policies and Rules

There are many policies, rules, and manuals apart from legislation, which empowers states and local bodies for the provision of water supply, sanitation and solid waste services in urban areas and developing transportation infrastructure in the country (Table 10.3). The thrust of these documents, which are bound to have an impact on the urban environment and the roles of urban local bodies in the provision of infrastructure are also highlighted.

The need for provision of potable water and expansion and improvement of sanitation facilities in urban areas has been reiterated in successive rules and government orders. A target of 100 per cent coverage of provision of safe drinking water in urban areas by the year 2000 was included among the seven basic services in the Basic Minimum Services Programme introduced in 1996 (GOI 1997).

Box 10.2

Moving Towards Environmentally Friendly Fuel Transport System for Urban India

The first centralized effort for improving fuel quality was initiated by judicial activism beginning with the phasing out of lead in petrol in the four metropolitan cities of the country (Chennai, Delhi, Kolkata, and Mumbai) in 1994. The MoEF (Ministry of Environment and Forests) notified fuel specifications in 1996. A similar programme to reduce the sulphur content in diesel has been in effect from 1996. CNG is used extensively in a few cities of India, such as Delhi, Mumbai, and Surat. In its April 2002 directive, the Supreme Court imposed fines on diesel buses, issued orders for phasing-out diesel buses, and accorded priority to the transport sector for CNG allocation. It also ordered for a schedule to be drawn up for supplying CNG to other polluted cities of the country such as Agra, Faridabad, Jharia, Jodhpur, Kanpur, Lucknow, Patna, Pune, and Varanasi. Delhi today has the largest CNG bus fleet in the world of about 7200 buses and 4000 mini buses forming a part of about 75,000 CNG vehicles. The auto-rickshaw and taxi fleet of the city have also been completely converted to CNG. Auto LPG (liquefied petroleum gas) for the automobile sector is also being actively promoted in the major cities of the country by a number of oil companies. In Bangalore, a directive issued by the Transport Department has made it mandatory for all auto-rickshaws to be fitted with authorized kits (fixed cylinder) to make them run on LPG by the year 2005. Alternate fuels, such as dimethyl ether, biodiesel, hydrogen, electricity, and fuel cell, are in various stages of experimentation.

The government has adopted stringent emission norms for vehicles. Based on the road map suggested by the Mashelkar Committee Report on auto-fuel policy, Bharat stage II emission norms have come into force for entire country with effect from April 2005 and more stringent Bharat III norms in selected 11 cities of the country (MoRTH 2005)[a]. Further, fitness norms for commercial vehicles have been tightened in 2001 and stricter Pollution Under Control norms have also come into force since October 2004.

Note: [a]*http://morth.nic.in/emission.htm* as seen on 7 October 2005.

Table 10.3
Policy Highlights

Year	Policy/Act/Programme	Highlights
1998	Aseem Burman Committee	In January 1998, Aseem Burman Committee was formed under the Supreme Court of India to review the solid waste management conditions in class I cities in India. The key recommendation of this committee's report was to enable private sector participation in SWM.
1998	The Biomedical Wastes (Management and Handling) Rules	Rules deal with segregation, treatment and disposal of biomedical waste and provide deadlines for health care facility with more than 30 beds or serving more than 1000 patients per month.
1999	National Highway Development Project	The largest-ever highway project seeking to connect the four corners of the country as well as the four metropolitan cities with world class roads and uninterrupted traffic flow. Work on National Highway Development Project's first phase and second is underway simultaneously.
2000	The Municipal Wastes (Management and Handling) Rules	The rules lay the procedure for waste collection, segregation, storage, transportation, processing, and disposal. Municipalities will be required to submit annual reports regarding municipal waste management in their areas to the Central Pollution Control Board. Further these rules mandate that all cities set up suitable waste treatment and disposal facilities by 31 December 2001 or earlier.
2000	Manual on hospital waste management	CPCB provides information on waste characterization, segregation, storage, and treatment technologies. It was meant to acquaint concerned authorities and personnel in the health care facilities with the methods and technologies required for the implementation of the Biomedical Waste Rules.
2000	Manual on Solid Waste Management for Local Bodies	In January 2000, the CPHEEO (Central Public Health Environmental Engineering Organization) under Ministry of Urban Development brought out a manual on solid waste management to provide guidance to local bodies.
2002	National Water Policy (revised)	Thrust areas of the National Water Policy are participation among users, improving water quality, rehabilitation, and resettlement in large scale irrigation projects, need for integrated approach within water sector, revamping institutional mechanism and improving sustainability of water projects.
2002	Mashelkar Committee (Auto-Fuel Policy)	The committee was constituted to recommend an 'auto-fuel policy' for the major cities in the country, to devise a road map for its implementation and recommend suitable auto fuels, automobile technologies and fiscal and institutional measures. Thrust is to achieve the twin objectives of providing assured supply of fuels at minimum costs and addressing environmental concerns (Box 10.2).
2003	The Hazardous Wastes (Management and Handling) Amendment Rules	Broadening the definition of hazardous waste and harmonizing the Rules with provisions of Basel Convention which were not part of Rules of 1989. The amended Rules also proposed the list of waste, which is prohibited for import and export in the country (schedule 8) as per provisions of Basel Convention.
2005	Draft National Urban Transport Policy	Main thrust is on incorporating urban transportation at the urban planning stage, bringing about a more equitable allocation of road space, encourage greater use of public transport and non-motorized modes instead of personal motor vehicles and reducing pollution levels. This is to be achieved by better enforcement, stricter norms, technological improvements, promoting the use of cleaner technologies and building capacity to plan for sustainable urban transport.
2005	Jawaharlal Nehru National Urban Renewal Mission	The thrust of this mission is on urban infrastructure and basic services for the poor. This mission plans to cover only 63 cities including 7 mega cities, 28 million plus cities, and 28 other cities over a 5 year period. The mission proposes an agreement between the states, urban local bodies and the central government to undertake reforms before delineation of funds from JNNURM to the ULBs.

Year	Policy/Act/Programme	Highlights
2005	Draft National Road Safety Policy (MoRTH 2005)[a]	The thrust of the policy is to address on a holistic basis, issues covering road engineering, signage, vehicle design, and education of road users and enforcement of traffic safety measures. It is also recognized that regardless of jurisdictions, the central and state governments have a joint responsibility in making a dent on the incidence of road accidents and fatalities.
2005	Draft National Road Transport Policy (MoRTH 2005)	The National Road Transport Policy aims at facilitating an efficient and safe road transportation system to fulfil the demand of users and the aspirations for improving the quality of life and concomitant economic development. The policy document seeks to cover both passengers and freight, accounting for the environmental, technological, fiscal aspects related to motorized transport.

Note: [a]*http://morth.nic.in/emission.htm* as seen on 7 October 2005.

Even today, provision of basic amenities continues to be among the core activities of the ULBs. The tenth plan proposes to give special attention to key areas like water supply and sanitation and urban transport in order to strengthen the institutional and resource base of ULBs (Planning Commission 2002).

Industry and Environment

The Indian industry too suffers from less energy efficient and high emission prone technologies. Environmental governance suffers from low capacity and is overly dependent on command-and-control type of environmental management. As a result, the monitoring of the small and medium scale industries, that comprise bulk of the production capacity and waste generation, has not been very successful.

The general attitude towards management of industrial waste is pathetic due to weak legislation, poor policy implementation and knowledge or information gap.

Exclusion of environmental consideration in existing legislation: The rules of 1989 and the amendments dealing with hazardous waste management fail to provide any incentive for waste reduction/minimization efforts[6]. Industries are therefore reluctant to adopt such measures, which would lead to resource conservation even though they result in an overall reduction in cost. Experiences in a number of developed countries suggest that cleaning up of hazardous wastes at a later stage is much more expensive in the longer term than its prevention at source. For instance, in the United States, cleaning of improperly managed wastes has been estimated to cost 10–100 times compared to prevention at source (IGPA 2002).

Also there is no incentive built into the existing regulations for the industry to reuse the waste. Though there are Waste Minimization Circles (WMCs) established in the country to facilitate waste exchange and waste reduction, these are not very effective in terms of reaching out to different industry types. There is a database on waste exchange activities maintained by CII and Assocham[7], but it suffers from low awareness in smaller units in remote places. There is no information on how much waste has been utilized by such initiatives in the country.

The rules of 1989 covered aspects related to maintaining an inventory of hazardous waste sites by states but did not specify that states will also be responsible for maintaining waste inventories. The subsequent amendments also remain silent on this. The hazardous waste inventories made by most of the states are based on Rules of 1989. Very few states have been able to revise their inventories based on amended HWM Rules of 2003. The state pollution control boards also lack the basic infrastructure and trained manpower to carry out waste characterization and inventory based on requirements of the amended Rules.

The Rules of 1989 and its amendment do not cover management of non-hazardous waste from industries. Neither have they specified mechanisms to dispose non-hazardous waste from such units.

In addition, the Rules do not specify standards for the cleaning up of contaminated sites and limits for disposal of waste on land. Due to this, industries which are causing contamination of land and water bodies through inappropriate waste disposal are not legally bound to clean the site unless ordered by judicial intervention to do so (Box 10.3).

Weaknesses in policy implementation: One of the most obvious signs of inadequate enforcement of legislation is the lack of reliable inventory of hazardous waste in the country. This is evident from the fact that the estimate for hazardous waste generation as provided to the High Powered Committee (HPC) by the MoEF was revised downwards several times from 9 million tonnes to 8 million and finally to 4.4 million tonnes per annum. Information on hazardous waste generated by industrial units required to be maintained under the HW

[6] *http://www.nlsenlaw.org/waste/articles/Document.2004-04-19.1749/view*

[7] *www.cleantechindia.com*

Box 10.3

Failure of Common Effluent Treatment Plant in Vapi Industrial Estate, Gujarat

The Vapi IE in the state of Gujarat is an industrial catastrophe as a result of unplanned investments in polluting industries and related infrastructure. The problem of pollution is highly visible and tangible—hundreds of tonnes of toxic waste are dumped on both land and water, ground water is noticeably contaminated, streams and rivers run foamy red and foul smelling, children and women are exposed and live among poisonous waste dumps. The Common Effluent Treatment Plant is a total failure and it hinders any attempts to move towards cleaner production. This example illustrates that if standards do not specify limits for disposal of waste and punishments to offenders, a common affluent plant facility can be misused by unscrupulous factory owners. Excessive industrial pollution can have long-term effects on environment.

Source: http://archive.greenpeace.org/toxics/html/content/india2info.html

Rules 1989 is not maintained by the SPCBs on a regular basis. Even the information pertaining to units that are formally registered with or authorized by SPCBs was found to be unreliable by the HPC. And there is no information at all about the waste being generated by units in the small scale and unorganized sectors, which are handling hazardous wastes without pollution, control safeguards. In addition there are a large number of units located in the Free Trade Zones that are not registered with the SPCB.

Again, few state governments have identified safe disposal sites for hazardous wastes as required by the HW Rules, 1989. Barring a few states like Gujarat, Andhra, Karnataka, Maharashtra, Haryana, and West Bengal, there is little success in terms of establishing common disposal sites despite such sites having been identified and notified. The absence of secure landfills provides industry the excuse to discharge their hazardous wastes at illegal dump sites outside industrial estates, along roadsides, in low-lying areas, along with municipal wastes or even in river and canal pits.

In the case of imported waste also, the situation is grim. Data procured by the HPC from the Directorate General of Commercial Intelligence and Statistics (DGCIS) indicates that such waste imports continued even in 1999–2000.

Knowledge and information gaps: Hazardous waste inventory carried out by various states is proving to be one time exercise. Data on hazardous waste generated is provided by the industry and is not based on inspection or verification by SPCB. There is a need to constantly update this waste inventory so that appropriate waste management strategies can be incorporated in waste management plans.

In the absence of reliable waste inventory, use of tools like EIA for hazardous waste problems has been minimal. This has led to very little research on exploring the risks and health impacts of hazardous waste disposal on surrounding ecosystem and communities.

The database on waste exchange (WMCs) and cleaner production practices needs to be more broad-based and should reach the smaller units, which have limited availability of funds and technical expertise.

Industrial Estate Planning in India

The Ministry of Industry at both central and state level is responsible for industrial planning and development. The role of the central government in the establishment and up-keep of industrial estates (IE) in India has been mainly that of laying down the guidelines for the state governments, and coordination, review and monitoring of the industrial estates development programmes. In addition, sector specific ministries for steel, petroleum, chemicals, textiles, mines, etc., have been established with a view to diversify and relegate policy and planning processes. For the establishment of IE the selection of sites for their location, development of the industrial areas, and provision of requisite infrastructural facilities lie within the jurisdiction of the state government. Commerce and industries departments at the state government level are responsible for the establishment of industrial growth centres, IE and export promotion zones. The department also takes decisions regarding the granting of licences, land, power, finance and all related concessions. In addition, states also have State Industrial Development Corporations (SIDCs), which build infrastructure and common facilities for the estate. SIDCs offer fiscal incentives to private investments in industry. There are specific agencies to ensure that pollution from industrial activities is kept under control.

The SIDC identifies the potential sites for industrial development. Industrial sites are selected mainly on the basis of socioeconomic considerations in accordance with the regional/state master plan. However, practically there is no emphasis on addressing the environmental concerns. SIDC's approach the development authorities for notification of the proposed sites for land use conversion. SIDC also monitors the development of industrial estates within the stipulated time frame in order to prevent artificial escalation in land prices.

Development Authorities (DA) of the region plan the physical and infrastructural development of the IE. In many regions instead of SIDCs, DA identifies the sites as well. DA also notifies the land use conversion once the site is selected.

Central Pollution Control Board's Zoning Atlas Programme (CPCB 1997) aims to support and simplify decision-making process on siting of industries based on environmental considerations. This is an attempt to identify suitable areas for planned industrial development, district-wise in various states. With the help of the zoning atlas, the industries can identify environmentally sound sites for setting up of IE as the atlas provides the information on alternate zones. By incorporating the economic considerations such as the availability of raw materials, transportation network, water supply, electricity, waste disposal facilities an initial list of possible sites can be drawn up for which detailed micro-level investigations can be carried to select the final sites (GIS 2002).

Industrial Waste

Industries survive on good management but, in general, industrial waste, a by-product of industrial production, is managed poorly. Industrial wastes include a very wide range of materials. These wastes may occur as relatively pure substances or as complex mixtures of varying compositions in different physio-chemical states. Examples of materials that may be found under this category are general factory rubbish, organic wastes from food processing, acids, alkalis, metallic sludges, and tarry residues. Mine tailings or spoils, generated in the process of mining, are another source of industrial wastes. Mining waste may include topsoil, rock, and dirt. It may be inert, such as material from china clay mining, or toxic such as mine tailings from ore extraction contaminated with metals or chemicals that have been used for mineral separation.

Rapid industrialization in India has resulted in the increased need for proper disposal of industrial wastes. The industrial sector in India has quadrupled in size in the last three decades. There has been a significant increase in industries such as pesticides, drugs and pharmaceuticals, textiles, dyes, fertilizers, tanneries, paint, chlor-alkali, etc. which are major generators of hazardous wastes. Hazardous wastes from these industries contain heavy metals, cyanides, pesticides, complex aromatic compounds, and other chemicals, that are toxic to humans, plants or animals, are flammable, corrosive, or explosive, or have high chemical reactivity.

The wastes generated from industrial activities can be classified as non-hazardous and hazardous wastes based on the threat they pose to the environment in handling and management.

Non-hazardous wastes

The major generators of non-hazardous wastes in India are:

- thermal power stations (coal ash),
- steel mills (blast furnace slag and steel melting slag),
- non-ferrous industries like aluminium, zinc, and copper (red mud and tailings),
- sugar industries (press mud),
- pulp and paper industries (lime sludge),
- fertilizer and allied industries (gypsum), and
- stone quarrying and processing operations (stone dust).

The reported non-hazardous waste from industrial process industry in the country grew from 77 MTPA (metric tonnes per annum) in 1990 to around 147 MTPA in 1999, which was roughly around 8 per cent of the waste generated in the Asia-Pacific region UNEP (2001) (Table 10.4).

In addition, the production of calcareous stones generates around 17.8 million tonnes of stone waste per annum. The

Table 10.4
Sources and Quantum of Waste Generated from Major Industrial Sources

Waste	Quantities MTPA 1990	1999	Source/origin
Steel and blast furnace slag	35.0	7.5	Conversion of pig iron to steel and manufacture of iron
Brine mud	0.02	–	Caustic soda industry
Copper slag	0.02	–	By-product from smelting of copper
Fly ash	30.0	58.0	Coal-based thermal power plants
Kiln dust	1.6	–	Cement plants
Lime sludge	3.0	4.8	Sugar, paper, fertilizer, tanneries, soda ash, calcium carbide
Phosphogypsum	4.5	11.0	Phosphoric acid plant, ammonium phosphate
Red mud/bauxite	3.0	4.0–4.5	Mining and extraction of alumina from bauxite
Lime stone	–	50.0	–
Iron tailings	–	11.25	–
Total	77.14	147.05	

Source: UNEP (2001); MoEF, New Delhi

accumulated waste in the country is of the order of 250 million tonnes (TIFAC 1999). Though there is no inventory for solid waste generated from marble and granite mining and processing, these wastes are serious environmental hazards. At present these are disposed at the mining and processing sites and adversely affect the fertility of the soil, contaminate the water bodies, and block drainage system, besides causing serious air pollution and associated occupational hazards.

Industrial Hazardous Wastes

Countries differ both in terms of defining hazardous wastes and in identifying the types of wastes that qualify as hazardous. These differences largely arise from variations in institutional and legal frameworks. Since most countries in the region are signatory to the Basel Convention, their definition of hazardous wastes closely follows that listed under the Convention. The annual hazardous waste generation in some countries of the region are presented in Table 10.5.

Table 10.5
Quantity of Hazardous Wastes

Country	HW quantity (tonnes per year)	Kgs per person per year
India[a]	4.4 ¥ 10^{6a}	4.6
Iran	8.0 ¥ 10^4	1.2
Pakistan	3.7 ¥ 10^5	3.0
Singapore	7.0 ¥ 10^4	23.0
Sri Lanka	5.4 ¥ 10^4	3.0
Taiwan	1.5 ¥ 10^6	68.0
Thailand	2.8 ¥ 10^6	45.0
Vietnam	2.8 ¥ 10^3	4.0

Sources: IGPA (2002); [a]MoEF (2000)

While per capita waste generation in India is lower than some of the other more industrialized countries in the region like Singapore and Taiwan, the impact of poor waste handling may be more critical in the country due to the wide geographical spread of industrial units, potentially leading to region wide impacts.

Major hazardous waste generating industries in India include petrochemicals, pharmaceuticals, pesticides, paint and dye, petroleum, fertilizers, asbestos, caustic soda, inorganic chemicals, and general engineering industries. Around 80 per cent of total hazardous waste in the country is generated from Maharashtra, Gujarat, Tamil Nadu, UP, and Rajasthan with Maharashtra topping the list (Figure 10.3). Karnataka and AP also contribute substantially to HW in the country.

The present waste inventory, however, does not include hazardous wastes generated from industrial units located in free trade zones which are not registered with state pollution control boards (SPCBs) and waste generated from activities like ship breaking, waste imported for recovery, waste disposed at illegal dumps, and present stockpile within the industries. It is expected that ship breaking at Alang (in Gujarat) alone generates around 4000 tonnes of waste every year (Box 10.4).

Another upcoming source of hazardous waste in the country is electronic waste generated when items such as computers, mobile phones, batteries, and other household electronic items are discarded at the end of their useful life. It is one of the fastest growing segments of waste in India as well as in the other parts of the world (UNEP 2004). Between 1995 and 2000, the Indian IT industry recorded a compounded annual growth rate of more than 42.4 per cent, which is almost double the growth rate of IT industries in many developed countries (Toxics Link 2003). It is reported that e-waste worth US$1.5 billion was generated in India in the year 2003 alone (UNEP 2004). E-wastes contain lead, cadmium, mercury, etc. which are environmental and health hazards.

Import of Hazardous Waste

The import of hazardous waste for recycling/recovery of resources is yet another major source of hazardous waste in the country. As per the Report of the High Powered Committee on management of hazardous waste (CPCB 2001), despite India being a signatory to Basel Convention, wastes came into the country till 1995–6 from USA, which has not ratified the Convention and is not party to it. Wastes also landed in India during this period from OECD countries through intermediary ports that are not a party to the Basel Convention and act as centres for transhipment of hazardous wastes from advanced countries. Such waste comprises slag, residues, scrap, ash, and alloys of lead, aluminium, copper, and zinc. Some of the plastic waste and cables are also identified on import list. However, the Supreme Court banned the import of hazardous wastes in 1997. The HWM (Hazardous Waste Management) Rules Amendments of 2003 (schedule 8) also

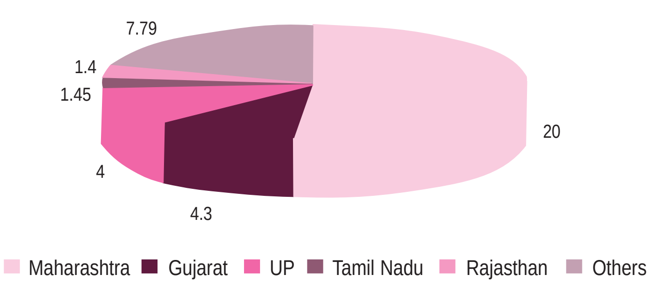

Fig. 10.3 Generation of Hazardous Waste in Selected States in India

Note: Waste generation is measured in lakh tonnes per annum (TPA)
Source: Estimates based on data provided by MoEF

banned import of wastes containing mercury, selenium, beryllium, arsenic, thallium, hexavalent chromium, cyanide, fluoride, and asbestos (dust and fibres). These imports are a matter of concern because most of the recovery/recycling is carried out either in the small scale or in the informal sectors not meeting the requirements of environmentally sound recycling/recovery norms.

Likewise, the disguised import of old computers and electronic accessories for material recovery is a matter of concern because of the informal nature of its recycling and recovery (at Bangalore, Hyderabad, Mumbai, and Delhi). Besides hazardous wastes, import of scrap for refining is also a recent concern due to possible presence of explosive ammunition in the waste (Box 10.5).

Box 10.4

Ship-breaking Activity at Alang, Gujarat

The ship-breaking industry disposes of old obsolete ships and recovers material and equipment for recycling. India is one of the major countries in the ship-breaking industry in the world. The ship breaking which was in 1960s confined to dismantling of small barges and coastal wrecks grew to full-fledged industry by 1979 when the Government of India recognized the activity as small-scale industry. This activity presently is carried out at following locations in the country.

- Alang and Sachana (Gujarat)
- Tadri and Maipe (Karnataka)
- Baypore, Cochin, and Azhical (Kerala)
- Vishakhapatnam (Andhra Pradesh)
- Valinokan and Tuticorin (Tamil Nadu)

The primary centres remain on the West coast at Alang and Sachana. Ship breaking generates resources such as re-rolling scrap, melting scrap, cast iron scrap, non-ferrous metals, machinery, and wooden articles. Currently, the ship-breaking activity produces around 2 million tonnes of re-rollable steel per annum. The industry also provides employment to around 40,000 people in direct and ancillary business. However, the industry also generates solid and hazardous wastes such as paint chips, scale produced during cutting of steel, ceramic tiles, glass wool and fibrous insulation material, oil sludge and waste oil, asbestos sheets, ropes, thermocole, plastics, fibre glass, linoleum, and sun-mica.

Currently, it's estimated that ship-breaking activity produces around 4000 tonnes of solid waste per annum. These wastes are disposed of on seashores and are potential health and environmental hazards to terrestrial and marine environments.

Source: CPCB (2001)

Box 10.5

Heavy Metal Scrap Trade in India

Heavy metal scrap (HMS) is being imported by the container load for decades, with the price depending on the origin and kind (disaster, war, quality) of waste. According to the Ministry of Finance, India imports between 10,000 and 12,000 metric tonnes of iron scrap every day at a cost of between US$250 and US$275 per metric tonne. Since it is not pre-sorted, it often contains live shells or explosives when sourced from war zones. Importers routinely sort the scrap for reusable or high value items including brass, copper wire, lead, and sometimes even re-usable equipment.

Danger of working with such scrap waste was first exposed on 30 September 2004 when 10 people died in an explosion at the Bhushan Steel Company in Ghaziabad, Uttar Pradesh. Since then, about 2000 explosive items, including 1000 cartridges, have been found in Chhattisgarh, Delhi, Gujarat, Maharashtra, Rajasthan, Uttar Pradesh, and West Bengal. Of these, 700 were live rockets and missiles.

As a fire-fighting measure, the government tightened the norms for steel scrap import. According to the new guidelines, steel scrap can be imported in two forms—shredded and heavy metal. While shredded scrap can be freely imported through all ports in the country, heavy metal scrap imports are permissible only through six major ports that include Jawaharlal Nehru Port Trust, Mumbai, Kolkata, Vishakhapatnam, and Chennai. Customs and para-military forces will scan all scrap import containers for the remains of ammunition and explosives. However, in order to avoid recurrence, there should be more effective implementation of norms, and scrap from war zone should best be avoided.

Source: News items in Times, New Network, Rediff.com, BBC, CNBC-TV 18

Hazardous Waste Recycling

Many materials that are disposed of either as hazardous or non-hazardous wastes have the potential to be reclaimed for another application. In some instances, contaminated liquid material may be of adequate quality to serve as solvent or cleaning material for less sensitive applications. The acid recovery process used by steel industry provides an example of the reuse of liquid waste stream. Iron scales are removed by an acid cleaning process referred to as pickling. The pickling liquor, which is a hazardous waste, can be used in neutralization and treatment of distillery wastewater. Solvents are the most common industrial wastes to be recycled.

The recycling of zinc, lead, and waste/used oil is carried out in India by both formal and informal sectors and is a source of major environmental and occupational hazards because of the use of improper technologies and working conditions. The three operations are regulated by central pollution control board (CPCB)/MoEF guidelines. Details of these three operations are discussed in the following sections.

Zinc

In India, the consumption of zinc is about 239,000 TPA. The primary production of zinc is about 142,000 TPA and secondary production is about 40,000 TPA. The demand–supply gap of about 57,000 TPA is met by secondary zinc producers using indigenous and imported zinc wastes (CPCB 2001). According to the HPC, however, there are no estimates regarding quantities of zinc waste available within the country. There are 20 secondary zinc units (production capacity 3000 tonnes of zinc ingots per month) and more than 200 zinc chemical units (zinc oxide, zinc sulphate, zinc chloride, etc.). Most of the secondary zinc units use both mechanical and electrolytic methods while some units recover zinc from zinc ash by mechanical methods and sell fines (mainly 50–60 per cent zinc oxide) to zinc chemical manufacturers (Boralkar and Biswas 2001). As of date there are 83 non-ferrous metal recyclers registered with CPCB/MoEF. The solid wastes generated from secondary zinc recycling are not usually handled properly causing soil and groundwater contamination.

Lead

The current demand for lead in the country is around 161,000 TPA of which around 50 per cent is met through imports. Spent battery scraps are the source of 80 per cent lead that is recycled in the country (CPCB 2001). The average life cycle of a typical lead acid battery is three to four years after which the lead, plastic casing and sulphuric acid from the exhausted battery can be recovered and reused. There are about seven medium-size secondary lead plants (total capacity 55,000 tonnes per year), 40 small operations (total capacity 15,000 tonnes per year), and more than 250 tiny/backyard plants (estimated combined capacity 25,000 tonnes per year). Generation of dust during manual breaking and crushing of batteries, and preparation of charge for smelting pose occupational hazards in informal secondary lead processing. Also drainage of untreated sulphuric acid causes contamination of soil and groundwater. At present there are about 52 lead recycling units registered with CPCB/MoEF as re-processors using environmentally sound technology/processes in the country.

Waste oil

Oil that has become contaminated with hazardous materials may require disposal as hazardous waste. For instance, used motor oil can be a dangerous pollutant due to the presence of high content of heavy metals (lead, zinc, copper, cadmium, chromium, nickel, etc.) and high concentration of PAH (poly-aromatic hydrocarbons) such as benzopyrenes that are carcinogenic in nature.

This oil is currently reclaimed in India either using acid bleaching by the informal sector or using vacuum distillation by the more organized sector. The HWM Rules of 2003 make it mandatory for used/waste oil industry to apply for environmentally sound technologies for the re-refining and recycling of waste oil. As a result, the quantity of waste/used oil recycled in the country went down from 49,000 tonnes per annum in 1991–2 to 10,000 tonnes per annum in 1996–7. As of date, around 32 recyclers are registered under this recycling programme.

Environmental Impact of Industrial Waste

Improper storage, handling, transportation, treatment, and disposal of industrial waste can adversely impact the environment. Heavy metals and certain organic compounds are phytotoxic and can damage plants and contaminate soil and groundwater. There have been several instances of contamination of surface and groundwater sources. For example, uncontrolled release of chromium-contaminated waste water and sludge resulted in contamination of aquifers in the North Arcot area in Tamil Nadu. These aquifers can no longer be used as sources of drinking water. The Thane Creek in Maharashtra is one of the most polluted seawaters in the country owing to the pollution caused by the discharges from Thane–Belapur industrial area. Yet another example is the Ahmedabad–Vadodara–Surat industrial belt, which has over 2000 industrial units in the organized sector and more than 63,000 small-scale units manufacturing chemicals like soda ash, dyes, yarns, and fertilizers. Most of these units usually dump their wastes in low-lying areas within a radius of 2 km, as a result of which a major illegal dump yard has sprung up on the banks of river Daman Ganga (Shankar et al. 1994). Industrial operations in small-scale dyestuff manufacturing facilities in Rajasthan also caused extensive soil and groundwater contamination by indiscriminate disposal of waste water and sludge (Box 10.6).

Gaps in regulatory management of industrial waste

The major issue connected with IE in India is the unplanned establishment of industries without infrastructure facilities for liquid and solid waste disposal. Siting criteria are not followed in the majority of the cases and many units are located within the municipal areas. A profusion of industrial activities is spread throughout the cities creating health and pollution-related problems. This is usually compounded by the absence of proper zoning laws (or more often, lack of enforcement of existing zoning laws or guidelines) (Jaitle and Varshney 1994).

In India most of the industries within industrial zones, are primarily small and medium enterprises and as a result, waste generation is usually low, therefore establishment of individual treatment facilities is not feasible. However, in cases where Common Effluent Treatment Plants (CETP) have been established, most of them fail to deliver the appropriate performance levels on account of the fact that the quality of effluents is complex and varied across industries. There are functional and operational difficulties associated with their operation and maintenance. The failure of CETP at Vapi Industrial Estate, one of the biggest and diverse IEs in India, demonstrates the issue suitably (Box 10.3).

Gaps in management of industrial estates

The set of environmental rules and regulations in India is very stringent, complex, and difficult to comply with given even the best available indigenous technologies. The impetus to adopt cleaner technologies and waste minimization techniques is hardly present, with the inclination towards a command and control regime. Most of the important environmental regulations such as Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Act, 1977, Air (Prevention and Control of Pollution) Act, 1981, Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, and Environment Impact Assessment Notification, 1994, pertain to operation and maintenance activities of individual manufacturing facilities. However, there are hardly any specific standards laid down for overall environmental performance of IE (Dalwadi 2000). In such circumstances regulatory agencies are unable to enforce collective action, especially for wastewater treatment and solid/hazardous waste disposal and penalties are usually enforced upon the individual non-confirming units. Besides formulating specific standards for the IE, there is also a need for regulation to create institutions, which on behalf of industries could be held accountable for management of common infrastructure facilities and environmental monitoring of the pollution abatement measures to ensure necessary performance and compliance (Box 10.7).

Box 10.6

Land Contamination by Toxic Waste

During 1988–9, M/s Silver Chemicals and Jyoti Chemicals located at Village Bichhri in Rajasthan were engaged in production of about 375 tonnes and 20 tonnes of H-acid (a naphthalene sulphonic acid based azo dye), respectively. This resulted in some 8250 cu m of wastewater and some 2400–2500 tonnes of process sludge. The toxic wastewater was let out without treatment and the process sludge was dumped on the plant premises. The wastewater flowed through Udaisagar canal across the entire region while rainwater washed the sludge across the soil into the groundwater. An official survey indicates that groundwater up to 70 feet (21.3 metres) below the ground level had been contaminated over an area of 7 sq km, affecting 8000 people in seven villages. The National Environmental Engineering Research Institute, Nagpur, studied the extent of contamination in this area and reported that an amount of Rs 44 crore will be needed for rehabilitation of 350 hectares of contaminated land.

Recently, the Hindustan Lever Limited owned unit at Kodaikanal manufacturing mercury-based thermometers was found to be dumping mercury-contaminated glass waste in and around the site and was closed by the order of Tamil Nadu Pollution Control Board in 2001. It is reported that even 1/70th of a teaspoon of mercury can contaminate a 25-acre lake and render the fish unfit for consumption. The company has now agreed to dig all the contaminated soil and glass waste and ship them to US for safe recovery and disposal of mercury.

Source: Sharma and Bannerji (1996) and IANS (2003)

Box 10.7

Management Failure at Narela Industrial Estate, Delhi

The Narela IE in the state of Delhi was initially well planned and designed with appropriate infrastructure to deliver excellent environmental performance. However, on account of mismanagement and lack of initiative by relevant stakeholders, the estate today depicts a despoiled state of environment posing a serious threat to the health and welfare of the local inhabitants. Effort to mitigate further detrimental effects would require appropriate environmental management and adequate foresight to limit the unplanned industrial growth in the estate.

Source: Kapoor (1998)

The existing end-of-pipe approach fails to capture the advantages of the preventive approach in environmental management of IE, which depends as much on good initial planning as on the good operation management practices followed on a day-to-day basis. Even if certain pollution control responsibilities are delegated to SIDCs, enforcement is often ineffective. Environmental control approaches for IE differ from those developed for individual companies. Problems in IE have to be resolved on a collective rather than an individual basis (UNEP 1997). Industries within an estate generate large quantities of effluent, air emissions, and solid/hazardous wastes, which have to be controlled within the IE confines. Air emissions are more or less controlled by industries adopting individual abatement measures. Building of CETPs in IE takes care of wastewater treatment to an extent but often the varied nature of effluents affects the efficacy of the treatment process (CPCB 1989). Despite treatment to bring effluents in line with conventional standards the total pollution load (air plus water) may overwhelm the assimilative capacity of the region. Availability of land within an estate for solid waste disposal is another recurring problem. Wastes dumped outside the estate pose health hazards to neighbouring townships and communities. Most manufacturing processes involve chemicals of some sort. In the closed confines of an estate, if adequate safety precautions are not taken, fire and explosion hazards and oil spills can lead to serious consequences.

Besides gaps in environmental regulation, there also exists lacunae in the planning process. The sites for industrial estates are selected without an assessment of potential risks to the surrounding ecosystems and communities. There are also no clear guidelines for Environmental Impact Assessment (EIA) of industrial estate sites and are presently limited to individual manufacturing facilities. In most of the cases, there is no conscious effort to address questions associated with the quality of life of the inhabitants in the surrounding areas.

Various problems arising out of unplanned industrial estates can be broadly categorized into economic, environmental, social, and health hazards. An integrated approach is necessary to bridge the regulatory gaps and ensure sustainable solutions to the environmental consequences of economic and industrial development.

Emerging Techniques to Measure Quality of Urban Environment

Ecological Footprint Approach

Although much qualitative work has been done to assess sustainability in urban areas, few quantitative measures exist. One of the more interesting quantitative techniques to emerge is Ecological Footprint or Appropriated Carrying Capacity Analysis. Developed by William Rees and Mathis Wackernagel, this technique measures the land and resources a society consumes in order to sustain. The ecological footprint of a region is the area of productive land required to provide all the energy and material resources consumed and to absorb all of the wastes discharged by the population of the region using current technology, wherever on earth that land is located (Wackernagel and Rees 1996). Small or decreasing per capita ecological footprints indicate that the region is moving towards sustainability, while those that are inordinately large or rapidly growing indicate just the opposite. Urban areas can use ecological footprint analysis as a yardstick against which the impact to sustainability of future developments and growth can be measured[8].

Eco-footprinting starts from the premise that modern human beings are integral components of the ecosystems that support them and therefore still very much dependent on 'land'. The method also explicitly recognizes a) that whether one consumes locally-produced products or trade goods the 'land' connection remains intact, however far removed from the point of consumption that land may be, and; b) that no matter how sophisticated our technology, the production/consumption process requires some land- and water-based ecosystem services.

Eco-footprint analysis thus incorporates the trade and technology factors simply by inverting the standard carrying

[8] *http://www.ecouncil.ac.cr/rio/focus/report/english/footprint*

capacity ratio: rather than asking what population can be supported by a given area, eco-footprinting estimates how much area is needed to support a given population, regardless of the location of the land or the efficiency of relevant technologies. Eco-footprinting is further based on the fact that many material and energy flows (resource consumption and waste production) can be converted into land- and water-area equivalents. A complete eco-footprint analysis would therefore include both the area the population 'appropriates' through commodity trade and the area it needs to provide its share of certain free land- and water-based services of nature (for example, the carbon sink function).

The area of a given population's eco-footprint actually depends on four factors: the size of the population, the people's average material standard of living, the productivity of the land/water base, and the technological efficiency of resource harvesting, processing, and use. Regardless of how these factors interact, eco-footprinting represents critical 'natural capital' requirements of the study population in terms of corresponding productive land and water area. We can also think of the ecological footprint as representing the extended 'patch' (productive habitat) occupied ecologically by the study population.

These findings when available for all habitats in large numbers should alter our perceptions about many things. To begin, they should change how we think about cities and urban land.

Eco-footprinting enables us to quantify the extent of this urban 'parasitism'. The dependence of urbanization can be gauged from a few studies available of different cities. In 1996 Canada's largest city, Toronto, had a population of approximately 2.39 million people living in an area of 630 sq km. Toronto's citizens had an average ecological footprint of about 0.08 sq km. Thus the ecological footprint of Toronto was 184 thousand sq km, or about 290 times the size of its then political area. Most of the city's supportive ecosystems are located at great distance from the people they sustain; indeed, they are scattered all over the planet.

This situation is characteristic of high-income cities. In a comprehensive analysis of the 29 largest cities of Baltic Europe, it was estimated that these cities appropriate for their resource consumption and waste assimilation, an area of forest, agricultural, marine, and wetland ecosystems 565 to 1130 times larger than the areas of the cities themselves (Folke et al. 1997). A study for the International Institute for Economy and Development in London shows that the biophysical demands of that city alone appropriate an area scattered around the world equivalent to all the ecologically productive land in the UK. A study of the city of Manali, India is an eye-opener. Manali which had an ecological footprint of 17.37 sq km in 1971 increased to 33.31 sq km in 1995 (Cole 1999).

Green Accounting

If environmental resources are free, they will be abused and over-used. Green accounting has germinated from the belief that environmental protection will cost more in the future. If global phenomena like the greenhouse effect are to be effectively tackled, now is the time to start.

Defining Green Accounting

Green Accounting, also referred to as natural resource accounting or environmental accounting, is a system in which economic measurements take into account the effects of production and consumption on the environment. It specifically takes into account the depreciation of natural resources and the environment while estimating net domestic product or net national product[9].

The concept dictates that natural resources, such as minerals, soils and forests, have an economic value. This is called natural capital, to be distinguished from manufactured capital such as roads, factories, and machinery. Until recently, changes in natural capital were not given money values, nor included in cost–benefit and other forms of economic analysis. Changes in manufactured capital, construction and depreciation, have always been considered in both financial and economic analysis.

In fact, natural resources have been priced only in terms of their cost of use: minerals were priced only at the costs of extracting them, forests at the logging costs. In the case of soils, these were treated as the 'land' factor in classical economics, priced at the market value of farmland. In effect, the capital value of the resources themselves was priced as zero. It was assumed that they were so abundant as to have no scarcity value. This has led to some gross distortions in the apparent creation of wealth. Minerals are extracted, or forests cut down, and the money received from their sale is treated as national income. The decrease in the reserves of minerals or area of forest does not appear in the accounts. Wealth appears to have been created, based on the 'free' natural resources (Box 10.8).

Initiatives towards Green Accounting in India

National Income accounting in India overlooks vital components of national wealth like changes in the quality of health, education, and changes in the quality and extent of India's environmental resources.

Efforts towards correcting the conventional GDP and developing alternative measures of growth have been increasing in India since the 1990s. The need for Green Accounting

[9] *http://www.gwagner.net/work/green_accounting.html*

Box 10.8

Natural Resource accounting in the Yamuna-basins

This project was sponsored by the Ministry of Environment and Forests and was undertaken in collaboration with several institutes by TERI. The Yamuna sub-basin consists of Delhi, almost the whole of Haryana, a very small part of Himachal Pradesh, a thin north-eastern section of Rajasthan, and a thin western section of Uttar Pradesh. The task consisted of several aspects.

(i) Assessing the impact of agricultural activities on soil: the objectives were to examine different agricultural activities; their impact on the soil resource, and develop physical accounts for soil degradation. It was observed that the area under forest has remained more or less constant at 2 per cent of the total geographical area since 1970s. Thus, the extensive impact of agricultural activities was not considered in this study. Physical accounts were developed by estimating the physical impact of soil degradation due to faulty agricultural practices using the yield reduction factors. The severity of degradation has been viewed as low, medium and high. Each severity class was associated with a certain level of decline in productivity of soil. The severity values for each type of soil degradation reported in the study area and the average yield of crops were used to estimate the loss of agricultural production.

(ii) Accounting for minerals where the objective was to prepare the physical and monetary accounts for 13 minerals. The monetary accounts required estimating the economic value of depreciation of the mineral resource. The physical and monetary accounts were prepared for the 13 minerals. The study used the Net Price Method and the User Cost Approach for calculating the depreciation allowance for all the minerals. The present value method was also used partially for 3 minerals only.

(iii) Estimating exposure to air pollution and health, that is, to assess the exposure to and health impacts of air pollution in the Yamuna river sub-basin. Exposure assessment component of the study formed a part of the broader objective to value the damage in economic terms caused by air pollution on human health. The main independent variable from the environmental side was chosen to be the daily-integrated exposure of each target population. Time budget information and concentration of the pollutant in various micro-environments were used to compute daily integrated exposure. It was observed from the study that urban, slum housewives were among those at the highest risk of exposure followed by female, urban and slum worker and slum marginal worker while the rural old people are least exposed to Respirable Suspended Particulates (RSP). Urban and slum housewives are the maximum exposed to carbon monoxide.

(iv) Finally, accounting for energy and emission. The objective here was to estimate at the district level, accounts for energy consumption and emissions of air pollutants. The pollutants considered were particulate matter (SPM), carbon monoxide (CO), hydrocarbons (HC), nitrous oxides (NO_x), sulphur dioxide (SO_2), and lead (Pb). The sectors for which the energy and emissions accounts were estimated were power, domestic, transport and industry. The first step in the accounting process was to make an inventory of different sources: Transport, Industry, Domestic and Power. Then energy consumption by each of these resources was estimated and emission factors were applied to estimate emissions. If these sources had pollution control devices, then the efficiency of the pollution control devices was taken into account.

and its integration into the system of national accounts has been emphasized in various policy documents of the MoEF. The ministry has gone from the development of a framework preparing such integrated accounts for India in 1993 to emphasizing on the need for implementing the Green Accounting system in the country in the draft National Environmental Policy 2004 (*Economic Survey 2004–5*).

One of the main problems in taking a rational decision on natural resource use is the lack of an appropriate information system and a methodology for natural resource accounting. As a result, the depletion of the national asset base is simply not taken into account while evaluating alternate strategies. This is now being rectified. The Central Statistical Organisation (CSO) launched a pilot project on Natural Resource Accounting in Goa in April 1999. Meanwhile, an Action Plan for the preparation of Natural Resource Accounting and estimation of Green Accounting in the country has been prepared by an Expert Group. Currently CSO has convened a methodology study to develop a framework for natural resource accounting in various resource sectors. As part of this larger study TERI is working on natural resource accounting of the minerals sector. The other institutions working towards developing a uniform framework for natural resource accounting are the Institute of Economic Growth (IEG, Delhi) on air and water resources, Indian Institute of Forest Management (IIFM, Bhopal) and Centre for Multi-disciplinary Development Research (CMDR, Dharwad) on land and forestry sector. Besides these, a number of organizations are involved in the efforts for greening the accounting system of India at various scales (Boxes 10.8 and 10.9).

Green accounting at the city level

While there are some preliminary efforts towards green accounting at the national and state levels, there is virtually no framework to incorporate it at the city level. India forms a part of the global trend towards increasing urbanization in which more than half of world's population will be living in

Box 10.9

Greening of GDP

One of the first projects in India on natural resource accounting, completed in 1994 called 'adjusting gross domestic product for depreciation of coal, soil, and forests' was developed by TERI. This study provided perhaps the first empirical estimates of natural resource degradation in India. The study estimated the value of depletion of coal, forest, and soil reserves in the country.

In an ongoing effort by the Green Accounting for Indian States Project (GAISP), Green Indian States Trust (GIST), a Chennai-based NGO developed the green report in which proper accounting of forest resources was done[a]. Under GAISP, the value of timber, carbon, fuelwood and non-timber forest products in India were studied to evaluate the gross state domestic product and a monograph for the same was prepared and published. According to GAISP, states should use Environmental Adjusted State Domestic Product (EASDP) to evaluate the Net State Domestic Product (NSDP) since it takes into account changes arising from environmental degradation. The gap between NSDP and EASDP indicates the extent of environmental degradation caused by economic activity like illegal logging. According to the Green Accounts report, if the ratio of EASDP to NSDP is less than one, the economy is doing well in terms of environment. But if it is higher, then it means that economic growth has come at the expense of environmental degradation in these states.

There have also been several efforts towards developing natural resource accounting for the forestry sector in India. Accounting for forest resources in the Yamuna basin was undertaken by Kanchan Chopra and Gopal Kadekodi from Institute of Economic Growth in 1997. In December 2001 Institute of Economic Growth again under Kanchan Chopra, B.B. Bhattacharya and Pushpam Kumar has calculated the contribution of forestry sector to GDP in India. TERI followed this up with 'Natural resources accounting in the Yamuna sub-basin' in which it prepared accounts for minerals, energy, and emissions; assessed health impacts of air pollution; and analysed the environmental impact of agricultural activities. The other participating institutions in the project were National Environmental Engineering Research Institute (NEERI), Institute of Economic Growth (IEG), Centre for Atmospheric Sciences (CAS) in IIT (Delhi), Indian Institute of Public Administration (IIPA), Operations Research Group (ORG, Vadodara), Centre for Interdisciplinary Studies of Mountain and Hill Environment (CISHME, Delhi University), World Wide Fund for Nature and Kalpavriksh (New Delhi).

Note: [a]*http://www.infochangeindia.org/features255.jsp*

cities and towns in the near future. It is important to note that the contribution of urban sector to GDP is currently expected to be in the range of 50–60 per cent. Cities hold tremendous potential as engines of economic and social development, creating jobs and generating wealth through economies of scale. They need to be sustained and augmented through the high urban productivity for the country's economic growth. Green accounting is a necessary step at this stage towards sustainable development. It provides indicators of loss of natural resources, changes in environmental quality and their consequences for long term economic development.

Undoubtedly, the preparation of green accounts is a vast exercise at the city level and cannot be completed in a short timeframe. However, it is important to establish a framework and baseline data for the present state of the environment in our cities so that one can periodically assess how the quality of environment has changed in terms of air, water, soil, biodiversity, and exhaustible resources. The framework chosen should be able to integrate these accounts with accounts at the city level and put this framework in the context of economic activities in different sectors.

This framework besides accounting for the existing natural resources like air, water bodies, soil and other non-renewable resources should also account for environmentally degrading processes and services. This would include the emission factors for the transportation sector, industrial effluents and their disposal practices, wastewater disposal, sewage disposal and solid waste management practices for the city as a whole.

It may not be possible nor necessary to do green accounting every year, the way it is done for conventional city level accounting. The quality of many resources change slowly. The periodicity of green accounting efforts has to be determined separately for different resources. Some indicators may be accounted every year whereas others every five years. Similarly, fast growing cities such as million plus or class 1 cities might be required to do green accounting more often than class 5 and class 6 cities which have a slow rate of urbanization. Needless to say, this is a complex exercise that will involve a host of organizations across the country. It is necessary to take affirmative steps to sensitize urban dwellers as well as policy-makers. Achievement of this target would be an important milestone in the broader target of preparation of green accounts for every settlement in the country.

Developing a framework at the city level

Although there has been wide consensus that preparation of green accounts is important, there has been no consensus on how to do it at the city level. Some of the approaches advocated for preparing green accounts at the national level can be grouped under four headings. These are: (1) pollution expenditure accounting; (2) physical accounting; (3) development of green indicators; and (4) extension of the System of National Accounts (SNA).

The environmental consequences of the various economic activities in the cities affect the different natural resources, their qualities as well as their amounts. Presently, the conventional economic accounts for a city provide a description of commodities and services in different uses, input in production of goods and services (intermediate uses) and final uses such as private consumption, public consumption, investment and exports. These add up to the city's output and imports. Along with the flows of commodities and services, are the flows of income generated in the process of production as value added in terms of wages, profits and rents and disposal for various final uses. To integrate these accounts with the green accounts, the emissions and effluents associated with the various economic activities of production and consumption should also be considered. Besides this, the preparation of sectoral detailed accounts for the resources of interest should be ensured.

The main natural assets at the city level which are of interest are land, water, air, biodiversity and various exhaustible resources such as oil, coal, gas, other minerals and ores, etc. The major steps that are missing in the conventional accounting system and can be useful for preparation of such accounts have been suggested. What qualities of each of these resources have to be included, how to measure them, how to summarize the consequences of change in their qualities, how to value them and their consequences on human welfare are all debatable topics which can either be adapted from the framework prepared for the national level or derived from extensive debates and discussions at city level forums.

For the production side, in the conventional economic accounts, those activities which produce the same output should be grouped together. Considering the environmental products, which get generated during production for accounting, the sectoral aggregation should be changed. This is because the scale of production may lead to different levels of emission and the techniques of production that is, the input uses and intensities also affect the associated environmental consequences. Thus, it is advisable to treat the large scale, medium scale, unorganized and small-scale sectors separately (Parikh et al. 1992).

The same arguments apply for the consumption side where a number of environmental changes take place in the process of consumption. These environmental effects depend not only on the level of consumption but also on the mode and manner of consumption. This can be explained by the fact that pollution per capita caused by public transportation is much less than that by car. Similarly, cooking done by LPG causes less emission than cooking with kerosene, wood, or dungcakes.

In addition to the sectoral disaggregation required due to scale and technique of production, inputs provided by natural resources can also be separated. For example, fuelwood, gathered wood such as lops and tops and agricultural residues may need to be separately accounted for as their use may have consequences for deforestation.

Valuation of each of these resources may require surveys as well as methodological research. The basis for valuation of a natural asset depends on its use and the service it provides. Often a natural resource may provide a service that is not so easy to value. Thus, the first step in valuation is to identify the services that the various assets provide. For example, a piece of land can be used for cultivation, for building a house, for a playground etc. A change in the quality that affects its suitability for a particular use can be used to assess the change in the value of the asset.

Integrated environment and green accounting, therefore, attempts at accounting for both socioeconomic performance and its environmental effects and integrating environmental concerns into mainstream economic planning and policies. Such integrated accounts can be useful in assessing the sustainability of economic growth and also the structural distortion of the economy by environmentally unsound production and consumption patterns. Such accounting can alter our perception of what kind of development is desirable and in turn, the policy choices we make.

Performance Measurement Tool for Urban Local Bodies

Urban local bodies in India provide services to cover the most basic human needs: drinking water, sanitation, waste management, street lighting, housing, roads, and health care. There is significant room for improvement in their overall governance. They must also respond adequately to new challenges posed by the rapidly changing urban scenario.

The Ministry of Environment and Forests and United Nations Development Programme have engaged TERI to develop a framework called USERS (Urban Services Environmental Rating System). The aim of this project is to measure the performance of a municipal body with respect to its service delivery in urban areas through a set of performance indicators that are benchmarked against set targets. The urban local bodies of Kanpur and Delhi have been identified as pilot case studies (Box 10.10).

The concept of performance measurement (PM) and benchmarking of the quality of service delivered by an urban local body is a new tool that is being introduced in India. Therefore, certain efforts would have to be made to develop the concept further and replicate the framework in other cities. There are a number of instruments for promoting, developing, and sustaining the concept of PM systems in local governments. One approach is to use legislative and regulatory mechanisms. Alternately, market-based financial instruments could be used to induce city governments to adopt PM. A third approach involves community-based pressure groups.

Box 10.10

Pilot Case Studies of Kanpur and Delhi

The objective of the study is to address the problem of environmental degradation in urban areas by empowering urban communities with information, which would foster the emerging trend towards transparency and accountability. The idea is to provide policy-makers/implementation agencies with an analytical tool, which would enable more informed planning/decision making and develop and disseminate a rating system for the environmental aspects associated with the operations of urban agencies involved in water supply, solid waste and sewerage management.

Measuring the performance of a local government body is a very worthwhile but complex exercise. The basic thrust of PM is that there should be continuous monitoring of an agency's performance in all functional areas and operations. The basic premise of PM for local governments is that 'what gets measured gets done'. PM in the context of urban local bodies is determination of how effectively and efficiently a jurisdiction is delivering the public services of interest. It tells us not only how much is being done, but also to what efficiency, of what quality, and to what effect. A well-designed PM system, together with a supporting management information system, can go a long way in improving the efficiency and effectiveness of managers at all levels in an urban local body. The relevance of performance indicators for urban local governments derives from the fact that they pursue multiple objectives in a complex socioeconomic setting. The main components in the PM are related to input, output, efficiency and outcomes. For this study, inputs were measured in terms of amount of resources used and outputs as level of services provided or amount of work done. Efficiency relates outputs to inputs and outcomes indicating the degree to which programme objectives are achieved and measures value of services from the perspective of the end-user.

PM must necessarily be accompanied with performance benchmarking, otherwise it becomes difficult to judge how well or how poorly the agency is currently performing and what types of corrective actions are required. Performance benchmarks provide a point of reference for drawing conclusions from a PM exercise. Four alternate benchmarking approaches identified for this were technical standard, trend over a long period, comparison with best practices and comparison with pre-established targets.

Performance measurement indicators of urban services providers were measured in terms of management, technical and financial indicators. The performance measurement indices (PMIs) for water sector are outlined in Tables B10.10.1, B10.10.2 and B10.10.3.

Table B10.10.1

Management PMIs for Water Production

S. No.	Indicator	Unit	Type	Level	Frequency	Benchmark
1.	Average daily intake of surface raw water	MLD	Output	C	Weekly	Trend
2.	Average daily clear water production	MLD	Output	C	Weekly	Trend
3.	Average daily withdrawal by tube wells	MLD	Output	C, Z	Weekly	Trend

Note: C City; Z Zone; MLD million litres per day

Table B10.10.2

Technical PMIs on Water Quality Surveillance

Indicator	Unit	Type	Level	Frequency	Benchmark
At water treatment plants,					
a) Residual chlorine tests					
• Samples tested	No.	–	C	Weekly	Water quality standards
• Not satisfactory	per cent	Efficiency	”	”	–
b) Full chemical tests					
• Samples tested	No.	–	C	Weekly	Water quality standards
• Not satisfactory	per cent	Efficiency	”	”	–
c) Bacteriological examination					
• Samples tested	No.	–	C	Weekly	Water quality standards
• Not satisfactory	per cent	Efficiency	”	”	–

Table B10.10.3
Financial PMIs for Revenue Collection

S. No.	Indicator	Unit	Type	Level	Frequency	Benchmark
1.	Average revenue collected per unit of water produced	Rs	Efficiency	C, Z	Monthly	Comparisons
2.	Average revenue collected per unit of water sold	Rs	Efficiency	C, Z	Monthly	Comparisons
3.	Total revenue collected / total revenue demanded	–	Efficiency	C, Z	Monthly	Trend

It was thought that the agencies responsible for providing these services would not be in a position to implement all of the indicators at the outset. It was, therefore, proposed that the agency should implement these indicators in a phased manner. Based on the data collected from the urban local bodies of the pilot cities of Delhi and Kanpur at the central, zonal and sub–zonal levels, a benchmark was created. Figures B10.10.1 and B10.10.2 show the initial data graphically.

In order to capture level of existing services, a weekly MIS report giving details of piped water, tanker water supply, water quality surveillance and complaints was requested to be generated. This data is to be collected at ward level.

Pilot case studies show that PM tools for urban local bodies are not readily available and initial task is to get benchmark figures. Even within a city one measure cannot be used, as variation in service quality is quite large within a city itself. Hence, the task ahead for the PM exercise is to first establish the benchmarks for different areas and then measure improvements against those benchmarks.

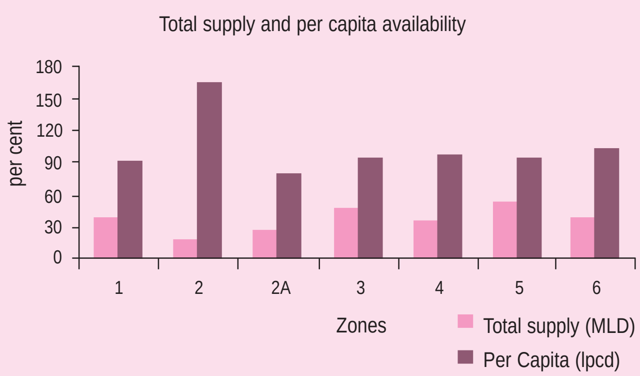

Fig. B10.10.1 Inter-zonal PM for level of water supply: total and per capita (lpcd)

Source: Kanpur Jal Sansthan

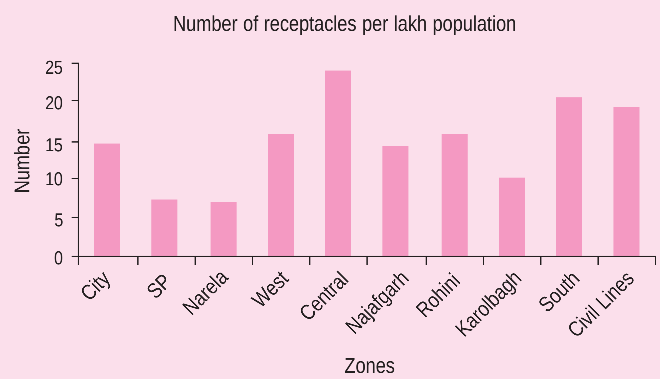

Fig. B10.10.2 Number of solid waste receptacles per lakh population

Source: Municipal Corporation of Delhi

Conclusion

On its onward path to economic development it is inevitable that urbanization in India should grow. The unintended cost of this is the deterioration of the environment. Degradation of the environment in urban areas is caused in part by changing patterns of lifestyle but more so due to neglect of proper disposal of refuse by households, industry and service providers such as hospitals and water services. Intermittent piped water supply is the main cause for pollution of drinking water. Ineffective treatment of waste water and industrial waste contaminates water bodies and land.

Our legal framework on air and water pollution needs to be expanded to the community level. Urban local bodies, which are entrusted with the responsibility to protect the environment and provide services are strapped for adequate financial resources as well as knowledge about treatment and disposal of refuse from various sources. Irony of the healthcare industry is that the industry which tries to improve health of an individual is not fully aware of the harm it causes to the environment through the disposal of untreated bio-medical waste.

Supreme Court intervention in limiting air pollution generated by public transport and government initiatives in using green fuels have improved air quality perceptibly in some cities. Awareness about sustainable economic development which includes environmental concerns is gaining ground and various tools such as ecological foot printing and green accounting are being developed to ensure that quality of air and water that we leave to our next generation is in a better condition than what we inherited from our past.

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