

Compliance with environmental legislations in Bangalore Metropolitan Region

Increasing population, rapid growth of industries and commercial activities in Bangalore have created tremendous pressure on its finite natural resources. Various legislations have been enacted to safeguard the precious resources and to improve the quality of life. A performance audit covering the period 2005-10 was conducted between May 2010 and August 2010 to verify compliance with the existing legislations and other instruments to prevent and control water and air pollution and to secure environmental safeguards in construction activities in Bangalore Metropolitan Region (BMR). The performance audit showed the following deficiencies.

- The Karnataka State Pollution Control Board had not drawn up any concrete action plan to address pollution related issues, leading to under-utilisation of available funds. The Board had unspent balance of ₹ 208.03 crore at the end of March 2010.
- The Board did not maintain a proper inventory of polluting sources and faced huge shortage of manpower. This resulted in ineffective identification and inspection of polluting units and facilitated operation of a large number of polluting units without installing pollution control systems.
- The existing sewage network covered only 40 *per cent* of BMR and the sewage treatment plants received only 47 *per cent* of the sewage generated. The remaining 53 *per cent* was discharged directly into storm water drains and lakes, contaminating the water bodies and ground water. The ground water quality in BMR was affected due to presence of pollutants in excess of permissible limits.
- Although concentrations of air pollutants continued to be high at many places in BMR, an effective plan to control air pollution could not be drawn up due to non-finalisation of source apportionment studies.

2.1.1 Introduction

Bangalore has witnessed a fast paced multifarious growth and development. Its population increased from 12 lakh in 1970 to 75 lakh and the vehicle population in the city increased exponentially over the years. The rapid growth of industries and commercial activities have created tremendous pressure on the finite natural resources. The increasing population has had an undesirable impact on water supply, sanitation, transport and management of waste in Bangalore. Air quality has also been badly affected. In recognition of the need for environmental protection, various legislations have been enacted to safeguard the precious resources and to improve the quality of life.

This review attempts to examine the operation of the safeguards in matters relating to water and air pollution and construction activities in Bangalore.

2.1.2 Organisational set-up

At the Government level, Additional Chief Secretary, Forest, Ecology and Environment Department assisted by Secretary, Ecology and Environment Department is responsible for coordinating various activities concerning ecology and environment, including monitoring of compliance with various environmental legislations. Karnataka State Pollution Control Board (KSPCB) headed by the Chairman and assisted by the Member Secretary and 15 other members enforces the environmental legislations relating to water and air pollution in the State. Eleven Regional Offices of KSPCB enforce these legislations in Bangalore Metropolitan Region (BMR). While Bangalore Water Supply and Sewerage Board (BWSSB) is responsible for water supply and sewerage services to the Bangalore City, Department of Mines and Geology (DMG) monitors ground water quality. Lake Development Authority (LDA) under the Department of Ecology and Environment is entrusted with the task of protection, conservation, reclamation, restoration, regeneration and integrated development of lakes in Bangalore.

While Government of India (GOI), Ministry of Environment and Forests (Ministry) issues environmental clearance (EC) for Category 2 'A' construction projects, the State Environment Impact Assessment Authority (SEIAA) is responsible for issuing EC for Category 'B' projects. The Ministry's Regional Office, Southern Zone, Bangalore (MRO) monitors the construction for which ECs are given by the Ministry and the SEIAA.

2.1.3 Audit objectives

The objectives of the audit were to examine whether:

- KSPCB utilised its financial resources economically, effectively and efficiently;
- the administration of Water and Air Acts by KSPCB and monitoring of air and water quality was efficient and effective in BMR and whether the environmental safeguards prescribed for construction projects/activities functioned effectively; and the institutional capacity of KSPCB was adequate to discharge its mandated functions.

2.1.4 Coverage, scope and methodology

Reviews on "Administration of Water Act" and "Implementation of Air Act" were included in the Report of the Comptroller and Auditor General (Civil) for the year ended March 2000 and March 2001 respectively. The Public Accounts Committee (PAC) in their Report No 10 of 11th Assembly (2002) had recommended several measures to be taken by KSPCB to mitigate the water pollution issues in the State. Performance Audit of "Waste (Solid & Biomedical) Management in Karnataka" was also included in the Comptroller and Auditor General's Report for the year ended 31st March 2008. The action taken by Bruhat Bangalore Mahanagara Palike (BBMP) on the recommendations made in the Report was verified. Action taken on the recommendations of the PAC was also verified. Audit of compliance with the provisions in the Water (Prevention and Control of Pollution) Act 1974, and Air (Prevention and

Control of Pollution) Act 1981 in BMR for the period 2005-10 was conducted during May 2010 to August 2010 by test-check of the records of Secretary, Ecology and Environment, KSPCB, BWSSB, LDA, DMG, BDA, BBMP and Commissioner of Transport. Besides, compliance with the environmental safeguards prescribed for construction projects undertaken in Bangalore was also verified through a test-check of the records of Secretary, Ecology and Environment, SEIAA, KSPCB and MRO. The audit commenced with an entry conference with the Principal Secretary, Forest, Ecology and Environment Department in May 2010 wherein the scope, audit objectives and criteria were explained. The audit comprised scrutiny of documents, discussion with officials and field visits and joint inspections. The audit findings were discussed with the Additional Chief Secretary, Forest, Ecology and Environment Department in 2.1.5 Action taken on PAC/Audit recommendations. PAC's recommendations, *inter-alia*, required the KSPCB to initiate the following measures to address water pollution related issues:

- Prepare annual action plan for implementing water pollution control programmes
- Identify and categorise industries and their monitoring, besides setting discharge standards
- Accord priority to enforcement of the Water Act
- Arrest uncontrolled growth of borewells in coordination with DMG and
- Install Sewage Treatment Plant as a pre-condition for the development of any private layout.

Except for the recommendation relating to installation of Sewage Treatment Plants in private layouts, none of the other recommendations had been acted upon as also discussed subsequently in this review. In pursuance of audit recommendations on Solid Waste Management review, BBMP took up development of landfill sites over 370 acres allotted by Government, set up three solid waste processing units at Mavallipura, Mandur and Doddaballapura, involved Resident Welfare Associations, NGOs and ragpickers in segregation of wastes at Sanjayanagar and Hennur Banaswadi and planned door-to-door collection of waste in a phased manner. BBMP stated (August 2010) that public resistance to setting up of disposal sites hindered the effective implementation of the recommendations.

Functioning of KSPCB

2.1.6 Finance

The receipts of KSPCB consist of grants received from GOI, appropriations made by GOI under the Water Cess Act, fees collected from industrial units for issuing permits or consents for establishment/operation, interest on investments and other miscellaneous receipts. The receipts and expenditure of KSPCB during 2005-10 are given in Table-2.1.

Table-2.1 : Receipts and expenditure

Year	Grant-in-Aid from GOI	Receipts				Total Receipts	Expenditure	Closing balance
		Water Cess	Other Fees ³	Interest on Investment	Misc. Receipts			
2005-06	2.00	155.94	2,441.56	239.93	2.36	2,841.79	1,450.52	5,042.52
2006-07	5.00	147.36	2,665.19	327.36	98.25	3,243.16	2,089.34	7,628.96
2007-08	23.50	148.59	3,233.25	609.04	189.34	4,203.72	1,698.53	10,654.84
2008-09	36.34	203.44	3,326.72	887.03	335.55	4,789.08	2,057.46	15,815.44
2009-10	13.87	88.00	3,618.22	1,470.22	136.54	5,326.85	2,722.87	20,803.36
Total	80.71	743.33	15,284.94	3,533.58	762.04	20,404.60	10,018.72	

Source: Annual Accounts of KSPCB

Out of ₹ 100.19 crore expended during 2005-10, ₹ 68.54 crore were spent on administrative expenses, ₹ 15.73 crore on creation of capital assets like land, building and office equipment and ₹ 15.82 crore on miscellaneous and maintenance including ₹ 4.98 crore on pollution related measures like laboratories, pollution awareness programmes, Spatial Environment Programme, Bio-mapping, National Air Monitoring Programme etc. Thus, only five per cent of the expenditure was spent on pollution control measures. Although the grants given by GOI and 75 per cent of the appropriations under the Water Cess Act are to be utilised on programmes and activities for the prevention and control of pollution, KSPCB had been accumulating funds year after year and investing these in Fixed Deposits. Out of these unspent balance of ₹ 208.03 crore, ₹ 121.01 crore had been invested in Fixed Deposits as of March 2010. KSPCB stated (August 2010) that savings were due to adoption of austerity measures in spending and inadequate staff. The reply was not acceptable as no austerity measures on spending had been prescribed by GOI. The Board had not drawn up any concrete action plan on its own to address the pollution related issues since inception, leading to under-utilisation of available funds.

2.1.7 Legal framework for pollution control

The following legal and regulatory instruments framed by GOI, empower KSPCB to enforce prevention and control of pollution of water and air.

- The Water (Prevention and Control of Pollution) Act, 1974 & Rules 1975
- The Water (Prevention and Control of Pollution) Cess Act, 1977 & Rules 1978
- The Air (Prevention and Control of Pollution) Act, 1981 & Rules 1982 and
- The Environment (Protection) Act, 1986 & Rules 1986.

KSPCB, *inter alia*, is entrusted with the following functions under these Acts and Rules:

- Planning comprehensive programmes for prevention, control or abatement of pollution of water and air and securing execution thereof

- Laying down location specific standards for (i) sewage and trade effluents and for the quality of receiving waters and (ii) emission of air pollutants into the atmosphere from industrial plants and automobile Inspecting (i) sewage or trade effluents, works, plants for the treatment of sewage and trade effluents and (ii) any control equipment, industrial plant or any manufacturing process, besides air pollution control systems for assessing the quality of air therein, and
- Collecting and disseminating information in respect of matters relating to water and air pollution

2.1.8 Regulation of pollution

KSPCB is to identify the polluting sources, prescribe the conditions for their operation and monitor the compliance by these sources under the Water and Air Acts.

2.1.8.1 Non-availability of a proper inventory of polluting sources

The Water and Air Acts require the KSPCB to plan comprehensive programmes for prevention and control of water and air pollution and secure the execution thereof. To discharge this function, knowledge of the polluting sources and an inventory thereof is essential. For this purpose, identification of the polluting sources and the type and quantity of pollutants discharged into environment is necessary. The resultant inventory is to form the basis for planning pollution reduction programmes. KSPCB did not conduct any survey to identify the polluting industries and also did not maintain any such inventory for planning purposes. Consequently, it did not draw up any comprehensive plan for preventing or controlling water and air pollution.

The inventory of polluting sources maintained by KSPCB was based on the industries applying for Consent for Establishment/Consent for Operation and others that came to light during the limited inspections conducted by its Regional Offices. Ineffective identification of the polluting sources enabled many polluting units to operate without obtaining the consent. The Chief Environmental Officer of the Board stated (September 2010) that staff constraints hampered effective identification of polluting sources. According to information furnished by KSPCB, 535 industrial units were operating without consent in BMR as of March 2010. KSPCB did not furnish information as to how long these industries had been operating without consent. A test-check of 30 consents issued for construction projects showed that seven projects, for which consents had expired in December 2008, continued to operate without renewal of consents (July 2010).

In order to secure the coordination of water pollution control efforts between departments such as Health, Agriculture, BWSSB, DMG, LDA, KSPCB *etc.*, a formal mechanism and means of co-operation and information exchange is essential. It was seen that no such mechanism had been set up and as a result, the ground water table declined alarmingly, water bodies were polluted and sewage and industrial effluents were inadequately treated as discussed below:

Industries operating in the catchment of a reservoir

Thippagondanahalli reservoir built in 1930 at the confluence of Arkavathi and Kumudavathi rivers, supplies 125 MLD of water to the city during normal monsoon. The increased development of industrial estates in the catchment area of the reservoir impacted water inflow, storage capacity and water quality due to untreated effluent discharge into these rivers. To protect the catchment of the reservoir from industrialisation, the Government had approved (November 2003) zonal division of the reservoir area and prescribed restrictions for setting up industrial units as shown in **Table-2.2**.

Table-2.2 : Restrictions for setting up industrial units

Zone	Area falling under the Zone	Restrictions for industrial development
1	Entire reservoir catchment	KSPCB not to issue any consent to any new industry, industrial operation, industrial activity or an extension or an addition thereto
2	Area within 2 km from the reservoir	
3	Area within 1 km from the river banks of Arkavathi and Kumadavathi	KSPCB to allow only those new industrial units listed in Green Category subject to adoption of rain harvesting systems and installation of waste water treatment plants
4	Area within 1 to 2 km from the river banks of Arkavathi and Kumadavathi	

Source: Annual Accounts of KSPCB

After KSPCB noticed operation of some industries in Zone 3, an inspection of the catchment area by a Committee appointed (May 2009) by the Principal Secretary, Department of Forest, Ecology and Environment was undertaken in June 2009. The Committee found that 46 industrial units (highly polluting-12, moderately polluting-6 and least polluting-28) were operating in Zone-3, besides 46 godowns, 12 layouts and three colleges. All these establishments had been set up in Zone-3 after issue of Government notification in November 2003. KSPCB stated (August 2010) that six industries had been closed, closure order had been issued for 31 polluting industrial units, three cases were pending with appellate authorities/court. Consent had been given to four units and applications for consent in 2 cases were pending. Records of the Board, however, revealed that 31 polluting industries for which closure orders had been issued between September 2004 and April 2010 continued to operate(August 2010). Unauthorised establishment and operation of a large number of industries in the catchment of the reservoir despite the ban, indicated failure of inventorisation of the polluting units by KSPCB in BMR. The State of Environment Report, Bangalore 2008 issued by the Department of Forest, Ecology and Environment observed that the number of industries registered with KSPCB accounted for only 10 *per cent* of the total industries in BMR and the number of actual polluters would, therefore, be greater. KSPCB replied (September 2010) that identification of polluting sources was not effective due to staff constraints.

2.1.8.2 Delay in issue of consents

Consents are of two types; Consent for Establishment (CFE) is sought for establishing a polluting unit while Consent for Operation (CFO) is required for operating the polluting unit. KSPCB is to issue consent to the potentially polluting operations. The principal steps leading to issue of consent by KSPCB are given in **Table-2.3**.

Table-2.3 : Steps for issuing consent by KSPCB

Action	Remarks
Submission of a formal application for consent by the polluter	The application for CFE or CFO is to be disposed of by KSPCB within 60 and 30 days respectively. Any consent, unless refused or given earlier, is deemed to have been given unconditionally on expiry of 4 months from the date of application
Advertisement ⁴	To enable public to comment/object
Technical consideration	To decide conditions if consent is to be granted
Decision	Taking into account comments/objections
Issue of consent	Consent is issued and entered in the register
Renewal of consent	After review on expiry of the period stipulated in the earlier consent

As of March 2010, 1,033 applications for CFO and another 168 for CFE received from April 2009 were pending with KSPCB. A check of 261 out of 1,201 pending applications showed that 220 applications for CFO and 41 for CFE were pending with KSPCB for periods ranging from 4 to 14 months as of August 2010. As a result, these cases were deemed to have been given consent unconditionally without the KSPCB having examined their merit. Thus, the important regulatory control of authorising/barring establishment of potentially polluting operations was not exercised effectively by KSPCB.

2.1.8.3 Irregular consents

According to Notification dated 14 September 2006 issued by the Ministry, Environmental Clearance (EC) is mandatory for eight categories of projects/ activities. These projects/activities are further grouped into two categories viz, Category A and Category B based on the spatial extent of potential impact and potential impact on human health, natural and man-made resources. While the Ministry is to issue EC for Category A projects, the State Environment Impact Assessment Authority (SEIAA) is responsible for issuing EC for Category B projects at the State level. Proposals for EC are to be submitted by the entrepreneur to the Ministry/SEIAA and work on the project is to commence only after EC is issued by the Ministry/SEIAA. Scrutiny of 50 CFOs issued by KSPCB during 2007-10 for projects operating in Bangalore showed that in five cases, work on the project was commenced without obtaining EC from SEIAA and KSPCB had issued CFO without insisting on EC. KSPCB replied (August 2010) that at the time of issuing CFO, it was ensured that the applicants were in the process of obtaining EC. As EC is a regulatory mechanism to ensure admissibility of a particular activity with remedial measures for the expected environmental impact, KSPCB's action of issuing CFO without EC in these cases showed that the controls

prescribed to ensure balance between development and environmental concerns were not effective in their functioning.

2.1.8.4 Non-Installation of Emission Control Systems by Industries

Section 21(5) of the Air Act requires that every person to whom consent has been given is to install air pollution control equipment in the premises where the industry is carrying on its operation and it is to be kept in good running condition. The position regarding industrial units working without Emission Control Systems (ECS) and those not complying with the standards out of the total 7,427 industrial units granted consents under the Air Act as of March 2010 is as shown in **Table-2.4**.

Table-2.4 : Industries working without ECS

(In numbers)				
Category of industries in Bangalore (Urban) with investment of	ECS installed & complying with standards	ECS installed but not complying with standards	ECS not installed	ECS under construction
More than ₹ 5 crore	1,015	5	27	156
₹ 1 crore to ₹ 5 crore	1,994	3	44	138

Source: Information furnished by KSPCB

Thus, 373 polluting units continued to operate without installing air pollution control systems. KSPCB stated (August 2010) that instructions had been given to industries where ECS were either not installed or were not complying with the standards. Operation of these industries without installing ECS indicated failure of the Board to enforce compliance by these units with the conditions imposed by it.

2.1.8.5 Non-installation of Effluent Treatment Plants

Section 25 of the Water Act envisages that every person to whom consent has been granted by KSPCB is to install treatment equipment in the premises where the industry is carrying on its operation and keep it in good running condition. The status of industrial units working without Effluent Treatment Plants (ETPs) and those not complying with the standards out of the total 8,029 industrial units granted consent under the Water Act is given in **Table-2.5**.

Table-2.5 : Industrial units working without ETPs

(In numbers)				
Category of industries in Bangalore (Urban) with investment of	ETPs installed & complying with standards	ETPs installed but not complying with standards	ETPs not installed	ETPs under construction
More than ₹ 5 crore	1,140	8	40	196
₹ 1 crore to ₹ 5 crore	1,593	11	89	160

Source: Information furnished by KSPCB

Thus, 504 industries continued to operate without treatment plants. KSPCB stated (August 2010) that the industries which did not install ETPs had been commissioned long back and notices were being issued to some of the chronic violators, besides initiating legal action in some cases. The action taken was not effective enough and these industries continued to contravene the provisions of the Water Act. Besides, KSPCB issued consents to such industries without ensuring compliance, thereby failing to discharge its duties as an enforcer.

2.1.8.6 Inadequate inspection of Industries

The frequency of inspection of industries prescribed (December 1999) by the Ministry varied according to the classification of the industries as Red (highly polluting), Orange (moderately polluting) and Green (least polluting). While the number of industries granted consent under Water Act in Bangalore was 8,029 (March 2010), those coming under the Air Act aggregated 7,427. KSPCB furnished category-wise details only for the industries covered by the Air Act as shown in **Table-2.6**.

Table-2.6 : Industries coming under Air Act

Category of industry	Number of Industries
Red	1,556
Orange	784
Green	5,087
Total	7,427

Source: Information furnished by KSPCB

The frequency of inspections of these industries prescribed by the Ministry is shown in **Table-2.7**.

Table-2.7 : Frequency of inspections

Category	Small Scale Industry	Large and Medium Industry
Red	At least once in a year	At least once in 3 months
Orange	At least once in 3 years	At least once in 6 months
Green	At least once in 3 years (random check)	At least once in 1 year

Source: Schedule IV of Notification dated December 1999

While prescribing the frequency, the Ministry also permitted the State PCBs to improve upon the frequency as might be necessary. KSPCB, instead of improving upon the frequency of inspections, reduced (November 2002) it for Orange and Green category industries as shown in **Table-2.8**.

Table-2.8: Reduction in number of inspections

Category	Small Scale Industry	Large and Medium Industry
Orange	At least once in 3 years	At least once in a year
Green	At least once in 5 years (random check)	At least once in 2 years (random check)

Source: Information furnished by KSPCB

As KSPCB's inventory of Red, Orange and Green categories of industries did not have information on the number of small, medium and large industries, the number of inspections to be undertaken by the

Board and the shortfall, if any, could not be assessed in audit. In the absence of this information, Board was also not in a position to determine whether all the polluting units were inspected at the prescribed interval. The number of inspections required to be conducted during 2005-10 for the industries under the Air Act even at the reduced scale fixed by KSPCB for small scale industries was 7,780, 784 and 5,087 for Red, Orange and Green categories respectively. Against this, only 186 air stack samples had been collected. KSPCB replied (August 2010) that it was a fact that there was requirement for more number of inspections than those carried out giving priority to complaints and red category industries. The reply of the Board is not acceptable as the mandate of KSPCB is to inspect the industries at the prescribed intervals and not to show only a reactive response. Further, any shortfall in assessing compliance meant a lost opportunity of measuring conformity by the industries with the standards prescribed. Audit observed that out of 2,162 industrial effluent samples and 30 air stack samples tested by KSPCB during 2008-10, 58 *per cent* of the effluent samples and 30 *per cent* of the air stack samples did not conform to the prescribed standards. As a large number of samples did not comply with the standards, the huge shortfall in inspection of industries assumes significance.

2.1.8.7 Environmental Statements

Section 14 of the Environment (Protection) Rules, 1986 lays down that every industry, operation or process requiring consent under Section 25 of the Water Act and Section 21 of the Air Act is to conduct environmental audit every year and submit an Environmental Statement to KSPCB by 30 September of the following year. Against 8,029 industrial units in operation in BMR, only 1,293 (16 *per cent*) had submitted Environmental Statements to KSPCB for the year 2008-09 (March 2010). KSPCB did not furnish the status of receipt of Environmental Statements for earlier periods. Non-receipt of Environmental Statements, besides evidencing poor enforcement, handicapped KSPCB in evaluating the policies, operations and activities of the industries and ensuring compliance with prescribed standards.

2.1.8.8 Research and Development

Although the provisions of the Water Act require KSPCB to research and investigate water and air pollution to evolve viable methods of prevention, control and abatement, KSPCB had neither taken up any research programme nor financed any research activity. KSPCB replied (August 2010) that it did not take up any such activity due to shortage of technical and scientific staff and that action was being taken to fill up the vacant posts.

2.1.8.9 Shortage of manpower

The pre-requisite for any sustainable development of the environmental resources is that organisations, assigned with the responsibility of managing and regulating the finite environmental resources, possess the capability to carry out this task. KSPCB's sanctioned strength as of March 2010 consisted of 251 technical posts comprising the cadres of Chief Environmental Officer, Senior/Deputy/Assistant Environmental Officer, 146 scientific posts consisting of Chief/Senior/Deputy/Assistant Scientific Officers

and Scientific and Field Assistants and 313 non-technical posts. Of these, 50 *per cent* of the technical posts, 67 *per cent* of the scientific posts and 62 *per cent* of the non-technical posts had remained vacant for five years. The existing sanctioned strength included additional posts (Technical Officers: 94, Scientific Officers: 85 and non-technical staff: 89) sanctioned by KSPCB in October 2005. Against this, KSPCB recruited only 12 scientific staff members and 32 members of non-technical staff and did not make any recruitment thereafter, despite increasing urbanisation and steep increase in the number of polluting industries. Eleven Regional Officers were entrusted with the compliance assessment of 8,029 industries in Bangalore Metropolitan Region. The staff composition of these Regional Offices in Bangalore showed that each Regional Office had only one Environmental Officer, one Deputy Environmental Officer, one Assistant Environmental Officer and meagre support staff. The distribution of industries under Red and Orange categories among these Regional Offices was also very uneven ranging from 78 in respect of Bangalore City-2 to 460 in respect of Peenya. KSPCB had not made any scientific assessment of the requirement of technical and scientific officers based on the distribution of industries among different regions. KSPCB with its present manpower shortages is significantly under-equipped to enforce pollution control, especially in BMR. KSPCB replied (July 2010) that a study on strengthening the Board had been entrusted to an outside agency in July 2009 and necessary action would be taken on receipt of the study report.

2.1.9 Water pollution

Bangalore generates 1,000 MLD of waste water, about 80 *per cent* of its daily water requirement, from both the surface water supplied by BWSSB and ground water resources. The city has natural undulating terrain and slopes that help easy flow of water in all the four directions. The city has three principal valleys, viz., Vrishabavathi, Koramangala/Challaghatta, Hebbal and five minor valleys. The geographical area of Bangalore was 598 square kilometres (sq kms) which increased to 800 sq kms (November 2006) on including the areas under seven City Municipal Councils and one Town Municipal Council. BWSSB's sewage network with 17 Sewage Treatment Plants (STPs) at various locations covers an area of only 317 sq kms. The Government had approved (June 2005) the Cauvery Water Supply Scheme, Stage-IV, (Phase II) at a cost of ₹ 3,383.70 crore to provide water, sewage system, etc., in the remaining 281 sq kms of the original area. A separate scheme for providing underground drainage facilities to the recently added areas was also approved (2005) by Government at a cost of ₹ 1,085 crore. While Phase-II is scheduled for completion in 2013, the underground drainage programme for the recently added areas is expected to be completed by March 2012. Thus, out of the total area of 800 sq.kms, the existing sewage network covers only 317 sq kms as of March 2010.

2.1.9.1 Grossly inadequate sewage treatment

A review of the performance of 17 STPs, including four Tertiary Treatment Plants (TTPs) under the control of BWSSB, during the period 2005-09 showed that against the total installed capacity of 781 MLD, waste water treated by these STPs averaged only 251 MLD (32 *per cent*). It was seen that only one

out of 17 STPs with an installed capacity of 1 MLD was functioning optimally. The sub-optimal functioning of other STPs was due to choking up of intermediate sewer lines, crown corrosion and incomplete sewage lines. Further, there was a huge mismatch between the quantities of waste water generated in BMR and those treated by the STPs as discussed below:

- According to the norms of Central Public Health and Environmental Organisation (CPHEO), 80 *per cent* of the water supplied flows back to the environment as waste water. Except during 2006-07, only 34 to 48 *per cent* of water supplied to the city by BWSSB had flowed back into the sewage network for treatment as shown in **Table-2.9**.

Table-2.9 : Waste water collecting in sewage network

(In million litres)				
Year	Water supplied	Sewage generation as per norms	Sewage treated	Percentage of sewage treated
2005-06	1,42,372	1,13,897	53,357	47
2006-07	1,52,233	1,21,786	96,208	79
2007-08	2,46,317	1,97,054	95,207	48
2008-09	3,45,807	2,76,646	1,06,687	39
2009-10 (up to January 2010)	2,98,238	2,38,590	82,298	34

Source: Information furnished by BWSSB

If the ground water extraction of 567 MLD5 in BMR is also considered in addition to the quantity of water supplied by BWSSB, the waste water generation would be higher than that estimated as per norms shown above. BWSSB stated (July 2010) that the present sewage system had been laid 30 years ago and was not functioning properly due to silting up or choking up of intermediate sewer stretches and crown corrosion. As a result, several sewer stretches remained surcharged chronically, leading to overflows through manholes. BWSSB further stated that it had resorted to temporary diversion of the surcharged sewers to lead the sewage into nearby storm water drains or open valleys and it was, therefore, not possible to convey the entire sewage generated to the STPs. KSPCB replied (August 2010) that it was a known fact that 53 *per cent* of the sewage was being discharged into storm water drains and lakes directly, thereby contaminating the water bodies and BWSSB had formulated action plans for laying of sewer lines and rehabilitation of the existing sewers by 2015. Thus, the sewage network in BMR is grossly inadequate to collect and treat the waste water generated.

Rehabilitation of existing trunk sewers

A review of the action plans formulated by BWSSB showed that three Environmental Action Plans (EAPs) were prepared for replacement and rehabilitation of the existing trunk sewers. While works on EAP-A and EAP-B commenced in 2003 and 2009 respectively, work on EAP-C had not started. The status of works under these two EAPs as of March 2010 is detailed in **Table-2.10**.

Table-2.10 : Status of EAPs

(₹ in crore)

	EAP-A	EAP-B
Cost of the project	46.27	176.75
Funding pattern	GOI share -70 per cent [under National River Conservation Plan (NRCP)] State share -30 per cent	GOI share-35 per cent State share -15 per cent Japan International Cooperation Agency - 50 per cent
Year of commencement	February/April 2003	June 2009
Scheduled date of completion	July 2010	December 2011
Status as of March 2010	93 per cent completed	Work in 3 out of 7 packages commenced between June 2009 and November 2009. The progress in these three packages ranged from five to 25 per cent as of March 2010. Work was yet to commence in the other packages.
Total expenditure as of March 2010	45.29	20.08

Source: Information furnished by BWSSB

EAP-A was sanctioned in August 2002 by the Ministry under NRCP for rehabilitation of the trunk sewers feeding four STPs. Although an investment of ₹ 47.20 crore had been made on EAP-A as of September 2010 and 94 per cent of the work completed, the quantity of waste water treated in 2008 and 2009 by these four STPs did not improve significantly from the 2004 levels prior to commencement of rehabilitation work as shown in **Table-2.11**.

Table-2.11 : Sewage treated by the STPs rehabilitated under EAP-A

Name of the STP	Capacity of STP	Average sewage treated (in MLD)		
		2004	2008	2009
Vrishabhavathi	180	54	51	67
Koramangala I	218	85	92	85
Koramangala II	30	2	9	9
Hebbal	60	31	32	33

Source: Information furnished by BWSSB

Thus, the rehabilitation of the existing sewers has largely failed to improve waste water collection and its treatment.

Inadequate design of STPs

Although KSPCB prescribed compliance by BWSSB with 32 standards before releasing the treated effluents into the valley, the design of the STPs operated by BWSSB was not capable of treating the effluents to all the prescribed standards. The design characteristics did not include treatment of pollutants like arsenic, copper, lead, cyanide, etc. The Chief Environmental Officer of KSPCB replied (August 2010) that the results of analysis of samples drawn from the STPs operated by BWSSB were not conforming to the prescribed standards and these STPs were overloaded and need to be upgraded. However, BWSSB had not taken up upgradation of the existing STPs (August 2010).

2.1.9.2 Non-utilisation of treated water

Tertiary Treatment Systems employ methodologies for treatment of wastewater to a level where the treated water can be used safely in irrigation and industries. Tertiary treatment reduces treatment costs considerably, pollution is minimised and economic activity is created due to reuse of treated water. In order to conserve fresh water and to reduce the demand for potable water, BWSSB set up (2003-05) four TTPs with an installed capacity of 73 MLD at a cost of ₹ 51 crore. BWSSB was to identify potential buyers for the treated water in order to recover the cost of treatment. During 2007-10, although these four TTPs treated 12.03 MKL of waste water, only 3.13 MKL of treated water was sold and the remaining quantity of 8.90 MKL of water treated at a cost of ₹ 5.35 crore was discharged into the water bodies. BWSSB replied (September 2010) that the water treated by three of these TTPs had been either used for irrigation or sold. TTP at Vrishabhavathi valley had been constructed mainly to cater to the Naphtha-based power plant planned by the Karnataka Power Corporation Limited (KPCL) at Bidadi. KPCL dropped the power plant due to steep increase in cost of Naphtha and changed over to a plant based on gas for which treated water would be supplied from 2012. As there were no takers for the treated water, 10 to 12 MLD of treated water was being discharged into a nearby stream, which helped in bringing down the pollution load. Thus, large quantity of treated water, though available, did not yield the desired result of conserving fresh water.

2.1.10 Pollution of lakes

The Lake Development Authority (LDA) registered in 2002 under the Karnataka Cooperative Societies Registration Act is responsible for protection, conservation, reclamation, restoration, regeneration and integrated development of lakes. As per the State of Environment Report, Bangalore 2008 prepared by the Department of Forest, Ecology and Environment, only 55 lakes are surviving (August 2009) against 603 lakes in Bangalore as per LDA's records. As sewage management by BWSSB was poor, untreated sewage water released into storm water drains flowed into the lakes contaminating the water bodies. Tests of 251 samples collected by LDA during January 2010-March 2010 from 59 lakes in Bangalore indicated that the levels of carbon-dioxide, lead, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), iron, etc., were in excess of the prescribed limits. A study of Bellandur and Varthur lakes taken up by the Indian Institute of Science in 2008 observed that most of the sewage from the city municipal limits flowed into the Bellandur lake, besides the natural storm water. Against more than 400 MLD of sewage generated in the catchment area of the lake, the STP established by BWSSB had an installed capacity of only 248 MLD, which was also partially utilised due to sewage network problems. The treated water, when released from the STP got mixed with untreated sewage and entered the Bellandur lake. Water from Bellandur lake flows to Varthur lake which ultimately joins the Pennar river. The study further highlighted that conversion of the watershed area of the lake for residential and commercial layouts had altered the hydrological region, lowering water yield in the catchment, affecting

the ground water recharge and impairing the ability of the ecosystem due to structural changes. Though contamination of lakes in Bangalore was known to LDA, it had not undertaken any restoration work during 2005-10. KSPCB replied (August 2010) that it was monitoring 55 lakes, of which 12 were in worst condition and 34 in bad shape. As a pollution control measure, it insisted on construction of STPs in apartments and commercial complexes and booked 18 criminal cases against polluters. As the lakes in BMR are increasingly polluted, their ecosystems have become very vulnerable to degradation.

2.1.11 Ground water pollution

Rapid industrialisation and poor waste water management have caused heavy ground water pollution, rendering it unfit for consumption in several parts of BMR. The State of Environment Report, Bangalore 2008 of Department of Forest, Ecology and Environment observed that over-exploitation of ground water in BMR beyond the rechargeable limit had resulted in emergence of increasing number of semi-critical, critical and over-exploited watersheds. Against the ground water extraction of 567 MLD, the recharge from all sources was only 221 MLD. However, no measures such as enactment of legislation to control extraction of ground water and enforce rain water harvesting, use of economic instruments to conserve ground water, prevention of fecal contamination through compulsory use of latrines *etc.*, had been taken up by the Government, resulting in continued depletion of ground water beyond its recharging capacity and health hazards due to the presence of pollutants in excess of permissible limits. The Department of Mines and Geology (DMG) monitors the quality of ground water by testing samples of water collected from dug wells and bore-wells. Test results of 22 ground water samples drawn by DMG from different locations in Bangalore Urban District during 2009 showed that eight samples had higher nitrate content while hardness was in excess of permissible limit in another five samples; one sample had high fluoride content. DMG attributed (July 2010) the deterioration of ground water quality to (i) septic tanks in areas not covered by the sewage network, (ii) industrial discharge and (iii) municipal sewage. The University of Agricultural Sciences, Bangalore had undertaken a study of the impact of ground water pollution in Vrishabavathi river basin in 2005. The study highlighted that the ground water contamination in the river basin had severely impacted the quality of ground water, rendering it unpotable and unfit for agricultural use. KSPCB also tested 161 samples collected from the bore-wells and open wells located on either side of three valleys viz. Vrishabavathi, Koramangala/ Chalaghatta and Hebbal during 2006-07. The results showed severe contamination of the ground water in these valleys. Besides high levels of nitrates (14 samples), fluorides (13 samples) and iron (23 samples), fecal matter and total coliform were found in all the samples. KSPCB replied (August 2010) that as the existing sewage network was insufficient, ground water was constantly contaminated by domestic sewage. Central Ground Water Board (CGWB) also analysed (March 2009) 30 underground water samples collected from different parts of Bangalore. The test results showed Radon6 concentration in the samples ranging from 55.96 Bq/l to 1,189 Bq/l against the permissible limit of 11.83 Bq/l. CGWB's report observed that the high concentration of Radon was not to be a cause of worry as Radon was reported in

bore-well samples only after flushing for 15- 20 minutes and not in stored water in the wells. The report, however, underlined the need for taking up detailed studies for further confirming the health hazards of Radon in ground water in the area. KSPCB had not initiated any further study in this regard. KSPCB replied (August 2010) that it was not monitoring Radon. Thus, ground water quality remains adversely affected in Bangalore due to presence of pollutants in excess of permissible limits.

2.1.12 Air pollution

Economic growth accelerates increase in the number of vehicles. The two-wheeler population in BMR was 7.5 lakh in 1997 which increased to 34.90 lakh in 2010. The four-wheeler population also increased from 6.18 lakh in March 2006 to 9.85 lakh in March 2010. With the increase in vehicular population, the fuel consumption has considerably increased. Combustion of fossil fuels by vehicles is the main reason for air pollution. The annual pollution load due to emission of various pollutants by vehicles in BMR is shown in **Table-2.12**.

Table-2.12: Pollution by vehicles in Bangalore

Category of vehicles	Number of vehicles	Average distance covered in Km / day	Distance covered in Km / annum	Emissions in Tonnes per annum				
				PM	SO ₂	NO _x	HC	CO
Motor Cycles	20,97,152	13.5	10,420,805,115	365	208	2,814	6,357	17,194
Light duty (Petrol)	1,88,810	50	3,445,786,150	21	3,032	724	655	9,441
Light duty (Diesel)	90,112	120	4,031,833,800	242	1,572	1,976	1,048	1,210
Heavy duty (Diesel)	1,47,456	150	8,455,918,500	6722	12,684	97,243	3,298	1,02,655

Source: State of Environment Report, Bangalore 2008

2.1.12.1 Issue of Pollution under Control Certificates

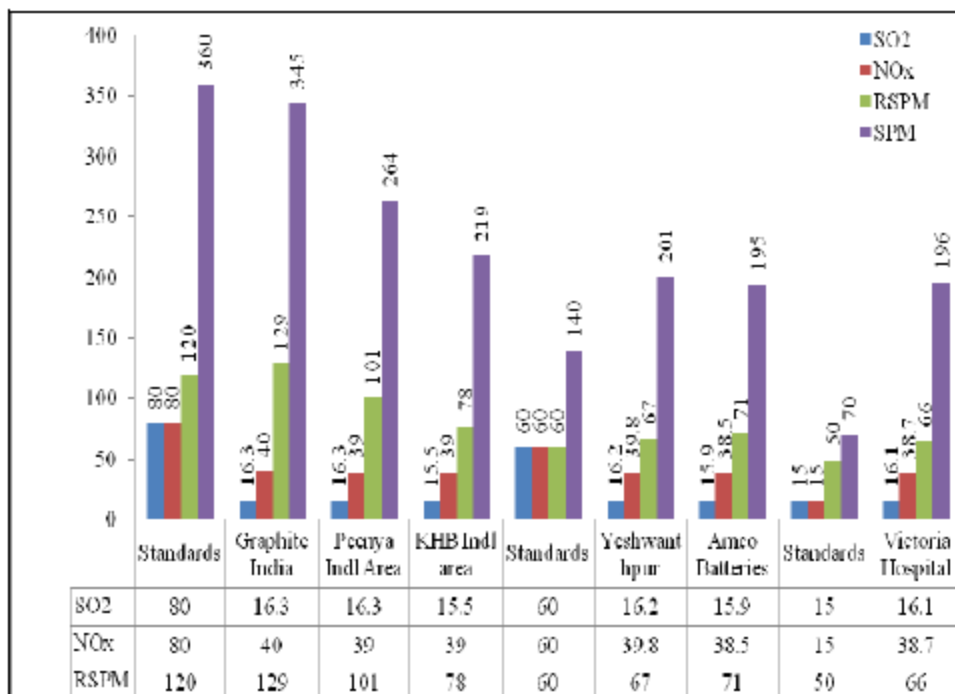
As per Rule 115 (7) of the Central Motor Vehicle Rules, 1989, all vehicles after a period of one year from the date of registration are to obtain Pollution Under Control Certificates (PUCs) from the agencies authorised by the Transport Department once in six months. During the period 2006-10, 73 per cent of the registered vehicles failed to obtain PUCs indicating poor enforcement by the Transport Department.

2.1.12.2 Monitoring of Air Quality by KSPCB

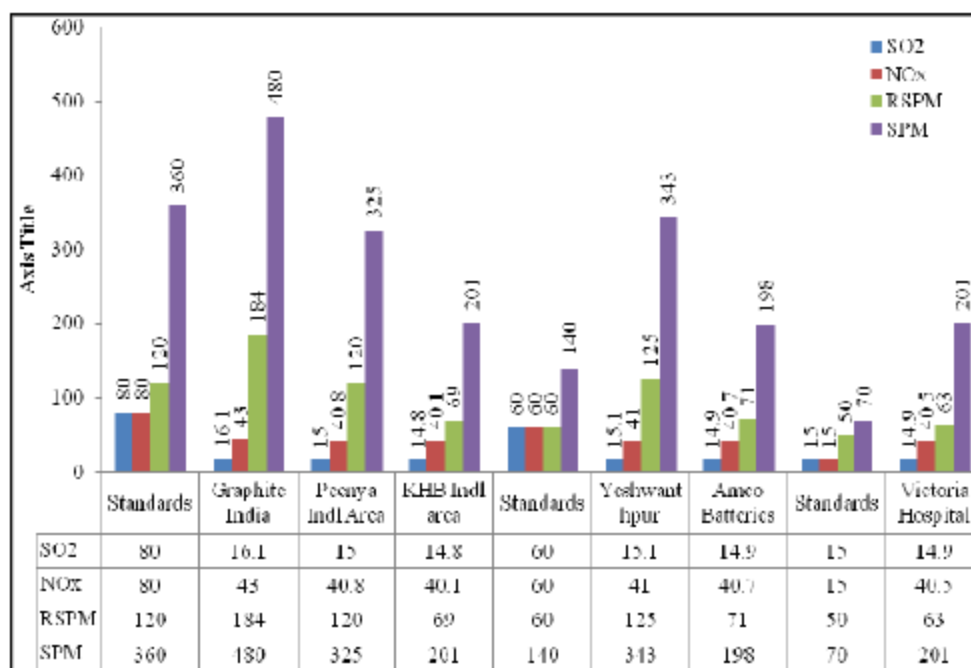
KSPCB monitors ambient air at seven7 locations in BMR as part of the National Air Ambient Quality Monitoring Programme (NAAQMP). The programme monitors standard air pollutants viz., Suspended Particulate Matter (SPM), Respirable SPM (RSPM), Sulphur-di-oxide (SO₂) and Nitrogen-dioxide (NO_x) in industrial, mixed and sensitive areas. KSPCB also monitors these four standard air pollutants through its Continuous Ambient Air Quality Monitoring Station (CAAQMS) at two8 other locations. Besides, KSPCB's mobile laboratory also monitors these pollutants at seven intersections and other polluted places. The

annual average air quality data for SPM, RSPM, SO₂ and NO_x at seven locations under NAAQMP during 2007-10 was as shown below:

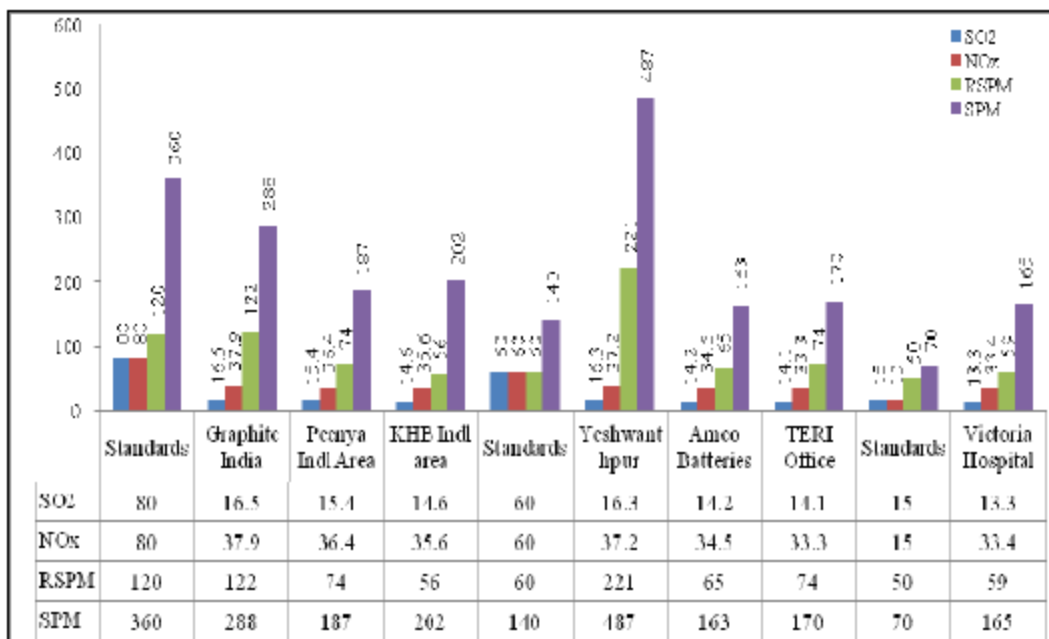
Annual average values of air pollutants at different locations in Bangalore city for the year 2007-08



Annual average values of air pollutants at different locations in Bangalore city for the year 2008-09



Annual average values of air pollutants at different locations in Bangalore city for the year 2009-10



An analysis of the NAAQMP data revealed:

Suspended Particulate Matter

The average annual concentration of SPM showed that the concentration of SPM at Victoria Hospital, a sensitive area and Yeshwanthpur Police Station, a residential and rural area persistently exceeded the National Ambient Air Quality Standards (NAAQS) during 2007-10, indicating that these two areas were highly pollution prone. SPM concentration was high at Graphite India during 2008-09. Though particulate matter persistently exceeded the limits in two locations, its chemical composition for identifying the sources was not available. KSPCB stated (August 2010) that a source apportionment study was entrusted to The Energy Resources Institute, Southern Region, Bangalore (TERI) by the Central Pollution Control Board (CPCB) with the objective of identifying the sources of air pollution, assessing the contribution of sources identified, prioritising sources that needed to be tackled, evaluating options for controlling the sources with regard to feasibility and economic viability and recommending the most appropriate action plan. The draft report submitted by TERI to CPCB was awaiting approval (August 2010).

Respirable Suspended Particulate Matter

The major source of RSPM is the combustion processes which produce inhalable toxic emissions smaller than 10 microns. Concentrations of RSPM exceeded the limits at Amco Batteries, Mysore Road (residential and rural area), Graphite India, Whitefield (industrial area), Victoria Hospital (sensitive area)

and Yeshwanthpur Police Station (a residential and rural area). Data of CAAQMS at Bangalore City Railway Station for 2007-10 also showed that the concentration of RSPM exceeded the limits in all the three years.

Sulphur Dioxide

Sulphur dioxide is a major air pollutant emitted from the combustion processes of all fossil fuels. Air monitoring results indicated that the annual average concentrations of SO₂ were compliant with the applicable standards in all the locations.

Oxides of Nitrogen

The source of Nitrogen Oxides is the same as that of Sulphur Dioxide. Annual average concentrations were well within the standards, except at Victoria Hospital and Bangalore City Railway Station. Government had set up (2001) a mutli-department Task Force with the objective of planning and coordinating the efforts of all stakeholders, non- Governmental organisations and the public to achieve abatement of air pollution. The Task Force drew up a 14-point Action Plan involving the departments of Transport, Food and Civil Supplies and Home, besides Bangalore Metropolitan Transport Corporation (BMTC) and KSPCB. The main components of the Action Plan were (i) conversion of three wheelers registered after 1 April 1991 to bi-fuel mode of Petrol and LPG, (ii) mandatory registration of three wheelers having bi-fuel mode commencing from December 2003, (iii) taking action for conversion of unauthorised LPG kits and detachable cylinders in 35,000 auto-rickshaws to authorised ones, (iv) setting up of Electronic Emission Testing Centres, (v) checking adulteration of fuel (vi) establishing Auto LPG Dispensing Stations (vii) increasing the fleet size of BMTC *etc.* Most of the activities envisaged in the Action Plan were, by and large, completed as of January 2010. However, as narrated earlier, the impact of the measures implemented by the Task Force is not visible as the concentrations of air pollutants continue to be high at many places in BMR. As there was no concrete plan for abatement of air pollution without source apportionment studies, respiratory diseases in BMR continued to be an area of concern and the incidence of cases of respiratory illness as furnished by BBMP and District Health and Family Welfare Officer (DH&FWO), Bangalore (Urban) during 2005-10 was as shown in **Table-2.13**.

Tabl-2.13: Cases of respiratory diseases in BMR

Sl No	Year	Cases of respiratory illness reported by	
		BBMP	DH&FWO, Bangalore(Urban)
1	2005-06	22,047	31,690
2	2006-07	24,265	33,520
3	2007-08	22,250	32,845
4	2008-09	23,822	41,902
5	2009-10	21,484	32,560
Total		1,13,868	1,72,517

Source: Information furnished by BBMP and DH&FWO, Bangalore

There was also no reduction in the incidence of respiratory illness during 2005-10 and the high levels of air pollution in BMR could be one of the contributing factors.

2.1.13 Environmental safeguards in construction projects

The Ministry revised the criteria for obtaining prior EC for construction projects in September 2006. As per these criteria, the construction projects were divided into two categories viz., Category A and Category B. While the Ministry’s prior EC is mandatory for building and construction projects belonging to Category A, prior EC is to be obtained from SEIAA for Category B projects. In respect of Category B projects, the proposals for EC are to be submitted by the entrepreneur to the SEIAA after obtaining CFE from KSPCB and work on the project is to commence only after EC is issued by the SEIAA. Besides Category B projects, KSPCB issues CFE/CFO for the following projects:

- Residential apartments – 50 units and above or having built-up area of 5,000 square metre (sqm) and above.
- Educational Institutions (non-residential) with built-up area of 10,000 sqm and above.
- Commercial Construction Projects (Hotel, Commercial Complexes etc.) with built-up area of 2,000 sqm and above.
- Layouts of area 10 acres and above.

KSPCB issued 1,148 CFEs for construction projects during 2005-06 to 2009-10 as shown **Table-2.14**.

Table-2.14: CFEs issued by KSPCB

Year	CFEs issued
2005-06	25
2006-07	233
2007-08	255
2008-09	363
2009-10	272
Total	1,148

Source: Information furnished by KSPCB

In 14 out of 57 test-checked projects where CFE had been issued by KSPCB, the irregularities as shown in **Table-2.15** were noticed

Table-2.15 : Irregularities in issue of CFE

Nature of irregularity	Number of works
Commencement of work before applying for CFE	1
Commencement of work before issue of CFE	8
Construction of additional tenements with altered plan/formation of excess sites	2
Alteration of building plan without approval	1
Occupation of flats without obtaining CFO	2

Section 15 of the Environment (Protection) Act prescribes a penalty of imprisonment extending to five years or levy of fine extending to one lakh rupees or both for contravention of the provisions of the Act. It was seen that out of these 14 projects, KSPCB issued CFO for six projects without levying any penalty and for eight projects after levying administrative charges ranging from five to ten times the consent fee. KSPCB stated (August 2010) that in the case of projects, where activity was commenced without CFE, punitive action under the Water Act was not taken as no sewage would have been generated from the projects during the construction phase. The reply was not acceptable as KSPCB's role was to enforce the provisions in the Water Act and it was not vested with discretionary powers to relax these. There was also no uniformity in levy of penalty for the contraventions which was arbitrary as there was no provision for levying administrative charges. KSPCB stated (August 2010) that while there was no provision for levy of administrative charges, these were, nevertheless, recovered as per the Board's decision. The reply is not acceptable as KSPCB's action of issuing CFO in spite of many contraventions

2.1.14 Monitoring

Although the State of Environment Report 2008 stressed on the importance of monitoring of the implementation of mitigating activities by various Government agencies for effective environmental management, the monitoring mechanism at the Government level was weak. The Government also did not establish linkages amongst the agencies responsible for environmental management. KSPCB did not furnish monthly progress reports to Secretary, Ecology and Environment regularly. The progress reports from April 2009 to March 2010 were submitted only in June 2010. MRO responsible for monitoring construction activities of Category A and B projects received 172 ECs from SEIAA and another 141 from the Ministry during 2005-10. While MRO monitored 70 projects cleared by the Ministry, its coverage of projects cleared by SEIAA was only 12. Although the MRO had brought to the notice of the Ministry several violations of the conditions prescribed in the ECs, no action was taken against the project proponents.

2.1.15 Conclusion

KSPCB did not maintain a proper inventory of polluting sources and faced huge shortage of technical and scientific staff. It also failed to draw up any concrete action plan to address pollution related issues leading to under-utilisation of available funds. Due to ineffective identification and inspection of polluting units, a large number of polluting units operated in BMR without installing pollution control systems. As the sewage network in BMR was poor and inadequate, 53 *per cent* of sewage generated was discharged directly into storm water drains and lakes, contaminating the water bodies and ground water. Despite data being available on air pollution trends at different locations in BMR, no action plan had been prepared due to non-finalisation of source apportionment studies.

2.1.16 Recommendations

- The institutional capacity of KSPCB needs to be strengthened by providing adequate technical and scientific staff to ensure that an appropriate match exists between the organisational mandate and the institutional structure.
- A comprehensive action plan for prevention and control of water and air pollution needs to be drawn up and implemented for effective utilisation of funds.
- In order to secure coordination of water pollution control measures, a formal mechanism ensuring the participation of all stakeholders such as departments of Health, Agriculture, BWSSB, DMG, LDA, KSPCB, *etc.*, needs to be established.
- Improvement to sewage network and sewage treatment needs to be given priority.

The matter was referred to Government in September 2010; reply had not been received (December 2010).