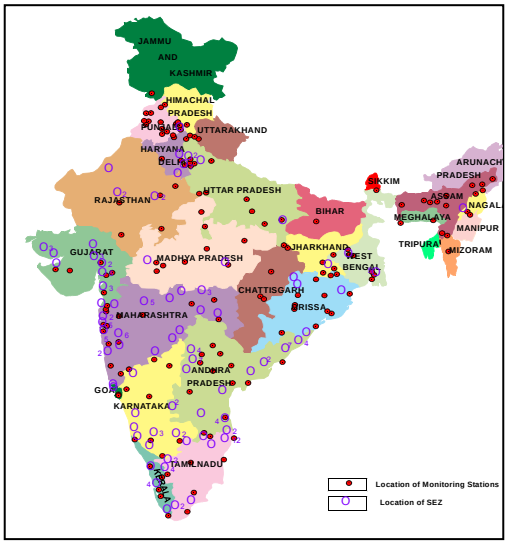
Project Report

Environmental Information System on GIS Platform



Central Pollution Control Board
Ministry of Environment & Forests

March 2011

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EXECUTIVE SUMMARY

The National Environment Policy is intended to mainstream environmental concerns in all development activities. It briefly describes the key environmental challenges currently and prospectively facing the country, the objectives of environment policy, normative principles underlying policy action, strategic themes for intervention, broad indications of the legislative and institutional development needed to accomplish the strategic themes, and mechanisms for implementation and review.

Weak enforcement of environmental compliance is attributed to inadequate technical capacities, monitoring infrastructure, and trained staff in enforcement institutions. In addition, there is insufficient involvement of the potentially impacted local communities in the monitoring of compliance, and absence of institutionalized public-private partnerships in enhancement of monitoring infrastructure. The action plan proposed to address this weakness was to develop feasible models of public-private partnerships to leverage financial, technical, and management resources of the private sector in setting up and operating infrastructure for monitoring of environmental compliance, with ironclad safeguards against possible conflict of interest or collusion with the monitored entities.

The policy has called for the steps to --

- Strengthen in all respects, the system of collection, collation and analysis of all significant and relevant environmental monitoring data.

- Strengthen the testing infrastructure and network for monitoring ambient environmental quality, including through participation by local communities, and public-private partnerships.

- ❖ Progressively ensure real-time, and on-line availability of the monitoring data.

- ❖ Develop and operate an online, real time, publicly accessible environmental information system to provide all relevant information on key environmental resources and parameters, including ambient quality, as well as major point sources of pollution, and make archival data available in convenient format.

- ❖ Further promote the use of Remote Sensing data to provide valuable inputs on the extent and quality of forests, wildlife habitats, biodiversity, wastelands, wetlands, groundwater, deserts, rivers, etc., and monitor pollution and its impacts

In line with the National Environmental Policy 2006, the Central Pollution Control Board has prepared a Project Report on "Environmental Information System on GIS Platform". The project consists of three major components –

i. Strengthening the air/water quality monitoring network,
ii. Strengthening the laboratories of CPCB/ SPCBs and
iii. Development of GIS Platform.

The present Air network consists of 530 manual stations and 28 Continuous Ambient Air Quality Monitoring Stations (CAAQMs). It is estimated that about 1300 manual stations and 450 CAAQM stations are required in first phase and another 1,500 stations to represent the small towns and sensitive areas of the country, taking the total numbers of stations to 3,500. The Water network consists of 1700 stations, 980 located on rivers, 170 on ponds/lakes, 60 on creeks and 490 representing ground water. It is estimated that about 3500 additional stations are required in addition to 500 automatic stations in the

country. Under the present project 60 automatic air quality monitoring stations, 435 manual air quality monitoring stations, 20 automatic water quality monitoring stations and 2500 manual water quality monitoring stations will be established.

The laboratories of Central Pollution Control Board and the State Pollution Control Boards required strengthening in view of the new set of standards notified, additional load due to expansion of the monitoring network and the advancements made in instrumentation and analytical technologies. It is proposed to strengthen the laboratories of SPCBs, which are on weaker grounds, both technically and financially.

The proposed project will be executed over a period of five years starting from the year 2011-12 and ending by the year 2015-16. The estimated cost of the project is `286 Crores (Annexure III) which is part of the larger exercise where the total estimated cost is `1308 Crores (Annexure II). The fund requirement for the project will be met from the Water Cess (CPCB share, including the backlog). It is also expected that the fund will be made available for execution of the project at the start of financial year 2011-12.

1.0 Background

1.1. Environmental Policy/Law

The National Environmental Policy 2006 calls for protection and conservation of critical ecological systems and resources, judicious use of environmental resources to meet the needs and aspirations of the present and future generations, and to integrate environmental concerns into policies, plans, programmes and projects for economic and social development.

Water (Prevention & Control of Pollution) Act, 1974, has been enacted for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Air (Pollution and Control) Act, 1981 has been enacted for the prevention, control and abatement of air pollution, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, include the preservation of the quality of air and control of air pollution.

As per the Water Act, Section 25(1), “subject to the provisions of this section, no person shall, without the previous consent of the State Board, (a) establish or take any steps to establish any industry, operation or process, or any treatment and disposal system or an extension or addition thereto, which is likely to discharge sewage or trade effluent into a stream or well or sewer or on land; or b) bring into use any new or altered outlets for the discharge of sewage; or begin to make any new discharge of sewage”. Under the Air Act, Section 21, “subject to the provisions of this section, no person shall, without the previous consent of the State Board, establish or operate any industrial plant in an air pollution control area”. For establishing industries, prior ‘consent to establish’ is required from the concerned state pollution control boards or pollution control committees.

The Environment Protection Act provides for the protection and improvement of environment and for matters concerned there with. As per this Act, “In particular, and without prejudice to the generality of the provisions of sub-section (1), such

measures may include measures with respect to all or any of the following matters, namely, restriction of areas in which any industries, operations or processes shall not be carried out subject to certain safeguards" [Section (2) (v)]. Also, as per the rules made under the Environment (Protection) Act, 1986, EIA and environmental clearance from Central/State Government is mandatory for establishment of scheduled industries and industrial Estates.

As per Notification No. S.O. 1533, dated 14th September, 2006 of the Environment (Protection) Act, 1986, certain projects or activities related to industries/industrial estates require prior environmental clearance from the Central Government in the Ministry of Environment and Forests for matters falling under Category 'A' in the Schedule and at State level the State Environment Impact Assessment Authority (SEIAA) for matters falling under Category 'B' in the said Schedule, before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity.

1.2 Central Pollution Control Board

The Central Pollution Control Board (CPCB) was constituted under the provision of the Water (Prevention & Control of Pollution) Act 1974. The main functions of CPCB include the following, as spell out in the Water Act and the Air Act:

I. To Promote cleanliness of stream and wells in different areas of the States through prevention, control and abatement of water pollution; and

II. To improve the quality of air and to prevent, control or abate air pollution in the country

The Central Pollution Control Board has been playing a key role in abatement and control of pollution in the country by generating relevant data, providing scientific information, rendering technical inputs for formation of national policies

and programmes, training and development of manpower, through activities for promoting awareness at different levels of the Government and Public at large.

In addition to the main functions of promoting cleanliness of streams, wells and improving the quality of air and to prevent, control or abate air pollution, CPCB has been assigned following National Level functions:

a) Advise the Central Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air;
b) Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water and air pollution;
c) Co-ordinate the activities of the State Boards and resolve disputes among them;
d) Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water and air pollution, and for their prevention, control or abatement;
e) Plan and organise training of persons engaged in programmes for prevention,
f) control or abatement of water and air pollution;
g) Organise through mass media, a comprehensive mass awareness programme on prevention, control or abatement of water and air pollution;
h) Collect, compile and publish technical and statistical data relating to water and air pollution and the measures devised for their effective prevention, control or abatement;
i) Prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts;
j) Disseminate information in respect of matters relating to water and air pollution and their prevention and control;

k) Lay down, modify or annul, in consultation with the State Governments concerned, the standards for stream or well, and lay down standards for the quality of air;
l) Establish or recognize laboratories to enable the Board to perform, and;
m) Perform such other functions as and when prescribed by the Government of India

1.3 Major Concerns related to Environmental Information

Development and Environment Conflicts - The development is seen in various forms such as building of roads, bridges, dams, houses, industrial estates, industrial parks, growth centers, software parks, textile parks, industrial development areas (IDA), industrial clusters, special economic zones (SEZ) etc. and isolated industries. In India, spatial planning (State Plans, Regional Plans, Master Plans etc.) where sites/zones for various activities are demarcated with land requirements catering to the planned development targets have limited existence. In the absence of such demarcated or designated lands, developmental projects including industries or industrial estates are forced to come up haphazardly. Also, the development that is attracted due to industrial activity is also bound to come up haphazardly thereby posing severe 'conflicts'.

Minimization of Pollution Control Requirements through up-to-date environmental information - The environmental authorities have set standards for pollutants from industries as well as of the quality of the receiving environment. The standards for industrial emissions/effluents are developed based on best practicable treatment technology (BPT) and it is generally seen that the ratio of annual burden to the industry on treatment (AB) to its annual turnover (AT) is about 3%. However, many industries find it difficult to invest on treatment to the level of 3% of AB/AT ratio and many of them would prefer it to be about 1%. If the location of the industry has high environmental sensitivity, it is required to comply with stricter standards and employ best available technology (BAT) that

can put an unaffordable high burden on the industry. Awareness about the status of the environment of the area concerned and also about the requirements of pollution control measures can help in minimization of pollution control requirements.

Reducing Pollution Threats and Regulatory Risks to Industries and Ensuring Investment Safety to Industries - Pollution is a major threat not only to the environment and the people, but also to the survival of the industry itself. Industry is seen associated with environmental risks and accidental hazards. The growing public awareness, environmental laws and concerns for environment, pose tremendous regulatory risks to the polluting industries, especially to those that are unable to comply with environmental norms/standards.

For sustainable development it is very important that there are no conflicts with the environment or at least that, such conflicts are minimal so that in the event of failure of pollution control systems by the industries there still is some time for them to rectify without having any adverse impact on the environment. Proper information on the status of environment would help in reducing pollution threats and regulatory risks to industries and ensuring their investment safety.

Improving Decision Making by Environmental Regulatory Authorities- The urban areas in the country are growing into bigger agglomerations with ever increasing influx of population. The urban population in India increased from 25 million in 1901 to 217 million in 1991 and it reached 286 Million in 2001 (27.8% of the total population). The number of urban centers (town and urban agglomerations) has grown from 2,843 in 1951 to 4378 in 2001. As in 2001, India had 35 cities having population more than 1 million. Presently the Indian economy is growing and it has grown consistently above 12.5% and it is expected to grow at a much higher rates resulting in more developmental activities and increased pressure on the resources and subsequently on the environment. The environmental problems are diversified in nature and one has to deal with number of environmental issues due to consistently high economic growth. Rapid urbanization and intensified

industrialization during the past decade in the country had put immense pressure on natural resources and environmental quality. The limited natural resources are being under constant pressure due to increased extraction / exploitation. The over-use of water resulted in reducing the rivers into river stretches and pools of water bodies. The change in life style of citizens and increase in consumerism further increased the waste materials in ambient air and water. The increased vehicles and un-scientific disposal of municipal solid waste, inadequate sanitary facilities made the urban life miserable, consequently increasing air-borne diseases, especially among the children. The task of managing the environment requires up-to-date information on various aspects such as 'polluted river stretches', 'critically polluted areas', 'noise pollution', 'health impacts', 'natural resource depletion' 'loss of ecology/ bio-diversity', 'diminishing green cover' , 'overcrowding and congestion', 'unhygienic and poor living conditions' and 'waste management' which impacts environment. Presently the information available is old, scattered or not available at all. There is a need to have a system where the information related to all the sectors of environment available and are geographically referenced with a mechanism for its easy retrieval, updation, analysis and presentation. This system as envisaged will be 'Environmental Information System on GIS Platform'. It will play a vital role in arriving at decisions related to environmental protection and sustainable development.

The environmental clearance to the sites by the environmental regulatory authorities does not necessarily imply zero pollution from an industry. Undertaking EIA (environmental impact assessment) by industries too is not necessarily fool proof as the EIA reports could be engineered to meet the vested interests and also the conditions around the site may change eventually not because of the industry but because of unregulated development. With the availability of information on click of mouse will help the regulator to arrive at appropriate decision. Regulatory institutions such as MoEF, CPCB and SPCBs have mixed success in protecting environmental quality through regulating

emissions/ discharges, planning and implementing various environmental quality improvement programmes.

1.4 Target Beneficiaries

1.4.1 Usefulness of Environmental Status

- Provides information on status of Environmental quality including air and water quality to the general public, NGOs, Government Departments, Ministries and Institutions

- Provides information on environmental resource areas including national parks, wild life sanctuaries, tiger reserve/elephant reserve/turtle nesting ground, breeding grounds, core zone of biosphere reserves, habitats for migratory birds, mangrove areas, areas with threatened flora/fauna (rare, vulnerable, endangered), protected corals, wetlands, botanical gardens, zoological gardens, gene banks, reserved forests, protected forests, other closed/protected areas under the wild life (protection) act, 1972, other areas as locally applicable or specified by the state or local government to the general public, NGOs, Government Departments, Ministries and Institutions

- Provides information on Industrial locations/Growth Centres/Industrial Estates/Trade Centres/ SEZs/ Industrial clusters/ corridors, Housing, Transportation (road, rail, water ways), Utilities (water supply, electricity), landfills /TSDFs /CETPs /STPs/CBWTF, Forestry to the general public, NGOs, Government Departments, Ministries and Institutions

- Provides information on sources of pollution including industries, vehicular, domestic fuels, sewage, storm water, garbage, hospital waste, and hazardous waste to the general public, NGOs, Government Departments, Ministries and Institutions

1.4.2 Usefulness of Predictive Environment

- Provides information on the future scenario owing to change in the environmental conditions to Regulator and Decision makers

2.0 Objective

The Overall objective of the Project is to strengthen the air/water monitoring network along with laboratories of CPCB and SPCBs and to provide information on key environmental resources and parameters including the ambient quality on a GIS platform which will be accessible to all stake holders including Government, Institutions and Public.

2.1 Specific Objectives for Air Environment

- To have an air quality monitoring network with automatic and manual stations, covering the industrial areas/estates,
- polluted areas, problem areas, metro cities, urban centers and ecologically fragile and sensitive areas, with capability to monitor SO_2, NOx, PM_{10}, $PM_{2.5}$, Ozone, Lead, Carbon Monoxide, Ammonia, Benzene, Benzo (a) pyrene, Arsenic & Nickel and Toulene & Xylene at selected places.

- To map all the air quality monitoring stations with 'latitude' and 'longitude' along with related attributes such as address (name of locality, town/city/district & state), important land mark, automatic or manual, frequency of monitoring, number of parameters and type of parameters;

- To provide online presentation of status of air quality on a geographically referenced map;

- To have capabilities to show temporal variations in the air quality with land use image in the background;

- To show time series data/layers on GIS platform;

- To have capabilities to predict changes in air quality due to addition of new industrial activities or developmental activities or due to any change in the land use pattern; and

- To present the changes dynamically in the air quality through a geographically referenced map.

2.2 Specific Objectives for Water Environment

- To have water quality monitoring network with automatic and manual stations, covering all the major rivers and its tributaries, polluted river stretches, lakes, ponds, major water bodies with capability to monitor monthly, quarterly, half yearly and annually, 28 parameters consisting of physico-chemical and bacteriological parameters for ambient water samples, 9 trace metals and 28 pesticide residues, organic pollution related parameters and micro pollutants in selected samples;

- To map all the water quality stations with 'latitude' and 'longitude' along with related attributes such as address (name of locality, town/city/district & state), important land mark, automatic or manual, frequency of monitoring, number of parameters and type of parameters;

- To provide online presentation of status water quality on a geographically referenced map;

- To have capabilities to show temporal variations in the water quality on a map with river image on the background using dynamic segmentation technique;

- To have capabilities to predict changes in water quality due to changes in flow characteristics due to addition of new industrial activities or developmental activities or due to change in the land use patterns; and

- To present the changes dynamically in the water quality through a geographically referenced map;

- To have geographically referenced maps showing drainage pattern in the country;

- To have maps with zooming facilities for moving from major rivers to its tributaries; and

- To have river basin wise maps for water quality, flow, perennial/non perennial, effluent discharge points and water intake points

2.3 Specific objectives for strengthening of CPCB laboratories (HO & ZOs) and SPCBs Laboratories (HO & ROs)

- To have Gas Chromatographs (GC) – ECD/FID/FPD and Mass Spectrophometer (GC-MS)- LR, High pressure Liquid Chromatographs (HPLC), Ion Chromatographs, Inductively Coupled Plasma – Atomic Emission Spectrometers (ICP-AES), PM 2.5 Dichotomous Samplers Systems, PM2.5 Samplers (FRM), High Volume Samplers with PUF (for ambient Dioxin / Furan), Speciation Sampler, Stack monitoring Kits with VOST and other supporting equipments and instruments at CPCBs Laboratories .

- To have supporting infrastructures including laboratories with equipments and instruments, vehicles to monitor ambient air and

water quality under the project at financially weaker State Boards and Pollution Control Committees

- To provide necessary training needed for the manpower for generation, reception, validation and transmission of the monitored or sampled data from the filed locations.

2.4 Specific Objectives for GIS Platform

- To have a web portal with geographically referenced air and water quality monitoring stations with availability of instantaneous, time series data with forecasting ability;

- To have the existing data and information integrated for providing comprehensive database for air and water quality ;

- To have information on environmentally relevant land uses such as Industrial locations/Growth Centres/Industrial Estates/Trade Centres/ SEZs/ Industrial clusters/corridors, Critically Polluted areas as per CEPI index, landfills /TSDFs /CETPs /STPs/CBWTF, Reserved forests, Protected forests, National parks, Wild life sanctuaries, Core zone of biosphere reserves, Soil type, Quarrying/mining Areas etc.;

- To have geographically referenced maps related to environmental themes with ability to zoom from national level to taluka level with increased information, to zoom from regions to local areas for air quality information, to zoom from major river to tributaries for water quality information ;

- To develop a strong GIS platform for seamless integration of databases generated across the organization with satellite imagery ;

- To have capabilities to overlay thematic maps, buffering of the sensitive areas, extraction of one theme from multiple themes, proximity of one feature with other relevant features;

- To have ability to present environmental status(air & water quality), easy retrieval, updation, modification and analysis of thematic spatial/non spatial information;

- To develop and operate an online, real time, publically accessible web based single window environmental information system and make archival data available in convenient form; and

- To have web based GIS application with ability to predict impacts/ scenarios due to different environmental conditions for facilitating decisions

3.0 Scope of Work

The major component of the project is collection of information related to ambient air, water and land environments, compilation of the data and its dissemination. The present monitoring network requires to be augmented to bridge the existing gaps in the network so that the network spreads all over the country presenting pan India information. Other components of the project include strengthening of laboratories, providing supporting infrastructure, development of web based GIS application having capability of seamless integration of data bases from various sources.

3.1 Project Tasks

In order to have pan India network of air quality monitoring station, it is estimated that about 1300 manual stations and 450 CAAQM stations are required in first phase and another 1,500 stations to represent the small towns and sensitive areas of the country, taking the total numbers of stations to 3,500. For establishing network of water quality monitoring stations, it is estimated that about 3000 manual water quality monitoring stations and 550 automatic water quality monitoring stations are required. However, the target under the present project being funded under the water cess fund is given below:

1. Establishing 435 manual air quality monitoring stations
2. Establishing 60 automatic air quality monitoring stations
3. Establishing 2500 water quality monitoring stations
4. Establishing 20 automatic water quality monitoring stations
5. Strengthening of CPCB and SPCBs laboratories at head office and field offices.
6. Data acquisition from Central Government Agencies
7. Establishing data centre and related infrastructure at CPCB/NIC
    a. Procurement of software and hardware

b. Application development

c. Data procurement and rectification

d. System Integration and uploading

8. Development of GIS Platform

3.2 Specific Tasks for Strengthening of Air and Water Quality Monitoring Stations

- **To identify locations of air and water quality monitoring stations**

  i. Consultation with SPCBs

  ii. Finalisation of the criteria

  iii. Selection of Locations

  iv. Technical Readiness/ Preparedness of the locations

- **Procurement and commissioning of instruments/equipments for manual stations**

  i. Listing of Instruments/ Equipments

  ii. Finalisation of the specifications

  iii. Listing of suppliers

  iv. Tendering

  v. Placing of supply orders

  vi. Installation and Commissioning

- **Procurement of instruments/equipments for automatic stations**

  i. Listing of Instruments/ Equipments

  ii. Listing of Suppliers

  iii. Finalisation of Specifications

iv. Global Tendering

v. Placing of Supply Orders

vi. Field Preparations

vii. Commissioning

viii. Software Development

ix. Software Deployment

x. Networking the Stations

xi. Data Sourcing

xii. Data Transmission

xiii. Data Validation

xiv. Data Analysis

- **To recruit, train, deploy the manpower and commissioning of the automatic stations**

i. Manpower Assessment

ii. Infrastructure Assessment

iii. Identify the Gaps

iv. Recruitment of Project Staff

v. Training

vi. Deployment

vii. Filed Preparedness

viii. Commissioning of Stations

ix. Running Stations

x. Review Status & reports

xi. Identify the Gaps

xii. Prepare Action Plan

xiii. Implement Action Plan

xiv. Streamline the Data Receipt

3.3 Specific Tasks for Strengthenining of CPCB and SPCBs Laboratories

- **CPCB Strengthenining**

  i. Preparing the latest Status

  ii. Revising the Requirements

  iii. Finalisation of Specifications of equipments

  iv. Tendering for procurement of equipments

  v. Supply Orders for equipments

  vi. Commissioning of the equipments

  vii. Training of manpower for running the equipments

- **SPCBs Strengthenining**

  i. Assessing the State Boards

  ii. Listing of the SPCBs for Assistance

  iii. Consultation with SPCBs

  iv. Finalisation of Specifications of equipments

  v. Tendering for procurement of equipments

  vi. Placing of supply orders for procurement of equipments

  vii. Commissioning of the equipments

  viii. Training of manpower for operation of equipments

3.4 Specific Tasks for GIS Platform

- **CPCB's Task**

  i. Preparation of Requirements

  ii. Assessment of Hardware & Software Requirements

  iii. Assessment of Manpower Requirement

  iv. Finalisation of Specifications

  v. Tendering for procurement of Hardware & Software

  vi. Recruitment of manpower

  vii. Placing of Supply Orders

  viii. Deployment of hardware and software

  ix. Procurement of Data

- **NIC's Task**

  i. Preparation of Requirements

  ii. Assessment of Hardware & Software Requirements

  iii. Assessment of Manpower Requirement

  iv. Finalisation of Specifications

  v. Tendering

  vi. Selection of System Integrator

  vii. Development of Application

  viii. Procurement, Processing and customization of Spatial Data

  ix. Data Integration

  x. Commissioning

  xi. Hosting & Maintenance

4.0 Strengthening of National Environmental Database Management System

CPCB under its National Air Quality Monitoring Programme (NAMP) has 530 Air Quality Monitoring Stations and under National Water Quality Monitoring Programme (NWMP) has a network of 1700 water quality monitoring stations spread all across the country. The cities, wherein the air quality monitoring stations located are shown in the Figure 4.1.

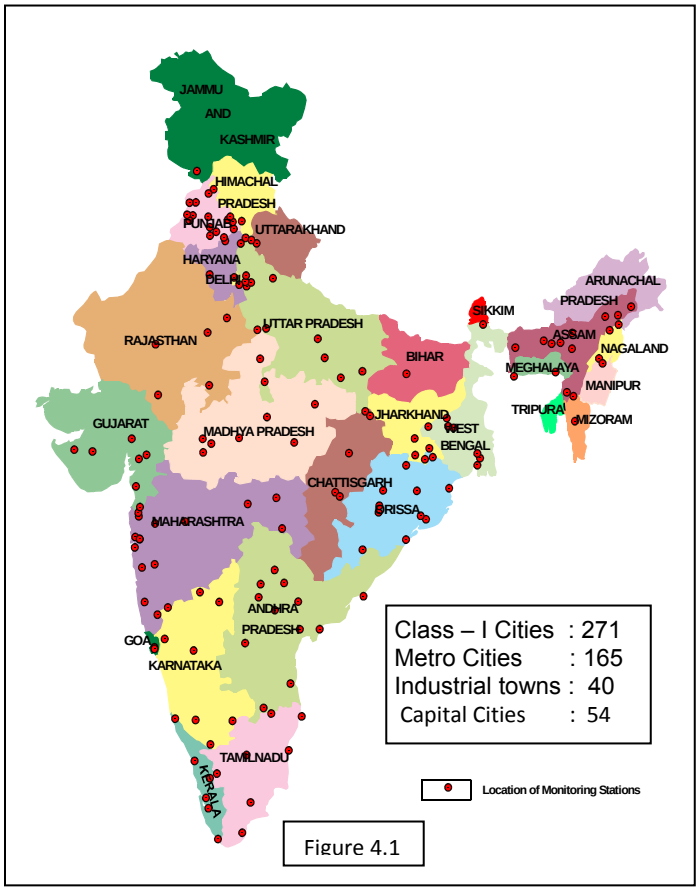


Figure 4.1

An estimated 450 automatic and 3500 manual ambient air quality stations would be required for sample representing the ambient air quality and about 5300 manual stations for ambient water quality in the country. Existing one-third of the desired monitoring stations need strengthening by increasing stations (both air and water) and also establishing automatic monitoring stations in PPP mode by pursuing SPCBs and public/ private developers of industrial clusters along with monitoring equipment.

4.1 Air Quality Monitoring

The present Indian air quality monitoring system is limited in its scope and accuracy. Information transferred to CPCB is sometimes unreliable due to absence of proper validation mechanism. CPCB felt the need to modernize and augment the system according to international standards.

Internationally, the use of automatic monitoring stations is widely recommended for its accuracy, reliability and the possibility to develop alert systems. The system can be further strengthened for incorporating decision making tools and forecasting techniques.

The Indian air quality monitoring system should be modernized to address the following problems:

- Integrate the monitoring network of private sector in the development and the operation of the system.
- Set up a standardized data transfer and data processing system that enables a free flow of information between cities, central government and the public.
- Standardize the monitoring and quality control procedures at the national level.
- Set up a validated air quality database at local and national level

CPCB has started National Air Quality Monitoring Programme (NAMP) to assess the present status of air pollution, to determine the effectiveness of pollution control programmes and to analyse air quality trends.

NAMP presently includes a network of 530 National Air Quality Monitoring Stations (NAMP) covering 175 cities in 26 States and 5 union territories. These stations are manually operated with involvement of various local and State agencies. The air quality parameters regularly monitored are SPM, RSPM, SO_2 and NO_2

CPCB receives monthly information from NAMP stations (monthly and daily averages). This information is processed by CPCB, which has records of the air quality evolution trends for all problem areas, important cities and state capitals.

4.1.1 Objectives for Air Quality Monitoring

- **To determine representative concentrations in areas of high population density**

  Monitoring stations should be located in areas of high population density. The parameters to be monitored would be a function of the sources impacting these areas.

- **To determine maximum pollution concentrations in populated areas**

  Monitoring stations should be located in areas where pollution concentrations are expected to be highest. For an urban area, there may be a need for a number of stations each addressing a different pollutant.

- **To determine pollutant concentrations near major industries**

  Monitoring stations should be located near major industrial sources. Pollutants associated with these facilities should be monitored.

- **To determine air pollution trends**

  Monitoring stations should be located in areas where significant growth is expected to occur. Impacts of development can thus be monitored over long-term period.

- **To develop a database for future pollution control strategies**

4.1.2 Automatic Air Quality Monitoring System

The automatic air quality stations were commissioned initially in Delhi and expanded to eighteen cities in the country. The air quality monitored at these stations is transmitted to CPCB on real time basis without any human interference. As mentioned earlier automatic monitoring stations are widely used for accurate and reliable data. CPCB has plans to establish a nation wide network containing continuous ambient air quality monitoring stations, operated by CPCB, SPCBs, Industries and other agencies.

The Indian air quality monitoring system should be modernized. The automatic monitoring has the following advantages over manual monitoring system:

- Measure continuously air pollution in cities and industrial areas and compare mean and peak values with air quality standards.
- Measure air quality in representative areas and time periods to inform and protect the public.
- Develop alert system in case of high pollution episodes.
- Develop air quality forecast systems and procedures.
- Set up a standardized data transfer and data processing system that enables a free flow of information between cities, central government and eventually the public.

4.1.2.1 Parameters Monitored

The Continuous Ambient Air Quality Monitoring Stations (CAAQMS) can measure 8 parameters out of 12 as per new notified National Ambient Air Quality Standards except Metals and BaP. The Parameters and their measurement principles are:

S. No.	Parameter	Measurement Principles
01.	Carbon Monoxide (CO)	NDIR Absorption
02.	Sulphur Dioxide (SO_2)	UV Fluorescence
03.	Oxides of Nitrogen (NO - NO_2 - NO_X)	Chemo- luminescence
04.	Ozone (O_3)	UV Photometric
05.	Ammonia (NH_3)	Chemo- luminescence
06.	Benzene, Toluene & Xylene (BTX)	FID & PID
07.	PM_{10}	Beta Ray Absorption Light Scattering TOEM
08.	$PM_{2.5}$	Beta Ray Absorption Light Scattering TOEM

Meteorology plays a significant role in study of air pollution and it is necessary to measure meteorological parameters. Besides the air pollutants measurement, the essential meteorological parameters that will be measured at CAAQMS are:

- Wind speed;
- Wind direction;
- Vertical wind speed;
- Ambient air temperature;
- Relative humidity;
- Solar radiation; and
- Barometric pressure.

Automatic Air Quality Monitoring Station

4.1.2.2 Operating the CAAQM Station/Network

- **Managing the operations**

To be effective, an air quality monitoring network has to be managed by an appropriate operating structure. The structure needs a good management that will decide on the general strategy needed to comply with national and local requirements. It will decide on personnel, on possible subcontractors, and will be responsible for data validation and distribution.

- **Maintenance and calibration:**
  - Automatic on line AQM systems
  - Preventive maintenance
  - Preventive maintenance is a general requirement of automatic air quality analyzers.
  - Regular maintenance operations are compulsory, usually every semester and year according to the provider recommendations.

- **Calibration and daily maintenance**

  The daily maintenance and calibration operations include regular visits to the stations varying from every week to every month (EU recommendations). It also includes trouble shooting operations.

- **Span gas standard**

  AQMN operators rely on standard gas manufacturers. Gases are bought and used according to the gas provider recommendations.

- **Reporting activities**

  Reporting of air quality manual activities should be carefully organized so that they can be included in official reports.

- **Data transfer**

  Data transfer of on line analyzers can be done on a periodic basis. The maintenance operator then collects the information at the station (each week…), or on an on line basis through a data logger and modem.

- **Data validation**

  Data validation is a time consuming task, even if part of it can be done automatically with appropriate data management tools. It is considered that all data must be reviewed /revised manually before being published.

- **Data processing**

  Data processing is now mostly done by automatic data management systems.

- **Data circulation**

  - Data circulation is one of the most important tasks of an air quality monitoring network. Very often the data management system includes automatic transfer of information on an internet site.
  - It is important, at the local level, to structure the data management system so that it can send regular information to the National Data Base.

- **QA/QC activities**

  The quality assurance and control activities are important in a field where the final product (data) is made public and can be used in some

legal actions. Those activities are integrated in the work of everybody within the structure of the operator.

4.1.3 Manual Air Quality Monitoring System

The manual stations mostly operated with involvement of various local or State agencies. The air quality parameters that are regularly monitored are SO_2, NO_2 and SPM/RSPM. The equipment used is high volume sampler and Respirable dust sampler. The method of measurement of different pollutants is described below:

Sulphur Dioxide (SO_2)

Sulphur dioxide content in the ambient air is measured by the modified West and Gaeke method. Sulphur dioxide in ambient air is absorbed in a solution of 0.04M sodium tetrachloromercurate at an average flow rate of 1 liter per minute (LPM), resulting in the formation of dischlorosulphitomercurate complex. The main interference is due to the oxides of nitrogen, ozone and trace metals. Interference from oxides of nitrogen can be prevented by adding sulphamic acid, which acts as a reducing agent and converts some of the oxygenated nitrogen species to nitrogen gas. Interference from ozone can be eliminated by aging the sample prior to analysis. Interference from trace metals can be prevented by adding EDTA (disodium salt) to the unexposed absorbing solution. For analysis, the exposed sample is treated with sulphamic acid, formaldehyde and acid bleached pararosaniline containing hydrochloric acid. Pararosaniline, formaldehyde and bisulfite anion react to form violet red coloured pararosaniline methyl sulphonic acid. The intensity of the colour is measured on a spectrophotometrer at 560 nm wavelength. The detection range of the SO_2 concentration is 4 – 1050 μg/m3.

Nitrogen Dioxide (NO_2)

In the method the NO_2 from ambient air is absorbed in a solution of sodium hydroxide and sodium arsenite. Sulphur dioxide is the major interfering compound. The interference of sulphur dioxide is eliminated by converting it to sulphuric acid by addition of hydrogen peroxide. The absorbed nitrogen dioxide is then reacted with sulphanilamide in the presence of phosphoric acid at a pH of less than 2 and then coupling it with N-(1Nepthyl) ethylenediamine dihydrochloride. The absorbance of the highly coloured azo dye is measured on spectrophotometer at a wavelength of 540 nm. The detection range of the NO2 concentration is 9 – 750 μg/m3.

Respirable Suspended Particulate Matter (RSPM/PM_{10})

PM_{10} are the particulate matter having aerodynamic diameter less than 10 μm and it is fraction of the particulate matter suspended in air and it represents the fraction that is considered to enter the respiratory system. Sources of PM_{10} include road dust, emission from petrol and diesel exhaust, construction and fireplaces. PM_{10} may also be formed from other pollutants (acid rain, NOx, SOx, organics) and from incomplete combustion of any fuel. Monitoring of RSPM is carried out for 24 hours with 8-hourly sampling. RSPM is measured gravimetrically with GFA/EPM 2000 filter paper using respirable dust sampler.

4.1.4 Target for Strengthening Air Quality Network

The criteria for sample representing the ambient air quality in the country is given below along with the present network and additional stations required:

S. No.	Category	Criteria, no./city	Total required	Present	Additional required	Project Target
01	Class–I Cities(437)	3	1311	271	1040	250
02	Mega Cities (35)	9	315	165	150	100
03	Industrial Areas(27)	6	162	40	115	100
04	Capital Cities (28)	6	168	54	116	45
		TOTAL	**1,956**	**530**	**1,426**	**495**

In addition to the above mentioned stations it has been estimated that another 1500 stations will be required to represent class II cities and sensitive zones of

the country. About 500 automatic air quality stations will be required to strengthen the national network.

The present network consists of 530 operating stations out of sanctioned 700 stations. Another 50 automatic stations are being made operational by March 2011. About 1256 manual stations and 450 automatic stations will be added to the network in the first phase. Continuous ambient air quality monitoring stations are required in metro cities to monitor the secondary pollutants. Some of the stations will be operated by the State Boards and public/ private developers in industrial areas / clusters.

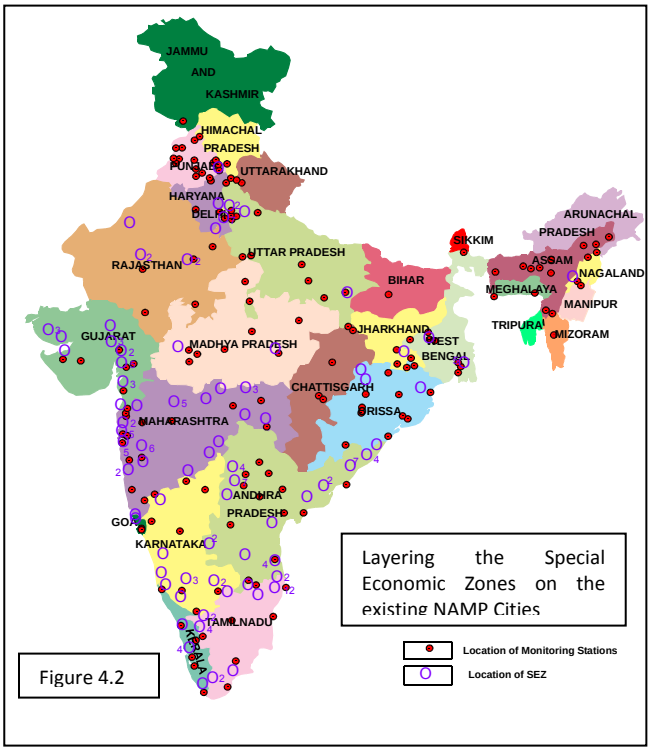


Figure 4.2

Automatic air quality monitoring stations will be established by the developers of Special Economic Zones (SEZ), Industrial Development Corporations (IDC), Export Promotion Industrial Parks (EPIPs)/Export Oriented Units (EOUs)/ Central Government Growth Centres, Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs), Biotech Parks/ Pharma Cities/ Auto clusters, Delhi – Mumbai Industrial Corridor, etc. Presently 181 SEZs are operating in the country. There are about 1000 Industrial Development Corporations, Export Promotion Industrial Parks (EPIPs)/Export Oriented Units (EOUs)/Central Government Growth Centres, Biotech Parks/ Pharma Cities/ Auto clusters are in the country. Petroleum, Chemicals and Petrochemical Investment Regions covering large areas have been notified [AP (603 KM^2), Gujarat (453 KM^2), WB (250 KM^2), and Orissa (284 KM^2)]. The developers of these areas as part of their

environmental obligations are being asked to establish automatic air quality monitoring stations.

At Figure 4.2 the SEZs and the existing air quality monitoring stations are shown, which clearly brings out the gap which needs to be filled up by increasing the number of monitoring stations. The monitoring responsibilities will be entrusted to the developers of the regions in Possible PPP mode.

The ambient air stations are proposed for locating in the Mega cities, Class I Cities, Polluted Areas, SEZs and PCPIRs and the state-wise distribution of cities and polluted areas and SEZs is given in Table 4.1

The technological advances in air pollution monitoring allow measurement of air quality wherein both three dimensional profiles could be prepared. The Light Detection and Ranging (LIDAR) and Multi-gas Open Path Differential Optical Absorption (DOAS) Spectrometry Analyzer are some of the devices available to map an area for air quality. CPCB will examine the application of proper technology in generating appropriate data for the EIS.

Some of the features of the DOAS are provided here:

- Monitoring path length: 100 to 500m
- Lower detectable limit: ppb level
- Linearity: < 1% Full Scale
- Response time: 3 min

Table 4.1 STATE-WISE DISTRIBUTION OF CITIES, POLLUTED AREAS & SEZs

S. NO.	Name of the State / UT	CITIES		Polluted Areas (CEPI)	SEZs
		Metro	Class-I		
1.	Andhra Pradesh	3	44	5	33
2.	*Andaman & Nicobar*	--	--	--	--
3.	*Arunachal Pradesh*	--	--	--	--
4.	Assam	--	4	2	--
5.	Bihar	1	22	2	--
6.	Chhattisgarh	--	5	3	--
7.	Chandigarh	--	--	--	1
8.	*Daman & Diu*	--	--	--	--
9.	Dadra & Nagar Haveli	--	--	--	1
10.	Delhi	1	--	1	--
11.	Goa	--	1		2
12.	Gujarat	4	23	9	23
13.	Haryana	1	19	2	9
14.	Himachal Pradesh	--	--	3	--
15.	Jammu & Kashmir	--	1	--	--
16.	Jharkhand	2	12	5	1
17.	Karnataka	1	31	5	11
18.	Kerala	1	6	1	7
19.	*Lakshadweep*	--	--	--	--
20.	Madhya Pradesh	3	21	5	3
21.	*Mizoram*	--	--	--	--
22.	*Manipur*	--	--	--	--
23.	*Meghalaya*	--	--	--	--
24.	Maharashtra	4	46	8	37
25.	Nagaland	--	1	--	1
26.	Orissa	--	11	4	4
27.	Pondicherry	--	1	--	--
28.	Punjab	2	18	4	1
29.	Rajasthan	1	21	4	7
30.	*Sikkim*	--	--	--	--
31.	Tamil Nadu	3	38	7	30
32.	*Tripura*	--	--	--	--
33.	Uttar Pradesh	6	53	12	5
34.	Uttrakhand	--	4	2	--
35.	West Bengal	2	55	4	5
	Total	**35**	**437**	**88**	**181**

Table 4.2 STATE-WISE DISTRIBUTION OF REQUIREMENT OF MONITORING STATIONS

S. NO.	Name of the state/ UT	Monitoring Stations			
		Existing	Overall Proposed	Total	Project Target
1.	Andhra Pradesh	44	121	165	40
2.	Andaman & Nicobar	1	5	6	2
3.	Arunachal Pradesh	2	4	6	2
4.	Assam	6	18	24	9
5.	Bihar	8	67	75	25
6.	Chhattisgarh	14	13	27	6
7.	Chandigarh	5	1	6	1
8.	Daman & Diu and Dadar & Nagar Haveli	2	4	6	2
9.	Delhi	11	0	11	-
10.	Goa	2	7	9	3
11.	Gujarat	20	103	123	39
12.	Haryana	32	34	66	11
13.	Himachal Pradesh	4	8	12	5
14.	Jammu & Kashmir	3	6	9	4
15.	Jharkhand	16	44	60	20
16.	Karnataka	29	79	108	28
17.	Kerala	19	14	33	7
18.	Lakshadweep	2	4	6	2
19.	Madhya Pradesh	37	62	99	20
20.	Mizoram	4	2	6	1
21.	Manipur	2	4	6	2
22.	Meghalaya	2	4	6	2
23.	Maharashtra	70	120	190	40
24.	Nagaland	4	5	9	2
25.	Orissa	26	19	45	10
26.	Pondicherry	6	3	9	1
27.	Punjab	24	54	78	20
28.	Rajasthan	24	60	84	20
29.	Sikkim	2	4	6	2
30.	Tamil Nadu	16	137	153	45
31.	Tripura	2	4	6	2
32.	Uttar Pradesh	51	162	213	61
33.	Uttrakhand	6	12	18	6
34.	West Bengal	32	164	196	55
	Total	**530**	**1352**	**1882**	**495**

- Simultaneous measurement of multiple gas compounds
- Average measurement over the optical path length
- Elimination of cross interference of measured components including stray light
- Extension to new compounds without any hardware modification
- Storage of the spectra for possible re-analysis
- Compact design avoiding the use of an optical fiber
- All weather integrated projector and receiver
- Urban air quality monitoring
- Airport pollution monitoring
- Background pollution measurement
- Fence line monitoring in industrial areas

The needs as per the criteria mentioned and the assessment made by CPCB in arriving the proposed stations in each state is provided in Table 4.2. In many States stations are not proposed as the criteria doesn't demand. However, in order to represent all the States and Regions in the States, it is proposed to provide stations in the under-developed regions of the States also.

The ambient air quality network will be strengthened, as per the environmental need and requirement. Such needs will be understood before finalizing the sampling locations in consultation with the State Boards.

4.1.5 Financial Support for Strengthening Air Quality Network

To have pan India network of air quality monitoring stations it has been estimated that about ` 672.4 Crores will be required to have a network of 1706 monitoring stations (automatic & manual). The industries and the developers will be sharing about ` 222 Crores out of the total estimated budget. In the present project it is proposed to establish 495 monitoring stations (automatic & manual). The automatic monitoring stations will be maintained for three years by CPCB and will be handed over to SPCB in fourth year. The detailed expenditure involved for automatic and manual stations is provided below:

A. AUTOMATIC AIR QUALITY STATIONS

TARGET: 60 Stations

Year	Stations installed	Total stations in operation	Capital cost, in ` crore	O & M Cost, in ` crore
	CPCB			CPCB
Yr. 01	30	---	24	---
Yr. 02	30	30	24	2.4
Yr. 03	---	60	---	4.8
Yr. 04	---	60	---	4.8
Yr. 05	---	60	---	2.4
Total	60	**60**	**48**	**14.4**

Total cost is ` 62.4 crore for 60 stations.

B. MANUAL AIR QUALITY STATIONS

TARGET: 435 Stations

Year	Stations installed	Total stations in operation	Capital cost, in ` crore	O & M Cost, in ` crore
	CPCB			CPCB
Yr. 01	200	---	8.0	---
Yr. 02	235	200	9.4	7.0
Yr. 03	---	435	---	15.225
Yr. 04	---	435	---	15.225
Yr. 05	---	435	---	8.225
Total	435	**435**	**17.4**	**45.675**

Total cost is ` 63.075 crore for 435 stations

Note: ` 8.0 lakh per year is required for each CAAQM station towards O & M cost and ` 3.5 lakh/ per year for manual station.

4.2 Water Quality Monitoring

CPCB in collaboration with SPCBs/PCCs established a nationwide network of water quality monitoring comprising 1700 stations in 27 States and 6 Union Territories. The monitoring is done on monthly or quarterly basis in surface waters and on half yearly basis in case of ground water. The monitoring network covers 200 Rivers, 60 Lakes, 5 Tanks, 3 Ponds, 3 Creeks, 13 Canals, 17 Drains and 321 Wells.

Presently the inland water quality-monitoring network is operated under a three-tier programme i.e. Global Environment Monitoring System (GEMS), Monitoring of Indian National Aquatic Resources System (MINARS) and Yamuna Action Plan (YAP). Water samples are being analysed for 28 parameters consisting of 9 core parameters, 19 other physico-chemical and bacteriological parameters apart from the field observations. Besides this, 9 trace metals and 22 pesticides are also analysed in selected samples. Bio monitoring is carried out on specific locations. In view of limited resources, selected organic pollution related parameters are monitored i.e. micro pollutants (Toxic Metals & POPs) once in a year.

4.2.1 Water Quality Monitoring Objectives

The pollution control boards in India are responsible for restore and maintain the wholesomeness of aquatic resources. It is important that the pollution control boards regularly monitor the water quality to ensure that the water quality is being maintained or restored at desired level

The Water Quality Monitoring is performed with following objectives:

- For Rational planning of pollution control strategies and their prioritisation;
- To assess nature and extent of pollution control needed in different water bodies or their part;
- To evaluate effectiveness of pollution control measures already in existence;

- To evaluate water quality trend over a period of time;
- To assess assimilative capacity of a water body thereby reducing cost on pollution control;
- To understand the environmental fate of different pollutants.
- To assess the fitness of water for different uses.

4.2.2 Designing of Water Quality Monitoring Program

The Water Quality Monitoring network is designed in such a manner that the objectives of Water Act, 1974 are fulfilled. Many factors are involved in the proper selection of sampling sites such as objectives of the study, accessibility, flow, mixing and other physical characteristics of the water body and personnel and facilities available for the monitoring.

- Before selection of monitoring sites one requires consideration of monitoring objectives and some knowledge of the basic characteristics land-use, human activities, water use wastewater discharge etc.
- Main processes affecting water quality and their influence need be taken into account when sampling sites are selected.
- The exact location of sampling station needs to be finalized after field investigation and sampling sites should be marked on the map.
- The sampling point needs to be identified based on the representative site.

4.2.3 Protocols in the water quality monitoring

Sampling Procedure

Sampling is the first step in water quality monitoring and the sample should be truly representative.

Sample for physical and chemical analysis

- The sample collection is through depth sampler which is build indigenously. The sampling depth is measured from the water surface to 0.6 percent for representative sampling. The depth sampler remains at the required depth for about 15 seconds before releasing the messenger device closes the sampler.

- ❖ The temperature of the sample is measured and recorded immediately after the sample is taken.
- ❖ For measurement of dissolved oxygen the sample is collected in DO bottle and fixed immediately. A DO sampler is used for collection of DO sample. If an electronic technique is being used, a portion of the sample is carefully poured into a beaker for measurement.
- ❖ For measurement of pH and conductivity separate portions of the sample should be collected. The same portion must not be used for both determinations because of the possibility of potassium chloride diffusing from the pH problem.
- ❖ All measurements taken in the field are recorded in the field notebook before leaving the sampling station.

Sample for Bacteriological analysis

- ❖ Samples for Bacteriological analysis are taken in a sterile sampling bottle.

Sample preservation

- ❖ Suggested chemical preservatives for samples are added in the field.

Transportation and storage of samples

The sample collection process is coordinated with the laboratory. Each sample bottle is provided with an identification label indicating

a) Name of the study
b) Sample station identification number/ sample code
c) Date and time of sampling
d) Name of the individual who collected the sample
e) Record of any stabilizing preservative treatment

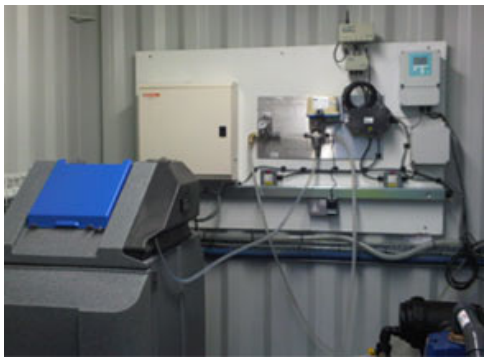
- ❖ Sampling bottles are placed in a box for transport to the laboratory. Sturdy, insulated wooden or plastic boxes are used to protect samples from sunlight, prevent the breakage of sample bottles, and allow a temperature of $4^{o}C$ to be attained and maintained during transport.

Laboratory Protocol

(i) Samples received in Laboratory are analysed as per the NABL Protocol and ISO Guidelines/ Documentation.

(ii) The instrumentation for analysis of different water quality parameters are spectrophotometer, pH meter, Colorimeter, Gas Chromatography (GC), Gas Chromatography – Mass spectroscopy (GC-MS), Inductively coupled plasma, Atomic absorption spectrophotometer (AAS), HPLC etc.

The CPCB experience with automatic water quality monitoring stations, when installed on River Ganga during 1990s was not fully satisfactory due many factors including the security/ safety of field equipment and instruments. Considering the practical feasibility and protection of the installed stations/ equipments, the automatic stations for water quality monitoring will be installed at abstraction points on rivers being operated by Central Government agencies such as Central Water Commission (CWC). It is also proposed to install these automatic stations on Polluted River Stretches. Some of the issues considered before finalizing the instrumentation are given below:



- Surface water quality monitoring
- Industrial wastewater monitoring (Grossly Polluting)
- Operation on an unfiltered samples
- Fully automated measuring, calibration and cleaning sequences
- Cold oxidation (low pressure UV), persulfate assisted
- Electronic compensation of all variations in the measurement process
- Electrochemical measurement rather than colorimetric (avoiding interferences due to color or suspended solids)
- Validity criteria calculated for each measurement before result transmission
- Large volume measuring cell for increased reproducibility
- Use of high precision pneumatic dozers

4.2.4 Target for Strengthening Water Quality Network

The criteria for sample representing the water quality in the country is given below along with the present network and additional stations required:

S. No.	Category	Total length	Criteria	Total required	Present	Additional required	Project Target
01	Rivers (16)	14,810 km	One/10KM	1485	302	1183	850
02	Tributaries of rivers	30,190 km	One/20KM	1510	678	832	400
03	Closed water bodies	68100 KM^2	One/100 KM^2	681	170	511	320
04	Creeks/sea water	---	---	60	60	0	0
05	Polluted River Stretches	150 no.	One/one	150	NA	150	150
06	Ground Water a) Identified wells b) Metro cities	 500 35 no.	 --- 25 to 28	 500 965	 490 ---	 10 965	 800
			TOTAL	**5351**	**1700**	**3651**	**2520**

The present network consists of 1700 stations, 980 located on rivers, 170 on ponds/lakes, 60 on creeks and 490 representing ground water. It is estimated that about 3650 additional stations are required and CPCB & SPCBs will start 3000 manual and 250 automatic stations. Considering the practical feasibility and protection of the installed stations/ equipments, the automatic stations for water quality monitoring will be installed at abstraction points on rivers being operated by Central Government agencies such as Central Water Commission (CWC) and on polluted river stretches by grossly polluting industries. The industries will install 300 and other agencies another 100 automatic stations. The data generated by other government agencies – Central Ground Water Board (CGWB), Central Water Commission will be supplemented to the proposed CPCB water network.

It is proposed to establish 550 automatic water quality stations to strengthen the manual network, wherein industries will install 300 stations.

In the present project it is proposed to establish 2520 (automatic and manual) water quality stations as detailed above.

4.2.5 Financial Support for Strengthening Water Quality Network

To reach the target of required water quality monitoring stations it has been estimated that about ` 233 Crores will be required for establishing 3550 monitoring stations (automatic & manual). Other agencies will bear the costs related to 100 automatic stations towards operation and maintenance. The industries and the developers will be sharing about ` 98 Crores out of the total estimated budget. In the present project it is proposed to establish 2520 monitoring stations (automatic & manual) by CPCB & SPCBs. The automatic monitoring stations will be maintained for three years by CPCB and will be handed over to SPCB in fourth year. The detailed expenditure involved for automatic and manual stations is provided below:

A. AUTOMATIC WATER QUALITY STATIONS

CPCB will install and operate NWMP stations. TARGET: 20 Stations

Year	Stations installed	Total stations in operation	Capital Cost, in `crore (@ `25 lakh/station)	O & M Cost, in ` crore (@ `2.5 lakh/ station)
Yr. 01	10	0	2.5	Nil
Yr. 02	10	10	2.5	0.25
Yr. 03	---	20	---	0.5
Yr. 04	---	20	---	0.5
Yr. 05	---	20	---	0.25
Total	20	20	**5.0**	**1.5**

Total cost is ` 6.5 crore for 20 stations

B. MANUAL WATER QUALITY STATIONS

TARGET: 2500 Stations

Year	Stations installed CPCB&SPCB	Total stations in operation	O & M Cost, in ` crore
Yr. 01	200(s)+400(gw)	600	1.80
Yr. 02	800(s)+400(gw)	1800	7.20
Yr. 03	700(s)	2500	11.4
Yr. 04	---	2500	11.4
Yr. 05	---	2500	11.4
Total	2500	**2500**	**43.2**

Total cost is ` 43.2 crore for 2500 stations

Note: ` 60,000/- per year is required for each surface water station sampling & analysis and ` 15,000 for ground water station.

4.3 Strengthening of Laboratories at CPCB & SPCBs

The infrastructure of CPCB and SPCBs needs upgradation to cater the additional responsibilities entrusted through various legislations under EPA. Many Boards suffer financial constraints leaving limited revenue to enforce the pollution abatement programmes. Thus the modernization and up-dation of laboratories, along with operation & maintenance is a must for CPCB & SPCBs, though the State Boards generate additional revenue from industries and local bodies through consent fees and other charges for law enforcement. Some of the State Boards have limited scope of generating revenue, as these States have seen limited industrial investment and infrastructure development. State Boards in North-East, Sikkim, Jammu & Kashmir, Bihar, Kerala and Pollution Control Committees in Andaman & Nicobar, Lakshadweep are amongst the Boards/ Committees required financial assistance. The desired training needed for the manpower has also been incorporated in the project for generation, reception, validation and transmission of the data from the filed locations.

4.3.1 Role of laboratories in CPCB's Mission

One of the major objectives of CPCB is monitoring of pollution sources and ambient environmental quality. Laboratory plays a vital role in carrying out these tasks.

The laboratory Divisions of CPCB at Delhi includes:

1) Water and Wastewater Laboratory
2) Air Laboratory
3) Bio-Science Laboratory
4) Treatability Laboratory
5) Instrumentation Laboratory
    i. Trace Organics Laboratory
    ii. Trace Inorganic Laboratory

4.3.2 Main purposes of the Laboratories

- Carrying out monitoring of water, waste water, air, soil and solid wastes
- Supporting services for various project with regard to sampling, analysis and reporting]
- Carrying out research and development project studies
- Standardization of new methodology for analysis of specific pollutants
- Carrying out bilateral Collaborative project studies with other countries
- Providing scientific laboratory related services to the State Pollution Control Boards and other organizations
- Conducting Inter Laboratory Analytical Quality Control (AQC) exercises for the benefit of the laboratories of SPCB and other for water, air and solid waste related parameters
- Conducting laboratory oriented training programmes for SPCBs, PCCs, industries, educational institutions and other organizations

The CPCB Laboratory at Delhi has been recognized as 'Central Laboratory" under the Ministry of Environment & Forests vide notification number 78(E) since November 19, 1991 and as 'Environmental Laboratory' under the Environment (Protection) Act, 1986 (29 of 1986) since July 21, 1987. The Laboratory has provision for sampling and analysis of environmental samples such as water, air soil and solid waste. The CPCB laboratory has obtained Laboratory Accreditation through the National Accreditation Board for Testing and Calibration Laboratories (NABL), Department of Science & Technology as per ISO / IEC 17025. The accreditation covers 85 chemical and 6 biological parameters

The CPCB Laboratory at Delhi is equipped with sophisticated instruments and equipment for analysis of water, as soil and solid waste. The CPCB Laboratories are involved in many applied and experimental research activities besides routine monitoring, sampling and analysis activities. The investigations related to public complaints, Matter related to Hon'ble Courts directives, association with all the divisions with reference to development of discharge standards, emission

norms, performance evaluation of pollution control devices in all types of industrial sectors and urban pollution, survey of river and its respective polluted stretches are other aspects of pollution and control of pollution in the country. In addition to these, CPCB's Laboratory carries out various R&D activities entrusted by Government Organizations (Ministry of Environment & Forests, National River Conservation Directorate etc.) in the country. Thus the objectives and functions are correlated with CPCB's mission.

4.3.3 Laboratory Up gradation

It is proposed to strengthen the Central Laboratories at Head office as well as Zonal office. These laboratories will be equipped to undertake Monitoring Programmes relating to:-

a) Water Quality Monitoring
b) Ambient Air Quality Monitoring (with reference to new ambient air quality standards)
c) Analysis of all the pollutants which have been notified with respect to Industrial Effluents, Emission, Hazardous Waste, etc.
d) Noise Assessment

An estimated amount of ` 24 Crores as per IIM Lucknow study commissioned by MoEF will be required for strengthening laboratories at CPCB as shown in Table 4.5.

Table 4.5: Requirement of Laboratory Instruments for CPCB Headquarters and Zonal Office laboratories

S.No.	Instrument	Total Units	Approx. Cost per unit in Lakh `	Total Cost in Lakh `
1.	Gas Chromatograph (GC) – ECD/FID/FPD	5	20	100
2.	Gas Chromatograph – Mass Spectrophometer (GC-MS)- LR	6	53	318
3.	High pressure Liquid Chromatograph (HPLC)	5	36	180
4.	Ion Chromatograph	3	22	66
5.	Inductively Coupled Plasma – Atomic Emission Spectrometer (ICP-AES)	4	42	168
6.	PM2.5 Dichotomous Sampler	15	8	120

S.No.	Instrument	Total Units	Approx. Cost per unit in Lakh `	Total Cost in Lakh `
	System			
7.	PM2.5 Sampler (FRM)	8	12	96
8.	High Volume Sampler with PUF (for ambient Dioxin / Furan)	6	6	36
9.	Speciation Sampler	3	10	30
10.	Stack monitoring Kit with VOST	4	25	100
11.	Zero Head space extractor 90 mm	4	2.5	10
12.	Zero Head space extractor 140 mm	4	2.5	10
13.	Rotary Agitator	4	1	4
14.	Flash point Apparatus	5	1.6	8
15.	Bomb Calorimeter	5	3.1	15.5
16.	Mobile Air Quality monitoring Van	10	100	1000
17.	Microwave Digester	7	5.5	38.5
18.	ICP-MS	1	100	100
Total ` (in Lakh)				**2400**

The requirement of laboratories in Central Board has been assessed, while the strengthening of the Laboratories at SPCBs has not been assessed. However, the SPCBs have provided the requirements related to infrastructure strengthening which includes laboratories. The Table 4.6 summarises the requirements of the SPCBs/PCCs in terms of manpower and funds towards strengthening laboratories. It is expected that about ` 26 crore fund will be available under the project for strengthening the laboratories at SPCBs.

Table 4.6: Strengthening of the State Pollution Control Boards/Pollution Control Committees

S.No.	Name of the States /UP	Funds Requested for Laboratory, `Crore	Funds proposed for allocation ` Crore
1.	Andaman & Nicobar	0.20	0.2
2.	Arunachal Pradesh	2.0	1.0
3.	Assam	5.5022	2.5
4.	Bihar	3.2	2.5
5.	Daman & Diu and Dadar & Nagar Haveli	1.0	1.0
6.	Goa	5.0	2.0

S.No.	Name of the States /UP	Funds Requested for Laboratory, `Crore	Funds proposed for allocation ` Crore
7.	Himachal Pradesh	1.879	1.0
8.	Jammu & Kashmir	10.0	1.5
9.	Kerala	5.25	2.8
10.	Lakshadweep	0.9	0.5
11.	Mizoram	2.4165	1.0
12.	Manipur	1.90	1.0
13.	Meghalaya	1.7186	1.0
14.	Nagaland	2.602	1.5
15.	Sikkim	1.5	1.0
16.	Tripura	2.0824	1.5
17.	Uttrakhand	8.5	4.0
	Total	**55.6507**	**26**

4.4 Environmental Information System

The environmental information system on GIS platform will be a web based information system with ability to provide spatial and non spatial information on all the aspects of environment. Some of the information will be on real time basis. The system will have capabilities of querying, retrieval, analysis and presentation along with regular updation facilities.

The Environmental Information System on GIS platform shall be able to work on all the ranges of computer operating system. The information system will have capabilities with zooming facilities starting from 1:1 or 2 million scales and zooming up to 1: 50,000 scale or even up to 1:5,000. The system will have environmental quality information such as ambient air quality, water quality (surface, ground), Industrial wastewater and emission loads, ambient & source wise noise levels, vehicular emission load. In addition, it will also provide information on all the environmentally relevant land uses such as

- Industrial locations/Growth Centres/Industrial Estates/Trade Centres/ SEZs/ Industrial clusters/ corridors
- Housing

- Transportation (road, rail, water ways)
- Utilities (water supply, electricity)
- Landfills/TSDFs/CETPs/STPs/CBWTF
- Forestry, National parks, Wild life sanctuaries
- Tiger reserve/elephant reserve/turtle nesting ground, breeding grounds
- Core zone of biosphere reserves
- Habitats for migratory birds
- Mangrove areas, Areas with threatened flora/fauna (rare, vulnerable, endangered)
- Protected corals, Wetlands, Botanical gardens, Zoological gardens, Gene Banks
- Reserved forests, Protected forests
- Other closed/protected areas under the Wild Life (Protection) Act, 1972
- Other areas as locally applicable or specified by the State or local government
- Ground water recharge areas
- Protected tribal settlements
- Monuments of national significance
- World Heritage Sites
- Scenic areas/tourism areas/hill resorts
- Flood prone areas
- Agricultural research stations
- Air port areas
- Quarrying/mining Areas
- Agricultural Areas(Highly Fertile lands/Double Crop Areas)

The Geographic Information Systems (GIS) will be the backbone of the proposed Environmental Information System and will have an important role with ability to link information with the location, analysis and presentation. Through GIS, thematic spatial information are analysed rapidly. The processes like overlay of thematic information, buffering of the areas, extraction of one theme from multiple themes, proximity of one feature with other relevant features can

be rapidly and accurately executed with the help of GIS. Forecasting different environmental scenarios can be easily done with the help of GIS, as it has the inbuilt abilities and tools. GIS is seen as a value addition to traditional Management Information Systems. GIS technology has been historically developed and deployed on monolithic systems. The proposed application shall bring a paradigm shift from desktop environment to an easy-to-use web interface where the user can create visually appealing maps on-the-fly and also making it available for a wider audience.

The basic functionalities like flexible compositions of different layout, identification of feature details, Clipping the desired area based on selection, Query data base, Buffer creation, Zoom based labeling, thematic mapping, value addition to MIS databases and extracting information through strong query builder etc.

Dissemination of GIS data and functionality has traditionally been restricted due to analytical complexity, the size and format of data sets and the limitations of network bandwidth. Web-based Geographic Information System (Web GIS) is a process designed to present spatial information with a friendly interface and the end user needs only a web browser to query, access, display and analyze GIS dataset. This greatly reduces fragmented and compartmentalized workflow and increases efficiencies. Web services make GIS cheaper by dramatically altering the cost-benefit ratios of GIS implementation when assessed against user accessibility. .

4.4.1 Salient Features of EIS on GIS:

1. A Web based GIS model up to critical polluted areas/problem areas/sensitive areas with thematic maps for identified parameters;
    i. All India Level showing State Aggregates
    ii. State level mapping showing District Aggregates and

iii. District/Taluka level mapping showing polluted areas/problem areas/sensitive areas wise details.

2. GIS functionalities like Navigation, query , print etc
3. Flexibility to re-compose the maps by changing colour ramp / palette.
4. Generation of Report along with the desired Map.
5. Query Builder module allows performing logical operator based feature query. Query based on layers, attribute columns, operators, saving the query, load the query etc.
6. Generate PIE/BAR chart based on query
7. View attribute information of the feature layers
8. Export the attributes to EXCEL / WORD
9. Spatial Analysis
10. Proximity analysis
11. Charts & report generation tools
12. High resolution Satellite Image as backdrop.

4.4.2 Salient Features of ERP implementation and IT strengthening at CPCB

It is conceived that the ERP implementation of CPCB activities will enhance the transparency and e-governance. The EIS on GIS platform will be integrated with the software of the ERP for better synergy and effective result. The salient features of the ERP implementation is listed in the table below:

Sl. No.	Key Features	Sought Benefits
1.	**Web enabled**	▪ Application will be used over the LAN in head office and on WAN in all other Zonal offices. Will be truly web browser based.
2.	**Online System**	▪ Will ensure **availability of real time information** on all aspects of the business ▪ Will ensure timely and accurate sharing of information across all departments ▪ Will enable management to obtain reports like **daily waste inventory, daily environmental information reports of air and water quality etc.**
3.	**Central**	▪ Online integration of all data from across locations

Sl. No.	Key Features	Sought Benefits
	database	▪ Previous year's data accessible at the click of a button
4.	**Highly scalable and Web Enabled Architecture**	▪ Add users as needed. Can scale up to 2000 (Two Thousand numbers) users without changing the system. ▪ Enable access from multiple locations and branches. ▪ Permit discretionary access for external entities.
5.	**Process Oriented System**	▪ Will enable a high degree of **management control over complete processes.**
6.	**Flexible & Dynamic Process Definition**	▪ New or changed processes created by a change in management policy will be configured and implemented without shutting down the system. ▪ **New process Lines will be easily added** without shutting down the system. ▪ Software adapts to the organization's changing process requirements. ▪ Will enable quick implementation of processes.
7.	**Dynamic Planning, Budgeting & Forecasting**	▪ **Will enable management to do What If analysis and obtain detailed financial information on cash, materials and resources under different scenarios.** ▪ **Will Enable management to see financial reports under different scenarios.**
8.	**Highly Definable Processes**	▪ Complex processes and the resources (materials, machines, manpower) and activities attached to these processes can be defined. Enables management to **understand the cost impact of each and every variable.**
9.	**Multi Location/ branches**	▪ Easily add new entities with separate financials/process ▪ View individual or consolidated MIS reports/Dashboard
10.	**Role based Single Sign off**	▪ Users are attached to roles, hence the **system is never person dependent.** ▪ **One Employee-one user id.** o Multiple designations o Multiple responsibilities o Responsibilities allocation etc.
11.	**Integration with CAAQMS, OEDM,EDB,ESS, CPF etc.**	▪ Application will be fully integrated with CAAQMS, OEDM.EDB & ESS software operational ▪ Development of activities of Laboratory sample analysis, reporting procedures etc. is to be done as a part of this software.
12.	**Integration with other applications used in CPCB**	▪ Application provider will study and integrate with all the existing Applications/systems present at CPCB.

Sl. No.	Key Features	Sought Benefits
13.	**Drill Down Access to Information**	▪ Quickly **reach relevant information without having to print out reports and waste paper** ▪ The result information page will have a facility on time scale to view the information of previous available date or to a next available date. This feature will be available throughout the system.
14.	**Powerful search option in all reports/MIS/Dashboards**	▪ Powerful search facility will be provided in all the Reports, MIS and dashboards
15.	**Task flow enabled**	▪ A definable task flow will be present for the document processing and will be designation based.
16.	**Built Work Flow & Online Authorization**	▪ Application will have built in workflow which is defined in the master definitions and enables management to know who did what and when through **extensive audit trails.**
17.	**Alerts Engine**	▪ Management will be alerted based on pre-defined benchmarks. Alerts will be sent through email, fax and even SMS.
18.	**Highly User Friendly**	▪ Common interface required for low lag time for users across functional areas to get proficient with using the system.
19.	**Dashboard/Control panel**	▪ Dashboards are generally used by top level management who needs up to date summaries information and might require details on any of the transaction. ▪ Dashboard will contain all required information in summarized form as per the access rights.
20.	**Import and Export**	▪ Will support seamless integration for information flow from Excel, Word, Microsoft office tools as well as from other software being used in various divisions, as far as applicable. ▪ All Reports will be exported to MS office tools and changes will be made there on, as per the user creativeness.
21.	**Entity Master**	▪ Entity master for each entity with the information flow.
22.	**Color Coding in Browsers**	▪ The Reports or MIS will have color coding to visibly segregate the items on the basis of status.

Sl. No.	Key Features	Sought Benefits
23.	**Printing Documents & Reports**	▪ Application will have prints for all the transactions, documents and reports. ▪ Each report will be properly time-stamped with date of generation and with CPCB logo (Stamp size) on each page.
24.	**Document Attachment manager Reference Documents**	▪ Will have functionality to attach documents for references and to provide details of the document attached by different divisions, date of attachment, reference of attachment, and the name of the official concerned. ▪ These reference documents will be available to the users performing the work/transactions for reference purpose. ▪ Reference documents of ISO, reference methods for laboratories, test results, standards etc, will be openly accessible.
25.	**Document Attachment Manager**	▪ Will enable the user to attach supporting or required documents with the transactions etc along with other details as of reference documents.
26.	**Workflow manager**	▪ This system function will allow administrator to define the workflow with a particular document. Multiple document types can have different work flows defined.
27.	**Procedural queues**	▪ Procedural queues at different windows according to work flow will be generated and which will be cleared upon approval from administrator inline. The non-responded queue files will be transferred automatically to the next administrator with a flag as unattended file and same information flows to designate competent authority as unattended file.
28.	**Time stamping**	▪ Total time elapsed at a window for clearance will be displayed as an attribute of the same

Sl. No.	Key Features	Sought Benefits
29.	**Menu Accessibility**	▪ Administrator will be able to customize the Application Software menu as per the requirements. The advantage is that users will have access to only those menus, which lie, in their area of activity. Through Menu Customization system administrator could hide the selected menu options.
30.	**Benchmark Speed**	▪ At prescribed standard PC the browser will open in not more than 4 seconds. ▪ Any entry form opening saving, report generation will not take more than 4 seconds.
31.	**GIS System**	▪ The GIS system will be designed in such a way so that further map scaling will be incorporated. ▪ System will be capable to adjust the map display over the user terminal automatically to its best resolution.
32.	**System independency**	▪ The development of the software will be done in such a way (Using standard technology and functions) so that any other software developer may take on the further expansion work without necessarily taking help of the supplier System Integrator.
33.	**Customization**	▪ To customize such Software Solution / ERP Solutions as may be required by the CPCB during the process of implementation of software.
34.	**Payment gateway**	▪ 128 bit encryption payment gateway compatible system.

4.4.3 Technology to be deployed

4.4.3.1 EIS on GIS Platform

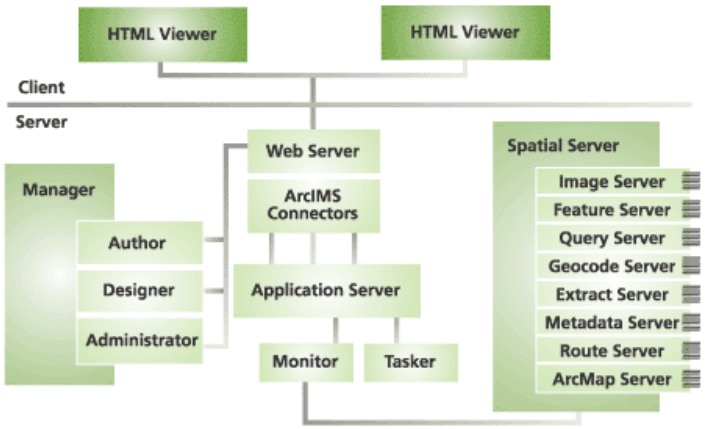
ESRI's ArcIMS/ ArcGIS Server technology may be used for the development of this application. Arc IMS is a server based tool that provides a scalable framework for distributing geographic information system (GIS) services and data over the web. Web publishing of dynamic and interactive GIS maps and

metadata catalogs for delivery to users will be enabled with a central repository for publishing and browsing metadata.

ArcIMS has a multitier architecture consisting of presentation, business logic, and data tiers. In addition, ArcIMS has a set of applications for managing a Web mapping site.

The presentation tier will include the ArcIMS client viewers for accessing, viewing, and analyzing geographic data. The components in the business logic tier will be used for handling requests and administering the ArcIMS site. The data tier will include all data sources available for use with ArcIMS.

Arc IMS Architecture Overview



ArcIMS can be easily scaled to handle the mapping demands of everything from the smallest Intranet to a high-volume Internet site. To successfully power large-scale sites, ArcIMS incorporates proven technology developed from ESRI's many years of experience in providing Web-enabled GIS.

ArcIMS establishes a common platform for the exchange of Web-enabled GIS data and services. It’s a framework for distributing GIS capabilities over the Internet. As a publishing technology, ArcIMS features unique capabilities for supporting a wide variety of clients. As a serving technology, ArcIMS includes a wide variety of ESRI server side technologies and provides unique opportunities for data integration. The details of technologies to be deployed for ERP implementation and IT strengthening are provided at Enclosure B.

4.4.4 Financial Support for establishing (A) GIS Platform, (B) ERP implementation at CPCB and IT strengthening

(A) Financial Support for GIS Platform

The Environmental Information system will be developed by NIC in consultation with CPCB, NRSC and Department of Space. NIC will lead a consortium of expert agencies for the task and it is estimated that about ` 40 Crores will be required for developing GIS platform to host environmental information system. It is also agreed by NIC and NRSC/SAC to share the available thematic layers for the project without any financial implications. The budget details as provided by NIC are given below:

S.No.	Items of Work Description	Cost in Crore of `
1.	**Project Consulting and Coordination Services** ➢ Business Process Study (As-is),Gap Analysis, To Be Framework, Spatial and Non-Spatial Information Framework, Data Collection, Data Services, Project Documentation	4
2.	**Multilayered Imagery and Geo-Spatial Engineering Services** ➢ Procurement, Tiles Creation, Mosiacing of Tiles, Colour Balancing, Digitization, Geo-Referencing etc.,	9
3.	**Application Development and System Integration Services** ➢ Database Design, Data Compilation and Integration, Development, Analysis, Customization, QA/QC	7
4.	**Application Interface Integration and Systems Integration Services**	8
5.	**IT Infrastructure for GIS/ GPS platform**	7
6.	**Training, Handholding, Travel, Miscellaneous**	2
7.	**Maintenance Services** ➢ Would Start from the 3rd Year till the 5th Year (1 Crore Per Year)	3
	Total	**40**

(B) I.T. Strengthening

(I) ERP Implementation at CPCB

It has been estimated that about ` 12 Crores will be required for ERP development at CPCB. This will include development and customization of ERP software. Detail of requirement of ERP is attached at Enclosure B (PART-I). The budget details are given below:

S.No.	Items of Work Description	Cost in Crore of `
01	Development of ERP software with all more than 13 modules	5.0

S.No.	Items of Work Description	Cost in Crore of `
02	Customization and maintenance of Software for next five years	0.5
03	Data Entry of about 2.5 Lakh pages	0.1
04	Data Procurement from Central Government Agencies	1.0
05	Data Validation	0.5
06	Hardware /software for Servers/Desktops etc. for ERP project	0.5
07	Operation and maintenance of system	0.4
	Sub -Total	**8.0**
Operational Cost (during the project period)		
01	Yearly Operational cost of DC with 2 MPLS lines for High availability+Leased lines + Video Conferencing+ Data Storage + DG Sets oil + Electricity etc	**3.5**
02	Yearly operational cost at HO & Zonal Offices	**0.5**
	Sub-Total	**4.0**
	Total	**12.0***

*Prepared in consultation with NIC, New Delhi

(II) Hardware Support

It has been estimated that about ` 8 Crores will be required for IT strengthening of CPCB. This will include IT systems requirement. Detail of requirement of systems is attached at Enclosure B (PART-II). The budget details are given below:

S.No.	Items of Work Description	Cost in Crore of `
Installation Cost		
01	**Datacentre (DC) at HO**	
a)	➢ Non-IT component for 500 to 700 sq feet size with Electrical, Fire Detection system, CCTV, Public Address System, DG Sets, UPS, Building Management etc	1.4
b)	➢ IT component with 16 Servers, 05 Work Stations, SAN storage, MPLS Gateway, Router, Internet Gateway, Core Switches, Load Balancer, Initial and external firewalls, IPS, Video Conferencing system, Plasma	3.6
c)	➢ Software for DC	1.0
02	**Local Area Network & Internet connectivity, Data Storage, Video Conferencing etc.**	1.0
03	**Desktops and Laptops with UPS etc.**	1.0
	Total	**8.0***

* As per the study conducted by M/s Vayam Technologies Ltd., New Delhi

5.0 Methodology

The methodology adopted for development of this environmental information system is as follows.

- **Manual Mapping -** All information as mentioned at 2.4 above will be transformed into maps. The sources of these information are identified as NIC, NRSA and SAC. If the information is readily available in digital form this step will be omitted,

- **Digital Mapping –** All the above manual maps will be converted into digital map for rapid analysis using ARC-GIS software**.** If the information is readily available in digital form this step will be omitted

- **Database Development-** All the statistical data will be keyed in using SQL Server for better security and management

- **Identification of effects and impacts -** Broadly, the following two steps will be used.

  Step1: The 'source'/project components are firstly identified. These components will be detailed out to the extent as per the scale of evaluation. For micro level assessments, detailed break-up of the project components will be done. For the various sources such as industries, primary survey will be conducted, wherever the required information is not available.

  Step2: The existing environmental status of the receiving environment will be identified. This includes identification of 'receivers' and environmental status. For information collection, depending on the scale, methods such as primary surveys or aerial photographs or remote sensing will be used.

- **Evaluating Impacts -** The impact parameters are identified and placed in the form of maps. The layers causing an effect and impact are overlaid systematically to arrive at end result. Computers, especially the modern GIS software have the overlay facilities that make it easier to use this method in a very reliable manner.

- **Prediction of effects and impacts -** For predicting the impacts, tools such as modelling and monitoring will be used. Also, the impacts will be qualitatively specified, for example, excellent, very good, good, bad, very bad or ranking or weightages techniques will be used giving the scores of 10, 7, 5, 3, 1 etc.

- **Transformation:** All the information will be bundled into a software using ARC-GIS platform so that environmental information can be seen on any system irrespective of operating system.

5.1 EIS on GIS platform - Implementation Strategy

The following strategy is suggested for implementing the EIS on GIS platform

Step 1:

Information available through the existing air and water quality monitoring stations will be transformed on the spatial information available with NIC and NRSC and will be geographically referenced. GIS platform will be developed and web enabled.

Step 2:

All the proposed air and water quality stations will be established and will be made functional. These functional stations will be transformed on the spatial information available with the NIC and NRSC and will be geographically linked.

Step 3:

Prediction models for air and water environment will be developed and will be integrated with the GIS Platform.

6.0 Output

The output will be an environmental information system on GIS platform which will work on all the ranges of computer operating system. The information system will have capabilities of querying, analysis, and presentation of analysis as per desired format. The information system will have zooming facilities starting from 1:1or 2 million scale and zooming up to1: 50,000; 25000 or up to 5000 scale It will have base line information on all the environmentally relevant land uses like trade and industry locations, housing, transportation (road, rail, water ways), utilities (water supply, electricity), refuse/ waste (landfills), wastewater treatment installations, forestry, National parks, Wild life sanctuaries, Game reserve, Tiger reserve/elephant reserve/turtle nesting ground, breeding grounds, Core zone of biosphere reserve, Habitat for migratory birds, Mangrove area, Areas with threatened (rare, vulnerable, endangered) flora/fauna , protected corals, Wetlands, Botanical gardens, Zoological gardens, Gene Banks, Reserved forests, Protected forests, Any other closed/protected area under the Wild Life (Protection) Act, 1972, Any other area as locally applicable, Ground water recharge areas, Protected tribal settlements, Monuments of national significance, World Heritage Sites, scenic areas/tourism areas/hill resorts, Flood prone areas, Agricultural research stations, Air port areas, Any other feature as specified by the State or local government and other features as locally applicable, quarrying/mining, power generation, agriculture, recreation and tourism. Also it will have environmental quality information like ambient air quality, water quality (surface, ground water, coastal), Industrial wastewater and

emission loads, ambient & source wise noise levels, vehicular emission load (if possible) in multi scale. In addition to this it will have information on all the industries/developmental activities which have bearing on environment.

6.1 Deliverables for Air Environment

- Network of air quality stations covering industrial areas/estates, critically polluted areas, problem areas, metro cities, urban centers and ecologically fragile and sensitive areas, with capability to monitor SO_2, NOx, PM_{10}, $PM_{2.5}$, Ozone, Lead, Carbon Monoxide, Ammonia, Benzene, Benzo (a) pyrene Arsenic and Nickel and Toulene and Xylene at selected places
- Web portal having online information on status of air quality on a geographically referenced map for the entire country with capabilities to show temporal variation in air quality.
- Web portal with capabilities to predict changes in air quality

6.2 Deliverables for Water Environment

- Network of water quality monitoring stations covering all the major rivers and its tributaries, polluted river stretches, lakes, ponds, major water bodies with capability to monitor monthly, quarterly, half yearly and annually 28 parameters consisting of physico-chemical and bacteriological parameters for ambient water samples, 9 trace metals and 28 pesticide residues, organic pollution related parameters and major cations, anions, other inorganic ions and micro pollutants in selected samples;
- Web portal having online information on status of water quality on a geographically referenced map for the entire country with capabilities to show temporal variation in water quality.

- Web portal with capabilities to predict changes in water quality.

- Web portal with zooming facilities for moving from major rivers to its tributaries.

6.3 Deliverable for CPCB and SPCBs Laboratories

- A modern laboratory capable of handling all the air and water quality monitoring stations
- Trained manpower for generation, reception, validation and transmission of the data from the field locations.

6.4 Deliverable for GIS Portal

- Web portal with environmentally relevant land uses such as Industrial locations/Growth Centres/Industrial Estates/Trade Centres/ SEZs/ Industrial clusters/ corridors, Housing, Transportation (road, rail, water ways), Utilities (water supply, electricity), Landfills/TSDFs/CETPs/STPs/CBWTF, Forestry, National parks, Wild life sanctuaries, Tiger reserve/elephant reserve/turtle nesting ground, breeding grounds, Core zone of biosphere reserves, Habitats for migratory birds, Mangrove areas, Areas with threatened flora/fauna (rare, vulnerable, endangered), Protected corals, Wetlands, Botanical gardens, Zoological gardens, Gene Banks, Reserved forests, Protected forests, Other closed/protected areas under the Wild Life (Protection) Act, 1972, Other areas as locally applicable or specified by the State or local government, Ground water recharge areas, Protected tribal settlements, Monuments of national significance, World Heritage Sites, Scenic areas/tourism areas/hill resorts, Flood prone areas, Agricultural research stations, Air port areas, Quarrying/mining Areas and Agricultural Areas(Highly Fertile lands/Double Crop Areas);

- Web portal with geographically referenced maps related to environmental themes with ability to zoom from national level to taluka level with increased information, to zoom from regions to local areas for air quality information, to zoom from major river to tributaries for water quality information ;
- Web portal with capabilities of overlay of thematic maps, buffering of the sensitive areas, extraction of one theme from multiple themes, proximity of one feature with other relevant features;
- Web portal with capabilities to present environmental status, easy retrieval, updation, modification and analysis of thematic spatial/non spatial information; and
- Web portal with ability to predict impacts/ scenarios due to different environmental conditions for facilitating decisions

6.5 Deliverable for IT Strengthening of CPCB

- Customized latest IT infrastructure at all the offices of CPCB is in place with video conferencing and data storage and recovery system.

6.6 Deliverable for ERP software

- Customized ERP software for helping day to day operation in a secured IT environment is in place.

6.7 Risk Analysis

The very purpose of the Environmental Management and Planning, which is based on dynamic systems enabling the policy makers to step in for pollution mitigation programme based on generated, collected, collated and depicted data. All above are enriched on strengthening, monitoring programme which is a scattered form which is scanty in the existing form and all the apprehended risks could and would be covered by a commensurate strengthening, monitoring

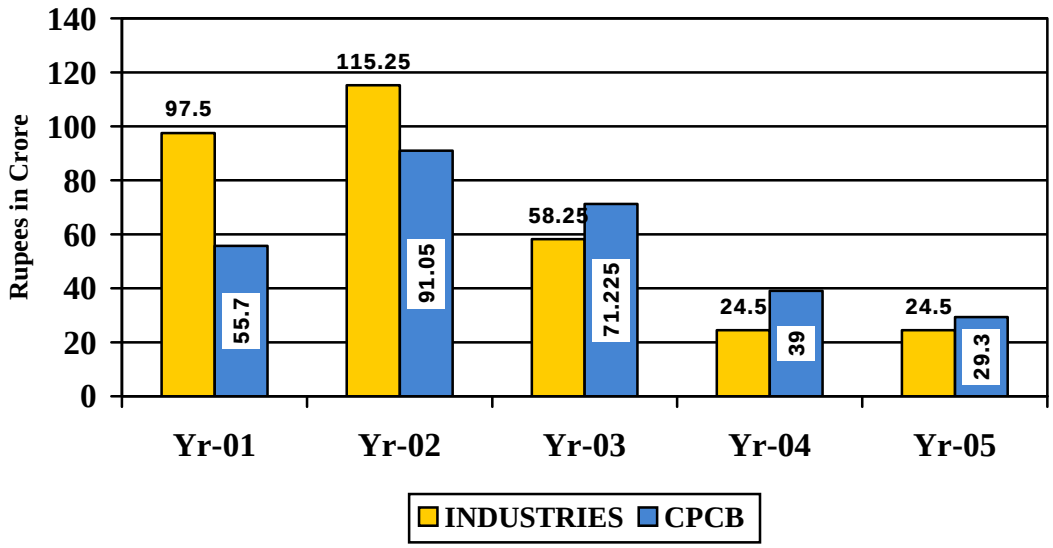
system programme including various factors such as HRD, equipments and other deliberations. Adequate repository safety measure could be installed in place and be continuously updated employing most modern technology.

6.8 Success Criteria

The very object of the project is well being of the eco system, ecology and human health. If any imbalance happens, life centric continuity is in danger. Different parameters covered under the programme will be critically analysed and validated data be placed on commensuration at respective places. All these will be not only being mere tools of impact assessment but would be special vehicle launchers for the driven mood and mode.

7.0 Budget:

The total required budget for overall exercise will be ` 1,308 Crore as given at Annexure – II. **The budget requirement for the present proposed project is ` 286 Crore**, which includes the O & M cost of monitoring stations and GIS platform maintenance for entire project period. The year-wise fund requirement is provided below:



The requirement of funds has been estimated as ` 286 crore, as shown and detailed in Annexure – III.

8.0 Time Frame

The Total time frame for the entire Project will be 5 years starting from the day of sanctioning of the Project and releasing the funds.

8.1 Work Schedule

The work schedule is given at Enclosure A

ANNEXURE - I

Criteria for ambient air and water quality monitoring stations and the Gap Analysis

Air Quality Network

S. No.	Category	Criteria, no./city	Total required	Present	Gap
01	Class–I Cities(437)	3	1311	271	1040
02	Mega Cities (35)	9	315	165	150
03	Industrial Areas(27)	6	162	40	115
04	Capital Cities (28)	6	168	54	116
		TOTAL	**1,956**	**530**	**1,426**

The gap of 1420 is reduced to **1256** as another 170 stations are already approved in CPCB Plan Activities of 2010-11. The network will be expanded to establish **435 stations by CPCB** and remaining 821 stations by SPCBs.

In addition there are about 40 Continuous stations are in operation and it is proposed to expand to 500 stations. **CPCB will establish 60 stations**, SPCBs 200 stations and another 200 stations will be provided by the industries.

It is also proposed have another 1500 manual stations in Class II cities/towns in Phase – II.

Water Quality Network

S. No.	Category	Total length	Criteria	Total required	Present	Gap
01	Rivers (16)	14,810 km	One/10KM	1485	302	1183
02	Tributaries of rivers	30,190 km	One/20KM	1510	678	832
03	Closed water bodies	68100 KM^2	One/100 KM^2	681	170	451
04	Creeks/sea water	---	---	---	60	0
05	Polluted River Stretches	150 no.	One/one	150	NA	150
06	Ground Water					
	a) Identified wells	500	---	500	490	10
	b) Metro cities	35 no.	25 to 28	965	---	965
			TOTAL	**5291**	**1700**	**3651**

The water quality network will be expanded from 1700 to 5291 as follows:

i) CPCB & SPCB Monitoring : 3000

ii) Abstraction points by other agencies : 650

iii) Industrial Monitoring (including developers) : 300 (automatic)

The industries are directed to establish 300 automatic stations, including 150 on polluted river stretches. **CPCB and SPCBs will establish 250 automatic stations**, out of overall target of 3,650.

ANNEXURE -II

BUDGET DETAILS OF OVERALL EXERCISE of EIS on GIS PLATFORM

(All figures are in ` crore)

S.No.	Head	CPCB	SPCBs	Industries*	Total
01	AIR QUALITY (PHASE-I)				
	a)Manual Stations (1256)				
	-- CAPITAL COST	17.4	32.8	---	50.2
	-- O & M COST	45.7	85.5	---	131.2
	b)Automatic Stations (450)				
	-- CAPITAL COST	48.0	152.0	160.0	360.0
	-- O & M COST	14.4	45.6	56.0	116.0
	d) Software & AMC	2.0	5.0	5.0	12.0
	e)Training & Miscellaneous	1.0	1.0	1.0	3.0
	SUB-TOTAL	**128.5**	**321.9**	**222.0**	**672.4**
01 A	AIR QUALITY (PHASE-II)				
	a)Manual Stations (1500)				
	-- CAPITAL COST	---	60.0	---	60.0
	-- O & M COST (3years)	---	157.5	---	157.5
	SUB-TOTAL	**---**	**217.5**	**---**	**217.5**
02	WATER QUALITY				
	a)Manual Stations (3000)				
	-- O & M COST	8.1	42.6	---	50.7
	b)Automatic Stations (550)	62.5	---	75.0	137.5
	-- CAPITAL COST	17.5	---	20.0	37.5
	-- O & M COST	1.0	2.0	2.0	5.0
	d) Software & AMC	1.0	1.0	1.0	3.0
	e)Training & Miscellaneous				
	SUB-TOTAL	**90.1**	**45.6**	**98.0**	**233.7**
03	STRENGTHENING OF LABORATORIES	**24.0**	**100.0**	**---**	**124.0**
04	GIS PLATFORM	**40.0**	**---**	**---**	**40.0**
	ERP Implementation at CPCB	**12.0**			**12.0**
	Data Centre including IT strengthening at CPCB	**8.0**			**8.0**
	TOTAL	**302.6**	**685.0**	**320.0**	**1307.6**
					Say ` 1,308 crore

GRAND TOTAL: Rupees One thousand three hundred eight crore only

* INDUSTRIES include the agencies and organizations involved in developing the SEZs, Industrial Clusters/ corridors, PCPIRs, etc.

ANNEXURE -III

BUDGET ESTIMATE of EIS ON GIS PLATFORM

AIR QUALITY NETWORK	
a) Manual Stations (435)	-- ` 17.4 crore
b) Automatic Stations (60)	-- ` 48.0 crore
c) O & M of the Stations	-- ` 60.075 crore
d) Training & Miscellaneous	-- ` 1.0 crore
	SUB-TOTAL -- ` 126.475 crore
WATER QUALITY NETWORK	
a) Manual Stations (2500)	-- ` 43.2 crore
b) Automatic Stations (20)	-- ` 5.0 crore
c) O & M of Stations	-- ` 1.5 crore
	SUB-TOTAL -- ` 49.7 crore
STRENGTHENING OF LABORATORIES	
a) Zonal Offices and HO of CPCB	-- ` 24.0 crore
b) Regional Offices of SPCBs	-- ` 26.0 crore
	SUB-TOTAL -- ` 50 crore
GIS PLATFORM	
a) GIS Platform development & maintenance	-- ` 40 crore
b) IT Strengthening at CPCB	
(i) Software (ERP)	-- ` 12 crore
(ii) Hardware	-- ` 8 crore
	SUB-TOTAL -- ` 60 crore

GRAND TOTAL --- ` 286.175 CRORE

` 286 CRORE required for execution of the proposed project

Enclosure A

PROJECT SCHEDULE OF EIS ON GIS PLATFORM

PROJECT COMPONENT	YEAR – I				YEAR – II				YEAR – III				YEAR – IV				YEAR – V				REMARKS
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
● IDENTIFICATION OF LOCATIONS																					
CONSULT SPCBS																					
FINALISE THE NEED/ DEMAND																					
SELECTION OF LOCATIONS																					
TECHNICAL READINESS/ PREPAREDNESS																					
a) CAAQMS		30				30															CPCB-60
b) AAQMS			200				235														CPCB-435
c) AWQMS		10				10															CPCB-20
● PURCHASE OF INSTRUMENTS/ EQUIPMENTS																					
■ MANUAL STATIONS																					
LIST THE INSTRUMENTS/ EQUIPMENTS																					
EXAMINE & FINALISE THE SPECIFICATIONS																					
TENDERING																					
SUPPLY ORDERS																					
COMMISSIONING																					
■ AUTOMATIC STATIONS																					
LIST THE INSTRUMENTS/ EQUIPMENTS																					

PROJECT COMPONENT	YEAR – I				YEAR – II				YEAR – III				YEAR – IV				YEAR – V				REMARKS
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
LIST SUPPLIERS																					
EXAMINE & FINALISE THE SPECIFICATIONS																					
TENDERING																					
SUPPLY ORDERS																					
FIELD PREPARATIONS																					
COMMISSIONING																					
SOFTWARE DEVELOPMENT																					
SOFTWARE DEPLOYMENT																					
NETWORKING THE STATIONS																					
DATA SOURCING																					
DATA TRANSMISSION																					
DATA VALIDATION																					
DATA ANALYSIS																					
MANPOWER RECRUITMENT, TRAINING, DEPLOYMENT																					
MANPOWER ASSESSMENT																					
INFRASTRUCTURE ASSESSMENT																					
IDENTIFY THE GAPS																					
RECRUITMENT OF PROJECT STAFF																					
TRAINING																					
DEPLOYMENT																					
COMMISSIONING & RUNNING STATIONS																					
FILED PREPARADNESS																					
COMMISSIONING STATIONS																					

PROJECT COMPONENT	YEAR – I				YEAR – II				YEAR – III				YEAR – IV				YEAR – V				REMARKS
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
RUNNING STATIONS																					
REVIEW STATUS & REPORTS																					
IDENTIFY THE GAPS																					
PREPARE ACTION PLAN																					
IMPLEMENT ACTION PLAN																					
STREAMLINE THE DATA RECEIPT																					
● STRENGTHENING OF CPCB & SPCBs																					
■ CPCB																					
PREPARE LATEST STATUS																					
REVISE THE REQUIREMENTS																					
FINALISE SPECIFICATIONS																					
TENDERING																					
SUPPLY ORDERS																					
COMMSSIONING																					
TRAINING																					
■ SPCBs																					
ASSESS THE STATE BOARDS																					
LIST THE SPCBs FOR ASSISTANCE																					
CONSULT SPCBs																					
FINALISE SPECIFICATIONS																					

PROJECT COMPONENT	YEAR – I				YEAR – II				YEAR – III				YEAR – IV				YEAR – V				REMARKS
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
TENDERING																					
SUPPLY ORDERS																					
COMMSSIONING																					
TRAINING																					
● DEVELOPMENT OF GIS PLATFORM & HOSTING OF EIS																					
■ CPCB																					
PREPARE REQUIREMENTS																					
ASSESS H/W & S/W REQUIREMENT																					
ASSESS MANPOWER REQUIREMENT																					
FINALISE SPECIFICATIONS																					
TENDERING																					
SUPPLY ORDERS																					
RECRUITMENT																					
DEPLOYMENT																					
PROCUREMENT OF DATA																					
■ NIC																					
PREPARE REQUIREMENTS																					
ASSESS H/W REQUIREMENT																					
ASSESS S/W REQUIREMENT																					
ASSESS MANPOWER REQUIREMENT																					

PROJECT COMPONENT	YEAR – I				YEAR – II				YEAR – III				YEAR – IV				YEAR – V				REMARKS
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
FINALISE SPECIFICATIONS																					
TENDERING																					
SI SELECTION																					
DEVELOPMENT OF SOFTWARE																					
PROCUREMENT OF SPATIAL DATA																					
DATA INTEGRATION																					
COMMISSIONING																					
HOSTING																					

Enclosure B

The Systems & Software Requirement Study of CPCB

This Systems & Software Requirements Study Report consists of two parts, one aiming to strengthen the I.T. Infrastructure at CPCB including the Zonal Offices and the other describing the Computerization & Digitization of CPCB Activities leading to ERP Development. The report is also incorporated with financial estimates, which could be part of the Project Cost.

The report contains inputs from the Studies done by the consultants engaged by CPCB, the reports prepared by the IT Division of CPCB and assessment reports provided by National Informatics Centre Services Inc. (NICSI). These reports and inputs were discussed and reviewed by the Computer Core Committee constituted with senior officials of CPCB & the external experts from IIT-Delhi, Institute of Electronics & Telecommunication Engineers and NIC.

In the past, various studies were conducted towards strengthening of I.T. Infrastructure of CPCB. The report prepared by the Indian Institute of Management, Lucknow in February 2010 has made a preliminary assessment of requirements in this regard at CPCB. Some of the important observations made by the Institute are mentioned here.

- IT division is one of the central units of CPCB and is responsible for the dissemination of information and data relating to pollution in the public domain. It also provides technical support through LAN setting, internet connection, computer services, publishing data and standards generated by different divisions on the website.
- It is the gateway for putting information in public domain. It has developed Environmental Databank containing air and water quality data from the SPCBs and PCCs. The application has contained historical data since 2006 and has in-built capabilities to generate data tables/graphs.
- It has real time data transmission and display system for Continuous Ambient Air Quality Monitoring (CAAQM) stations. It is capable to pick up any number of parameters from monitoring station and customized data is acquired at 15 minute interval without human intervention.
- The division is also entrusted with the development of computerized system for random inspection of industries and follow-up actions. This web-based software is ready for deployment.
- The Online Emission Data Display System has also been identified as one of the core areas for linking the data from industrial sources. The data transmission & display systems have been developed with various capabilities.

The constraints and weak areas of the division were also mentioned in the report.

- Dependency on other divisions for data dissemination. These divisions sometimes, do not provide data on time
- Few of the works are outsourced due to lack of expertise. Also, lucrative salary in private sector acts as a barrier to procure highly talented people to this sector.

Thus, the division is deprived of getting talented and well informed people into its service.

- Lack of technical expertise in specific domains like GIS, Networking, Programming etc.

The suggested activities for the division as mentioned in the report were business process engineering leading to systematic functioning of the organization. The activities and the data generated by CPCB need to computerized which will be ensure the periodic updating of all the information. For computerization, adequate PCs and supporting software need to be procured and requirement will also be extended to the existing Zonal offices. The Zonal offices will be linked with all the divisions at Head Office. Further, Video Conferencing facility will be developed between CPCB & MOEF and Head office of CPCB & the Zonal offices.

In view of the recommendations made by the IIM, Lucknow and the subsequent discussions had with the Ministry of Environment & Forests, CPCB consolidated its requirements under various project activities and presented here. The budget requirements of ` 20.0 Crores estimated for funding under the project “EIS on GIS Platform” towards the establishment of Datacenter, Setting up of Network connectivity, implementation of ERP, and strengthening of IT infrastructure. An amount of ` 4.0 Crores included in the above budget estimate towards the operational cost during the project period.

PART I

The basic issues that the Software Requirements addressed are the following:

a) ***Functionality:*** It defines what the software supposed to do.
b) ***External interfaces:*** It shows how the software interacts with people, the system's hardware, other hardware, and other software.
c) ***Performance:*** It spells out the requirement of the speed, availability, response time, recovery time of various software functions, etc.
d) ***Attributes:*** The considerations related to the portability, correctness, maintainability, security, etc. are identified.
e) ***Design constraints imposed on an implementation:*** Examine if there are any required standards in effect, implementation language, policies for database integrity, resource limits, operating environment(s) etc.

The complete description of the functions being performed by the officials of the organisation is first understood and then software is identified meeting the specific needs. The software will also have capabilities to accommodate the future needs. The requirements have been identified after going through rigorous exercises. The required care is also taken in minimising the omissions, misunderstandings and the inconsistencies. Series of meetings were conducted with the Divisional Heads.

1.0 Objective

Basic concept is to automate and re-engineer various CPCB processes to bring in transparency, timeliness, responsiveness along with competitiveness among its divisions/sections and officials in terms of quality, quantity with sense of responsibility.

Firstly, the aim is to digitize all the documents available in CPCB as on date from the date of inception of CPCB. This includes data of Finance and Accounts, Administration and all other technical sections like HWMD, Laboratories, PCIs, UPCD & ESS etc. from back years.

Secondly, It aims at integration of information at spatial base maps in terms of air, water quality data along with its trends, which would be easily accessed by any stakeholder like MoEF, SPCBs, PCCs, Industries (Limited access), Zonal Offices of CPCB, and all of its employee,s who will enter into the portal through proper security system on real time basis. Specifically the spatial information on bigger scale will be made available on the specific monitoring locations of CPCB (1:50000 scale)

Thirdly, it is aimed at facilitating its field officers with the information fetching possibility from Central database through GPS handheld devices which can interact with the central software to upload and download the spatial as well as non-spatial information directly instantly. This will make CPCB monitoring system more accurate and quicker and at par with any other agency in the world.

2.0 Functionality

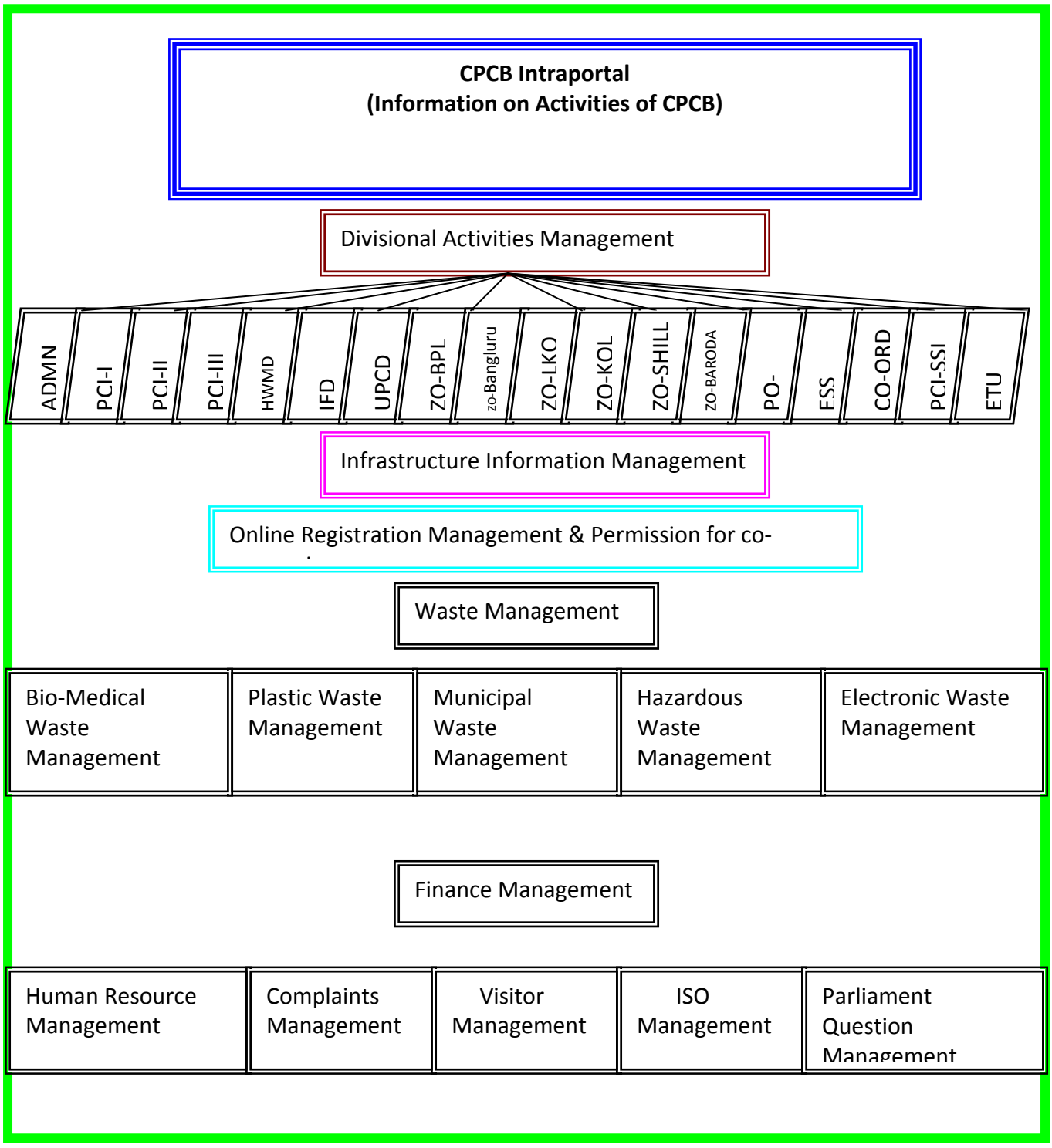
CPCB desires to develop web based applications with the use of Information and Communication Technologies (ICTs). The main purpose is to achieve the ultimate goal of setting up of true knowledge based system that delivers updated information quickly in terms of reports, inventories, spatial dissemination of information on true scale with accuracy as well as to establish a work flow based system to account each activity of CPCB workforce done on daily basis in a hierarchy.

The development of ERP system will be the first step towards implementation of concept of paper-less office. Other functionalities desired by the system are:

- To develop an Integrated Environmental Management Information System for Core Activities of CPCB like Hazardous Waste Management, Urban Pollution Control Management, Pollution Control Implementation–I,II,II,SSI, Planning, Environmental Surveillance, Pollution Assessment and Monitoring, Laboratory Management, Co-ordination.
- To develop the management system for Non-Core Activities like HR Management, Materials Management, Administration management, Training Management, Finance Management, Visitor Management, ISO Management etc.
- To integrate various departmental activities of CPCB Headquarter with its Zonal offices and Project Offices.
- To make available real-time information and data with clarity, accuracy and speed to all users, management, and other stakeholders.
- To create integrated data banks at departmental levels & then at Central level to create a national level knowledge base.
- Integrate existing Management Information Systems (CAAQMS, OEDM, EDB, ESS etc.)
- Data dissemination on spatial basis through existing MIS.
- To provide effective time management and timely intervention at even the remotest geographical location in the country through GPS based bi-directional information exchange system through PDAs.
- Exchange of Information between monitoring team and CPCB Server on real time basis.
- Data Mining and data warehousing.
- Interoperability of existing systems.
- To provide facility of data fetching/uploading from different agencies.
- To improve the organizational image constantly by creating quick, seamless and accurate environment for efficient functioning like online application forms filling facility for recruitment, e-tendering procedures, material management, online response forms receiving and distribution and follow-up etc.
- To avoid repetition and duplication of work at different levels.
- To achieve optimal utilization of various available resources including manpower, materials, etc.
- To improve functional and operational efficiencies of all technical as well as administrative processes etc.

Various modules specific to various divisions are to be developed as detailed below:

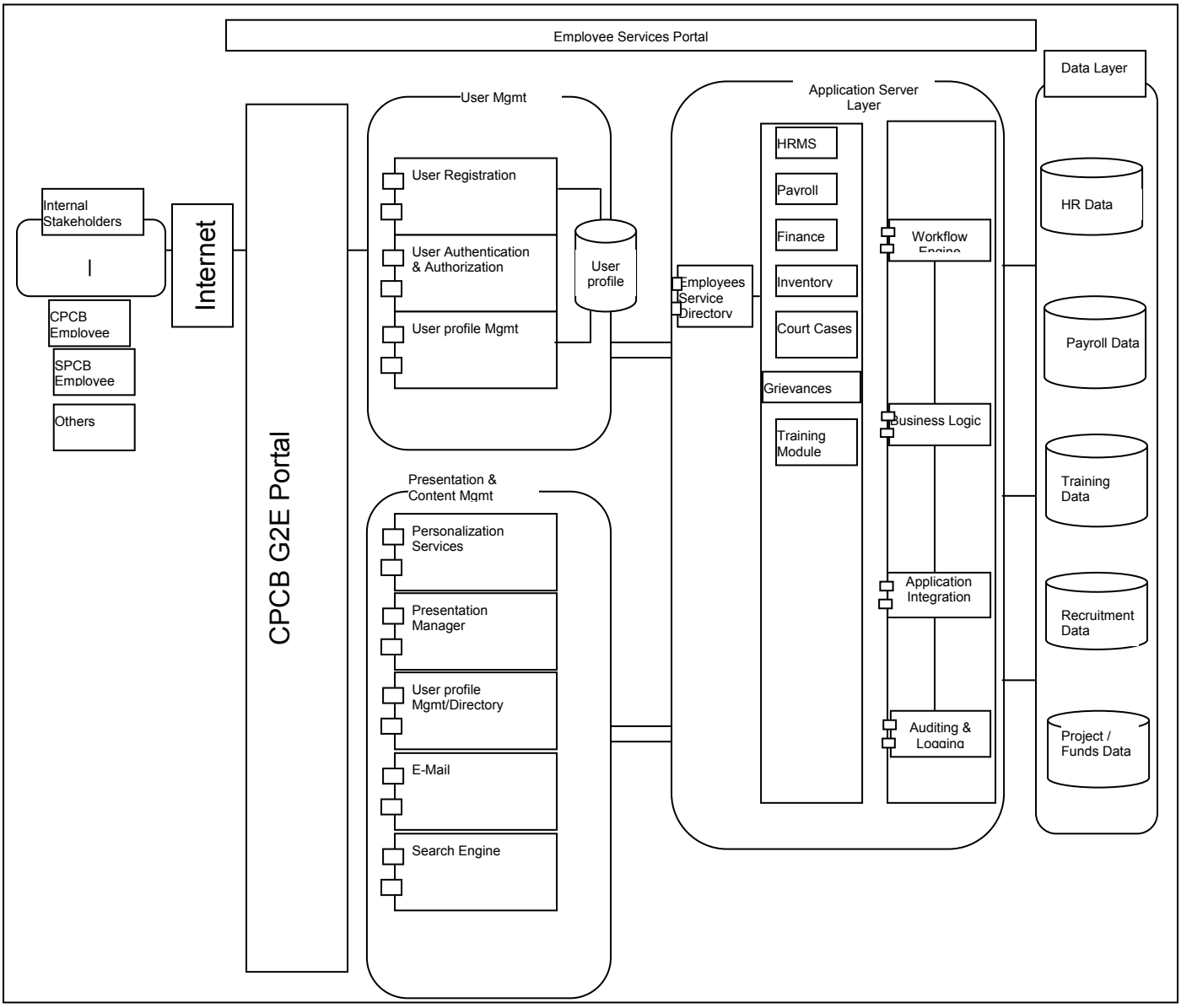
S. No	Module Name	Divisions/Activities Covered
1	Technical PCI Divisions	PCI-I, II, III, SSI & ESS
2	Technical PCP Division & Other Sections	PCP, Chairman Section, Member Secretary Section & AS Section
3	HWMD & Inventory of Wastes	HWMD & Inventory Waste Management
4	PAMS	PAMS Division
5	Infrastructure Division (IFD)	Air Laboratory, Water Laboratory, Bioscience Laboratory, Treatability Lab, Instrumentation Laboratory, NRTOL Laboratory, IFD General
6	UPCD	UPCD
7	Computer, ETU, PR Division with Library	Computer, ETU, PR Division with Library
8	Financial Accounting & Financial Management	FAFM & Payroll Management
9	Personal Information System (PIS)	PIS, Hindi Section, Dispatch Section, Recruitment , Material, Personnel, Visitor Management
10	Building Division	Building Division, Stores & Inventory Management & Asset Management
11	Zonal Office & Project Office	Zonal Offices & Project Office
12	File Tracking System	For all divisions
13	Payment Gateway etc.	Specially for FA& FM & PR and others


CPCB Intraportal
(Information on Activities of CPCB)
Divisional Activities Management
ADMN
PCI-I
PCI-II
PCI-III
HWMD
IFD
UPCD
ZO-BPL
ZO-Bangluru
ZO-LKO
ZO-KOL
ZO-SHILL
ZO-BARODA
PO-
ESS
CO-ORD
PCI-SSI
ETU
Infrastructure Information Management
Online Registration Management & Permission for co-
Waste Management
Bio-Medical Waste Management
Plastic Waste Management
Municipal Waste Management
Hazardous Waste Management
Electronic Waste Management
Finance Management
Human Resource Management
Complaints Management
Visitor Management
ISO Management
Parliament Question Management

3.0 External Interfaces

3.1.a Employees Service Portal

The diagram below outlines the functional view of proposed employee service portal, which is aimed at providing all the Government to Employee (G2E) services to CPCB employees using a single interface and using single sign on (SSO).



This portal will also provide a window to employee to do self-service work flow tasks related to Government to Business (G2B), and Government to Citizens (G2C). The System Integrator will make use of employee status, employees assignment and profile information maintained in administration for access control management to G2B, G2C, G2E services. Any changes in profile, assignment, status in administration would be automatically and dynamically updated based on its current status.

3.1.b G2E Portal

The user interface layer would provide the CPCB employees with secured, personalized access to G2E and other (e.g. inventory management, common portal, administrative services etc.) IT enabled functions. This layer would ensure centralized access to all employees to information systems implemented in CPCB and gives them consistent view of information and data.

3.1.c User Registration, User Authentication

The module facilitates registration, authentication, authorization and management of roles and privileges of CPCB employees for accessing the portal with single-sign-on.

3.1.d Presentation and Content Management

This module based on the user category, preferences, mode of access to the portal facilitates customized view of the portal including services, content, look and feel etc. after due authorization the content uploading can be done by employee which needs to be checked and verified by divisional heads and then transaction of information on common portal would be assigned.

3.1.e E-forms

The online or e-forms created for delivering CPCB services through portal shall be designed keeping in view of the bandwidth capacity. Form filing will be easy, user friendly and will avoid common form filing errors (such as, ensuring all mandatory fields are entered, number entry etc.). E-forms will support digital signatures. Portal will provide the printable formats for all e-forms and user, upon filing up of details, can obtain its print-out. All the e-forms will have appropriate field level and form level business validations built into the system to ensure that scope for inaccurate information is eliminated and the information captured for all the mandatory fields in the form.

3.1.f Online Payment and e-Tendering Process

CPCB intends to provide the online payment facility for services identified by the CPCB through integration with payment gateways. The system to be developed will be compatible for online transaction system.

Features

- online e-tender document
- enabling RTI Act for collection of fees
- payment through cards
- audit functionality for tracking and monitoring/reconciling the financial transactions

- 128bit encryption
- HTTP protocol
- SSL (Secured Socket Layer)
- Online MIS to check, control and access financial transactions on daily, weekly and fortnightly basis
- Details of payments made, effective date, payment amount, contact information of individual etc.

3.2.a Online Industries Information Collection System

The system so developed will have provisions to provide link to industries to enroll them with CPCB as per their area of activities such as Cement, Power, Petroleum, Refinery, Petrochemicals, Chemical Manufacturing, Pharmaceuticals etc.

The data collection will be done through defined formats for various industries. The System Integrator will provide a mechanism to enrol each of these industries based on their categorization (17categories/Red/Orange/SSI etc.) with proper security mechanism. Accordingly, central repositories will be created.

These repositories will be used for data mining and data warehousing for various activities of CPCB. The data collected so will be made available on Common Portal to all stake holders of the Portal with proper identification and verifications by the respective CPCB divisions dealing with these categories of industrial units.

3.2.b Online data collection system from State Pollution Control Boards

The data is being forwarded by SPCBs on various activities to CPCB throughout the year as statutory requirements or on demand. The procedures to receive and preserve the information systematically and on continuous basis will be developed for which defined formats will be generated and databases will be created.

4.0 Expected Outputs

The expected outputs from implementation of ERP software are as follows:

(i) Software system incorporating all CPCB activities over LAN, WAN, Internet, which will be accessible for authorized users with administrative permissions. Initially the ERP system will be implemented on LAN and later on it will be accessed through Intranet Login, for which space is already allocated in CPCB website homepage.

(ii) Common portal will be available to all stake holders, while other ERP modules will be accessible to the employees of concerned sections/divisions.

(iii) Track record of transactions will be kept for reference and data mining.

(iv) Quick data fetching procedure will be incorporated, wherein data fetching will be done on milestone technique basis.

(v) Quick data retrieval system based on RDBMS will provide high end capacity transactions.

(vi) The system will be operational on modular basis, so that addition or deletion of different modules will be possible.

(vii) More than 2.50 Lakhs of documents/ data records will be a part of scanned databases which will be integrated with digitized data in several hundreds GBs.

(viii) The system will have adequate Artificial Intelligence tools that will be able to perform robust data mining/data warehousing exercise for generating Analytics and MIS reports as required from time to time.

(ix) The project Software Development Life Cycle (SDLC) and project plan will ideally follow the Waterfall model of execution with clear demarcation and timelines for various phases: System Design, Prototyping, Software Development, Testing, User Training and Handholding, User Acceptance & Final Deployment.

4.1a Features of the proposed software:

Sl. No.	Key Features	Sought Benefits
1.	**Web enabled**	▪ Application will be used over the LAN in head office and on WAN in all other Zonal offices. Will be truly web browser based.
2.	**Online System**	▪ Will ensure **availability of real time information** on all aspects of the business ▪ Will ensure timely and accurate sharing of information across all departments ▪ Will enable management to obtain reports like **daily waste inventory, daily environmental information reports of air and water quality etc.**
3.	**Central database**	▪ Online integration of all data from across locations ▪ Previous year's data accessible at the click of a button
4.	**Highly scalable and Web Enabled Architecture**	▪ Add users as needed. Can scale up to 2000 (Two Thousand numbers) users without changing the system. ▪ Enable access from multiple locations and branches. ▪ Permit discretionary access for external entities.
5.	**Process Oriented System**	▪ Will enable a high degree of **management control over complete processes.**
6.	**Flexible & Dynamic Process Definition**	▪ New or changed processes created by a change in management policy will be configured and implemented without shutting down the system. ▪ **New process Lines will be easily added** without shutting down the system. ▪ Software adapts to the organization's changing process requirements. ▪ Will enable quick implementation of processes.
7.	**Dynamic Planning, Budgeting & Forecasting**	▪ **Will enable management to do What If analysis and obtain detailed financial information on cash, materials and resources under different scenarios.** ▪ **Will Enable management to see financial reports under different scenarios.**

#	Key Features	Sought Benefits
8.	**Highly Definable Processes**	▪ Complex processes and the resources (materials, machines, manpower) and activities attached to these processes can be defined. Enables management to **understand the cost impact of each and every variable.**
9.	**Multi Location/ branches**	▪ Easily add new entities with separate financials/process ▪ View individual or consolidated MIS reports/Dashboard
10	**Role based Single Sign off**	▪ Users are attached to roles, hence the **system is never person dependant.** ▪ **One Employee-one user id.** o Multiple designations o Multiple responsibilities o Responsibilities allocation etc.
11	**Integration with CAAQMS, OEDM,EDB,ESS, CPF etc.**	▪ Application will be fully integrated with CAAQMS, OEDM.EDB & ESS software operational ▪ Development of activities of Laboratory sample analysis, reporting procedures etc. is to be done as a part of this software.
12	**Integration with other applications used in CPCB**	▪ Application provider will study and integrate with all the existing Applications/systems present at CPCB.
13	**Drill Down Access to Information**	▪ Quickly **reach relevant information without having to print out reports and waste paper** ▪ The result information page will have a facility on time scale to view the information of previous available date or to a next available date. This feature will be available throughout the system.
14	**Powerful search option in all reports/MIS/Dashboards**	▪ Powerful search facility will be provided in all the Reports, MIS and dashboards
15	**Task flow enabled**	▪ A definable task flow will be present for the document processing and will be designation based.
16	**Built Work Flow & Online Authorization**	▪ Application will have built in workflow which is defined in the master definitions and enables management to know who did what and when through **extensive audit trails.**
17	**Alerts Engine**	▪ Management will be alerted based on pre-defined benchmarks. Alerts will be sent through email, fax and even SMS.
18	**Highly User Friendly**	▪ Common interface required for low lag time for users across functional areas to get proficient with using the system.

#	Key Features	Sought Benefits
19	**Dashboard/Control panel**	▪ Dashboards are generally used by top level management who needs up to date summaries information and might require details on any of the transaction. ▪ Dashboard will contain all required information in summarized form as per the access rights.
20	**Import and Export**	▪ Will support seamless integration for information flow from Excel, Word, Microsoft office tools as well as from other software being used in various divisions, as far as applicable. ▪ All Reports will be exported to MS office tools and changes will be made there on, as per the user creativeness.
21	**Entity Master**	▪ Entity master for each entity with the information flow.
22	**Color Coding in Browsers**	▪ The Reports or MIS will have color coding to visibly segregate the items on the basis of status.
23	**Printing Documents & Reports**	▪ Application will have prints for all the transactions, documents and reports. ▪ Each report will be properly time-stamped with date of generation and with CPCB logo (Stamp size) on each page.
24	**Document Attachment manager Reference Documents**	▪ Will have functionality to attach documents for references and to provide details of the document attached by different divisions, date of attachment, reference of attachment, and the name of the official concerned. ▪ These reference documents will be available to the users performing the work/transactions for reference purpose. ▪ Reference documents of ISO, reference methods for laboratories, test results, standards etc, will be openly accessible.
25	**Document Attachment Manager**	▪ Will enable the user to attach supporting or required documents with the transactions etc along with other details as of reference documents.
26	**Workflow manager**	▪ This system function will allow administrator to define the workflow with a particular document. Multiple document types can have different work flows defined.

#	Key Features	Sought Benefits
27	**Procedural queues**	▪ Procedural queues at different windows according to work flow will be generated and which will be cleared upon approval from administrator inline. The non-responded queue files will be transferred automatically to the next administrator with a flag as unattended file and same information flows to designate competent authority as unattended file.
28	**Time stamping**	▪ Total time elapsed at a window for clearance will be displayed as an attribute of the same
29	**Menu Accessibility**	▪ Administrator will be able to customize the Application Software menu as per the requirements. The advantage is that users will have access to only those menus, which lie, in their area of activity. Through Menu Customization system administrator could hide the selected menu options.
30	**Benchmark Speed**	▪ At prescribed standard PC the browser will open in not more than 4 seconds. ▪ Any entry form opening saving, report generation will not take more than 4 seconds.
31	**GIS System**	▪ The GIS system will be designed in such a way so that further map scaling will be incorporated. ▪ System will be capable to adjust the map display over the user terminal automatically to its best resolution.
32	**System independency**	▪ The development of the software will be done in such a way (Using standard technology and functions) so that any other software developer may take on the further expansion work without necessarily taking help of the supplier System Integrator.
33	**Customization**	▪ To customize such Software Solution / ERP Solutions as may be required by the CPCB during the process of implementation of software.
34	**Payment gateway**	▪ 128 bit encryption payment gateway compatible system.

5.0 Attributes

5.a Integrate existing operational software systems like Environmental Databank **(EDB)**, Online Emission Data Management **(OEDM)**, Environmental Surveillance Squad **(ESS)**, Continuous Ambient Air Quality Monitoring Stations Data **(CAAQMS)**, TALLY, etc.) and their databases will be attached in such a way, so that, query based information dissemination system will be made available over the internet, without any human intervention.

5.b Data warehousing and data mining so as to make central repositories of HW, BMW, MSW, CHWI, CETPs, ETPs, Air & Water Quality Data, Noise Data, Industries Databases, Industries Emission Levels, Laboratory Sampling and Analysis, etc. and all other activities of CPCB.

5.c Dissemination of data on GIS platform with a facility to both way communicate from GPS device to GIS system and from GIS system to GPS device in any part of the country at the inspection site. Maps for specific locations where air, water quality monitoring stations of CPCB are located will be procured and GIS data verification will be done in class-I cities. For 35 cities the project work has been planned.

5.d Develop the ERP software which will join together all Zonal Office employees with HO employees in terms of their daily activities as well as in terms of their administrative activities.

5.e A less paper office with e-governance is being targeted.

5.f Security: The system will manage all security issues through different devices. The management of security will be executed even in the absence of CPCB DC.

5.g Handholding for initial rollout of ERP: The system will be monitored for next five years and helpdesk services will be provided on 24x7 basis.

6.0 Design implementation

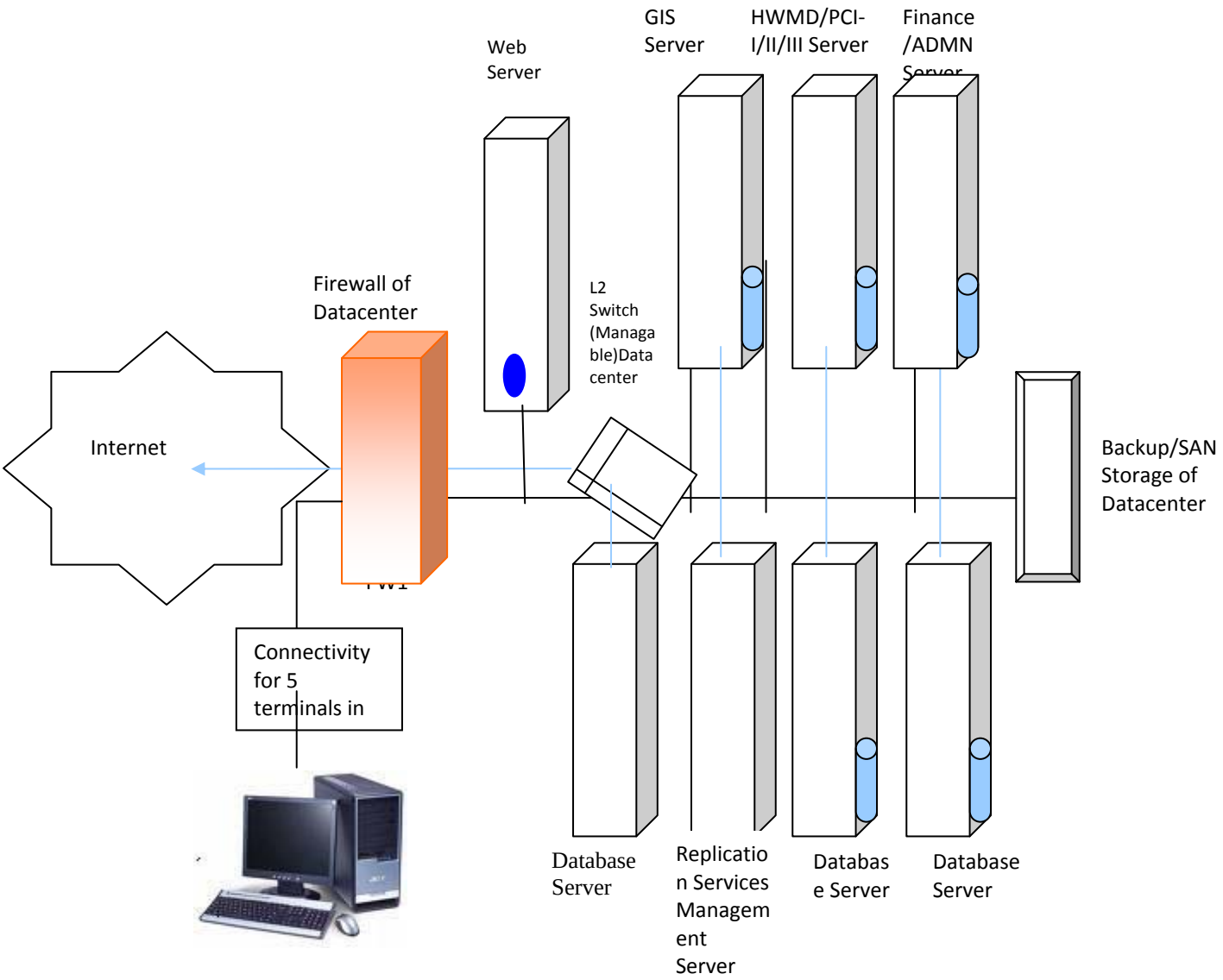
6.1 Proposed Technologies

1. Operating system: To work on any open source/Windows platform
2. Compatibility: Biometric, Barcode, GPRS, GPS

6.2 Deployment Platform

The Database servers will be segmented according to requirement.
Client will access application over any Internet Browser
Security systems will be implemented.

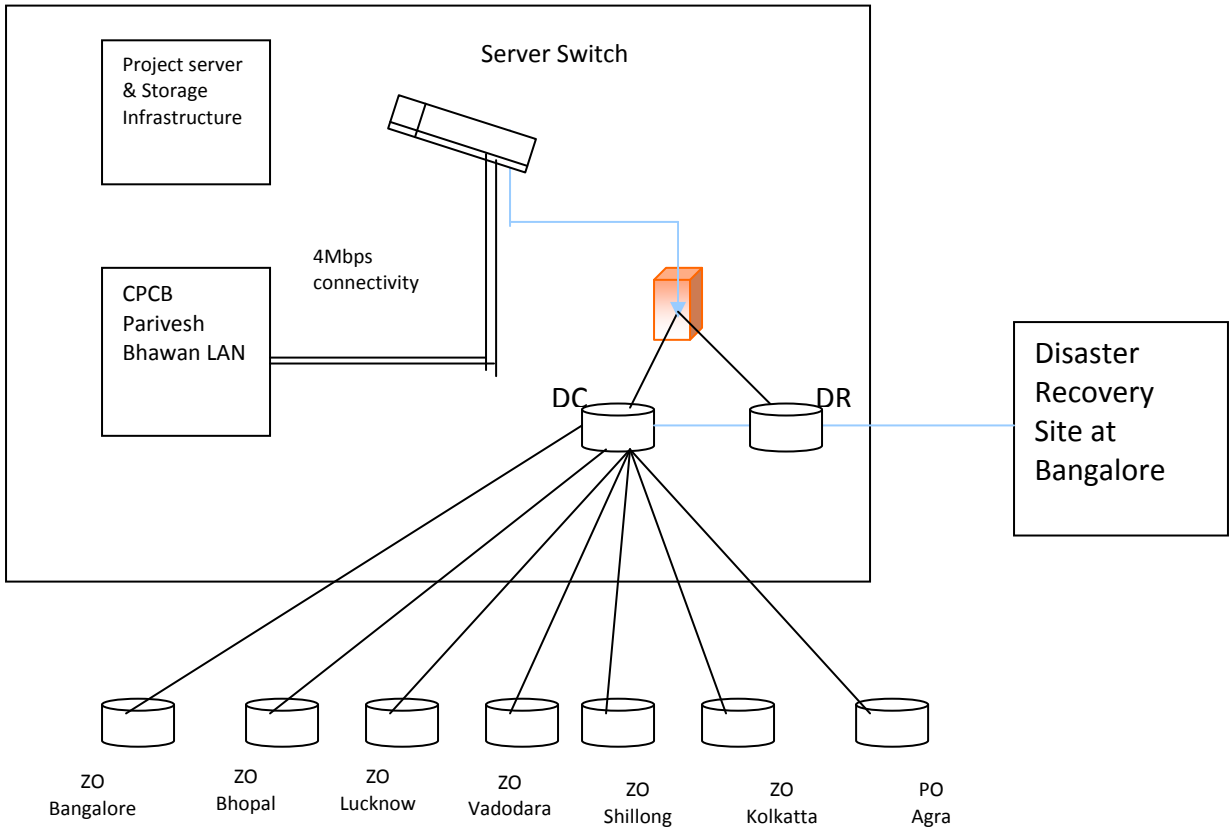
6.3 Deployment Server Architecture



(Clustered Servers with Virtualization)

6.4 Indicative Architecture for Datacenter (DC) & Data Recovery (DR)

Presently 2Mbps connectivity at HO & ZO Bangalore is operational. Following diagram provides indicative network architecture for the CPCB ERP project:



6.5 System Functions and Features

Applications functionalities for various activities

Functionalities	
	MODULES
1	**LEGAL & COURT MATTERS**
1.1	Legal/Court Entry
1.2	Legal/Court matters Browser
1.3	Schedule View Report
1.4	Document Attachment
1.5	Party Wise Details
1.6	Advocate wise Detail Report
1.7	Progress Report
1.8	Payment/Fees Tracking
1.9	Results/Decisions/Orders Capturing
1.10	Capture show cause notices

Functionalities	
1.11	Proposed directions
1.12	Interim directions
1.13	Integration with other modules
2	**COMPLAINT MANAGEMENT**
2.1	Complaint details entry
2.2	Complaint View Browser
2.3	Complaint assignment details
2.4	Complaint Allocation
2.5	Complaint types
2.7	Complaint category
2.8	Complaint nature
2.9	Acknowledgement receipt
2.10	SMS generation as per status of complaint
2.11	access rights/ security settings to view complaints
2.12	printing of complaints with details
2.13	attachment of supporting documents/files
2.14	MIS reports
3	**FILE TRACKING SYSTEM**
3.1	Inward file tracking
3.2	Outward file tracking
3.3	Unique Serial no. generation for each record
3.4	marking to different desks
3.5	Marking to different employees
3.6	Marking to multiple Desks/Employees
3.7	Attachment to Files
3.8	Outward marking to External parties
3.9	Pendency monitoring
3.10	MIS reports Desk wise/Employee wise
3.11	Circulars/memos/office order etc tracking
4	**PCI-I, PCI-II, PCI-III, PCI-SSI, ESS – CORE DIVISIONS**
4.1	Environment statement
4.2	Category wise details
4.3	State wise details
4.4	Development of standards
4.5	Development of Guidelines
4.6	Attachment of standards & Guidelines in soft copies
4.7	Task flow enabled system
4.8	Reports for managerial action and follow-up
4.9	Report generator
4.10	Management dashboard

Functionalities	
4.11	Inventorisation of Industries
5	**HWMD & INVENTORY OF WASTES**
5.1	Environment statement
5.2	waste reports
5.3	Reconciliation of waste as per authorisation
5.4	Tracking of waste
5.5	GIS tracking
5.7	Agencies management (Recycling/ disposal/ treatment)
5.8	Bio medical waste management
5.9	Hazardous waste management
5.10	Batteries waste
5.11	Used oil
5.12	MIS reports
5.13	Dashboards for senior management
6	**DOCUMENT ATTACHMENT SYSTEM**
6.1	Separate & Secure Document Attachment Server
6.2	Attachment of Reference documents
6.4	Attachment of Standard or Required documents
6.5	Attachment of Additional documents
6.6	Attachment view as per access rights
6.7	Attachment update/modify as per access rights
6.8	Attachment prints as per access rights
6.9	Updating & saving documents on servers
6.1	Attachment of word/excel/pdf/tif/ or any other type
6.11	Attachment with all the transactions
6.12	Attachment option in all masters
6.13	Additions and removal of documents as per access rights
6.14	MIS reports on Document attached
7	**PDA Application**
7.1	Entry from PDA or online handheld devices
7.2	Required details on the transaction
7.3	Air monitoring data
7.4	Water monitoring data
7.5	Hazardous waste data state wise
7.6	Hazardous waste data sector wise
7.7	Query of industrial data in database
7.8	Report on PDA after query received
7.9	Support to format of report generated at HQ
7.10	Latitude and Longitude data transfer
7.11	Map data transfer with transaction capability

Functionalities	
7.12	Time stamping of events
7.13	support all utilities at HQ database with user name and password

6.6 Activities of CPCB Divisions

The elaborations about number of activities have been done for each division, based on which the complete module utility will be developed. The Data sizing of each activity has been done in order to estimate the efforts required to be made to complete the assigned task by the System Integrator.

Data available as on date will be digitized for each activity which will provide a repository of information related to all CPCB activities and in turn the same database will keep on appending in future with relational capability to show recent and earlier transactions with time stampings of individuals operating the system and modifying the information at a particular point of time.

In total 600 activities have been identifies requiring complete computerization of system so that related information and its flow can be maintained. Some of the activities have been mentioned here as below.

6.7 Other Responsibilities

a. Deployment
b. Handholding
c. Training
d. Change Management
e. Gap Analysis and its implementation

7.0 Budget Estimate

Cost estimates prepared for implementation of ERP Project:

S. No.	Description	Cost in Crores `
01	Development of ERP software with all more than 13 modules	**5.00**
02	Customization and maintenance of Software for next five years	**0.50**
03	Data Entry of about 2.5 Lakh pages	**0.10**
04	Data Procurement from Central Government Agencies	**1.00**
05	Data Validation	**0.50**
06	Hardware /software for Servers/Desktops etc. for ERP project	**0.50**
07	Operation and maintenance of system	**0.40**
	Total	**8.00**

8.0 ERP Project milestones

S. No.	Project Milestone/Deliverables	Week No. from the Zero Date	
		Start week	End week
1	To procure Hardware for supporting ERP Application	**04**	**08**
2	Submission of System Design Document (SDD) with Prototype	**02**	**08**
3	Delivery & Issue of Certificate of Proper Functionality for Service modules	**04**	**12**
	Modules:		
	File Tracking System		
	Personal Information System		
	Financial Accounting & Finance Management		
	Building Division		
	Computer, ETU, PR Division with Library		
4	Delivery & Issue of Certificate of Proper Functionality for modules mentioned below including integration with other software, PDA and GIS system.	**04**	**20**
	Modules:		
	Technical PCI Divisions		
	Technical PCP Division & Other Sections		
	Hazardous Waste Management Division & Inventory of Wastes		
	Pollution Assessment Monitoring & Survey Division		
	Infrastructure Division		
	Urban Pollution Control Division		
	Zonal Office & Project Office		
	Payment Gateway etc.		
5	Implementation at all Zonal offices & Training of Staff on Application Software	**21**	**28**
6	Roll out at other Zonal offices with DR functionality establishment	**29**	**36**
7	C-AMC support for five years after successful rollout.		

PART II

Systems Requirement

Central Pollution Control Board proposed to used state of the art business application for its day to day operations. CPCB looks forward to use existing building infrastructure at Head Office to cater the needs of corporate datacenter operations. In order to achieve its strategic objectives and to meet the expanding regulatory needs as per the statutory requirements, CPCB envisages setting up a mission critical facility, which also will provide office space to the team of CPCB researchers for analyzing and interpreting the data stored at this central repository.

The IT Infrastructure availability and requirements at Head Office, Zonal Offices and Project Office of CPCB including strengthening of CPCB in terms of hardware and software requirements for the existing and projected works have been consolidated. The technical specifications were identified for IT Systems, Datacenter, Video conferencing & CCTV facilities. The supporting requirements related to power, safety, air-conditioning, etc. have also been identified. The details are summarized here:

- **IT Systems**
  i. Technical specifications of Blade servers with enclosure, storage and backup software solutions, Local Area Networking, Desktops, Laptops, Scanners, Printers have been identified.

- **Datacenter (Type –II)**
  i. The basic design for the data centre is planned with 99.746% availability with maximum 22 hours cumulative breakdown.
  ii. It has been proposed to have Datacenter (DC) at HO having Dual 16 Mbps communication base link of MPLS, 2Mbps MPLS for all 6 locations and 8 Mbps MPLS link at ZO Bangalore selected as the Data Recovery Setup centre. All locations will have 2Mbps Leased line Internet connectivity, while ZO Bangalore will have 8 Mbps Internet leased line and HO will have 10 Mbps Dual leased line.
  iii. This will make the Centralized controlled system of connectivity and secure network access for each employee of CPCB at all its offices. Once complete system is centralized, whole setup will be managed from HO and CPCB network will become robust, secure Internet system. This system would be able to handle the ERP proposed for day to day activities data management and data storage.
  iv. CPCB will develop capability to Host its applications from DC at CPCB with antivirus support system in High Availability mode.
  v. DC architecture proposed in Active-Active mode to manage High Availability for which required components quantity has been kept as two like leased line of 10 Mbps, MPLS line, Servers, Switches, Firewalls etc.

vi. DC Deployment architecture has been provided with various IT components like Security, Performance, Remote Access, Flexibility and Power requirements.

vii. Technical specifications of all DC components have been provided keeping in mind the requirements of presently operating Application Software: i) EDB ii) CAAQM iii) OEDM and all necessary servers like Internet Proxy Server, Patch Servers, Mail Servers, Application Hosting Servers, Backup servers, Load Balancers, etc. Other specifications included for Backup software, Storage Area Network (SAN), Access Points, LAN switches, Routers, Firewalls Intrusion Prevention System, etc.

viii. The setup proposed has been analyzed to accommodate Servers of ERP into the system, so that whenever such system is ready can be installed in this DC and can be operated successfully all across the offices of CPCB.

ix. Data Recovery (DR) Site will be placed at 50% capacity of DC at Bangalore, so that the complete system works without any failure.

x. Requirements of supporting systems along-with Specifications of Precision air conditioners, UPS, DG sets, electrical cabling, earthing, public address system, card reader based access control system, CCTV, fire proof enclosures, flooring, and other structural requirements have been identified.

- **Video Conferencing (VC) & CCTV**

i. The system will be developed for video conferencing in between CPCB HO and Zonal offices with multi-channel facility.

ii. The system will also have capability for desktop to desktop video conferencing facility for upto 100 users.

iii. The system will be developed for HO & ZO committee halls with 16 sites multi VC support and 100 viewers streaming in terms of Audio, Video and data recording services.

- **Manpower requirement**

i. Manpower requirement has been assessed to include technically qualified persons from Project Manager to system engineers with relevant qualifications.

Budget Estimate

Cost estimates projected for installation and operation of different systems are tabulated as below:

S. No.	Description	Cost in Crores `
Installation Cost		
01	Datacentre (DC) at HO	
a)	Non-IT component for 500 to 700 sq feet size With Electrical, Fire Detection system, CCTV, Public Address System, DG Sets, UPS, Building Management etc	**1.40**
b)	IT component with 16 Servers, 05 Work Stations, SAN storage,	**3.60**

S. No.	Description	Cost in Crores `
	MPLS Gateway, Router, Internet Gateway, Core Switches, Load Balancer, Initial and external firewalls, IPS, Video Conferencing system, Plasma	
c)	Software for DC	**1.00**
02	Local Area Network & Internet connectivity, Data Storage, Video Conferencing etc.	**1.00**
03	Desktops and Laptops with UPS etc.	**1.00**
	Total	**8.00**