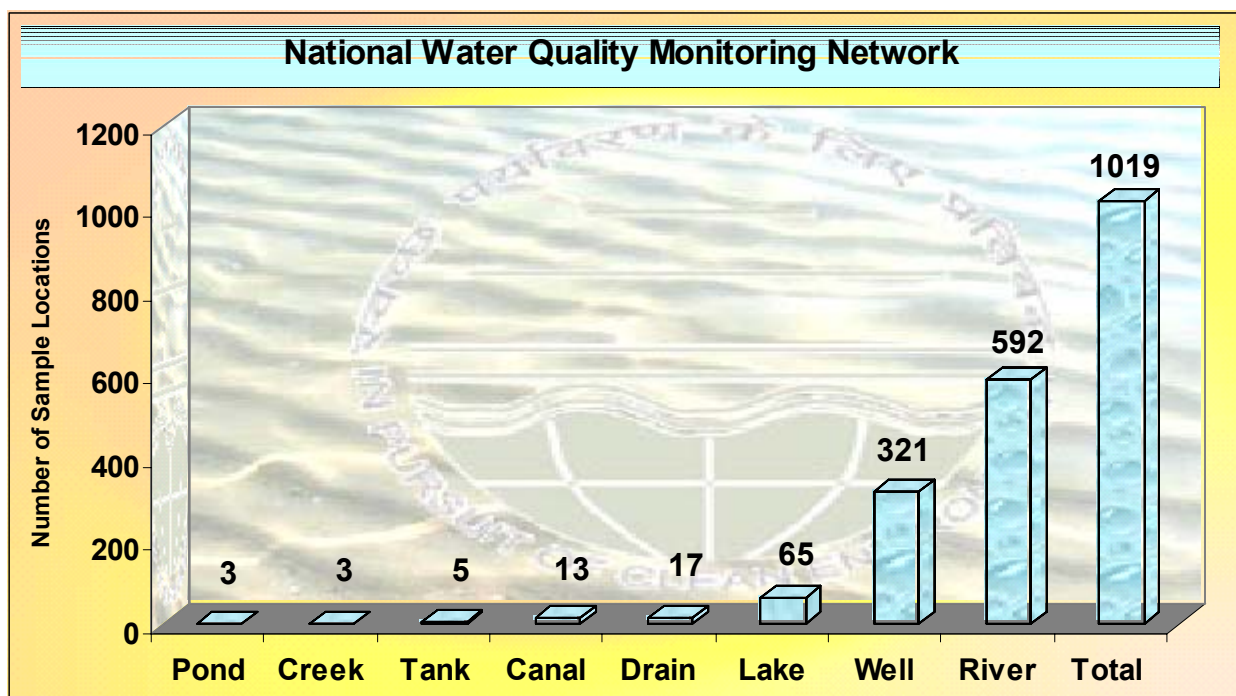


## WATER QUALITY ASSESSMENT

### National Water Quality Monitoring Programme (NWMP)

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). CPCB in collaboration with concerned SPCBs/PCCs established a nationwide network of water quality monitoring comprising 1019 stations in 27 States and 6 Union Territories. The monitoring is done on monthly or quarterly basis in surface waters and twice in a year for ground water. The monitoring network covers 200 Rivers, 60 Lakes, 5 Tanks, 3 Ponds, 3 Creeks, 13 Canals, 17 Drains and 321 Wells. Among the 1019 stations, 592 are on rivers, 65 on lakes, 17 on drains, 13 on canals, 5 on tanks, 3 on creeks, 3 on ponds and 321



are groundwater stations.

Water samples are being analysed for 28 parameters consisting of 9 core parameters and 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. Biomonitoring is also carried out on specific locations. In view of limited resources, limited numbers of sample are analysed once in a year for micro pollutants (Toxic Metals & POPs) to assess the water quality. The water quality data are reported in Water Quality Status Year Book.

## National Water Quality at a Glance

The water quality data on rivers, lakes, ponds, tanks and groundwater locations being monitored under the network is evaluated against the water quality criteria and the monitoring locations in exceedence with respect to one or more parameters are identified as polluted and action for restoration of water quality is contemplated. The locations on rivers, lakes, ponds, tanks and groundwater not meeting the criteria during the year 2005 are summarized ahead.

- The Biochemical Oxygen demand (BOD), one of the most important indicators of pollution, was observed highest in Amalkhadi at Ankleshwar (714 mg/L) followed by Ghaggar at Moonak, Punjab (626 mg/l), Khari at Lali village, Ahmedabad (320 mg/L); Musi at Hyderabad (225 mg/L); Sabarmati at Ahmedabad (207 mg/L); Kalinadi at Kannauj, UP (136 mg/L); Khan at Kabitkhedi, Indore, MP (120 mg/L); Damanganga d/s Daman at Kachigaon (112 mg/L); Kalinadi at D/s of Muzaffarnagar, U.P (110 mg/l), Saroonagar, Ranga Reddy Dist. A.P (71 mg/l), Gandigudem at Medak Dist. (60 mg/l), Hindon at Saharanpur (60 mg/L); Yamuna at Sonapat (59 mg/l), Krishna D/s of Islampur (40mg/l), Satluj D/s Hussainwala Ferozpur, Punjab (40 mg/L); Bhima at Pune (36 mg/L); Elangabeel System point, Assam (64 mg/l), Bharalu at Guwahati, Assam (43 mg/L); Sukhna at Parwanoo Dist., Solan (36 mg/l), Chandola Lake at Ahmedabad (36 mg/l), Hussain Sagar Lake, Budamaru, A.P (33 mg/l), Dhadar at Kothada (32 mg/L), Bhaleshwar Khadi at N.H. No. 8 (27 mg/l), Gomti at Sitapur U/s (25 mg/l), Chambal at Dholpur (25 mg/l), Yamuna d/s Delhi (59 mg/L) and Tapi at Uphad, Maharashtra (25 mg/L). Due to high BOD dissolved oxygen in these stretches was observed most of the time either nil or very low.

State / UT	Location	River	BOD, mg/l
Gujarat	Ankleshwar	Amalkhadi	714
Punjab	Moonak	Ghaggar	626
Gujarat	Lali village, Ahmedabad	Khari	320
Andhra Pradesh	Hyderabad	Musi	225
Gujarat	Ahmedabad	Sabarmati	207
Uttar Pradesh	Kannauj	Kalinadi	136
Madhya Pradesh	Kabitkhedi, Indore	Khan	120
Daman	Kachigaon, d/s Daman	Damanganga	112
UP	Muzaffarnagar	Kalinadi	110
Uttar Pradesh	Saharanpur	Hindon	60
Haryana	Down stream Delhi	Yamuna	59
Assam	Guwahati	Bharalu	43
Maharshtra	Islampur	Krishna	40
Punjab	Hussainwala Ferozpur	Satluj	40
Maharshtra	Pune	Bhima	36
Himachal Pradesh	Parwanoo Dist., Solan	Sukhna	36
Uttar Pradesh	Sitapur	Gomti	25
Maharshtra	Uphad	Tapi	25

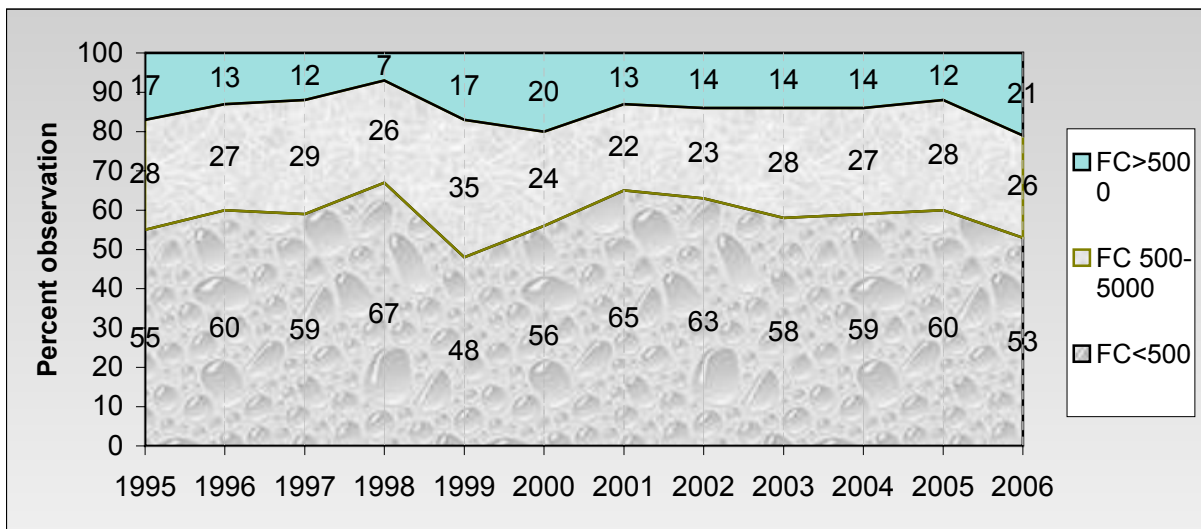
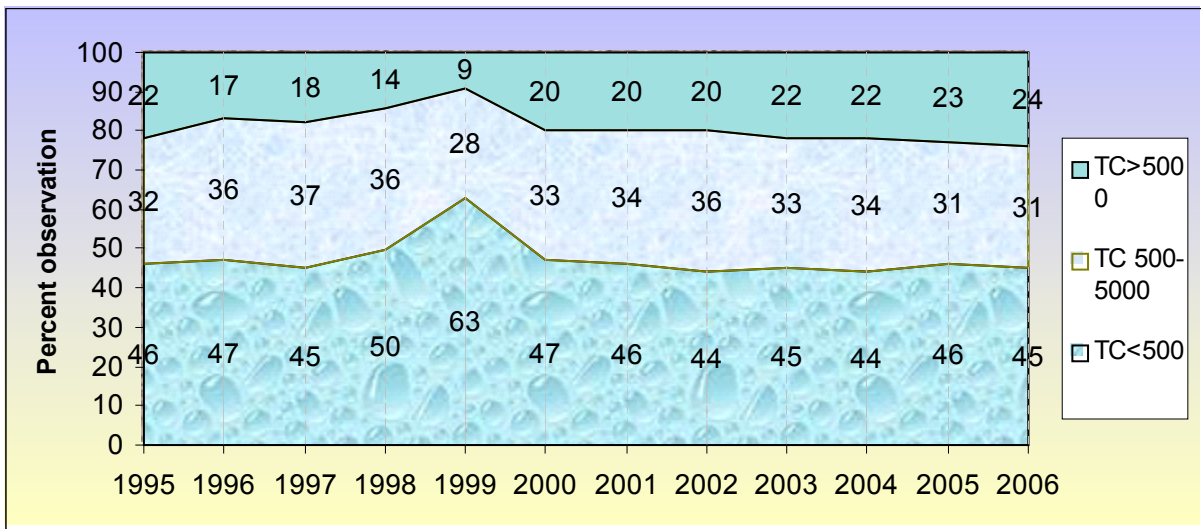
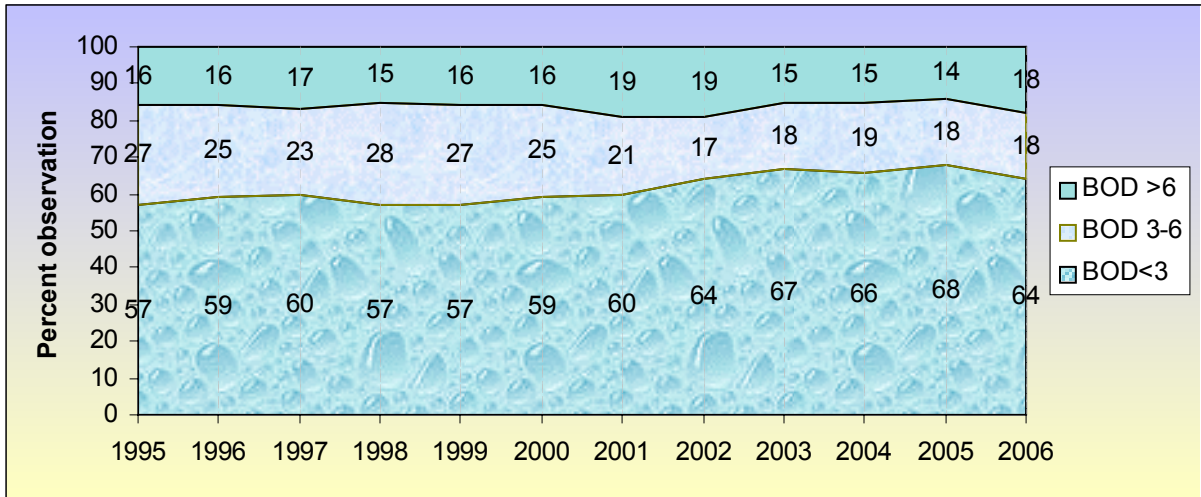
- Faecal Coliform another important indicator of pollution was found highest in Yamuna river at Agra, Nizamuddin, Mazawali and Okhla ( $5.2 \times 10^6$  to  $3.7 \times 10^6$ ) followed by Hindon after confluence with Krishna ( $1.1 \times 10^6$  to  $4.6 \times 10^5$ ); Ganga at Dakshineswar & Uluberia ( $1.1 \times 10^6$  to  $2.8 \times 10^5$ ); Damodar at Haldia ( $1.4 \times 10^6$ ); Khari at Lali Village, Ahmedabad ( $7.5 \times 10^5$ ); Sabarmati at Ahmedabad ( $1.1 \times 10^6$  to  $4.6 \times 10^5$ ); Bharalu at Gauhati, Assam ( $2.4 \times 10^5$ ); Ganga at Varanasi ( $1.1 \times 10^5$ ); Satluj at Ludhiana ( $1.1 \times 10^5$ ); Tapi at Ukai ( $1.5 \times 10^5$ ); Kalinadi at Muzaffarnagar ( $3.1 \times 10^5$ ); Damanganga at Silvassa ( $1.2 \times 10^6$ ); and Brahmaputra at Dhenukapahar & Pandu ( $2.4 \times 10^5$ );
- Total numbers of observations having BOD less than 3 mg/l, 3 to 6 mg/l and above 6 mg/l were 64%, 18% and 18%, respectively. The total number of observations having Total Coliform number less than 500 MPN/100 ml was 45%, between 500-5000 MPN/100 ml was 31% and exceeding 5000 MPN/100 ml was 24% MPN/100 ml. The number of observations having Faecal Coliform bacterial count less than 500 MPN/100 ml was 53%, between 500-5000 MPN/100 ml was 26% and 21% observations were exceeding 5000 MPN/100 ml.

## Water Quality Trend

The water quality monitoring results obtained between years 1995 to 2005 were analysed with respect to indicator of oxygen consuming substances (Bio-chemical demand) and indicator of pathogenic bacteria (total coliform and faecal colliform). The results indicate that the organic and bacterial contamination continued to be critical in water bodies because of discharges of domestic wastewater mostly in untreated form from the urban centres of the country and there is gradual degradation in water quality.. The municipal corporations of various urban agglomerations are not able to treat sewage thereby increasing the untreated sewage load. This is further aggravated as the receiving water bodies also do not have adequate water for dilution.

The number of observations with excessive BOD load and coliform density has increased during 1995 to 2006. The water quality status for the period 1995 to 2006 in terms of number of observations having values of parameters in different ranges are presented ahead.

## Water Quality Trend - BOD (mg/l)



## Water Quality trend of BOD in Rivers

The Water Quality trend between year 2002 to 2006 in terms of BOD in river Ganga, Yamuna, Sabarmati, Mahi, Tapi, Narmada, Godavari, Krishna, Cauvery, Mahanadi, Brahmani, Baitarni, Subernarekha, Brahmaputra, Satluj, Beas, Amlakhedi and Kali (East) suggest:

- Decreasing trend of BOD in river Ganga, Tapi, Narmada, Krishna, Cauvery, Mahanadi, Brahmani, Baitarni, Brahmaputra, Satluj, Beas and Amlakhedi.
- Increasing trend of BOD in river Yamuna, Sabarmati, Mahi, Godavari and Kali (East).

## Monitoring of River Water Quality at Interstate Boundaries

There are increasing number of incidences, where several locations on interstate rivers are polluted and the states located downstream complain frequently about the quality of water it receives from the upstream state. The issue has been discussed in the 51<sup>st</sup> Conference of Chairman & Member Secretaries of various State pollution Control Boards / Committees held in February 14-15, 2005 and it was decided that CPCB would regularly monitor the water quality of the rivers at interstate borders. As a follow-up of the decision CPCB initiated monitoring of all the important rivers at interstate borders. The results obtained during the year 2005-06 indicated that out of 61 rivers monitored, 14 rivers at 24 locations constituted higher levels of Biochemical Oxygen Demand. The concerned SPCBs/PCCs have been directed to take remedial measures to restore water quality of the above rivers.

River	Sample Location	State Boundary
River Yamuna	Paonta Sahib, H.P.	HP / Uttranchal
River Yamuna	Sonipat Baghpat Road, Haryana	Haryana / U.P.
River Yamuna	Palla, Delhi	Delhi / Haryana
River Yamuna	Asgarpur Village, U.P.	U.P. / Delhi
River Yamuna	Asgarpur Village, U.P.	U.P. / Delhi
River Yamuna	Asgarpur Village, U.P.	U.P. / Delhi
River Ghaggar	Parwanoo, H.P.	H.P / Haryana
River Ghaggar	Sirsa Dabwali Road, Haryana	Haryana / Punjab
River Ghaggar	Mubarakpur, Punjab	Punjab / Haryana
River Ghaggar	Tiwana Village, Punjab	Punjab / Haryana
River Ghaggar	Tiwana Village, Punjab	Punjab / Haryana

River	Sample Location	State Boundary
River Ghaggar	Chandrapur Siphon, Haryana	Hayana / Rajasthan
River Ghaggar	Chandrapur Siphon, Haryana	Hayana / Rajasthan
River Ghaggar	Sirdulgarh, Punjab	Punjab / Haryana
River Ghaggar	Sirdulgarh, Punjab	Punjab / Haryana
River Chambal	Eklingpura village, Rawatbhata, Rajasthan	Rajasthan / MP
River Mahi	Bajna,R., Ratlam, M.P.	M.P. / Rajasthan
River Mahi	Bajaj sagar, near Bansawara, Rajasthan	Rajasthan / MP
River Wardha	Pandhurana Village, M.P.	MP / Maharashtra
River Churni	Bijoypur, West Bengal	West Bengal
River Betwa	D/S Dukwan Dam at Babina, Birdha Road,Distt. Lalitpur, U.P.	UP / MP
River Betwa	Kanjia bridge sagar, M.P.	M.P. / U.P.
River Ganga	Tarighat, Gazipur, U.P.	U.P. / Bihar
River Ganga	Tarighat, Gazipur, U.P.	U.P. / Bihar
River Thenpennai	Mugalur Bridge, Karnataka	Karnataka
River Thenpennai	Mugalur Bridge, Karnataka	Karnataka
River Thenpennai	Mugalur Bridge, Karnataka	Karnataka
River Beas at	Narainpur (Talwara, Changarwa Village, Changarwa Minor, Punjab	Punjab / HP
River Markanda	Naraingarh, Haryana	Hayana / HP
River Sone	Chopan, U.P.	U.P. / Bihar
River Tapi	Prakasha, Maharashtra	Maharashtra / Gujarat
River Manjara	Aurad Shahajani, Maharashtra	Maharashtra
River Sabarmati	Khedbrahma	Maharashtra

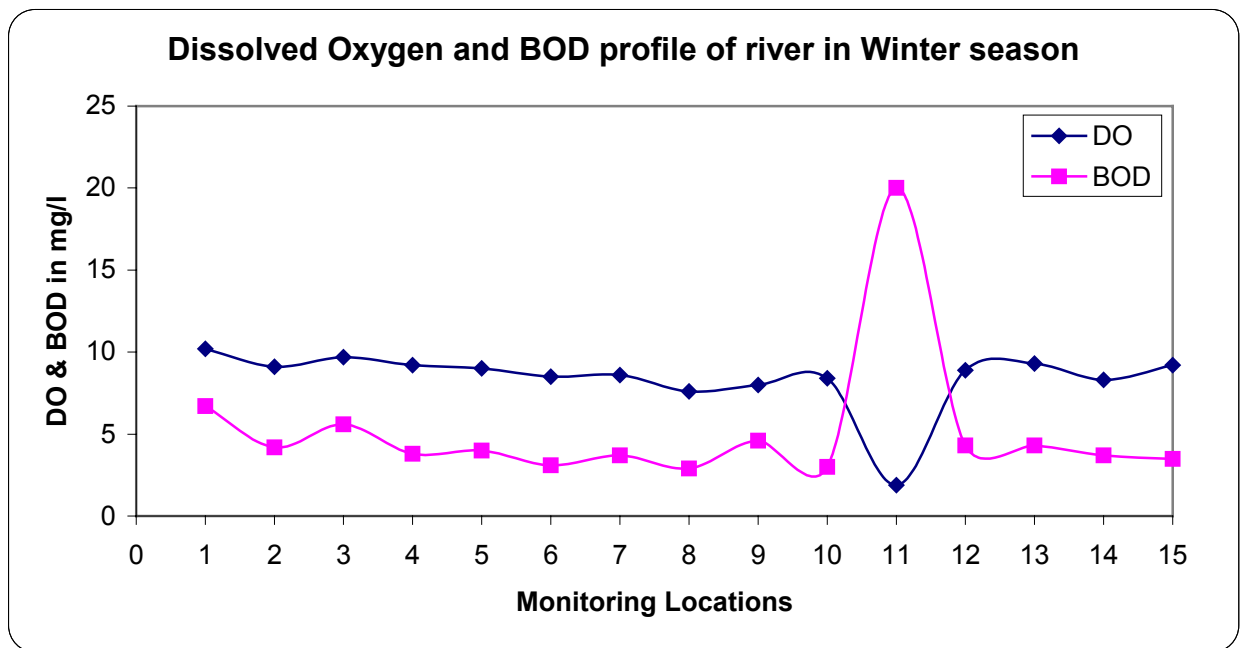
The water quality of rivers at locations on interstate boundaries between Gujrat and Maharashtra indicated no significant variation in water quality

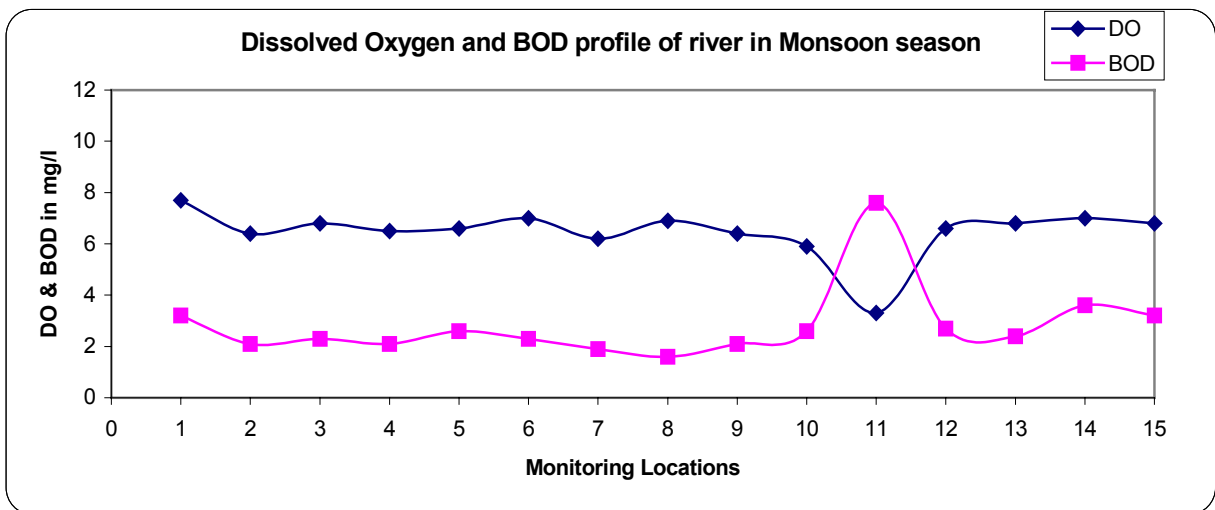
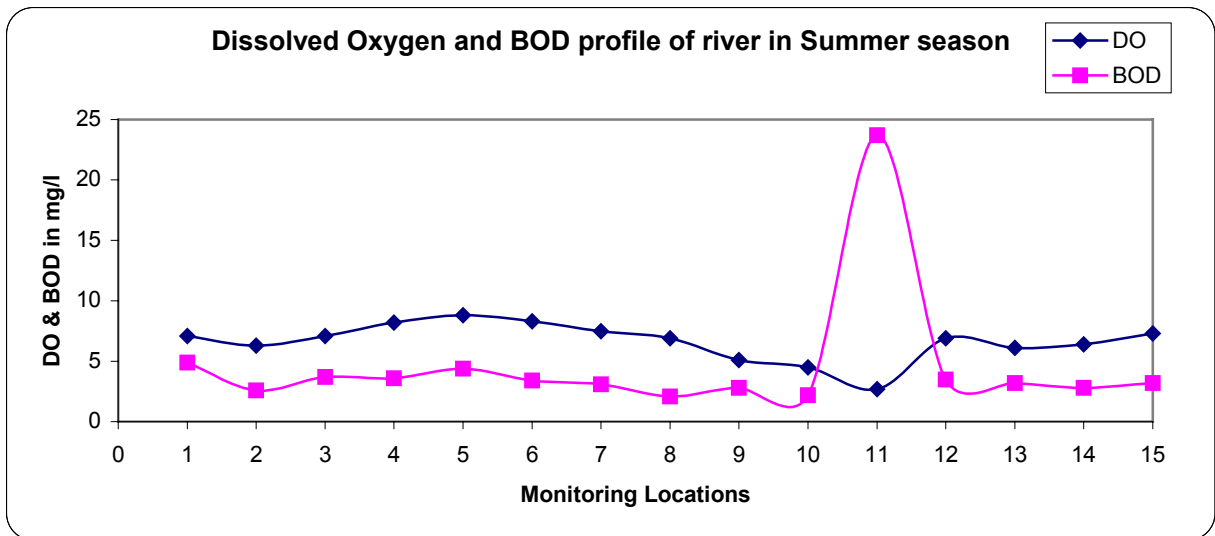
## Water Quality Status of River Ganga

River Ganga is monitored by CPCB Zonal Office Lucknow under NRCD project twice in a month from u/s Allahabad up to Tarighat i.e. Ganga after confluence of River Gomti.



Season wise observation in water quality of River Ganga during year 2006 is presented below:





Monitoring locations legends:

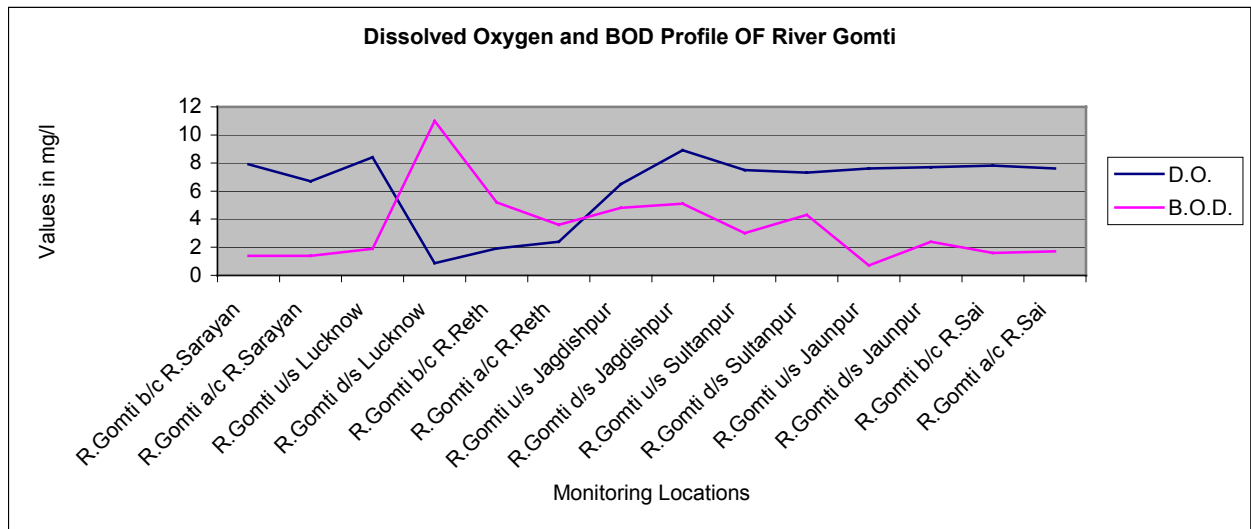
1	River Ganga u/s Allahabad	9	River Ganga at Dashashwamegh Ghat
2	River Yamuna b/c with River Ganga	10	River Ganga near Malviya Bridge at Varanasi
3	Bathing Ghat at Sangam	11	River Varuna b/c with River Ganga
4	River Ganga d/s Allahabad ¼ width	12	River Ganga d/s Varanasi ¼ width
5	River Ganga d/s Allahabad ½ width	13	River Ganga d/s Varanasi ½ width
6	River Tons b/c with River Ganga	14	River Gomti b/c with River Ganga
7	River Ganga at Pakka Ghat	15	River Ganga at Tarighat
8	River Ganga u/s Varanasi		

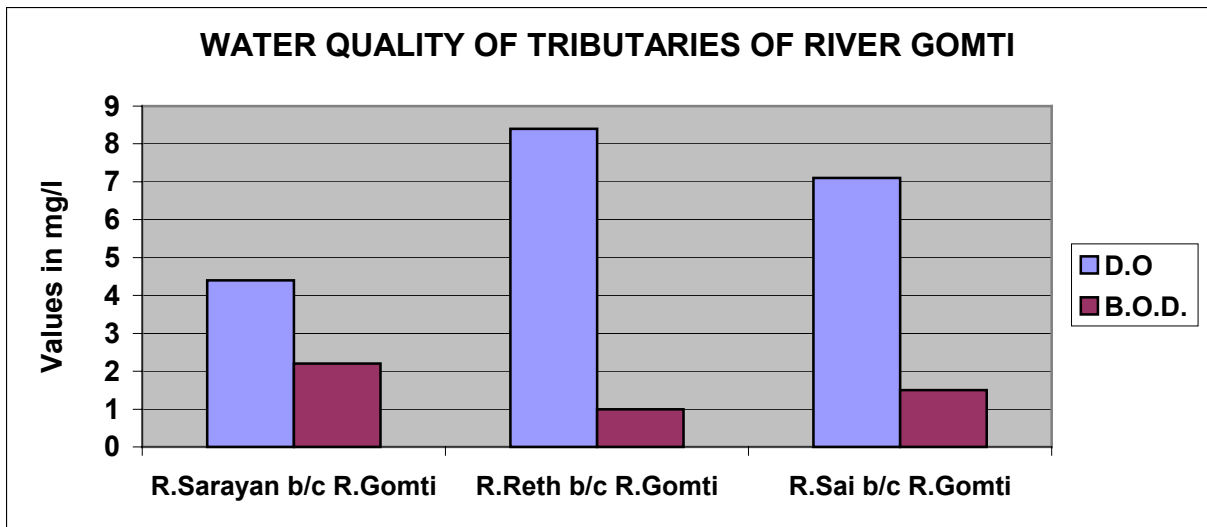
The water quality in entire stretch of River Ganga from Haridwar to Tarighat has been conforming to class B of Designated Best Use criteria, which implies that water quality conforms for uses like bathing, swimming, water contact sport. The status of water quality as observed is as below:

- The Dissolved Oxygen was more than 5 mg/l i.e. well within the limit to confirm the water quality as class 'B'.
- In terms of BOD, the river stretch does not confirm the water quality under class -B and found exceeding the BOD limit especially in summer season.
- The water quality has been mainly affected by high bacterial contamination.
- The high BOD (5.0 mg/L) at Sangam in Allahabad and Dashashwamegh ghat (Varanasi) has rendered the water unfit for bathing in winter season.
- Water quality of River Varuna is deteriorating every year due to uncontrolled discharge of city waste and by pass of konia pumping station feeder to Dinapur STP. The River acts as channel to carry the excess effluent of Dinapur STP and few minor drains of Varanasi.

## Water Quality Status of River Gomti

The monitoring of River Gomti and its tributaries was carried out at selected locations during November 2006 in compliance to the directives of Hon'ble Supreme Court of India under writ petition no. 327 of 1990. D.O. & B.O.D. profile of the River Gomti and quality of some of its tributaries is presented below:

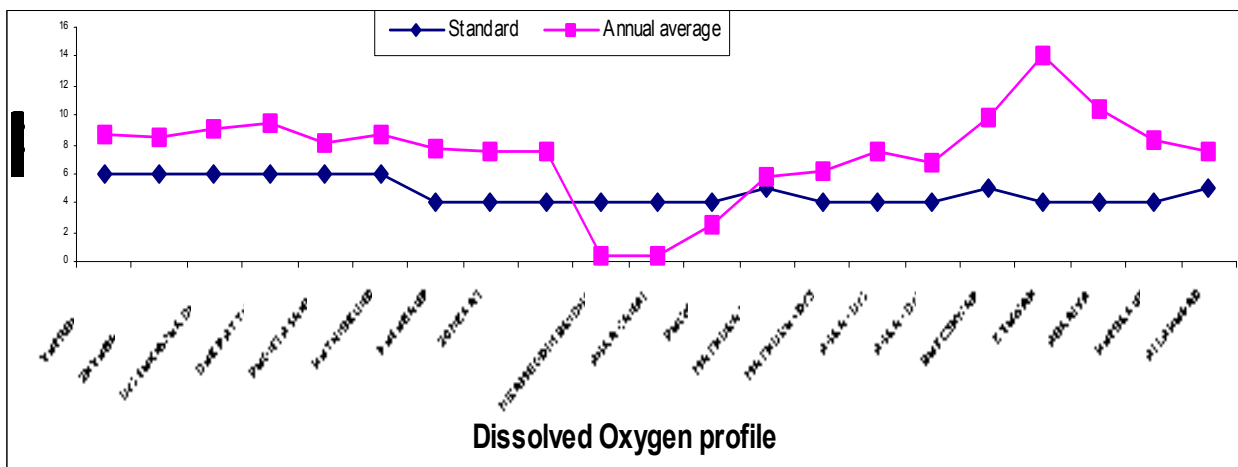


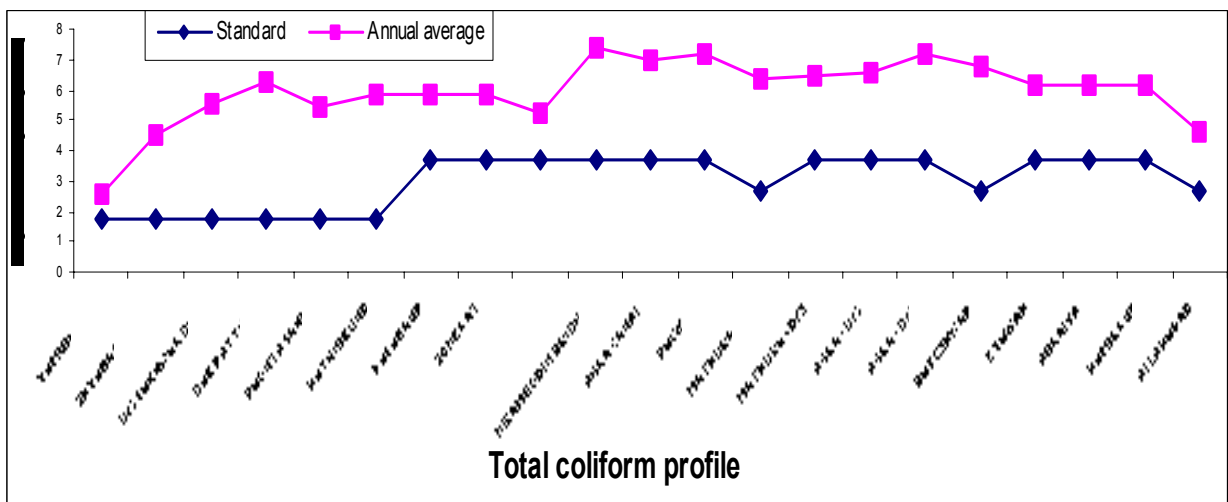
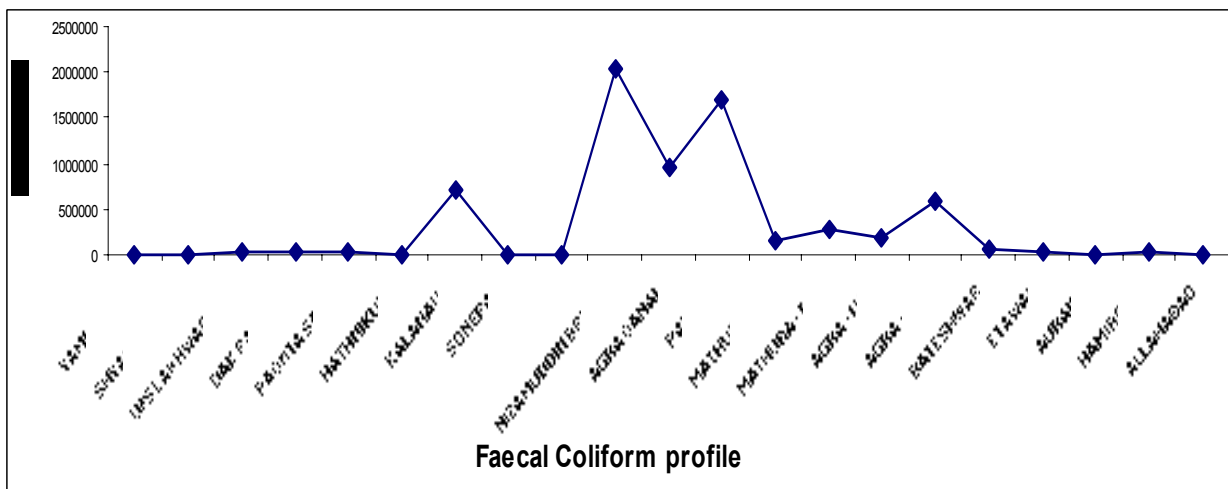
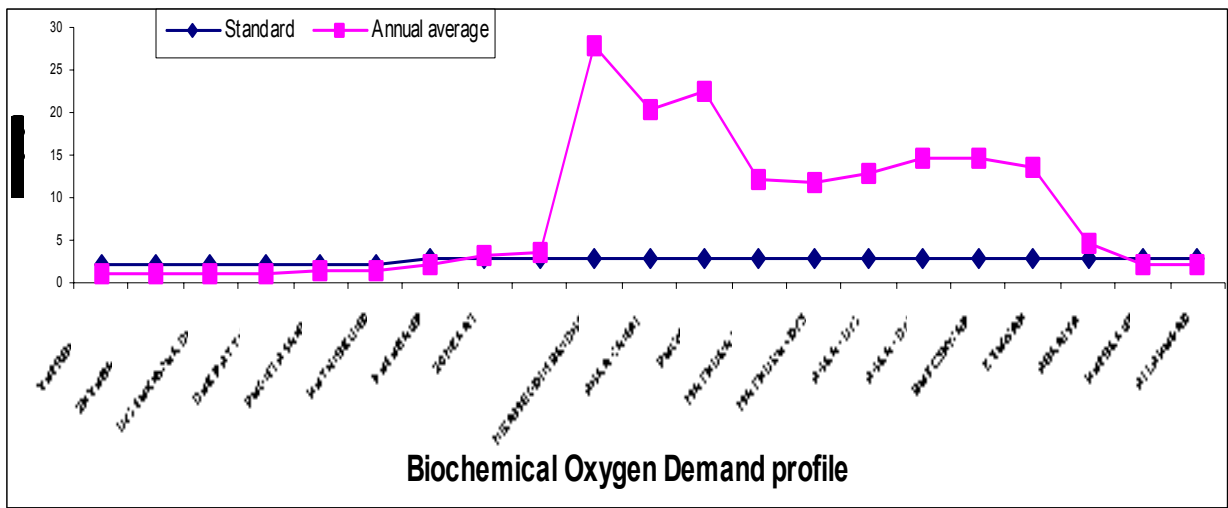


### Water Quality Status of River Yamuna

The entire stretch of River Yamuna is being regularly monitored by Central Pollution Control Board at 21 locations. The water quality status of the river during the year 2006 in terms of Dissolved Oxygen (DO), Bio-chemical Oxygen Demand (BOD), Total Coliforms (TC) and Faecal Coliforms (FC) is depicted in figures below. The river maintains good water quality from origin at Yamunotri till Delhi upstream at Palla and DO and BOD generally meeting the standards. At Sonapat & Palla, the annual BOD average has been slightly higher than the limit due to accidental pollution discharges in the river by the towns located upstream. The river water quality deteriorates from Delhi downstream till upstream Chambal confluence. The Delhi stretch is the most polluted stretch of the river where BOD generally exceeds the limits at all the locations.

**Water Quality Profile of River Yamuna during year 2006**  
(from Yamunotri to Allahabad)





The Dissolved Oxygen has not met the desirable water quality standard at Nizamuddin Bridge, Agra Canal (both located in Delhi stretch) and Palwal. After Chambal confluence, the river water quality improves gradually and BOD level comes within the limit at Hamirpur and Allahabad. The Total coliforms in Yamuna

River at various locations also violate the designated river water quality standard. The upper most river locations i.e. Yamunotri & Shayana Chetti were monitored during June when the pilgrimage influences the Total Coliform and these violates the designated river water quality best use standards. The reason of excessive pollution in the stretch from Delhi to Chambal confluence is the discharges of wastewater from various urban centres and over exploitation of fresh water from the river, which is essential to maintain self-purification capacity of the river.

The river stretch from Delhi to Etawah is the polluted stretch of river Yamuna because of various anthropogenic factors such as withdrawal of excessive water through construction of barrages on the river viz. Tajewala (for supply of both drinking as well as irrigation water for Haryana, UP and Delhi; Wazirpur (for supply of drinking water for Delhi); Okhla (for supply of irrigation water for UP and Haryana) and Gokul (for water supply at Mathura and Vrindavan and also to maintain a flow down stream of Mathura). Additionally, there is continuous discharge of wastewater at Delhi (both treated and untreated), UP (both treated and untreated) and Haryana (both treated and untreated). As a result, very little or no water is left to flow in the river and the water supply at down stream cities (Mathura & Agra) are badly affected. The water quality at Agra has been observed offensive due to increase of ammonia in the flowing water in addition to organic matter.

### **Participation in VI Framework European Commission Funded Programme on Evaluation of Ecological Status of Rivers in Hindu-Kush Himalayan (HKH) Region**

The Central Pollution Control Board has participated in a Workshop "Regional Capacity Building on the Macro-invertebrates Taxonomy and Systematics for Evaluating the Ecological Status of Rivers in the Hindu Kush Himalayan (HKH) region held at Kathmandu University in Nepal during 20<sup>th</sup> August to 17<sup>th</sup> September, 2006 under the Sixth Frame Work Programme of European Commission Funding. The University of Natural Resources and Applied Life Sciences, Austria in collaboration with eight institutions including Central Pollution Control Board has organized the programme & workshop. The workshop focused on Identification of Macro-invertebrates taxonomy up to Family, Sub family, Genus level for evaluation of ecological status of rivers in the Hindu-Kush Himalayan (HKH) Region with the help of various resource persons and experts from various countries.

### **Bio-Monitoring of River Yamuna in Delhi Stretch**

Bio-monitoring of River Yamuna at Delhi stretch was undertaken at 15 locations on its western and eastern banks. These locations are Palla; Sonia Vihar; ISBT at Bela road; Shanti Vana, Pantoon Pul; Raj Ghat; ITO, Gautam Puri; Nizamuddin Bridge at Abu Fazal Enclave; Okhla Barrage B/C Hindon Cut; D/S Okhla Barrage at Asgarpur and at Agra Canal. Bio-monitoring data indicates that 40 macro-invertebrate families belonging to 11 number of taxa within three Phyla (Arthropoda, Mollusca and Annelida) were encountered. The taxa included Ephemeroptera,

Trichoptera, Odoneta, Crustacea, Hemiptera, Diptera, Coleoptera, Gastropoda, Bivalvia, Hirudinea and Oligochaeta. Phylum Arthropoda dominated the taxonomic composition followed by Mollusca and Annelida.

River stretch upstream of Wazirabad Barrage inhabits maximum number of benthic families (32 in number) reflecting high biodiversity and relatively clean water. The biodiversity significantly reduces with only two or nil families of benthic macro-invertebrates observed in the middle stretch of the river at ISBT; ITO, Gautampuri and Nizamuddin Bridge indicating severe pollution in the river. Benthic macro-invertebrates diversity is regained in the river at upstream of Okhla Barrage, indicating slight improvement in the water quality because of transformation of river into reservoir by the barrage, which acts as an oxidation pond.

## Bio-Mapping of Major Rivers in Karnataka State

The concept of bio-mapping of water quality has been initiated with the identification of water resources in terms of Clean (Class A), Slight Pollution (Class B), Moderate Pollution (Class C), Heavy Pollution (Class D) and Severe Pollution (Class C), respectively. The bio-maps based on bio-monitoring studies may provide extensive water quality information and may be an effective tool for preparation of action plan for control of pollution and improvement of water quality in rivers. Keeping in view the importance of bio-mapping technique, the Central Pollution Control Board has assisted Karnataka State Pollution Control Board to assess the ecological status of major rivers in the Karnataka State such as; River Cauvery and River Krishna.

## Groundwater Quality Assessment in Metropolitan Cities

Central Pollution Control Board (CPCB) in association with National Institute of Hydrology (NIH), Roorkee has been undertaking groundwater quality survey in metropolitan cities. Reports on 8 cities were finalized during year 2005 and reports on ground water quality of the 14 other cities - Faridabad, Delhi, Jaipur, Bhopal, Indore, Jabalpur, Nagpur, Nasik, Pune, Bangalore, Hyderabad, Vishakhapatnam, Patna and Kochi - are completed during year 2006. Twenty five ground water samples were collected each during pre- and post-monsoon seasons and analyzed for various physico-chemical and bacteriological parameters, heavy metals & pesticides. The data was analyzed with reference to BIS and WHO standards. Percentage distribution of various water quality parameters out of 50 nos. of sample analysed in each metropolitan cities have been summarized below:

**Delhi:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that TDS exceeded the limit of BIS standard in 8% groundwater samples (Pre-monsoon), Hardness 8% each in pre & post monsoon. Calcium 8% in each season, Chloride (Cl) & Magnesium (Mg) 4% in pre-monsoon, Sulphate (SO<sub>4</sub>) 4% in each season, Fluoride 16% (pre-monsoon) & 12% (post monsoon). The complying status against BIS standards of trace/toxic metals revealed that Iron (Fe) exceeded the permissible limits in

12% & 28% samples in both the seasons, for Manganese (Mn) 16% samples exceeded BIS permissible limit in both the seasons. Lead (Pb) indicates 12% samples above in each season, Cadmium indicates above the desirable limit & showed 4% (pre-monsoon) and 20% (post monsoon) exceedance.

**Faridabad:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards (1991) revealed that TDS exceeded BIS limits in 24% & 20% groundwater samples in both seasons respectively, alkalinity 12% & 4%, Hardness 36% & 24%, Calcium 32% & 24%, Sulphate (SO<sub>4</sub>) 12% samples in each season, Fluoride 16% & 12% samples were found above the permissible limit in both the seasons respectively. The complying status of toxic & essential metals revealed that Fe was exceeding in 28% and 84% samples, Mn 24% & 8%, Chromium exceedance was 4% in both the seasons respectively.

**Jaipur:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that Hardness had shown 24% (Pre-monsoon) & 16% (Post-monsoon) samples exceeding the permissible limit of BIS (1991). Calcium 8% & 4%, Magnesium 12% & 8%, Nitrate 40% & 36% & Fluoride indicates 40% & 8% samples exceeded the permissible limit of BIS (1991). The compliance status of essential and toxic metals exceeding the limit of BIS for Fe i.e. 44% & 32%, Manganese (Mn) 4%, Lead (Pb) 8% & 20% samples in both the seasons respectively.

**Bhopal:** Groundwater quality with respect to critical parameters and compliance status against BIS standards revealed that Hardness 4% samples in pre-monsoon only while Nitrate in 12% & 4% samples in Pre & Post Monsoon respectively. The essential & toxic metals exceeding the limit of BIS and indicates Iron exceedance in 16 % & 56% samples in both the seasons respectively whereas lead (Pb) showed exceedance in 8% samples in pre-monsoon only.

**Indore:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that Hardness exceeded the BIS limit in 12% and 8% samples, Nitrate in 20% & 8% samples in both the seasons respectively, whereas Fluoride indicates 4% samples crosses the permissible limit of BIS in post monsoon only. The complying status of essential & toxic metals such as Iron exceeded the BIS limit in 28% and 48% groundwater samples, Lead (Pb) in 4% & 12% samples, Cadmium (Cd) in 4% and 8% groundwater samples, respectively in both the seasons.

**Jabalpur:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that only Fluoride exceeded the BIS limit in 12% groundwater samples in pre-monsoon season, essential & toxic metals such as Iron 28% and 48%, Manganese 24% & 16% groundwater samples in both the seasons, respectively whereas Cadmium exceedance was observed in 12% groundwater samples in pre-monsoon only.

**Nagpur:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that Hardness exceeds in 8% samples in each season, Calcium 8% and 4%, Mn 4% in each season, Sulphate (SO<sub>4</sub>) 4% in each season and Nitrate crosses the permissible limit in 4% samples in each seasons whereas essential & toxic metals showed Fe in 50% & 40% groundwater samples, Mn 8% & 4% samples, Lead 20% and 8% groundwater samples, Cadmium 8% & 28% samples in both seasons respectively.

**Nasik:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that 4% samples of Calcium crosses the permissible limit of BIS only in pre-monsoon whereas Nitrate crosses permissible limit of BIS in 4% groundwater samples each in both the seasons respectively. In other hand essential and toxic metals such as Fe crosses permissible limit of BIS in 28% & 8% groundwater samples, Mn 4% each, Chromium 8% and 4%, Lead 8% each, Cadmium 36% and 24% samples in both the seasons, respectively.

**Pune:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that 4% samples of Calcium & Hardness each in both the seasons crosses the permissible limit of BIS (1991) whereas Nitrate 4% each groundwater samples crosses the permissible limit in both the seasons. Essential and toxic metals such as Fe 8% samples violate the BIS limits in each seasons, Mn 8% and 16% in both the seasons respectively whereas Chromium 4% in post monsoon, Lead 8% in pre-monsoon, Cadmium 4% in pre-monsoon violate the BIS limits.

**Bangalore:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that 4% samples of TDS in each season crosses the permissible limit of BIS, Hardness 8% each, Calcium 4% each in both the seasons respectively whereas Nitrate also crosses 4% groundwater samples in each season respectively. Micro-pollutants such as Mn 4% and 8%, Lead 8% each in both the seasons respectively.

**Hyderabad:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that Alkalinity in 4% groundwater samples of pre-monsoon, Hardness in 8% and 4% samples, Calcium in 4% samples in each season violate BIS limits. Nitrate in 12% and 8% samples and Fluoride 76% and 28% samples violate the permissible limit of BIS in both the seasons respectively. Essential & toxic Metals such as Mn 4% and 8% samples, Lead 8% in each seasonal sample violates the permissible limit of BIS in both the seasons respectively.

**Vishakhapatnam:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that TDS in 8% samples of each season violate the permissible limit of BIS, Alkalinity in 4% samples in per-monsoon, Hardness in 4% samples in each season, Calcium in 4% groundwater samples in each season, Magnesium in 4% in post-monsoon,

Chloride 4% samples in each season, Sulphate in 4% samples violate during each season, Nitrate in 24% samples each in both seasons respectively while Fluoride in 4% samples crosses the permissible limit of BIS in pre-monsoon only. Trace Metals such as Fe in 4% and 12%, Mn in 8% and 4% and Lead in 12% and 4% groundwater samples violate the permissible limit of in both the seasons respectively.

**Patna:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that 8% samples crosses the permissible limit of Fluoride in pre-monsoon whereas Fe 20% and 12% groundwater samples, Lead 4% samples each, Cadmium 12% samples violate each in both the seasons respectively.

**Kochi:** Groundwater quality problems with respect to critical parameters and compliance status against BIS standards revealed that 4% groundwater samples of Nitrate crosses the permissible limit of BIS in pre-monsoon whereas essential and toxic metals such as Fe violates in 32% and 48% groundwater samples, Mn 8% & 12% groundwater samples crosses the permissible limit in both the seasons respectively, while indication of Lead 8% (post-monsoon) & Cadmium 8% (Post Monsoon) samples crosses the permissible limit of BIS (1991).

## **Sustainable Hydrologic Information System for Water Quality Information Management**

The Hydrology Project-II is undertaken to develop a National Hydrological Information System (HIS). The work programme of CPCB is to give thrust on creation of Data Bank, rationalisation of water quality monitoring stations being operated by various monitoring agencies, water quality data validation, conversion of data into information and quality assurance. Water quality data generated on surface as well as groundwater resources in the States covered under Hydrology Project Phase-I, and the new States included in Hydrology Project Phase-II shall be integrated while developing the facilities for management of data. The Project Development Objective (PDO) will be to extend and promote the sustained and effective use of the Hydrological Information System by all potential users concerned with water quality planning and management, both public and private, thereby contributing to restoration and maintenance of wholesomeness of water resources in India. The Project activities undertaken during the year are:

- The concept on calling Expression of Interest for development of Hydrologic Design Aid for water quality information system and for development of Decision Support System finalized in consultation with CWC, CGWB, NIH & CWPRS
- Three training programme were organised for State and Central agencies of Ministry of water resources on the subjects of Integration of water Quality Monitoring Networks; Data Acquisition, Validation, Analysis and

Water Quality Data Interpretation at Bangalore, Vadodara and Bhopal respectively.