

# A REVIEW OF GANGA RIVER POLLUTION-REASONS AND REMEDIES

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## ABSTRACT

Water quality deterioration has serious implications for the supply of water for drinking, irrigation, industrial use, and is important determinant of public health. The Ganga River, largest river in India, occupies nearly one-third of the geographical area of India, has been considered as the most sacred river of India. Having an extraordinary religious importance for Hindus, the river Ganga is affected from increasing level of pollution from urban and industrial areas. The level of natural contaminants such as fluoride and arsenic, and chemical pollutants specially pesticides and insecticides and industrial pollutants is high and rising at several places in Ganga River. Today, Ganga has been considered as sixth most polluted river in the world. The problem has arisen largely due to the discharge of untreated urban wastes and industrial effluents, crimation of dead bodies on the river bank etc., from the cascade of large and medium cities located along the course of Ganga and its tributaries. The use of poor water quality of Ganga River causes dysentery, cholera, hepatitis, as well as severe diarrheea which continue to be one of the leading causes of death of children in India. A number of initiatives have been undertaken to clean the river including Ganga action plan, Yamuna action plan, and constitution of National River Ganga Basin Authority etc. Recently Namami Ganga Project has been initiated by the Government of India to clean the Ganga River.

**Keywords:** Ganga, Pollution, Causes, Remedies, GAP

## INTRODUCTION

Earth is also known as a blue planet because more than 75% of its surface area is covered by water. However, about 97% of earth's water is contained in oceans and sea and fresh water is only 2.7% of the total available water. Out of this, nearly three quarter (75.2%) is frozen in Polar Regions and about 22.6% is buried as ground water. Thus a small proportion of the remaining water is available in rivers, lakes, soil, etc. results only a very small fraction of earth's water is utilizable by the mankind.

Himalayas, the great mountain chains of Asia are the source of three major river systems of the world. These are the Indus, the Ganga (or the Ganges), and the Brahmaputra. The Ganga River, Which occupies nearly one-third of the geographical area of India, has been considered as the most sacred river of India in *Puranas*. The word *Ganga* is considered as a synonym of pure and holy water. People call him *Ganga Maa* (or mother Ganga) or *Ganga ji* (or reverend Ganga) and believe that a bath in the holy waters of Ganga washes all the past sins of a person. If a few drops of the Ganga water are given to a person at the time of death, this is enough to elevate his soul to heaven. The Ganga is also known with several synonyms as *Vishnu Padee Mandakini*, *Devnadi*, *Sursari*, *Tripathga*, *Jahanvi*, *Bhagirathi*, etc. The objectives of the present paper are to review the past & present status of pollution in different stretches of Ganga River and its causes, to discuss the different efforts carried out to remove the pollution from Ganga River, possible remedial measures to prevent pollution in Ganga River, and possible future efforts to be taken up to make Ganga Clean.

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Manuscript No. 1402

## THE GANGA BASIN

The Ganga basin extends over an area of 1,086,000 km<sup>2</sup> falls in four countries, namely India, Nepal, China, and Bangladesh. The catchment area of the basin lies between east longitudes 73°30' to 89°00' and north latitudes 22°30' to 31°30'. The total length of the Ganga River is 2,525 km. It is the 20<sup>th</sup> longest river in Asia and the 41<sup>st</sup> longest in the world. The drainage area of the basin lying in India is 862,769 km<sup>2</sup>, which is nearly 26.2% of the total geographical area of the country.

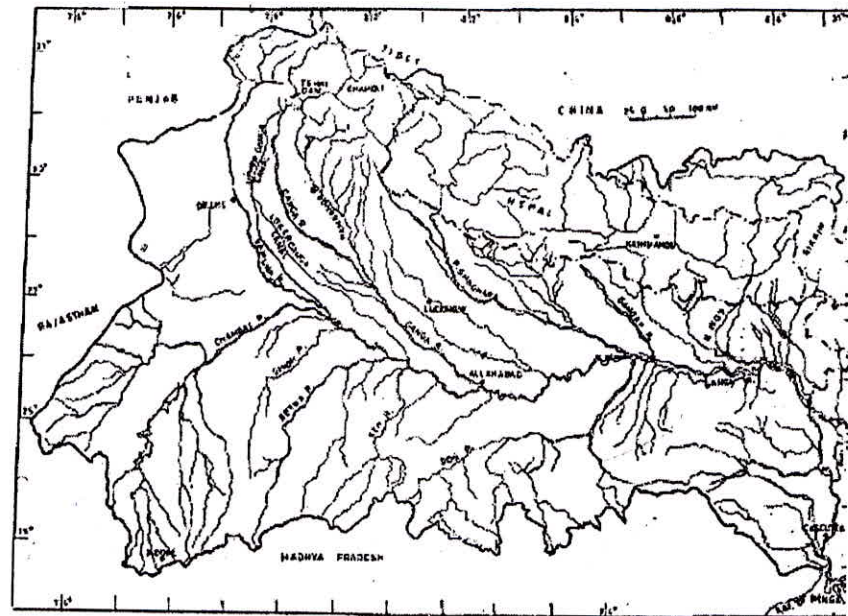


Fig. 1: Index map of Ganga Basin (After Jain et al., 2007)

The navigable length of Ganga River is 631 km which mostly lies in Bihar. Some tributaries, such as the Ghagra, the Gandak and the Kosi, drain areas in Nepal amounting to 190,000km<sup>2</sup>. The Ganga basin is bounded on the north by the Himalayas, on the west by the Aravalis and the ridge separating it from the Indus basin, on the south by the Vindhyas and Chhotanagpur plateaus and on the east by the Brahmaputra ridge. The catchment area of the basin lies in the States of Uttarakhand, Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan, West

Bengal, Haryana, Himachal Pradesh and the Union Territory of Delhi. An index map of the basin is given in Fig.1.

Although the headwaters region of Ganga in the Himalayas is dotted by a number of mighty tributaries, the Bhagirathi River that rises from the Gangotri glacier near Gomukh at an elevation of about 7,010 m above mean sea level is traditionally considered to be the source of Ganga River. The other main stream that originates in the Uttarakhand state of India is the Alakhnanda. Flowing downhill, Bhagirathi and Alakhnanda are joined by a number of streams, such as the Mandakini, the Dhuli Ganga, and the Pindar. Bhagirathi and Alakhnanda rivers meet at a place called Devprayag and thereafter the combined flow is known by the name Ganga. The principal tributaries joining the Ganga River through its 2,525 km course are Tons, Yamuna, Ramganga, Ghaghra, Gandak, Kosi, Mahananda, Pun-Pun, Kiul, Burhi Gandak and Sone. Chambal and Betwa are the two important sub-tributaries of Yamuna (Jain et al., 2007).

### **Pollution scenario of river Ganga**

The Ganges river basin is one of the most fertile and densely populated regions in the world. Increasing level of pollution from urban and industrial areas has created a sharp decline in the quality of Ganga water. Today, it is considered to be sixth most polluted river in the world. The problem has arisen largely due to the discharge of untreated urban wastes and industrial effluents from the cascade of large and medium cities located along the course of Ganga and its tributaries. Although Ganga is considered as a holy river in mythology, people do not hesitate while dumping domestic and industrial waste in the river.

In the hilly reaches up to Rishikesh, Ganga water is quite clean except for sediments. From Rishikesh onwards, disposal of sewage into Ganga begins. Besides the municipal waste of Rishikesh and Haridwar, industrial units discharge partly treated effluents into the river. Haridwar City has a population of 2.25 lakh (Census 2011) and nearly 60,000 people visit the city every day on an average. This number rises to a few lakh on important religious days and may go up to 15 millions on the auspicious days during Kumbha Mela (fair). Considerable lengths of sewer lines are clogged by silts that flow in from the adjoining hills.

Further downstream from Haridwar, Ganga flows through Bijnor, Garhmukteshwar, Narora and Kannauj. Here, water is not much polluted as these two towns do not have any large industry. A note worthy feature of this area is considerable quantity of baseflow that joins the river in this reach during the post-monsoon season. Moving downstream, the situation changes for the worse at Kanpur from the quality point of view. Sewage from the city (population 2.9 million) coupled with untreated toxic waste discharge from about 150 industrial units results in severe damage to water quality. The mean value of DO of 3 mg/l at Jajmau, near Kanpur, reflects the levels of pollution caused by discharge from industries. The leather industry in Kanpur which employs around 50,000 people in more than 400 tanneries uses chemicals such as toxic chromium compounds. Effectively, chromium levels have not decreased in the Ganges even after a common treatment plant was established in 1995. It now stands at more than 70 times the recommended maximum level.

At Allahabad with population of more than a million, municipal wastes are the major contributor to river pollution. Yamuna whose water is highly polluted joins Ganga at Sangam. Large volume of municipal and industrial waste is dumped in the river at Varanasi, a city with approximately 1.2 million population, The Varuna River, which joins the Ganga in the vicinity of Varanasi, receives waste from many drains. Besides, due to the religious belief that those who die in Varanasi are sure to go to heaven, on average, more than 40,000 dead bodies are cremated on the river bank and the ashes and remains are dumped in the river. A measurement of pollution in the Ganges during the year 2006 revealed that river water monitoring over the previous 12 years had demonstrated fecal coliform counts up to 100,000,000 MPN (most probable number) per 100 ml and biological oxygen demand levels averaging over 40 mg/l in the most polluted part of the river in Varanasi. The overall rate of water-borne/enteric disease incidence, including acute gastrointestinal disease, etc and was estimated to be about 66% (Hamner et al., 2006).

Entering in Bihar, a number of industries (including fertilizer and oil refining) have come up along Ganga River. Patna is the most populous city whose wastes are dumped in the river. At Kolkota in West Bengal, the Hooghly (Ganga) river basin is highly polluted as the waste from numerous industries as well as municipal sewage is dumped in the river. The Farakka Barrage, which was built originally to divert fresh water into the Hooghly River, has since caused an increase of salinity in the Ganges. The barrage has caused major tension between Bangladesh and India. The government of India has planned about 300 dams on the Ganges and its tributaries in the near future despite a government-commissioned green panel report that has recommended scrapping 34 of the dams citing environmental concerns.

In brief, the major causes of the Ganga Pollution may be summarized as: (i) disposal of untreated urban, municipal waste/sewage as well as industrial effluents and industrial wastes; (ii) disposal of ashes after cremation of dead bodies and partly burn bodies; (iii) disposal of agriculture wastes, fertilizers, chemicals etc. (iv) disposal of heavy waste generated during religious fairs on the banks of river Ganga and (v) huge amount of untreated waste contributed by countless tanneries's chemical plants, textile mills, distilleries, slaughterhouses, and hospitals.

A systematic classification done by Uttarakhand Environment Protection and Pollution Control Board's (UEPPCB) on river waters into the categories *A*: safe for drinking, *B*: safe for bathing, *C*: safe for agriculture, and *D*: excessive pollution. Based on the results obtained the Ganges water has been found in *D* category. Coliform bacteria levels in the Ganges have also been tested and found to be at 5,500, a level too high not safe for drinking and bathing.

### **Impacts of polluted water of river Ganga**

An analysis of the Ganges water by Hamner et al. (2006) showed significant associations between water-borne/enteric disease due to use of the river for bathing, laundry, washing, eating, cleaning utensils, and brushing teeth. Water in the Ganges has been correlated to contracting dysentery, cholera, hepatitis, as well as severe diarrhea which continue to be one of the leading causes of death of children in India. A study

conducted by the National Cancer Registry Program (NCRP) under the Indian Council of Medical Research in 2012, suggested that those living along its banks in Uttar Pradesh, Bihar and Bengal are more prone to cancer than anywhere else in the country (Ghosh, 2012; Rai, 2013)

The results of mercury analysis in various specimens collected along the basin indicated that some fish muscles tended to accumulate high levels of mercury. A strong positive correlation between mercury levels in muscle with food habit and fish length was found. The Ganges River dolphin is one of few species of fresh water dolphins in the world. Listed as an endangered species, their population is believed to be less than 2000. Hydroelectric and irrigation dams along the Ganges that prevents the dolphins from travelling up and down in the river is the main reason for their reducing population

([http://en.wikipedia.org/wiki/Pollution\\_of\\_the\\_Ganges](http://en.wikipedia.org/wiki/Pollution_of_the_Ganges)).

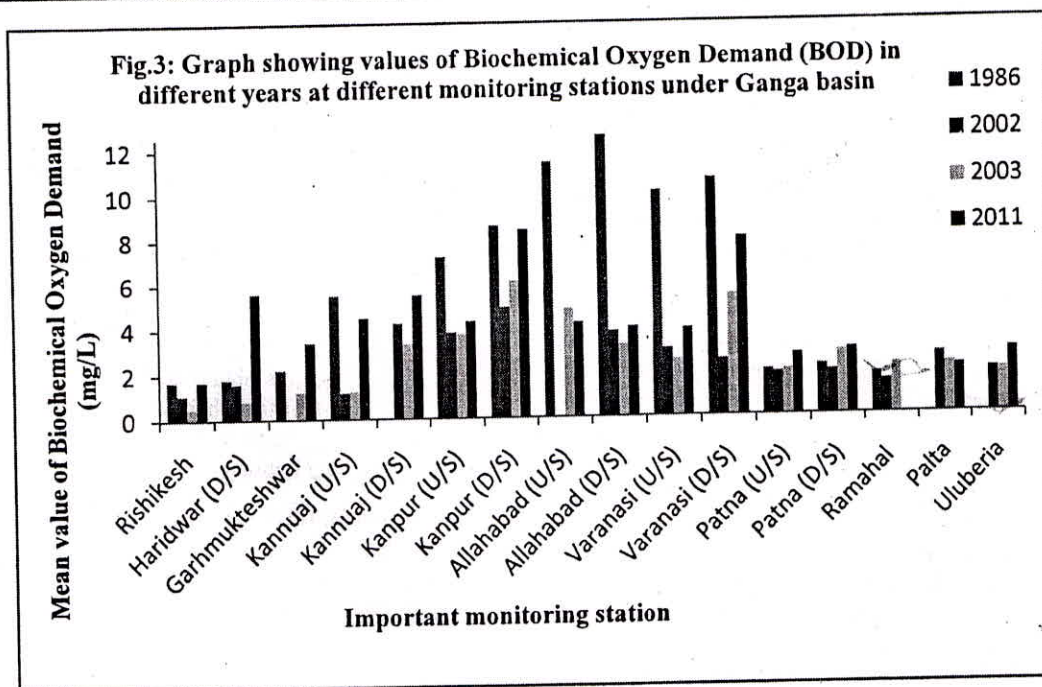
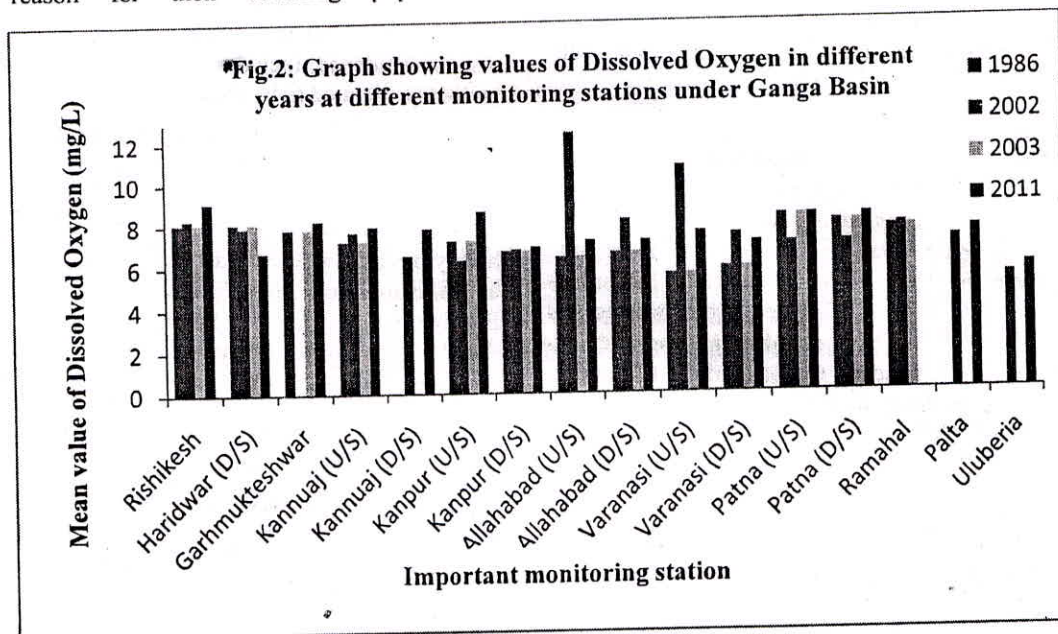
## EFFORTS MADE FOR GANGA CLEANING

### Past and future actions plans for Ganga cleaning

A number of initiatives have been undertaken to clean the river but failed to deliver desired results. In view of the magnitude of water quality problems in the Ganga basin, two action plans were launched by the Government of India: the Ganga action plan and the Yamuna action plan.

### Ganga Action Plan

The Ganga Action Plan (GAP) was launched in April 1986 main thrust areas i.e., (i) interception and diversion of sewage generated in the town, (ii) establishment of domestic/municipal wastewater treatment systems, (iii) construction of elect



Source: CPCB(2006); CPCB (2013); Jain et al.,(2006) D/S= Downstream U/S= Upstream

crematoria, improved wood Crematoria and low cost community toilets near the river banks, (iv) improvement of bathing ghats, (v) afforestation of river banks and (vi) to serve as a model to demonstrate the methodology of improving the water quality of the other polluted rivers and water bodies of the country to their designated best use class. The pollution load dumped in the river by human interference is a serious health hazard to the dense population of the basin. Under the GAP, the Government of India started the planning and execution of several programs to check the pollution of the river Ganga from Rishikesh to Diamond Harbour and its tributaries. Attempts have also been made to build a number of waste treatment facilities and to collaborate with a number of voluntary organizations. Pollution abatement works for the Ganga River had been taken up in 25 class I towns (population exceeding one lakh) along the main Ganga River under the three basin States of U.P., Bihar, and West Bengal.

The first phase of the plan envisaged major works such as renovation of sewage pumping and treatment plants, setting up of new treatment plants to produce energy, manure and biogas and laying down sewage disposal systems. It has been found that all the sewage pumping stations in Rishikesh and Haridwar are in order and pollution of the river has been largely checked. Works have been initiated for cleaning the main stream and renovation and restoration of the existing sewage pumping station and treatment plants at Kanpur, Varanasi, Allahabad, and Patna. It is notable that there is no significant improvement in the river water quality with time, in fact the quality has deteriorated at many places. Further, total coliform remains a serious problem at majority of the locations. The water quality of the Ganga has been monitored at 27 locations from Rishikesh to Uluberia by several institutes and central agencies in India. The summer average values (for the month of March to June when the temperature is high and flow is low) of two important parameters viz. Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) for some of the important monitoring stations observed by these agencies has been given in Fig. 2 & 3.

The steering Committee of the National River Conservation Authority reviewed the progress of the GAP and found that the efforts to decrease the pollution level in the river could not be achieved.

#### Yamuna Action Plan

Yamuna river, a major tributary of River Ganga, has become highly polluted due to various reasons, mainly due to discharge of untreated wastewater into the river from the towns located along its banks and this has adversely affected human health and bio-diversity of the eco-system. To prevent pollution of the Yamuna River Yamuna Action Plan has been initiated in 1993 by Govt. of India. Under this plan, 12 towns of Haryana, 8 towns of Uttar Pradesh and Delhi have been selected. It has been observed that Delhi alone contributes around 3,296 MLD (million litres per day) of sewage by virtue of drains out falling in Yamuna (Jain et al. 2007). Due to the low perennial flow and the huge quantity of waste it receives, Yamuna is one of the most polluted rivers of the country. The Government of India has prepared plans to rebuild and repair the sewerage systems and the drains that empty into the river over the next five years.

Rapid urbanization as well as increase of population from 4 million in 1911 to 13.9 million in 2001, there is an ever-increasing pressure on the water resources in Delhi. Trunk sewers are in poor condition, there is a shortage of sewage treatment capacity and lack of sanitation facilities in unsewered areas of Delhi which account for nearly 50% of the population. These are the factors that are responsible for the continued pollution of the Yamuna in Delhi. Although the water treatment capacities have increased from 159 MLD in 1951 to nearly 2,951 MLD by 2002, the average shortfall in 2002 was about 68 MLD.

Similar to Ganga, there is no significant improvement in the river water quality of Yamuna with time and the quality has deteriorated at many places. Further, total coliform remains a serious problem at majority of the locations including the locations in Uttarakhand. Planning Commission (2006) reported the following values for Yamuna at Okhla (Delhi): total dissolved solids 569 mg/l, BOD 52 mg/l (norm 3 mg/l), coliform count 85,000 maximum probable number (MPN) per 100 ml (norm 5,000 MPN/100 ml). Despite huge investments made in the two projects, these have not been very effective in improving the river water quality.

#### National River Ganga Basin Authority (NRGBA)

National River Ganga Basin Authority (NRGBA) was established by the Government of India, on 20 February 2009 under Section 3 of the Environment Protection Act, 1986. It also declared Ganges as the "National River" of India. The chair includes the Prime Minister of India and Chief ministers of states through which the Ganges flows. (Rai 2013)

#### 2010 Government cleanup campaign

In 2010, it was announced that "the Indian government has embarked on a \$4 billion campaign to ensure that by 2020 no untreated municipal sewage or industrial runoff enters the 1,560-mile river." A World Bank spokesman described the plan in 2011, saying "Earlier efforts to clean the Ganga concentrated on a few highly polluting towns and centers and addressed 'end-of-the-pipe' wastewater treatment there; Mission Clean Ganga builds on lessons from the past, and will look at the entire Gangetic basin while planning and prioritizing investment instead of the earlier town-centric approach. In 2010 itself, the government declared the stretch of river between Gaumukh and Uttarkashi an "eco-sensitive zone".

#### Namami Ganga Project

Namami Ganga project was announced by the Government of India in July 2014 budget. *Ganga Manthan*, a national dialogue on river Ganga, organized on July 07, 2014 at New Delhi marked the beginning of a national level stakeholder interaction on the challenges, issues and possible solutions to achieve the ambitious objective of 'Ganga Rejuvenation'. In the budget tabled in Parliament on July 10, 2014, Union Finance Minister announced an integrated Ganga development project titled *Namami Ganga* and allocated ₹2,037 crore for this purpose. As a part of the program, government of India ordered the shut down of 48 industrial units around Ganga (MOWR 2014).

Namami Ganga Project for the Ganges river has come in for criticism from various quarters. India's Supreme Court, has

observed that the government's action plan may not result in a clean Ganges "even after 200 years." The apex court has ordered the government to provide a cleanup plan with stages and a schedule. Prime Minister has taken the cleaning of the Ganges on priority by creating a Ministry for Water Resources, River Development and Ganges Rejuvenation. It promised a clean Ganges in three years (Sudha Ramchandran 2014).

#### **Present status of pollution in Ganga river**

An study has been made by Central Pollution Control Board to find out the pollution status of Ganga River (CPCB,2013). From the study it has been observed that presently, the River Ganga suffers from myriad problems, most significant ones being the lean flow during dry season. Discharge of untreated and/or partially treated sewage and industrial wastewater into the river is a key issue. Diversion of river water through Upper and Lower Ganga canals, leaving virtually very little flow in the main river stream makes dilution difficult even for the treated sewage. Based on the study, made by CPCB-2013, the present status of Ganga River in different stretches can be summarised as below.

- From its origin to Rishikesh and in the segment of Bihar, BOD in Ganga water is found within prescribed limit. However, in the stretch of Rishikesh Downstream to Garhmukteshwar and Kannauj Upstream to Trighat and few locations at West Bengal (Dakshineshwar, Uluberia & Diamond Harbour) water quality exceeds the criteria in terms of BOD.
- Dissolved Oxygen & pH is meeting the criteria at almost all the monitoring locations while Faecal Coliform is not meeting the criteria at most of the monitoring locations from Kanpur Downstream onwards upto Diamond Harbour.
- It has been observed that 76 % of the pollution load was contributed by the drains in Ganga River Catchment falling in Uttar Pradesh. In Uttar Pradesh, Chhoyia, Permiya, Sisamau nala are the major polluters which contributes maximum pollution load. In West Bengal maximum numbers of point sources were identified. This indicates that if the pollution load in the major drains of Uttar Pradesh, Bihar and West Bengal is addressed, water quality would show substantial improvement.
- Performance evaluation of 64 Sewage Treatment Plants was conducted. It was observed that West Bengal needs immediate attention. All the non functional STPs needs to be made functional. The STP's at Bhatpara (new), Titagarh, Bandipur need improvement. With respect to Uttar Pradesh, Jajmau, Dinapur, Bhagwanpur at BHU needs improvement in its performance. In case of Bihar, treatment plant at Chapara, Patna needs to be made functional. STP at Lakkarghat in Utrakhand needs improvement in its performance.
- CPCB has surveyed and monitored river Kali (East) and Ramganga and inventorize point sources of pollution. Major tributaries of river Ramganga are river Kho, Gagan, Kosi, Dhela, Bhakara, East and Waste Begul and Deohra (Gorra). It has been observed that Moradabad and Rampur drain are two major drains discharging

industrial/domestic wastewater in river Ramganga. Total BOD load discharge to river Ramganga by tributaries/darins is 132 TPD. There are nine point sources namely Abu Nallah-1, Abu Nallah-2, Odean drain, Chhoyia drain, Hapur drain, Kadrabad drain, Gulaothi drain, Bulandshar drain-1 and Bulandshar drain-2 which carry industrial and domestic wastewater into river Kali. Total BOD load discharged by 09 drains to river Kali (East) is 165 TPD.

- 764 grossly polluting industries were identified in main stem of River Ganga and its two important tributaries, Kali-east and Ramganga in Uttarakhand, Uttar Pradesh, Bihar and West Bengal. It was observed that water consumed by grossly polluting industries is 1123 MLD. In terms of number industrial units, tannery sector is dominating where as in terms of wastewater generation Pulp & paper sectors dominate followed by chemical and sugar sector. It is also observed that GPI in Bihar generate minimum wastewater (19%) in terms of water consumed whereas GPI in West Bengal generate maximum wastewater 75.5% in terms of water consumed this followed by Uttarakhand (56.7%) and Uttar Pradesh (39%).

#### **Future possible remedial measures to be taken up**

For formulating the present and future water pollution control programmes and policies in the Ganga basin, in-depth knowledge of development of agriculture, use of fertilizers, pesticides, location and growth of industries, spread of human settlement, prevalent human use of rivers and social habits, development of sewer system in urban communities, water supplies in urban and rural areas etc. are essential.

The success of Cleaning Ganga depends on its adequate planning. Success of the project depends on the identification of the major sources of the pollutions in Ganga and proper treatment of the same to be made to stop pollution in the river. A brief description of the same is given in the following sections.

#### **Major sources of pollution in river Ganga:**

1. Pollution due to Domestic Sewage
2. Pollution due to Industrial Sewage
3. Pollution due to Religious Issues
4. Pollution due to Agricultural wastes
5. Environmental and other reasons

#### **Pollution due to domestic sewage**

- Domestic sewage is the primary cause of the Ganges's contamination. The study conducted by CPCB indicates that urban population consisting of Class I Cities and Class II Towns in the Ganga basin is 57 million (as per 1991) which is projected to be over 72 million in 2002. There are 101 Class I cities and 122 Class II towns in the basin. To Clean the Ganges it should be planned to build infrastructure for the treatment of sewage at several points along the Ganges. The recent survey of Class I and Class II cities by CPCB indicated that about 8250 mld of wastewater is generated in the Ganga basin out of

which treatment facilities are available only for 3500 mld of wastewater. Out of 3500 mld treatment capacity, 880 mld is created under the Ganga Action Plan, 720 mld under the Yamuna Action Plan and about 2189 mld is created by Govt. of Delhi for restoration of water quality of river Yamuna. A huge part of the untreated waste falling in the river is a main cause of the pollution. As a result more Sewerage plants on the suitable locations are required to be established for the treatment of this waste. Further, existing sewerage plants, under non working conditions, constructed under Ganga Action Plan Project must be rejuvenated.

#### **Pollution due to industrial sewage**

- As estimated by Central Pollution Control Board (CPCB), about 501 MLD of industrial wastewater after treatment is being discharged into river Ganga from the 764 Grossly Polluted Industries (GPI). Grossly Polluting Industries are those industries, which (i) discharge their effluents into a water course including rivers and lakes, and (ii) are either involved in manufacture & use of hazardous substances or discharge effluents with a BOD load of 100kg/day or more, or both. Type of industries located along the main stem of river Ganga include tanneries, distilleries, pulp and paper, textiles & dyeing, slaughter houses etc. that discharge its effluents into the river Ganga. In terms of number, tanneries are dominant whereas in terms of waste water, maximum is generated by Pulp and paper industries. Considering the high toxicity of Industrial effluents, it is extremely important to abate the industrial pollution in order to save our holy river Ganga. The outflow from industries having natural contaminants such as fluoride and arsenic, and chemical pollutants such as pesticides and insecticides as well as industrial pollutants must be treated through treatment plants. Effluents from these plants must be discharged in the Ganges only after treatment through treatment plants.

#### **Pollution due to irrigation/agricultural wastes**

- During recent years, non-point sources of water pollution have been recognized as greater importance. Excess use of pesticides, fertilizers, chemicals increases the pollution in agriculture waste and subsequently increases the pollution in river water. A proper watershed management approach needs to be adopted to tackle the problem. Awareness should be developed among the farmers and the river management authorities about the potential hazard of pollution due to excessive use of fertilizers and pesticides in agricultural fields. Farmers should be given awareness about the use of optimum use of chemicals, pesticides, fertilizers etc and non-use of banned Chemicals.

#### **Pollution due to religious issues**

- Due to the religious reasons, dead bodies are cremated on the river bank especially in Varanasi, Garhmukteshwar & Haridwar, and the ashes and

remains are dumped in the river. It is a huge source of pollution in the river. Due to religious region, it is not possibly to avoid and stop the same. However, the better solution of the same is that a small part of the ashes should be dumped in the centre of the Ganges and the remaining major part of the ashes should be dumped at some place by below the ground level by digging a pit.

- People take bath in the Ganges due to their religious thinking. However, while taking bath, garbage should not be dump in the Ganges. Use of Soap, oil, etc should also be avoided while taking baths in the Ganges.
- While worshipping the Ganges, flowers and other material used for worship should not throw in the Ganges.

#### **Pollution due to environmental issues**

- According to the Environmental experts, the pollution of the Ganges is important, but focusing on pollutants alone is not the best approach. "The decrease in water flow in the Ganges has reduced its capacity to purify or dilute its pollutants.
- Open defecation along the Ganges as well as other rivers increases the pollution level of the river. In the rural as well as urban areas, open defecation along the rivers should be discouraged. For the same toilets should be constructed on the banks of the Ganges. Sewerage of these toilets should be treated in the sewerage treatment plants before outfall in the Ganges.

#### **Other issues**

- Continuous water quality monitoring stations should be installed at critical locations especially near the major cities, industries, etc. so that presence of toxic substances, heavy metals arising out of industrial effluents and pesticides from agricultural fields should be determined in the Ganges. A systems analysis and systems optimization study should also be taken to drive more comprehensive and meaningful recommendations in terms of self purification capacity of the different stretches, the desirable intensities and distribution of the inputs of organic loads etc.

#### **Challenges in Ganga cleaning**

As criticized by India's Supreme Court, the cleaning of Ganga is not an easy task. It is required to get the lessons from the failure of Ganga Action Plans. Hence, for cleaning the Ganges a bottom-up approach is required. Experts emphasize that participation of ordinary people in identifying problems, finding solutions and implementing them is imperative for a sustainable solution to the Ganges's problems. Ultimately, for India to find a sustainable solution to the problems that afflict not just the Ganges and other rivers as well, it will need more than a mass movement. An approach that includes all communities, irrespective of their faith, will be required. Communities and common people should be involved as key participants, in cleanup program. Unless the millions common people living in the basin want it to be so, and will participate

in not dirtying it in the first place, any scheme for cleaning Ganges will not work. In this regard, a mass movement to rejuvenate the Ganges is called by the Government of India. In this mass movement program volunteer teams from across the country would be involved in creating public awareness and performing "Ganga seva" (service).

### CONCLUSION

Water quality deterioration has serious implications for the supply of water for drinking, irrigation, industrial use, and is important determinant of public health. The level of natural contaminants such as fluoride and arsenic, and chemical pollutants such as pesticides and insecticides and industrial pollutants is high and rising at several places in Ganga River. Although several studies and pilot programs have been sponsored by the Government of India and external funding agencies, however, success in reducing pollution from Ganga River has not been received. New risks are emerging from the rise in wastewater production and its inappropriate disposal that accompanies the increased coverage and service levels.

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