Report of the Committee

on

Pollution of surface and ground water caused by Simbhaoli sugar mill and distillery

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Executive Summary

The Ministry of Water Resources (MOWR) took a note of the news article "Ganga chokes a sugar mill dumps waste" published by Akash Vashishtha in "Mail Today" from New Delhi on 19 July 2010. The MOWR, after scrutiny of the report, sought comments from NIH, CWC and CPCB, through its Water Quality Division. The comments/observations of National Institute of Hydrology were sent to MOWR. The MOWR constituted a committee under the chairmanship of Director, NIH, to look into the pollution of surface and ground water caused by Simbhaoli sugar mill and distillery, with other members of the committee as (1) Director (RDD), CWC, and (2) Regional Director, CGWB, NR, with option to co-opt member from CPCB and UPSPCB. The other term of reference of the committee is to look into the various aspects of ground water pollution and Ganga water pollution in the industrial areas downstream of Simbhaoli up to Puth village about 30 km from Garhmukteswar in Gahaziabad district. A team comprising of officers of NIH surveyed on 15 June 2011 the area surrounding Simbhaoli sugar mill and distillery plant with particular emphasis to the survey of the unlined drain carrying the industrial waste from the Simbhaoli sugar mill and distillery plant to river Ganga at Puth. Director NIH and chairman of the committee convened a meeting on 20 June 2011 at NIH Roorkee with the nominated members by MOWR. In the meeting, it was decided to make a joint visit of the area of concern by NIH, CWC and CGWB to collect water samples from key locations for chemical analysis. Officers and staff from NIH (Roorkee), CWC (New Delhi) and CGWB (NR Office Lucknow) visited the concerned area on 28-29 June 2011 and collected water samples from surface and ground water sources from key locations, for chemical analysis. The samples were analyzed by NIH, CWC and CGWB in their Water Quality Laboratories and a comprehensive report has been prepared using the results of the analysis.

Sri R. D. Singh, Director, Dr. S. K. Singh, Scientist F and Dr. M. K. Sharma, Scientist C from NIH, Roorkee; Sri Anupam Prasad, Director (RDD) and Dr Zakir Hussain, Incharge, NRWQ Lab. from CWC, New Delhi; Sri K B Biswas, Regional Director, Dr. S. K. Shrivastava, Scientist C and Sri Sant Lal, Scientist B from CGWB NR, Lucknow contributed to the field survey and preparation of this report.

Study Group

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Introduction

The Ministry of Water Resources (MOWR) took a note of the news article "Ganga chokes a sugar mill dumps waste" published by Akash Vashishtha in "Mail Today" from New Delhi on 19 July 2010. The original article as downloaded from the Internet is enclosed at Annexure-1. The concerns highlighted in the article are (1) Black and sinking industrial wastes from Simbhaoli Mills is directly discharged into the river at Puth through a 20 km drain passing through Baksar, Jamalpur, Vet, Jakhera, Nehcholi, Siyana, Longa, Sehl, Bahadurgarh, Alampur, Paswada and Nawada villages causing surface water and groundwater pollution severely and adversely affecting the public and cattle health in many villages adjoining along the drain , (2) The drain is also carrying industrial effluents from Gopaljee milk factory at Siyana town, (3) Rich aquatic life in the river is threatened, (4) Simbhaoli Sugar Mill GM's denial of discharging of Mill waste to the drain, (5) GM of distillery plant stresses that they obtain NOCs from PCB (Pollution Control Board) every year and are allowed to discharge the effluent within the permissible limit and tries to utilize the waste by extracting methane and a RO plant is installed to treat the waste-water.

The MOWR, after scrutiny of the report, sought comments through its Water Quality Division (vide Letter nos.: F.No. 1/4(3)/2010-WQAA(Vol.II)/2408-10 dated 19 April 2011 and F.No.1/4(3)/2010-WQAA(Vol.II)/2480-82 dated 25 April 2011; copy enclosed at Annexure-2). The comments/observations of National Institute of Hydrology (NIH) are given at Annexure -3. The MOWR constituted a committee under the chairmanship of Director, NIH (vide F.No. 1/4(3)/2010-WQAA(Vol.II)/2709-2714 dated 26 May 2011, to look into the pollution of surface and ground water caused by Simbhaoli mills and distilleries, with other members of the committee as (1) Director (RDD), CWC, and (2) Regional Director, CGWB, NR, with option to co-opt member from CPCB and UPSPCB. The other term of reference of the committee is to look into the various aspects of ground water pollution and Ganga water pollution in the industrial areas up to Puth village about 30 km from Garhmukteswar in Gahaziabad district, with scientific and technical aspect/study to address the issue of contamination of the river and aquifer considering their interaction. The comments on the topic from CWC, CGWB, and UPSPCB are given at Annexure-4.

Report of preliminary survey by NIH

A team comprising of officers of NIH, Dr S K Singh, Scientist F, Dr M K Sharma, Scientist C and Sri Dayanand, Tech. II visited (on 15 June 2011) the area surrounding Simbhaoli Sugar Mill and Distillery Plant with particular emphasis to the survey of the unlined drain carrying the industrial wastes from the Simbhaoli sugar mill and distillery plant to river Ganga at Puth. Identified and surveyed the nallas joining the drain, the canal-escape (with no water in it) from Ganga canal, to which the drain is joining at Siyana, and the canal-escape ultimately joining river Ganga at Puth village. Also visited Puth village and Brijghat at river Ganga.

The effluent from Simbhaoli distillery is being discharged through a concrete pipe over the Ganga canal into an unlined drain running parallel to the canal, about 500m upstream of the distillery. However, as per the site condition, the waste discharge from the distillery plant up to the covered concrete pipe over the Ganga canal is not visible and is possibly through underground pipe. The effluent from Simbhaoli sugar mill joins the unlined drain parallel to the Ganga canal about 1 km downstream from Simbhaoli. The colour of the slurry type of effluent flowing in this unlined drain is dark brown and having foul smell between the two discharge points. This unlined drain carrying effluents from Distillery and Sugar mill runs parallel Ganga canal from Simbhaoli to Sayana. Between Simbhaoli and Siyana town, the villages Baksar, Vaith, Jamalpur, Jakhera, and Nehcholi are close to the drain towards left of the drain. The colour of the effluent flowing in this unlined drain was observed dark brown and having foul smell up to Sayana. Enquiry from villagers revealed that they are quite hopeless with their views that nothing can be done. They also informed that many times the slurry-type effluent in the drain catches fire, sometimes at such a scale to burn the items including agricultural produce and waste kept near and along the drain; which may be because of the anaerobic digestion and release of gases like methane. They also showed the samples of water from the village hand-pumps, which are yellow/brown in colour or become so after some time. The team also collected water samples from distillery discharge and unlined drains at key locations along its way to Puth.

No prior appreciable monsoon rain has occurred up to the time of the preliminary survey and the drain was devoid of carrying monsoon discharge. As per the enquiry and field observation, the unlined drain does not receive any major nalla from any village and it mainly carries effluent from the sugar mill and distillery and it carries and escapes the excess flood/rain water during monsoon season. At Sayana, the unlined drain perpendicularly joins a small-escape

from Ganga canal with no water from Ganga canal to the escape. Most of time of the year, no water is discharged into the escape from the Ganga canal as per the villagers' information. At Sayana, the industrial effluent from Gopaljee milk factory joins the escape-cum-drain. Between Siyana and Puth, villages Longa, Sehal, Bahadurgarh, Alampur, Paswada, and Nawada are close to and situated either left or right of the escape-cum-drain.

First meeting of the committee

Director NIH and chairman of the committee convened a meeting on 20 June 2011 at NIH Roorkee. The following members were present:

(1) Sri Anupam Prasad
Director (RDD)
CWC, New Delhi

(2) Sri K. B. Biswas
Regional Director
CGWB North Region
Lucknow

(3) Dr S K Singh
Scientist F
NIH, Roorkee

(4) Dr M K Sharma
Scientist C & OIC
Water Quality Lab., NIH, Roorkee

In the meeting, various aspects of the ground water pollution and Ganga water pollution due to the Simbhaoli mill and distillery plant were discussed along with the observations of the preliminary survey and the following decisions were made:

(1) A team consisting of officers of CWC, CGWB and NIH will visit the problem area and will collect the samples from the River Ganga at different locations in the area, canals, drains flowing in the area with especial reference to the drain from Simbhaoli to Siyana and small escape from Siyana town to Puth village.

(2) To collect water samples from ground water sources such as hand-pumps extensively being used for drinking purpose in the villages close to the drains discharging effluents.

(3) To ascertain the effect of the pollution from sugar mills/distillery in surface water and ground water by collecting and analyzing water samples from Ganga river, drains/nallas, groundwater source.

(4) To prepare the report based on survey and results of water quality analysis along with recommendations, for submitting it to the Ministry of Water Resources for further necessary action.

General description of area and industries of concern

Area of concern lies in Garhmukteshwar block of Ghaziabad district situated on the right bank of river Ganga. The irrigation in major part of the Ghaziabad district is by means of minor irrigation structures such as tubewells, cavity wells and surface irrigation system, i.e., canals. Anup Shahar branch of Upper-Ganga Canal irrigates eastern part of the district. A total area of 4144 ha-m is irrigated by canals in Garhmukteshwar block, and 17891 ha-m is irrigated by groundwater abstraction structures. Thus contribution of groundwater to irrigation in the block is 81%.

The entire area form the part of Ganga-Yamuna doab and eastern boundary is marked by river Ganga. The area represents almost a monotonous flat plain dissected by drainage of different order. Morphologically, the area can be divided into three morphological units, viz, (1) Older alluvial plain, (2) Older flood plain and (3) Active flood plain. The banks of rivers are steep and ravenous. The older alluvium occupies the entire upland and interfluves area occurring between major drainage. The groundwater resources of Simbhaoli and Grahmukteshwar blocks as worked out (source: CGWB, NR, Lucknow) on 31 March 2009 are:

	Simbhaoli block	Garhmukteshwar block
Net groundwater availability	12182 ha-m	15207 ha-m
Existing groundwater drafts for all uses	9319 ha-m	10993 ha-m

In the area of concern, Simbhaoli Sugars Limited (SSL) and Simbhaoli Distillery Limited are located at Simbhaoli, and Gopaljee Milk factory is at Siyana. These three industries are discharging their waste effluent into the unlined drain. Simbhaoli Sugars Limited (SSL),

formerly known as the Simbhaoli Sugar Mills Limited (SSML) is a 75 years old company and was established as a partnership firm in 1933 with 400 tons of sugarcane crushed per day. It was incorporated in 1936 as a private limited company. The company went public in 1989 and has followed a stable growth strategy in its business. In the year 1992 it acquired a distillery plant. The distillery plant has a 75 KLPD Rectified Spirit production capacity. It has a product mix of 60 KL/D Ethanol – power alcohol which is being mixed with petrol and 20 KL/D Extra Neutral Alcohol- a special category spirit used in premium IMFL products. 1MW of co-generation facility and 40 Ton of CO_2 (Carbon Dioxide, marketed as dry ice) production per day. It has many liquor brands in country liquor segment as well as IMFL segment. (source: web site of SSL)

First joint survey by NIH, CWC, and CGWB officials

Officers from NIH (Roorkee), CWC (New Delhi) and CGWB (NR Office Lucknow) visited (on 28-29 June 2011) the concerned area and collected water samples from surface and ground water sources from key locations, for chemical analysis. Water samples were collected at 11 points along the drain in its reach from Simbhaoli to Puth, 05 points along the river Ganga in its reach from Garhmukteswar to Puth, 23 points in 13 villages situated close to the drain along its reach from Simbhaoli to Puth. Unlike the condition during the preliminary survey, good amount of prior appreciable monsoon rain had occurred up to the time of the first joint survey with substantial rainfall just a day before the sampling.

Nature of pollutants from the sugar mill and dairy factory

Sugar mills are seasonal industries operating for about 6 months (from October to March) in a year. The chemicals used in the sugar industries are: (1) Calcium hydroxide, $Ca(OH)_2$, used for clarifying and raising the pH of juices, it is known as liming, (2) Hydrogen phosphate, H_3PO_4 is used prior to liming for improving the clarification, (3) Polyelectrolytes are used for coagulation of impurities during defecation and carbonation process, (4) Sulphur di-oxide gas, SO_2, is used to remove colour from the raw sugar, (4) Sodium hydroxide (NaOH) and sodium carbonate (Na_2CO_3) are used for periodic descaling of heaters, (5) Lead sub-acetate is used for the analysis of sugar content. A typical sugar mill consume around 1500-2000 litres of water and generate about 1000 litres of wastewater for each ton of sugar-cane crushed.

A typical sugar industry effluent discharge is approximately 5000 cubic meter per day. The waste load in the effluents from sugar industries is oxygen demanding, adverse to fish and aquatic life resulting in their extinction. These discharges need to be treated before getting discharged to a surface-water source. The effluent from a sugar mill is mainly waste water from floor-washing and condensate water. Sugar-cane juice, syrup and molasses get added to the waste water due to leakages in valves and glands of the pipelines. The sugar mill effluent has a BOD of 1000 to 1500 mg/l, it initially appears relatively clean, turns black and start emitting foul odour after stagnating for some time. A typical sugar-industry effluent also contains heavy metals, such as, lead (Pb), copper (Cu), zinc (Zn), iron (Fe), chromium (Cr), cadmium (Cd), manganese (Mn), and nickel (Ni).

In India, sugar is produced by using techniques not used elsewhere in the world. The characteristics of the molasses produced in India therefore are different in nature and the foreign technology cannot be directly adopted for effluent treatment in distilleries. Spent wash, the main pollutant from distilleries, results in effluents having very high BOD (40000 - 50000 mg/1) and COD (8000 - 10000 mg/1). If the untreated effluent from a sugar mill is discharged in water courses, it will deplete dissolved oxygen (i.e., BOD of the water course will be high) making the water unfit for aquatic life. If untreated effluent is discharged on land, decaying organic solids and oil and grease will clog the soil pores.

Bagasse is mostly used as a sugar mills fuel in boilers, which produces particulate matter, oxides of nitrogen, carbon, and sulphur. The particulate matter usually referred to as fly ash, consists of ash, unburnt bagasse, and carbon particles. Fly ash is very light and can escape in the atmosphere through chimney and travel long distances causing dizziness and irritation eyes, nose, throat and lungs of human and animal populations of the affected areas, if proper pollution-control equipments are not installed. The heavier particles can settle on vegetation damaging them. The prominent solid wastes generated from a typical sugar industry are lime-sludge and press-mud. Lime-sludge containing dirt and other impurities, and milk of lime is generated from the process of purifying the sugarcane juice by organic matter. The impurities from the sugarcane juice are either vacuum filtered or press have filtered and removed as press mud. In addition to these, solid wastes are also generated from the pollution control facilities like ETP sludge and fly ash collected from the dusting devices. Huge amount of suspended solid is generated from sugarcane washing, lime cake, pulp screen and pulp press, pulp silo, etc., which

is generally converted into slurry before being disposed into a surface water source or spread on land. Sugar mills have a great potential to pollute the water body and land by discharging a large amount of untreated wastewater as effluent directly in the water body and/or on the land.

| The general details, nature, and pollution potential of effluents from sugar industries can also be had from Baskaran et al. (2009), and Khan et al. (2003). Groundwater pollution can also be caused due to the effluents from a typical sugar mill discharged to a surface drain, through interaction of surface water and groundwater. The extent this groundwater pollution can extend far away up to 1 km (see, Pawar et al. 1998) from the either side of surface drain and propagate downstream.

Details of water quality sampling in the area of concern

During the preliminary survey and first joint survey, water samples from selected key locations were collected by dip/grab sampling method. The water samples were collected in polyethylene bottles. The sampling bottles were washed thoroughly, rinsed with distilled water and finally rinsed with the sample to be sampled, before taking a sample at a particular location. All samples from the river Ganga were collected at a depth of 15 cm to avoid introduction of floating particles, using standard water sampler (Hydro Bios, Germany). The water-samples for physico-chemical analysis were collected and stored in clean narrow mouth polyethylene bottles fitted with screw caps. The water-samples for bacteriological analysis were collected in wide-mouth sterilized high-density polypropylene bottles covered with aluminium foils, as per the standard method. The water samples for trace-element analysis were collected in acid leached polyethylene bottles and preserved by adding ultra-pure nitric-acid (5 ml/l). For analyzing other parameters, samples were preserved by adding an appropriate reagent and brought to the laboratory in sampling kits maintained at 4^{o}C for detailed chemical and bacteriological analysis. Details of key sampling locations for during the preliminary survey and first joint survey are given in Tables 1 and 2, respectively, and are shown in |Figs. 1 and 2, respectively.

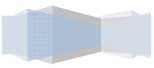
Table 1. Sampling locations: Preliminary survey on 15 June 2011

S. No.	Sampling location	Nearby village/town
	Drain/Canal/River Ganga	
S-1	Simbhaoli distillery drain just outside the Plant in the Plant-campus	Sambhaoli
S-2	Unlined drain u/s of distillery discharge (to the unlined drain) point	Sambhaoli
S-3	Distillery discharge point just before meeting the unlined drain	Sambhaoli
S-4	Unlined drain just d/s of distillery discharge point	Sambhaoli
S-5	Unlined drain at Simbhaoli road-bridge	Sambhaoli
S-6	Unlined drain d/s of Simbhaoli road-bridge u/s of Sugar mill discharge (to the unlined drain) point	Baksar
S-7	Sugar mill discharge point just before joining the unlined drain	Baksar
S-8	Unlined drain just d/s of Sugar Mill discharge (to unlined drain) point	Baksar
S-9	Unlined drain just before perpendicularly meeting the canal-escape at Siyana	Siyana
S-10	Gopaljee milk factory discharge point just before meeting the canal-escape	Siyana
S-11	Canal-escape at road bridge d/s of Gopaljee milk factory discharge point	Siyana
S-12	Canal-escape at Alamnagar	Alamnagar
S-13	River Ganga at Brijghat u/s of Puth village	Garhmukteshwar
S-14	River Ganga at Puth village	Puth
	Groundwater	
G-1	Groundwater (Handpump): Between Simbhaoli road-bridge and Sugar mill discharge point	Baksar
G-2	Groundwater (Handpump)	Alamnagar

Table 2. Sampling locations: First joint-survey on 28-29 June 2011

S. No.	Sampling location	Nearby village/town
	Drain/Canal/River Ganga	
S-1	Ganga-canal at Simbhaoli	Sambhaoli
S-2	Unlined drain u/s of distillery discharge (to the unlined drain) point	Sambhaoli
S-3	Distillery discharge point just before meeting the unlined drain	Sambhaoli
S-4	Unlined drain just d/s of distillery discharge point	Sambhaoli
S-5	Unlined drain d/s of Simbhaoli road-bridge u/s of Sugar mill discharge (to the unlined drain) point	Baksar
S-6	Sugar mill discharge point just before joining the unlined drain	Baksar
S-7	Unlined drain just d/s of Sugar Mill discharge (to unlined drain) point	Baksar
S-8	Unlined drain just before perpendicularly meeting the canal-escape at Siyana	Siyana
S-9	Gopaljee milk factory discharge point just before meeting the canal-escape	Siyana
S-10	Canal-escape at road bridge d/s of Gopaljee milk factory discharge point	Siyana
S-11	Garh Nalla before meeting river Ganga	Garhmukteshwar
S-12	Canal-escape at Puth village before discharging to river Ganga	Puth
S-13	Mixing point of canal-escape with River Ganga at Puth village	Puth
S-14	River Ganga u/s of Garh nalla between Garhmukteshwar and Brij-Ghat	Garhmukteshwar
S-15	River Ganga at Brijghat u/s of Puth village	Garhmukteshwar
S-16	River Ganga u/s of canal-escape at Puth village	Puth
S-17	River Ganga at Puth village d/s of canal-escape	Puth
	Groundwater	
G-1	Groundwater (Handpump)	Nawada
G-2	Groundwater (Handpump)	Brahmgarhi
G-3	Groundwater (Handpump)	Brahmgarhi
G-4	Groundwater (Handpump)	Baksar
G-5	Groundwater (Handpump)	Baksar

G-6	Groundwater (Handpump)	Baksar
G-7	Groundwater (Handpump)	Vaith
G-8	Groundwater (Handpump)	Jamalpur
G-9	Groundwater (Handpump)	Jakhera Rahmatpur
G-10	Groundwater (Handpump)	Sarai Nahar Pul
G-11	Groundwater (Handpump)	Dehra Kutti
G-12	Groundwater (Handpump)	Sehal
G-13	Groundwater (Handpump)	Sehal
G-14	Groundwater (Handpump)	Sehal
G-15	Groundwater (Handpump)	Bahadurgarh
G-16	Groundwater (Handpump)	Bhadsyana
G-17	Groundwater (Handpump)	Alamnagar
G-18	Groundwater (Handpump)	Alamnagar
G-19	Groundwater (Handpump)	Puth
G-20	Groundwater (Handpump)	Puth
G-21	Groundwater (Handpump)	Puth
G-22	Groundwater (Handpump)	Puth
G-23	Groundwater (Handpump)	Puth



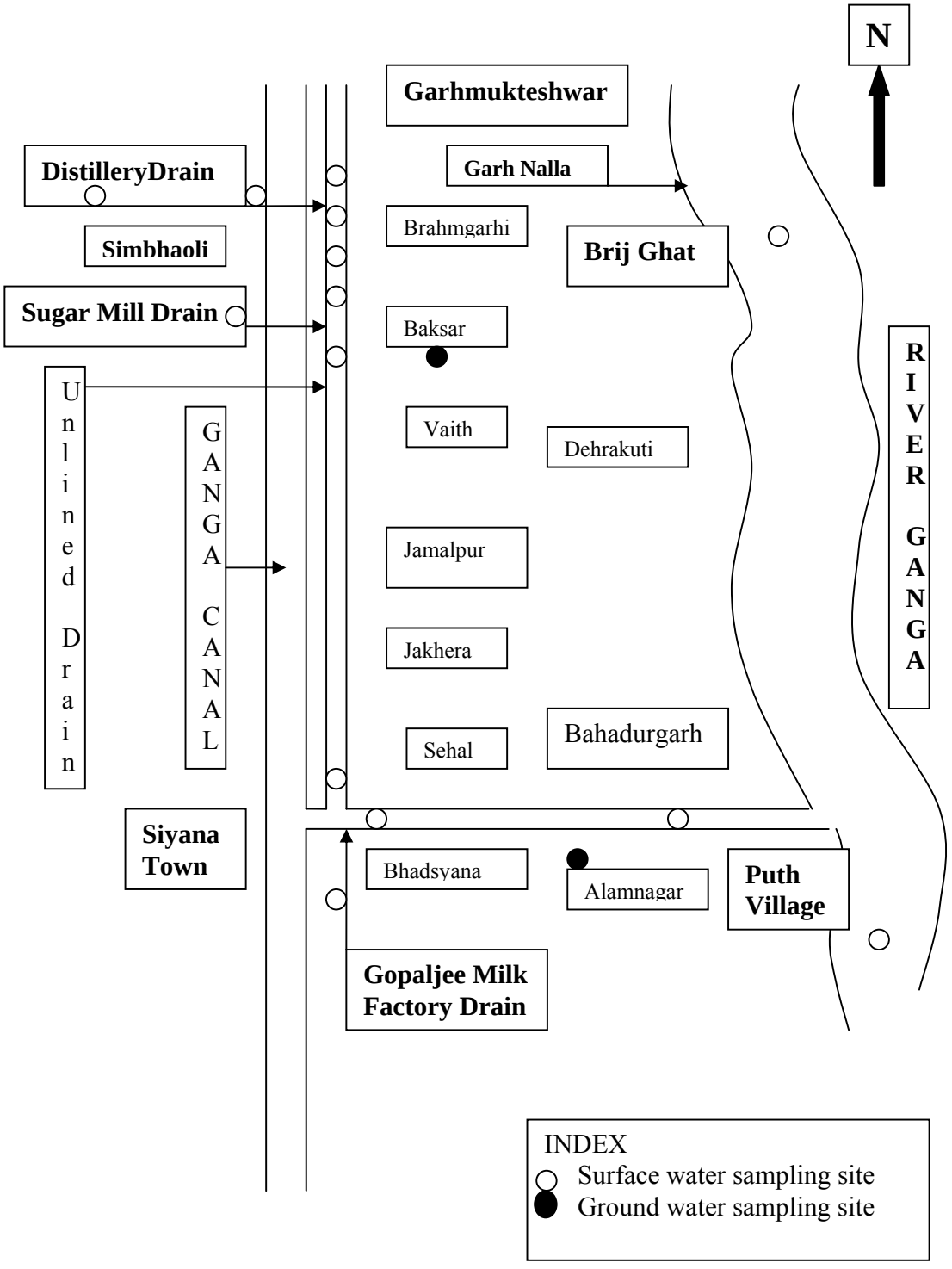


Fig. 1. Line diagram showing sampling locations: Preliminary survey-15 June 2011

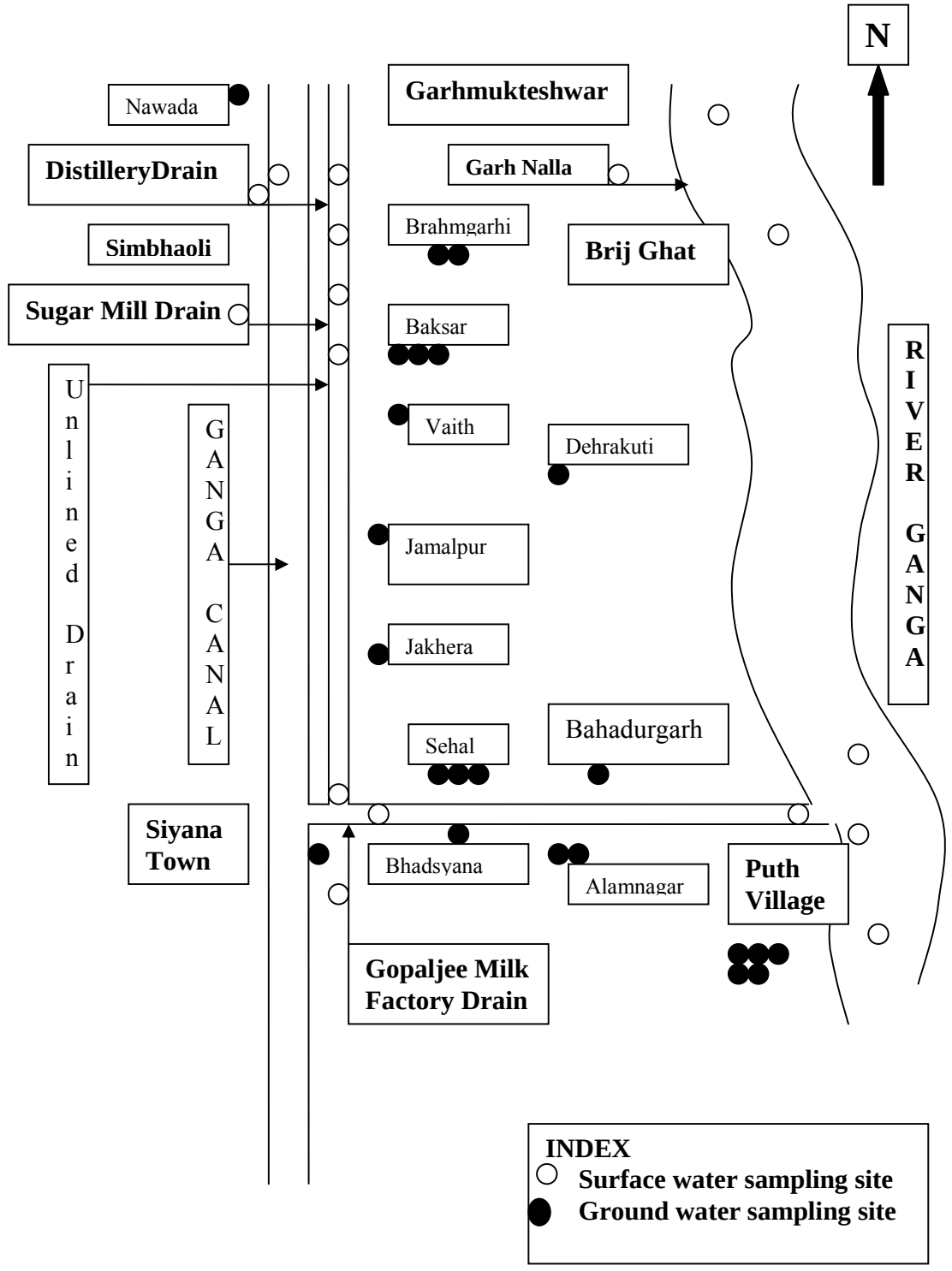


Fig. 2. Line diagram showing sampling location: First joint-survey on 28-29 June 2011

Analysis of water samples

All glassware and other containers used for trace element analysis were thoroughly cleaned by soaking in detergent followed by soaking in 10% nitric acid for 48 h and finally rinsed with de-ionized water several times prior to use. All glassware and reagents used for bacteriological analysis were thoroughly cleaned and sterilized before use.

The physico-chemical (pH, EC, TDS, Alkalinity, Hardness, DO, COD, BOD, Major Cations (Na, K, Ca, Mg), Major Anions (HCO_3, Cl, SO_4, NO_3, NO_2), Minor Ions (F, B, PO_4, SiO_2, NH_3-N) and bacteriological (Total Coliform and Faecal Coliform) analysis was performed as per standard methods (Jain and Bhatia, 1988; APHA, 1992). The details of analytical methods and equipment used in the study are described in Table 3.

Perkin-Elmer Atomic Absorption Spectrometer (model 3110) using air-acetylene flame was used for metal analysis of water samples. Average values of five replicates were taken for each determination. Operational conditions were adjusted in accordance with the manufacturer's guidelines to yield optimal determination. Quantification of metals was based upon calibration curves of standard solutions of respective metals. These calibration curves were determined several times during the period of analysis. The detection limits for iron, manganese, copper, nickel, chromium, lead, cadmium and zinc are 0.003, 0.001, 0.001, 0.004, 0.002, 0.01, 0.0005 and 0.0008 mg/l respectively.

Table 3. Analytical methods and equipment used in the study

S.No.	Parameter	Method	Equipment
A.	**Physico-chemical**		
1.	pH	Electrometric	pH Meter
2.	Conductivity	Electrometric	Conductivity Meter
3.	TDS	Electrometric	Conductivity/TDS Meter
4.	Alkalinity (CO_3 & HCO_3)	Titration by H_2SO_4	-
5.	Hardness	Titration by EDTA	-
6.	Chloride	Titration by $AgNO_3$	-
7.	Sulphate	Turbidimetric	Turbidity Meter

8.	Nitrate	Ion selective electrode	Ion meter
9.	Nitrite	Colorometric method	UV-VIS Spectrophotometer
10.	Ammonical Nitrogen	Ion selective electrode	Ion meter
11.	Silica	Molybdosilicate method	UV-VIS Spectrophotometer
12.	Phosphate	Molybdophosphoric acid	UV-VIS Spectrophotometer
13.	Fluoride	Ion selective electrode	Ion meter
14.	Sodium	Flame emission	Flame Photometer
15.	Potassium	Flame emission	Flame Photometer
16.	Calcium	Titration by EDTA	-
17.	Magnesium	Titration by EDTA	-
18.	Boron	Carmine	UV-VIS Spectrophotometer
19.	DO	Winkler titration method	-
20..	BOD	5 days incubation at 20^{o}C followed by titration	BOD Incubator
21.	COD	Digestion followed by titration	COD Digestor
B	**Bacteriological**		
22.	Total coliform	Maximum Probable Number (MPN) method	Bacteriological Incubator
23.	Faecal coliform		
C.	**Heavy Metals**		
24.	Iron	Digestion followed by Atomic Spectrophotometry	Atomic Absorption Spectrometer
25.	Manganese		
26.	Copper		
27.	Nickel		
28.	Chromium		
29.	Lead		
30.	Cadmium		
31.	Zinc		

Water quality standards and designated use classification

The water is used as multipurpose resource with its main uses as public water supply, outdoor bathing & recreation, fisheries & wildlife propagation, irrigation & other agricultural uses, cooling in power plants, navigation and disposal of wastes. Most of these uses are often conflicting. In order for any water body to function adequately in satisfying any one of the above mentioned use, it must have corresponding degree of purity. In terms of quality, drinking water needs highest level of purity, whereas disposal wastes may have an inferior quality. Therefore, there is need to maintain the quality of water apart from its quantity.

National River Conservation Directorate (NRCD), Ministry of Environment & Forest, Govt. of India, has classified the water bodies including coastal waters in the country according to their "designated best uses" as given in the Annexure 5.

The Bureau of Indian Standards (BIS) earlier known as Indian Standards Institution (ISI) has laid down the standard specifications (BIS standard) for drinking water (IS 10500:1991). The maximum permissible limit has been prescribed, especially where no alternate sources are available, to enable the users exercise their discretion towards water quality criteria. The BIS standard specifications describe essential and desirable characteristics required to be evaluated to ascertain suitability of water for drinking purpose. The important water quality characteristics as laid down in BIS standard are given in Annexure 6.

In water quality control technology, the principal indicator of suitability of water for domestic, industrial, or other use is coliform group of bacteria. The density of coliform group is the criterion of the extent of contamination and has been the basis for bacteriological water quality standard. In ideal situation all the samples taken from the distribution system should be free from coliform organisms but in practice, it is not always attainable and following standard for bacteriological quality has been recommended in IS10500:1991:

- 95% of water samples should not contain any coliform organisms in 100 ml throughout any year.
- No water sample should contain E.Coli in 100 ml water.
- No water sample should contain more than 10 coliform organisms per 100 ml.
- Coliform organisms should not be detected in 100 ml of any two consecutive water samples.

From bacteriological point of view, the objectives should be to reduce the coliform count to less than 10 per 100 ml and more importantly the absence of faecal coliform should be ensured.

Further, the presence of faecal colifirms in ground water is the indicator of a potential public health problem, because faecal matter is a source of pathogenic bacteria and viruses. The faecal coliform bacteria contaminate ground water through percolation from contamination sources (domestic sewage and septic tank) into the aquifers and also because of poor sanitatory system. Shallow aquifers are more susceptible for such contamination. The indiscriminate land disposal of domestic and industrial waste on surface, their improper disposal, leaching of waste water from domestic and industrial landfills further aggravate the problem of bacterial contamination in ground water.

Results of water-sample analysis and discussion

In the present investigation, the status of surface water quality and ground water quality was evaluated by analyzing water samples collected from surface water and ground water sources at selected key points in the area of concern during the preliminary survey and first joint survey (15 June 2011 and 28-29 June 2011).

During preliminary survey, a total of 16 samples were collected (see Table 1 for location-detail of sampling site), which were analyzed in the laboratory for water quality parameters. The parameter values obtained from physico-chemical, trace element, and bacteriological analyses of the water samples are given in Annexure - 8.1, 8.2, and 8.3, respectively. These data revealed that all physico-chemical parameters (except TDS, BOD, and DO; and nitrate) of samples collected from the unlined drains lies within the maximum limit prescribed by CPCB for disposal of industrial effluent on inland surface water (CPCB, 1998). Dissolved oxygen (DO) was observed to be almost nil in the whole stretch of unlined drain and canal-escape from Simbhaoli to Puth village indicating anoxic condition. As per NRCD classification, Class D water should have DO $\geq$ 4 mg/l. High values of BOD in all locations of unlined drains indicate high degree of organic pollution rendering the water unsuitable for different designated uses and creating anaerobic condition unfit for survival of aquatic cultures. TDS values are observed more than the tolerance limit at two locations in the unlined drain. COD values are also higher but within the maximum limit prescribed by CPCB. In river Ganga, at Brijghat and Puth-village as well as in

ground water at Baksar and Alamnagar, all analyzed physico-chemical parameters (except nitrate) are within the limits prescribed by BIS (1991) for drinking water. Very high concentration above the maximum prescribed limit for disposal industrial effluent on inland surface water, of iron (Fe), is observed in the upstream section of the unlined drain before the road-bridge at Simbhaoli. Concentration of iron (Fe), manganese (Mn), nickel (Ni), chromium (Cr) and cadmium (Cd) are observed more than the permissible limit prescribed by BIS (1991) for drinking water, in the river Ganga at Brijghat and Puth village and in ground water at Baksar and Alamnagar. The bacteriological analysis data of surface water and ground water revealed that very high bacteriological pollution exist in the surface water of the unlined drain from Simbhaoli to Puth village as well as ground water in the area of concern.

During first joint survey (on 28-29 June 2011) by NIH, CWC and CGWB, a total of 40 samples were analyzed, out of which 11 samples were from unlined drain, and canal-escape, 5 samples from river Ganga, 1 sample from Ganga-canal and 23 samples from groundwater sources. The physico-chemical data, trace element data and bacteriological data of surface water are given in Annexure 9.1, 9.2 and 9.3, respectively. These data revealed that nitrate (as N) at almost all site in the unlined drain and canal-escape exceeds the maximum limit prescribed by CPCB for disposal of industrial effluent on inland surface water (CPCB, 1998). The concentration of nitrate (as N) also exceeds the maximum permissible limit of 10 mg/l prescribed by BIS (1991) in the river Ganga at Garhmukteshwar and Puth village, with its concentration being higher (approximately double) at Puth than at Garhmukteshwar. Dissolved Oxygen (DO) is observed to be nil at all sites in unlined drain from Simbhaoli to Siyana, and very low in canal-escape reach from Siyana (DO = 0.0 mg/l) to Puth village (DO = 1.2 mg/l). As per NRCD classification, Class D water should have DO $\geq$ 4 mg/l. The BOD and COD values at all sites in unlined drain from Simbhaoli to Siyana are observed very high exceeding the limit prescribed by CPCB (CPCB, 1998). High concentration of iron (Fe) with its value being greater than the permissible limit of 3000 µg/l is observed in the unlined drain at the distillery discharge point and subsequent points up to just u/s of the sugar mill discharge point at Baksar. Concentration of lead (Pb) more than permissible limit of 100 µg/l is observed at all sites in the unlined drain, and canal-escape from Simbhaoli to Puth. High concentrations of nickel (Ni) and lead (Pb) are observed more than permissible limit prescribed by BIS (1991) for drinking water, in the river Ganga at Garhmukteshwar, Brijghat, and Puth village. The concentration of cadmium (Cd) is

observed more than the permissible limit of 10 µg/L (BIS, 1991) for drinking water, in the river Ganga at Brijghat and Puth village. Very high bacteriological pollution is observed in the surface water of unlined drain and canal escape at all sites from Simbhaoli to Puth and also in river Ganga at Garhmukteshwar, Brijghat, and Puth village. As per the classification proposed by NRCD, the river Ganga water from Garhmukteshwar to Puth falls under class-C due to very high bacteriological content.

The physico-chemical data, trace element data and bacteriological data of ground water samples are given in Annexure 10.1, 10.2, and 10.3, respectively. Data revealed that ground water of village Alamnagar and Puth is contaminated due to high nitrate (as NO_3) concentration above the maximum limit prescribed by BIS(1991) for drinking water. High values of BOD (>2.0 mg/L) are observed in the ground water of Brahmgarhi and Baksar village situated close of unlined drain indicating the presence of organic pollution in groundwater. In the groundwater of the villages (Sehal, Bahadurgarh, Bhadsyana, Alamnagar and Puth) by the side of the canal-escape, the values of hardness are observed more than the desirable limit of 300 mg/l but within the maximum permissible limit. In the one of the handpump of Alamnagar, hardness exceeds the maximum permissible limit of 600 mg/L. More than 50% of the ground water samples of the area revealed the concentration of iron (Fe) more than the maximum permissible limit of 1000 µg/L (BIS, 1991) for drinking water. High concentration (>300 µg/l) of manganese (Mn) is observed in the hand pumps of Baksar and Sehal villages. About 25% of analyzed groundwater samples showed bacteriological contamination and the severely affected villages are Sehal, Bhadsyana, Alamnagar, and Puth.

Conclusions and Recommendations

The following are the conclusions and recommendations:

1. A typical sugar industry effluent discharge is approximately 5000 cubic meter per day during its operation, which is generally from October to March each year. The waste load in the effluents from sugar industries is oxygen demanding (high BOD), adverse to fish and aquatic life resulting in their extinction. These discharges need to be treated before getting discharged to a surface-water source. Heavy reduction (up to 75%) in BOD and COD can be

achieved by flocculation with mixing aluminium sulphate [$Al_2(SO_4)_3$] and ferrous sulphate ($FeSO_4$).

2. Huge amount of suspended solid is generated from sugarcane washing, lime cake, pulp screen and pulp press, pulp silo, etc., which is generally converted into slurry before being disposed or spread on land. A proper care need to be taken to avoid the pollution of groundwater due to the percolation from landfill or spreading of waste on land. Anerobic digestion tanks can be used for the treatment of organic and slurry type of wastes.
3. A typical sugar-industry effluent also contains heavy metals, such as, lead (Pb), copper (Cu), zinc (Zn), iron (Fe), chromium (Cr), cadmium (Cd), manganese (Mn), and nickel (Ni). Spread of these toxic metal-pollutions to surface water and groundwater sources beyond permissible limit should be checked and strictly avoided.
4. In India, sugar is produced by using techniques not used elsewhere in the world. The characteristics of the molasses produced in India therefore are different in nature and the foreign technology cannot be directly adopted for effluent treatment in distilleries. The sugar industries should have an appropriate ETP (effluent treatment plant) to treat its effluent before discharging to a surface water source, such as, a drain, a stream, or river.
5. With particular reference to the area of concern, the DO was observed to be nil and BOD values observed to be high in the whole stretch (from Simbhaoli to Puth village) of unlined drain and canal-escape indicating organic pollution and thereby rendering the water unsuitable with creation of anoxic condition adverse to the survival of aquatic life. Further high concentration of iron (Fe) in the upstream section of unlined drain at Simbhaoli exceeds maximum limit for disposal of industrial effluent on inland surface water. The concentration of Fe, Mn, Ni, Cr, and Cd (in the river Ganga at Brijghat and Puth village and in groundwater in adjoining villages) exceeds the maximum limit for drinking purpose making Ganga water and groundwater in adjoining villages unfit for drinking. Very high bacteriological pollution in the unlined drain and even in river Ganga and in groundwater in adjoining villages, have been found. This type of pollution further aggravate the chances of various water borne diseases, such as, jaundice, typhoid, cholera, etc.
6. Presence of heavy metal, such as, lead (Pb), copper (Cu), zinc (Zn), iron (Fe), chromium (Cr), cadmium (Cd), manganese (Mn), and nickel (Ni) have been found during both spot surveys (preliminary survey and first joint survey) in the effluent flowing through the unlined

drain from Simbhaoli to Siyana and canal-escape from Siyana to Puth at all locations. Lead (Pb) was found above maximum permissible limit (about 1.5 times the maximum permissible limit) prescribed for disposal of industrial effluent on inland surface water, at all locations during the first joint survey, however, it was found below detection limit at all locations during the preliminary survey. The concentration of iron (Fe) was found exceeding the limit (about 2 times the maximum permissible limit of 3000 µg/l) at seven locations from Simbhaoli to Puth during the preliminary survey, while it was found (during first joint survey) exceeding the permissible limit at the distillery discharge point with its concentration being below the maximum limit at all other locations.

7. In the groundwater of the villages (Nawada, Brahmgarhi, Baksar, Jamalpur, Jakhera Rahmatpur) close to unlined drain from Simbhaoli to Siyana, the concentration of iron (Fe) was found to exceed the maximum permissible limit for drinking water, while groundwater of village Dehrakutti, Sehal, Bahadurgarh, Alamnagar and Puth close to canal-escape from Siyana to Puth, was found to have the concentration of iron (Fe) exceeding the limit (2-4 times the maximum permissible limit of 1000 µg/l). The presence of copper (Cu), zinc (Zn), manganese (Mn), and lead (Pb) were also found in the groundwater of the area of the concern during the first joint survey. During the preliminary survey, concentration of Fe, Mn, Ni, Cr, and Cd were found exceeding the respective maximum permissible limits in the groundwater of villages Baksar and Alamnagar situated upstream of Siyana.
8. In the river Ganga at Garhmukteshwar, the concentration of nickel (Ni) and lead (Pb) were found to be more than maximum permissible limit for drinking water, while concentration of (Ni), lead (Pb) cadmium (Cd) was found to exceed the permissible limit at Brijghat and Puth village.
9. Vacuum distillation technique can be used by a sugar/distillery industry to remove the suspended solids, BOD, and COD, heavy metals and mineral compound.
10. For waste and wastewater treatment, sugar/distillery industry can adopt, with technology upgradation using R&D efforts, the anaerobic biological treatment of spent wash with methane (biogas) generation employing appropriate technologies, such as, diphasic fixed film anaerobic filter system, upflow anaerobic sludge blanket (UASB) process, and anaerobic fluidised and expanded bed reactors. Other options are activated sludge process, extended aeration, and aerobic lagoon.

11. The unlined drain from Simbhaoli to Siyana, and that of canal-escape from Siyana to Puth was observed throughout anerobic with foul smell creating unhygienic condition. The unlined drains need to be widened and lined (it is worth mentioning here that it mainly carries the discharge from Simbhaoli sugar mill and distillery unit). Its periodic cleaning with ample flushing water must be insured along with possible provision of its aeration.
12. A detailed scientific study is required to be taken up to technically address the issue of contamination of groundwater considering analysis of surface water and groundwater interaction supported by water and bed-sediment analysis in the area of concern, with extensive field and laboratory investigations addressing the problems in space and time.

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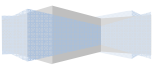
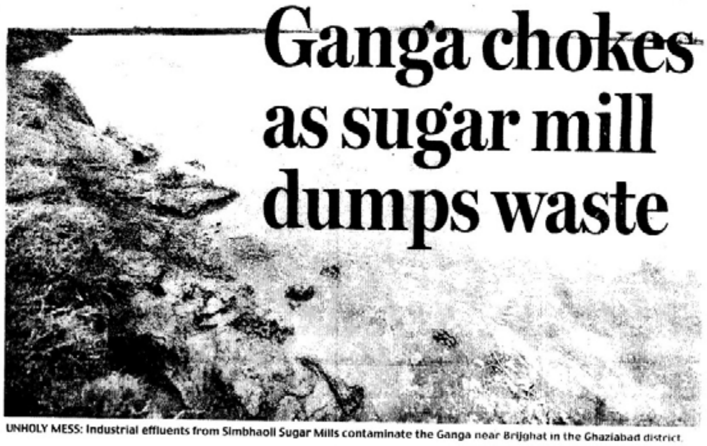


Annexure-1

20 NEWS — Mail Today, New Delhi, Monday, July 19, 2010

Ganga chokes as sugar mill dumps waste

By **Akash Vashishtha**
in Garhmukteswar (Ghaziabad)



UNHOLY MESS: Industrial effluents from Simbhaoli Sugar Mills contaminate the Ganga near Brijghat in the Ghaziabad district.

BLACK, stinking and toxic — that's the way villagers of Puth describe the Ganga's water.

And all thanks to the Simbhaoli Sugar Mills, which has been gushing its poisonous industrial waste directly into the river.

In one of the worst cases of river pollution, the sugar giant is discharging its effluents through a drain that opens into the mainstream river at an isolated point at Puth village, about 30 km from Garhmukteswar (Brijghat) in the Ghaziabad district.

The 30-km drain originates at the mill and passes through Buxar, Jamalpur, Vet, Jakhera, Nebcholi, Syana, Longa, Sehal, Bahadurgarh, Alampur, Paswada and Nawada villages, before ending at the river near Puth.

Villagers reveal the drain has been flowing for several years.

"The colour of the drain water is black and it stinks round the year. Several large fish died last week. And four of our buffaloes were killed after they drank its water recently," Puth villager Raju said.

He added: "Our tubewells and handpumps also give out black stinking water. Five children died recently after drinking the water. Jaundice is a common problem too."

Raju said the villagers had complained many times to the SDM but no action had been taken. They had even gone on a dharna at the Simbhaoli mills.

'Pollution will destroy aquatic life'

When asked about the villagers' complaints, Simbhaoli mills GM I.S. Bhatia said: "We adhere to the pollution norms. There has to be a place where the sewer waste will go. The drain waste is discharged by our distillery unit and not by the sugar mills."

The distillery plant's GM R.K. Singh added: "We obtain NOCs from the Pollution Control Board every year and are allowed to discharge effluents within the permissible limit. We try our best to utilise the waste. We extract methane, plus an RO plant is installed to treat the water. The waste is used for producing bio-compost, which is then sold."

Contrary to Singh's claim, UP Pollution Control Board regional manager T.U. Khan said notice had been sent to Simbhaoli two months ago and it had been asked to recycle the waste.

"The board has asked them to break the concrete pipeline through which they discharge effluents into the drain," Khan added.

When asked about the black-coloured drain water flowing into the Ganga, Khan said, "It is not really black. It just gives a reflection of the colour."

Ghaziabad DM Hridesh Kumar said he had asked the SDM to inquire into the issue and report within two days.

The drain is also said to be carrying industrial effluents from Gopaljee milk factory at Syana (Bulandshahr).

Ramji Srivastava, a senior scientist at the Central Pollution Control Board (CPCB) said: "This is a serious issue and threatens the rich aquatic life in the river."

And indeed so. The World Wildlife Fund (WWF) has declared the Ganga's 165-km stretch from Bijnore to Narora as one of the best in the country with respect to aquatic biodiversity.

The stretch was the first to be declared a Ramsar Site in 2005, having rich species of freshwater dolphins (Ganges dolphins) and crocodiles, which are listed as endangered under the Wildlife Protection Act 1972.

The WWF has also recorded over 12 species of freshwater turtles, two species of crocodiles, 82 species of fish and over hundred species of wetland birds in this Upper Ganga River zone.

"We have been doing our best to protect the dolphins and other endangered species in the Upper Ganga River stretch. But pollution of this kind will destroy the aquatic habitat," Dr Sandeep Behera, senior coordinator, Freshwater and Wetlands Programme of WWF India, said.

No action has been taken by authorities

"We have raised our concerns several times with the central and state governments but they have taken no steps to check the hazard. We particularly mentioned our concern regarding the effluent discharge at Puth," Behera said, adding that "they don't seem interested in tackling the problem".

The government had constituted the National Ganga River Basin Authority last February — headed by the Prime Minister — to clean up the Ganga, but it seems to have been ineffective upto now.

One of its members said: "Nothing has been done by the authority in the last one year. The government declared the dolphin as the national aquatic animal but no steps are being taken to protect it."

akash.vashishtha@mailtoday.in

THE DYING RIVER

A Simbhaoli Sugar Mills drain carrying poisonous industrial waste has been releasing its contents into the Ganga at Puth village for years. This is destroying the aquatic life in the river, as well as affecting the nearby villages

Black water from the drain.

DANGEROUS WASTE
Puth villagers say the colour of the drain's water is black and it stinks round the year. Even the tubewells and handpumps give out the foul-smelling water

DEATHS CAUSED
- Five children died after drinking contaminated water
- Four buffaloes were killed
- Jaundice is common in the villages
- Many large fish are dying

RICH AQUATIC LIFE
The World Wildlife Fund has declared the Ganga's 165-km stretch from Bijnore to Narora as one of the best with respect to aquatic biodiversity. It has varied species of dolphins, turtles, crocodiles and fish and over hundred species of wetland birds. All these are being affected by the pollution

DIFFERENT VERSIONS
Simbhaoli distillery plant's GM R.K. Singh
"We obtain NOCs from the Pollution Control Board every year and are allowed to discharge effluents within the permissible limit. We try our best to utilise the waste"
UP Pollution Control Board regional manager T.U. Khan
"We sent them notice two months ago and asked them to recycle the waste. We told them to break the concrete pipeline through which they discharge the waste"

No agreement on national judicial service says Moily

A LACK of consensus among various high courts on setting up an all-India judicial service may mean that the Centre's ambitious plan is unlikely to come to fruition anytime soon.

Law minister M. Veerappa Moily on Sunday chaired a meeting of six states on implementing the recommendations of the 13th finance commission.

"The issue of an all-India judicial service came up for discussions. But there was no unanimity. The states and their respective high courts have their own views. The debate will continue. We do not wish to impose ourselves."

Moily said his ministry's department of justice will prepare a consultation paper on the issue.

The parliamentary standing committee on personnel, public grievances, law and justice had in 2006 recommended the creation of a national-level judicial service, on the lines of the All-India Civil Services, for appointing district-level judges.

The committee had asked the law ministry to expedite steps to set up the service.

Almost all states have their own state-level judicial services, but such a mechanism lacks on the national level.

On the issue of states not being keen on setting up Gram Nyayalayas, Moily said the Centre was willing to release more funds. "States say they do not have sufficient funds. We are ready to raise the finances," he said.

On another note, he said besides the Rs 5,000 crore recommended by the finance commission and approved by the Centre, an additional Rs 8,000 crore would be provided on a one-time basis for improving court infrastructure across the nation.

PTI

Suicide attacks in Baghdad kill 48 militiamen fighting Qaeda

TWIN suicide bombings killed 48 people on Sunday, including dozens from a government-backed, anti-al-Qaeda militia lining up to collect paychecks near a military base southwest of Baghdad, Iraqi officials said.

The bombings were the deadliest in a series of attacks across Iraq on Sunday that were aimed at the Sons of Iraq — Sunni groups also known as Awakening Councils — that work with government forces to fight the al-Qaeda in the country.

The attacks highlighted the stiff challenges the country faces as the US scales back its forces in Iraq, leaving their Iraqi counterparts in charge of security.

The first attack in the morning, the worst against Iraq's security forces in months, killed at least 45 people and wounded more than 40.

It occurred at a checkpoint near a military base where the Awakening Council members had lined up to collect paychecks in the mostly Sunni district of Radwaniya, southwest of Baghdad.

A man grieves over the dead.

"There were more than 150 people sitting on the ground when the explosion took place. I ran, thinking I was a dead man," said Uday Khamis, 24, who was sitting outside the Mahmoudiyah hospital where many of the wounded were taken.

His left hand was bandaged and his clothes were stained with blood. "There were more dead than wounded," he added.

At least a dozen men, dressed in military-style uniforms, were seen lying in pools of blood in front of a blasted wall shortly after the blast.

There were conflicting reports as to how many of the dead were Iraqi soldiers and whether any of the civilian accountants handing out money were among them.

A military official at the base said the explosion was the work of one suicide bomber wearing an explosives vest.

All officials spoke on condition of anonymity.

Some of the [illegible] complained about the lack of protection from the Iraqi [illegible] for the men lined up to receive their paychecks.

AP

Annexure-2

REMINDER

निदेशक कार्यालय
DIRECTOR'S OFFICE
डायरी सं./Dy. No. 683
दिनांक/Date 27/4/11

F.No.1/4(3)/2010-WQAA(Vol.II) /2008-10
Government of India
Ministry of Water Resources
(Water Quality Division)
***

1103, Ansal Bhawan
Kasturba Gandhi Marg
New Delhi – 110 001
Dated: April 18, 2011
19th April

Subject: Paper cutting from 'Mail Today' dated July 19, 2010 under the heading "Ganga Chokes as Sugar Mills Dumps Waste' - reg.

Please refer to this Ministry's letter of even number dated 27-07-2010 (photo copy enclosed) on the subject mentioned above. The reply in the matter has not been received till date in this Ministry. As such, it is requested to expedite the same without further delay.

Encl: as above.

Yours faithfully,

18/4
(Dr. P.K. Mehrotra)
Director(WQ)

To

1. Chairman, CWC, Sewa Bhawan, R.K. Puram, New Delhi.
2. Chairman, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi – 110 032.
3. Director, NIH, Jal Vigyan Bhawan, Roorkee, Uttranchal.

Most Urgent

Dr. V. K. Choubey SCF for ms

Raj Deva Singh
27/4/11

Sent to Dr. V.K. Choubey on 3rd May 2010

Tel:(011)2335 2130/Fax:(011)2335 2129 | email: wqcell-mowr@nic.in

REMINDER-II

F.No.1/4(3)/2010-WQAA(Vol.II)/2980 - 82
Government of India
Ministry of Water Resources
(Water Quality Division)
***

1103, Ansal Bhawan
Kasturba Gandhi Marg
New Delhi – 110 001
Dated: April 25, 2011

Subject: **Paper cutting from 'Mail Today' dated July 19, 2010 under the heading "Ganga Chokes as Sugar Mills Dumps Waste' - reg.**

Please refer to this Ministry's letter of even number dated 27-07-2010 and reminder dated 18-04-2011 on the subject mentioned above. The reply in the matter has not been received till date in this Ministry. As such, it is requested to expedite the same without further delay.

Yours faithfully,

(Dr. P.K. Mehrotra)
Director(WQ)

To

1. Chairman, CWC, Sewa Bhawan, R.K. Puram, New Delhi.
2. Chairman, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi – 110 032.
3. Director, NIH, Jal Vigyan Bhawan, Roorkee, Uttranchal.

Tel:(011)2335 2130/Fax:(011)2335 2129 | email: wqcell-mowr@nic.in

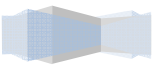
Annexure-3

Comments/observations of NIH on the News Article "Ganga Chokes as Sugar mill dumps waste" published by "Mail Today" on July 19, 2010

Mail today published the above mentioned article which covers the views of villagers, General Manager of the Mills, regional manager of UP state Pollution Control Board, Ghaziabad local administration, Scientist of CPCB and WWF etc. The comments/observations of NIH are as follows:

1. Villagers of Puth village said that Simbhaoli Mills has been gushing its poisonous industrial waste directly into the river. As a result the Ganga's water, at Puth village, about 30 km from Garhmukteswar (Brijghat) in Ghaziabad district, becomes black, stinking and toxic. It appears that the mills are discharging the waste through concrete pipe line into drain. A villager informed that several large fish died and four of their buffaloes wee died after drinking the polluted water recently. Villagers also informed that their tube wells and hand pumps give out black stinking water and five children died recently after drinking the water. In the village jaundice is a common problem.
2. Simbhaoli mills GM said that the mills adhere to the pollution norms and the drain waste is discharged by the distillery unit and not by the sugar mils. The distillery plant's GM said that NOCs are obtained from the Pollution Control Board every year and they are discharging effluents within permissible limit. He also informed that the wastes are being utilized and the methane is extracted & RO plant is installed to treat the water. The waste is used for producing bio-compost.
3. Regional Manager of UP state pollution control board said that notice had been sent to Simbhaoli mills two months back and it had been asked to recycle the waste. The board also asked them to break the concrete pipeline through which the effluents are discharged into the drain. About the black coloured drain water flowing into the Ganga, he said that it is not really black and it just gives a reflection of the colour.
4. Ghaziabad DM said that he asked SDM to enquire the issue and report to him. It was also informed that the drain is also carrying industrial effluents from Gopalji milk factory at Sayna (Bulandshahr)

5. A senior scientist of CPCB said that it is a serious issue and threatens the rich aquatic life in the river.
6. WWF has declared the Ganga's 165-km stretch from Bijnore to Narora as one of the best in the country with respect to aquatic biodiversity. Senior Coordinator, Freshwater and Wetlands Programme of WWF India, said that the pollution of this kind will destroy the aquatic habitat.
7. From the above observations, it appears to be the serious water quality problem in the specified stretch of Ganga River because of discharge of effluents by the sugar mills, distilleries and other industries.
8. As reported by the villager, the water of tube wells and hand pumps located in the area are also polluted and not fit for drinking and other domestic uses. Thus the possibility of discharging the untreated effluents by the industries directly to the ground water wells cannot be ruled out. Another reason could be movement of the pollutants during the river-aquifer interaction. However, a scientific study is required to establish the facts about the movement of the pollutants in the aquifer system.
9. An expert group may be formed to look into the various aspects of ground water pollution and Ganga water pollution in the specified area. A scientific study may be taken up by an independent technical or academic institution in order to address the issue of contamination of the river and aquifer considering their interaction. In this regard, water quality monitoring and analysis are required collecting the samples from strategic places in different seasons and analyzing those samples in the laboratories.

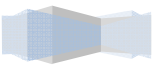


Annexure -4

Comments/suggestions on the topic from CWC New Delhi

The recycling of water for reducing wastewater volume.

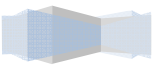
1. Recycling of condensate and cooling water helps in minimizing the amount of water joining the wastewater stream. This also helps in conservation of water, which has become a scare resource for several sugar mills
2. Sugar mill wastewater contains large quantities of biodegradable organic matter and therefore biological treatment processes are most commonly used for its treatment. In general, anaerobic biological processes (oxidation ponds and bio-methanation) have several advantages over aerobic processes (aerated lagoons, activated sludge process). Anaerobic process decomposes the organic compound in an atmosphere free of oxygen and consequently require significantly less energy as compared to aerobic process. As compared to aerobic processes, anaerobic processes are easier to control and operate, produce a lower quantity of sludge and their annualized costs are lower. In view of the above, it is preferable to treat sugar mill wastewaters by anaerobic processes rather than aerobic processes.
3. Improve the quality of wastewater discharge to the river Ganga.
4. Increase the efficiency of the treatment lagoons.
5. Generate a trend to “zero discharge.”



Comments/suggestions on the topic from CGWB, NR, Lucknow

It is proposed to take up scientific study to look into various aspects of Pollution caused by Simbhaoli Mills and Distilleries, Ghaziabad (UP) as suggested by Ministry of water Resources on the following lines :-

- Collection of baseline information regarding possibilities of pollution of surface and ground water
    - Type of process used by the industry and possible contaminants being discharge as effluent
    - Operational Status of Effluent treatment plant by the industry --- UPPCB
    - How the Effluent is being discharged whether directly on to surface or by any other means
    - Status of monitoring of ETP by UPPCB
    - Any report by CPCB in this regard
    - Ground water scenario around the Simbaoli industries
- Water sample collection to determine nature and extent of the water pollution
    - Collection of water samples from shallow Hand pumps and shallow tube wells
    - Collection of water samples from river Ganga in case effluent reached the river
    - If so, collection of water samples throughout the stretch of Ganga river upto which pollution might reach
    - Collection of Ground water samples from nearby Hand pumps of river Ganga
    - Information to be obtained from local farmers about any pollution being observed from ground water
- Analysis of Surface and Ground water samples for general and specific parameters
- Report preparation



Comments/suggestions (in the form of data) on the topic from UPSPCB, Lucknow

REGIONAL OFFICE
U.P. POLLUTION CONTROL BOARD, GHAZIABAD.

Analysis Report of River Ganga (October 2010 to March 2011)

S.no	Name of Sampling point	Date	Colour	Odour	pH	D.O. mg/l	BOD mg/l	COD mg/l	Total Coliform
1	Ganga River U/s Garhmuketshwar (Befor meeting Nala)	09.10.10	0 to 5 Hazen	Odourless	7.4	7.1	4.7	18	2100
	Ganga River U/s Garhmuketshwar (After meeting Nala)	09.10.10	0 to 5 Hazen	Odourless	7.3	7.2	4.9	20	2300
	Ganga River D/s Garhmuketshwar at Brij Ghat	09.10.10	0 to 5 Hazen	Odourless	7.3	7.2	5.0	----	2400
2	Ganga River U/s Garhmuketshwar (Befor meeting Nala)	17.11.10	0 to 5 Hazen	Odourless	7.5	8.7	3.3	10	2100
	Ganga River U/s Garhmuketshwar (After meeting Nala)	17.11.10	0 to 5 Hazen	Odourless	7.4	8.6	3.8	11.2	2300
	Ganga River D/s Garhmuketshwar at Brij Ghat	16.11.10	0 to 5 Hazen	Odourless	7.6	8.5	4.0	----	2300
3	Ganga River U/s Garhmuketshwar (Befor meeting Nala)	27.12.10	0 to 5 Hazen	Odourless	7.3	8.9	3.5	9.6	2100
	Ganga River U/s Garhmuketshwar (After meeting Nala)	27.12.10	0 to 5 Hazen	Odourless	7.4	8.7	4.0	10.8	2300
	Ganga River D/s Garhmuketshwar at Brij Ghat	21.12.10	0 to 5 Hazen	Odourless	7.5	8.6	4.2	----	2400
4	Ganga River U/s Garhmuktesh war. (Before meeting Garh Nala).	15.01.11	5 Hazen	Odorless	7.3	9.5	2.0	10.0	3000
	Ganga River D/s Garhmuktesh war at Brij Ghat.	15.01.11	5 Hazen	Odorless	7.5	9.0	2.5	12.0	4600
	Ganga River U/s Garhmuktesh war. (Before meeting Garh Nala).	18.01.11	5 Hazen	Odorless	7.3	9.3	3.0	8.0	2800
	Ganga River D/s Garhmuktesh war at Brij Ghat.	18.01.11	5 Hazen	Odorless	7.4	9.0	3.5	10.0	4300

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	Ganga River U/s Garhmukteshwar. (Before meeting Garh Nala).	21.01.11	0 to 5 Hazen	Odorless	7.5	9.4	2.8	7.5	2500
	Ganga River D/s Garhmukteshwar at Brij Ghat.	21.01.11	0 to 5 Hazen	Odorless	7.3	9.0	3.8	9.8	4100
	Ganga River U/s Garhmukteshwar. (Before meeting Garh Nala).	28.01.11	0 to 5 Hazen	Odorless	7.5	9.5	2.7	7.5	2300
	Ganga River D/s Garhmukteshwar at Brij Ghat.	28.01.11	0 to 5 Hazen	Odorless	7.5	9.2	3.6	10.0	3900
5	Ganga River U/s Garhmuketshwar (Befor meeting Nala)	02.02.11	0 to 5 Hazen	Odourless	7.5	9.0	2.8	10.0	2300
	Ganga River U/s Garhmuketshwar (After meeting Nala)	02.02.11	0 to 5 Hazen	Odourless	7.3	8.9	3.0	12.0	2800
	Ganga River D/s Garhmuketshwar at Brij Ghat	02.02.11	0 to 5 Hazen	Odourless	7.5	8.7	3.3	12.0	2300
6	Ganga River U/s Garhmuketshwar (Befor meeting Nala)	14.03.11	0 to 5 Hazen	Odourless	7.5	9.5	3.0	9.0	2400
	Ganga River U/s Garhmuketshwar (After meeting Nala)	14.03.11	0 to 5 Hazen	Odourless	7.3	9.3	3.2	11.0	2600
	Ganga River D/s Garhmuketshwar at Brij Ghat	01.03.11	0 to 5 Hazen	Odourless	7.5	9.4	3.4	11.0	2600

M.A. S.A. A.S.O.

REGIONAL OFFICER.

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Annexure-5

Designated best use classification of surface water proposed by NRCD

Designated Best Use	Quality Class	Primary Water Quality Criteria
Drinking water source without conventional treatment but after disinfaction	A	pH: 6.5 to 8.5 Dissolved Oxygen: ≥ 6 mg/l Biochemical Oxygen Demand: ≤ 2 mg/l or Total Coliform: ≤ 50MPN/100 ml)
Outdoor bathing (organized)	B	pH: 6.5 to 8.5 Dissolved Oxygen: ≥ 5 mg/l Biochemical Oxygen Demand: ≤ 3 mg/l or Total Coliform: ≤ 500MPN/100 ml)
Drinking water source with conventional treatment followed by disinfection	C	pH: 6.5 to 8.5 Dissolved Oxygen: ≥ 4 mg/l Biochemical Oxygen Demand: ≤ 3 mg/l or Total Coliform: ≤ 5000MPN/100 ml)
Propagation of wildlife and fisheries	D	pH: 6.5 to 8.5 Dissolved Oxygen: ≥ 4 mg/l Free ammonia (as N): ≤ 1.2 mg/l
Irrigation, industrial cooling and controlled waste disposal	E	pH: 6.0 to 8.5 Electrical conductivity: ≤ 2250 µ mhos/cm, Sodium Absorption Ratio: ≤ 26 Boron: ≤ 2 mg/l

NRCD: National River Conservation Directorate, Ministry of Environment and Forest, Government of India

Annexure-6

Drinking water specifications (IS 10500:1991)

S.No.	Characteristics	Requirement (Desirable Limit)	Permissible Limit in the Absence of Alternate Source
Essential Characteristics			
1.	Colour, Hazen units, Max	5	25
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity, NTU, Max	5	10
5.	pH value	6.5 to 8.5	No relaxation
6.	Total hardness ($CaCO_3$), mg/l, Max	300	600
7.	Iron, mg/l, Max	0.3	1.0
8.	Chlorides, mg/l, Max	250	1000
9.	Residual chlorine, mg/l, Min	0.2	-
10.	Fluoride, mg/l, Max	1.0	1.5
Desirable Characteristics			
11.	Dissolved solids, mg/l, Max	500	2000
12.	Calcium (as Ca), mg/l, Max	75	200
13.	Magnesium (as Mg), mg/l, Max	30	100
14.	Copper (as Cu), mg/l, Max	0.05	1.5
15.	Manganese (as Mn), mg/l, Max	0.1	0.3
16.	Sulphate (as SO_4), mg/l, Max	200	400
17.	Nitrate (as NO_3), mg/l, Max	45	No relaxation
18.	Phenolic compounds (as C_6H_5OH), mg/l, Max	0.001	0.002
19.	Mercury (as Hg), mg/l, Max	0.001	No relaxation
20.	Cadmium (as Cd), mg/l, Max	0.01	No relaxation
21.	Selenium (as Se), mg/l, Max	0.01	No relaxation

22.	Arsenic (as As), mg/l, Max	0.01	No relaxation
23.	Cyanide (as CN), mg/l, Max	0.05	No relaxation
24.	Lead (as Pb), mg/l, Max	0.05	No relaxation
25.	Zinc (as Zn), mg/L, Max	5	15
26.	Anionic detergents (as MBAS), mg/l, Max	0.2	1.0
27.	Chromium (as Cr^{6+}), mg/l, Max	0.05	No relaxation
28.	Mineral oil, mg/l, Max	0.01	0.03
30.	Pesticides, mg/l, Max	Absent	0.001
30.	Alkalinity, mg/l, Max	200	600
31.	Aluminium (as Al), mg/l, Max	0.03	0.2
32.	Boron, mg/l, Max	1	5

Source: Bureau of Indian Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi

Annexure-7

Industrial Effluent Standards* (CPCB, 1998)

S. No.	Parameter	Standards			
		Inland Surface	Public sewers	Land for irrigation	Marine /coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	See 6 of Annexure-1	-	See 6 of Annexure-1	See 6 of Annexure-1
2.	Suspended Solids (mg/L), max	100	600	200	a. For process waste water. b. For cooling water effluent 10 percent above total suspended matter in influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			a. Floatable solids, max. 3mm. b. Settle able solids, max. 856 microns
4.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	Shall not exceed 5°C above the receiving water temperature	-	-	Shall not exceed 5°C above the receiving water temperature
6.	Oil and grease mg/l, max.	10	20	10	20
7.	Total residual chlorine, mg/l max.	1.0	-	-	1.0
8.	Ammonical nitrogen (as N), mg/L max.	50	50	-	50
9.	Total Kjeldahl	100	-	-	100

	Nitrogen (TKN) (as N), mg/l max.				
10.	Free ammonia (as NH_3), mg/L, max	5.0	-	-	5.0
11.	Biochemical Oxygen Demand (3 days at 27°C), mg/l, max.	30	350	100	100
12.	Chemical Oxygen Demand, mg/l, max.	250	-	-	250
13.	Arsenic (as As), mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (as Hg), mg/l, max.	0.01	0.01	-	0.01
15.	Lead (as Pb), mg/l, max.	0.1	1.0	-	2.0
16.	Cadmium (as Cd) mg/l, max	2.0	1.0	-	2.0
17.	Hexavalent Chromium (as Cr^{+6}) mg/l, max	0.1	2.0	-	1.0
18.	Total Chromium (as Cr) mg/l, max.	2.0	2.0	-	2.0
19.	Copper (as Cu) mg/l, max.	3.0	3.0	-	3.0
20.	Zinc (as Zn) mg/l, max.	5.0	15.0	-	15.0
21.	Selenium (as Se) mg/l, max.	0.05	0.05	-	0.05
22.	Nickel (as Ni) mg/l, max.	3.0	3.0	-	5.0
23.	Cyanide (as CN)	0.2	2.0	0.2	0.2

	mg/l, max.				
24.	Fluoride (as F) mg/l, max.	2.0	15.0	-	15.0
25.	Dissolved phosphates (as P) mg/l, max.	5.0	-	-	-
26.	Sulphide (as S) mg/l, max.	2.0	-	-	5.0
27.	Phenolic compounds (as C_6H_5OH) mg/l, max.	1.0	5.0	-	5.0
28.	Radioactive materials: Alpha emitters micro curie mg/l, max.	10^{-7}	10^{-7}	10^{-8}	10^{-7}
	Beta emitters micro curie, mg/l, max	10^{-6}	10^{-6}	10^{-7}	10^{-6}
29.	Bio-assay	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent
30.	Manganese (as Mn) mg/l, max.	2.0	2.0	-	2.0
31.	Iron (as Fe) mg/l, max.	3.0	3.0	-	3.0
32.	Vanadium (as V) mg/l, max.	0.2	0.2	-	0.2
33.	Nitrate nitrogen(as N) mg/l, max.	10.0	-	-	20

Source: Central Pollution Control Board, Parivesh Bhawan, Arjun Nagar, Delhi

Note:

1. "6 of Annexure 1" states "All efforts should be made to remove colour and unpleasant odour as far as practicable."* These standards shall be applicable for industries, operations or processes other than those industries, operations or processes for which standards have been specified in Schedule of the Environment Protection Rules, 1989.

Annexure 8.1: Physico-chemical data of samples - Preliminary survey on 15 June 2011

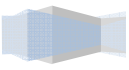
Surface Water

S.No.	Location	Source	Depth	pH	EC	TDS	Hardness	Alkalinity	Cl
			feet		µS/cm	mg/l	mg/l	mg/l	mg/l
S-1	Simbhaoli Distillery Drain inside Plant	SW		6.80	450	288	220	120	32
S-2	Unlined drain U/s of Distillery Discharge point	SW		7.40	850	544	324	64	128
S-3	Distillery Discharge drain	SW		6.00	880	563	460	156	120
S-4	Unlined drain D/s of Distillery Discharge point	SW		6.70	1420	909	400	220	84
S-5	Unlined drain D/s of Distillery Discharge point at bridge	SW		7.40	2070	1325	400	160	280
S-6	Unlined drain U/s of Sugra Mill Discharge point at Baksar	SW		7.70	3040	1946	312	640	320
S-7	Sugar Mill discharge point	SW		6.50	780	499	120	240	84
S-8	Unlined drain D/s of Sugar Mill discharge point at Baksar	SW		7.00	1400	896	400	112	236
S-9	Unlined drain U/s of Canal Escape at Siyana	SW		8.30	6330	**4051**	260	1080	996
S-10	Gopaljee Milk factory Discharge point	SW		7.00	1520	973	660	720	96
S-11	D/s of Canal Escape after Milk factory discharge point	SW		8.20	5310	**3398**	248	940	548
S-12	Canal Escape at Alamnagar			7.80	1400	896	236	220	120
	Tolerance limit for disposal of industrial			5.5-9.0		2100			1000
	effluent into inland surface water as per CPCB (1998)								
S-13	River Ganga at Brijghat	SW		7.30	262	167	168	70	1.0
S-14	River Ganga at Puth village	SW		7.20	368	235	256	80	1.0
	Permissible limit for driniking purpose			6.5-8.5		2000	600	600	1000
	as per IS:10500 (1991)								

Ground Water

S.No.	Location	Source	Depth	pH	EC	TDS	Hardness	Alkalinity	Cl
			feet		µS/cm	mg/l	mg/l	mg/l	mg/l
G-1	Ground Water at Village Buxer	HP	110	6.90	930	595	388	134	140
G-2	Ground Water at Village Alamnagar	HP	110	7.10	632	404	392	196	1
	Permissible limit for driniking purpose			6.5-8.5		2000	600	600	1000
	as per IS:10500 (1991)								

ND = Not Detected
SW = Surface Water
HP = Handpump



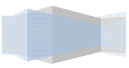
Annexure 8.1 Continued

Surface Water

S.No.	SO_4	Na	K	Ca	Mg	DO	BOD	COD	
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
S-1	170	73	27	56	19	ND	**53**	122	
S-2	65	19	109	63	41	ND	**63**	224	
S-3	40	38	85	50	82	0.70	**93**	237	
S-4	60	35	146	50	67	ND	**73**	134	
S-5	155	74	295	88	44	ND	**143**	243	
S-6	430	35	710	35	54	ND	**78**	96	
S-7	105	29	36	32	10	ND	**103**	198	
S-8	110	78	315	164	57	ND	**93**	237	
S-9	150	33	190	80	15	ND	**93**	192	
S-10	88	170	160	96	102	ND	**183**	237	
S-11	110	33	40	71	18	ND	**113**	160	
S-12	40	33	190	32	38	ND	**93**	**256**	
	1,000						30	250	
S-13	14.0	4.6	2.7	22	12	7.5	ND	70	
S-14	28	5.6	22	28	14	6.0	ND	58	
	400			200	100	6	2		

Ground Water

S.No.	SO_4	Na	K	Ca	Mg	BOD	COD		
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l		
G-1	102	30	35	61	55	2.5	6.4		
G-2	34	14	5.0	48	36	ND	13		
	400			200	100				



Annexure 8.2: Trace element data of samples - Preliminary survey on 15-6-2011

Surface Water

S.No.	Location	Source	Depth	Fe	Mn	Cu	Ni	Cr	Pb	Cd	Zn
			feet	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
S-1	Simbhaoli Distillery Drain inside Plant	SW		**18475**	1272	78	106	73	ND	24	450
S-2	Unlined drain U/s of Distillery Discharge point	SW		**4767**	438	44	139	62	ND	23	230
S-3	Distillery Discharge drain	SW		**6701**	668	153	33	43	ND	24	198
S-4	Unlined drain D/s of Distillery Discharge point	SW		**6307**	746	146	164	51	ND	25	353
S-5	Unlined drain D/s of Distillery Discharge point at bridge	SW		**7868**	489	98	83	56	ND	24	319
S-6	Unlined drain U/s of Sugra Mill Discharge point at Baksar	SW		2171	146	71	58	51	ND	18	606
S-7	Sugar Mill discharge point	SW		1342	330	45	28	45	ND	19	121
S-8	Unlined drain D/s of Sugar Mill discharge point at Baksar	SW		608	394	31	9	19	ND	21	124
S-9	Unlined drain U/s of Canal Escape at Siyana	SW		**7108**	509	73	176	65	ND	28	979
S-10	Gopaljee Milk factory Discharge point	SW		1285	325	59	80	41	ND	27	118
S-11	D/s of Canal Escape after Milk factory discharge point	SW		**5379**	**4064**	73	123	53	ND	27	236
S-12	Canal Escape at Alamnagar	SW		1772	180	43	36	24	ND	24	148
	Tolerance limit for disposal of industrial			3000	2000	3000	3000	100	100	2000	5000
	effluent on inland surface as per CPCB (1998)										
S-13	River Ganga at Brijghat	SW		**1477**	**604**	65	**82**	**60**	ND	**25**	230
S-14	River Ganga at Puth vilalge	SW		**1309**	5	42	**94**	**66**	ND	**23**	108
	Permissible limit for driniking purpose			1000	300	1500	20*	50	50	10	15000
	as per IS:10500 (1991)										
	*WHO (1996)										

Ground Water

S.No.	Location	Source	Depth	Fe	Mn	Cu	Ni	Cr	Pb	Cd	Zn
				µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
G-1	Ground Water at Village Buxer	HP	110	**5390**	**1954**	62	**64**	ND	ND	**28**	270
G-2	Ground Water at Village Alamnagar	HP	110	**5263**	191	44	**115**	**300**	ND	**26**	640
	Permissible limit for driniking purpose			1000	300	1500	20*	50	50	10	15000
	as per IS:10500 (1991)										
	*WHO (1996)										

ND = Not Detected
SW = Surface Water
HP = Handpump

Annexure 8.3: Bacteriological analysis data of samples : Preliminary survey on 15-6-2011

Surface Water

S.No.	Location	Source	Depth	Total Coliform	Feacal Coliform
			feet	per 100 ml	per 100 ml
S-1	Simbhaoli Distillery Drain inside Plant	SW		24,00,000	17000
S-2	Unlined drain U/s of Distillery Discharge point	SW		4000	ND
S-3	Distillery Discharge drain	SW		9000	ND
S-4	Unlined drain D/s of Distillery Discharge point	SW		15000	2000
S-5	Unlined drain D/s of Distillery Discharge point at bridge	SW		11,00,000	2000
S-6	Unlined drain U/s of Sugar Mill Discharge point at Baksar	SW		24,00,000	90000
S-7	Sugar Mill discharge point	SW		7,50,000	20000
S-8	Unlined drain D/s of Sugar Mill discharge point at Baksar	SW		24,00,000	8000
S-9	Unlined drain U/s of Canal Escape at Siyana	SW		28000	7000
S-10	Gopaljee Milk factory Discharge point	SW		9,30,000	50,000
S-11	D/s of Canal Escape after Milk factory discharge point	SW		24,00,000	14000
S-12	Canal Escape at Alamnagar			2100000	90,000
S-13	River Ganga at Brijghat	SW		9,30,000	50,000
S-14	River Ganga at Puth vilalge	SW		4300	1400
	Permissible limit for driniking purpose			10	Nil
	as per IS:10500 (1991)				

Ground Water

S.No.	Location	Source	Depth		
G-1	Ground Water at Village Buxer	HP	110	900	ND
G-2	Ground Water at Village Alamnagar	HP	110	2400,00	14,00
	Permissible limit for driniking purpose			10	Nil
	as per IS:10500 (1991)				

ND = Not Detected
SW = Surface Water
HP = Handpump

Annexure- 9.1: Physico-chemical analysis of surface water samples: First joint survey on 28-29 June 2011

S.No.	Location	Source	pH	EC µS/cm	TDS mg/l	Hardness mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l
Canal/Escape/Drain										
S-1	Ganga Canal at Simbhaoli	SW	7.08	151	97	71	0	88	11	27
S-2	Unlined drain U/s of Distillery Discharge point	SW	6.68	121	77	47	0	59	11	5.5
S-3	Distillery Discharge drain	SW	5.72	1002	641	362	0	244	110	131
S-4	Unlined drain D/s of Distillery Discharge point	SW	5.68	1326	849	422	0	254	125	150
S-5	Unlined drain U/s of Sugra Mill Discharge point	SW	6.82	590	378	279	0	249	43	156
S-6	Sugar Mill discharge point	SW	6.99	675	432	306	0	351	54	134
S-7	Unlined drain D/s of Sugar Mill discharge point	SW	6.88	673	431	274	0	293	42	154
S-8	Unlined drain U/s of Canal Escape at Siyana	SW	6.98	544	348	215	0	165	41	100
S-9	Gopaljee Milk factory Discharge point	SW	7.99	950	608	391	0	210	55	99
S-10	D/s of Canal Escape after Milk factory discharge point	SW	7.88	695	445	238	0	187	38	123
S-11	Garh Nalla at Garhmukteshwar	SW	7.02	249	159	114	0	112	13	42
S-12	Canal Escape at Puth village	SW	7.22	412	264	165	0	195	35	114
S 13	Mixing point of Escape with River Ganga at Puth village	SW	7.48	166	106	102	0	102	12	36
	Maximum permissible limit for industrial effluent discharges into inland surface water as per CPCB (1998)		5.5-9.0		2100				1000	1,000
River Ganga										
S-14	River Ganga U/s of Garh Nalla at Garhmukteshwar	SW	7.48	130	83	74	0	98	9.0	36
S-15	River Ganga at Brijghat	SW	7.42	159	102	80	0	83	11	33
S-16	River Ganga U/s of Canal Escape at Puth village	SW	7.59	153	98	82	0	88	11	47
S-17	River Ganga at Puth vilalge	SW	7.51	158	101	84	0	98	13	40
	Permissible limit for driniking purpose as per IS:10500 (1991)		6.5-8.5		2000	600		600	1000	400

SW = Surface Water

Annexure 9.1: Continued

S.No.	NO_3-N mg/l	NO_2-N mg/l	NH_3-N mg/l	F mg/l	PO_4 mg/l	SiO_2 mg/l	B mg/l	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	DO mg/l	BOD mg/l	COD mg/l
S-1	9.9	0.00	0.10	0.10	0.08	2.68	0.01	6.3	9.1	26	1.4	5.91	1.50	2.24
S-2	**11**	0.00	0.89	0.18	0.48	2.90	0.01	3.6	11	15	2.4	2.13	7.50	29
S-3	**150**	0.22	28	0.32	1.9	11.8	0.35	34	185	120	15	0.00	**107**	**354**
S-4	**650**	0.00	38	0.29	1.9	11.6	0.52	44	200	132	21	0.00	**103**	**309**
S-5	**130**	0.00	10	0.22	1.8	7.23	0.22	8.0	134	84	16	0.00	**106**	**309**
S-6	**160**	0.00	12	0.21	2.2	19.1	0.32	33	93	63	35	0.00	**118**	181
S-7	**200**	0.00	11	0.17	2.0	7.81	0.38	9.1	123	82	16	0.00	**109**	**269**
S-8	**30**	0.00	4.9	0.11	1.9	5.89	0.33	90	10	60	15	0.00	**100**	245
S-9	**48**	0.00	2.4	0.19	2.7	4.78	0.36	60	46	125	19	0.00	**600**	**432**
S-10	**36**	0.21	4.3	0.21	2.2	6.89	0.42	102	30	78	10	0.00	**89**	**269**
S-11	**22**	0.35	0.34	0.19	0.10	5.25	0.15	29	10	38	4.6	2.20	12	27
S-12	**58**	0.00	9.3	0.13	2.3	7.37	0.32	4.9	88	55	6.3	1.20	**68**	110
S-13	**22**	0.00	0.73	0.16	0.17	3.57	0.13	5.2	34	34	3.8	5.95	1.75	9.24
	10		50	2.0	5.0		2.0						30	250
S-14	**11**	0.00	0.1	0.17	0.12	4.54	0.10	4.2	5.1	21	5.4	6.81	0.36	3.92
S-15	10	0.00	0.11	0.11	0.08	4.45	0.04	4.1	8.0	27	3.0	6.76	0.36	4.48
S-16	**17**	0.00	0.52	0.12	0.11	4.57	0.16	12	34	29	2.5	6.35	0.60	2.24
S-17	**20**	0.00	0.59	0.10	0.16	4.63	0.14	5.1	37	26	4.4	6.05	0.90	6.20
	10			1.50			5			200	100			

Annexure 9.2: Trace element data of surface water -First joint survey on 28-29 June 2011

S.No.	Location	Source	Depth feet	Fe µg/l	Mn µg/l	Cu µg/l	Ni µg/l	Cr µg/l	Pb µg/l	Cd µg/l	Zn µg/l
Canal/Escape/Drain											
S-1	Ganga Canal at Simbhaoli	SW		2005	51	36	ND	ND	**130**	4	163
S-2	Unlined drain U/s of Distillery Discharge point	SW		1328	125	43	ND	ND	**120**	6	178
S-3	Distillery Discharge drain	SW		**4084**	447	44	ND	1	**130**	6	221
S-4	Unlined drain D/s of Distillery Discharge point	SW		**4860**	334	46	78	10	**110**	6	182
S-5	Unlined drain U/s of Sugra Mill Discharge point	SW		2948	367	50	42	5	**160**	7	206
S-6	Sugar Mill discharge point	SW		2359	403	55	44	4	**140**	11	159
S-7	Unlined drain D/s of Sugar Mill discharge point	SW		1125	317	51	57	12	**140**	11	188
S-8	Unlined drain U/s of Canal Escape at Siyana	SW		1645	130	45	37	1	**160**	10	132
S-9	Gopaljee Milk factory Discharge point	SW		1108	178	39	81	ND	**140**	14	342
S-10	D/s of Canal Escape after Milk factory discharge point	SW		2253	135	48	29	ND	**140**	10	2524
S-11	Garh Nalla at Garhmukteshwar	SW		61	ND	35	113	ND	90	13	73
S-12	Canal Escape at Puth village	SW		73	ND	35	44	18	**160**	12	86
S-13	Mixing point of Escape with River Ganga at Puth village	SW		561	ND	31	120	ND	**200**	14	79
	Maximum permissible limit for industrial effluent discharges into inland surface water as per CPCB (1998)			3000	2000	3000	3000	2000	100	2000	5000
River Ganga											
S-14	River Ganga U/s of Garh Nalla at Garhmukteshwar	SW		88	ND	29	**49**	ND	**120**	8	66
S-15	River Ganga at Brijghat	SW		72	ND	46	**138**	3	**160**	**16**	105
S-16	River Ganga U/s of Canal Escape at Puth village	SW		102	ND	32	**76**	12	**200**	10	74
S-17	River Ganga at Puth vilalge	SW		13	15	39	**104**	ND	**200**	**14**	636
	Permissible limit for driniking purpose as per IS:10500 (1991)			1000	300	1500	20*	50	50	10	15000

ND = Not Detected (Below detection limit)
SW = Surface Water

Annexure 9.3: Bacteriological analysis data of surface water - First joint survey on 28-29 June 2011

S.No.	Location	Source	Total Coliform per 100 ml	Feacal Coliform per 100 ml
Canal/Escape/Drain				
S-1	Ganga Canal at Simbhaoli	SW	230000	70000
S-2	Unlined drain U/s of Distillery Discharge point	SW	150000	110000
S-3	Distillery Discharge drain	SW	230000	110000
S-4	Unlined drain D/s of Distillery Discharge point	SW	90000	50000
S-5	Unlined drain U/s of Sugra Mill Discharge point	SW	90000	70000
S-6	Sugar Mill discharge point	SW	230000	80000
S-7	Unlined drain D/s of Sugar Mill discharge point	SW	2100000	90000
S-8	Unlined drain U/s of Canal Escape at Siyana	SW	40000	10000
S-9	Gopaljee Milk factory Discharge point	SW	2400000	80000
S-10	D/s of Canal Escape after Milk factory discharge point	SW	90000	20000
S-11	Garh Nalla at Garhmukteshwar	SW	430000	110000
S-12	Canal Escape at Puth village	SW	150000	50000
S-13	Mixing point of Escape with River Ganga at Puth village	SW	90000	50000
River Ganga				
S-14	River Ganga U/s of Garh Nalla at Garhmukteshwar	SW	150000	70000
S-15	River Ganga at Brijghat	SW	40000	20000
S-16	River Ganga U/s of Canal Escape at Puth village	SW	2100000	110000
S-17	River Ganga at Puth village	SW	90000	50000
	Permissible limit for driniking purpose as per IS:10500 (1991)		10	Nil

SW = Surface Water

Annexure 10.1 Physico-chemical analysis of groundwater samples - First joint survey on 28-29 June 2011

S.No.	Location	Source	Depth	pH	EC	Field TDS	Hardness	CO_3	HCO_3	Cl
			feet		µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l
G-1	Ground Water at Village Nawada	HP	110	7.25	223	130	100	0	122	3.5
G-2	Ground Water at Village Brahmgarhi	HP	152	7.36	610	340	300	0	305	7.1
G-3	Ground Water at Village Brahmgarhi	HP	110	7.55	688	390	330	0	305	11
G-4	Ground Water at Village Baksar	HP	200	7.18	249	160	130	0	171	3.5
G-5	Ground Water at Village Baksar	HP	40	7.86	211	100	120	0	101	3.5
G-6	Ground Water at Village Baksar	HP	110	7.65	222	120	110	0	101	3.5
G-7	Ground Water at Village Vaith	HP	130	7.26	338	180	140	0	207	3.5
G-8	Ground Water at Village Jamalpur	HP	110	7.58	609	340	180	0	366	7.1
G-9	Ground Water at Village Jakhera	HP	120	7.94	700	400	280	0	415	11
G-10	Ground Water at Sarai Nahar Pul	HP	110	7.48	290	190	140	0	159	7.1
G-11	Ground Water at Village Dehra Kutti	HP	110	7.88	839	480	430	0	415	43
G-12	Ground Water at Village Sehal	HP	100	7.54	786	440	350	0	458	14
G-13	Ground Water at Village Sehal	HP	50	7.38	660	370	180	0	232	18
G-14	Ground Water at Village Sehal	HP	87	7.34	978	540	380	0	354	53
G-15	Ground Water at Village Bahadurgarh	HP	110	7.48	1130	640	460	0	549	82
G-16	Ground Water at Village Bhadsyana	HP	90	7.75	697	390	340	0	390	11
G-17	Ground Water at Village Alamnagar	HP	100	7.48	791	450	370	0	488	11
G-18	Ground Water at Village Alamnagar	HP	60	7.68	1330	760	**610**	0	512	110
G-19	Ground Water at Village Puth	HP	60	7.95	1440	830	350	0	464	82
G-20	Ground Water at Village Puth	HP	70	7.84	1480	840	510	0	500	36
G-21	Ground Water at Village Puth	HP	70	7.36	1620	900	440	0	464	106
G-22	Ground Water at Village Puth	HP	60	7.25	1110	610	420	0	476	71
G-23	Ground Water at Village Puth	HP	50	7.36	509	290	250	0	305	7.1
	Min			7.18	211	100	100	0	101	3.5
	Max			7.95	1620	900	610	0	549	110
	Average			7.54	761	430	301	0	342	30
	Permissible limit for driniking purpose as per IS:10500 (1991)			6.5-8.5		2000	600		600	1000

HP = Handpump

Annexure 10.1 Continued

S.No.	SO_4 mg/L	NO_3 mg/L	F mg/L	Na mg/L	K mg/L	Ca mg/L	Mg mg/L	BOD mg/L	COD mg/L
G-1	12	0.1	0.33	6.8	3.1	32	5.0	**2.4**	50
G-2	84	0.1	0.16	19	5.9	80	24	2.0	22
G-3	125	0.1	0.06	28	6.6	88	26	**4.6**	7.2
G-4	8.0	0.6	0.27	9.6	2.7	40	7.0	**2.2**	22
G-5	48	2.4	0.34	7.3	2.2	28	12	**8.5**	14
G-6	36	1.3	0.26	5.9	3.1	36	5.0	**7.4**	7.2
G-7	12	0.2	0.34	20	4.3	44	7.0	1.4	7.2
G-8	48	0.2	0.45	80	5.0	48	15	1.2	14
G-9	64	4.9	0.30	65	5.4	76	22	1.0	14
G-10	18	1.0	0.28	6.8	3.9	44	7.0	**4.8**	14
G-11	60	**59**	0.44	34	5.6	108	38	1.6	7.2
G-12	1.0	34	0.32	31	5.7	108	19	1.2	14
G-13	0.0	23	0.39	22	3.9	96	19	1.2	22
G-14	135	38	0.23	59	23	120	19	1.2	22
G-15	23	35	0.42	69	6.2	128	34	1.2	36
G-16	45	0.2	0.35	16	5.1	92	26	1.0	43
G-17	0.0	20	0.41	25	5.0	120	17	1.0	7.2
G-18	100	**72**	0.11	56	4.8	16	50	0.8	65
G-19	14	**148**	0.49	84	181	72	41	1.2	14
G-20	185	**158**	0.37	100	45	100	62	1.2	22
G-21	125	**169**	0.40	99	114	100	46	1.2	7.2
G-22	85	**53**	0.26	88	8.9	112	34	**2.4**	7.2
G-23	45	11	0.32	28	4.7	64	22	2.0	14
	0	0.1	0.06	6	2	16	5.0	0.8	7.2
	185	169	0.49	100	181	128	62	8.5	65
	55	36	0.32	42	20	76	24	2.3	20
	400	45	1.50			200	100	2	

Annexure 10.2: Trace element data of ground water samples : First joint survey on 28-29 June 2011

S.No.	Location	Source	Depth feet	Fe µg/L	Mn µg/L	Cu µg/L	Ni µg/L	Cr µg/L	Pb µg/L	Cd µg/L	Zn µg/L
G-1	Ground Water at Village Nawada	HP	110	**1156**	ND	19	ND	ND	ND	ND	162
G-2	Ground Water at Village Brahmgarhi	HP	152	**2183**	62	1	ND	ND	ND	ND	567
G-3	Ground Water at Village Brahmgarhi	HP	110	**4565**	85	10	ND	ND	ND	ND	503
G-4	Ground Water at Village Baksar	HP	200	**1711**	36	8	ND	ND	ND	ND	155
G-5	Ground Water at Village Baksar	HP	40	693	**832**	10	ND	ND	ND	ND	218
G-6	Ground Water at Village Baksar	HP	110	469	ND	12	ND	ND	ND	ND	544
G-7	Ground Water at Village Vaith	HP	130	209	ND	10	ND	ND	ND	ND	126
G-8	Ground Water at Village Jamalpur	HP	110	**1891**	67	13	ND	ND	ND	ND	456
G-9	Ground Water at Village Jakhera	HP	120	**1303**	141	53	ND	ND	ND	ND	291
G-10	Ground Water at Sarai Nahar Pul	HP	110	105	119	17	ND	ND	ND	ND	305
G-11	Ground Water at Village Dehra Kutti	HP	110	**1555**	ND	38	ND	ND	20	ND	85
G-12	Ground Water at Village Sehal	HP	100	949	9	40	ND	ND	20	ND	1037
G-13	Ground Water at Village Sehal	HP	50	148	ND	38	ND	ND	ND	ND	120
G-14	Ground Water at Village Sehal	HP	110	**2266**	**2041**	58	ND	ND	ND	ND	178
G-15	Ground Water at Village Bahadurgarh	HP	90	**2178**	56	32	ND	ND	ND	ND	137
G-16	Ground Water at Village Bhadsyana	HP	100	87	ND	24	ND	ND	10	ND	889
G-17	Ground Water at Village Alamnagar	HP	60	**1471**	ND	25	ND	ND	30	ND	859
G-18	Ground Water at Village Alamnagar	HP	60	**2967**	ND	321	ND	ND	10	ND	523
G-19	Ground Water at Village Puth	HP	70	**2488**	ND	52	ND	ND	ND	ND	169
G-20	Ground Water at Village Puth	HP	70	105	ND	25	ND	ND	ND	ND	76
G-21	Ground Water at Village Puth	HP	60	144	ND	22	ND	ND	ND	ND	31
G-22	Ground Water at Village Puth	HP	50	**4077**	ND	29	ND	ND	ND	ND	578
G-23	Ground Water at Village Puth	HP	87	329	ND	26	ND	ND	ND	ND	635
	Min			87	ND	1.0	ND	ND	ND	ND	31
	Max			4565	2041	321	ND	ND	30	ND	1037
	Average			1437	345	38	ND	ND	18	ND	376
	Permissible limit for driniking purpose as per IS:10500 (1991)			1000	300	1500	20*	50	50	10	15000

ND = Not Detected
HP = Handpump
* = WHO (1992)

Annexure 10.3: Bacteriological data of groundwater samples -first joint survey on 28-29 June 2011

S.No.	Location	Source	Depth feet	otal Coliformacal Coliform per 100 ml	per 100 ml
G-1	Ground Water at Village Nawada	HP	110	<3	ND
G-2	Ground Water at Village Brahmgarhi	HP	152	<3	ND
G-3	Ground Water at Village Brahmgarhi	HP	110	<3	ND
G-4	Ground Water at Village Baksar	HP	200	<3	ND
G-5	Ground Water at Village Baksar	HP	40	<3	ND
G-6	Ground Water at Village Baksar	HP	110	<3	ND
G-7	Ground Water at Village Vaith	HP	130	9	ND
G-8	Ground Water at Village Jamalpur	HP	110	<3	ND
G-9	Ground Water at Village Jakhera Rahmatpur	HP	120	<3	ND
G-10	Ground Water at Sarai Nahar Pul	HP	110	<3	ND
G-11	Ground Water at Village Dehra Kutti	HP	110	<3	ND
G-12	Ground Water at Village Sehal	HP	100	14	<2
G-13	Ground Water at Village Sehal	HP	50	9	ND
G-14	Ground Water at Village Sehal	HP	110	4	ND
G-15	Ground Water at Village Bahadurgarh	HP	90	<3	ND
G-16	Ground Water at Village Bhadsyana	HP	100	23	<2
G-17	Ground Water at Village Alamnagar	HP	60	75	<2
G-18	Ground Water at Village Alamnagar	HP	60	240	<2
G-19	Ground Water at Village Puth	HP	70	4	ND
G-20	Ground Water at Village Puth	HP	70	23	<2
G-21	Ground Water at Village Puth	HP	60	9	ND
G-22	Ground Water at Village Puth	HP	50	23	<2
G-23	Ground Water at Village Puth	HP	87	9	ND
	Min			<3	ND
	Max			240	<2
	Average			37	ND
	Permissible limit for driniking purpose as per IS:10500 (1991)			10	Nil

ND = Not Detected
HP = Handpump