

Chapter-4
Water Quality Monitoring of
River Ganga

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Audit found that quality of treatment of sewage by Sewage Treatment Plants (STPs) was poor. Most of the STPs did not comply with norms of National Green Tribunal (NGT) or Government of India (GoI). The water quality up to Devprayag was A category. In Rishikesh, the water quality of river Ganga remained in B category from 2019 to 2023, with the exception of COVID-19 period (2020 & 2021), when it improved to A category. The river water quality in Haridwar remained consistently in B category throughout the audit period. Uttarakhand Pollution Control Board (UKPCB) was not able to get National Accreditation Board for Testing and Calibration Laboratories (NABL) accreditation for its laboratory which monitors water quality of river Ganga and effluents discharged from STPs. The monitoring of the online continuous effluent monitoring system was inadequate for several reasons like- manual data entry of parameters is permitted on the Ganga Tarang Portal, which raises concerns about data accuracy. Additionally, the Ganga Tarang Portal is not accessible to the public, limiting transparency.

4.1 Significant indicators of cleanliness of river water

Quality of river water is measured by the parameters of Total Coliforms, Faecal Coliforms, pH, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids and Total Dissolved Solids. A brief description of these parameters is provided in **Table-4.1** below:

Table-4.1: Description of water quality parameters

Parameter	Description
Total Coliforms	Total Coliforms counts give a general indication of the sanitary condition of a water supply and it includes bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste.
Faecal Coliforms	Faecal Coliforms are the group of the total coliforms that are considered to be present specifically in the gut and faeces of warm-blooded animals.
pH	pH is a figure between 0 and 14 defining how acidic or basic a body of water is. The lower the number, the more acidic the water is. The higher the number, the more basic it is.
Dissolved Oxygen	Dissolved Oxygen (DO) is the amount of oxygen that is present in water.
Biochemical Oxygen Demand	Biochemical Oxygen Demand (BOD) is the amount of dissolved oxygen needed by bacteria in decomposing the biodegradable organic wastes present in water.
Chemical Oxygen Demand	Chemical Oxygen Demand (COD) measures the amount of oxygen required to oxidise organic (biodegradable and non-biodegradable) and oxidizable inorganic compounds in a water sample.
Total Suspended Solids	Total Suspended Solids (TSS) refer to waterborne particles that exceed two microns in size.
Total Dissolved Solids	Total Dissolved Solids (TDS) refer to any particle that is smaller than two microns.

4.2 Ganga water quality monitoring network

UKPCB monitors the water quality of river Ganga and its tributaries through its eight monitoring locations (Vishnuprayag, Nandprayag, Karnprayag, Rudraprayag, Uttarkashi, Devprayag, Rishikesh and Haridwar) with 33 sampling points. This monitoring is currently carried out under a Namami Gange project named ‘Strengthening of Laboratories’. Audit utilized data of UKPCB to analyse water quality parameters of river Ganga.

4.3 Ganga water quality during audit period

Pollution in river water can generally be gauged through the fact whether it is fit for use in a specific purpose or not. Central Pollution Control Board (CPCB) has classified river water quality into five categories as detailed in *Appendix-4.1*.

Audit examined data of above eight monitoring locations with respect to eight sampling points¹ for four parameters (TC, pH, DO and BOD) relevant for Class A, B and C of water *i.e.* potability of water. The results are shown in **Table-4.2** below:

Table-4.2: Ganga Water quality during audit period

Place (downstream)	Category of Water Quality of Ganga					
	2018	2019	2020	2021	2022	2023
Vishnuprayag	Not measured				A	A
Nandprayag	Not measured				A	A
Karnprayag	Not measured				A	A
Rudraprayag	A	A	A	A	A	A
Uttarkashi	Not measured				A	A
Devprayag	A	A	A	A	A	A
Lakkarghat Rishikesh	Data not available	B	A	A	B	B
Haridwar- Har Ki Pauri	B	B	B	B	B	B

A category - Drinking Water Source without conventional treatment but after disinfection, **B category** - Outdoor bathing (Organised), **C category** - Drinking water source after conventional treatment and disinfection, **D category** - Propagation of Wildlife and Fisheries, and **E category**- Irrigation, Industrial Cooling, Controlled Waste Disposal.

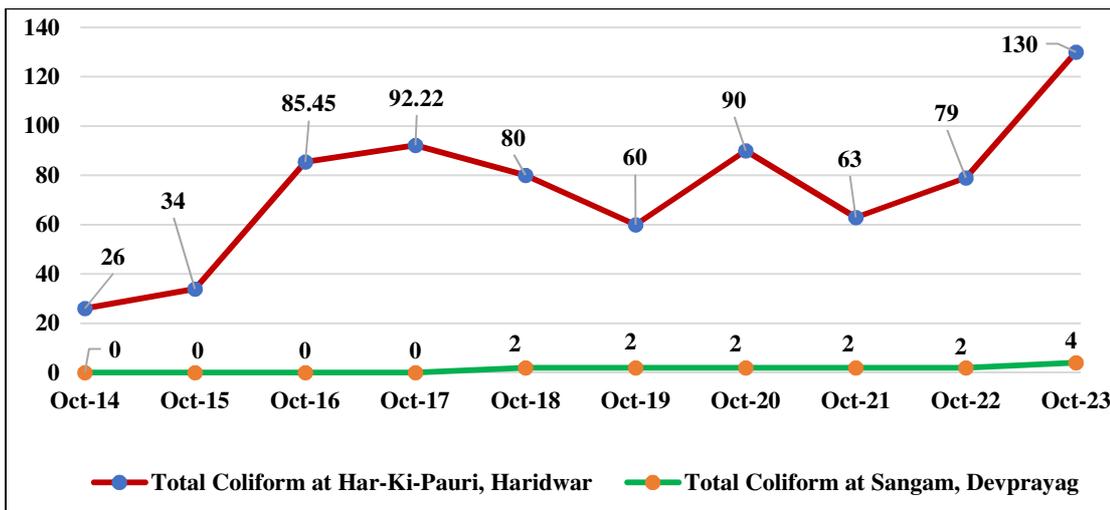
Source: Data provided by UKPCB.

The details indicate that the water quality up to Devprayag is of A category. In Rishikesh, the water quality of river Gange remained in B category from 2019 to 2023, with the exception of COVID-19 period (2020 & 2021), when it improved to A category. The river water quality in Haridwar remained consistently in B category throughout the audit period.

The audit also compared 10-year data of total coliform at Har-ki-Pauri, Haridwar, and Devprayag. It shows that the level of total coliform increased 32 times (as of October 2023) between Devprayag and Haridwar (a distance of 93 km), as depicted in **Chart-4.1** below:

¹ Downstream of above seven monitoring locations and Har Ki Pauri at Haridwar.

Chart-4.1: Comparison of Total Coliform data over the last 10 years at Haridwar and Devprayag



4.4 Quality monitoring of treated effluent of STPs

The CPCB monitors the quality of sewage treatment in STPs on a quarterly basis. It compares the tested parameters of treated sewage against two standards: those notified by the Ministry of Environment, Forest and Climate Change (MoEF&CC), GoI and those set by the NGT. Additionally, the UKPCB monitors the quality of STP discharge according to MoEF&CC norms on a monthly basis.

A comparative summary of both the norms is given in **Table-4.3** below:

Table-4.3: Norms of Treated Discharge of STPs as per MoEF&CC and NGT

Parameter	Limit/ range set by MoEF&CC	Limit/ range set by NGT
pH	6.5-9.0	5.5-9.0
BOD	30mg/l	<10mg/l
TSS	<100mg/l	< 20mg/l
Faecal coliform	<1000MPN/100ml	desirable <100MPN/100ml permissible < 230 MPN/100 ml
COD		< 50mg/l
Nitrogen-Total	Not notified	< 10 mg/l
Phosphorous-Total		< 1.0 mg/l

Audit noticed following shortcomings in the monitoring of STP effluent discharge:

4.4.1 Obsolete monitoring of treated discharge of STPs by UKPCB

Audit found that UKPCB completely overlooked norms set by NGT and evaluated the discharge quality of STPs *vis-à-vis* norms of MoEF&CC which were not accepted by the NGT. Besides, the parameters of COD, Nitrogen-Total and Phosphorous-Total were not even measured. Hence, monitoring of discharge of STPs by UKPCB was obsolete in view of NGT norms.

The Government has stated (May 2024) that the standards of MoEF&CC are still applicable to the STPs because MoEF&CC had preferred (December 2020) to appeal before Supreme Court. Procurement for instruments to measure Total Nitrogen and Phosphorus has been initiated after approval from the competent authority for which tendering process will be initiated and measurement of COD has been started from the month of April 2024.

The Government reply is not acceptable because NGT is a statutory body empowered to pass orders and judgements under the NGT Act, 2010. Its decisions are binding and compulsorily enforceable. Even CPCB, the controlling body of UKPCB, evaluated STPs on both norms *i.e.* NGT norms as well as MoEF&CC norms. Besides, all new STPs in Uttarakhand are constructed in compliance of norms set by NGT. Hence, overlooking NGT norms during evaluation of performance of STPs was not proper.

4.4.2 Poor quality treatment of sewage by STPs

CPCB conducts testing of treated effluents of STPs on quarterly basis. Its testing reports revealed substandard treatment of sewage and non-compliance of norms in most of the 44 STPs. Summary of the latest available quarterly testing reports from CPCB and UKPCB for these 44 STPs located in Ganga front towns is detailed in **Table-4.4** below:

Table-4.4: Compliance Status of STPs according to MoEF&CC and NGT

Period	STPs inspected	Complying with NGT Norms	Not complying with NGT Norms	Complying with MoEF&CC Norms	Not complying with MoEF&CC Norms
Jan-March 2023	44 ²	05 ³	35	12	28
April-July 2023	44 ⁴	05 ⁵	35	09	31
Aug-Nov 2023	44 ⁶	03 ⁷	36	06	33

Source: CPCB quarterly reports of Uttarakhand.

As evident from the above table, the majority of inspected STPs did not comply with NGT norms as well as standards set by MoEF&CC. The level of non-compliance persisted throughout three quarters and was acute as depicted in **Table-4.5 (A)** and **4.5 (B)** below:

Table-4.5 (A): Details of Non-Compliant STPs according to MoEF&CC

Parameter and norm	Range of non-compliance (Number of STPs)		
	Jan-March 2023	April-July 2023	Aug-Nov 2023
BOD < 30mg/l	42-1237 (06)	37-1237 (09)	43-702 (10)
TSS < 100mg/l	113-909 (03)	113-909 (04)	129-354 (02)
COD not mentioned	Not notified	Not notified	Not notified
Faecal coliform: <1000 MPN/100 ml	1700-24 X 10 ¹¹ (28)	2000-13 X 10 ¹¹ (31)	14x10 ² -17 X 10 ⁸ (31)

² Four STPs were Non-Operational during inspection by CPCB: i) Old Suspension bridge STP, Gopeshwar Chamoli, ii) Forest *nalla* STP, Nandprayag, iii) STP Anoop Negi Memorial School, Rudraprayag and iv) Tekla Biodigester STP, Uttarkashi.

³ i) Chamoli Ghat STP, ii) Pokhari Bend STP Chamoli, Pokhari iii) Pokhari 1.08 STP Joshimath, iv) Ward 1&3 STP-05 Karnaprayag and v) one MLD STP near ITI Srinagar.

⁴ Four STPs were Non-Operational during inspection by CPCB: i) Old Suspension bridge STP, Gopeshwar Chamoli, ii) Forest *nalla* STP, Nandprayag, iii) STP Anoop Negi Memorial School, Rudraprayag and iv) Tekla Biodigester STP, Uttarkashi.

⁵ i) Chamoli Ghat STP, ii) Pokhari Bend STP Chamoli, Pokhari, iii) STP Joshimath, iv) Ward 1&3 STP Karnaprayag and v) one MLD STP Srinagar.

⁶ Five STPs were non-Operational during inspection by CPCB: i) Badrinath 0.01 MLD STP, Badrinath ii) Old Suspension Bridge STP, Gopeshwar Chamoli iii) Sangam *nalla* STP, Nandprayag iv) BRO Bridge STP 04 Karnaprayag and v) Tekla STP Uttarkashi.

⁷ i) Badrinath 1.0 MLD, Badrinath ii) Pokhari Bend STP, Chamoli-Gopeshwar iii) Marwari STP, Joshimath.

Table-4.5 (B): Details of Non-Compliant STPs according to NGT Norms

Parameter and norm	Range of non-compliance (Number of STPs)		
	Jan-March 2023	April-July 2023	Aug-Nov 2023
BOD <10mg/l	11-1237 (20)	11-1237 (18)	12-702 (23)
TSS < 20mg/l	21-909 (15)	21-909 (21)	23-354 (14)
COD < 50mg/l	52-1803 (20)	52-1803 (17)	52-1157 (23)
Faecal coliform: desirable <100MPN/ 100ml permissible < 230 MPN/100 ml	450-24 X 10 ¹¹ (31)	450-13 X 10 ¹¹ (34)	680-17 X 10 ⁸ (32)

In the exit conference (May 2024), the Secretary instructed all officials involved to ensure that STPs meet all designated criteria for treated effluent set by MoEF&CC.

4.4.3 Non-accreditation of UKPCB laboratories

The UKPCB operates three laboratories: the Central Laboratory in Dehradun, the Regional Laboratory in Roorkee, and the Regional Laboratory in Kashipur. In June 2018, the National Mission for Clean Ganga (NMCG) sanctioned a project for 'Strengthening of Laboratories of UKPCB' at an estimated cost of ₹ 16.21 crore. The duration of the project was set for five years from the date of the sanction order. The laboratories were required to achieve NABL accreditation within a specified timeframe to ensure the quality assessment and control of the monitored data. NABL accreditation enhances confidence in the testing and calibration reports issued by the laboratories, emphasizing accuracy and reliability.

Examination of UKPCB records revealed that it utilized only ₹ 5.55 crore (34 per cent of the sanctioned amount by NMCG) over the five-year period for operating its laboratories. Despite being a regulatory body, UKPCB did not apply for NABL accreditation for its laboratories during the project period. After the expiration of the original project period, UKPCB applied for NABL accreditation for its Central Laboratory in September 2023, but it had not yet been awarded. In the absence of the required accreditation, the results of testing conducted by UKPCB lacked the reliability that an accredited laboratory could ensure.

The Government replied (May 2024) that NABL accreditation for central laboratory of UKPCB was currently underway, with the final assessment scheduled for June 2024.

Reply confirms that UKPCB could not obtain NABL accreditation in scheduled target time for all its laboratories, even after six years of sanction.

4.4.4 UKPCB testing was not reliable

Audit observed significant discrepancies between the test results from the UKPCB laboratory and those from the CPCB laboratory. This discrepancy was evident in the testing results of the 68 mld STP at Jagjeetpur, Haridwar (the largest STP in the state) conducted in March 2023, May 2023, and October 2023. During these periods, both CPCB and UKPCB tested the treated effluent from the 68 mld STP, and the results are shown in **Table-4.6** below:

Table-4.6: Test results for 68 MLD STP according to UKPCB and CPCB

Parameter	UKPCB March 2023	CPCB March 2023	UKPCB May 2023	CPCB May 2023	UKPCB October 2023	CPCB October 2023
BOD	10	03	6.4	8	9.6	4
TSS	08	<i>below detection limit</i>	07	25	10	<i>below detection limit</i>
Faecal coliform	58	14 X 10 ³	58	17 X 10 ³	170	39 X 10 ³

From above table, we can see that test results of all parameters (BOD, TSS and faecal coliform) were different in UKPCB and CPCB testing. Similar discrepancies were observed in the test results for other STPs as well.

In the exit conference (May 2024), UKPCB official stated that variations in the results of samples of treated effluents tested by UKPCB and CPCB might be due to differences in sampling methods and the timing of sample collection.

The reply is not acceptable because, although STP discharge results can vary daily, the significant discrepancies between the results from the CPCB laboratory and those from the UKPCB laboratory raise questions on efficacy of UKPCB testing.

4.5 Online continuous effluent monitoring system

Ganga Tarang web portal has been deployed by NMCG as an Online Continuous Effluent Monitoring System (OCEMS) which records parameters of treated sewage being discharged from STPs. State Mission for Clean Ganga (SMCG) and implementing agencies utilize it for monitoring and manual data entry respectively.

Audit noticed following shortcomings in functioning of that portal:

- Manual data entry of parameters is also allowed in Ganga Tarang Portal. However, there was no system through which SMCG could check authenticity of such manual data entry by STP operators;
- Ganga Tarang is not open for access to general public. It requires departmental ID/password and does not show any data without ID/password. Hence, it could not achieve the objective of connecting common people with the affairs of Ganga cleanliness through STPs;
- During audit of selected O&M agencies and physical inspection of STPs, records of calibration of OCEMS components were not provided to Audit. At SMCG too, there was no record containing details of such calibration. Hence, calibration of OCEMS components was not ensured.

Thus, OCEMS was not functioning in a proper manner. Audit noticed that the State Government/SMCG did not take any initiative with NMCG to get the portal developed in such a way which could have enabled the respective authority to verify the authenticity of the manual data entered by the STP operators which was a critical gap that needed to be addressed.

The State Government replied (May 2024) that as per recommendations of Audit, SMCG, Uttarakhand could seek approval of NMCG to offer the access to Ganga Tarang portal to general public. Regarding manual data entry, it was stated that manual data entry was allowed to integrate offline STPs (which do not have OCEMS), so that data of general parameters of these STPs could be fed into Ganga Tarang portal.

4.6 Recommendations

- 1. National Accreditation Board for Testing and Calibration Laboratories accreditation for all its laboratories may be ensured by Uttarakhand Pollution Control Board.*
- 2. Shortcomings noticed in Ganga Tarang portal i.e. online continuous effluent monitoring system for Sewage Treatment Plants may be rectified.*
- 3. The issue of Sewage Treatment Plants doing poor quality treatment of water may be taken up by the Department with the respective monitoring agencies & contractors to ensure that sewage treatment plants meet all designated criteria for treated effluent.*

