सत्यमेव जयते

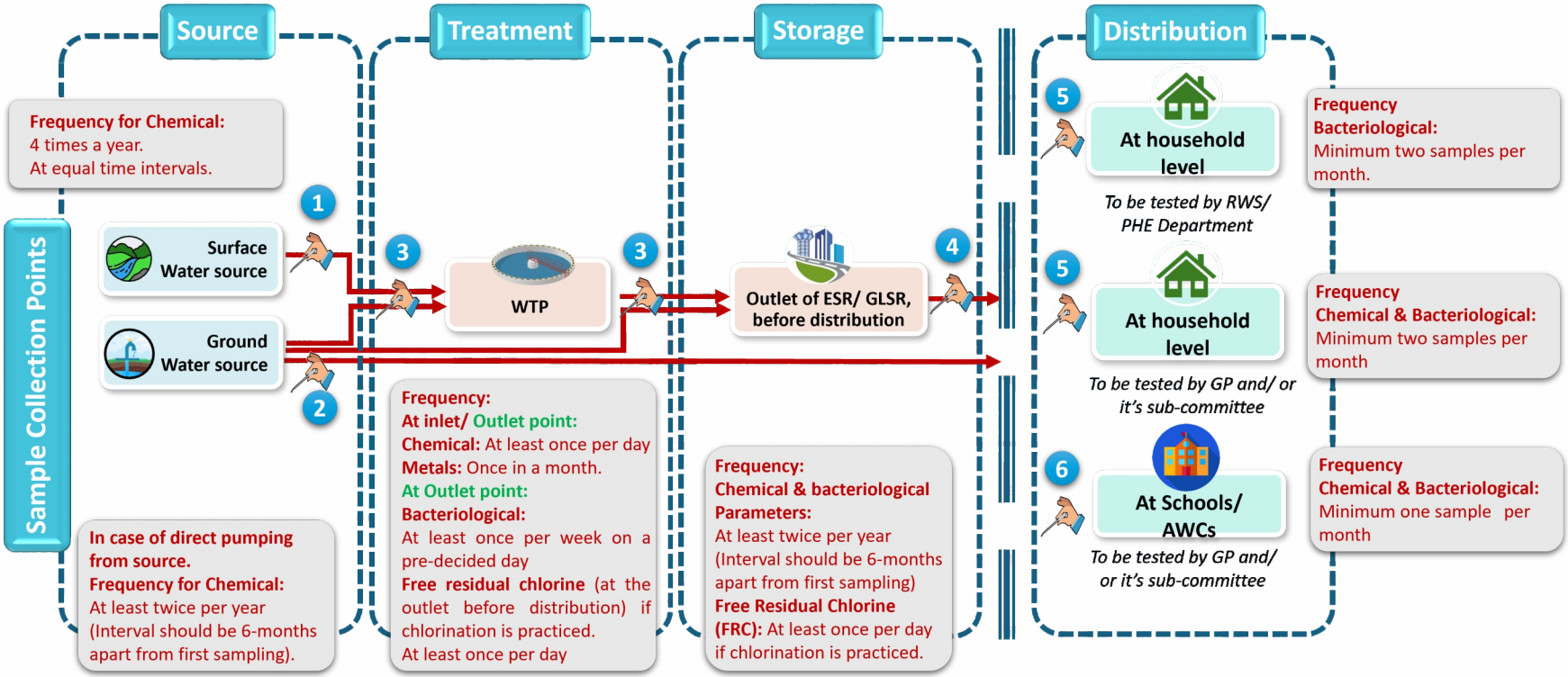
Government of India
Ministry of Jal Shakti
Department of Drinking Water & Sanitation
National Jal Jeevan Mission

Har Ghar Jal
Jal Jeevan Mission

Building Partnership
Changing Lives

Concise Handbook
for
Monitoring Water Quality of
Piped Drinking Water Supply to Rural Households

New protocol for testing of water samples from various supply components including sources and delivery points



Sampling Locations

1. At the intake point/ jack well of surface water source
2. At the outlet of ground water source (in case of direct pumping from source)
3. At the inlet/ outlet points of WTP
4. At the outlet of ESR/GLSR, before Distribution
5. At Household level
6. At School/AWCs

Note: The frequency and parameter are suggestive in nature. Each Chief chemist of state/ UT must decide the parameter and frequency as per their specific requirement.

Narendra Modi
Prime Minister

When water reaches every house, our sisters and future generations benefit the most and our fight against malnutrition gets stronger. Our mothers and sisters suffer the most due to every water related problem, and therefore, our sisters and daughters are also at the center of this Mission.

Excerpts from the Prime Minister's address at 'Har Ghar Jal Utsav' in Goa, 19th August, 2022

To ensure that the quality of water is up to the mark, a system of periodic water testing should also be developed.

PM's video message at All India Annual State Ministers' Conference on Water, Bhopal, 5th January 2023

Foreword

It is with immense pride that we acknowledge the visionary leadership of our Prime Minister, Shri Narendra Modi Ji, whose foresight has led to the amalgamation of all water-related subjects under one Ministry. The Jal Jeevan Mission (JJM) stands as a testament to his commitment and collaborative approach with State Governments to ensure the regular provision of potable water in adequate quantities to every rural household. The Jal Jeevan Mission will help India to achieve the Sustainable Development Goal 6.1, which aims for universal and equitable access to safe and affordable drinking water, well ahead of the 2030 target.

To date, the Jal Jeevan Mission has made remarkable progress, having successfully provided household tap connections to more than 79% of rural households. This significant milestone not only reflects our advancement towards the Mission's goals but also positions India as a global frontrunner in the commitment to water security.

The Jal Jeevan Mission has consistently given priority to water quality, and this handbook is a crucial step in upholding that commitment serves as an indispensable resource for field workers, equipping them with the knowledge required to ensure water quality at the village level, in line with new protocol. The handbook clearly defines the roles and responsibilities of Gram Panchayat, District Water & Sanitation Mission (DWSM) & State Water & Sanitation Mission (SWSM) along with Rural water supply departments. It also offers framework for executing a water supply monitoring program that ensures the safety of water supply.

This concise booklet also marks a significant move towards the digital transformation of the water sector. By integrating digital information systems and portable devices for water testing, we are fostering an ecosystem that enhances communication, coordination, and collaboration among all stakeholders.

I am confident that this document will become a foundational tool for all State Governments, guiding water supply departments to create localized handbooks and engage community participation. This initiative will undoubtedly contribute to the improvement of public health, particularly the health of children and ensure the fulfilment and sustainability of the Jal Jeevan Mission's objectives.

Let us remain inspired by our Prime Minister's vision and continue our collective efforts to secure a future where access to clean water is not just an aspiration but a reality for every rural household in India.

Shri C R Patil
Hon'ble Minister of Jal Shakti

Foreword

Jal Jeevan Mission is an important tale in the grand narrative of our national development journey – being written by the central government in collaboration with states to ensure the health and well-being of rural people. This mission is of utmost importance which shows our government's unwavering commitment to assure potable water. It is a commitment that goes beyond just the provision of water supply and goes to the root of public health.

I am happy write foreword for the "Handbook for Monitoring Water Quality of Piped Drinking Water Supply to Rural Households'. This booklet is an important initiative to guide the States with the means to protect the purity of our country's water supply. This is a evidence to our proactive governance and our determination to avert the challenges of waterborne diseases through careful inspection and vigilant monitoring.

Under the visionary guidance of our Hon'ble Prime Minister, Jal Jeevan Mission has already made commendable progress. This booklet is the next step in our journey, ensuring that the water provided in the homes of our rural families is not only accessible but also meets the highest standards of quality. I would urge the rural water supply departments to strive to create trust among households that they would not need the Individual household water purification system.

Let us move ahead with new enthusiasm, with the inspired by our Prime Minister's vision, and work together towards creating a future where every rural household has access to assured potable water, thus nurturing a healthier, wealthier India.

Shri V. Somanna
Hon'ble Minister of State for Jal Shakti

Foreword

The World Health Organization (WHO) estimated in their study that if the Jal Jeevan Mission provided safely managed drinking water in the country, it would result in averting almost 400,000 diarrheal disease deaths. With universal coverage, almost 14 million DALYs (disability-adjusted life years) would be saved, resulting in estimated cost savings of up to $101 billion. The study also estimates that 6.66 crore hours will be saved per day, mostly for women, due to the provision of tap water connections to homes.

Nobel laureate Michael Kremer et al. estimate that the provision of safe water to all rural households could avert about 1.36 lakh under-5 deaths per year.

The Government of India, in partnership with the states, has been working to provide safe and assured water to households under the Jal Jeevan Mission. Monitoring and maintaining the quality of piped water supply are crucial components of these efforts.

I am pleased that this "Concise Handbook for Monitoring Water Quality in Piped Drinking Water Supply to Rural Households" has been brought out, which will help the states develop their water quality monitoring programs considering district-specific parameters, risk exposure, and the incidence of waterborne diseases. The purpose of this handbook is to provide a comprehensive framework for water supply monitoring and surveillance, ensuring the delivery of safe water to all rural households. The guidelines within offer a clear and systematic approach for sampling at various locations starting from the source to water treatment plants and delivery points.

I am confident that this handbook will help the State Water & Sanitation Mission (SWSM) to institutionalize the monitoring of water supply and provide tools for surveillance where all stake holders such as Gram Panchayat, Rural Water Supply Department, Health Department, can work towards the goal of assuring safe water supply to all the rural households.

Ms. Vini Mahajan
Secretary,
Department of Drinking Water & Sanitation

Foreword

In an era when digital revolution is transforming every aspect of our lives, the Jal Jeevan Mission (JJM) is at the forefront of integrating advanced technology to ensure the provision of safe drinking water to rural communities. The Jal Jeevan Mission (JJM) has embarked on a groundbreaking journey to institutionalize water quality monitoring and surveillance (WQM&S) in rural India for realizing the gain expected in public health and well-being. The mission is also committed to provide the water quality related information with all stakeholders in easy & transparent manner. The 'Citizen Corner' on the JJM Dashboard, which displays water quality data for every village along with trend demonstrate the mission dedication to transparency and community engagement.

The "Concise Handbook for Monitoring Water Quality in Piped Drinking Water Supply to Rural Households" is a significant extension of this commitment. It serves as a practical guide for field practitioners, policymakers, and stakeholders in the Rural Water Supply and Public Health Engineering Department. The handbook details protocol for water quality testing in terms of frequency, location and parameters. It also discusses roles and responsibilities of various institutions such as Gram Panchayat, Rural Water Supply, District Water and Sanitation Mission, State Water and Sanitation Mission etc.

Furthermore, the handbook also provides insight into use of digital water quality monitoring system and use of disinfection system such as chlorination.

I encourage all readers to engage with the information and apply their knowledge to build resilient communities, where access to safe drinking water is a universal service.

Let us embrace the revolution of digital transformation and innovation in water quality monitoring. Through the collective efforts of stakeholders and the empowering communities, we can achieve the vision of clean water for all, fostering healthier lives and sustainable development in rural areas.

Shri Ashok K. K. Meena
Officer on Special Duty (OSD),
Department of Drinking Water & Sanitation

Preface

Water is essential for the survival of humanity. In the modern journey of nations, there has been a struggle to supply safe water equitably and universally across the vast landscapes of countries. Its scarcity has forced women to endure the drudgery of collecting and prevented them from participating in developmental activities. The unreliable quality of the water, thus fetched, results in health burden, especially on younger children, in the form of water borne diseases.

The Jal Jeevan Mission, launched by the Honorable Prime Minister on 15th August 2019 to provide safe and potable water supply to all rural households, with a focus on water service delivery has been a game changer. It has transformed the rural India by positively, impacting the lives of crores of population. It is utmost important that the water being supplied remains portable and complies with the prescribed standards. Keeping this in view the National Jal Jeevan Mission has drafted this handbook.

This handbook has been meticulously crafted by the experts in the field, incorporating insights from practitioners, policymakers, and taking inputs from the latest guideline of the CPHEEO manual. It provides an overview of the protocols for monitoring the quality of the piped drinking water supply in rural households.

This valuable resource will undoubtedly aid professionals, community leaders, and practitioners in fulfilling their crucial roles in providing safe drinking water to rural households. I trust that this handbook will serve as a practical and informative tool, fostering a shared commitment to the noble cause of ensuring safe and reliable drinking water for all. It is necessary that the information and the processes contained in it are disseminated amongst all the stakeholder appropriately. May it contribute significantly to the success of ongoing efforts to enhance the well-being of our rural communities.

Dr. Chandra Bhushan Kumar
Additional Secretary & Mission Director (NJJM)
Department of Drinking Water & Sanitation

Acknowledgement

Constituted department of Drinking Water and Sanitation, a committee to develop “Concise Handbook for Monitoring Water Quality in Piped Water Supply to Rural Households” with a focus on water quality and safety.

At this juncture, I would like to thank Ms. Vini Mahajan, Secretary DDWS, for constituting committee and providing guidance and support to the entire team for preparing a handbook. I would also like to acknowledge Shri Ashok K. K. Meena, Officer on special Duty, for providing guidance to put in shape the final document.

I would like to express my sincere gratitude to Dr. Chandra Bhushan Kumar, Additional Secretary & Mission Director (JJM), for providing valuable insights and guidance to improve the document and to ensure the inclusion of CPHEEO comments. I would also like to express my sincere thanks to the ex-chairperson of the committee, Shri Vikas Sheel, for providing guidance to the committee during early stage.

I also thank the esteemed members of the committee, Shri VK Madhavan, Shri Santosh R, Dr. Sunderrajan Krishnan, Shri Amit Singh, Shri P D Bhamre, and Shri A Muralidharan, and team members from NPMU-PHE for enriching the deliberations with their valuable inputs. I would also like to thank Shri Santosh R, Assistant Adviser (PHE) and Dr. Divya Chauhan, Water Quality Expert (NPMU-PHE) for providing significant policy perspective inputs, studying various documents, and customizing them to the rural context. They diligently worked on compiling, editing, and designing the document.

The cooperation extended by officials of the Department of Drinking Water and Sanitation is sincerely acknowledged for providing assistance in this handbook.

I am sure this document will be of immense practical value for all the field practitioners of the Rural Water Supply/Public Health Engineering Department/ GP’s as well as policymakers to design effective water quality monitoring and surveillance activities in their States/UTs for ensuring safe water supply.

Shri Pradeep Singh
Director, NJJM
Department of Drinking Water & Sanitation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Abbreviations

APHA	American Public Health Association
BIS	Bureau of Indian Standards
CPHEEO	Central Public Health & Environmental Engineering Organisation
DALY	Disability-Adjusted Life year
DWSM	District Water and Sanitation Mission
ESR	Elevated Storage Reservoir
FHTC	Functional Household Tap Connection
FRC	Free Residual Chlorine
FTK	Field Test Kit
GLSR	Ground Level Storage Reservoir
GP	Gram Panchayat
IIMB	Indian Institute of Management, Bangalore
ILO	International Labour Organization
IS	Indian Standard
NJJM	National Jal Jeevan Mission
LPCD	litre per capita per day
MBR	Master Balancing Reservoir
NABL	National Accreditation Board for Testing and Calibration Laboratories
OHT	Over Head Tank
PAC	Poly Aluminium Chloride
PHED	Public Health Engineering Department
PWS	Pipe Water Supply
RWS	Rural Water Supply
SPM-NIWAS	Syama Prasad Mookerjee-National Institute of Water and Sanitation
SWSM	State Water and Sanitation Mission
TDS	Total Dissolve Solid
UT	Union Territory
VWSC	Village Water and Sanitation Committee
WHO	World Health Organisation
WQMIS	Water Quality Management Information System
WTP	Water Treatment Plant

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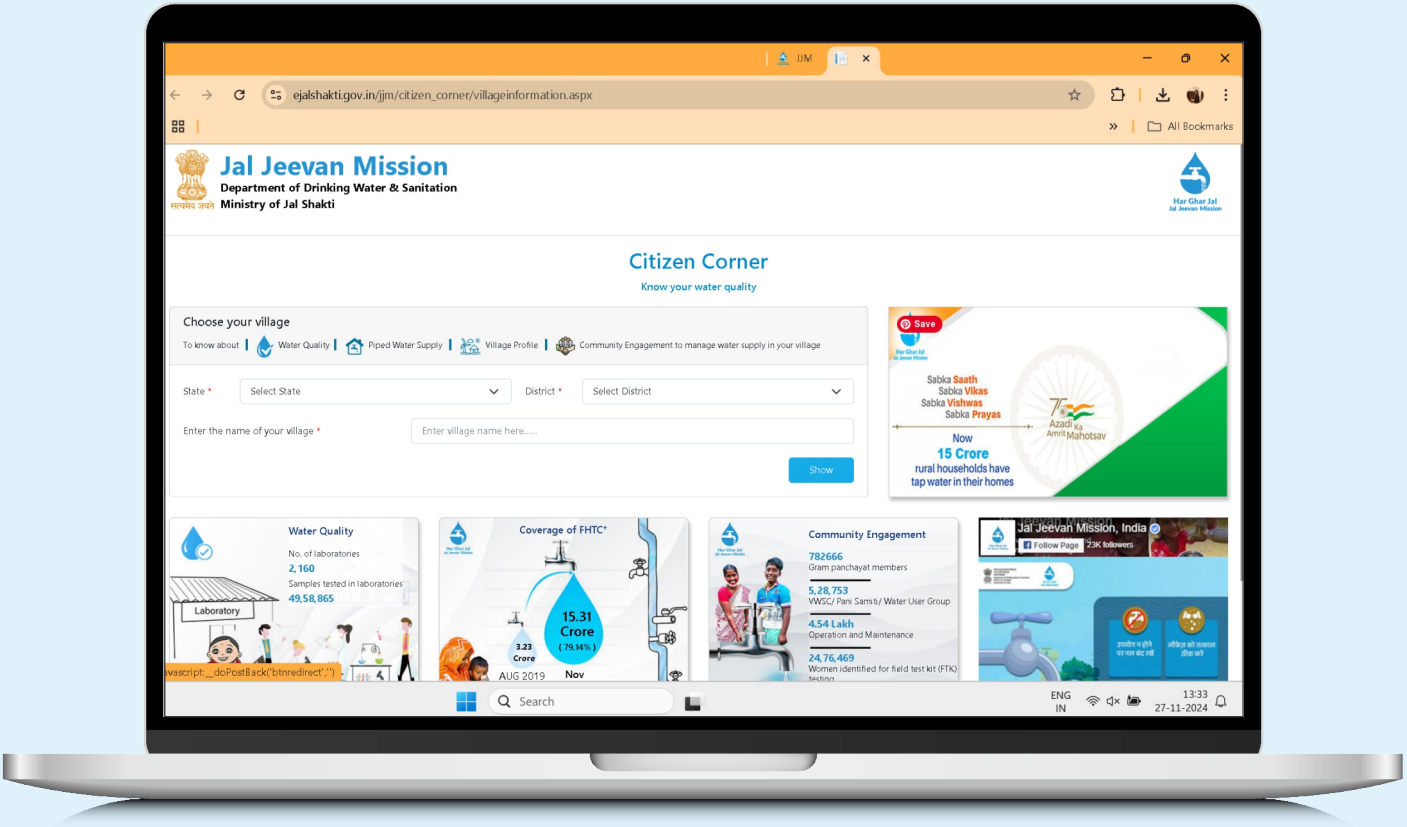
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Department of Drinking Water & Sanitation
Ministry of Jal Shakti
Har Ghar Jal
Jal Jeevan Mission
Citizen Corner
Know your water quality
Choose your village
To know about
Water Quality
Piped Water Supply
Village Profile
Community Engagement to manage water supply in your village
State *
Select State
District *
Select District
Enter the name of your village *
Enter village name here.....
Show
Save
Sabka Saath
Sabka Vikas
Sabka Vishwas
Sabka Prayas
Azadi Ka Amrit Mahotsav
Now
15 Crore
rural households have tap water in their homes
Water Quality
No. of laboratories
2,160
Samples tested in laboratories
49,58,865
Laboratory
Coverage of FHTC*
15.31 Crore (79.14%)
3.23 Crore
AUG 2019
Nov
Community Engagement
782666
Gram panchayat members
5,28,753
WWSC/ Pani Samiti/ Water User Group
4.54 Lakh
Operation and Maintenance
24,76,469
Women identified for field test kit (FTK)
Jal Jeevan Mission, India
Follow Page
23K followers
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IN
13:33
27-11-2024

Chapter 1:
Introduction

Water is a basic need. This is a precondition for any thriving society to exist. Its significance goes beyond just meeting basic needs, extending to economic, social, cultural, political, and ecological dimensions, contributing to an overall improvement in people's quality of life.

To achieve the objective of providing safe and assured water to all the rural households, the Hon'ble Prime Minister announced the Jal Jeevan Mission - Har Ghar Jal on 15th August 2019. The objective of providing safe and assured water was envisaged to be achieved through functional household tap connections (FHTCs). The FHTC is defined as a tap connection provided to the household that provides water in adequate quantity and of prescribed quality on a regular and long-term basis. This will also enable the ease of living and free people in the rural areas, especially women and adolescent girls, from the age-old drudgery of fetching water, often from long distances, and thereby unlock the potential for people to engage in activities of their choice.

World Health Organisation (WHO) in their study, estimated that if the Jal Jeevan Mission provided safely managed drinking-water in the country, it would result in averting almost 400,000 diarrheal disease deaths. With universal coverage almost 14 million DALYs (disability adjusted life years) will be saved, resulting in estimated cost savings of up to $101 billion. The study also estimates that 5.5 Crore hours will also be saved per day in rural areas, mostly by women, due to the provision of tap water connections to homes.

Indian Institute of Management, Bangalore (IIMB) and International Labour Organization ILO study estimates that during the implementation phase of JJM a total of 2.82 Cr person-year employment will be generated, and 11.84 Lakh person-year will be generated during O&M phase, which is perpetual in nature.

The Jal Jeevan Mission has established a supportive environment for community engagement, coupled with professional assistance from Rural Water Supply departments (RWS)/ Public Health Engineering Departments (PHED) for safe and assured water supply. To assure the quality of water, a substantial investment is also being made in upgrading laboratory infrastructure, enhancing the capabilities of women in testing, and fostering awareness about water quality.

Ensuring safe water requires a robust water quality monitoring program. With the JJM, the water is being supplied directly to households from a secure source through pipes. This requires a revision of the roles and responsibilities of field officers, laboratory professionals, and the community in the water quality monitoring program. The findings of water quality monitoring should lead to prompt remedial actions when needed.

For piped water supply to households, the service benchmarks are clearly defined under the Jal Jeevan Mission, viz, to provide drinking water of prescribed quality (BIS 10500:2012 and its subsequent amendments) in adequate quantity (55 lpcd) on a long-term and regular basis.

To assure the quality of water being supplied, more than 2,119 Labs have been setup in the country, and detailed guidelines on water quality management & surveillance are already provided in Drinking Water Quality Monitoring & Surveillance Framework for rural areas but still the need to have a concise handbook for field practitioners such as pump operators, valve operators, Gram Panchayats and / or it's sub-committee, Junior Engineers, Assistant Engineers and laboratory professionals was felt.

The Chief Secretaries conference held in the month of December 2023, it was decided to ensure testing of both source & delivery points for both chemical (yearly once) & bacteriological parameters (yearly

twice), to build confidence on water being supplied, each district to have at least one NABL accredited lab, each Each Water Treatment Plant to have an in-house lab or linkage to NABL accredited lab, and ensure robust chlorination system.

In this context, a committee was constituted to develop a roadmap for water quality monitoring & surveillance and result dissemination to stake-holders, including rural households. Incorporating insights from the recommendations provided by the constituted committee and incorporating inputs from the States/UTs gathered during the "National Symposium on Safe Water and Disinfection/ Chlorination Initiatives" held on 02nd February 2024 at SPM NIWAS, Kolkata, and "National Conference on Jal Jeevan Mission & Swachh Bharat Mission" held on 16-17th February 2024 at Lucknow, and incorporating modifications in accordance with the latest edition of "The Manual on Water Supply and Treatment Systems (Drink from Tap), Part B- Operation & Maintenance, published by CPHEEO in March 2024" with some customization, this concise handbook has been prepared.

The second Chapter of the concise handbook comprises water quality testing methodology such as identifying sample collection points, testing parameters, testing frequency and number of samples, sample testing turnaround time, and remedial actions for contamination. This chapter also talks about lab management of water testing laboratories managed by RWS/ PHED departments.

The third Chapter emphasizes the protocol for result dissemination to stakeholders, institutional framework for ensuring the sustained delivery of safe drinking water through piped systems, roles, and responsibilities of Gram Panchayats and/ or it's sub-committee, RWS/PHED, DWSM, and State Water and Sanitation Mission (SWSM).

The handbook concludes with the fourth Chapter where additional recommendations on enabling environment, such as additional testing parameters, deployment of portable digital water quality testing devices, and chlorination/ disinfection units, etc. are provided.

The purpose of this document is to establish fundamental standards and offer a practical guide for field practitioners, ensuring a comprehensive understanding of the efforts necessary for an assured and safe water supply. It is anticipated that the State Water and Sanitation Mission (SWSM) will carefully consider this document and subsequently develop a customized, concise handbook for field practitioners based on the provided guidance. All State/ UT shall use this document along with the existing Drinking Water Quality Monitoring & Surveillance Framework and CPHEEO Guidelines. It is necessary to provide the disclaimer that the parameters mentioned in this handbook should be used for framing the water quality monitoring & surveillance activities and not used as criteria of acceptance of a water source while deciding the source for PWS.

Chapter 2:
Protocol for Water Quality Testing

Introduction

It is prescribed in Operational Guidelines for the implementation of Jal Jeevan Mission that the water source for a PWS should be tested for various physical, chemical, & bacteriological parameters and scheme should be designed to include Water Treatment Plant (WTP) if required. In order to ensure that the water from the source/ WTP remains safe during the period of operation, the monitoring protocol ensures timely detection of the contamination and taking informed decisions. The Manual on Water Supply and Treatment Systems (Drink from Tap), Part B- Operation & Maintenance, published by CPHEEO in March 2024, underscores the need to test sources and delivery points for chemical and bacteriological parameters.

It is also envisaged that based on the geogenic situation and contamination found in a specific region, SWSM should carefully consider and declare the list of parameters that should be included in the water quality monitoring & surveillance activities of PWS for the rural areas.

In this chapter, the standard protocol regarding locations of samples, parameters to test, frequency of testing and number of samples to be collected is discussed. It is emphasized that the samples should be taken both at source and at the delivery point (household tap). This chapter also provides standards for the turnaround time for sample testing and remedial actions to be taken in case of contamination.

2.1 Testing of Water Sources

Surface water (e.g., rivers and reservoirs) and groundwater are the primary drinking water sources. Natural contaminants derived from the native rocks/ minerals through which water traverses and micro-organisms and chemicals contributed by anthropogenic sources are present in water at variable concentrations.

For the sampling of surface and groundwater sources, samples should be taken at regular intervals to ensure no significant quality changes occur between sampling times. Streams are continually subjected to diverse forces and environmental changes, resulting in variations in chemical water quality.

2.1.1 Frequency and Parameters for testing of surface water source

Surface water sources include different water bodies such as rivers, lakes/ponds, springs, tanks, reservoirs, and sea water. In the case of surface water, the water sample should be collected and tested as mentioned in Table 2.1.

2.1.2 Frequency and Parameters for testing of ground water source

Most schemes based on ground water do not have water treatment plants or they have water treatment plants to deal with the geogenic contamination. The sample in case of ground water-based schemes should be taken at a convenient location after the outlet of the storage structure/ ESR from where the water is going into the distribution network. Raw water samples should be taken for the purposes of investigation of causes of failure whenever the sample at the outlet is found to be not conforming to the norms. It is recommended to collect ground water samples and do testing (including sources that are created only for schools and Anganwadi centers) as prescribed in Table 2.2.

Table 2.1 Frequencies and parameters for analysis of surface water sources

Type of Water source	Location	Parameters	Frequency
Surface Water Rivers and Lake/Pond/Springs or any other surface water body	The location of sample collection should be the intake point/ jack well.	**Chemical parameter:** Colour, Odour, pH, Turbidity, Total Dissolved Solid (TDS), Total Hardness, Total Alkalinity. **Nutrients:** Nitrate. **Demand Parameters: To be decided by the SWSM.** **Major ions:** Sulphate, Chloride. **Other inorganic:** To be decided by the SWSM. **Pesticides:** To be decided by the SWSM. **Other contaminants:** Test should be done as per the contamination found in surface water such as Arsenic, Fluoride, Iron etc. (to be decided by the SWSM)	Frequency: **a)** 4 times a year. **b)** At equal time intervals. **c)** The date of sample should be approximately same for a particular source so that data can be compared.

Table 2.2: Frequencies and parameters for analysis of groundwater sources and storage structures

Type of Water source	Location	Parameters	Frequency
Ground water	Sample should be taken at the outlet of ground water source, in case of direct pumping from source.	**Chemical parameter:** pH, Turbidity, Total Dissolved Solid, Total Hardness, Total Alkalinity, Nitrate, Sulphate, Chloride **Region specific:** To be decided by the SWSM. Note: Apart from the above-mentioned parameters SWSM can add other organic and inorganic contaminants	**At least twice per year** (Interval should be 6-months apart from first sampling).
Ground water/ Surface water	Sample should be taken at the suitable location at the outlet of ESR/GLSR, before distribution	**Chemical parameter:** pH, Turbidity, Total Dissolved Solid, Total Hardness, Total Alkalinity, Nitrate, Sulphate, Chloride **Region specific:** To be decided by the SWSM **Bacteriological Parameter:** Faecal coliforms/Thermotolerant coliforms, Total coliforms. Note: Apart from the above-mentioned parameters SWSM can add other organic and inorganic contaminants	Chemical & bacteriological Parameters: **At least twice per year** (Interval should be 6-months apart from first sampling) **FRC** At least once per day if chlorination is practiced.

2.1.3 Frequency and parameters for testing both surface and ground water at WTPs

For surface water sources, water treatment involves aeration, coagulation, flocculation, sedimentation, filtration, and disinfection. The ground water source is presumed to be protected, and a conventional water treatment plant is provided to remove naturally occurring contaminants. A specific treatment is essential if a geogenic contaminant is present in water. Groundwater requires less extensive treatment than surface water. Water treatment for geogenic contaminants can be categorized based on treatment processes such as filtration, electrocoagulation, adsorption, etc. In case geogenic contaminants are not present in groundwater, it requires only disinfection as treatment before delivery.

The minimum frequency of key water quality parameters for both surface & ground water at the inlet and outlet of Water Treatment Plants (WTPs) as presented in Table 2.3.

Table 2.3: Frequency and parameters for testing both surface and ground water at WTPs

Water source	Location	Parameters	Frequency
Surface water source: Rivers/ Lakes/ Ponds/ Reservoirs/ Spring Water and Ground water	At inlet/ outlet point	**Chemical:** pH, Turbidity, Total Dissolved Solid, Total Hardness, Total Alkalinity, Nitrate, Chloride, and Sulphate.	At least once per day
	At outlet point	**Bacteriological: F**aecal coliforms/ Thermotolerant coliforms, and Total coliforms.	At least once per week on a particular day
	At outlet point	Free residual chlorine (at the outlet before distribution) if chlorination is practiced.	At least once per day
	At inlet/ outlet point	**Metals:** Aluminium if PAC or Alumina is used as coagulant. Other region-specific parameters such as Arsenic, Fluoride, if any (to be decided by the SWSM)	Once in a month

It is imperative for every Water Treatment Plant to either establish an in-house laboratory that is either recognized/ accredited by NABL. To maintain WTP labs, the operators must maintain electronic records of sample collection times, testing procedures, laboratory results of parameters tested, contamination reported, and remedial actions taken at the water treatment plant. This documentation may serve as a crucial reference for future considerations and audits. In-house laboratories must have a minimum facility to test basic parameters like pH, Turbidity, Total Hardness, Total Alkalinity, Nitrate, Chloride, Sulphate, Free Residual Chlorine (if chlorination is done), and Total Dissolved Solids. All such laboratories must be onboarded in JJM-WQMIS, and regular reporting should be done.

2.2 Testing water samples from Delivery points (Household level/ Schools and Anganwadi Centers (AWCs):

Each village is required to test a minimum of two samples per month of households (FHTC). The locations and frequency of key water quality parameters for testing piped water supply are presented in Table 2.4.

To ensure the quality of drinking water being supplied to the schools, including residential schools and AWCs, it is essential to test a minimum of one sample per month from the drinking water tap of each School, especially the residential schools and AWCs. The frequency of key water quality parameters for piped water supply is presented in Table 2.5.

Table 2.4: Frequencies and parameters for analysis of water at Village/ Household level

Source	Location	Parameters	Frequency
Gram Panchayat and/ or it's sub-committee	Preferably one of the nearest (first 10 household) delivery points and one of the farthest (last 10 household) delivery points in the village	**Chemical:** Turbidity, Free Residual Chlorine (FRC) in case of chlorination is done. **Bacteriological:** Fecal coliforms/ Thermotolerant coliforms, Total coliforms, if chlorination is not done.	Minimum two samples per month
RWS/ PHE Department	Location to be decided by RWS/ PHED in places where chances of bacterial contamination is high	**Bacteriological:** Faecal coliforms/ Thermotolerant coliforms, and Total coliforms.	Minimum two samples per month

Table 2.5: Frequency and parameters for testing in all Schools and AWCs

Source	Location	Parameters	Frequency
Piped Water	Schools including residential schools (drinking water tap or mid-day meal kitchen)	**Chemical:** Turbidity, Free Residual Chlorine (FRC) in case of chlorination is done. **Bacteriological:** Fecal coliforms/ Thermotolerant coliforms, Total coliforms (if FRC absent)	Minimum one sample per month
	AWCs (drinking water tap or mid-day meal kitchen)	**Chemical:** Turbidity, Free Residual Chlorine (FRC) in case of chlorination is done. **Bacteriological:** Fecal coliforms/ Thermotolerant coliforms, Total coliforms (if FRC absent)	Minimum one sample per month

It is recommended to test turbidity and free residual chlorine (FRC) in water at the points prescribed in the above Tables 2.4 & 2.5 using Field Test Kits (FTKs). If the FRC is found to be zero or the result is not as per the prescribed BIS 10500 limit, then the sample must be sent to the laboratory for testing of bacterial (Total Coliform & E. Coli or Thermo-tolerant Coliform) contamination.

In addition to the above, SWSM may decide the other parameters, frequency, number of samples to test at household level and for non-PWS source using FTKs.

2.3 Sanitary Inspection

In addition to the surveillance carried out at the household level by the Gram Panchayat and/ or it's sub-committee, it is necessary for the RWS/ PHE Department to conduct an annual sanitary survey in each village to find out locations with high risk of contamination and take actions. This survey should involve a thorough field inspection of critical areas with high risk of contamination to drinking water, including water sources, distribution network, and water logging sites in the village. The sample should be taken from the delivery point (FHTC) that has the highest risk of contamination for bacteriological testing in the presence of the community.

The collected samples should be tested for bacteriological contamination in a designated laboratory, targeting contaminants such as Total Coliform and E. coli. The report should be immediately shared with the Gram Panchayat and/ or it's sub-committee & RWS/ PHED to take

corrective measures such as repairing leakage or correcting the dosing of chlorine/ disinfectant. This will instil a sense of confidence for drinking from tap.

2.4 Protocol for Sample Collection:

A dedicated tap must be provided at the appropriate location for sample collection. The assigned sample collector should follow standardized protocols for sample collection, including proper sterilization of sampling bottles, equipment, and sample preservation methods as mentioned by the Bureau of Indian Standards, i.e., IS-3025/1622, or Standard Methods for the Examination of Water & Wastewater (APHA Methods–Latest Edition).

Briefly, to collect a sample from the tap, first flame the tap (in the case of plastic tap, apply alcohol or spirit, preferably rectified, and allow it to dry). The tap shall be opened fully, and the water allowed to run for **two to three minutes** or for a sufficient time to permit clearing of the service line. The flow from the tap shall then be restricted to permit filling the bottle without splashing. Leaking taps that allow water to flow over the outside of the tap should be avoided as sampling points.

When the sample is to be collected directly from a stream, river, lake, reservoir, spring, or a shallow well, it shall be representative of the water that will be taken for supply to the consumers. Hence a sample shall not be taken too far from a point of draw-off or too close. Areas of relative stagnation in a stream should be avoided. Sample from a river, stream, lake, or a reservoir, sample by holding the bottle in the hand near its base and plunging it neck downward, below the surface. The bottle shall then be turned until the neck points slightly upward, the mouth being directed against the current. If no current exists, as in a reservoir, a current shall be artificially created by pushing the bottle horizontally forward in a direction away from the hand. If it is not possible to collect samples in this way, a weight may be attached to the base of the bottle which can then be lowered into the water.

2.5 Turnaround Time of testing:

The turnaround time for laboratory testing is the period from when the sample(s) are received at the laboratory to the time when reports are finalized. It is reasonably expected that the turnaround time for sample testing can be T+1 day (48 hrs) for chemical and T+2 day (72 hrs) for bacteriological parameters. In case of contamination found in the sample, retesting must be done within 48-72 hrs. It is also recommended to expedite testing in emergency situations or if initial results suggest potential health risks to the community.

2.6 Remedial Action:

It is suggested to develop a protocol for responding to identified contamination or quality issues. This includes the immediate closure of chemically contaminated water sources, notifying the result to the relevant authorities and affected communities, providing safe drinking water as per JJM guidelines (at least 8-10 lpcd) through a safe source or through tankers immediately within 24 hrs till piped water supply is restored, implementing emergency treatment measures such as cleaning of OHTs, check pipe line leakage, etc. within 7 days, testing all basic and area-specific chemical as well as bacteriological parameters, and, if found safe, restore water supply from a safe source in case of chemical contaminants.

If a non-PWS source is discovered to be chemically contaminated, it must be immediately discontinued from use and painted with a 'RED' colour to signify it has chemical contamination and unsuitability for drinking purposes.

On the other hand, in case of bacterial contamination, immediate action (within 24 hrs) must be taken, which includes proper disinfection, intimate concern for authority and affected communities, and temporary arrangements to provide safe drinking water through tankers (8 -10 LPCD).

2.7 Lab management and NABL Accreditation:

The effective management of the laboratory plays a decisive role in maintaining high standards of water quality testing. It involves strategic planning, resource allocation, and ensuring adherence to established protocols. Robust lab management contributes to the reliability and credibility of the testing process.

It is expected that all the labs should take NABL accreditation for chemical as well as bacteriological

parameters. The care should be taken to see that all chemical parameters as listed by SWSM for a particular district are covered in accreditation process.

a) Enhancing the testing capability in the district:

To enhance testing capabilities, each district should aim to have at least one National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratory, covering both chemical and bacteriological parameters.

To expand testing capabilities, states should foster collaborations or establish Memorandums of Understanding (MoUs) with reputed agencies, including government bodies, private entities, NABL-accredited labs, colleges, universities, and other relevant organizations. The integration of laboratory details and test results into the JJM-WQMIS portal is essential for comprehensive monitoring. Furthermore, States should strategize for NABL accreditation for physical, chemical, and bacteriological parameters for all laboratories. In cases where collaborated or MoU laboratories have NABL accreditation for specific parameters, the accreditation process should focus only on the remaining parameters.

b) Monitoring chemical inventory for testing water quality:

Ensure the availability of Field Test Kits and reagents to the Gram Panchayat and/ or it's sub-committee or community. A system for monitoring the stock, expiration date, and tests done should be developed. The information should also be discussed at DWSM in their monthly meeting.

It is suggested to keep the record of raw water data as it can provide insights into how the water quality is changing over time over a long-term period. This may also help us relate to the changes at landscape level and take action to mitigate the undesirable changes. The date of sampling should be fixed for each WTP so that results over the year can be compared and conclusions can be drawn.

Chapter 3:
Institutional Framework for Roles and Responsibilities

The three C's of Water quality monitoring and surveillance

Communication, Coordination, and collaboration are the three C's for water quality monitoring & surveillance. Managing the water supply is a multi-disciplinary task. Communication, Coordination and Collaboration with various stakeholders are necessary to provide assurance of water service in the long term. The results of monitoring the water quality must be shared and discussed with stakeholders. With clear guidance available on the roles and responsibilities of various stakeholders, accountability can be ensured. This also helps in evidence-based decision-making to improve the water supply monitoring program. This chapter provides the institutional framework for communication, coordination, and collaboration to develop a water quality monitoring program with clear objectives, an institutional system of sharing the data, compilation of reports, discussion, and evaluation to improve the water quality monitoring program.

3.1 Role and responsibility of various institutions to assure water quality:

3.1.1 Role of SWSM

The drinking water quality monitoring & surveillance framework provides the responsibility of water quality monitoring & surveillance activities in the State/UTs to SWSM. The following specific work for SWSM is recommended for assuring safe water supply:

i.) The Executive Committee of the SWSM should finalize the parameters to be included in the water quality monitoring & surveillance activities, frequency of testing, location of testing, etc. as per guidance provided in Chapter 2. A concise handbook should be developed for each State/ UT after contextualizing this handbook for their States/ UTs.

ii.) The Chief Chemist of State level Laboratory should be nominated as a member of the Executive Committee of SWSM.

iii.) The Chief Chemist should present the Status of water quality report to SWSM along with salient points received from DWSM for taking guidance and refining the water quality monitoring & surveillance activities. The JJM-WQMIS may be used for preparing water quality report which has details of samples tested, details of samples found contaminated, and remedial action taken by the States/ UTs.

iv.) The representative from the health department should present the data on incidence of water borne disease to discuss the population with exposure to unsafe drinking water, assessing risk levels, and understanding the severity of associated disease burdens. For better coordination, effort should be made to have immediate sharing of outbreaks of water borne disease with water supply departments on a common dashboard.

v.) Additionally, comprehensive guidance and facilitation should be extended to laboratories at all levels, supported by policies and financial assistance and the provision of human resources for ensuring a concerted effort for safe and sustainable drinking water for all.

3.1.2 Role of DWSM:

The role of district administration is important to ensure the safe water supply. It is recommended that:

i.) A regular district level meeting must be held quarterly with a minimum agenda on water quality monitoring & surveillance activities.

ii.) The lab in-charge of the district level laboratory should prepare a report on water monitoring & surveillance activities and present it for discussion with DWSM. The district report should cover the following key points:

   a) Number of water samples tested in the last three months;

   b) Number of samples found contaminated for chemical and bacteriological parameters;

   c) What remedial measures have been taken against contaminated samples; and

   d) If remedial action is pending, then what are the reasons for the delay;

   e) Status and review of lab consumables, and availability of FTKs.

iii.) It is recommended that a representative from the Department of Health and Family Welfare and the lab in-charge from district level laboratories be a member of district level meetings. Information about the occurrence of waterborne disease must be shared in the meetings.

iv.) In case of a surge in waterborne diseases, Health officials should coordinate with Rural Water Supply Department/ Public Health Engineering Department (PHED) officials to broaden the water testing in affected areas and take necessary remedial action.

3.1.3 Role of Gram Panchayat and/ or it's sub-committee

i.) It is recommended that the information about the collection of water samples and results of testing in Labs must be shared with the Gram Panchayat and/ or it's sub-committee and the community.

ii.) The Gram Panchayat and/ or it's sub-committee should share the result of water quality testing through FTK/ Lab may by writing the results on public boards in each village (preferably near panchayat Bhawan) and should be updated by a sample collector/ Gram Panchayat and/ or it's sub-committee member.

iii.) The Gram Panchayat and/ or it's sub-committee should also maintain a register of water quality testing.

iv.) It must also be ensured that results are easily accessible to households getting tap water, if required.

v.) The Gram Panchayat and/or its sub-committee members should encourage water quality testing of water samples from their schools and AWCs for residual chlorine and turbidity by secondary, senior secondary, and higher senior secondary students. Additionally, the committee must ensure the availability of necessary FTKs in schools and Anganwadi for the testing process. The Students may also be engaged in monthly testing of water from FHTCs in the village and other locations.

vi.) NJJM should make efforts to communicate results via 'SMS' to the sample collector and Gram Panchayat and/ or it's sub-committee regarding confirmation of sample collection and results of the collected samples, whether it is safe or not, and the same information must be shared with Gram Panchayat and/ or it's sub-committee members.

3.3 Undertaking campaign to raise awareness about water quality testing:

a) School level campaign:

It is recommended that States involve students from senior and higher secondary schools to learn about the importance of water quality in a healthy life and encourage them to perform water quality testing,

preferably on '18th September' on the event of 'World Water Monitoring Day' to raise awareness.

b) State Level Campaign:

- It is recommended that a state-wide campaign emphasizing the importance of water quality and the consequences of using contaminated water for drinking purposes to raise community awareness must be taken every year during the season when there is a spike in water borne disease.

- It is recommended to carry out a campaign on regular cleaning of drinking water tanks inside the house premises to avoid contamination.

c) National Level Campaign:

At the national level, a challenge to design or idea to generate 'awareness about water quality even when water looks clean' with professional agencies and media institutes to select the best idea. The actual campaign can then be run using the selected idea by giving proper credit to students/ agency/ institute.

3.4 Training and capacity building of communities:

To mainstream the water quality and sustain the capacities regarding testing, understanding results, taking remedial action, periodic training sessions, and capacity building for Field Test Kit (FTK) users and interested individuals should be continued regularly.

3.5 Incentives:

Providing honorarium for the testing is an important issue that should be decided at the GP level. If there is no guidance available from the SWSM. The Gram panchayat can decide honorarium for the FTK users for providing testing services and sharing the results on the village information board. The incentives **shall be financed exclusively** from the amount of user charges collected by the Gram Panchayat and/ or its sub-committee.

Chapter 4:
Other Recommendations

In addition to the advice provided on water quality testing and the communication of results to various stakeholders, the Department of Drinking Water & Sanitation wishes to put forward further recommendations aimed at enhancing the monitoring of water quality in the states.

4.1 Procurement of Digital Water Quality testing portable devices

States/UTs are advised to plan for the procurement of portable water quality testing devices as an alternative to establishing new laboratories. The digital devices should have the capability to share data directly without any need for manual entry into the WQMIS database.

4.2 Deployment of Chlorination/ disinfection System

Maintaining water quality in piped systems requires effective disinfection. Chlorination, being both cost-effective and versatile, provides continual protection, ensures adherence to regulations, facilitates easy monitoring, and has a proven track record against waterborne diseases. This enhances the overall quality of the water. Therefore, it is advised that all states acquire chlorination systems. The detailed guideline for operation and maintenance of disinfection system including chlorination is provided in "The Manual on Water Supply and Treatment Systems (Drink from Tap), Part B- Operation & Maintenance, published by CPHEEO in March 2024". As a practical approach, the following procedure is described for fixing the chlorine dose.

Fixing chlorine dose:

To ensure effective chlorination without over-dosing or under-dosing, it is pertinent to understand the right chlorine dose to be injected at the source before water enters the distribution network. To fix the right dose, the following procedure may be adopted:

Identify critical points (mostly the farthest tail end households) in the distribution system which is most vulnerable for bacteriological contamination. Start injecting chlorine at source before water enters the distribution network with a minimal dose of 0.3 ppm, and after 30 minutes, observe free chlorine at identified critical points. If free chlorine at these critical points is zero or less than 0.2 ppm, increase the dose at source by a small increment of 0.1 ppm and again observe free chlorine at critical points after 30 minutes. Keep increasing chlorine dose at source till the time 0.2 ppm is maintained at critical points. The dose at source corresponding to 0.2 ppm at critical points may be fixed for chlorination.

If even after increasing the dose at source to 1.0 ppm, the free chlorine at critical points is zero or less than 0.2 ppm, an assessment of the distribution network should be carried out to ensure that there are no leakages causing the ingress of contaminated water.

4.3 Work decided in Chief Secretaries conference:

As decided in the Chief Secretaries conference, the Executive Committee of SWSM must work towards achieving the following decisions:

By September 2024

a) Ensure testing of sources and delivery points as per the water quality monitoring program decided.

b) Building confidence of people in water quality – JJM dashboard and State specific portal for sharing information about water quality.

By March 2025

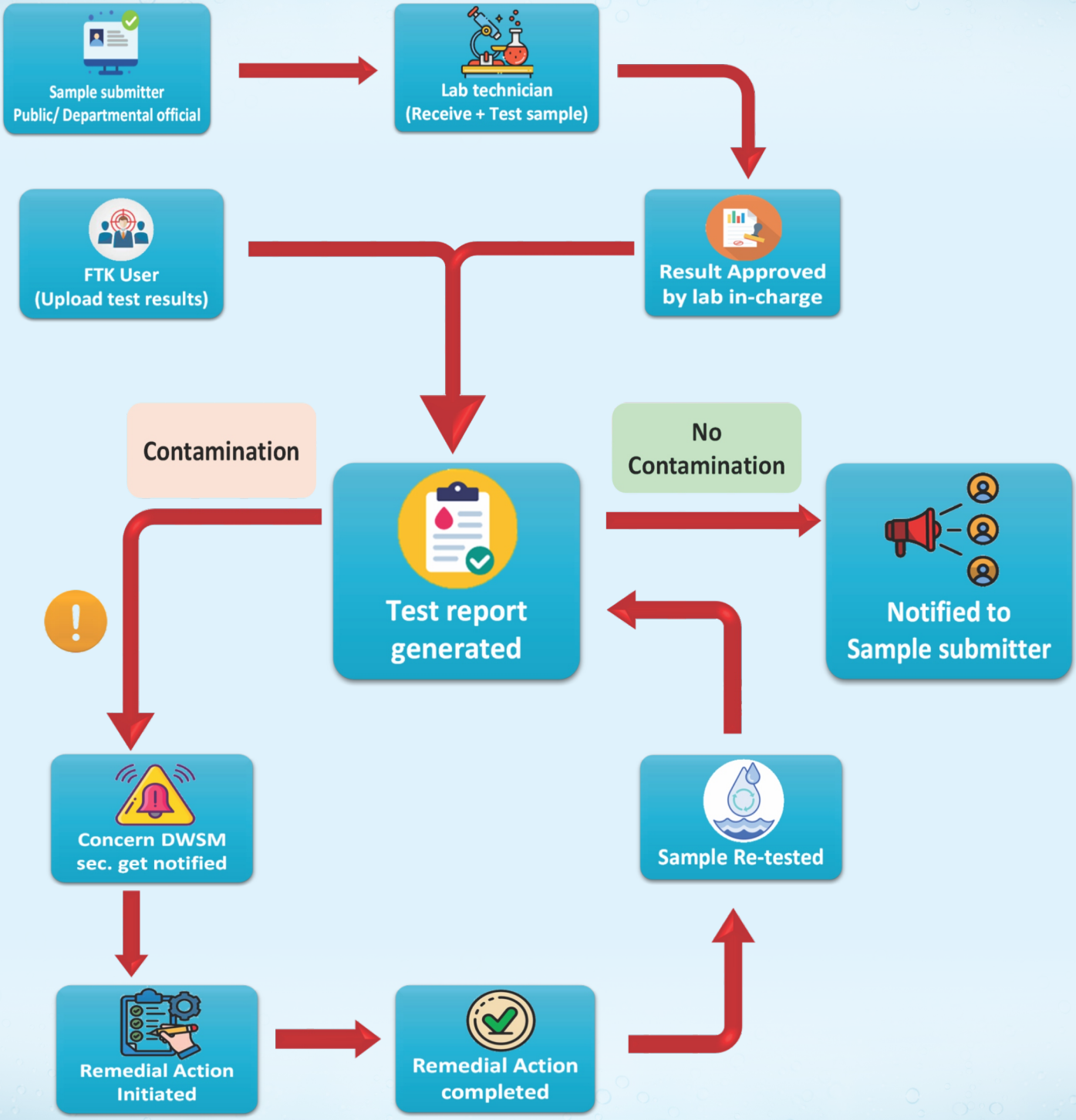
a) Each District to have at least one NABL accredited lab (both chemical and bacteriological parameters).

b) Each Water Treatment Plant to have in-house lab or linkage to NABL accredited lab.

March 2026

a) Ensure robust chlorination systems.

Remedial Action Module



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