T.M. Vijay Bhaskar, *I.A.S.*
Joint Secretary
टी.एम. विजय भास्कर,आई.ए.एस
संयुक्त सचिव

सत्यमेव जयते

भारत सरकार
पेयजल एवं स्वच्छता मंत्रालय
राजीव गांधी राष्ट्रीय पेयजल मिशन
Government of India
Ministry of Drinking Water and Sanitation
Rajiv Gandhi National Drinking Water Mission

D.O.No.W-11027/02/2010-WQ

Dated: 31st August, 2012

Dear Sir/ Madam,

This Ministry had constituted an Expert Committee headed by Director, NEERI, Nagpur which has prepared draft Uniform Drinking Water Quality Monitoring Protocol which give details of Laboratory infrastructure that may be required at various levels viz, State, district and sub-district laboratory.

2. Copy of the protocol is attached. Soft copy of this draft protocol is uploaded in the Ministry's website at www.ddws.gov.in. You are requested to direct the Chief Chemist of your State to examine this document and send comments/observations on the same to this Ministry on or before 17.09.2012 to enable us to finalize the same. If no comments/observations are received on or before this date, it will be presumed that the State has no objections on the draft protocol.

With regards,

Your sincerely,

TMVijayBhaskar

(T.M. Vijay Bhaskar)

To
Principal Secretaries/Secretaries,
In-charge of Rural Water Supply in all States/UTs

Draft- Final (16 Aug 2012)

Government of India

Ministry of Drinking Water and Sanitation

Uniform Drinking Water Quality Monitoring Protocol

1.0 Introduction

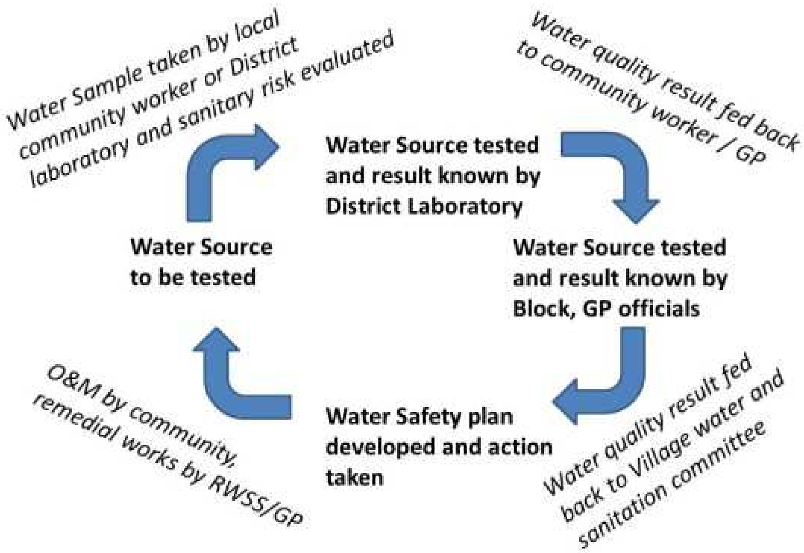
Drinking-water supply agencies are usually required to verify that the quality of water supplied to the consumers meets specific numerical standards. Yet, by the time, water quality analysis is completed and results indicate that the water is not safe to drink; thousands of people may have consumed that water putting them on risk. Moreover, even with frequent monitoring, the vast majority of water distributed to consumers will never be tested. **Therefore reliance on only end-of-pipe monitoring is inadequate to address the problem in totality.**

In above context, it is relevant to quote some sentences from *G*uidelines for Drinking-water Quality, Fourth Edition, published by the World Health Organization (WHO) which states that "*The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer.*" in 2011.

Such approaches are termed as Water Safety Plan (WSP).The purpose of a Water Safety Plan (WSP) is to consistently ensure the safety and acceptability of a drinking-water supply. This is done by eliminating/minimizing potential risk of contamination in raw water sources, water treatment plants, catchment, distribution network, storage, collection and handling. WSP is an essential tool in providing safe water to the people for all types of water supply systems i.e. large piped drinking water supplies, small community supplies, stand-alone household systems such as wells and also in rain harvesting systems. Water safety plan aims to minimize risks of contamination via sanitary surveillance and can be conjoined with water quality monitoring for ensuring safe water to the communities. This means that the water quality data is useful along with Water Safety Plans (WSP) for preventive and curative management measures. **Conjoined approach of using WSP with Water Quality**

Monitoring is an important tool which extends its application beyond the creation of water quality database. This can be achieved by shifting emphasis of drinking-water quality management to a holistic risk-based approach. Such an approach is called WSPs. **Wide spread implementation of WSPs can contribute to reducing the portion of the disease burden attributed to poor quality of drinking-water.**

Water quality monitoring resulting in identifying sources of contamination and implementation of corrective actions and subsequent verification comprises of components of water safety plan. In this case, utility of water quality monitoring is extended to provision of safe water to the community. A framework of water safety in rural context is prepared and presented below:



2.0 Drinking water quality monitoring

Bureau of Indian Standards (BIS), has specified drinking water quality standards in India to provide safe drinking water to the people. It is necessary that drinking water sources should be tested regularly to know whether water is meeting the prescribed standards for drinking or not and, if not, then, the extent of contamination/ unacceptability and the follow-up required. Apart from BIS specification for drinking water, there is one more guideline for water quality, brought out by Ministry of Water Resources, Government of India in 2005. This is known as Uniform Protocol for Water Quality Monitoring. A need has arisen to have a seperate uniform protocol for Drinking Water Quality Monitoring in view of increasing risk of geogenic and anthropogenic contamination. Drinking Water Quality Monitoring protocol describes specific requirements for monitoring drinking water quality with a view to ensure provision of safe drinking water to the consumers. In addition, this document also includes setting-up laboratories at State, District and Sub-district level and their quality control for regular testing and surveillance of drinking water sources. **The purpose of this document is to describe various elements of laboratory management practices to ensure that the data generated is comparable and scientifically correct and in a form that can then be used to result in interventions to improve water quality.** The protocol will be helpful at the grass-root level for the personnel working in various drinking water testing laboratories. In addition, it will provide guidance to the persons at different managerial levels to tackle water quality-affected habitations by adopting water safety approach.

There are about 45 lakh reported public drinking water sources in the country. Considering many unreported and/or private sources, the total number of drinking water sources in rural India may be likely to exceed 60 lakh. If these are to be tested twice in a year (for bacteriological analysis) and once a year (Pre-monsoon) for chemical analysis, 120 lakh water samples have to be tested in the country in a year. At present slightly more than 800 district water testing laboratories exist in the country, though many of them are still not fully functional. Even if all such laboratories are made fully functional and considering capacity of 3,000 samples to be tested in a year per laboratory, the number of sources that could be tested in a year would be 3,000x800 = 24,00,000 or 24 lakh samples could only be tested, less than 20% of the requirement. Therefore, under National Rural Drinking Water Programme (NRDWP), the provision for setting up new sub-district level laboratories has also been made to bridge the gap. This type of screening effect could bring down the overall load of sample testing in laboratories and provide access to “discrete” sampling apart from “regular sampling of drinking water sources. Alternatively representative sampling can be undertaken to identify broad communication issues and technical problems for large-scale follow-up. Further monitoring could be used to verify this. Further, the decentralized Water Quality Monitoring & Surveillance Programme started in the year 2005-06 envisages testing of all drinking water sources (both public and private) using simple field test kits and positively tested samples could be referred to District and Sub-district water testing laboratories. Sanitary inspection is also a part of this programme.

It is proposed in the protocol to apply concepts of water safety plan so as to utilize water quality data in continuously improving water quality. If water quality monitoring will indicate contaminated water source, an improvement plan will also be prepared and implemented. Follow-up water quality monitoring will also be carried out after implementation of improvement plan to determine efficacy of the plan in providing safe water to the community.

It is well established that microbial contamination imposes maximum acute disease burden in India though chemical contaminants like arsenic and fluoride are also having tangible chronic health effects in sporadic though numerous habitations in India. **It is, therefore, proposed that sanitary inspection will also be given due importance in establishing sanitary risk to the water sources.** This will also help in implementing corrective actions if sanitary risks are found high and water quality monitoring establishes microbial contamination.

2.1 Definition of drinking water quality

BIS has set specifications in its IS–10500 standards for drinking water. This standard shall be followed as per in the Uniform Drinking Water Quality Monitoring protocol. This standard has two limits i.e. desirable limits and maximum permissible or cause for rejection limits. If any parameter exceeds the cause for rejection limit, that water is considered as contaminated. Broadly speaking water is defined as contaminated if it is bacteriologically contaminated (presence of indicator bacteria particularly *E-coli*, viruses etc.) or chemical contamination exceeds maximum permissible limits (e.g. excess fluoride [>1.5mg/l], Salinity i.e., Total Dissolved Solids (TDS) [>2,000mg/l], dissolved iron [>1mg/l], arsenic [>0.05mg/l], nitrates [>45mg/l] etc.). In rural areas, more than 85% of drinking water sources are ground water based and in the short-term, chemical constituents in groundwater do not change much, therefore testing once in a year for chemical contaminants is adequate. **Testing for bacteriological contamination is suggested 4 times a year, once in every quarter. However, every year it should be carried out at least twice i.e. during pre-monsoon and post-monsoon seasons. If microbial contamination is detected in water, corrective action based on sanitary inspection need to be initiated immediately.**

In Japanese Encephalitis/ Acute Encephalitis Syndrome (JE/AES) and Acute Diarrhoeal Diseases (ADD) affected districts, sanitary inspections should be made mandatory once in a month by the VWSC/GP especially during monsoon and post monsoon seasons. Strict surveillance and remedial action by the Water Supply agency is also mandatory during this period.

It is highly desirable that all States/UTs supply drinking water with the quality constituents at least within the cause for rejection limits of IS-10500 and graduate steadily to supply drinking water within the desirable limits. For all new/existing piped water supply schemes, design requirements of water treatment plants has to take care of supplying drinking water with quality parameters within the "desirable" limits of IS-10500.

2.2 Sanitary Inspection

A sanitary inspection is an on-site inspection of a water supply to identify actual and potential source of contamination. The physical structure and operation of the system and external environmental factors (Such as latrine location) are evaluated. This information can be used to select appropriate remedial action to improve or protect the water supply.

Sanitary inspections should be carried out for all new sources of water before they are used for drinking water and on a regular basis. Inspections should be carried out by a suitably trained person using a simple, clear report form. **The sanitary inspection forms are given in Annexure-I.** These forms consist of a set of questions which have "yes" or "no" answers. The questions are structured so that the "yes" answers indicate that there is risk of contamination and "no" answers indicate that the particular is absent. Each "yes" answer scores one point and each "no" answer scores zero point. At the end of the inspection the points are added up, and the higher the total of identified risks, the greater the risk of contamination.

The results of sanitary inspections and the remedial actions that need to be taken to improve conditions should be discussed with the community. In small water supplies it is often possible for community members to carry out most of the inspections themselves using a standard form. The information gathered can then be sent to the sub-district, district or state level surveillance agency, which should also **undertake a minimum of two annual inspections along with microbial water quality monitoring to check the reliability of the information.**

3.0 Need to revise Uniform Protocol on Water Quality Monitoring Order, 2005

Vide notification dated 17/6/2005; the Ministry of Environment & Forests, Government of India has notified the Uniform Protocol on Water Quality Monitoring Order, 2005, which is applicable to all organizations and any other body monitoring surface and ground water quality. Though the drinking water source is either groundwater or surface water (including rain-water) sources, the quality of water may be different spatially following a variety of factors influencing it. Further, some of the pollution load indicators like DO, BOD, COD, etc. and agriculture quality water indicators like SAR, N, P, K, NH_3, etc. are not required for drinking water quality monitoring. Therefore, these were aptly not mentioned in the BIS standard for drinking water ie., IS-10500. Water of higher standards is required for drinking purposes, especially with respect to microbial quality. However, the existing Uniform Protocol on Water Quality Monitoring relies more on BOD and COD surrogate to biological and chemical contamination. Furthermore, in order to maintain bacteria free drinking water, there has to be certain concentration of residual chlorine, if chlorination is adopted as unit process for disinfection in the water treatment plants. This parameter is not monitored as per the Uniform Protocol on Water Quality Monitoring Order, 2005. All the afore-referred issues warrant specialized guidance on requirements for drinking water quality testing in the Country. Therefore, there is a need to evolve Uniform Drinking Water Quality Monitoring Protocol to have emphasis and relevance to drinking water quality and amend the Uniform Protocol on Water Quality Monitoring Order, 2005 with respect to the following requirements:

- Specific laboratory requirements at State, district and sub-district drinking water testing laboratories
- Frequency of testing of drinking water sources of important parameters
- Suggestive list of instrumentation, glassware, equipments, chemicals
- Simple messaging formats for VWSC, BRC, CRC, GP on risks assessments and follow-up corrective actions

- Awareness generation amongst the community not to consume water for cooking and drinking purposes from the contaminated sources.
- Corrective actions for chemical contaminants by identifying safe source and identifying suitable treatment technologies

All provisions as made under the Uniform Protocol on Water Quality Monitoring Order, 2005 shall be applicable for drinking water sources monitoring also. The State-level Water Quality Review Committee constituted as per the notification of WQAA shall monitor the action taken by the SPCB/CPCB on abatement of pollution of drinking water sources. The action taken report shall be submitted to the State Water and Sanitation Mission (SWSM) and Public Health Engineering Department (PHED) periodically under intimation to the Ministry of Drinking Water and Sanitation, Government of India.

4.0 Functions of a Water Quality Testing Laboratory

Well defined functions of a water-testing laboratory are to:

- Determine the water quality for drinking and domestic use. These can be classified into following activities:
    - Collection of water samples from the field and suitable preservation
    - Sanitary surveillance
    - Water sample storage and analysis
    - Data analysis
- Delineate areas of contamination (hotspots);
- Determine the risk of pollution from various sources
- Communication of results to the concerned engineer (preferably to Executive Engineer) for corrective actions
- Follow-up water quality monitoring after implementation of corrective actions particularly if source is bacteriologically contaminated

4.1 Functions of State Water Quality Monitoring Laboratory

It is proposed to set-up/upgrade **State level drinking water quality testing laboratory in each State which will have capability of analyzing a full range of physical, chemical, and**

microbiological parameters specific to drinking water quality. This laboratory shall be a **referral institute** to analyze specific or new/emerging water quality problems and not routine water quality analysis. It should also perform the duties of the **State Referral Institute** as mentioned in the guidelines of National Rural Drinking Water Programme. The state laboratories will also monitor performance of district and Sub district laboratories and ensure Quality Assurance-& Quality Control (QAQC) in District and sub-district laboratories. This will keep responsibility for quality assurance of testing while undertaking water quality surveillance and monitoring in a decentralized manner using field test kits at the grass roots level in the Gram Panchayats.

However, learnings from the field indicates that **field test kits** have their own problems and government supported laboratories need to be strengthened. However, **the use of field test kits and H2S vials cannot be ignored as they not only serve the purpose of initial screening of contamination but also is an effective tool for awareness generation amongst the community to consume only safe drinking water.** For this purpose, it will select/establish few baseline/reference stations in the state, based on hydro-geological characteristics and monitor the water quality in specific hotspots while strengthening community based water quality monitoring programme. Specific R&D interventions like creation of **water quality hotspots** using GIS platform shall also be taken-up by the State laboratory. Obviously, the instrumentation required at the **State laboratory shall be more sophisticated than other laboratories.** This will include analysis of heavy metals and toxic elements by advance spectrophotometric techniques, pesticides by gas chromatography/ HPLC, more specific bacteriological and virological examination, etc. This laboratory shall also co-ordinate with DAE-approved laboratories for monitoring radioactive elements such as uranium in drinking water. One of the core functions of the State Laboratory will be to strengthen district and sub-district laboratories. The State laboratory shall be headed by a senior level experienced Chief Water Analyst/Chief Chemist/ Chief Microbiologist and he / she shall report directly to the Engineer-in-Chief of the concerned Department.

4.2 Functions of District and Sub-district Laboratory

District and Sub-district laboratories shall undertake drinking water quality monitoring of the sources under their jurisdiction. These laboratories will analyze physico-chemical and microbiological parameters in drinking water sources as prescribed under IS-10500. District and Sub-district laboratories laboratories will be under administrative control of Assistant

Chemist. District and Sub-district laboratories will also provide a support service pertaining to water quality in remote areas using on-site or laboratory based analytical equipment. These laboratories will share all data to the relevant stakeholders in the State and also enable Gram Panchayats to undertake sanitary surveillance and verify these by testing their own drinking water sources and spread awareness about water quality in rural areas. **The district and sub-district laboratories shall share their data on microbiological testing of drinking water sources with the District and State Public Health Departments and also to converge with other laboratories established/ proposed under Food Security Act, etc.**

5.0 Requirements for Setting-up Water Quality Testing Laboratory

5.1 Water Quality Field Test Kit

All Gram Panchayats and water quality testing laboratories should use Water Quality Field Test Kits for primary investigation.

5.1.1 Multi-parameter Water Quality Field Test Kits

Multi-parameter Water Quality Field Test Kits is used for physico-chemical analysis. The kit offers quantitative and semi-quantitative results. Quantitative test includes total hardness, total alkalinity, and chloride tests. Semi-quantitative tests are used for remaining parameters using color comparison charts. This kit carry out 100 nos. of test for nine parameters listed below:

i. Turbidity by visual comparison method
ii. pH by pH strips colour comparison method
iii. Total Hardness by Titrimetric method
iv. Total Alkalinity by Titrimetric method
v. Chloride by Titrimetric method
vi. Residual Chlorine by visual colour comparison method
vii. Iron by visual colour comparison method
viii. Nitrate by visual colour comparison method
ix. Fluoride by visual colour comparison method

A separate arsenic field test kit is also available in the market, which could be used in States where arsenic is detected in drinking water sources.

The colour comparator is quick and easy to use. The kit is used in conjunction with tablet reagents and colour charts to test different parameters. Just add a tablet reagent to the test sample, place the tube in the comparator and match the colour against the appropriate colour disc. The kits are portable, easy to carry anywhere, easy to operate, simple in use, does not require any kind of energy or power. So simple in use that even a layman can also use it comfortably and not require any technical support. The kit provides a user's manual with simple step-by-step instructions on how to conduct the water quality tests. This makes it easy for people to use and does not require a high level of training.

5.1.2 Bacteriological Test Vials

A simple bacteriological test vials indicate the presence/ absence of pathogens in water samples. This is simple reliable field test kit to detect fecal contamination in drinking water. The principle of test is similar to that of Presumptive Coliform Test. It does not attempt to find pathogens but only shows the indicator for the presence of pathogens. The test kit can be used for any water irrespective of its source, including the chlorinated water. The test can detect very low bacterial contamination with high specificity and sensitivity. The advantage of the method is its simplicity, low cost and ability to be performed in the absence of a typical microbiology laboratory or field laboratory test kit tubes or other containers holding the test material to be used in the field by minimally trained personnel.

The latest intervention is the availability of reusable bacterial vials, which could also be used, so as to reduce dumping of plastic/ glass bottles.

5.2 Water Quality Analysis Requirements

5.2.1 Parameters to be monitored

Parameters to be monitored at State, District and Sub-district laboratories are provided in Annexure-II and methods, instruments and chemicals required for these parameters are provided in Annexure-III. However, basic minimum parameters that need to be tested for drinking water quality will be pH, turbidity, TDS, calcium and magnesium hardness, alkalinity, fluoride, chloride, sulphate, nitrate, arsenic, dissolved iron, total coliforms and E-coli. For establishing a baseline status in the country, it is suggested that all States conduct analysis once in pre-monsoon and post-monsoon seasons for all the parameters as suggested in Annexure-II and subsequently monitor those parameters which are found to be present or the concentrations nearing the desirable limits.

5.2.2 Protocol for Sampling

There are many important factors for accurate analysis of the sample. These factors include proper collection of the samples, method of storage and protocol for microbial and chemical analysis, data analysis and interpretation. If any of these steps are carried out with insufficient care, the result will be inaccurate and, the entire operation will result in waste of energy, time and money. The general guidelines and precautions to be followed are given here. However, Bureau of Indian Standards i.e., IS-3025/2488/1622 and/or Standard Methods for the Examination of Water & Wastewater- latest edition [Published jointly by American Public Health Association (APHA), American Water Works Association (AWAA) and Water Environment Federation (WEF)] may be referred for detailed information on sampling and testing procedures.

5.2.1 General Guidelines and Precautions for drinking water sampling

- Collect a sample that conforms to the requirements of the sampling programme and handle it carefully so that it does not deteriorate or get contaminated during its transport to the laboratory. Before filling the container rinse it two or three times with the water being collected. Representative samples of some sources can be obtained only be making composites of samples collected over a period of time or at a number of different sampling points.

- While collecting a sample from the distribution system, flush lines adequately, taking into consideration the diameter and length of the pipe to be flushed and the velocity of flow.

- Collect samples from tube-wells only after sufficient pumping to ensure that the sample represents the ground water source.

- ❖ When samples are to be collected from a river or stream, analytical results may vary with depth, flow, distance from the shore and from one shore to the other. If equipments are available for collection of "integrated" sample from top to be bottom in the middle of the stream and composite the sample according to the flow, Grab or catch sample should be collected in the middle of the stream and at mid depth.

- ❖ Make detailed record of every sample collected and identify each contained by attaching a tag or label. Record information like date, time and exact location, weather condition, stream-flow etc.

5.2.2 Quality of Sample to be Collected

Normally a 2-litre sample would be sufficient for most physical and chemical tests. Sample for chemical & bacteriological analysis should be collected separately as the method of sampling and preservation is completely different from each other. The interval between collection and analysis of the sample should be shortest possible.

5.2.3 Analytical Quality Control

The basic objective of a water analysis laboratory is to produce accurate data describing the physical-chemical characteristics of water samples under study. Quality assurance is the total programme for assuring the reliability of analytical data. Items discussed in this document can all be considered as contributing to the overall programme of quality assurance. Another essential component of a quality assurance is analytical quality control which refers to the routine application of procedures for controlling the measurement process.

Internal quality control or statistical quality control is the most important component of any laboratory quality control programme. Experience indicates that 10-20% of the resources of a laboratory should be devoted to such work. Suitable approaches to internal quality control should be followed.

External quality control is best applied after incorporating internal quality control practices in the laboratory, and consists in the periodic analysis of reference samples. These reference samples may not be different from the control samples which the laboratory has been preparing for its own.

5.2.3 Annual Analysis load

For State level: About 2000 samples/year including specialized analysis of metals, pesticides, uranium, etc.

For District & Sub-district level: About 3000 samples/year

The targeted number of water samples is indicative in nature and shall depend upon the local conditions.

5.2.4 Frequency of testing

State level Laboratory

Discrete monitoring for areas with changing local hydro-geology

- Discrete monitoring for heavy metals, pesticides and specific contaminants
- Analysis/Evaluation/ Impact assessment of specific contaminants
- Virological examination of drinking water sources of such areas where contamination is likely (Peri-urban/ rural area having surface water based drinking water sources and possibility of untreated/ partially treated sewage discharged from urban areas is like to pollute) and linked to key follow-up actions

District and Sub-district Laboratory

- 2 times/year for water quality hot spot areas. Monitoring is to be intensified, if following criteria are met:
  - sanitary risk exceeds 3/10 and/or H_2S vial result is positive
  - waterborne diseases are reported by community using source water
  - Source is rejected by community due to taste, odour, colour etc

  - Source water is reported to be contaminated in the last monitoring or exceeded 0.8 times the standard
  - To verify efficacy of the water quality improvement interventions undertaken

- **2 times per year/source for bacteriological parameters and once a year for chemical parameters with positive detects triggering clear pre-defined interventions. However, for establishing the base line status, all parameters as mentioned in Annexure-II shall be analysed once during Pre-monsoon and Post-monsoon season duly registering the GPS co-ordinates and depth of ground water.**
- Discrete monitoring during calamities

5.2.5 Recording and reporting of data

The laboratories shall keep records of submitted samples and completed analysis in a manner that provides for easy data retrieval ability. All laboratory data sheets shall be dated and signed by the concerned Chemist and the Head of the Laboratory or his designee.

- It is highly desirable to generate water sampling reports through a **standardized format** which can also be hyperlinked easily to the IMIS through the internet.
- All laboratories (i.e. State level laboratory, District laboratories & Sub-district laboratories in each State) shall report the analysis periodically into **Integrated Management Information System (IMIS)** of Ministry of Drinking Water and Sanitation.
- The database shall have a feature of generating **special reports** for assessing the performance of laboratory periodically.
- Reporting should also include action taken if source is found contaminated. Follow-up monitoring results should also be included.
- State laboratory may also consider to undertake **regular technical evaluation checks / audits** of District laboratories – e.g. quality of analysis, repeatability statistics etc., to maintain a quality assurance oversight in the data as confidence in the quality of the data is key to the effectiveness and reputation of the water quality monitoring and surveillance systems.

5.3 Infrastructure requirements

The suggestive list of minimum infrastructure requirements for setting-up laboratory is provided in Annexure-IV. *(These are only suggestive in nature and the State Government may decide appropriate infrastructure facility in laboratories to carry-out drinking water analysis and for getting accreditation from NABL/ISO).*

5.3.1 Specification for laboratory and other infrastructural requirements

(These are only suggestive in nature anticipating basic requirements needed for NABL accreditation)

i) Physical facility: The design of the laboratory shall depend on the volume of analytical work required to be done. In deciding requirement of space, due attention shall be given to space needed for permanently installed equipment and smooth performance of analytical work by the laboratory personnel. While constructing the new laboratory, or modifications of the existing laboratory, necessary provision for future expansion should also be kept in view.

ii) Location of laboratory: The location should be such that adequate natural lighting and ventilation should be available. In-vitro UV laminar-flow chamber shall be used for testing microbiological parameters and for preparation of organic media. The location of all laboratories shall be given wide publicity so that the common man can understand where water quality analysis could be done. A standard design of laboratories may be devised in all districts so that people can recognize them easily. The location and contact details of all laboratories within a district should be prominently displayed by sign boards, posters, wall paintings etc so that the local community are aware of such facility.

iii) Renovation/Upgrading existing laboratories and establishment of new laboratories: NRDWP funds (Programme or Support) shall not be used for construction of the building for the laboratories. However, renovation/refurbishment cost of existing building (if required) for laboratories is allowed from NRDWP-3% WQMS funds. Wherever laboratory is established in private premises, the payment for rent/electricity/ water charges can be booked under NRDWP-3 % WQMS funds.

iv) Floor space: Floor space for laboratory shall be as mentioned above. Use of smooth tiles on floors should be avoided.

v) Walls of laboratory: The walls should be finished smooth in light colour and should have sufficient thickness and provision for built in cabinets. A Standard Do's and Don'ts chart should be placed in a manner it is clearly visible.

vi) Lighting: All work rooms including passages in the laboratory should be well lighted. There should be sufficient number of windows provided in the laboratory area (except microbiological lab) with transparent window glasses. Translucent roofs are now available to facilitate adequate illumination during daytime. This may be thought of, while planning the roof of the laboratory. Adequate provision of artificial lighting should be provided to supplement natural light. Additional plug points should be provided for extra lighting if needed.

vii) Fuel gas supply: Provision for supply of fuel gas and gas burners at suitable intervals on the work benches shall be provided wherever required.

viii) Balance room: The digital balance shall be placed on a separate table in a cubicle or enclosure in the laboratory.

ix) Media preparation and sterilization room: For bacteriological analysis, additional facilities for media preparation, centrifuging, sterilization by autoclaving etc. are mandatory and separate enclosure for accommodating these facilities need to be provided.

x) First Aid Box: All laboratories must ensure that they have adequately equipped first aid box with proper medicines/bandages/ eye wash. The first aid box should be placed at such a place in laboratory where it should be easily accessible to all staff members.

xi) Library: Each State Laboratory shall have a computerized library facility having all Standard Operating Procedures (SOPs) and books/journals/periodicals related to drinking water quality, rainwater harvesting and artificial recharge. Adequate number of IEC material on consumption of safe drinking water, personal and environmental hygiene may be kept so that these could be distributed to the rural people who visit the laboratories.

xii) Accreditation: Laboratories at all levels (i.e. State, District and Sub district) shall strive for accreditation in a phased manner. **State level laboratories shall be given top priority for accreditation by NABL/ appropriate agency of Government of India, within two years of commissioning.** As previously mentioned, a means of continuously checking the quality of data produced by labs should be in place, including checking of records (including duplicate and blanks testing) and follow-up on samples testing positive for contamination.

5.3.2 Work tables and benches

Suitable laboratory furniture's shall be procured by State, District or Sub district laboratories as per local requirement and should be such that they can be easily maintained clean. Adequate provision should be kept for storing chemicals and reagents.

5.3.3 Instruments

Instruments required are provided in **Annexure-V**. (These are only suggestive in nature and any other addition/deletion with advancement in technology may be undertaken as may be deemed appropriate by the State Government)

5.3.4 Glassware

The list of glassware's required is provided in **Annexure-VI**. *The list is only indicative in nature. The approximate quantity of the glassware's mentioned hereunder is for 2 years period. This may vary with the routine parameters that have to be analyzed. Subsequent procurement could be based on actual glassware needs.*

5.3.5 Chemicals for State, District and Sub-district laboratories

The list of chemicals for State, District and Sub-district laboratories is provided in **Annexure-VII**. *The list is only indicative in nature. The approximate quantity/volume of the chemicals mentioned hereunder is 2 years. This may vary with the routine parameters that are intended for testing. Subsequent procurement could be based on actual chemical needs.*

The list is only indicative and any additional chemicals required, especially for State level laboratory may be procured. However, it is mandatory **to standardize procurement strategy**

by the States so that adequacy of chemicals is ensured at all times. Also States to should ensure that only AR grade chemicals are used for water quality testing.

5.4 Human Resources

Staff needs for an effective water quality assessment laboratory in water supply services vary a great deal and there is no reliable method of determining the number of staff necessary to serve a given population, or the number needed for taking a given quantity of samples in different types of water supply systems. To estimate needs in terms of human resources, the following factors have to be taken into account:

- Analytical parameters
- Schedule of on-site analysis, camp analysis and laboratory analysis
- Sample preservations
- Frequency of sampling
- Geomorphology of the area
- Demographic conditions
- Size and complexity of the supply system
- Distance of sampling points and water supply systems
- Condition of road and traffic
- Type of vehicle used
- Season and climate
- Sampling facilities
- Degree of training to the staff conducting surveillance

5.4.1 Staffing Pattern

Staffing pattern shall be based on State norms. A suggestive guideline for staff required for various levels of laboratories are as below:

State Level Water Testing Laboratory:

- ❖ Chief Chemist/Chief Water Analyst: 1
- ❖ Assistant Chemist/ Water Analyst : 3
- ❖ Microbiologist: 1
- ❖ Laboratory Assistant: 3

- Data Entry Operator: 2
- Lab Attendant: 2
- Sampling Assistants (contractual or task based field staff) : 2

District/Sub District Level Water Testing Laboratory:

- Assistant Chemist/Water Analyst : 1
- Microbiologist: 1
- Laboratory Assistant: 2
- Lab Attendant : 1
- Data entry operator : 1
- Sampling Assistants (contractual or task based field staff) : 2

These positions will be filled with regular or contractual personnel or services obtained from manpower agencies or fully outsourced to NGOs etc. **However, all States should ensure that at least one regular post of Water Analyst/Chemist is made available in each Water Testing Laboratory**. If the same is not available, States should consider immediately appointing one regular Chemist in each laboratory.

5.4.2 **Suggested minimum qualification for Laboratory Staff:**

- Chief Chemist/ Chief Water Analyst: Post Graduation in Chemistry.
- Assistant Chemist: Graduation in Science
- Microbiologist: Graduation in Science (with Biology) .
- Laboratory Assistant: Graduation in Science (Chemistry).
- Sampling Assistant: Higher Secondary in Science.
- Laboratory Attendant: Higher Secondary or at least X class
- Data entry operator : Any Higher Secondary Passed with skills in MS Office and Internet operations

5.4.2 Roles and responsibilities of laboratory personnel

District laboratory plays a pivotal role in ensuring adequate monitoring water quality and water safety in the entire rural water supply system. In addition to administering the field operational groups and providing leadership and overview for the quality system, the district laboratory team is responsible for allocating resources needed to ensure that the water quality monitoring is undertaken with an objective of undertaking corrective action in ensuring safe water provision to the community. The head of the district laboratory will be coordinating with Executive Engineer and interventions in improving water supply in the district will be based on the results received from the district laboratory. To maintain the quality system, Executive Engineer should support the staff by promoting team work, facilitating exchange of information from both inside and outside the field organization, and providing training and necessary resources to meet expectations of quality.

5.4.3 Specific roles and responsibilities of the district laboratory staff are described below. The titles shown are functional descriptions of the roles that various individuals play in discharging their duty rather than the particular title of any individual.

Assistant Chemist/Water Analyst/: Water Analyst/Assistant Chemist will be the Head of the District/Sub-district laboratory and will be reporting to SE/EE. He/she will provide laboratory-wide overview to ensure that the tasks assigned to the laboratory is properly followed. In addition, the Water Analyst / Assistant Chemist is responsible for ensuring that laboratory staff members recognize and understand their respective roles and have the requisite training needed to properly carry out their functions and responsibilities. He/she is also responsible for the following activities:

- Upkeep of the central repository of Water Quality Analysis Manual, Standard Operating Procedures(SOPs), and other related documentation
- Maintain equipment and ensure that chemicals/glassware/consumables are procured in time by ensuring quality
- Supervise and guide reporting staff on sampling, water quality analysis, data analysis, identification of standard corrective actions based on water quality analysis data
- Analyze sanitary surveillance data after selective field check
- Plan corrective actions in consultation with Executive Engineer and the Gram Panchayats (GPs) and ensure allocation of funds for corrective actions
- Compile details on water treatment technologies and corrective actions
- Recheck water quality data after corrective actions
- Data analysis and reporting water quality affected habitations
- Upload water quality data in IMIS

- Provide assistance to laboratory management and staff for solving water quality/safety related issues.

The Chief Chemist/Chief Water Analyst and Water Analyst/ Assistant Chemist shall necessarily be a Government Officer and his/her pay band may be decided by the concerned State Government.

The Water Analyst/ Assistant Chemist if outsourced, may be provided a monthly salary of Rs 15,000 to Rs 20,000 (at 2012 rates) depending upon the skills required for conducting chemical analysis like use of ICP, AAS, GC, Uranium Analyser. He/She may also be provided an honorarium of Rs 100 per sample if more than 250 samples are analyzed every month.

Microbiologist: Microbiologist will carry out the microbiological analysis of drinking water samples. She will ensure that Sampling Assistant is trained for the protocol of collecting, and transporting the samples to the laboratory. Microbiologist will also ensure that Microbiological laboratory is fumigated periodically and the sanctity of the microbiological laboratory is maintained. Microbiologist may be paid a monthly salary of Rs 10,000 to 15,000 (at 2012 rates). He/She may also be provided an honorarium of Rs 50 per sample if more than 250 samples are analyzed every month.

Laboratory Assistants: Laboratory Assistants will be responsible for preparing reagent solutions and in assisting Chemist and Microbiologist in carrying out analysis. He/She will be provided an honorarium of Rs 25 per sample if more than 250 samples are analyzed every month. Lab Assistant may be paid a monthly salary of Rs 8,000 to 10,000 (at 2012 rates).

Sampling Assistant (Field Staff): The individuals who provide specific knowledge, skills and expertise, and carryout the field and measurement activities involved in the data collection process. This includes the field sampling personnel, the members of the staff who transport, log-in, store or otherwise handle but do not analyze samples, and the analysts who prepare and analyze samples in the field. They are individually responsible for following the policies, methods and procedures as described in the Manual as it pertains to their roles and responsibilities and for adhering to the appropriate SOPs. Each member of the field staff is responsible for identifying and reporting any quality problems that he/she encounters to the irrespective team leader. The Sampling Assistants may be provided an honorarium of Rs 25-50 for every water sample collected apart from monthly salary of Rs 6,000 to Rs 8,000. He/She should be well trained by the State/District laboratory chemists. In order to collect and bring water samples to the laboratory, they may be provided with a suitable hired vehicle.

Laboratory Attendant: Laboratory Attendant would be an outsourced/contractual staff who would clean the glassware's and would help in maintaining the laboratory in clean condition. He would be paid a monthly honorarium of Rs 4,000 to Rs 6,000 per month.

Date Entry Operator: Data Entry Operator would be an outsourced/contractual staff who will ensure that all data as per IMIS formats are reported timely on IMIS of the website. He/She will keep record of all of the samples collected and analysed in laboratory on computer. He/She would be paid a monthly honorarium of Rs 6,000 to 8,000.

The above proposed salary pattern indicated are suggestive and the States could lower/higher them depending upon the local need and due justification thereof be recorded and approved in the State level Scheme Sanctioning Committee meeting.

5.4.4 Provision of outsourcing of laboratory staff : State may hire services of any agency for providing staff services for carrying out analysis of drinking water sources for chemical and bacteriological testing. States may also hire the services of NGOs (if they have good infrastructure and testing facilities of drinking water sources) for analysis of drinking water samples. All costs of outsourced/contractual staff for laboratories including mobility allowances as well as engagement of NGOs for analysis of drinking water samples is allowed under NRDWP (3 % WQM & S Funds).

5.4.4 Sampling of drinking water: Sampling may be done by Sampling Assistant. If they are not available, Staff working in District /Sub district laboratory should identify some local villagers /students and train them in sampling procedures for different type of parameters (chemical and bacteriological). After training, they may be allocated cluster of GP's to bring the samples in a planned manner. Laboratory staff should also ensure that the samplers who are assigned work of collecting samples are provided 1 Lt (acidified sample), 2 Lt. (non-acidified sample) and 250 mL (sterilized) bottles, ice boxes and necessary chemicals for addition in samples.

While taking samples from drinking water sources or consumers the samplers should take the signatures of the operator, GP member or household member in the register to verify genuineness of the sample.

5.4.5 Mobility Allowance for collection of samples

Sampling Assistants may also be provided a Mobility Allowance of Rs 500-1000 per month over and above the monthly salary. If the vehicle is not hired or not available, samples may be collected by trained local villagers and they may be paid monthly honorarium per sample as prescribed above.

6.0 Safety measures to be followed in Laboratory

6.1 Precautions with Hazardous Chemicals:

- All containers must be clearly labeled and read before opening. If dispensing into another container, put label along with warning.
- Minimal stocks not exceeding 500 ml of corrosive or flammable solvents only may be kept in work room. Keep rest of the volume/quantity in safe place.
- Glacial acetic acid must be regarded as a flammable solvent.
- Ether and low boiling point flammable liquids must not be kept in fridge.
- Large container of corrosive or flammable liquids should never be put on high shelves or where they can be knocked down or fall. Also, never put liquids that react violently together closely.
- Never carry bottles by neck alone. Open bottles with care.
- When diluting concentrated sulphuric acid or other strong acids, it should be added to water in heat resistant vessel. Gloves and safety glasses should be used at such times.
- Paint circles on shelves for keeping bottles in the right places.

6.2 Spillage of Hazardous Chemicals:

- If amount/volume of spillage is small, dilute with water or detergent. If amount is large, protective aprons, rubber gloves and boots should be worn and treatment carried out according to wall chart showing how to manage chemical spillage.
- Hydrochloric acid and sulphuric acid can be neutralized with anhydrous sodium carbonate then shovel into a plastic bucket which is subsequently diluted by water and run to waste.
- Ammonia solution, ethanol, methanol and formalin are best treated by diluting with water, collection and running to waste. Windows must be opened.
- Phenols must be diluted with at least 20 times the volume of tap water before draining.

6.3 Avoidance of Hazards of Equipment

- Only trained staff should operate the equipment.
- Operating instructions should be available for each instrument.
- Check the autoclave filled with water to correct level before loading.
- If fire breaks out, nearby electrical equipment should immediately be switched off and disconnected.
- Take care to avoid live wires.
- When not in use, switch off and withdraw plug from socket.
- Avoid use of multi-adaptors, if have to use it, must be fitted with fuses.

6.4 Using Fire extinguishers

- Water extinguishers are suitable for fires involving ordinary combustible materials e.g. wood, paper, textile, upholstery. Never use on electrical fires or liquids that will catch fire.
- Dry powder extinguishers or sand are suitable for liquids on fire, electrical fires and burning metals.

6.5 First Aid

- First Aid Chart should be mounted on a nearby wall in laboratory.
- First Aid box must be always equipped and should be accessible to Laboratory Staff. An emergency eye wash bottle with a bottle of sterilized water should be readily available.

- A Universal poison antidote is useful. Activated aluminum oxide or a tin of evaporated milk should be readily available. A tin opener and some waterproof dressing material should also be readily available.

6.6 Additional safety/hygiene requirements:

- Safety and precautions to be followed in laboratory must be displayed inside the laboratory.
- All laboratories (State, Districts and Sub-district) should follow uniform operational procedure for testing water. However, district/sub-district laboratory may also use field test kits for primary investigation.
- **BIS specifications (IS 10500-Drinking Water Specification, IS 3025 -Method of Sampling & Test-Physical & Chemical, IS 1622- Methods of Sampling & Microbiological examination of water) and APHA Manual should be made available in each laboratory. NRDWP Support fund may be used for procurement of these specifications.**
- Always take double volume of the sample required for testing and keep one part of sample preserved for at least 15 days.
- Date of preparation of reagent solutions and date of expiry for each solution prepared should be clearly mentioned on bottles wherein chemical solution is kept.
- Under no circumstances, sanctity of the laboratory should be disrupted. Unauthorized persons should not enter into laboratory. Any type of eating should not be allowed in laboratory space meant for analysis.
- A clean and well maintained toilet MUST be attached to the laboratory with hand washing facility and soap.
- Laboratory should also have AC fitted in it when significant number of testing is required to be carried-on.
- Personal hygiene is must for all staff of laboratory, especially for Microbiologist. All laboratory staff should wear gloves during preparation of solution and testing (requirement is parameter specific). Staff should be provided white lab coat/aprons which should be washed at regular interval.
- Drinking water samples should only be tested after proper calibration of the instruments.

7.0 Treatment Technology for Laboratory Wastewater

Wastewater from chemical laboratories is generally composed of organic and inorganic matter, and a wide range of chemicals and heavy metals, being one of the most difficult wastewaters for treating. If a chemical waste cannot be transported safely without treatment, it needs to be treated at its present site. If the chemical waste originates in a laboratory, it should be treated there. In some cases, on-site treatment has been performed under special permits issued by the regulatory agency.

A good safety program requires constant care in disposal of laboratory waste. Corrosive materials should never be poured down a sink or drain. These substances can corrode the drain pipe and/or trap. Corrosive acids should be poured down corrosion-resistant sinks and sewers using large quantities of water to dilute and flush the acid. Hazardous chemicals/substances must be disposed of by methods that comply with local environmental regulations. Confirm the local requirements before disposal.

Laboratories should maintain a comprehensive listing of wastewater discharges that includes sources and locations of the discharges, analytical or other data characterizing the nature and volume of the discharge. After careful consideration, management determines that limited drain disposal of nonhazardous substances is acceptable**. USEPA, 2000 provides following general guidelines:**

- Use drain disposal only if the drain system flows to a wastewater treatment plant and not into a septic tank system or a storm water sewer system that potentially flows directly into surface water.
- Make sure that the substances being disposed of are compatible with each other and with the piping system.
- Discharge only those compounds that are soluble in water (such as aqueous solutions), that are readily biodegradable, are low in toxicity, and contain no metals that can make the sludge toxic.

Laboratory wastewater neutralization is significant before discharge. Therefore, the discharge of weak corrosive solutions ($5.5<pH<12.0$) to the laboratory sinks in small quantities (less than one liter per hour) is permissible. Corrosive solutions with pH ranges ($2.0<pH<5.5$) and

$12.0<pH<12.5$) must be neutralized before sink/drain disposal. Corrosive solutions with pH ranges ($pH<2.0$) and ($pH>12.5$) at the conclusion of the lab process must be managed as hazardous waste.

The coagulation-flocculation (CF) process is a versatile method used either alone or combined with biological treatment, in order to remove suspended solids and organic matter as well as providing high color removal in wastewater. Likewise, coagulation followed by flocculation process is an effective way for removing high concentration of organic pollutants. **Ozonation** is one of the chemical processes in which the mechanism of ozone is used to transform harmful chemicals to less harmful compounds. It has been used for the disinfection, oxidation of inorganic and organic compounds, including taste, odor, color and particle removal. In this technology, the treatment is carried out in batch process. In this process pH is adjusted followed by ferric sulphate dose, stirring time is 2 minutes at 500 rpm and after settling of flocs, ozonation is carried out of supernatant water for 15 mins.

Annexure-I

1. Sanitary Inspection Form for Piped Water

I. Type of Facility PIPED WATER
1. General Information: Zone: Area:
2. Code Number
3. Date of Visit
4. Water samples taken? …….. Sample Nos. ………

II Specific Diagnostic Information for Assessment
(Please indicate at which sample sites the risk was identified) Risk Sample No
1. Do any tapstands leak? Y/N ………….
2. Does surface water collect around any tapstand? Y/N ………….
3. Is the area uphill of any tapstand eroded? Y/N ………….
4. Are pipes exposed close to any tapstand? Y/N ………….
5. Is human excreta on the ground within 10m of any tapstand? Y/N ………….
6. Is there a sewer within 30m of any tapstand? Y/N………….
7. Has there been discontinuity in the last 10 days at any tapstand?Y/N ………….
8. Are there signs of leaks in the mains pipes in the Parish? Y/N………….
9. Do the community report any pipe breaks in the last week?Y/N ………….
10. Is the main pipe exposed anywhere in the Parish? Y/N ………….
Total Score of Risks ..../10
Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III Results and Recommendations:
The following important points of risk were noted :(list nos. 1-10)
Signature of surveyor:
Comments:

2. Sanitary Inspection Form for Piped Water with Service Reservoir

I. Type of Facility PIPED WATER WITH SERVICERESERVOIR
1. General Information: Zone: Area:
2. Code Number:
3. Date of Visit:
4. Water samples taken? …….. Sample Nos. ………

II. Specific Diagnostic Information for Assessment
(please indicate at which sample sites the risk was identified) Risk Sample No
1. Do any standpipes leak at sample sites? Y/N ………….
2. Does water collect around any sample site? Y/N ………….
3. Is area uphill eroded at any sample site? Y/N …………..
4.Are pipes exposed close to any sample site? Y/N ………….
5. Is human excreta on ground within 10m of standpipe? Y/N ………….
6. Sewer or latrine within 30m of sample site? Y/N ………….
7. Has there been discontinuity within last 10 days at sample site? Y/N ………….
8. Are there signs of leaks in sampling area? Y/N ………….

9. Do users report pipe breaks in last week? Y/N ………….
10. Is the supply main exposed in sampling area? Y/N………….
11. Is the service reservoir cracked or leaking? Y/N ………….
12. Are the air vents or inspection cover insanitary? Y/N ………….
Total Score of Risks ..../12
Risk score: 10-12 = Very high; 8-10 = High; 5-7 = Medium; 2-4 = Low;
0-1 = Very Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-12)
Signature of surveyor:
Comments:

3. Sanitary Inspection Form for Hydrants and Tanker trucks

I. Type of Facility HYDRANTS AND TANKER TRUCKS
1. General Information: Zone: Area:
2. Code Number:
3. Date of Visit:
4.Is water samples taken? …….. Sample Nos. ………Thermotolerant Coliform Grade………

II. Specific Diagnostic Information for Assessment
Risk
1. Is the discharge pipe dirty? Y/N……..
2. Is the discharge water dirty/ smelly/ coloured? Y/N………
3. Is the delivery nozzle dirty or in poor condition? Y/N…………
4. Are there any leaks close to the riser pipe of the hydrant? Y/N………
5. Is the base of the riser piped for the hydrant sealed with a concrete apron?.Y/N………
6. Is the tanker ever used for transporting other liquids? Y/N…….
7. Is the inside of the tanker dirty? Y/N………..
8. Does the tanker fill through an inspection cover on the tanker? Y/N……..
9. Is there direct contact of hands of supplier with discharge water? Y/N……..
10. Does the tanker leak? Y/N………
Total Score of Risks …./10
Risk score: >8/10 = Very high; 6-8/10 = High; 4-7/10 = Intermediate;0-3/10 = Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos.1-10)
And the authority advised on remedial action
Signature of surveyor:
Comments:

4. Sanitary Inspection Form for Gravity-fed Piped Water

I. Type of Facility GRAVITY-FED PIPED WATER
1. General Information: System name:

2. Code Number
3. Date of Visit
4. Water samples taken? …….. Sample Nos. ………

II. Specific Diagnostic Information for Assessment
(please indicate at which sample sites the risk was identified) Risk Sample No
1. Does the pipe leak between the source and storage tank? Y/N………….
2. Is the storage tank cracked, damaged or leak? Y/N………….
3. Are the vents and covers on the tank damaged or open? Y/N………….
4. Do any tapstands leak? Y/N ………….
5. Does surface water collect around any tapstand? Y/N ………….
6. Is the area uphill of any tapstand eroded? Y/N ………….
7. Are pipes exposed close to any tapstand? Y/N ………….
8. Is human excreta on the ground within 10m of any tapstand?Y/N ………….
9. Has there been discontinuity n the last 10 days at any tapstand?Y/N ………….
10. Are there signs of leaks in the main supply pipe in the system?Y/N ………….
11. Do the community report any pipe breaks in the last week?Y/N ………….
12. Is the main supply pipe exposed anywhere in the system?Y/N ………….
Total Score of Risks …./12
Risk score: 10-12 = Very high; 8-10 = High; 5-7 = Medium; 2-4 = Low;0-1 = Very Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-12)
Signature of surveyor:
Comments:

5. Sanitary Inspection Form for Deep borehole with Mechanized Pumping

I. Type of Facility DEEP BOREHOLE WITH MECHANISEDPUMPING
1. General Information: Supply zone: Location:
2. Code Number:
3. Date of Visit:
4. Water sample taken? …….. Sample No. ……… FC/100ml ………..

II. Specific Diagnostic Information for Assessment Risk
1. Is there a latrine or sewer within 100m of pumphouse? Y/N……..
2. Is the nearest latrine unsewered? Y/N……….
3. Is there any source of other pollution within 50m? Y/N………
4. Is there an uncapped well within 100m? Y/N………
5. Is the drainage around pumphouse faulty? Y/N……..
6. Is the fencing damaged allowing animal entry? Y/N……….
7. Is the floor of the pumphouse permeable to water? Y/N……..
8. Does water forms pools in the pumphouse? Y/N……
9. Is the well seal insanitary? Y/N……..
Total Score of Risks …./9
Risk score: 7-9 = High; 3-6 = Medium; 0-2 = Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-9)
Signature of surveyor:
Comments:

6. Sanitary Inspection Form for Borehole with Hand pump

I. Type of Facility BOREHOLE WITH HANDPUMP
1. General Information: Zone: Location:
2. Code Number:
3. Date of Visit:
4. Water sample taken? …….. Sample No. ……… FC/100ml ………..

II. Specific Diagnostic Information for Assessment Risk
1. Is there a latrine within 10m of the borehole? Y/N…….
2. Is there a latrine uphill of the borehole? Y/N…….
3. Are there any other sources of pollution within 10m of borehole? Y/N………
(e.g. animal breeding, cultivation, roads, industry etc)
4. Is the drainage faulty allowing ponding within 2 m of the borehole? Y/N………
5. Is the drainage channel cracked, broken or need cleaning? Y/N……..
6. Is the fence missing or faulty? Y/N……….
7. Is the apron less than 1m in radius? Y/N……..
8. Does spilt water collect in the apron area? Y/N……..
9. Is the apron cracked or damaged? Y/N……..
10. Is the handpump loose at the point of attachment to apron? Y/N…….
Total Score of Risks …./10
Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-10)
Signature of surveyor:
Comments:

7. Sanitary Inspection Form for Protected Spring

I. Type of Facility PROTECTED SPRING
1. General Information: Zone: Location:
2. Code Number:
3. Date of Visit:
4. Water sample taken? …….. Sample No. ……… FC/100ml ………..

II. Specific Diagnostic Information for Assessment Risk
1. Is the spring unprotected? Y/N……..
2. Is the masonry protecting the spring faulty? Y/N……..
3. Is the backfill area behind the retaining wall eroded? Y/N……..
4. Does spilt water flood the collection area? Y/N………...

5. Is the fence absent or faulty? Y/N……..
6. Can animals have access within 10m of the spring? Y/N………
7. Is there a latrine uphill and/or within 30m of the spring? Y/N………
8. Does surface water collect uphill of the spring? Y/N……..
9. Is the diversion ditch above the spring absent or non-functional? Y/N…….
10. Are there any other sources of pollution uphill of the spring? Y/N……..
(e.g. solid waste)
Total Score of Risks …./10
Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-10)
Signature of surveyor:
Comments:

8. Sanitary Inspection Form for Rainwater collection and Storage

I. Type of Facility RAINWATER COLLECTION ANDSTORAGE
1. General Information: Zone: Location:
2. Code Number:
3. Date of Visit:
4. Water sample taken? …….. Sample No. ……… FC/100ml ………..

II. Specific Diagnostic Information for Assessment Risk
1. Is rainwater collected in an open container? Y/N………
2. Are there visible signs of contamination on the roof catchment? Y/N……..
(e.g. plants, excreta, dust)
3. Is guttering that collects water dirty or blocked? Y/N…….
4. Are the top or walls of the tank cracked or damaged? Y/N……
5. Is water collected directly from the tank (no tap on the tank)? Y/N……
6. Is there a bucket in use and is this left where it can become contaminated?Y/N………
7. Is the tap leaking or damaged? Y/N……..
8. Is the concrete floor under the tap defective or dirty? Y/N………
9. Is there any source of pollution around the tank or water collection area?Y/N………
10. Is the tank cleans inside? Y/N……..
Total Score of Risks …./10
Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III. Results and Recommendations:
The following important points of risk were noted:
(list nos. 1-10)
Signature of surveyor:
Comments:

Annexure II

List of Parameters to be monitored

Sl.N.	Parameters	Whether req. at State lab.	Whether req. at District lab.	Whether req. at Sub-district
Physical parameters				
1	Temperature	Yes	Yes	Yes
2	Colour	Yes	Yes	Yes
3	Odour	Yes	Yes	Yes
4	Taste	Yes	Yes	Yes
5	Turbidity	Yes	Yes	Yes
6	pH	Yes	Yes	Yes
Chemical parameters				
7	TDS/Elect. Conductivity	Yes	Yes	Yes
8	Total Alkalinity	Yes	Yes	Yes
9	Chloride	Yes	Yes	Yes
10	Fluoride	Yes	Yes	Yes
11	Phosphate	Yes	Yes*	No
12	Nitrate	Yes	Yes	Yes
13	Nitrite *	Yes	No	No
14	Total Kjeldal Nitrogen *	Yes	No	No
15	Sulphate	Yes	Yes	Yes
16	Silica	Yes	No	No
17	Sodium	Yes	Yes	No
18	Potassium	Yes	Yes	No
21	Boron *	Yes	No	No
22	Calcium (as Ca)	Yes	No	No
23	Magnesium (as Mg)	Yes	No	No
24	Total Hardness	Yes	Yes	Yes
25	Bromide	Yes*	No	No
	Toxic metals			
26	Iron	Yes	Yes	Yes
27	Manganese	Yes	Yes	Yes
28	Copper	Yes	Yes*	No
29	Chromium (as Cr^{+6})	Yes	Yes*	No
30	Cadmium	Yes	No	No
31	Lead	Yes	Yes*	No
32	Nickel	Yes	Yes*	No
33	Arsenic	Yes	Yes	Yes
34	Mercury	Yes	No	No
35	Barium *	Yes	No	No
36	Zinc	Yes	Yes*	No
37	Aluminum *	Yes	Yes*	No
38	Antimony *	Yes	No	No
	Microbiological			
39	Total coliforms	Yes	Yes	Yes
40	E-coli / Thermotolerant coliforms	Yes	Yes	Yes
41	V.Cholera, S.Typhi, S.Dysentrae, Staphiloccocus, F.Streptococci, G.Lamblia testing – may be included in the State level laboratory and viral parameters in certain cases			

Sl.N.	Parameters	Whether req. at State lab.	Whether req. at District lab.	Whether req. at Sub-district
	Specific parameters			
42	Total Pesticide Residue	Yes	No	No
43	Radioactive elements	**	No	No
44	Cyanide	Yes	No	No
45	Poly Aromatic Hydrocarbons (PAH) *	Yes	No	No
46	Residual Chlorine	Yes	Yes	Yes
47	TCM*	Yes*	No	No
48	NDMA*	Yes*	No	No
49	Phenolic compounds *	Yes	No	No
50	Anionic Surfactant / Detergents/ MBAS *	Yes	No	No
51	Oils& Grease*	Yes	Yes	No
Total Number of Parameters to be monitored		**50**	**31**	**21**

* : Indicate discrete sampling. Water quality monitoring to be continued only if these are traced in drinking water sources.

** :To be converged with AMD/BARC/PRL/BRIT and other DAE approved laboratories. Alternatively, BARC/BRIT can be requested to provide technical support in providing uranium testing facility by upgrading existing laboratories
The suggestion of "No" above is also prescriptive. Depending upon the occurrence of different parameters, they may be monitored regularly.

District and Sub District laboratories will carry out analysis of the above-mentioned parameters at least once in Pre Monsoon and Post Monsoon season to establish a baseline survey. However, in case of detection of any pollutants listed above, the parameters would be analysed on routine basis. It is mandatory for District and Sub District laboratories to carry out analysis of at least 15 basic water quality parameters viz., pH, Total Dissolved Solids, Turbidity, Chloride, Total Alkalinity, Calcium and Magnesium Hardness (as $CaCo_3$), Sulphate, Iron, Arsenic, Fluoride, Salinity , Nitrate, Total Coliforms and E-Coli.

Annexure-III

Methods, Instruments and Chemicals required for parameters

S.N.	Parameters	Standard Method	Chemicals Required
	Physical parameters		
1	Temperature		
2	Colour	Visual comparison method	1. Potassium Chloroplatinate K_2PtCl_6 2. Crystallised cobaltous Chloride ($CoCl_2.6H_2O$) 3. Conc. HCl
3	Odour		
4	Taste		
5	Turbidity	Nephelometric method	1. Turbiditymetric standard Solution
6	pH	Electrometric method	1. pH 4 buffer solution 2. pH 7 buffer solution 3. pH 9.2 buffer solution
	Chemical parameters		
7	TDS/Elect. Conductivity	Instrumental Method	1. Potassium Chloride
8	Total Alkalinity	Titration method	1. Sulphuric acid (H_2SO_4) 2. Phenolphthalein indicator 3. Methyl orange indicator
9	Chloride	Argentometric method	1. Potassium chromate (K_2CrO_4) 2. Silver nitrate ($AgNO_3$) 3. Sodium Chloride (NaCl)

S. N.	Parameters	Standard Method	Chemicals Required
10	Fluoride	Ion selective electrode method	1. Stock fluoride solution: 221 mg anhydrous NaF 2. Total Ionic Strength Adjustment Buffer (TISAB)
		Sodium 2-(parasulphophenylazo)-1,8-dihydroxy-3,6-naphthalene disulphonate (SPADNS) method	1. Conc. Sulphuric acid (H2SO4) 2. Silver sulphate (Ag_2SO_4) 3. SPADNS solution 4. Zirconyl acid reagent: $ZrOCl_2.8H_2O$ & Conc. HCl 5. Sodium arsenite ($NaAsO_2$)
11	Phosphate	Stannous chloride method	1. Anhydrous Potassium dihydrogen phosphate (KH_2PO_4) 2. Ammonium molybdate $(NH_4)_6Mo_7O_{24})$ 3. Strong acid reagent: conc. H_2SO_4 & 4 mL conc. HNO_3 4. Sodium hydroxide 5. Phenolphthalein Indicator 6. Stannous chloride reagent I: $SnCl_2.H_2O$ & glycerol.
12	Nitrate	UV spectrophotometric method	1. Anhydrous potassium nitrate 2. Hydrochloric acid 1N.
		Phenol disulphonic acid (PDA) method	1. Silver sulphate (Ag_2SO_4) 2. White phenol 3. Conc. H_2SO_4. 4. Ammonium hydroxide (NH_4OH) 5. Potassium hydroxide (KOH) 12 N 6. Anhydrous potassium nitrate 7. EDTA reagent

SN	**Parameters**	**Standard Method**	**Chemicals Required**
13	Nitrite *	Colorimetric method	1. Sulphanilamide reagent: sulphanilamide & conc. HCl 500mg N-(1-naphthyl)-ethylenediamine 2. Sodium oxalate 3. Sodium nitrite ($NaNO_2$)
14	Total Kjeldal Nitrogen *	Kjeldal Nitrogen	1. Borate buffer solution: NaOH & sodium tetraborate ($Na_2B_4O_7$) 2. Sodium hydroxide 3. Sodium sulfite (Na_2SO_3) 4. Sodium thiosulfate ($Na_2S_2O_3$.5H2O) 5. Phenyl arsine oxide (C_6H_5AsO) 6. Sodium arsenite ($NaAsO_2$) 7. Sulfuric acid, H_2SO_4
15	Sulphate	Turbidimetric method	1. Barium chloride crystals, 20-30 mesh. 2. Anhydrous sodium sulphate (Na2SO4) 3. Glycerol
16	Silica	Molybdosiliicate Method	1. Sodium metasilicate nanohydrate 2. Sodium Bicarbonate 3. Sulphuric acid 4. Hydrochloric acid 5. Ammonium Molybdate 6. Sodium Hydroxide 7. Oxalic acid 8. Potassium chromate 9. Sodium borate decahydrate
17	Sodium	Flame emission photometric method	1. Sodium chloride (NaCl)
18	Potassium	Flame Photometric method	1. Potassium chloride (KCl)
19	Boron *	Carmine method	1. Sulphuric acid 2. Hydrochloric acid 3. Carminic acid

S.N.	**Parameters**	**Standard Method**	**Chemicals Required**
20	Calcium (as Ca)	EDTA Titrimetric method	1. Sodium hydroxide 2. Murexide indicator 3. Eriochrome Blue Black R indicator 4. Disodium ethylenediamine tetraacetate (EDTA)
21	Magnesium (as Mg)	EDTA Titrimetric method	5. Sodium hydroxide 6. Murexide indicator 7. Eriochrome Blue Black R indicator 8. Disodium ethylenediamine tetraacetate (EDTA)
22	Total Hardness	EDTA Titrimetric method	1. Buffer solution 2. Eriochrome black T indicator 3. NaCl. 4. Murexide indicator 5. Sodium hydroxide 2N 6. Standard EDTA solution 0.01 M:
23	Bromide	Phenol Red Colorimetric method	1. Sodium acetate trihydrate ($NaC_2H_3O_2.H_2O$) 2. Glacial acetic acid 3. Phenol red indicator 4. Chloramine-T 5. Sodium thiosulphate 6. Anhydrous potassium bromide

S. N.	**Parameters**	**Standard Method**	**Chemicals Required**
		Toxic metals	
24	Iron	Inductively coupled plasma method	
		Phenanthroline method	1. Hydrochloric acid, HCl, conc. 2. Hydroxylamine hydrochloride ($NH_2OH.HCl$) 3. Ammonium acetate ($NH_4C_2H_3O_2$) 4. Conc. (glacial) acetic acid 5. Sodium acetate ($NaC_2H_3O_2.3H_2O$) 6. 1,10-phenanthroline monohydrate ($C_{12}H_8N_2.H_2O$) 7. Ferrous ammonium sulphate ($Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$) 8. Conc. H_2SO_4
25	Manganese	Persulphate Method	1. $HgSO_4$ 2. Conc. HNO_3 3. 85% phosphoric acid (H_3PO_4) 4. Silver nitrate ($AgNO_3$). Ammonium persulphate: $(NH_4)_2S_2O_8$ solid. 5. Potassium permanganate ($KMnO_4$) 6. Hydrogen peroxide: H_2O_2, 30% 7. Nitric acid: HNO3, conc. 8. Sulphuric acid: H_2SO_4, conc.

			9. Sodium nitrite ($NaNO_2$) 10. Sodium oxalate ($Na_2C_2O_4$) 11. Sodium bisulphate ($NaHSO_3$)
S. N.	**Parameters**	**Standard Method**	**Chemicals Required**
26	Copper	ICP/AAS/GC-MS/ Spectrophotometer	
27	Chromium (as Cr^{+6})	ICP/AAS/GC-MS/ Spectrophotometer	1. Potassium dichromate ($K_2Cr_2O_7$)
			1. Potassium dichromate ($K_2Cr_2O_7$)
28	Cadmium	ICP/AAS/GC-MS/ Spectrophotometer	
29	Lead	ICP/AAS/GC-MS/ Spectrophotometer	
30	Nickel	ICP/AAS/GC-MS/ Spectrophotometer	
31	Arsenic	Silver diethyldithiocarbamate (SDDC) method	1. Anhydrous Sodium acetate, ($NaC_2H_3O_2$) 2. Acetic acid (CH_3COOH). 3. Sodium acetate trihydrate, ($NaC_2H_3O_2.3H_2O$) 4. Sodium borohydride ($NaBH_4$) 5. Sodium hydroxide ($NaOH$) 6. Hydrochloric acid (HCl) 7. Lead acetate Pb ($CH_3COO)_2$. 8. Silver diethyldithiocarbamate $AgSCSN(C_2H_5)_2$ 9. Morpholine 10. chloroform, $CHCl_3$. 11. Sodium arsenite ($NaAsO_2$ 12. Sodium arsenate ($Na_2HAsO_4.7H_2O$).
		ICP/AAS/GC-MS/ Spectrophotometer	
32	Mercury	Cold-vapor Atomic	

		Absorption Spectrometric method	
33	Barium *	ICP/AAS/GC-MS/ Spectrophotometer	

S.N.	Parameters	Standard Method	Chemicals Required
34	Zinc	ICP/AAS/GC-MS/ Spectrophotometer	
35	Aluminum *	ICP/AAS/GC-MS/ Spectrophotometer	Aluminium potassium sulfate, ($AlK(SO_4)_2$. $12H_2O$)
		Eriochrome cyanine R method	1. Sulphuric acid (H_2SO_4) 2. Ascorbic acid 3. Sodium acetate ($NaC_2H3O_2.3H_2O$) 4. Acetic acid 5. Eriochrome cyanine: R 6. Methyl orange indicator 7. Bromocresol green indicator 8. EDTA (sodium salt of ethylenediamine-tetraacetic acid dihydrate) 9. Sodium hydroxide: NaOH
36	Antimony *	ICP/AAS/GC-MS/ Spectrophotometer	

SN	Parameters	Standard Method	Chemicals Required
		Microbiological	
37	Total coliforms	Multiple Dilution Technique Membrane Filtration Technique Plate Count with colony counter	1. M-Endo Agar 2. Ethyl Alcohol
38	Thermotolerant coliforms/ E-coli	Multiple Dilution Technique Membrane Filtration Technique	1. M-FC Agar 2. Rosolic Acid 3. EMB Agar 4. MacConkey Agar
39	V.Cholera, S.Typhi, S.Dysentrae, Staphiloccocus, F.Streptococci, G.Lamblia testing – may be included in the State level laboratory	Multiple Dilution Technique Membrane Filtration Technique	1. TCBS Agar 2. XLD Agar 3. Bismuth Sulphite Agar 4. Salmonella Shigella Agar 5. KF Streptococcus Agar 6. Mannitol Salt Agar 7. Lactose Lauryl Tryptose broth
	Specific parameters		
40	Total Pesticide Residue	HPLC / GC-MS	
41	Radioactive elements		
42	Cyanide	Cyanide-Selective Electrode method	1. Potassium cyanide 2. Sodium hydroxide 3. Potassium nitrate (KNO_3) 4. Potassium hydroxide
43	Poly Aromatic Hydrocarbons (PAH) *	HPLC/ GS-MS	
44	Residual Chlorine	Iodometric method	1. Acetic acid, conc. (glacial) 2. Potassium iodide, KI, crystals 3. Sodium thiosulphate 4. Starch indicator 5. Anhydrous potassium biiodate ($KH(IO_3)_2$) 6. Sulphuric acid 7. Potassium dichromate ($K_2Cr_2O_7$)

S. N.	**Parameters**	**Standard Method**	**Chemicals Required**
45	Phenolic compounds *	Chloroform extraction method	1. Phosphoric acid 5% H_3PO_4 2. Methyl orange 3. Sulphuric acid 4. Sodium chloride: NaCl, 5. Chloroform $CHCl_3$ 6. Ethyl ether:, AR grade 7. Sodium hydroxide 8. anhydrous $KBrO_3$ 9. KBr crystals 10. Hydrochloric acid: HCl 11. Sodium thiosulphate $Na_2S_2O_3$. $5H_2O$ 12. Starch solution 13. Ammonium hydroxide NH_4OH 14. K_2HPO_4 15. KH_2PO_4 16. 4-aminoantipyrine 17. Potassium ferricyanide $K_3Fe(CN)_6$ 18. Sodium sulphate Na_2SO_4 19. Potassium iodide: KI
46	Anionic Surfactant / Detergents/ MBAS *	Methylene Blue Active Substances (MBAS)	1. Alkylbenzene Sulfonate (LAS) solution 2. Phenolphthalein Indicator solution, alcoholic 3. Sodium Hydroxide 4. Sulphuric acid,H_2SO_4 5. Chloroform, $CHCl_3$ 6. Methylene Blue 7. Sodium phosphate, monobasic monohydrate, $NaH_2PO_4.H_2O$. 8. Methanol, CH_3OH. 9. Hydrogen Peroxide: H_2O_2,
47	Oils & Grease*	Partition-gravimetric method	1. Hydrochloric acid: HCl 2. n-hexane 3. Petroleum ether 4. Anhydrous sodium sulphate-Na_2SO_4

Annexure IV

Suggestive list of infrastructure requirements for setting up laboratory

Sl.N.	Infrastructure	State Laboratory	District Laboratory	Sub-District Laboratory
1.	Space for Analysis	80 m^2 (including 20 m^2 for biological)	60 m^2(including 20 m^2 for biological testing)	50m^2(including 10m^2 for biological testing)
	Space for Storage (in m^2)	45	25	20
	Space for office & library (in m^2)	45	15	10
	Total space req. (in m^2)	170	100	80
2.	No. of Computers	03 (include 1 system for library)	01	01
3.	Internet	Yes	Yes	Yes
4.	No. of UPS	02	01	01
5.	Inverters (back up time= 3 hrs)	02	02	01
6.	Printer	02	01	01
7.	Telephone facility	Yes	Yes	Yes
8.	Fax	Yes	Yes	Yes
9.	AC	Yes	Yes	Yes
10.	Provision for Fume hood	Yes	Yes	May not be needed at this level
11.	Provision for gas connection	Yes	Yes	Yes

@ : State laboratory may like to upgrade for virological examination in a phased manner.
All laboratories shall invariably adopt roof-top rainwater harvesting structure and include waste-water/spent-water treatment before being disposed off and also adopt proper SLWM procedures for safe disposal of plastics, bio-waste etc.

Annexure V

Instruments requirement

Sl.N.	Item	Specifications	State lab	District lab	Sub-district lab
1.	pH meter (both lab based and potable type)	Digital Display (0-14 range)	Yes	Yes	Yes
2.	TDS/Conductivity meter (both lab based and potable type)	Direct reading digital display	Yes	Yes	Yes
3.	Nephelometer (Turbidimeter)	Direct reading Range:0-100 NTU	Yes	Yes	Yes
4.	Digital balance	Single pan Cap.200 gr. Tarring device Accuracy-0.001gm	Yes	Yes	Yes
5.	UV-Visible Spectrophotometer	Should cover wavelength of important metals/ ions	Yes	Yes	Yes
6.	Refrigerator	295 lts. Cap.	Yes (2 Nos)	Yes	Yes
7.	Water still	Stainless steel Cap. 5 lts/hr.	Yes	Yes	Yes
8.	Voltage stabilizer/ Inverters	Standard make	3 nos.	2 nos.	2 nos.
9.	Hot plate	Big size	2 nos.	1 no.	1 no.
10.	Heating mentle	Cap. 1 lt.	Yes	Yes	Yes
11.	Water bath	Big size Temp.0 to 50 C	Yes	Yes	Yes
12.	Hot air oven	Standard make- Big size	4 nos.	2 nos.	2 nos.
13.	Bacteriological Incubator	Temp.control device Range 0 to 500 C Medium size	2 Nos.	02 No.	01 No.
14.	Autoclave	Medium size steel cabinet	2 nos.	1 no.	1 no.
15.	Magnetic stirrer	With speed control and Teflon paddle	2 Nos.	01	01
16	Microscope	Binocular	Yes	Yes	No
17.	Vacuum pump	1 HP cap.	Yes	Yes	Yes
18.	Flame Photometer	--	Yes	Yes	No
19.	Atomic Absorption Spectro-photometer (AAS) with electrodes	--	Yes	No/ Yes#	No
20.	Inductively coupled plasma-optical emission spectrometry (ICP-OES)	---	Yes/No	No	No

Sl.N.	Item	Specifications	State lab	District lab	Sub-district lab
21.	UV Laminar Air Flow chamber for bacteriological analysis	--	Yes	Yes	Yes
22.	MiliporeFiltration assembly with a Vacuum pump	--	Yes	Yes	Yes
23.	Plate count and colony counter	Standard make	Yes	Yes	Yes
24(a)	Arsenic testing instrumentation (portable type)		Yes	Yes^	Yes^
24(b)	Hydride generator with all accessories		Yes	Yes**	No
25.	DO meter	Digital	Yes	No	No
26.	Coolbox with icepacks		Yes	Yes	Yes
27.	Specific Ion meter along with electrodes (for Fluoride and Nitrate etc.)	Digital	Yes	Yes	Yes
28.	Fume coup board		Yes	Yes	No
29	GC-MS	Digital	Yes	No	No
30	Auto Burette & Auto-Pippette		Yes	No	No
31	Uranium Analyzer	Digital	Yes^	No/Yes#	No
32	Thermometers		Yes	Yes	Yes
33	Single Stage distillation Apparatus	-	Yes	Yes	Yes
34	Double distillation Apparatus	-	Yes	Yes	Yes
35	Argon, Nitrogen & Oxygen Gas Cylinders (To be used with AAS/Advanced Spectrophotometer)	-	Yes	Yes	No

: Wherever heavy metals contamination/ uranium is found to be high
** : Wherever arsenic contamination is found to be high
*** : Where pesticides/uranium are detected.
^ : Wherever applicable

Annexure-VI

Glassware requirement

Sl.N.	Item	State lab	District lab	Sub-district lab
1.	Conical flask Cap. 100 ml 250 ml 500 ml 1000 ml	 24 50 24 10	 16 30 16 06	 12 20 12 03
2.	Beakers Cap. 100 ml 250 ml 500 ml 1 lt. 2 lt	 24 24 24 12 06	 16 16 16 08 04	 12 12 12 04 02
3.	Pipette Cap. 5 ml 10 ml 25 ml 50 ml 100 ml	 12 20 12 06 04	 08 12 08 04 02	 04 08 04 02 02
4.	Pipette (Graduated) Cap. 1 ml 5 ml 10 ml 20 ml	 06 10 12 06	 04 06 08 04	 02 04 04 02
5.	Burette (ordinary) 50 ml 100 ml	 12 02	 08 01	 04 01
6.	Burette (Automatic) Cap. 50 ml	 3	 Not Req.	 Not Req.
7.	Desiccators	6	4	3
8.	Reagent Bottles Cap. 500 ml 1 lit 2 lit	 50 36 24	 35 24 10	 30 18 06
9.	Sample bottles (food grade plastic) Cap. 250 ml 500 ml 1 lit 2 lit	 50 50 24 12	 35 35 15 08	 30 30 12 05
10.	Test Tubes (Packet of 100)	01	01	01
11.	Durham tubes	200	140	100
12.	Round bottom flask Cap. 250 ml	 12	 08	 04

Sl.N.	Item	State lab	District lab	Sub-district lab
13.	Measuring cylinders (graduated) Cap. 10 ml 50ml 100 ml 250 ml 500 ml 1 lit 2 lit	 10 10 10 10 10 10 05	 6 6 6 6 6 6 3	 4 4 4 4 4 4 3
14.	Measuring flask Cap.10 ml 25 ml 50 ml 100 ml 250 ml 500 ml 1000 ml	 24 24 12 12 12 12 10	 15 15 15 15 15 15 06	 12 12 12 12 12 12 04
15.	Funnels 3” dia 4” dia 5 “ dia	 12 12 5	 08 08 3	 05 05 2
16.	Porcelain dish Medium size Big size	 10 06	 07 03	 05 03
17.	Crucibles	12	08	06
18.	Distillation flask (Kjeldalh unit)	One	Not Req.	Not Req.
19.	Standard joints (grouted) Bends	 24 12	 24 12	 24 12
20.	Glass rods (Packet of 50)	02	01	01
21.	Glass beads	1 kg	0.5 kg	0.5 kg
22.	Nessler cylinders 50 ml 100 ml	 100 100	 70 70	 50 50
23.	Thermometers $100^{o}C$ $250\ ^{o}C$ $500\ ^{O}C$	 12 12 06	 08 08 03	 05 05 02
24.	Wash bottle	30Nos	20Nos	15Nos
25.	Separating flask	12 Nos	08Nos	04Nos
26.	Single stage water distillation apparatus (Either glass or steel) Double distillation water apparatus	02 01	01 01.	01 01.
27.	Petri dishes	100 Nos	70 Nos	Nos

Annexure-VII

Chemicals requirement

Sl.N.	Name of Chemical	State Laboratory	District Laboratory	Sub-district Laboratory
1	Acetic acid, glacial	(15x500 ml)	(10x500 ml)	(6x500 ml)
2	Alizarin Red S	(2x500 g)	(1x500 g)	(1x500 g)
3	Ascorbic acid	(5x100 g)	(3x100 g)	(2x100 g)
4	Absolute alcohol	(10x500 ml)	(7x500 ml)	(5x500 ml)
5	Aluminium Potassium Sulphate	(5x500 g)	(3x500 g)	(2x500 g)
6	Ammonium Acetate	(10x500 g)	(7x500 g)	(5x500 g)
7	Ammonium Chloride	(10x500 g)	(7x500 g)	(5x500 g)
8	Ammonium Hydroxide	(15x500 g)	(10x500 g)	(7x500 g)
9	Ammonium Purpurate / Muroxide	(7x100 g)	(5x100 g)	(3x100 g)
10	Arsenic Trioxide	(5x500 g)	(4x500 g)	(2x500 g)
11	Barium Chloride	(15x 500 g)	(12x 500 g)	(10x 500 g)
12	Bromocresol green indicator	(5x100 g)	(3x100 g)	(2x100 g)
13	Boric Acid	(4x500 g)	(3x500 g)	(2x500 g)
14	Calcium Chloride (fused)	(7x500 g)	(5x500 g)	(3x500 g)
15	Calcium Chloride	(4x500 g)	(3x500 g)	(2x500 g)
16	Disodium Ethylenediaminetetra Acetate (EDTA)	(7x500 g)	(3x500 g)	(2x500 g)
17	Erichrome Black T	(5x10 g)	(3x10 g)	(2x10 g)
18	Eriochrome cyanine: R	(5x10 g)	(3x10 g)	(2x10 g)
19	Ferrous Ammonium Sulphate	(5x500 g)	(3x500 g)	(2x500 g)
20	Hydrochloric Acid	(7x2.5 L)	(5x2.5 L)	(3x2.5 L)
21	Hydroxylamine Hydrochloride	(5x500 g)	(3x100 g)	(2x500 g)
22	Hydrogen Peroxide	(5x500 ml)	(3x500 ml)	(2x500 ml)
23	Electrolytic Iron	(3x100 g)	(2x100 g)	(1x100 g)
24	Lead Acetate	(3x500 g)	(2x500 g)	(1x500 g)
25	Methyl Orange Indicator	(7x100 g)	(5x100 g)	(3x100 g)
26	Phenolphthalein Indicator	(7x100 g)	(5x100 g)	(3x100 g)
27	Potassium Hydroxide	(10x500 g)	(7x500 g)	(5x500 g)
28	1-10, Phenanthroline, Monohydrate	(10x10 g)	(7x10 g)	(7x10 g)
29	Potassium permanganate	(5x100 g)	(3x100 g)	(2x100 g)
30	Potassium Iodide	(5x500 g)	(3x500 g)	(2x500 g)
31	Potassium Chromate	(5x500 g)	(3x500 g)	(2x500 g)
32	Potassium Hydrogen Phthalate	(3x500 g)	(2x500 g)	(1x500 g)
33	Stannous Chloride	(5x100 g)	(3x100 g)	(2x100 g)
34	Silver diethyl-dithio-carbamate	(5x100 g)	(3x100 g)	(2x100 g)
35	Sodium Hydroxide	(10x500 g)	(7x500 g)	(5x500 g)

Sl.N.	Name of Chemical	State Laboratory	District Laboratory	Sub-district Laboratory
36	Silver Nitrate	(10x250 g)	(7x250 g)	(5x250 g)
37	Sodium Acetate	(5x500 g)	(3x500 g)	(2x500 g)
38	Sodium Thiosulphate	(10x500 g)	(7x500 g)	(5x500 g)
39	Starch (Soluble)	(10x500 g)	(7x500 g)	(5x500 g)
40	Sodium Fluoride (Anhydrous)	(5x500 g)	(3x500 g)	(2x500 g)
41	Sodium Arsenate	(4x100 g)	(3x100 g)	(2x100 g)
42	SPADNS (for Fluoride)	(3x100 g)	(2x100 g)	(2x100 g)
43	ZirconylOxichloride, Octohydrate ($ZrOCl_2 . 8H_2O$)	(5x100 g)	(3x100 g)	(2x100 g)
44	Sodium Sulphate (anhydrous)	(5x500 g)	(3x500 g)	(2x500 g)
45	Sulphuric acid sp. gr. 1.84	(7x2.5 L)	(5x2.5 L)	(3x2.5 L)
46	Sulphuric acid (Fuming) Oleum (if specifically required)	(5x250 g)	(3x250 g)	(2x250 g)
47	Sodium Chloride	(5x500 g)	(3x500 g)	(2x500 g)
48	Potassium Dichromate	(5x500 g)	(3x500 g)	(2x500 g)
49	Calcium Carbonate (anhydrous)	(7x500 g)	(5x500 g)	(4x500 g)
50	Phenol, white	(5x500 g)	(3x500 g)	(2x500 g)
51	Potassium Nitrate	(5x500 g)	(3x500 g)	(2x500 g)
52	Sodium Sulphate, non-hydrate, Na_2S, $9H_2O$	(5x500 g)	(3x500 g)	(2x500 g)
53	pH Indicator paper, Range 2-14 with comparator	(5 rolls)	(3 rolls)	(2 rolls)
54	Methylated spirit	(10x500 ml)	(7x500 ml)	(5x500 ml)
55	MacConkey broth, dehydrated (Hi-media)	(10x500 ml)	(7x500 ml)	(5x500 ml)
56	Total Ionic Strength Adjustment Buffer (TISAB)	(15x500 ml)	(10x500 ml)	(7x500 ml)
	Oxalic acid	(5x100 g)	(3x100 g)	(2x100 g)
57	Silver sulphate	(5x100 g)	(3x100 g)	(2x100 g)
58	Sodium arsenite	(4x100 g)	(3x100 g)	(2x100 g)
59	Potassium dihydrogen phosphate	(5x100 g)	(3x100 g)	(2x100 g)
60	Ammonium molybdate	(7x100 g)	(5x100 g)	(3x100 g)
61	Nitric acid	(7x2.5 L)	(5x2.5 L)	(3x2.5 L)
62	Ammonium metavanadate	(7x100 g)	(5x100 g)	(3x100 g)
63	Anhydrous potassium nitrate	(5x100 g)	(3x100 g)	(2x100 g)
64	Sulphanilamide	(5x100 g)	(3x100 g)	(2x100 g)
65	Sodium nitrite	(5x100 g)	(3x100 g)	(2x100 g)
66	Sodium oxalate	(5x100 g)	(3x100 g)	(2x100 g)
67	Sodium metasilicate nanohydrate	(5x100 g)	(3x100 g)	(2x100 g)
68	Sodium bicarbonate	(5x100 g)	(3x100 g)	(2x100 g)

Sl.N.	Name of Chemical	State Laboratory	District Laboratory	Sub-district Laboratory
69	Sodium borate decahydrate	(5x100 g)	(3x100 g)	(2x100 g)
70	Sodium Tetraborate	(5x100 g)	(3x100 g)	(2x100 g)
71	Glycerol	(7x100 ml)	(3x100 ml)	(2x100 ml)
72	Potassium chloride	(5x100 g)	(3x100 g)	(2x100 g)
73	Carminic acid	(5x100 ml)	(3x100 ml)	(2x100 ml)
74	Ammonium solution	(10x100 ml)	(7x100 ml)	(5x100 ml)
75	Phenol red indicator	(5x10 ml)	(3x10 ml)	(2x10 ml)
76	Chloramines-T solution	(10x10 g)	(7x10 g)	(7x10 g)
77	Anhydrous Potassium Bromide	(10x10 g)	(7x10 g)	(7x10 g)
78	Mercury Sulfate	(5x100 g)	(3x100 g)	(2x100 g)
79	Silver Nitrate	(10x250 g)	(7x250 g)	(5x250 g)
80	Sodium bisulphate	(5x100 g)	(3x100 g)	(2x100 g)
81	Sodium Acetate	(5x500 g)	(3x500 g)	(2x500 g)
82	Zinc metal	(5x100 g)	(3x100 g)	(2x100 g)
83	Potassium ferricyanide	(5x100 g)	(3x100 g)	(2x100 g)
84	Zincon (2-carboxy-2'-hydroxy- 5'-sulfoformazyl benzene)	(5x100 g)	(3x100 g)	(2x100 g)
85	Methanol	(5x100 ml)	(3x100 ml)	(2x100 ml)
86	Phosphoric acid	(5x100 ml)	(3x100 ml)	(2x100 ml)
87	Anhydrous potassium biiodate	(5x100 g)	(3x100 g)	(2x100 g)
88	Chloroform	(7x100 ml)	(3x100 ml)	(2x100 ml)
89	Ethyl ether	(7x100 ml)	(3x100 ml)	(2x100 ml)
90	Anhydrous potassium bromide	(5x100 g)	(3x100 g)	(2x100 g)
91	Potassium ferricyanide	(5x100 g)	(3x100 g)	(2x100 g)
92	Alkylbenzene Sulfonate (LAS) solution	(10x100 ml)	(7x100 ml)	(5x100 ml)
93	Methylene Blue	(5x10 g)	(3x10 g)	(2x10 g)
94	Sodium phosphate, monobasic monohydrate	(5x100 g)	(3x100 g)	(2x100 g)
95	N-hexane	(5x100 ml)	(3x100 ml)	(2x100 ml)
96	Petroleum ether	(5x100 ml)	(3x100 ml)	(2x100 ml)
97	M-Endo Agar	(3x500gm)	(2x500gm)	(1x500gm)
98	M-FC Agar	(3x500gm)	(2x500gm)	(1x500gm)
99	EMB Agar	(3x500gm)	(2x500gm)	(1x500gm)
100	MacConkey Agar	(3x500gm)	(2x500gm)	(1x500gm)
101	TCBS Agar	(4x500gm)	(3x500gm)	(2x500gm)
102	XLD Agar	(3x500gm)	(2x500gm)	(1x500gm)
103	Bismuth Sulphite Agar	(3x500gm)	(2x500gm)	(1x500gm)
104	Salmonella Shigella Agar	(3x500gm)	(2x500gm)	(1x500gm)

Sl.N.	Name of Chemical	State Laboratory	District Laboratory	Sub-district Laboratory
105	KF Streptococcus Agar	(3x500gm)	(2x500gm)	(1x500gm)
106	Mannitol Salt Agar	(5x500gm)	(3x500gm)	(3x500gm)
107	Lactose Lauryl Tryptose broth	(3x500gm)	(2x500gm)	(1x500gm)
108	Ethyl Alcohole	(5x100 ml)	(3x100 ml)	(2x100 ml)
109	Rosolic Acid	(5x100 ml)	(3x100 ml)	(2x100 ml)
110	Bromocresol purple	(5x100 ml)	(3x100 ml)	(2x100 ml)
111	TTC solution	(5x100 ml)	(3x100 ml)	(2x100 ml)