

**NATIONAL DRINKING WATER MISSION**  
(Department of Rural Development, Government of India)

**EXECUTIVE GUIDELINES FOR IMPLEMENTATION  
OF WATER QUALITY TESTING LABORATORIES**

May 1990

# I

## INTRODUCTION

### 1.1 NATIONAL DRINKING WATER MISSION

The National Drinking Water Mission" has been set up by the Government of India under the Department of Rural Development, Ministry of Agriculture in 1986.

#### 1.1.1 Mission Objectives

The primary objectives of the Mission are to improve the performance and cost effectiveness of the on-going ; programmes in the field of rural drinking water supply and to ensure the availability of an adequate quantity of drinking water of acceptable quality on a long term basis. This is being done by providing low cost but practical and effective solutions to identified problems, associated with the supply of safe drinking water in rural areas ,through the application of available scientific and technological inputs drawn from various Governmental and Non-Governmental Agencies specializing in the relevant fields.

#### 1.1.2 The primary objectives of the Mission include:

- Identification of sources in the selected areas where none could be identified so far;
- Utilization of appropriate technologies to insure that the water source is made available to the population, using in particular traditional means for such exploitation;
- Monitoring the quality of water after identification of problems, tackling the same by the application of science and technology to ensure that the water available is of acceptable quality; and
- Ensure that the quantity and quality of water is sustainable on a long term basis by proper water management technique and implementations of management information system.

#### 1.1.3 The Secondary objectives of the Mission include:

- Survey of various kinds of water sources;
- Adoption and improvement of both conventional and non-conventional methodologies for the reduction of cost and dependence on external inputs;
- Prevention of pollution of drinking water;
- Educating the public in conservation of the quantity and quality of water through awareness campaigns, community participation and health education programmes; and

- Training of both governmental and non-governmental personnel, particularly women, in the various aspects relating to the effective management of the water supply system.

## **1.2 NEED FOR WATER QUALITY MONITORING AND SURVEILLANCE PROGRAMME.**

The water problem is not only confined to the quantity of water available, but also to the quality of water available. In many sources, the water has excess iron, brackishness and fluoride and infected with guineaworms. Bacteriological contamination is found in vast number of villages. In many areas water borne diseases are being reported. The situation can be improved by water quality monitoring, safety of water source and treatment. As such the necessity of a regular water quality monitoring of the existing sources and the newly developed sources, all over the country, has been considered as an important priority in the Mission. A regular water quality monitoring is particularly important for bacteriological contamination. To facilitate this work, initially, district level water quality testing laboratories will be set up. The ultimate aim is to provide safe drinking water and generate awareness about water quality among rural masses. While many states have set up a State Level and a few district level laboratories for water quality monitoring, many others have yet to set up such laboratories. With the launching of the Water Mission and more emphasis on water quality analysis, many States have desired to strengthen their existing laboratory facilities in terms of meeting the additional requirement of water quality testing and induction of modern equipment in these laboratories. The States in the north hilly region, do not have even State Level laboratories. These states also demanded setting up of such laboratories at state headquarters. Additionally, there is a demand from some hill states for mobile laboratories. In addition, they demanded setting up of (district level) laboratories also.

## **1.3 OBJECTIVES OF THE PROGRAMME**

The objective of the water quality monitoring and surveillance programme is to develop an integrated system by setting up of district level laboratories for water quality testing, reporting and generating awareness among rural masses about importance of water quality and its relation to health.

### **1.3.1 WATER QUALITY TESTING LABORATORIES**

1. Initially 85 stationary district level laboratories and 15 mobile laboratories will be set up in various states. These will be linked with Mission activities at various levels.
2. The district level laboratories to be set up under this programme will have scope of catering to 2/3 districts.
3. In locating these laboratories preference would be given to Mini Mission Districts.

4. The set up will develop a management information system(MIS) for reporting data on water quality and creation of computerized data base at Mission Headquarters.

**1. 3.2 The List of stationary laboratories to be set up in the States are given below:**

S. No.	State	Regional Centre	Stationary	Mobile
DL, JODHPUR				
1.	Gujarat		5	1
2.	Rajasthan		3	1
3.	Daman & Diu		1	-
		Sub total	9	
S. No.	State	Regional Centre	Stationary	Mobile
AIIH & PH, CALCUTTA				
4.	Andaman&Nicobar		1	-
5.	Mizoram		1	1
6.	Tripura		1	1
7.	Meghalaya		1	1
8.	Orissa		6	1
		3		
AIIH & PH, CALCUTTA				
9.	Manipur		1	1
10.	West Bengal		4	1
11.	Bihar		5	-
12.	Sikkim		1	1
13.	Assam		2	-
14.	Nagaland		1	1
15.	Arunachal pradesh		1	1
		Sub total	25	
ITRC, LUCKNOW				
16.	Punjab		3	-
17.	J & K		2	2
18.	Haryana		4	-
19.	UP		7	1

20.	HP		2	1
21	Delhi		2	1
		Sub total	19	
BARC, BOMBAY				
22.	MP		6	1
23.	Goa		1	1
24.	Maharashtra		3	1
25.	Andhra Pradesh		3	-
		Sub total	13	
JC ENGG.College, Mysore				
26.	Kerala		3	-
27.	Pondicherry		1	-
28.	Tamil Nadu		5	1
29.	Lakshadweep		1	-
30.	Karnataka		7	-
		Sub total	17	
Total			83	19

### 1.3.3 Decentralised approach

In order to formalize linkage and to facilitate monitoring of the activities at various levels, the country has been divided into 5 regions. This division will also help in making areas specific need assessment and accordingly decide the plan of action in each region. The details of regional centers and their linkages with the states are given below:

S.No.	Regions	States	Regional centre
1.	East Zone & North Eastern Zone	Andaman&Nicobar, Mizoram, Tripura, Meghalaya, Orissa, Manipur, W. Bengal, Bihar, Sikkim, Assam, Nagaland & Arunachal Pradesh.	All India Institute of Hygiene & Public health 110, Chittaranjan Avenue, Calcutta.
2.	North Zone	Punjab, J&K, Haryana, UP, HP.	Industrial Toxicological Research Centre, P.B.No. 80, M.G. Marg, Lucknow.

3.	West Zone	Gujarat, Rajasthan, Daman & Diu	Defence Laboratory, Jodhpur.
4.	Central Zone	MP,Goa, Maharashtra, Andhra Pradesh	Bhabha Atomic Research centre,Trombay, Bombay.
5.	South Zone	Kerala,Pondicherry, Tamil Nadu, Lakshadweep, Karnataka.	Sri Jayachamarajendra college of Engg., Mysore.

### 1.3.4 Functions of Regional Centre(RCs)

Each Regional Centre will undertake the following activities:

- (i) Organise meeting with their respective states to discuss about the availability of infrastructure and finalise plan of action for implementation of this programme.
- (ii) Prepare a training schedule for laboratory staff, incharge of laboratory of their respective states after ascertaining of the gaps and areas needing skill upgradation.
- (iii) Guidance in procurement of laboratory equipment and other requirements as per specification prepared by NIDC.

In addition,the Regional Centre will advise PHED/Water Board in setting up of Water Quality Testing Laboratories covering the following:

- (i) identification and assessment of present facilities and needs.
- (ii) Scope of strengthening the existing laboratories at different levels.
- (iii) Water quality surveillance.
- (iv) Random sampling of water to monitor the programme of District Laboratories.

### 1.3.4 Action Points for States

- i) Acceptance of the Sate Government for maintenance of laboratory beyond March, 1990
- ii) To nominate one officer of the PHED as a nodal officer for implementing this programme.
- iii) To provide suitable building for laboratory.
- iv) To procure laboratory equipment, chemicals,glasswares etc. from the shortlisted manufactures/suppliers.
- v) To identify and communicate the names of trainees to their respective Regional Centre.
- vi) To submit monthly progress report to DRD under intimation to their respective

Regional Centre.

vii) To develop proper linkage between PHED and Health Department to make use of data generated.

viii) Preparation of annual budget estimates.

The budget estimates for the year shall be prepared by the Executive Engineer for their respective laboratories giving information for the following:

- water quality problem
- water load anticipated
- Cost estimates for each laboratory

i) capital costs i.e. cost of equipment and furniture and building cost. In case of hired accommodation, rent per year.

ii) Recurring cost i.e. cost of consumables, salary, maintenance cost etc.

The budget estimates shall be submitted to respective regional centre.

## II

### IMPLEMENTATION OF WATER QUALITY MONITORING AND SURVEILLANCE PROGRAMME

#### 2.1 Central Coordination Committee

**The National Drinking Water Mission constituted a Central Coordination Committee for effective implementation with the following members:**

1. Prof. K.J.Nath, AIIH&PH, Calcutta, Chairman
2. Prof. P.Khanna, Director, NEERI
3. Dr. P.K.Ray, Director, ITRC
4. Shri J.M.Barot, Joint Director GJTI
5. Dr. Ram Gopal, Dy. Director, DL Jodhpur
6. Shri N.Sen, Adviser, CSIR
7. MD, NRDC or his representative
8. CMD,NIDC or his representative
9. Shri S.C.Saxena, Supdt.Chemist,PHED, Jaipur
10. Shri S.Sen, Associate Director,Chem.Engg.Group,BARC
11. Dy. DG., CAPPART
12. Director, CSIO,Chandigarh or his representative
13. Dr. M.A.Ghare, Secretary, AWDA, Pune
14. Director,CEE,Ahmedabad or his representative
15. Dr.A.Gopalakrishnan,Director CMERI
16. Mohd. Inamul Haq, Adviser <sup>TM</sup>, DRD
17. Shri A.K.Sen Gupta, Dy. Adviser,DRD
18. Shri R.Gopalakrishnan, DS(RWS),DRD
19. Representative of AIIH&PH
20. Representative of NEERI
21. Representative of ITRC
22. Representative of DL, Jodhpur
23. Representative of SJ Engg. College, Mysore
24. Representative of BIS, New Delhi
25. Dr. J.C.Srivastava, Consultant(S&T),DRD-Member Secretary

2.1.1 The terms of reference of the above Committee are as follows:

- i) To draw a proposal for the setting up of water quality testing facilities at different levels.
- ii) To frame policy guidelines for functioning of the laboratory.
- iii) To monitor the functioning of network of laboratories and their utility.
- iv) To liaise with regional and state level centers.



- v) To establish state level centre committee through the State Water Mission.
- vi) To train manpower.

## **2.2 State Level Committee(SLC)**

There will be a State Level Committee to monitor state water quality testing and surveillance programme in the states.

The State Water Mission Coordinator i.e Secretary PHED will be focal point for linkages with the NDWM, Regional Centres and District Laboratories.

2.2.1 The composition of the State Level Committee will be as follows:

1. Secretary, State PHED- Chairman
2. Development Commissioner, Rural Development Deptt.
3. Director Health Services.
4. Director, Education
5. Director, Child and Women Welfare
6. In charge, State Level Laboratory
7. Public representative to be identified by the Chairman
8. Representative of Regional Laboratory
9. Chief Engineer,PHED-Convenor

2.2.2 The main functions of State Level Committee will be as follows:

- i) Assist Regional Centres in successful implementation of programme.
- ii) Provide feed back data on water quality alongwith information relating to quality consciousness and awareness.
- iii) Plan,execute and monitor the collection, testing and reporting of water samples by State & district level laboratories.
- iv) Promote people's participation by involving target groups, educational institutions voluntary organizations, women etc.

## **2.3 District Level Committee (DLC)**

Keeping in view, the area, population and local resources, District Level Centres will be set up. Such a Centre will have a laboratory to serve(to begin with) a cluster of 2-3 districts. In the first phase, such laboratories will be set up in the 55 Mini-Mission Districts or other districts which have known problems of water quality.

The District Level Committee will be constituted to plan and guide the activities of the district level laboratories.

2.3.1 Composition of District Level Committee

1. Chairman DRDA/Zila Parishad- Chairman
2. District Health Officer
3. District Education Officer
4. Representative of Voluntary agency
5. Child and Women development officer
6. Executive Director, Mini Mission
7. In charge of District Water Quality Testing Laboratory
8. Public representative to be identified by Chairman(Preferably representative of local science school/ college)
9. Executive Engineer(PHED) of adjoining districts.
10. Superintending Engineer/Ex.Engineer(PHED)- Convenor

2.3.2 The functions of the district level committee will be as under:-

- i) Provide facilities for routine analysis of Physico-Chemical and Bacteriological parameters relating to drinking water as shown in this report.
- ii) Implementation as per the action plan decided by State level/Zonal laboratory to which it is attached.
- iii) Help analyse samples from each village under their jurisdiction atleast twice in a year for public water supply and other sources.
- iv) Supervise the operation of portable kits supplied to villages under their jurisdiction and provide them with necessary chemicals/glassware etc.
- v) Arrange periodical monitoring of bacteriological quality of water from the sources in villages and report to state PHED for remedial measures.

## **2.4 Village Level Committees**

To generate awareness on water surveillance, a village level committee will be established.

The Village Level Committee will consist of local school science teacher nominated by Principal/Headmaster, representatives of voluntary agencies, primary health centers, youth clubs, mahila mandals, NGOs and village panchayat.

The portable waater quality testing kits will be provided to the science teacher/lecturers, primary health centers and voluntary agencies for water quality testing.

These persons will give their report to the principals/headmasters of the college/school, who will in turn furnish the total test report on a prescribed format to the District Level Centre

## **2.5 Monitoring**

- i) Regular progress report to be submitted by Laboratory incharge.
- ii) Executive Engineer PHED at district would supervise the work of laboratory.
- iii) Communication to be developed between the district laboratory and the Gram Panchayats.
  
- iv) Executive Engineer PHED to submit monthly report to the District Collector, Chief Engineer PHED, District Medical and Health Officer. The Chief Engineer, PHED will pass on this report with his comments to DRD under intimation to Director Health Services , secretary PHED and Regional Centre.
- v) Regional Centre would examine the report and communicate their comments to DRD under intimation to PHED and Director Health services.
- vi) At National Level the data so generated will be consolidated for the purpose of planning and future monitoring about quality of water.

## **2.6 Water Quality Database**

A database network is necessary to ensure efficient storage and retrieval of the voluminous data generated at different levels.

While the PHED's will maintain water quality database at the State Headquarters, they will simultaneously furnish the data to Regional Centres and to National Drinking Water Mission, who would monitor the programme of water quality assurance. Necessary data bank on water quality data received by the States would be created by NIDC, as stated later.

The water quality data should also be made available to the State Health Department.

### **2.6.1 Role of NIDC**

The National Industrial Development Corporation Limited(NIDC) will assist the state PHEDs(on behalf of DRD) in the development of computerized database for management information system for proper monitoring at various levels.

## **2.7 Linkage of water quality testing programme with other activities of National Drinking water mission**

After source finding activity in a particular area is completed, the water samples will be collected and analysed to establish the quality of water. If the water is found to be of portable quality(according to prescribed standards) it can be used for drinking purposes,if not a suitable treatment plant will be set up to convert that water into potable water.

## **2.8 Human Resources Development**

The development of human resources by appropriate education and training to make the Water Mission success is an essential pre-requisite for all efforts of quality assurance and treatment technology. This requires a well planned programme for all personnel connected with the Water Quality Testing and surveillance programme as well as involvement of the educational and scientific institutions, NGOs and voluntary agencies including women groups.

2.8.1 To meet the above need, a number of short term and long term courses will be conducted for in-service staff. These courses should also include awareness in respect to new scientific developments that have been incorporated in the NDWM

### **2.8.2 Training of Trainers**

Since the skills at state and district level laboratory will require proper staff, the same should be selected as per norms suggested by co-ordination committee. The training of trainers from State level laboratories is proposed to be undertaken by Regional Centres. These trainers, in turn, will impart training to district level laboratory staff and to voluntary agencies etc. working at village level.

### **2.8.3 Motivation**

A scheme with adequate incentives would be evolved to ensure motivation and involvement of voluntary/quasi-government agencies(NGOs) and the village women groups.

## **2.9 AWARENESS CAMPAIGN**

To generate awareness and consciousness on the need and importance of safe drinking water, extensive use of media like newspaper, newsletter in local languages, village camps, posters in local languages, documentaries video films and traditional medial will be used to convey messages like:-

- i) importance of personal hygiene to ensure potability
- ii) Education about the standards of drinking water,
- iii) Effect of different parameters of water quality on human body.
- iv) Knowledge of necessary water treatment process,
- v) Importance of integrating other programme like health education, water and soil conservation etc. with drinking water,
- vi) Importance of operation and maintenance of the treatment plant, and hand pump by the community.
- vii) How people/community can join hands in WQT programme.

2.9.1 In the awareness campaign agencies handling the health of people i.e. primary

health centre, health visitor/educator DWACRA,ICDs, voluntary agencies, etc.will be involved by PHEDs.

2.9.2 This campaign can further be strengthened through Communication/Information cell of the State Government and the educational institutions by :

- celebrating water mission day.
- Organising essay competition in school on 'Drinking water' and related subjects.
- Organising exhibition and films on the subject.

## **2.10 COMMUNITY PARTICIPATION & HEALTH EDUCATION**

Realising the importance of participation of community in the operation and maintenance (Q&M) of Rural Water Supply, emphasis will be given to involve the community in rural water supply schemes in the villages.

2.10.1 It has been experienced that in assessing the quality of drinking water, the consumer mostly relies upon his own senses. Generally, water constituents may affect the appearance, smell or the taste of the water and the consumer will evaluate the quality and acceptability essentially on these criteria. Water that is highly turbid, highly coloured or has an objectionable taste will be regarded as unacceptable and will be rejected for drinking purposes whereas other visually clear water but containing bacteriological contamination may be accepted by consumer. The bacteriological contamination causes widespread water borne diseases and health hazards. This requires awareness about importance of water quality and health education.

2.10.2 Health Education and Community Participation could be undertaken through following means:

- i) Introduction in the curriculum of Health Workers, Gram Sewaks, Agricultural Extension workers, other village level workers, teachers, hand pump misteries and TRYSEM workers,
- ii) Media material like models, posters, slides, files etc. be developed for use of general public and target group;
- iii) Community involvement in the form of labour and land donation, helping maintenance facilities should begin from the start of the programme ;
- iv) Inter-sectoral co-ordination between different departments namely Health, agriculture, Rural Development, Social welfare education, public health Engg.DRDA and Zila Parishad should be established by involving their staff to carry out health education programme and
- v) Introduction of special health education to school going children and teachers.

2.10.3 The role of women in health education and community participation is very vital. Thrust should be given to educate them on health aspects. Women voluntary

organizations should be actively involved in the programme.

2.10.4 The main objective of above activities is to make people conscious about the importance of safe drinking water; its relation with the health. Implementation of each of these activities requires planning, involvement of a number of institutions/organizations and co-ordination at different levels.

### III

## FUNCTIONAL REQUIREMENTS

### 3.1 Requirement of Building

It has been decided that suitable accommodation shall be provided by the state PHEDs for housing the district level laboratories. However, if new building is to be constructed, the same shall be constructed by the respective states. The area requirement for the new building will be about 80 sq.m of covered area. The details of which are as given below:

No.	ITEM	AREA IN M2
1)	Chemical and physical testing laboratory	50
2)	Store room for glasswares chemicals and Allied material.	10
3)	Office room	20
	Total	80

#### 3.1.1 Specification for laboratory and other infrastructural requirements

##### i) Physical facilities

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

In case of new laboratory, the location should be such that adequate natural lighting and ventilation should be available.

##### iii) Floor space

Floor space of 80M2 has been estimated for laboratory as mentioned above.

##### iv) Walls of laboratory

The walls should be finished smooth in light colours and should have sufficient thickness and provision for built in cabinets. The working table should be placed along the walls.

##### v) 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 with transparent window glasses. North south facing of the windows should be preferred for elimination of glare on work tables. Adequate provision of artificial lighting should be provided to supplement natural light. Additional plug points should be provided for extra lighting if needed.

**vi) Flooring**

Floors should smooth but not slippery and should be easy to clean. Concrete flooring with terrozo finish and dodooing upto window levels is recommended.

**vii) Fuel gas supply**

Provision for supply of fuel gas(Natural or biogas) and gas burners at suitable intervals on the work benches shall be provided.

**viii) Balance room**

The monopan balance shall be placed on 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 essential and separate room for accommodating these facilities needs to be provided. This room shall be attached to the laboratory and located within easy reach of analyst.

**3.1.2 Work tables and benches**

The work tables should be arranged along with walls. The wall side tables shall be generally 60 to 75 cms wide and centre tables shall be 140 cm wide to facilitate working space on both sides. The height of tables shall be around 90 cms for working in standing posture and 75 cms for working in sitting posture. Table tops shall be black acid resistant glossy sheets. Adequate number of cushioned working stools shall be provided. The list of furniture is given below:

S.No.	ITEM	Quantity
1.	Laboratory table 1.5m x.75x1m (LxWxH)	6 Nos.
2.	Racks on lab table with two shelves 1.5m x 0.25 x 0.5m	6 Nos.
3.	Fume chamber with exhaust fan. Four legs of 1 mt. Height then glass cabinet of 2mt. H x 1ML x 0.5W	1 No.
4.	Wooden table with drawers	6 Nos.



	1.5 m x 0.75 m	
5.	Chairs	6 Nos.
6.	Stool	6 Nos.
7.	Bench-wooden	2 Nos.
8.	Steel cup board	6 Nos.
9.	Glass door cup board (for books+ chemicals storage)	6 Nos.

Adequate provision shall be kept for storing chemicals and reagents. These storing cabinets shall be provided with sliding glass panels.

### 3.2 Laboratory Equipment, glasswares, chemical and allied materials.

3.2.1 Keeping in view the parameters to be analysed for water quality assessment and method of analysis, the list of equipments/instruments with their brief specifications alongwith numbers has been identified. The list of glasswares, chemicals and allied materials required for each laboratory are also identified. The list is given below. The quantity mentioned here is adequate for analysis of approximately 20-25 samples per day or one year.

#### A. List of Instruments required

S.No.	ITEM	Specifications
1.	PH meter	Digital Display Auto buffer.(0-14 PH range)
2.	Conductivity meter or pH-cum-conductivity meter	Direct reading Digital display
3.	Nephelo meter (Turbidimeter)	Direct reading Range:0-100 & 100-1000
4.	Monopan balance	Single pan Cap.200 gr. Tarring device Accuracy-0.001
5.	Spectrophotometer	Visible range
6.	Refrigerator	295 lts. Cap.
7.	Water still	Stainless steel Cap. 5 lts/hr.
8.	Voltage stabilizer	3 Nos.
9.	Hot plate	Big size 2 Nos

10.	Heating mentle	Cap. 1 lt. 2 Nos.
11.	Water bath	Big size Temp.0 to 50 C
12.	Hot air oven	Menest type Inner chamber of alu Minium. Big size 4 shelves
13.	Bacteriological Incubator	Temp.control device Range 0 to 50 C Medium size 2 Nos.
14.	Autoclave	Medium size steel cabinet
15.	Magnetic stirrer	With speed control and Tefion paddle 2 Nos.
16	Microscope	Binocular 10 x 45 x
17.	Vacuum pump	1 HP cap.

### B. List of Glasswares

S.No	Item	Quantity
1.	Conical flask Cap. 100 ml 250 ml 500 ml 1000 ml	12 50 24 12
2.	Beakers Cap. 100 ml 250 ml 500 ml 1 lt. 2 lt	24 24 24 12 6
3.	Pipetee (Oridinary) Cap. 5 ml 10 ml 25 ml 50 ml	12 12 12 6

4.	Pipette (Graduated) Cap. 1 ml 2 ml 5 ml 20 ml 25 ml	12 12 12 12 6
5.	Burette (ordinary) Cap. 10 ml 25 ml 50 ml 100 ml	6 12 12 6
6.	Burette (Automatic) Cap. 50 ml	3
7.	Desiccators Small Big	6 3
8.	Reagent Bottles Cap. 500 ml 1 lit 2 lit	36 36 24
9.	Sample bottles (Plastic) Cap. 250 ml 500 ml 1 lit 2 lit	50 50 24 24
10.	Test Tubes Medium size Big size	39 39
11.	Durham tubes	200
12.	Round bottom flask Cap. 250 ml	12
13.	Measuring cylinders (graduated) Cap. 5 ml 25 ml 50ml 100 ml 250 ml 500 ml 1 lit 2 lit	6 6 6 6 6 3 3
14.	Measuring flask Cap.10 ml 25 ml 50 ml 100 ml	24 24 12 12

	250 ml	12
	500 ml	12
	1000 ml	6
15.	Funnels	
	3" dia	12
	4" dia	12
	5" dia	4
16.	Porcelain dish	
	Small size	36
	Medium size	24
	Big size	12
17.	Crucibles	12
18.	Distillation flask (Kjeldalh unit)	6
19.	Standard joints (grouted)	24
	Bends	12
20.	Glass rods	5 kg
21.	Glass bids	2 kg
22.	Glass tubes	5 kg
23.	Thermometers	
	100 °C	12
	250 °C	6
24.	Wash bottle	6 Nos
25.	Separating flask	12 Nos
26.	Nessler tubes	
	Cap 25 ml	12
	50 ml	12
27.	Petri dishes	60 Nos

### C. List of Miscellaneous Stationary and other items

1.	Filter paper	12 packs
2.	Plastic carboys	
	Cap. 1 lt	25
	Cap. 2 lts	50
	5 lts	25
	10 lts	12
	20 lts	6
	50 lts	3
3.	Water sampler (steel)	
	2 lts	3 Nos
	5 lts	3 Nos
4.	Rubber tubing	

	Plastic tubing Small dia Medium dia Big dia (2.5 cms)	50 mts 25 mts. 10 mts.
5.	Forecep Medium Big	6 3
6.	Burette Stand	6 Nos
7.	Rubber cork Various sizes	50 Nos
8.	Ice Box (Big) Iron (Medium) Thermocole	3 Nos 3 Nos
9.	Cotton	2 kg
10.	Test tube stand	12 Nos
11.	Gas cylinder	2 Nos
12.	Burners	6 Nos
13.	Tripod Stand	12 Nos
14.	Iron ring with clamp	12 Nos
15.	Heating mentles (Loose)	6 Nos
16.	Blotting papers	100 sheets
17.	Physical balance with weight box	1 No
18.	Wire guage	12 Nos
19.	Asbestos sheets	6 Nos
20.	Spatula	6 Nos
21.	Wash bottle plastic one lit cap.	6 Nos
22.	Stop watch	2 Nos
23.	Glazed tiles ( 6 x 6" size)	6 Nos
24.	Enamel tray Small ( 1'x 1') Big ( 2' x 2')	3 Nos 3 Nos
25.	Plastic beakers Cap. 100 ml 250 ml 500 ml 1000 ml	12 12 12 6
26.	Spirit lamp Stove (Kerosine)	3 1

#### D. List of Chemicals

1. Acetic acid, glacial (10x500 ml)
2. Alizarin Red S (1x500 g)
3. Absolute alcohol (2x500 ml)

4. Aluminium Potassium Sulphate (1x500 g)
5. Ammonium Acetate (5x500 g)
6. Ammonium Chloride (5x500 g)
7. Ammonium Hydroxide (5x500 g)
8. Ammonium Purpurate / Muroxide (2x100 g)
9. Arsenic Trioxide (2x500 g)
10. Barium Chloride (2x 500 g)
11. Boric Acid (1x500 g)
12. Calcium Chloride (fused) (5x500 g)
13. Calcium Chloride (2x500 g)
14. Disodium Ethylenediaminetetra Acetate (EDTA) (2x100 g)
15. Erichrome Black T (5x5 g)
16. Ferrous Ammonium Sulphate (2x500 g)
17. Hydrochloric Acid (5x2.5 L)
18. Hydroxylamine Hydrochloride (5x100 g)
19. Hydrogen Peroxide (2x500 ml)
20. Electrolytic Iron (1x100 g)
21. Lead Acetate (2x500 g)
22. Methyl Orange Indicator (2x100 g)
23. Phenolphthalein Indicator (2x100 g)
24. Potassium Hydroxide (5x500 g)
25. 1-10, Phenanthroline, Monohydrate (10x10 g)
26. Potassium permanganate (2x100 g)
27. Potassium Iodide (5x100 g)
28. Potassium Chromate (5x100 g)
29. Potassium Hydrogen Phthalate (1x500 g)

30. Stannous Chloride (5x100 g)
31. Silver diethyldithiocarbamate (5x100 g)
32. Sodium Hydroxide (5x500 g)
33. Silver Nitrate (10x250 g)
34. Sodium Acetate (5x100 g)
35. Sodium Thiosulphate (5x500 g)
36. Starch (Soluble) (2x500 g)
37. Sodium Fluoride (Anhydrous) (2x500 g)
38. Sodium Arsenate (2x100 g)
39. SPADNS, Sodium 2-(parasulphophenylazo)-1,8-dihydroxy-3, 6-naphthalene disulphonate, also called 4,5-dihydroxy-3-(parasulphophenylazo)-2,7 naphthalenedisulphonic acid trisodium salt ( 1x100 g)
40. Zirconyl Oxichlorid, Octohydrate,  $ZrOCl_2 \cdot 8H_2O$  (5x100 g)
41. Sodium Sulphate (anhydrous) (2x500 g)
42. Sulphuric acid, sp. gr. 1.84 (5x2.5 L)
43. Sulphuric acid (Fuming) Oleum (5x250 g)
44. Sodium Chloride (2x500 g)
45. Potassium Dichromate (1x500 g)
46. Calcium Carbonate (anhydrous) (5x500 g)
47. Phenol, white (5x500 g)
48. Potassium Nitrate (2x500 g)
49. Sodium Sulphate, non-hydrate,  $Na_2S, 9H_2O$ (2x500 g)
50. PH Indicator paper, Range 2-14 with comparator (10 rolls)
51. Methylated spirit (10x500 ml)
52. MacConkey broth, dehydrated (Hi-media) (10x500 ml)

53. Peptone (1x500 g)
54. Oxgall (1x500 g)
55. Lactose (2x500 g)
56. Brilliant green (2x100 g)

---

3.2.2 To facilitates the procurement of equipment, glasswares, chemicals and allied materials, 85 Nos. of firms / suppliers have shortlisted by NIDC and the same has already been circulated to the State/Union Territories. These firms/suppliers almost cover all the regions of the country.



## IV

### PORTABLE WATER QUALITY TESTING KITS

4.1 Portable kits will be required to supplement district level testing laboratories for surveillance, training and awareness generation.

4.2 The kits developed by research laboratories :

- a) DL, Jodhpur
- b) NEERI, Nagpur
- c) ITRC Lucknow

4.3 Portable Kit is a simplified mini lab for water quality testing both qualitative and quantitative for meeting urgency as well as regular water quality monitoring at micro level. It is also used for testing samples in sites within a specified time. These Kits are meant for water quality monitoring and testing by PHED engineer, NGOs, Voluntary agencies, Women group etc. In case of alarming results, the district laboratory is to be informed for immediate inspection and counter checking of the results.

## V

### MOBILE LABORATORY

- 5.1 The concept of mobile lab has been thought to cover remote and hilly areas for water quality testing and related awareness generation. It is a motor van equipped with essential lab equipments needed for water quality testing and analysis.
- 5.2 For the present 15 such mobile labs will move to respective States.
- 5.3 The mobile laboratory will be under direct control of the Chief Engineer PHED or his nominee and will be deployed in remote and tail-end village.
- 5.4 This mobile laboratory will be linked to a Stationary District Laboratory for recouping its consumable supplies and necessary maintenance.
- 5.5 Chief Engineer will plan in advance the movement of van in a particular stretch deciding the date of arrival of van at a particular village. In this planning, care will be taken of fuelling of vehicle en route and the minimum quantities of consumables that can be stored in van.

**VI**

**CAPITAL COST ESTIMATE  
&  
RECURRING EXPENDITURE**

**Cost Estimates**

District Level Laboratory (stationary)

S No	Item	Cost in Rupees
a)	Capital Expenditure	
1	Instruments/Equipment	1,50,000
2	Office furniture	35,000
3	Bicycles - 2 nos	1,500
Total	Total (a)	1,86,500
b)	Recurring expenditure (per year)	
1	Man power @ Rs. 8,000 per month (6 persons)	96,000
2	Chemicals, glassware and other lab. Consumables	60,000
3	Service petrol, water, electricity, telephone, contingencies and maintenance expenditure	30,000
Total	Total (b)	1,86,000
Total	Total (a+b)	3,72,500

The cost to be incurred by DRD includes the above capital cost and recurring cost for one year (upto March, 1990) for each District Laboratory.

District Level Laboratory (mobile)

S No	Item	Cost in Rupees
a)	Capital Expenditure	
1	Instruments/Equipment	2,00,000
2	Mobile van	8,00,000
Total	Total (a)	10,00,000

b)	Recurring expenditure (per year)		
1	Man power @ Rs.5,000 per month (4 persons)		60,000
2	Chemicals, glassware and other lab. Consumables		50,000
3	Service petrol, water, electricity, telephone, contingencies and maintenance expenditure		40,000
Total	Total (b)		1,50,000
Total	Total (a+b)		11,50,000

This includes the capital cost of Rs. 10 lakhs and recurring expenditure for one year (upto March 1990) Rs. 1.50 lakhs for each Mobile Laboratory.

## VII

### WATER QUALITY SAMPLING

#### Area and Task Coverage

In a district, on an average there will be 1000 villages. In a month, there will generally be 21 working days. Hence 250 working days will be available in a year ( $1000/250 = 4$ ). Thus 4 villages could be covered in a day for sample collection. Water quality testing is expected to be done twice a year in a village preferably before and after rains.

Total number of samples thus collected from villages in a year will be ( $250 \times 8 \times 3 = 6000$ ). It is therefore, presumed that the district level laboratory should be able to analyse 6000 samples in a year.

To facilitate primary collection of water samples bicycles could be provided.

For bacteriological testing, appropriate kit would be installed in the district level laboratories.

The officer-in-charge of the laboratory will also visit villages to :

- Supervise the sample collection work and its surprise checking
- Awareness generation about water quality
- Suggest hygienic measures
- Special sampling in case of epidemics
- Suggest chemical dose fixation for chlorination and disinfection of water sources

## VIII

### WATER QUALITY PARAMETERS

The following tests will be carried out by the District/Mobile laboratories

a) Physico-chemical

- Visual appearance/smell(colour)
- Turbidity
- pH
- Conductivity
- Hardness
- Fluoride
- Sulphate
- Nitrate
- Iron
- Total dissolved solids
- Calcium/magnesium

b) Bacteriological

- Coliform
- Faecal coliforms
- Residual chlorine (to be tested regularly when water is disinfected)

## IX

### SAFETY EVALUATION OF WATER QUALITY

#### **Total dissolved solids**

This is an indicator of brackishness of water which is contributed due to presence of chloride and sulphate in water. In India, the upper permissible limit is 1500 ppm for drinking water. There is no toxic effect of salinity of water on human being except brackish taste of water.

#### **Fluoride**

Fluoride ion have dual significance in water supply system. Excess concentration of fluoride ion causes dental fluorosis (disfiguration of teeth). At the same time, a concentration of less than 0.8 mg/l results in 'dental carries'. Hence it is essential to maintain the concentration of fluoride ion in drinking water between 0.8 mg/l to 1 mg/l. The upper limit for fluoride concentration is 1.5 mg/l.

#### **Iron**

The presence of iron in drinking water creates problem when the iron is present in large amount in water. It imparts colour and also develops turbidity when exposed to air due to its conversion into ferric states. The water becomes unacceptable for drinking purposes from an aesthetic point of view. Further it interferes with laundering operation, imparts objectionable stains, difficulties in the distribution system and imparts typical taste even at low concentration. The maximum permissible limit is 1.0 mg/l in potable water.

# X

## WATER QUALITY STANDARDS

### Water Quality Standards

The idea of water works management is to ensure that water supplied is free from pathogenic organisms, clear, potable and free from undesirable taste and odour, of reasonable temperature, either corrosive nor scale forming and free from minerals which could produce undesirable physiological effect. The establishment of minimum standards of quality for public water supply is of fundamental importance in achieving this ideal. Standards of quality from the yardstick with which the quality control of any public water supply has to be assessed. In India, certain minimum standards have already been prescribed and given here.

### Standards for Potable and Safe water

It is defines as the water that is free from pathogenic micro-organisms, poisonous substances, excessive amounts of minerals and organic matter which would produce undesirable physiological effects. It should be free from colour, turbidity, taste and odour , of moderate temperature and aerated.

#### i) Physical & Chemical Standards

The physical and chemical quality of water should not exceed the limits shown in the table below :

Sl.No.	Characteristics	* Acceptable	** Cause for Rejection
1.	Turbidity (Units on JTU scale)	2.5	10
2.	Colour (units on platinum-cobalt scale)	5.0	25
3.	Taste and odour	Unobjectionable	Unobjectionable
4.	pH	7.0 to 8.5	6.5 to 9.2
5	Total dissolved solids	500	1500
6	Total hardness (mg/l as CaCO <sub>3</sub> )	200	600
7	Chlorides (mg/l as Cl)	200	1000
8	Sulphates (as SO <sub>4</sub> , mg/l)	200	1000
9	Fluorides (as F, mg/l)	1.0	1.5
10	Nitrates (as NO <sub>3</sub> , mg/l)	45	100
11	Calcium (as Ca, mg/l)	75	200
12	Magnesium (as Mg, mg/l)	30	150
13	Iron (as Fe, mg/l)	0.1	1.0
14	Manganese (as Mn, mg/l)	0.05	0.5



## Notes

\* 1. The figure indicated under the column acceptable are the limits upto which the water is generally acceptable to the customers.

\*\* 2. Figures in excess of those mentioned under acceptable render the water non-acceptable but still may be tolerated in the absence of alternative and better source but upto the limits indicated under column cause for rejection above which the supply will have to be rejected.

(Source : From Document of National Drinking Water Mission)

### ii) Bacteriological Standards

- a) Coliform count in any sample of 100 ml should be zero. A sample of water entering the distribution system that does not conform to this standard calls an immediate investigation into both efficacy of the purification and the method of sampling.
- b) Water in the distribution system shall satisfy all the three criteria indicated below:
  - E,Coli count in 100 ml of any sample should be zero
  - Coliform organisms not more than 10 per 100 ml shall be present in any sample.
  - Coliform organisms should not be detectable in 100 ml of any two consecutive samples or more than 50% of the samples collected for the year

### iii) WHO guidelines (values for health related organic contaminants)

Contaminant	Guideline value
Aldrin and dieldrin	0.03
Benzene	10
Benzo(a)pyrene	0.01
Clordane (total isomers)	0.3
Chloroform	30
2,4 -D	100
DDT (total isomers)	1
1,2 Dichloroethane	10
1,1, Dichloroethane	0.3
Heptachlor and heptachlor epoxide	0.1
Hexachlorobenzene	0.01
Gamma-BHC(HCH lindane)	3
Methoxychlor	30
Pentachlorophenol	10
2,4,6- trichlorophenol	10

## REQUIREMENT OF MANPOWER

### Staff requirement (for stationary district level laboratory)

Requirement of staff for carrying out laboratory operation shall be as under :

Sl. No.	Designation	No. of posts	Qualification
1.	Chemist	1	(B.SC in Chemistry/Bio-chemistry/Biosciences)
2.	Lab.Assistant	2	12 <sup>th</sup> Standard (10+2)
3.	Driver	1	

### MONTHLY PROGRESS REPORT FOR SETTING UP OF DISTRICT LAB

State: \_\_\_\_\_

Month: \_\_\_\_\_

Name of the Nodal Officer: \_\_\_\_\_

1. Name of the District  
Mini Mission District:  
Other District :
2. Building acquired  
Rented building:  
Land acquired:  
Under construction :
3. Recruitment of Staff  
On deputation:  
On daily basis:  
Being recruited by:  
Waiting for Govt. approval:
4. Equipment & Other items  
Tendering done:  
Scrutiny of tender:  
Order placed on date:  
Equipment received by:
5. Equipment & other items  
Being done of date:  
Furnished on date:

6. Training  
Name of your Regional Centre (RC)  
When was your last meeting held with RC  
Schedule of training programme  
No. of trainees identified
  7. What is the scheduled date of start of laboratory ?
  8. Any other problem in implementing the programme ?
- 

### **Reporting channel**

The nodal officer of State will prepare progress report for each laboratory in above Proforma and send one copy to Chief Engineer, PHED and another copy to DRD, New Delhi.