

## CHAPTER 17

# HUMAN RESOURCES DEVELOPMENT

### 17.1 NEED FOR HUMAN RESOURCE DEVELOPMENT

Adequate and safe drinking water supplies and appropriate sanitation facilities form a sound basis for improvement in community health. Maximum health benefits will be achieved only when the water supply and sanitation facilities operate continuously and to full capacity in conformity with the acceptable standards of quantity and quality. If the O&M tasks are to be carried out effectively and efficiently there is a need for strengthening the technical, operational and managerial capabilities of the O&M managers and staff. The management orientation shall change and the management shall become service oriented and be prepared to run the organisation on a commercial basis. The management must be able to motivate the staff to perform better. It is essential that the organization responsible for O&M has well qualified, experienced, efficient staff. Human resource development through training programmes, career plans and adequate salary system should be given special emphasis to improve the knowledge and skills of the staff. This objective is achieved by first developing proper job description and undertaking training schemes for the O&M managers and personnel. This chapter covers the following topics on Human Resources Development in water supply sector:

- Job description
- Training needs assessment
- Training for capacity building
- Training for refreshing skills
- Training of trainers
- Training in outside institutions
- Long term training needs
- Short term training needs
- On-the-job training
- Quantification of training
  - ◆ Categories
  - ◆ Number
  - ◆ Frequency
  - ◆ Duration

- Training Schedule
- Yearly programme
- Institutions
- Training budget

## **17.2 JOB DESCRIPTION**

### **17.2.1 CATEGORIES OF O&M STAFF**

The O&M function is performed by (a) operating staff and (b) supervisory staff. While the former actually runs the system, the latter monitor the operations and provide managerial support. The O&M staff should know the procedures for routine tasks to be performed by them and supervision and inspection managers should know the checks and inspections to be carried out by them at specified intervals to monitor and evaluate the status of operation and maintenance. The supervision or inspecting officers have to ensure that the operation and maintenance staffs perform their assigned duties promptly and properly. While in most of the cities, a large work force has been already created over a number of years and is being used for O&M of the systems; the suitability of skills and experience has not necessarily been tested.

### **17.2.2 JOB DESCRIPTION**

The managers of water utilities deal with planning, organization and finance in water supply and sanitation. They will also be required to formulate programmes and implement activities aimed at improving the effectiveness of operation and maintenance practices. This job description is quite general in nature and the water utilities should have well defined duties and responsibilities at various levels of employees.

As a first step to preparation of job descriptions, an O&M plan or programme containing procedures to be adopted or actions to be taken is prepared for each piece of equipment in the system and the person to carry out this action is to identify. The job description of operating personnel shall clearly define the limits up to which these personnel can carry out normal maintenance. The job description of the Supervisor/Manager shall include the requirement that they shall ensure that the operating personnel conform to these limits and thus ensure the safety of the equipment. (Sample job requirements are given in Annexure-17.I).

## **17.3 TRAINING NEEDS ASSESSMENT**

### **17.3.1 TRAINING**

Training is a planned process to modify attitude, knowledge or skill through learning experience to achieve effective performance in activity and to develop abilities of the individual to satisfy the current and future needs of the organization.

The personnel who are already available or chosen to carryout the actions contained in the O&M programme may have to be trained through special courses or by “on the job training” to ensure that these personnel are thoroughly trained to carryout the actions listed in the plan of maintenance. This training is essential to prevent experimentation by operating

personnel to meddle with equipment since often these operating personnel may not be capable to take up the required maintenance. On the job training is preferred to classroom training. The supervisors can be trained initially; they can later train their operators. A systematic plan of action of any training programme include:

- Identification and assessment of the need for planned training.
- Defined training objectives.
- Appropriate strategy for training.
- Provision for assessing effectiveness of training.

### **17.3.2 TRAINING NEEDS IDENTIFICATION**

#### **17.3.2.1 Objective of Training Needs Identification**

The objectives of training needs identification are:

- To identify a profile of the training needs and interests of the employees.
- To gather information on the climate, culture and communication links of the work place.
- To make recommendations for a training initiative that would be the basis for a strategic plan for employee development.

#### **17.3.2.2 Process of Identification of Training Needs**

The basic process of identifying training needs involves the following steps:

- Determine what is required or expected in the job.
- Determine the degree to which this requirement is being met.
- Determine whether training can bridge the gap between what is required in the job and the present knowledge, skills, attitudes or behaviour of the employees.

#### **17.3.2.3 Data Collection**

Data on the assessment of training needs can be collected in the following ways:

- Discussions with the officials and employees, supervisors and top management.
- Observing the employees, their work, work flow and relationships.
- Review of records and reports, particularly the reports if any which provide the reaction of the consumers to the services provided by the utility, organization structure, organization policies, records of past trainings etc.

#### **17.3.2.4 Analysis of data**

The analysis of the data is carried out with a view to make the assessment of training needs for various levels as below:

- Needs for the organization as a whole – corporate needs
- Needs for departments/teams within the organization – group needs
- Needs for individual employees – individual needs

There is a need for a i) Job analysis and ii) A person analysis for carrying out a training need analysis.

**17.3.2.4 I. Job analysis**

The information is obtained on the following aspects :

- Problems faced by jobholders in learning basic skills and applying them successfully in work.
- Weakness in performance of existing jobholders due to gap in knowledge, lack of skills or motivation.
- Areas where competence levels are not up to standards required.
- Areas where future changes in work process or methods or job responsibilities indicate training needs.
- How training is carried out at present.

A job analysis work sheet is shown below:

What has to be done?	Why?	How?	How well?
To .....	In order to .....	With whom? Where? Process or Procedure? What equipment or facilities?	Quantity? Output required? Results needed? Quality?

**17.3.2.4. II. Person analysis**

The information obtained from person analysis is:

- Details of job holders with adequate knowledge and skill for the job.
- Effectiveness of a person in putting his work to practice.
- Behavioural changes and work efficiency of job holders after attending training programmes.
- Level of job satisfaction.

A person analysis work sheet is shown below:

Personal particulars	Detailed information		
	Essential	Useful	Not necessary
Educational/Training/Experience			
Sex, Age			
Occupation			
Affiliation/ Special interests/Aptitudes			
Languages			
Attitudes, beliefs			
Knowledge of subject			
Authority			

### 17.3.2.5 Presentation of results of the training need analysis

From the training need analysis described above; the present knowledge and skill of jobholders of the organization can be arrived at. A table showing results of training needs is shown below:

Job requirement	Trainee's current knowledge & skills				
	Excellent	Good	Fair	Poor	Nil
1.					
2.					
3.					
4.					
Etc.					

Training needs are identified from the above information, taking the identified training needs as indicators, training objectives can be listed out to arrange the training.

### 17.4 TRAINING FOR ENHANCEMENT / REFRESHING SKILLS

The purpose of any training programme is to provide individuals with skills necessary for them to perform their assigned duties effectively and efficiently. After ascertaining the skills of the job holders, it has to be decided as to whether trainings to enhance the skills or refreshing the skills are to be arranged.

- *Employees creative model:*
  - ◆ Organizations provide trainings for enhancement of skills to encourage personal advancement.
- *Organizational strategy model:*
  - ◆ Basic skills are identified as a critical component in achieving corporate goals, for refreshing the skills of work for increasing production and efficiency.
- *Problem centered model:*
  - ◆ The need for basic skills training was identified as a specific issue or difficulty faced by the organization.

### 17.5 TRAINING OF TRAINERS

Training of trainers plays a key role in how effectively a trainer can operate to satisfy the needs of the trainees. Trainer's training is a specific programme set out to enable new trainers to learn the basic techniques and approaches of training or to enable existing trainers to develop the training skills they already possess. Some of the specific objectives of trainer's training in water supply sector are:

- To explain the necessity and objectives of training in water supply, operation and maintenance.
- To practice participatory learning activities.
- To carry out systematic training needs identification or training needs assessment.

- To demonstrate appropriate technology for urban and rural water supply.
- To prepare and review curriculum for various categories of trainees.
- To select and use appropriate audio visual aids in training programmes.

With the new or improved skills of trainers, they (trainers) are able to arrange training programmes to enable others (trainees) to develop skills, knowledge and attitudes. (Some specific training needs for a water utility are listed in Annexure 17.2).

## **17.6 TRAINING IN OUTSIDE INSTITUTIONS**

Off-the-job training can take place in institutions outside the organization, which are specially equipped and staffed for training.

- It is the best way to acquire knowledge on advanced or latest office procedures, planning and monitoring, project implementations methods, quality assurance methods and proper maintenance of schemes.
- Use of systematic training techniques, special equipments and trained trainers.
- Basic skills and knowledge can be acquired quickly and often economically.
- Training courses cover standard theory and practice which are easily translated from general to be particular.
- Useful to implant highly specialized knowledge and advanced skills.

List of a few training Institutions is presented in Para 17.3.

## **17.7 LONG-TERM TRAINING NEEDS**

Long-term training needs will largely be addressed by deputing staff to undergo formal educational programmes in water supply and sanitations (regular/distance learning) as well as specifying recruitment criteria for new entrants.

- Universities, Technical Colleges, Public/Private Sector institutes offer formal programmes leading to degree/diploma in Water Supply.
- Evaluations of short-term training programmes will lead to assessment of long term training needs.
- Existing staff of organization can undergo formal programmes by distant learning.
- Long-term training needs addresses the future demands of the organization.

## **17.8 SHORT-TERM TRAINING NEEDS**

Short-term training needs are for the existing staff of the organization that are likely to be met by short courses or other similar interventions.

- Specific training needs identified can be met by appropriate short-term training programmes.
- This improves competence of employees.

Proper job analysis and training analysis can identify short-term training needs. Short-term training needs can mostly be attended to by means of in-house training programmes.

## 17.9 ON-THE-JOB TRAINING

Depending on the place or location where training takes place, training can be called on-the-job training if the trainee gets training while working on the job assigned to him. The trainee in the physical and social environment of the work place is simultaneously involved in the process of acquiring knowledge.

- The trainee requires little specialized attention in terms of extra equipment and manpower.
- It helps to develop and practice specific managerial/technical/administrative skills needed in operation and maintenance of Water Supply System.
- The trainee works, learns and develops expertise at the same time concepts and theory are put into practice immediately.
- Gives guidance to supervisors and instructs new employees in performing their tasks.
- It is considered to be an acceptable means to train officials in new developments and new systems when they are introduced.

For example, a mechanic/plumber may be given field experience in Pump Houses and small water supply schemes to operate and maintain them. This helps them –

To Skill Development	Learns how to do it
Practical knowledge	Learns when to do it
Education	Learns what to do
Hands on experience	Knows the impact

## 17.10 QUANTIFICATION OF TRAINING

The training programmes can be quantified in terms of category of staff being trained, the number of staff members who also can be accommodated in a training programme, how often this training has to be given (frequency) and the duration of each course.

### 17.10.1 Category of trainees

- ◆ Executive Officers.
- ◆ Supervising staff.
- ◆ Administration and establishment staff.
- ◆ Last grade servants.
- ◆ Training for grass root level personnel.

### 17.10.2 Category of the training course

- ◆ Technical/Public Health Engineering.
- ◆ General Management.
- ◆ Finance.
- ◆ Operation and Maintenance.
- ◆ Industrial/Personal Relations.
- ◆ Computer application/IT.

### **17.10.2.1 Number, frequency & duration**

The number of trainees in a particular training course, how frequently that course is offered and duration of the course are factors used to quantify the training programmes.

## **17.11 INCENTIVES FOR EFFICIENT PERFORMANCE**

There is a need to provide for incentives and awards to recognize and encourage those employees whose performance has been found to be exceptionally efficient. This will enthruse other employees also to strive to improve their work efficiency. The HRD budget should provide for the incentives and awards.

## **17.12 TRAINING SCHEDULE AND YEARLY PROGRAMME**

The change from a crisis type of O&M to a planned O&M can be undertaken gradually or in a relatively short period of time depending on the resources available. The change should be planned and coordinated with a schedule of training. The training schedule should ensure that each staff member gets training periodically and training should be made mandatory for all the staff members of the utility.

A tentative action plan for the year (or yearly programme) can be prepared in advance. Each and every staff member will get training periodically and it shall be made mandatory. This action plan would give the yearly programme of various training courses. It gives the following:

- Course group, title.
- Category and number of participants.
- Duration (including date on which training is to be held).

## **17.13 TRAINING INSTITUTIONS**

External training facilities for a substantial proportion of the staff and personnel engaged in supply of drinking water are available at both the national and local level. Such training facilities are being used by many of the Water Authorities.

### **17.13.1 INTERNATIONAL TRAINING NETWORK (ITN)**

There exist a number of institutions coming under an International Training Network (ITN) established for the implementation of HRD activities. In India the following institutions are in the network:

- i) All India Institute of Hygiene & Public Health, Kolkata (ITN Centre).
- ii) Gujarat Jalseva Training Institute, Gandhinagar.
- iii) Environmental Sanitation Institute, Ahmedabad.
- iv) S.J. College of Engineering, Mysore.
- v) Gandhigram Rural Institute, Gandhigram.
- vi) Institute of Engineering & Rural Technology, Allahabad.
- vii) Motilal Nehru National Institute of Technology, Allahabad.



## 17.13.2 NATIONAL EDUCATION/TRAINING FACILITIES

### 17.13.2.1 Masters Degree in Public Health/Environmental Engineering

Post Graduate programmes are recommended/sponsored by the Ministry of Urban Development for inservice engineers working in water supply and sanitation agencies including urban local bodies. The name of the recognised institutes for in service engineers for P.G.C. are:

	Institute	Course Duration (Months)
1.	All India Institute of Hygiene & Public Health, Kolkata	24
2.	V.J.T.I., Mumbai	24
3.	National Institute of Technology, Nagpur.	24
4.	Indian Institute of Technology, Delhi	24
5.	Sri Jayachamrajendra College of Engineering, Mysore.	24
6.	Motilal Nehru National Institute of Technology, Allahabad.	24
7.	Shri G.S. Institute of Technology & Science, Indore.	24
8.	Indian Institute of Technology, Powai, Mumbai.	24
9.	Malaviya National Institute of Technology, Jaipur.	24
10.	Anna University, Chennai.	24
11.	Indian Institute of Technology, Kharagpur	24

### 17.13.2.2 Management education at degree/diploma level

Management Courses are offered inter-alia, at the following five management Institutes:

1. Indian Institute of Management - Ahmedabad
2. Indian Institute of Management - Bangalore
3. Indian Institute of Management - Kolkata
4. Indian Institute of Foreign Trade - New Delhi
5. International Management Institute - Delhi
6. Administrative Staff College of India - Hyderabad

### 17.13.2.3 National Institute for Training in Industrial Engineering (NITIE)

Short term non-residential and residential courses are held by the National Institute for Training in Industrial Engineering (NITIE). The courses are from five days to two weeks' duration and are held at five centers. Courses held in Mumbai are residential. Courses held in Bangalore, Delhi, Hyderabad and Madras are non-residential.

### 17.13.2.4 Central Public Health and Environmental Engineering Organisation (CPHEEO)

Refresher Courses are conducted by various recognized institutes under the sponsorship of the CPHEEO, by the Ministry of Urban Development under the Public Health Engineering Training Programme. The courses being offered are in Annex 17.3.

### **17.13.2.5 National Environmental Engineering Research Institute (NEERI), Nagpur**

NEERI is a research Institute primarily engaged on research and development work in the field of public health and environmental engineering. Training & consultancy services are offered by this Institute in the following areas :

Water Treatment and Supply.

Sewage Treatment and Disposal.

Industrial Waste Treatment.

Stream Sanitation.

Industrial Hygiene and Air Pollution.

Rural Sanitation.

### **17.14 NEED FOR SEPARATE HRD/TRAINING BUDGET**

It is preferable to have a separate Budget for HRD for each utility. While preparing budget for each training, one should plan and budget for the following items:

- The professional/registration fee.
- Honorarium and travel expenses for the trainer/faculty.
- Accommodation for Trainer(s).
- Ground Transportation for Trainer(s).
- Training Rooms.
- Library facilities.
- Audio-Visual Equipment (OHP, TV, VCR etc.).
- Snacks & tea (refreshment).
- Travel expenses for trainees for field visit.
- Stationery articles.
- Computer time; stationery; etc. for computer aided training courses.
- Incentives and awards for improvement in work efficiency.

A typical worksheet for developing a Training Budget is given below:

### WORKSHEET I: DEVELOPING A TRAINING BUDGET

Questions to consider	Cost	Comments
<b>Event fees:</b>		
Is there a registration fee, course fee, or tuition fees for the event?		
<b>Trainer or Consultant Fees:</b>		
What is the trainer's or consultant's hourly, daily, or weekly fee?		
Does the trainer or consultant charge for preparation time? If so, how much?		
<b>Materials:</b>		
Are there course materials associated with the training? How much do they cost? Does each trainee need a copy, or can they share?		
Will the training require printing or photocopying of materials? If so, how much will these services cost? Are they included in the trainer's fees?		
Will the trainer need audio or visual aids (e.g., overhead projector and slides, VCR and TV)? How much will it cost to purchase or rent these items?		
Will you need to purchase other assorted materials (e.g., name tags, paper and pens, files, or computer stationary)? If so, what will they cost?		
How much will refreshments cost? How will you pay for them?		
<b>Space:</b>		
Where will you hold the training? What will the space cost?		
Will you provide on-site care? Are the necessary space and resources available? What will this cost?		
<b>Travel:</b>		
Will the training require staff to travel? Will they need to stay over? How much will this cost, including mileage, per diem, and lodging?		
If the trainers are from out of town, what will their travel, lodging, and per diem expenses total? Are their travel costs covered separately or included in the contract?		
If volunteers are included in the learning event, will they have transportation or parking expenses? Are they eligible for reimbursement?		
<b>Staff Time/Substitutes:</b>		
Will some employees involved in the training need to be replaced by substitute staff? How much will the substitutes cost?		
If follow-up training or assistance will be needed, what will this cost?		
<b>Other:</b>		
Accommodation for the out station trainees		

Budget for Training is frequently expressed as a percentage of the total payroll. On an average 2 to 2.5% is preferred, out of which 75% can be spent for in-house training and rest can be utilized for training in external institutions.

## JOB REQUIREMENTS

### 1. Responsibility of Senior Management

- (a) The senior management shall define the role of the agency and set out strategies for long term objectives. They should be in close contact with other agencies involved in infrastructure services and work for coordination with government and private agencies in design, construction, O&M, monitoring and evaluation of the functioning of the agency.

Their responsibilities will be to:

- Establish delivery mechanisms and type and level of service for water supply to the population in their service area and determine priorities and define areas for expansion of coverage.
- Determine and administer staffing structure, service conditions, job descriptions, salary levels, performance standards, staff training and promotions.
- Ensure efficient use of funds and control construction and O&M costs (preferably to link to per unit of water produced).
- Set targets for achieving excellence in quality, quantity, continuity, cost, and set tariff levels keeping in view the social equity and agency's need for financial self-sufficiency.
- Promote dissemination of information and seek support and acceptance of the agency's programmes and plans by public and private bodies.
- Initiate actions for conservation of water.
- Work with other water users such as agriculture, industry and other drinking water supply agencies for managing the water resources by proper water allocations amongst all users.
- Carry out a situation analysis of technological capacity, government policies, sources of funding which affect the O&M.
- Prepare an inventory of the installations and equipment.
- Reduce amount of water wasted or not accounted for.
- Institute water conservation practices.
- Adopt appropriate technologies to minimise O&M costs.
- Ensure quality control in the purchase and installation of materials and equipment and thus ensure prolonged useful life of materials and equipment through preventive maintenance.
- Raise the productivity of workforce.
- Draw up plans to explore, exploit, and manage water resources in coordination with appropriate agencies.
- Monitor plans for prevention and control of pollution of water at source.

- Consolidate programmes formulated by middle and operational management levels and prepare a long term plan for O&M with targets set for each unit for the coverage, output, productivity and cost.
- (b) Determine the technical, economic and organisational feasibility of the O&M plan, adjustments where necessary, and carry out cost benefit analysis or undertake socio-economic studies or other studies if found necessary.
- (c ) Arrange for dissemination of O&M plan with other agencies, authorities and public.
- (d) Approve the long term plan and prepare programme for investment and implementation of the long term plan for O&M and set targets for implementation of long term plan for O&M and allocate resources as per priorities, set targets, monitor and re-allocate resources where necessary to ensure that the targets set in the plan are achieved.
- (e) Encourage programmes of a strategic nature and have potential for research and development and adaptation of new technologies and approaches.
- (f) Create enabling environment in adaptation by the agency of technical, regulatory and political changes.
- (g) Prepare contingency plans for continued service delivery in emergency situations.

## **2. Responsibility of Middle Management**

- (a) Middle management should contribute in the formulation of a long term plan for O&M and also for preparing projects for expanding the facilities and making them work effectively. For achieving this they should,
  - i) update system data, select design criteria and decide how to meet the technical standards and social needs in the most cost effective way,
  - ii) formulate and implement programmes for increasing productivity,
  - iii) formulate and implement programmes for exploitation and management of water resources and provide data to senior management for formulation and implementation of pollution control programmes.
- (b) Middle management should be responsible for defining the type of service and coverage, deciding the capacity of treatment, transmission, storage and distribution of water and formulate medium term programmes for O&M. These programmes should aim at:
  - Expanding coverage of service.
  - Making best use of existing physical, financial and human resources.
  - Improving quality of services provided.
  - Reducing and controlling of water loss.
  - Rehabilitation (as part of preventive maintenance) component parts of water supply installations and equipment with a view to extend their useful life.
  - Reducing costs and raising productivity in the agency's O&M programmes.
  - Controlling production and quality of drinking water.
  - Supervising the O&M of water supply.

- Monitoring of pollution of water sources.
  - Promoting awareness of and educating users about the proper use of drinking water services.
- (c) Middle management shall determine the technical, economic and organisational feasibility of the O&M plan. They should determine priorities and set targets for implementation of long term plan for O&M.
- (d) Middle management will consolidate all the short term O&M plans prepared by the operational management level and submit it to senior management to ensure that it is compatible with the long term plan and they will monitor and re-allocate resources where necessary to ensure that the targets set in the plan are achieved.

### **3. Responsibility of Operational management**

Operational management is primarily responsible for short term planning and also participate in formulating medium term and long term O&M plans. Operational management has responsibilities in the planning, design and construction work as well as O&M of the agency's equipment. They also propose medium term activities to provide water supply and participate with middle management in defining objectives, strategies and resources both to extend the coverage of service and ensure full use of them. They should also evaluate the feasibility of medium term investments for O&M. In line with long term and medium term programmes for O&M they should formulate short term objectives, targets and programmes. They will assess the resources required and allocate them, monitor and evaluate the performance in the following areas:

- Studies and designs needed for rehabilitation of the installations or for expansion of the services.
- Maintain the units under operation so that they will work efficiently and last as long as possible.
- Measurement of water flow rates, pressures and levels (Macro metering).
- Diagnosis process by way of simulation or otherwise for the working of distribution system.
- Introduce process for reducing and controlling leakages.
- Update the distribution system plans/maps.
- Processes for improvements of house connections and domestic plumbing.
- Processes for production and quality control of water.

### **JOB DESCRIPTION**

Based on the above identified responsibilities for various management levels, the suggested job descriptions are given below:

#### **I. Senior Management level (Director/Chief Engineer)**

1. To assist the Agency in designing and developing appropriate organizational structure and formulation of policies pertaining to operations and maintenance of water supply and sewerage.

2. To initiate perspective planning for augmentation of water supply, strengthening of sewerage system and improvement of sewage treatment.
3. To provide professional leadership in formulation of projects pertaining to augmentation storage treatment and distribution of water supply collection treatment and disposal of sewage.
4. To provide technical guidance in achieving the desired level as well as quality of service.
5. To provide leadership and guidance to the heads of various service circles in achieving the organisational goals.
6. To develop data base management culture pertaining to monitoring, review and coordination of control systems in operations and maintenance.
7. To prepare contingency plans for lean monsoon/drought years.
8. To undertake periodic inspection of sources, prescribe operation schedules for meeting floods/emergencies and ensure implementation.
9. To coordinate with external organisations such as electricity Boards, roads and communications, railways, telecom, pollution control, revenue, industries and industrial infrastructure departments to ensure smooth interface operations.
10. To schedule and organise periodic inspections of the dams by panel of experts on dam safety and ensure appropriate documentation of the panel reports.
11. To ensure timely preparation and approval of the annual budget plans.
12. To ensure timely processing of requisition for allocation of funds.
13. To develop procedures as well as ensure implementation of material vendor rating.
14. To prescribe methods and ensure implementation of inventory control.
15. To cause preparation of type designs.
16. To ensure updating of the existing plans.
17. To prescribe norms for evaluation and registration of contractors.
18. To cause preparation of model bid documents for execution of works as well as procurement of goods.
19. To prescribe methods and ensure implementation for evaluation of tenders.
20. To coordinate with other Chief Engineers in preparation of manpower plans and training plans.

## **II. Senior/Middle Management level (Superintending Engineer)**

1. To undertake program planning for implementation of agency's policies on procurement of materials, maintenance, repair and operations, contract services, tooling, equipment and supplies etc.
2. To supervise the interdivisional task assignment and monitor performance.
3. To initiate activity planning pertaining to the following functions and ensure effectiveness of implementation in the service jurisdiction. (a) augmentation of

storage, treatment and distribution of water supply; and (b) collection, treatment and disposal of sewerage services.

4. To prescribe norms of implementation and monitor the operations pertaining to quality assurance.
5. To prescribe procedures for generating data on service delivery and monitor their implementation.
6. To coordinate with external organisations, such as Electricity Board/Agency, City Municipal Corporation, Roads & Buildings Department, Urban Development Authority, Housing Agency, Telecom, Revenue & Public Health Engineering Department for resolving interface problems.
7. To undertake performance review of the subordinate units, and provide direction and guidance to the heads of the units, in achieving the performance targets pertaining to the following elements: a) inspection of level of service delivery; (b) service interruptions; (c) quality assurance;
8. To formulate, implement, monitor and review procedures pertaining to the following:
  - (a) Provision of advance information to consumers on service interruptions:
  - (b) Assignment of quota of connections for water supply division wise and subdivision wise: so as to be in conformity with the available capacity:
  - (c) Procurement, storage and issue of materials, tools, plant and equipment;
  - (d) Safety and security of properties materials, tools. plants and equipment by servicing schedules for various machines, tools, plants and equipment;
  - (e) Preparation of utility plans;
  - (f) Formats and procedures for generation of management control data;
  - (g) Preventive maintenance & leak detection;
  - (h) Water quality etc.,
9. To monitor the implementation and to effect suitable revision of contingency plans for service delivery during lean and drought years;
10. To monitor implementation of agreed staff welfare measures.

### **III. Middle/Operational Management level (Executive Engineer)**

1. To cause preparation of water distribution plans - source wise and area wise.
2. To ensure preparation and periodic updating of plans of the service area-subdivisions/zones and sections/reservoirs.
3. To implement the procedures pertaining to advance notification on likely occurrence of floods/interruptions in water supply to public.
4. To ensure timely preparation of budget estimates of annual maintenance and maintain cash books.
5. To implement the procedures pertaining to requisitioning of funds, processing, scrutinizing, approval and obtaining sanction thereof.



6. To ensure that procedures are followed for prompt and timely payments to agencies for works done/supplies made.
7. To ensure that the expenditure on O&M is maintained as per the heads of accounts indicated.
8. To ensure implementation of prescribed procedures for indenting and receipt of materials from stores division for operation and maintenance.
9. To ensure implementation of procedures in acquisition of cash, undertake scrutiny of accounts and accord authorization.
10. To cause for the audit of accounts, at the end of monthly accounting period and arrange for addressing the audit authorization.
11. To cause preparation of O&M establishment's salary claims, processing, approval, disbursement and maintenance of pay rolls, in accordance with the approved procedures.
12. To undertake periodic review of manpower availability at the concerned service sub-divisions and sections and effect staff transfers if necessary to conform to requirements.
13. To arrange for shoes, raincoats, uniforms and safety gear etc., for operation and maintenance staff as per the requirement.
14. To cause preparation, scrutiny and accord sanctions for maintenance of vehicles used in operation and maintenance or to arrange for hiring of vehicles for O&M.
15. To formulate proposals for hiring private water tankers and to implement the approved proposals.
16. To cause preparation of normal/emergency operation schedules of each source and ensure implementation.
17. To undertake periodic inspection of sources, especially the spill ways, gates and emergency gates, sand bag stocks, etc., to ensure implementation of prescribed norms. To ensure that prescribed procedures are followed for removal of any carcasses and drift wood etc. from reservoirs.
18. To take personal charge of operations and provide guidance to the personnel in critical areas during high intensity floods.
19. To evolve methodologies for collection of flood flow information and ensuring data collection, documentation and dissemination of data.
20. To coordinate inspections of dam safety committees and ensure compliance with their recommendations in accordance with prescribed procedure.
21. To schedule the statutory inspections by the electrical inspectorate and ensure implementation of their suggestions.
22. To arrange for energy audit and ensure that power is conserved.
23. To arrange that generator sets are procured for use in power cut periods as per prescribed procedures.

24. To undertake water demand forecasting/projections.
25. To undertake periodic inspection of subordinate offices and evaluate their state of effectiveness.
26. To prepare and ensure implementation of inspection schedules for store materials, small tools, plant and machinery.
27. To generate data on MIS from subordinate offices for processing or transmit to the concerned for processing.
28. To undertake surprise checks of bulk water meters of industrial, commercial and other large water consumers and ensure that reading, billing and collection is done properly and ensure that deliberate under billing, pilferage and unauthorised use of water is avoided.
29. To undertake a trend analysis of water supplied, bills demanded and amount collected.
30. To coordinate with external organisations, such as Electricity Agency, city Municipal Corporation, Roads & Buildings Department, Urban Development Authority, Housing Agency, Telecom, Revenue & Public Health Engineering Department for resolving interface problem.
31. To prescribe methods and norms in respect of quality assurance, organise, implement and monitor their implementation.
32. To cause preparation, maintenance and implementation of all staff welfare measures.
33. To meet the guide line values for water quality control, water quality monitoring, preventive maintenance and leak detection etc.
34. To assess training needs for all categories of field staff involved in water treatment, water quality control and monitoring, O&M of treatment plant, distribution system net work etc. and prepare training schedule for imparting training with in the department and or outside and forward detailed proposal to the heads of the department with financial implications.

#### **IV. Middle/Operational Management (Deputy Assistant to the Executive Engineer)**

1. To monitor, review and reschedule of inflows into service reservoirs and sumps, in accordance with delivery schedules in the relevant service area.
2. To monitor supply pressures with a view to identify problems and their removal.
3. To monitor the implementation of water quality control.
4. To monitor the leakage rectification.
5. To monitor the pollution cases.
6. To monitor, guide and supervise maintenance and other works.
7. To initiate timely check measurement of works.
8. To monitor the quality of filling for road cuttings of leakage rectification.
9. To verify conformity with bye-laws for regulating sanction of new consumer connections, and arrange for onward transmission where necessary.

10. To monitor the service section performance and render guidance to the section officers in problem resolution through weekly meetings.
11. To guide service area section officers in organising staff review meetings at section level.
12. To guide service area section officers in organising of consumer meetings at section level.
13. To carryout periodic physical verification of materials, tools and plants.
14. To verify and initiate corrective actions on the level of O&M staff strength.
15. To monitor the performance of concerned revenue collection center.
16. To coordinate with City Municipal Corporations and Electricity Agencies to resolve interface problems.
17. To monitor the maintenance, status of log books and other records in the concerned section and pumping stations and render technical guidance for oil operation and maintenance.
18. To schedule and carry out periodic service inspection and initiate corrective action on the status of: (a) Chlorination Plants; (b) Switch gear and HRC fuses; (c) Emergency lighting points; (d) Requirement and availability of tools; (e) Vibration levels of motors/pumps; (f) pump alignments; (g) General condition of base plates and foundation bolts; (h) Pressure gauges on suction/delivery; (i) Voltmeters/ Ammeters; (j) Conservation of energy of power factor meters and performance of capacitors; (k) Replacement of oils/lubricants; (l) By-pass valves in delivery sluice valves; (m) History register of each machine with specific reference to entries on supplier details and service specifications and implementation; (n) Fire fighting equipment; (o) First aid kits; (p) Safety equipment like rubber mats, hand gloves, helmets, gas masks etc.; (q) Weed control and metalling at substations; (r) Clearance between trees and overhead power lines; and (s) Ventilators, manhole covers and ladders at reservoirs.
19. To schedule and monitor the implementation of cleaning and weed removal schedules at reservoirs/sources.
20. To monitor the implementation of procedures for storing and issue of materials.
21. To carryout periodic preventive checks against encroachments on foreshore areas at the sources.
22. To ensure effective regulation of visitors at the source premises.
23. To undertake periodic inspection to identify spots/areas of degeneration and ensure timely repair, rebuilding and maintenance of affected areas, pertaining to the following (a) Spillway gates including the wire ropes, pulleys and the operating parts; (b) Emergency gates including the wire ropes, pulleys and the operating parts; (c) Upstream paving; (d) Down stream aprons, revetment and leakage; (e) Bunds-Status of consolidation, growth of weeds and vegetation etc.; (f) Lighting at surplus release points; (g) Raw water conduits and trunk lines - special focus on sections

vulnerable to pilferage encroachment and unauthorised modifications, and pollution;  
(h) Sluice valves and air valves, approach roads, cross drainage works.

24. To formulate and obtain approval for flood regulation measures and train the staff in carrying out various operations in emergency.
25. To take direct charge of flood regulation at reservoirs and areas that may be flooded.
26. To undertake periodic inspection and initiate corrective action of the following: (a) Raw water conduits and trunk lines; (b) Verification and prevention measures pertaining to pilferage; (c) Encroachment and unauthorised modifications on main pipelines; (d) Pollution spots; (e) Status of all sluice valves and air valves and expansion joints; (f) Condition of approach roads; (g) Cross drainage works before and after monsoon.
27. To monitor alum dosage, consumption and stock of alum at treatment plants.
28. To monitor chlorine dosage, consumption and stock of chlorine at treatment plants.
29. To formulate and monitor periodic cleaning of all Tanks.
30. To monitor the movement of water tankers.
31. Undertake periodic assessment of service delivery in the concerned sections, identify the factors causing deficiency in service levels and initiate measures for maintaining the required service levels.
32. Cause preparation of inventories of assets/estate by value and age.
33. Monitor status of functioning of zonal flow meters and need for servicing them.
34. Prepare section wise requirement of funds (annual budget) and compile and forward to division.
35. Prepare proposals for extension of service to new layouts.
35. To cause preparation, maintenance and implementation of all staff welfare measures
36. To analyse the work turned out by staff and identify the cases where overtime is paid and initiate remedial measures to avoid payment of overtime.
37. Undertake review of consumer complaints, monitor the lead time for addressing the complaints and initiate measures to reduce the lead time in attending to consumer complaints.

**V. Section Officer/Asst. Engineer or Junior Engineer (To assist the Sub-divisional Officer or to Manage a survey section) (Operational Management)**

1. To formulate and ensure implementation of action plans for equitable supply of water in service areas.
2. To schedule, implement, monitor and revise the service delivery timings in the areas concerned to be in tune with consumer convenience.
3. To monitor and undertake appropriate measures to improve supply pressures and reconciliation between the demand & supply of water.
4. To ensure implementation of prescribed measures on quality control standards in the service area.

5. To cause timely detection and rectification of leakages in the concerned service area.
6. To ensure implementation of procedures for detection and monitoring pollution cases and to undertake appropriate measures for immediate rectification of both repairs.
7. To supervise the progress of various ongoing works in the service area and ensure implementation of the prescribed norms on quality.
8. To inspect, measure, record and ensure timely submission of bills for payment.
9. To undertake periodic performance review of contractors and vendors and analyse information to effect appropriate rating.
10. To ensure proper maintenance of contractor ledger.
11. To undertake periodic review and ensure updating of utilities and system plans:
12. To ensure balance between the available capacity of the system demand and sanctions for new service connections.
13. To undertake inspection and authorise road cuttings for leakage rectification or as necessary and ensure refilling as per the prescribed norms.
14. To undertake preparation of discharge tables and other connected technical reports.
15. To ensure implementation of preventive maintenance schedules on chlorination plant and equipment and ensure operations free of leakages or other defects or break downs.
16. To ensure implementation of prescribed maintenance schedules and safe operations of safety and fire fighting equipment.
17. To undertake scheduling of meter reading in the service area, ensure billing, prompt ledger entries and service of bills to consumers.
18. To identify problems in employee welfare through periodic staff meetings.
19. To organise consumer meets in service area, identify consumer problems and deficiencies in service delivery and ensure corrective follow up action.
20. Undertake inspection visits in the service area during water supply timing and note the visible leaks, leaking valves, cross connections, absence of residual chlorine, missing inspection chambers' covers etc. and initiate measures to attend to these.
21. To take part in water quality control, water sampling etc.

#### **VI. Senior Level-Finance & Accounts**

1. To cause maintenance of proper accounts and other records in relation thereto to be kept, and cause preparation of annual and periodical statements of accounts (balance sheets, revenue and expenditure account, and schedules) in such forms as may be prescribed by regulations.
2. To cause timely preparation and presentation of annual, quarterly and monthly accounting reports like balance sheets, income and expenditure accounts, funds flow statements etc.
3. To ensure implementation of accounts system and procedures and timely preparation of periodical accounting statements and reports at office of the Agency.

4. To design and implement financial procedures and policies.
5. To cause quarterly/monthly/financial reports and forecasts.
6. To establish sound pricing policies.
7. To organise effective systems of pre-audit and payments and to arrange receipts of recoverable and to cause proper accounting of cash and bank transactions.
8. To arrange institutional finance and manage public issues.
9. To liaise with Government and various lending agencies and ensure compliance with the requirements of Government and lending institutions.

#### **VII. Middle Level Finance & Accounts**

1. Maintaining cash book and bank books.
2. Sending copy of cash/bank book to agency office.
3. Prompt posting of ledgers (day by day).
4. Posting of sub-ledgers within set date.
5. Bank reconciliation statements.
6. Action on the reconciled items.
7. Monthly trial balance.
8. Monthly balance-sheet income & expenditure account.
9. Monthly cash forecast (for the next month).
10. Cash flow statement.
11. Monthly work wise schedules.
12. Monthly schedule of sub-ledgers.
13. Monthly requisition of funds (for the next month).
14. Monthly statements of receipts, payments, income & expenditure comparing actual figures with budget.

#### **VIII. Manager Material Accounting**

1. Maintenance of (computerised) stock accounts of the agency, material wise, scheme wise, section wise, stock point wise and contractor wise.
2. Arranging data entry of stores receipts, issues and uses of stock points and sections.
3. Custody and issue of stationery of stores accounting forms and reconciling the data entered with stationery issued.
4. Reconciliation of materials accounts and communication with Divisions/Sections regarding un-reconciled balances and effecting rectification.
5. Ensuring implementation of stock valuation procedures for closing stocks and for stocks issued to works and consumption.
6. Preparation and submission of materials at site accounts and reports.

## **IX. Manager – Revenue Accounts**

1. Collection of data from bill/cash collection counters at specified intervals and incorporation in the common data base.
2. Arrange for checking of cash collections counter-wise with remittances in the banks.
3. Preparation of consolidated revenue accounts including ledgers, demands, debtors statements.
4. Quantitative billing analysis and reconciliation.
5. Preparation and submission of analyzed divisions reports to managing director and concerned officers.
6. Monitoring collection of dues from major consumers and pursuing divisions for collections and demands.
7. Compilation of statements of collection counters and reconciliation with bank accounts, arranging data entry, computerised reconciliation and feed back to systems of collection counters.
8. Prompt reporting to the management of any deviations from the norms of demand, collection, billing and balances and of any abnormalities.

## **X. Manager – Personnel & Training**

1. To assist the agency in formulating personnel training policies.
2. To cause preparation of manuals on service regulations for facilitating effective implementation of personnel policy.
3. To cause preparation of standing orders to guide the officers and employees in carrying out respective duties and responsibilities and ensure easy access to them by all the concerned.
4. To develop and update the data base on the following elements of personnel management in the agency.
  - i) Manpower, inventories including employee turnover.
  - ii) Salaries and & wage structures.
  - iii) Employee training inventories and calendars.
  - iv) Manpower distribution - by cadre, sanctioned strength and actual.
  - v) Implementation of performance appraisals as well as individual performance summaries.
  - vi) Status of implementation of measures on employee welfare and social security.
  - vii) Disciplinary proceedings litigation and redressal of grievances.
  - viii) Sanctions on gratuities, pensions and other terminal benefits.
  - ix) Promotions, empaneling and implementation of relevant schemes.
  - x) Medical and Health Service coverage.
  - xi) Accidents
  - xii) Housing & Estate management.

5. To undertake liaison activities for building rapport with various departments of the State Government.
6. To monitor the progress of proceedings involving the agency, pending in courts, tribunals and other statutory agencies.
7. To ensure implementation of pertinent provisions under trade union and industrial disputes acts and other labour laws.
8. To undertake constitution of medical advisory committees, arrange for documentation indexing and retrieval at call, of the proceedings thereof.
9. To take initiative in regard to procurement of books, journals and magazines and servicing the agency's membership in professional associations.
10. To ensure compliance with the schedules for budget preparation revision, preparation of revised estimates pertaining to personnel functions, submission for approval by all the units down the line.
11. To undertake scheduling of welfare meetings and ensure compliance by the units down the line, ensure follow up action on the minutes of the meetings held.
12. To organise awareness improvement programmes on fire accidents, hazards, safety and first aid.
13. To organise consumer contact programmes and public relations campaigns.
14. To assist the agency in the preparation of agenda for Agency meetings and follow up action on the minutes of the meetings.
15. To convene the meeting of training coordination committee. Prepare agenda for discussions and record the minutes thereof.
16. To prepare training calendars and develop deputation programs.
17. To develop organisational linkages with institutions of higher learning in the neighbourhood, outside the city, and the country.
18. To undertake scientific assessment of availability, adequacy and cost of using the existing resources.
19. To develop a training need inventory.
20. To develop training capsules for in-house training.
21. To arrange for effective utilisation of training facilities available in house.
22. To undertake preparation of lists of resource persons in regard to subjects related to training programs.
23. To develop methods for identifying and developing in-house training capabilities.
24. To develop/up date MIS.
25. To develop GIS.

**XI. Public Relation Officer & Staff Welfare Officer**

1. To develop rapport with media services.
2. To maintain liaison with local police and administration in times of emergency.
3. To bring out a house journal highlighting the activities of the Agency.



4. To assist the management in organising important functions.
5. To arrange for press and other media meets.
6. To organise customers meets and provide feed back to management.
7. To maintain cordial industrial Relations.
8. To help the management in conducting negotiations with Employees /workers unions.
9. Follow up action on the implementation of memorandum of understanding between management and unions.
10. Resolving Inter-union disputes.
11. Redressal of grievances of various employees association and works unions.
12. To ensure that the policies and programmes of the Management are properly communicated to various Associations and unions.
13. To implement the rules and regulations on Medical & Health Services.
14. To implement rules and regulations pertaining to prevention of fire hazards and adoption of safety and security measures.
15. To implement procedures for receiving and disposal of grievances of the employees.
16. To implement rules and regulations on staff welfare measures, terminal benefits and other compensation benefits.

## **XII. Senior Technicians**

To guide, monitor and control various categories of technical staff in performance of highly skilled level of work.

### **Mechanical**

1. To undertake operations and maintenance of laying, jointing and testing of pipelines and sewers including specials, valves, meters etc.
2. To undertake operations and maintenance pertaining to filter beds, washing of beds, valves, flash mixers, flocculators/clarifier machinery and alum mixing machinery, wash water pumpsets, flow meters, pressure gauges and chlorination equipment.
3. To undertake maintenance of cranes, air tech machines, bucket machines, tackles, winches and hoists.
4. To undertake operation and maintenance of welding machines and accessories and Oxygen cutting torches.
5. To undertake operation and maintenance of hand tools for drilling, threading, fitting, pipe bending and maintenance of log book.

### **Electrical**

1. To undertake recording and mounting, removal, dismantling, repairing, servicing and re-assembly of switches, switchgears, starter, motors, blowers, generators, compressors and battery charge equipment.

2. To undertake preparation of layout diagram for domestic and industrial wiring energising low and medium voltage machine control panels as per I.E. rules.
3. To undertake installations wiring testing fault finding and rectification and connecting industrial and street light fittings.
4. To undertake operation and maintenance pertaining to transformers, Boosters, fault rectification, jointing of HV underground cables, drawing overhead service lines to undertake operation and maintenance of meggers insulation testers, continuity tests, frequency meters, power factor meters.
5. To undertake operation and maintenance of fire fighting and first aid kits.
6. To undertake maintenance of log book and to undertake operation and maintenance of wireless equipment, receipt and transmission of messages, detection of minor faults and rectification and operation of fax machine.

### **Civil**

1. To guide, monitor and control various categories of technical staff.
2. To maintain check lists on progress of work and quality control.
3. To collect samples of water and analyse for residual chlorine.
4. To verify flow calculations of water supply connections.

### **XIII. Junior Technician**

To undertake operations and maintenance requiring skilled level of ability.

#### **Mechanical**

1. To undertake operations and maintenance of laying, jointing, testing of pipelines and sewers including specials, valves, meters, etc.
2. To undertake operations and maintenance pertaining to filter beds, washing of beds, valves, flash mixers, flocculator/clarifier machinery and alum mixing machines, wash water pumpsets, flow meters, pneumatic and pressure gauges and chlorination equipment.
3. To undertake operation and maintenance of cranes, air tech machines, sewer cleaning bucket machines, tackle winches and hoists.
4. To undertake operation and maintenance of welding machines and accessories, oxygen cutting torches.
5. To undertake operation and maintenance of hand tools for drilling, threading, fitting, pipe bending and maintenance of log book.

#### **Electrical**

1. To undertake operations pertaining to mounting, removal, dismantling, repairing, servicing and re-assembly of switches, switchgear, starters, motors, blowers, generators, compressors, battery charging equipment.
2. To undertake preparation of layout diagrams for domestic and industrial wiring, energising low and medium voltage machines, control panels as per I.E. rules.

3. To undertake operations and maintenance pertaining to wiring and testing of installations, fault finding and rectification and connecting industrial and street light fittings.
4. To undertake operation and maintenance pertaining to transformers and boosters. Fault rectification and joining high voltage underground cables and drawing overhead service lines.
5. To undertake operation and maintenance of meggers, insulation and continuity testers, frequency meters, power factor meters, volt meters, flow meters, fire fighting equipment and first aid kits.
6. To undertake maintenance of log books of all machinery and equipment.
7. To undertake operation and maintenance of wireless equipment, receipts and transmission of messages, detection of minor faults and rectification, operation of fax machines.

#### **Civil**

1. To guide, monitor and control various categories of technical staff. To maintain check lists on progress and quality control.
2. To collect samples of water to analyse.
3. To assist the management in maintenance of records, reports and accounts.
4. To assist the management in preparation of estimates.
5. To prepare a consolidated list of consumer wise readings and submit to the manager in charge.
6. To detect faults in domestic water meter.
7. To identify sources of pollution in and around consumer meter and assist to schedule and undertake periodic visits of the (Metering) premises of domestic and commercial category of consumers for recording the meter readings.

#### **Transport**

1. To drive heavy vehicle, operating crane, air tech machine and excavator.
2. Forklift, trippers, road rollers, paver - grader.

### **XIV. Skilled Employee**

Work not requiring judgement but simple levels of mechanical ability and dexterity.

#### **Mechanical**

Assisting the technicians in carrying out simple operations pertaining to operation and maintenance of water pipe lines, valve cleaning, greasing and lubricating of pumps and motors, excavator, vehicles and other mechanical equipment, borewells, fitting, smithy, welding, tinkering and moulding, carpentry, and other works.

#### **Electrical**

Assisting the technicians and also carrying out operation of pumps, motors installation up to 440 volts, operation of valves, cleaning, greasing and lubrication, changing of fuse

on LT side, wiring connections at terminals, receiving of telephone calls at pumping installation contacting the APSEB fuse call Office, maintenance of log book first aid, operation of fire fighting equipment.

### **Civil**

Assisting the technicians and carrying out simple operations to operate and maintain, cleaning repairing, test ware, general assistance in the laboratories, carpentry, Masonry, painting, carrying of survey instruments, keeping of level staves, surveying and general assistance to surveyor, recording of water level, receiving registering and communicating messages.

## **XV. Unskilled Employee**

All types of manual work not requiring any special training or aptitude and independent judgement. The tasks under the category are simple and entail physical labour of varying intensities.

Operations pertaining to excavation, de-watering, de-silting, assisting the skilled workers in carrying, handling, loading, stacking of materials, tools and equipment, general purpose cleaning including machines, tools, equipment, pipelines, couplings, water meters, filters and valves etc.

Dusting, sweeping and washing.

Gardening, maintaining, spraying and dusting of pesticides etc., cleaning, preparing test-ware, waste disposal and general assistance to lab technicians.

Cleaning of vessels, crockery and other kitchen equipment, linen washing and door keeping and attending to office errands.

Performing the relevant technical functions in the workshop, assisting the skilled worker in operation of valves and cleaning of water pumps.

Watch and ward (day and night) not requiring the use of fire arms.

Receiving telephone calls and paging, carrying files, notes, books, courier etc.

### **House Keeping**

*Utilities:* cooking and maintenance of crockery and other kitchen equipment, linen changing, attending to the guest requirements door keeping, gardening, watering, grass cutting, mowing, manuring, spraying of pesticides.

Women personnel unskilled employees shall be employed only for gardening, house keeping, attending manual duties in offices, carrying materials, lab attendants and such other work not involving heavy physical labour.

The unskilled employees are interchangeable from one function to other.

ANNEXURE 17.2

**TRAINING NEEDS  
SUBJECTS/PERFORMANCE AREAS IDENTIFIED  
FOR ORGANISING TRAINING INPUTS**

**I. Chief Engineer**

1. Corporate policy and management, personnel.
2. Management Information System – Automation.
3. Personnel management - Organisational development - Management of Urban utilities.
4. Bilateral/Multilateral funding and management.
5. Financial management - commercial pattern.
6. Project management.
7. Systems Engineering.
8. Contracts - application of specifications.
9. Quality engineering.
10. Material planning and control.
11. Construction management.
12. Environmental impact assessment.

**II. Superintending Engineer**

1. Corporate planning.
2. Organisational behaviour.
3. Industrial relations.
4. Personnel management and industrial relations.
5. Management Information system – applications.
6. Human resource development.
7. Project planning & control – computer applications.
8. Computer aided designing.
9. Standardisation of designs.
10. Quality circles.
11. Material Planning and control techniques.
12. Preparation of manual on servicing and repair and testing of Electrical and mechanical equipment.
13. Unaccounted for water management.
14. Analysis of industrial effluents.
15. Construction management.

16. Water audit.
17. Rehabilitation of structures.
18. Leakage rectification and cleaning of pipelines.
19. Programme planning and budgeting systems.
20. Bilateral/Multilateral funding – issues and problems.
21. Import procedures.
22. Commercial accounting.
23. Basic financial management.

### **III. Other Engineers**

1. Construction management.
2. Project preparation – feasibility studies.
3. Project report writing.
4. Dam Safety – monitoring, and evaluation techniques.
5. Leak detection, rectification techniques.
6. Capacity estimation of impounding reservoirs.
7. Updating of codes standards.
8. Unaccounted for water management.
9. Water audit.
10. Construction quality control.
11. Laying, jointing testing and commissioning of pipelines.
12. Pipe network analysis.
13. Tooling for operations, maintenance and repair.
14. Civil structures – maintenance management.
15. Pollution – detection, prevention and control – techniques and applications.
16. Preparation of discharge tables for flow in pipes.
17. Maintenance management.
18. Energy audit.
19. Basic instrumentation.
20. Project estimates – preparation and documentation.
21. Systems engineering - simulation/modeling.
22. Hydrographic survey techniques – application.
23. Material testing and certification.
24. Total station survey – computerised analysis and mapping of survey data.
25. GIS methods Preparation and updation of maps.

26. Swabbing and cleaning of pipelines.
27. Rehabilitation of structures.
28. Office management – automation.
29. Industrial relations.
30. Fire fighting and first aid.
31. Material (stock accounting).
32. MS office – Computer applications in office management.
33. Human resource development.
34. Management Information Systems (MIS) in urban utilities.
35. Basic financial management.
36. Commercial accounting – accounting in Public utilities.
37. Planning and Monitoring of metering and billing for water.
38. Basic business accounting.
39. Financial analysis – techniques.
40. Budgeting – Principles and applications.
41. Management accounting.
42. Stores accounting.
43. Costing, budgeting and accounting.
44. Financial ratio analysis.

#### **IV. ALL TECHNICAL AND NON-TECHNICAL OFFICERS (other than engineers)**

1. Introduction to MIS – (Application to respective functions).
2. Maintenance, manuals – updating.
3. Engineering Drawing.
4. Work execution – measurement recording and billing.
5. Water quality testing and control.
6. Preparation of estimates.
7. Sewer cleaning techniques.
8. Scouring and cleaning techniques.
9. Data collection and statistical analysis.
10. Computer applications.
11. Introduction to MIS (Application in respective functions).
12. Personnel management.
13. Labour laws and industrial relations.
14. General management – introduction.

15. Office management – automation.
16. Metering, billing and customer services.
17. Commercial accounting – procedures.
18. Budgeting and Audit – procedures.
19. Capital budgeting – procedures.
20. Costing, cash flow and credit management – Procedures.
21. Stores accounting – procedures.
22. Book keeping and accounts.
23. Preparation of budgets.
24. Materials (stock) accounting.
25. Management accounting.
26. Costing, budgeting and accounting.

## **SPECIFIC TRAINING COURSES**

### **1. UTILITY PLANS**

To make detailed plans/sketches indicating water supply lines with pipe size, material, date of installation, number of connections between road junctions, tapping for bulk consumers, flow rates with ground contours relative to local source of supply, superimpose location of sluice valves duly indicating normally closed/open positions, scour valves, air valves, reflex valves, bulk meters, borewells, public stand posts, areas susceptible for low pressure, fire hydrants etc.

Prepare detailed assignment to individual function plans when there are a number of inter connections – duly indicating the location of each in the main plan.

Develop schedules for updating the utility plans;

Gain technical familiarity with the plans already prepared;

Identify the gaps and fill the gaps as necessary.

### **2. MANAGEMENT INFORMATION SYSTEM**

1. To assist the participants in identifying the data needs for water supply and prepare:
  - i) Utility plans;
  - ii) Operation plans;
  - iii) Maintenance plan;
  - iv) Quality control plan;
  - v) Consumer inventories, revenue data sheets;
  - vi) Layouts and individual units, specific focus on multistoried buildings and public institutions;



- vii) Demographic;
- viii) Data on unserved areas within zone;
- ix) Vacant government and private lands suitable for locating, reservoirs, treatment plants and pumping stations;
- x) Man power, requirements – available deployment – turnover workload;
- xi) Location and status of serviceability borewells, PSP's etc.;
- xii) Number and status of serviceability of tankers;
- xiii) Inventories of mechanical and electrical equipment available and status of serviceability, servicing schedule, scales of spares for operation voltages and energy requirements;
- xiv) Implementation of development plants by local municipality/Roads and Buildings Department;
- xv) Spots vulnerable to fire hazards, accidents etc.;
- xvi) Likely spots vulnerable to pollution and types of pollution;
- xvii) Areas/location susceptible to low Pressures;
- xviii) Location and population resident in slums;
- xix) Data on consumption of power and emerging power factor;
- xx) Develop data, records, type designing, compile and analyse, draw inference for decision making.

3. Storage and retrieval of data on call.
4. Maintenance of registers and inspection notes.

### **3. PIPE NETWORK ANALYSIS**

- i) Familiarize the participants with design parameters of pipelines.
- ii) Calculation for deriving pipe size in case of dead end as well as loops and water connections.
- iii) Methods of calculating systems capacity.

### **4. STATISTICAL QUALITY CONTROL**

Familiarising the participants with: statistics, statistical methods, sampling, sampling techniques, statistical application in analysis, matrix analysis forecasting trend analysis, rating.

Methods of sample collection in water supply works, soils, concrete and building materials and reliability analysis.

### **5. COMPUTERS IN ENGINEERING APPLICATIONS**

*Familiarize the participants with:*

Computer applications in engineering

CAD and CAM, MS Project & MIS

## **6. LAYING, JOINTING AND TESTING OF WATER SUPPLY PIPE LINES**

- i) To develop skills in leak detection,
- ii) Assessment of soil characteristics,
- iii) Bedding, of pipes – usage of jacking equipment,
- iv) Usage of tripods, pulley blocks,
- v) Usage of winches and hooks,
- vi) Types of joints and jointing material,
- vii) Hydraulic testing equipment and anchorages, test pumps and pressure gauges and valves,
- viii) Tools, hand tools/machine tools, assessment of requirement and servicing,
- ix) Trench refilling techniques,
- x) Thrust blocks, anchor blocks,
- xi) Testing for valve alignments, rubber insert/gasket, lubrication. Use of torque wrench,
- xii) Flange alignments,
- xiii) Appurtenances,
- xiv) Protection against pollution,
- xv) Fixation of pipe levels with reference to scouring of pipelines,
- xvi) Welding techniques, filter material, blow torches, nozzles, fluxes, electrodes, compatibility, welding temperatures,
- xvii) Anti corrosive measures,
- xviii) Dewatering pumps,
- xix) Shoring and strutting techniques,
- xx) Rock cutting techniques, detonators, drilling equipment and compressors.

## **7. Material Specification and Application**

- i) To familiarise with codes in use, control of specification and testing,
- ii) Identification of material, classification, stocking,

## **8. Civil Engineering Structures, Maintenance & Rehabilitation**

- i) To familiarise condition monitoring of roofs, foundation failures, preservation of wood work, electrical fixtures, sanitary fittings, plastering, colouring, anti-termite treatment, protection of iron and steel structures,
- ii) To arrest leakages in water retaining structures,
- iii) Rehabilitation of corrosion affected structures,
- iv) Repairs of manhole covers and frames,
- v) Repairs to expansion joints,

## **9. Detection of Pollution of water supplies – prevention and control**

- i) To familiarise with tools/equipment for detection of pollution and usage of same for tracing pollution,
- ii) Techniques for assessing magnitude of pollution,
- iii) Methods of control and contingency planning for isolating polluted system and alternate supply routes,
- iv) Fouling with storm water drains.

### **Technical Training in Operation and Maintenance**

Laying, Jointing and Testing techniques for pipelines, including detection of leaks and identification of various types of leakages.

Maintenance and repairs of valves and valve chambers.

Maintenance of pumps, motors, and electrical systems, identification of trouble shooting and rectification.

Maintenance of chlorinators.

Maintenance of water treatment plants.

Road cutting and restoration techniques.

Collection of samples, analysis, water quality standards.

Safety procedures.

Fire-fighting and first-aid.

Customer relation.

Repair and maintenance of water meters and flow meters.

Maintenance of Instrumentation in automation.

## ANNEXURE 17.3

**MINISTRY OF URBAN DEVELOPMENT  
GOVT. OF INDIA**

**CPHEEO  
LIST OF REFRESHER COURSES SPONSORED BY THE MINISTRY**

Sl. No.	Name of the Refresher Course	Place	Conducting Agency	Duration
1.	Water Works Supervisors Course	Nasik Road	R&T.C., M.J.P.	4 weeks
2.	—do—	Trivandrum	K.W.A.	4 weeks
3.	—do—	Palasuni Bhubaneswar	P.H. Deptt.	4 weeks
4.	Water Supply System Management	Chennai	TWAD Bd.	1 week
5.	—do—	Nasik Road	R & T.C., M.J.P.	10 days
6.	Pipes & Conduits	Nasik Road	—do—	12 days
7.	—do—	Mumbai	C.T.I. & R.C. M.C.G.B.	9 days
8.	New Development in Water Treatment	Kolkata	AIIH & PH	10 days
9.	Structural Design on Water Treatment Plants and other Related Structure	Nagpur	V.N.I.T.	1 week
10.	Water Treatment Plant Design	Nagpur	V.N.I.T.	1 Week
11.	Public Health Engineering Structures	Chennai	TWAD Bd.	9 days
12.	Waste Stabilisation Pond Practices	Kolkata	AIIH & PH	1 week
13.	—do—	Chennai	TWAD Bd.	-do-
14.	Filter Operation	Nasik Road	R&T.C., M.J.P.	10 days
15.	—do—	Chennai	C.M.W.S.S. Board	12 days
16.	Care & use of Chlorinators	Mumbai	C.T.I. & R.C., M.C.G.B.	1 week
17.	—do—	Chennai	CMWSS Bd.	-do-
18.	Water analysis	Kolkata	AIIH & PH	4 weeks
19.	Waste water analysis	—do—	-do-	-do-
20.	Water & waste water analysis	Jaipur	P.H.E.D.	-do-
21.	—do—	Chennai	TWAD Bd.	-do-
22.	Solid waste management	Kolkata	AIIH & PH	10 days
23.	Solid waste management	Bhopal	AIIHSG	1 week
24.	Municipal solid waste management	Allahabad	MNNIT	-do-
25.	Preventive maintenance and leak detection in Water distribution system	Nasik Road	R&T.C., M.J.P.	10 days

Sl. No.	Name of the Refresher Course	Place	Conducting Agency	Duration
26.	—do—	Mumbai	C.T.I. & R.C. M.C.G.M.	10 days
27.	—do—	Chennai	T.W.A.D. Board	10 days
28.	Corrosion control	Chennai	C.M.W.S.S. Board	1 week
29.	Project planning and Preparation	Indore	SGSIT & S	10 days
30.	Recycling and reuse of wastes	-do-	-do-	10 days
31.	Computer application in PHE structures design	-do-	-do-	10 days
32.	Sewage works supervisors course	Chennai	C.M.W.S.S. Board	2 weeks
33.	Low cost sanitation	Poonamallee Chennai	I.P.H.	1 week
34.	—do—	Jaipur	R.I.L.S.G.	-do-
35.	Sewer maintenance and cleaning	-do-	-do-	9 days
36.	Computer application for water distribution	Mysore	S.J.C.E.	-do-
37.	System management and water treatment plant design			
38.	Computer aided design of Water supply & sewer network	New Delhi	AILSG	10 days
39.	Computer application for water Distribution system Management	Mumbai	A.I.L.S.G.	10 days
40.	Computer aided Design of Water and Waste Water treatment plants	Allahabad	MNNIT	1 week
41.	Scientific source Finding	Gandhinagar	G.J.T.I.	1 week
42.	Maintenance & management Related to municipal water works	Kolkata	I.P.H.E.	12 days
43.	—do—	Chennai	TWAD Bd	1 week
44.	Surface drainage in medium and small towns	Bhopal	AILSG	1 week
45.	Laying of water mains & sewer lines	Chennai	CMWSS Bd.	1 week
46.	Ground water	Kolkata	I.P.H.E.	1 week
47.	Water supply & sanitation to buildings	Kolkata	I.P.H.E.	1 week
48.	Operation and maintenance of W.S. and sanitation projects	Kolkata	AIH & PH	10 days
49.	Water quality surveillance	Mysore	S.J.C.E.	12 days

Sl. No.	Name of the Refresher Course	Place	Conducting Agency	Duration
50.	Positive preventive maintenance of water supply and sewerage system	Bhopal	AILLSG	1 week
51.	Pumping & non pumping mains for water supply system-design, Operation and maintenance	-do-	-do-	1 week
52.	Total quality management in Water supply system	-do-	-do-	1 week
53.	Water supply from ground water sources-Quantity/Quality and ground water recharge	-do-	-do-	-do-
54.	Preparation of water supply projects	-do-	-do-	-do-
55.	Tenders & contract	-do-	-do-	-do-
56.	Pump and pumping machinery for Public Health Engineering Jobs	Kolkata	IPHE	-do-

#### ABBREVIATIONS

1.	R&T.C	Research & Training Center
2.	M.J.P	Maharashtra Jeevan Pradhikaran
3.	K.W.A.	Kerala Water Authority
4.	P.H. Deptt.	Public Health Department
5.	T.W.A.D. Bd.	Tamil Nadu Water Supply and Drainage Board
6.	A.I.I.H. & P.H.	All India Institute of Hygiene and Public Health
7.	M.N.N.I.T.	Motilal Nehru National Institute of Technology
8.	V.N.I.T.	Visvesvaraya National Institute of Technology
9.	C.T.I. & R.C.	Civic Training Institute and Research Centre
10.	M.C.G.B.	Municipal Corporation of Greater Bombay
11.	P.H.E.D.	Public Health Engineering Department
12.	A.I.I.L.S.G.	All India Institute of Local Self Govt.
13.	S.G.I.T. & S.	Shri G.S. Institute of Technology and Science
14.	C.M.W.S.S.B	Chennai Metropolitan Water Supply and Sewerage Board
15.	I.P.H.	Institute of Public Health
16.	I.P.H.E.	Institution of Public Health Engineers
17.	R.I.L.S.G.	Rajasthan Institute of Local Self Govt.
18.	S.J.C.E.	Sri Jayachamarajendra College of Engineering
19.	G.J.T.I.	Gujarat Jalseva Training Institute

## CHAPTER 18

# PUBLIC AWARENESS & CUSTOMER RELATION

### 18.1 OBJECTIVE OF PUBLIC AWARENESS PROGRAMME

The objective of a water supply agency is to provide adequate supply of safe, good quality potable water at a reasonable cost and serve its consumers in a prompt and courteous manner. The consumers must be made to understand that potable water is not a free commodity and that it is a value-added commodity with cost implications. The quality of people's lives often depends on what the water utilities do and how they do it. The objective of any programme for public awareness is to achieve better customer relations, greater water conservation, and enhanced organisational credibility. This chapter discusses the need for public awareness with regard to water supply system maintained by local body. It also deals with the various aspects that are to be considered to improve the local public awareness by involving individually or with the voluntary organisation groups.

### 18.2 SCOPE OF A PUBLIC AWARENESS PROGRAMME

Scope of a public awareness programme is :

1. To enable the public to understand the operational dynamics of the water supply system.
2. To promote civic consciousness.
3. To understand and appreciate the water distribution strategies.
4. To inculcate consumer responsibility.
5. To establish good reputation for quality/service.
6. To inform and to obtain approval of public for various improvement measures thus creating a feeling of close participation.
7. To educate them on the basic rights of consumers and efforts undertaken by water utility/local body to ensure their basic rights.

### 18.3 PROCESS OF BUILDING UP PUBLIC AWARENESS

It is necessary to identify the audience such as community leaders, school children, or the average customer. It is advisable to prepare the publicity material to suit the target audience. Its public communication policy shall involve the elected Civic Body, Consumer Action Groups etc. The agency shall try new and imaginative ways of involving local communities in its plans and programmes thus according the public, its due pride of place.

### **18.3.1 DEFINING THE LOCAL COMMUNITY CONCERNED**

- Geographic or administrative boundaries.
- Major media in the locality concerned (newspapers, radio/televisions, local speakers, and town meetings).
- Customers and stake holders/local residents.

### **18.3.2 IDENTIFYING EXISTING LOCAL COMMUNITY CONTACTS**

- Elected officials (Joint Council/Sub Committee/Ward Committee members of local body).
- Prominent civic leaders.
- Clubs and associations (Chamber of Commerce, Consumer Service Committee consisting Consumer Association and Consumer action groups).
- Voluntary Organisations, Residents Association, etc.
- Industry Consumers.
- Schools/Colleges.
- Professional bodies (Doctors, Lawyers etc.).
- NGO, Community based organisations, Ward committees.

### **18.3.3 LISTING OUT THE MESSAGES TO BE COMMUNICATED**

- Status position of water supply.
- Service related issues such as temporary suspensions of services due to construction, maintenance and augmentation of supply.
- Changes in policy, launching of new schemes etc.
- Adoption of a Citizen's Charter containing objectives, mission statement, facts about the organisation, growth profile, achievements, commitments, major schemes to be implemented, service standards, customer assistance etc.
- Quality assurance related messages.
- Leak detection and repair works.
- Functioning of Information and Facilitation counters, customer assistance, grievances handling and redressal system, feed back from the public, Vigilance Committee, Consumer Service Committee.
- Billing and collection procedures/queries, tariff related issues, collection drives and special camps, levy of surcharge, reconciling of accounts.
- Need for rain water harvesting and artificial recharge.
- Extraction of ground water.
- Drought management - mobile lorry supply.
- Consumers survey - to issue questionnaire and obtain feed back from the consumer about the services of organisation at regular intervals for refining the service standards.
- Celebration of National Festivals, functions, World Water Day.



### **18.3.4 SELECTION OF COMMUNICATION METHODS**

A variety of media and communication methods exist, each with its own advantages and disadvantages. The use of several media at the same time can reinforce the messages. Person to person contact from community members who are already convinced of the message's truth is usually the most effective means of communication. The following are the some of the consumer friendly measures that could be effectively used for Public Awareness Programme for attaining complete transparency in operations.

- Fact sheets/brochures/pamphlets/handbills/Bill boards.
- Telephones/Telex/FAX/computer based Interactive Voice Response System (IVRS) dialing service.
- Visual Aids-Radio/T.V./Films/Video.
- Modern Electronic/Computer aids-E-mail.
- Hosting a web site.
- Slide/speech presentations.
- Small group meetings, Conferences, Seminars, Congresses.
- Community newsletters and oral communications, direct letter correspondences.
- News releases, advertising.
- Press meet and tours.
- Participation in Exhibition, Trade Fair.
- Open house meetings by involving Voluntary organisation, Residents Association and concerned interested group.
- In-house House journal to provide information to employees and stakeholders and to motivate to write articles/stories/lyrics/related subject.

### **18.4 BUDGET FOR PUBLIC AWARENESS CAMPAIGN**

The authorities shall list out the various aspects of public awareness programme as mentioned above and work out cost implications for implementing the Awareness Programme. With proper evaluation and necessary modifications if any, it would be possible to make the programme a success. Further, a form of planning and reporting is needed to monitor and control the public awareness activity.

### **18.5 FORMATION OF PUBLIC RELATIONS UNIT**

The following services may be offered under public relations Information & Facilitation:

- i) Registration and redressal of public complaints with feed back from complainant with help of reply cards, maintenance of suggestion books for customers to record their suggestions/remarks on the function of public relations counter.
- ii) Guidance to the public for new water connections and assistance for filling up of application form.

- iii) Guidance to the public for new assessment for water tax, name changes, annual value changes, classification changes and other tax and charges matters.
- iv) Guidance to the public to meet the concerned officer to make their representations and redressal of their grievances.
- v) Information regarding disruption of water supply due to urgent repair works.
- vi) Supply of self explanatory application form for the use of consumers that would help the consumer to tick and submit application with required enclosure to obtain various services such as new water connections, new assessments, name changes, annual value changes, classification changes, reconciliation of wrong demand, payment of water charges in installment, etc.
- vii) Supply of pamphlet on procedure on complaint registration and redressal.
- viii) Obtaining feed back from the consumers in redressal of their complaints/grievances.
- ix) Supply of Citizen's Charter to consumer to know the service standards of the organisation and also assurances for adherence to such service standards.
- x) Supply of pamphlet on rain water harvesting methods, procedures, and approximate estimate.
- xi) Creation of a single window system for redressal of grievances.
- xii) A separate telephone line should be available round the clock to record complaints for addressing them.

It will be better if one could have four digit telephone numbers for easy remembrance.

## **18.6 COURTEOUS BEHAVIOUR OF PUBLIC RELATIONS**

Since public relation and field staff are at the cutting edge level they should be properly trained. Courteous behaviour towards the public by public relation staff will give a better image of the utility in the minds of public. Since the first impression of the consumer is always the best impression it is necessary to impress on the consumer at the very first contact itself. Public relation staff should follow simple guidelines while answering telephone calls from consumers to create a positive image in the minds of public.

### **18.6.1 SUGGESTED GUIDELINES FOR ANSWERING CALLS**

- i) The staff at the telephone shall answer the call promptly say by third or fourth ring.
- ii) The agency's staff at the telephone shall identify himself/herself and let the caller know whom the caller is talking to.
- iii) The staff at the telephone shall not conduct side conversation and minimise distractions so that the caller can be given full attention avoiding repetition of names, addresses etc.
- iv) The staff at the telephone shall minimise transfers of the calls to other concerned officers.

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### **18.6.2 ANSWERING CONSUMER ENQUIRIES**

The staff at the telephone of the Public Relations Counter shall:

- Be familiar with the information of the services and policies of the utility.
- Learn to listen rather than interrupt the caller.
- Avoid technical jargon/unnecessary high sounding terms while talking to the caller.
- Summarise the caller's problem and repeat it to the caller for confirmation.
- Make every effort to promise specific action on the caller's complaint.

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# CHAPTER 19

## SAFETY PRACTICES

### 19.1 INTRODUCTION

As in any utility or industry, dangers are associated with Water Supply System Operation and Maintenance. There is therefore a need for safety practices. Physical injuries, cuts, bruises, and infection are common. However serious injuries necessitating long layoff, loss of limbs, eyesight, death due to accident or electrocution may also occur though not so frequently.

Adoption of safe practices and use of safety equipment may largely minimise occupational hazards.

Accidents do not happen – **they are caused.**

### 19.2 ACCIDENT INJURIES AND DEATHS IN WATER SUPPLY SYSTEMS

Figures of accidents/injury in various water works organisations or in utility concerns may be collected and included to show the extent of accidents. This can be in the following form or any other forms as available:

<i>Utility</i>	<i>Rates of accidents</i>
	OR
<i>No. of employees</i>	<i>Accident frequency rates</i>
Injury Frequency Rate F.R. =	$\frac{\text{Number of injuries} \times 1,000,000}{\text{Man-hours worked}}$
Severity rate S.R.	= $\frac{\text{Number of days lost} \times 1,000,000}{\text{Man-hours worked}}$

### 19.3 IDENTIFICATION OF ACCIDENTS

#### 19.3.1 SOURCE

In developing a safety programme it is necessary to know the source of accidents. It is then possible to take precautions and corrective action. Besides knowledge of accidents in the utility itself, review of records or information at other water supply systems or in other utilities is helpful. Record of injuries/accidents maintained by the concerned department of labour, industries or factory department of the state can also be consulted. Other sources of information are safety manuals, insurance company brochures etc.

The main dangers at a water works system include, but are not limited to, the following:

- (a) Physical injuries arising from handling objects, falling objects, lifting objects, falls, tools and equipment,

- (b) Stepping on or striking objects,
- (c) Machinery,
- (d) Infections,
- (e) Toxic gases,
- (f) Chemicals,
- (g) Fire,
- (h) Electrical shock,
- (i) Too much noise,
- (j) Collapse of trenches during repair of water mains.

### 19.3.2 LOCATION

The above dangers may exist at several locations in a water works system. These include, inter alia:

Intakes, Pumping stations, Transmission mains, Distribution system, Water Treatment plants, Storage places which include chemical hazards, large open filters, handling of materials, cleaning of internal sewerage system, septic tanks etc., mechanical & electrical hazards.

The person responsible for the safety programme should constantly on the alert for hazards, which may cause an injury to a workman.

### 19.3.3 TYPES OF INJURIES

To draw up a safety programme, it is important to know the type of injury that is most prevalent in water supply systems. The general injuries occurring in water supply systems are:

Bruises, cuts, sprains, fractures, burns, eye irritation and injuries, shocks, irritation by gases and other occupational diseases, deaths, permanent disabilities, temporary total disabilities

Statistical data of major type of accidents, which occur in Water Supply System in the country, have not been well documented. Some data which may serve as a rough guide to understand the overall injury pattern at one of the water utility in the country is given in Table 19.1

**TABLE 19.1**  
**STATISTICAL DATA OF MAJOR TYPE OF ACCIDENTS**

Cause of Accident	Percentage
Over exertion	20
Chemicals/gases	15
Fall on same level	11
Struck by falling object	10
Struck by moving object	9
Electrical shock injuries	8
Failure to wear safe attire	6
Caught in/on in between moving objects	5
Burns	4
Horseplaying, mischief making	4
Insect/animal bite	3
Others	5

### **19.3.4 COST COMPONENTS**

#### **Cost components of Accident**

The cost component of accidents include the following:

- Compensation paid to workers and/or affected persons.
- Medical expenses incurred on the injured/accident persons.
- Cost of repairing or replacement of equipment.
- Loss of production and consequential payment of overtime/damages.
- Legal expenses.
- Industrial relations.
- Loss of good will and reputation.
- Resiting of injured person on resumption and/or additional cost of hiring a new person including training cost.

### **19.4 SAFETY PROGRAMME**

#### **19.4.1 INTRODUCTION**

Safety practices require good management. For years, there may be minor injuries like cuts and bruises, but suddenly there could be a loss of limb, eyesight or even death.

Safety organisation is what you make of it. It may be a full-fledged safety organization with a Safety Officer with necessary staff. It could be only the person in charge of the plant with a few personnel picked out for special assignments. Everybody on the job knows what can happen under certain conditions but each is busy with his own duties and responsibilities. However, a safety officer works at safety full time. A Safety Committee may also be constituted. Whether you need a full time safetyman or not depends on the size of the Undertaking/organisation. *However, we need full-time attention to Safety.*

#### **19.4.2 SAFETY PRACTICE PROGRAMME**

##### **19.4.2.1 Preliminary step**

A safety programme is a must for a water supply system. It must have the full cooperation of the management; otherwise it will not be successful. A safety officer who can devote part-time or full time to the job in a large organisation may be designated as responsible for the programme. In a smaller organisation, that person may be the officer in charge of the plant.

##### **19.4.2.2 Records**

Keeping injury records is necessary for a safety programme. It is also mandatory in some of the Acts or Rules and Regulations framed by the Government. With records, the programme is given direction and will succeed.

For maintenance of records, standard forms are available. The formats could include items such as:

- (a) Accident report
- (b) Description of the accident

- (c) Doctor's report
- (d) Action taken
- (e) Accident analysis

Frequency rate and severity rate may be worked out as in para 19.2

A summary of types and causes of accidents should be prepared periodically; A suggestive format is given in Table 19.2

**TABLE 19.2**  
**SUMMARY OF TYPES AND CAUSES OF ACCIDENTS**

Type of injury	Primary cause of injury										
	Unsafe Act	Chemical	Falls	Handling Objects	Heat	Machinery	Falling Objects	Electrical	Striking	Misc.	Total
Fractures											
Sprains											
Eye Injuries											
Cuts											
Bruises											
Burns											
Miscellaneous											

There must be a review of all reports by the foreman/supervisor, safety officer and management. There must be recommendations to avert such accidents. A follow-up is necessary to see that proper action has been taken.

**19.4.2.3. Searching out hazards**

Hazards can be removed and will give increase in safety and will cost little time and money to correct. Some methods are:

- To examine records for conditions and situations that has caused accidents. Recall circumstances that led to the accidents. See if you can put your finger on some of the sore spots in your building, equipment or bad practices that are occurring.
- See what parts of the body are injured in the accidents. Protective gear may be required.
- Look around and inspect in an organised manner. Take help of your supervisors. Dig around for potential causes of personal injury and fire and health hazards.
- Be on the watch for unsafe practices and doing the job the wrong way. Always be on the watch.
- Reduce risks in the workplace, equipment and materials. With the supervisory staff you can cut down the amount of personal handling of tools and materials. It may be cheaper to buy power equipment.
- See that the work is done in the right and safe way.

#### **19.4.2.4 Motivation and training**

- For a good safety record, all individuals must be educated in safety measures. They must have conviction that accidents can be prevented. A safety programme must start on the new operator who has been freshly recruited or transferred from another work site. He must be exposed to the importance of safety, proper reporting and policies. Copies of Safety Practices should be supplied to him. Deeper training can be given to him subsequently after a few months. In the case of an individual who has been transferred, only the specific safety requirements in the new job are to be explained to him.
- Training will include how to perform the job. The plant supervisor must train the individuals in all aspects of plant safety. This will include dangers of electrical hazards, fire hazards, handling of tools and proper maintenance of tools to prevent accidents. Special instructions for specific work in confined environment such as pits, manholes, gas etc. must be given.
- The training must be continuous and not a one-time affair. During refresher education, case studies can be discussed. Victims of injuries can give their experience on how the accident happened. Safety posters placed at strategic points around the plant are a constant reminder and contribute to the continuing education.
- Proper guidance and use of tools, equipment must be given. Supervisors must continually check on proper use of tools. They must also see that the methods adopted are right and also safe.
- Motivate people to work safely when they are not being watched. Positive approaches like recognition of safety record, competitive interests etc. can be tried. Importance of good personal relations, a high morale and a sensitive management to the needs and interests of people plays a vital role in the programme of Safety Practices.

### **19.5 OPERATOR PROTECTION**

#### **19.5.1 PERSONAL SAFETY EQUIPMENT**

The first step in controlling an unsafe condition is to remove the hazard mechanically. A secondary measure of protection is to provide personal protective equipment to the workman. Study of records has indicated the large number of injuries to various parts of the body. Personal safety equipment is designed to help protect the person's eyes, face, head, nose throat, lungs, ears, hands, feet and body. Such safety equipment cannot protect the worker from unsafe actions or conditions. It can only supplement safe work or work habits.

##### **19.5.1.1 Head protection**

- All personnel working in any areas where there may be danger from falling, flying tools or other objects must wear approved hard hats. Such hats should be according to the relevant BIS. Special insulated hard hats must be worn when working around high voltage to protect from electrical shock.
- It is advisable to have detachable cradle and sweat bands for two reasons (1) to permit easy replacement of cradles and sweat bands and (2) to make possible assignment of



one helmet to several workers each with his own cradle and sweat band for sanitary reasons.

- Once broken, the crown of a hard hat cannot be effectively repaired. It must be replaced.

#### **19.5.1.2 Face and Eye Protection**

- Impact Goggles must be worn to protect against flying objects. They can be spectacle or cup goggles.  
Spectacle goggles must have rigid frame to hold lenses in proper position before the eyes. Frames must be corrosion resistance and simple in design for cleaning and disinfection.  
Cup goggles should have cups large enough to protect the eye socket and to distribute impact over a wide area of facial bones.
- Chemical Goggles and Acid Hoods for protection against splashes of corrosive chemicals. A hood treated with chemical-resistance material having a glass or plastic window gives good protection. There should be a secure joint between the window and the hood material.
- Face Shields can be used against light impact. Plastic shields should be non-inflammable, free from scratches or other flaws, which introduce distortions.
- Welding Masks must be used from splashes and radiation produced by welding.
- Protective Creams are used to protect the skin from contamination and penetration by oils, greases, paints, dust etc.

#### **19.5.1.3 Hands and Lower Arms**

- Protective sleeves, gloves and finger pads are used for different types of hazards and jobs.
- Rubber and asbestos gloves should be long enough to come well above the wrist, leaving no gap between the glove and coat or shirtsleeve.
- Gloves or mittens having metal parts for reinforcements should never be used around electrical equipment.
- Linemen and electricians working on energized or high voltage electrical equipment require specially made and tested rubber gloves.

#### **19.5.1.4 Body protection**

Overalls are sufficient for most jobs. Always use rubber aprons when working with chemicals. When working on ladders or scaffolding use extreme caution to prevent falls.

#### **19.5.1.5 Legs and Feet**

- Leggings are provided where leg protection is necessary and are in the same category as coats, frocks and aprons, kneepads made of cloth, padding, rubber, cork are used on jobs where kneeling is required.

- Ordinary work shoes are acceptable for many jobs. They should have nonskid soles to prevent slips. Safety shoes are required where there is danger of dropping tools or materials on the feet. Toe guards have been designed for the men to wear when operating machines as air hammers, concrete breakers etc. For working on electrical equipment suitable safety shoes must be used.

#### **19.5.1.6 Respiratory Equipment**

In all dusty areas, effective filter masks shall be used to guard against the specific hazard. Hose Mask should be used by men entering tanks or pits where there may be dangerous concentrations of dust, vapor, gases or insufficient oxygen. Hose mask with blower and the airline respirator are used where the hazard is immediate i.e., hasty escape would be impossible or could not be made without serious injury if there is failure of the equipment. Oxygen or Air Breathing Apparatus i.e. self-contained oxygen breathing equipment using cylinders or bottles of compressed oxygen or air is used where required. This is a must when the length of the hosepipe on on-line supply of oxygen exceeds more than 45 m.

Gas Masks - Canisters consist of a face piece connected by a tube to a canister. Chemicals in the canister purify contaminated air. No one chemical has been found to remove all gaseous contaminants. It does not supply oxygen and can be used where there is sufficient oxygen.

#### **19.5.1.7 Ear Protection**

Where noise levels are high and exceeds specified limits, effective ear-pads or earplugs must be used

#### **19.5.1.8 Training**

Supplying the appropriate equipment to the worker does not solve the problem. The employee must know when, how and where to use the equipment provided as well as its limitations. This requires that the men must be trained.

### **19.5.2 PERSONAL HYGIENE PRACTICES**

Every employee must practice personal cleanliness to prevent body infections. A clean plant is safer, both from physical accidents and infection. Hands must be washed with soap after working and before eating or smoking.

Use the first-aid kit for immediate treatment of minor cuts, bruises and scratches.

### **19.5.3 PROPER USE OF TOOLS**

Some of the basic tool rules are:

- (a) Always select the right tool for the job. Screwdrivers are not prying bars. Pliers are not wrenches.
- (b) Repair or replace broken or worn tools regularly.
- (c) Never use tools on or near moving machinery.
- (d) Be sure you have enough room, if the tool should slip.
- (e) Be sure you have good footing to prevent slipping.

- (f) Wear well fitted gloves except when hammering.
- (g) Never wear rings or loose clothing around moving machinery.
- (h) Always wear goggles whenever using any impact tools, power grinder or sharpener.
- (i) After using each tool, wipe, clean and replace in carrier or work belt. A greasy wrench can be dangerous.
- (j) Do not lay tools on top of ladders or where they may fall on someone working below.
- (k) Always use non-sparking tools on any job where explosive gases could be present.

## **19.6 SAFETY IN PLANT MAINTENANCE**

### **19.6.1 MAINTENANCE HAZARDS**

Plant maintenance also called housekeeping or cleaning up is an important function of the treatment plant and essential for plant equipment. Maintenance requires an operator to handle machinery, manual and power tools, repair electrical equipment, enter pits, sumps, manholes etc. All these functions can pose a hazard and cause injury, fire, disease or death.

Fixed safety features are designed or built into the structures. However there are instances where the maintenance engineer may alter or augment the existing structure. Prompt effective maintenance can prevent many accidents.

### **19.6.2 CLEANING**

Keeping the entire plant clean will provide a much nicer place to work. Just keeping the working areas free of tripping hazards will add safety in the plant. Cleaning should be performed when others are not exposed to danger or inconvenience. Wet floors become slippery. Use notices to warn people.

Provide and use trashcans for used oily rags. Hazardous waste, acids and caustics should be cleaned up immediately.

Doorways, aisles, stairways and work places must be kept free of rubbish to reduce hazards of tripping and fire.

### **19.6.3 PAINTING**

Regular painting is done at most plants. The following considerations must be kept in mind:

- When working with toxic paints i.e. containing lead, zinc or organics, be sure to clean your hands before eating or handling food.
- Avoid exposing your skin to solvent and thinners and try not to use compounds such as carbon tetrachloride.
- When spray painting, use a respirator to avoid inhaling fumes.
- No smoking or open flames of any kind should be allowed around the area being painted.
- When painting or cleaning the spraying equipment avoid closed containers where heat is involved. At a certain temperature called the flash point, spray or vapours could ignite and burn the operator or start fires. Always clean the spray equipment in an area with sufficient ventilation.

- Be very careful when using scaffolding or ladders. They must be strong and in good repair.
- Rags containing paint or oil should be placed in a closed container to avoid fires.

#### **19.6.4 ACCESS TO EQUIPMENT**

Safe access to equipment will reduce dangers from falls. Ramps and step stairs provide the safest means. Slope of ramps and rise of steps should not be excessive. Step stairs should have hand railings and the tread at least 9 inches (25 cms).

Vertical ladders should be discouraged. However, they are commonly employed. A vertical ladder of 10ft (3m) or more in length should be equipped with a hoop cage to enable the operator to regain his hold in case of a slip. Rungs of vertical ladders should not be less than 30 cms (12 in) or more than 40 cms (15 in) vertically. Minimum width should be 25 cms (9 in): preferably 30 cms to 40 cms.

Adequate workspace around equipment is important.

#### **19.6.5 GUARDS, RAILS, FENCING, ENCLOSURES, SHIELDS**

These are designed to prevent, slipping, falling or contacting machinery when in operation. If they are missing they should be repaired or replaced. When removed for repairs, put a temporary safety line. Protective devices must be replaced promptly.

Settling tanks, basins, manholes, sumps and other underground structures must be provided with railings or fencing. Safety belts must be used where necessary.

#### **19.6.6 LIGHTING**

Adequate glare free lighting should be provided especially in the vicinity of steps and vulnerable places. Flood lighting should be provided at suitable places for safety and security of the complex.

#### **19.6.7 VENTILATION**

Ventilation is a major factor in water supply systems. This can be secured by:

- (a) By open exterior windows or door louvres.
- (b) By fresh air intakes and mechanical exhaust fans/ducts.
- (c) By use of forced-draft fans.
- (d) By use of portable air compressors or air blowers.

#### **19.6.8 SAFETY FROM EQUIPMENT**

When maintaining and operating equipment, the following precautions should be taken:

- Always stop the machine before removing any guard.
- Personally lock out all power before starting any equipment maintenance. Put a warning sign and tag on the lockout.
- Do not unlock any power, which has been closed by others.
- Block any counter balance or weighted machine to prevent dead movement.
- Have enough help and hoisting gear to handle heavy equipment safely.
- Block up under any heavy equipment when on jacks or hoists before starting work.

- Keep tools in a kit bag or belt (not on the floor).
- Keep goggles handy. Use them wherever needed.
- Don't be in a hurry. Haste makes accidents.
- An authorized person should handle overhead travelling cranes. Circuit breakers, limit switches, hook and wire should be checked. Only standard hand signals, known to all, should be used. When loads are to be moved give a warning and make sure everyone is in a safe position. Hard helmets must be used.
- When using portable power tools use safety protective devices when operating grinding, chipping, buffing or pavement breaking equipment. Extension cords provide a tripping hazard. When working in damp or wet conditions use rubber mats. Electric tools should be grounded. For pneumatic tools use safety clamps and connectors. Electrical cords and air hoses should be kept away from oils, chemicals or sharp objects.
- Portable electric lamps should not be more than 24 volts and should conform to I. E. regulations.
- In gas or electric welding, the operator must be trained. Fire protection and personal protection practices must be followed. Storage of gas cylinders must be done with the same care as those of other gases in a water supply system.
- All safety valves in the system must be regularly inspected according to the maintenance schedule.
- Where forklifts are used, do not permit anybody, except the operator, to ride on it. Make sure the warning signals are operating. Check brakes. Make sure the forklift load is stacked properly before lifting or moving.

#### **19.6.9 LUBRICATION SAFETY**

1. Avoid lubricating machinery when it is running. If you have to do so, ensure that the lubricating point is at 30 cms. away from the moving part or the lubricant should be piped outside a guard.
2. Wipe spilled oil or grease immediately.
3. Never point a grease gun at anyone. Never squirt grease into your hands.

#### **19.6.10 SAFETY IN CONFINED SPACES**

Any place where oxygen deficiency or dangerous air contamination can occur and where ready ingress or egress for removal of a person is not available can be defined as a confined space. Some of such places are pits, manholes, basins and tanks. Accumulation of gases and vapours in confined spaces can produce explosive mixtures.

Oxygen deficiency occurs when oxygen is removed or when another gas displaces it. Oxygen is removed from air when it is used up due to bacterial action; by the oxidation of metals; combustion and when inert or toxic gases displace it.

When oxygen in air is reduced to less than 17%, shortness of breath takes place and further reduction leads to loss of consciousness. Death occurs at 10% or less. Toxic gases cause injury or death by their own action.

Safety checks must be carried out when working in such spaces. More information is available in the Manual of Sewerage and Sewage Treatment issued by the Ministry of Urban

Development, Government of India in Chapter 8 (8.9-Hazards; 8.10-Precautions; and 8.11-Safety Equipment).

When working in confined spaces ensure that sufficient air changes as required takes place.

## 19.7 HAZARDS IN CHEMICAL HANDLING — GASES

Gases commonly used in water treatment in this country are listed in Table 19.3

They are supplied in cylinders or drums. Some chemicals are generated at the plant itself. Exposure to the liquid form of the gases causes damage to human tissues such as skin burn. Most gases are heavier than air and displace air-containing oxygen. It is therefore important to have proper ventilation and use the right type of respirator.

**TABLE 19.3**  
**GASES USED IN WATER TREATMENT PLANTS**

Name and Formula	Common Name	Available Forms	Specific Gravity	Flammability	Colour	Odour	Containers
Chlorine, Cl <sub>2</sub>	Liquid Chlorine	Liquid-Gas	1.468@ 0°C	None	Greenish Yellow	Irritating	Cylinder One-ton
Carbon Dioxide, CO <sub>2</sub>	Dry Ice	Liquid-Gas	0.914	None	Colourless	Odourless	Bulk Liquid under pressure

### 19.7.1 CHLORINE

Chlorine is considered as a hazard in the water industry. Chlorine gas is poisonous to humans. It is very corrosive when in contact with water. Extreme care must be taken when working with chlorine to prevent accidental injury to operators. Small amount can cause severe coughing and irritation of the nose, throat and lungs.

Precautions to be taken when handling Chlorine are given in Chapter 8 Disinfection

### 19.7.2 CARBON DIOXIDE

Carbon Dioxide has limited use in water treatment plants but it is dangerous and causes suffocation due to lack of oxygen. Therefore, when using carbon dioxide keep in mind the safety requirements. Since the gas is a heavy vapour, it does not tend to diffuse away rapidly. Persons must be on guard when entering pits, manholes, wells etc.

First aid involves moving the victim to fresh air, giving resuscitation and getting medical attention.

## 19.8 HAZARDS IN CHEMICAL HANDLING — ACIDS

The antidote to all acids is neutralisation. Most often large amount of water will serve the purpose. If acid is swallowed, then lime water or milk of magnesia may be needed. If vapours are inhaled, first aid usually consists of providing fresh air, artificially restoring breathing or supplying oxygen. Baking soda is used to neutralise acid falling on the skin.

Many acids are used in water treatment. However in this country, Sulphuric acid is extensively used. The properties of Sulphuric acid are shown in Table 19.4:

**TABLE 19.4**

Name, and Formula	Common Name	Available Forms	Specific Gravity	Flam-mability	Color	Odor
Sulphuric Acid, H <sub>2</sub> SO <sub>4</sub>	Oil of Vitriol; Vitriol	Solution	1.841	N/A	Clear	Odonrless

### 19.8.1 SULPHURIC ACID

1. Sulphuric acid is the most dangerous chemical handled at the plant. The main hazard is from contact. Fumes are dangerous but normally at room temperatures, there are not many fumes.
2. Always use protective clothes and equipment. Contact with the acid on body tissue results in severe burns immediately. Immediate flooding with water is essential.
3. Clean the acid spill immediately. Do not leave the area until it is well marked or guarded. Neutralise the acid with soda ash and then flush it down the drain.

First aid is speed in removing sulphuric acid from the body. Continue irrigation with running water and alternating applications of mild alkaline solutions (bicarbonate of soda). Irrigate eyes with large amounts of water. If swallowed, do not induce vomiting but encourage patient to wash out his mouth with large amount of water and then drink as much water as possible. Get medical help immediately.

### 19.9 HAZARDS IN CHEMICAL HANDLING – BASES

The bases used in water treatment are known as hydroxides. They are used to raise pH. Compounds of sodium, calcium and ammonia are strong bases. Silicate, carbonate and hypochlorite are weak bases. Table 19.5 lists some of the basic compounds used in water treatment in this country.

**TABLE 19.5  
BASES USED IN WATER TREATMENT**

Name and Formula	Common Name	Available Forms	Spec.Grav. or lbs/cu ft	Flamma-bility	Color	Odor	Contai-ners
Calcium Hydroxide and Calcium Oxide Ca(OH) <sub>2</sub> or CaO	Hydrated Lime or Quick-lime	Dry Powder, Lump	50-70	N/A	White	Dust	Bags, Bulk, Trucks
Sodium Hydroxide, NaOH	Caustic, Lye	Lump, Liquid, Flake	1.524	May Cause Flammable Conditions	Opaque White	Toxic, Pungent	Drums, Bulk, Trucks
Sodium Silicate, Na <sub>2</sub> SiO <sub>2</sub>	Water Glass	Liquid	1.35-1.42	N/A	Opaque	N/A	Drums, Bulk Trucks

### **19.9.1 CALCIUM HYDROXIDE (HYDRATED LIME)**

1. Lime has a great affinity for water and a great deal of heat is evolved when the two come in contact. Storage in damp places may cause a fire in nearby flammable materials. Calcium hydroxide (hydrated lime) is less troublesome than calcium oxide (quicklime).
2. They should be stored in a cool, dry place. In damp places fire may be caused in nearby flammable material. Also do not mix dry quicklime with other chemicals that contain water of crystallisation like alum or ammonium sulphate
3. Persons exposed to lime dust must be protected with personal protective equipment. Prolonged exposure to lime dust causes dermatitis especially at points of perspiration. Face shields, chemical goggles must be used when inspecting lime slakers.
4. First aid for lime burns is about the same for any caustic burn - Thorough flooding with water.

### **19.9.2 SODIUM HYDROXIDE (CAUSTIC SODA)**

1. Dry caustic soda should be stored in a dry place where it will not be exposed to moisture, liquid caustic in steel covered tanks.
2. Workers are exposed to splash and mist. They must wear protective equipment like safety goggles, face shields, rubber gloves aprons, boots and cotton overalls.
3. First aid is the same as for any caustic burn. Irrigate well with water.

### **19.9.3 SODIUM SILICATE**

1. Sodium silicate is a liquid. Although non-toxic, non-inflammable and non-explosive it presents the same hazards to the skin and eyes as other base compounds.
2. Avoid prolonged contact with the skin. Wash with plenty of warm water. Use face shield and rubber gloves when working with the solution. Use goggles.

## **19.10 HAZARDS IN CHEMICAL HANDLING – SALTS**

The various salts (chemicals) used in water treatment in this country are given in Table 19.6.

### **19.10.1 ALUMINIUM SULPHATE (ALUM) AND FERROUS SULPHATE**

1. These materials should be stored in a clean dry place, for moisture has a tendency to cake the material.
2. Handlers should wear protective clothing and protective cream on exposed skin surfaces because these chemicals can cause irritation to the skin and mucous membranes and serious injury to the eyes. Use the same precautions for liquid solutions, with added protection for the eyes.
3. Do not use compressed air to clean dry feed machines and equipment. Keep covers on feeding equipment.
4. Remember that mixtures of dry alum and quicklime can explode. Ferrous sulphate dust is more corrosive to equipment, and, when moist, is a good conductor of electricity.



**TABLE 19.6**  
**SALTS USED IN WATER TREATMENT**

<b>Name, Formula</b>	<b>Common Name</b>	<b>Available Forms</b>	<b>Density, lbs/cu ft</b>	<b>Flammability</b>	<b>Color</b>	<b>Odor</b>	<b>Containers</b>
Aluminum Sulphate, $Al_2(SO_4)_3 \cdot 14H_2O$	Alum, Filter Alum	Liquids, Powder, Lump	1.69 38-67	None	Ivory	N/A	Bags, Tank Truck, Bulk
Ferric Chloride, $FeCl_3$	Ferrichlor, Chloride of Iron	Syrup, Liquid, Lump	60-90	None	Dark Brown, Yellow	N/A	Carboys, Tank Cars
Ferric Sulphate, $Fe_2(SO_4)_3$	Ferrifloc, Ferrisul	Powder, Granule	70-72	None	Red-Brown	N/A	Bags, Drums
Ferrous Sulphate, $FeSO_4 \cdot 7H_2O$	Coppras, Green Vitriol	Crystal, Granule, Lump	63-66	None	Green	N/A	Bags, Drums, Bulk
Sodium Aluminate, $NaAlO_2$	Soda Alum	Dry Crystal, Liquid	(27°)	None	White, Green-Yellow	N/A	Bags, Bulk
Copper Sulphate, $CuSO_4$	Blue Vitriol, Blue Stone	Crystal, Lump, Powder	60-90	None	Blue	None	Bags, Drums
Sodium Chlorite, $NaOCl$	Technical Sodium Chlorite	Powder, Flake, Liquid	70 dry	Oxidizer	Light Orange	None	Tank Truck, 100 lb-Drums
Potassium Permanganate, $KMnO_4$	Permanganate	Crystal, Powder	90-100	Oxidizer	Purple	None	Drums, Bulk

Ferrous sulphate dryers can also corrode essential instruments or equipment in the vicinity of dusty conditions. Electrical equipment in the area should be of the dust-proof type and frequently cleaned

5. First aid for skin irritations and mild burns should be the same as for any acid burn. Scrub with plenty of warm water and soap, followed by a good shower as soon as possible. For any irritation of the mouth and nasal passages, irrigate freely with warm water. If the material is in the eyes, flush with large quantities of warm water, and consult a physician.

### **19.10.2 FERRIC CHLORIDE**

1. This is a very corrosive compound and should be treated as you would treat any acid.
2. The salt is highly soluble in water, but in the presence of moist air or light, it decomposes to give off hydrochloric acid, which may cause other problems regarding safety. When handling liquid ferric chloride, normal precautions should be taken to prevent

splashing, particularly if the liquid is hot. Use a face shield to protect your eyes and rubber aprons to protect clothing.

3. First aid for eyes exposed to the liquid is that the eyes must be flushed out immediately for 15 minutes with large amounts of water. Ferric chloride should also be washed off the skin with water, as prolonged contact will cause irritation and staining of the skin.

### **19.10.3 FERRIC SULPHATE**

1. Because of its acidic nature, operators using this compound should be provided with protection suitable for dry or liquid alum.
2. Use protective clothing and a respirator. Avoid prolonged exposure to the dry form because of its acidic reaction with moisture on the skin, eyes and throat.
3. First aid for exposure to the eyes requires the eyes to be flushed immediately with lots of water. The skin should also be flushed with large amounts of water. Prolonged contact may cause irritation.

### **19.10.4 SODIUM ALUMINATE**

1. There are few hazards with this compound, but as with other chemicals, you should use precautions when handling it.
2. Use respiratory protection when handling the dry compound to prevent the inhalation of dust.

First aid for eyes that are exposed is to flush with water; keep the skin clean with water.

## **19.11 SAFETY IN CHEMICAL HANDLING – POWDERS**

### **19.11.1 ACTIVATED CARBON**

1. One of the greatest dangers in carbon storage is the fire hazard. Storage bins for dry bulk carbon should be of fireproof construction, and equipped with carbon dioxide equipment or water spray for fire control.
2. Bag storage should be in a clean dry place, in single or double rows with access aisles around every stack for frequent fire inspections, and to facilitate removal of any burning carbon.
3. Smoking should be prohibited at all times in the carbon handling and storage areas. Keep carbon away from heated pipes, or any possible fire hazard such as electric motors or electric wiring.
4. Dust-proof motors and explosion-proof electrical equipment that can be kept dust-tight should be used. Damp carbon dust is a conductor of electricity and can short circuit electrical equipment.
5. Dust masks should be worn when handling carbon, and good dust collecting equipment should be used. When loading carbon bins or hoppers, the personnel should also wear dust-proof goggles, a cap, and loose clothing tied at the wrists and ankles.

### (a) Controlling fires

Activated carbon burns like ordinary charcoal, without smoke or flame, and glows with intense heat. Such fires are sometimes difficult to detect, and when found, are hard to handle. A fire in a large storage bin or stack may burn for some time before being discovered. The smell of charred paper from the bags, or an area of scorched paint on the side of the hopper is indication that a fire is in progress.

Burning carbon should never be doused with a large stream of water, as the steam produced will scatter burning carbon in all directions. A fine spray or fog nozzle works much better. In working with a carbon fire in a confined area, remember there is danger from carbon monoxide, so air-supplied hoods or self-generating oxygen masks should be available.

Most activated carbon has sufficient oxygen adsorbed in the material so that it can burn in the absence of air. Carbon will start to burn if a temperature of 350 to 450 degrees Fahrenheit is reached, depending on the type of material and the fineness of grinding. The best way to combat the fire is to reduce the surrounding carbon below this ignition point, by soaking with water from spray nozzles

## 19.12 FIRE PROTECTION

Very little attention is paid to fires. Three elements cause a fire – fuel, oxygen and a means of ignition. If any one is missing, there is no fire. Fire fighting is based on removing one of these elements. In any fire, only the cause or fuel for burning varies.

### 19.12.1 CLASSIFICATION OF FIRES

TABLE 19.7

Class of Fire	Description	Extinguishing medium	IS No.
A	Fires involving ordinary combustible materials like wood, paper, textiles etc. where the (constant air pressure) cooling effect of water is essential for the extinction of fires.	Water Soda acid type, Water type (gas pressure), Water type	934 940 6234
B	Fire in flammable liquids like oils, solvents, petroleum products, varnishes, paints etc. where a blanketing effect is essential.	Foam Carbon dioxide Dry Powder	933 2878 2171 4308
C	Fires involving gaseous substances under pressure where it is necessary to dilute the burning gas at a very fast rate with an inert gas or powder.	Carbondioxide Dry powder	2878 2171 4308
D	Fires involving metals like blanketing aluminium, zinc, potassium etc. where the burning metals is reactive to water and which requires special extinguishing media or technique.	Dry powder Special dry powder for metal fire.	2171 4861
E	Fires involving electrical equipment where the electrical non-conductivity of the extinguishing media is of first equipment importance.	Carbon dioxide Dry Chemical powder when electrical is de-energised, same as for Classes A and B.	2878 2171 4308

Note: "E" type category has been recently removed.

## 19.12.2 FIRE EXTINGUISHERS

There is no one extinguisher that is effective for all fires, so it is important that you understand the class of fire you are trying to control. One must be trained in the use of the different types of extinguishers, and the proper type should be located near the area where that class of fire may occur. A preventive maintenance program for fire extinguishers requires a considerable amount of time from the operator and requires a system of record keeping.

### Types of fire extinguishers

#### (a) Stored Pressure, Cartridge Operated, Water Pump Tank, and Soda-Acid

These are suitable for Class A fires. Proper maintenance is essential and a schedule should be drawn up.

1. The method of operation for a stored pressure extinguisher is simply to squeeze the handle or turn a valve. The maintenance is also simple: check air pressure and recharge the extinguisher as needed.
2. For the cartridge type, the maintenance consists of weighing the gas cartridge and adding water as required. To operate, turn upside down and bump.
3. To use the water pump tank type of extinguisher, simply operate the pump handle. For maintenance, one has only to discharge the contents and refill with water annually or as needed.
4. The soda-acid type must be turned upside down to operate; it also requires annual recharging.

#### (b) Foam Type

Foam type of extinguishers will control Class A and Class B fires well. They, like soda-acid, operate by turning upside down and require annual recharging.

The foam and water type extinguishers should not be used for fires involving electrical equipment. However, they can be used in controlling flammable liquids such as gasoline, oil, paints, grease and other Class B fires.

#### (c) Carbon Dioxide (CO<sub>2</sub>)

Carbon Dioxide extinguishers are common. They are easy to operate, just pull the pin and squeeze the lever. For maintenance, they must be weighed at least semi-annually. Many of these extinguishers will discharge with age. They can be used on a Class C (electrical) fire. All electrical circuits should be switched off, if possible, before trying to control this type of fire. A carbon dioxide extinguisher is also satisfactory for Class B fires, such as gasoline, oil and paint, and may be used on surface fires of the Class A type.

#### d) Chemical Extinguishers

Chemical extinguishers are either (1) cartridge operated (2) stored pressure. These are recommended for Class B and C fires and may work on small surface Class A fires.

1. The cartridge-operated extinguishers only require you to rupture the cartridge, usually by squeezing the lever. The maintenance is a bit more difficult, requiring weighing of the gas cartridge and checking the condition of the dry chemical.

2. For the stored-pressure extinguishers, the operation is the same as the CO<sub>2</sub> extinguisher. Just pull the pin and squeeze the lever. The maintenance requires a check of the pressure gauges and condition of the dry chemical.

### **19.12.3 DANGER POINTS**

The danger points are:

- Unattended storage rooms where combustibles are present
- Workshops with cleaning liquids, oil and soaked rags
- Laboratories with chemicals, heaters, burners
- Offices where much paper is present.

### **19.12.4 PREVENTION**

1. Emphasis should be on good housekeeping. A clean environment raises morale and reduces tendency for slovenliness and carelessness.
2. Rubbish and waste not properly cared for is the biggest fire hazard.
3. Oil-soaked waste or rags should be stored in metal cans and covered.
4. Additions, alterations must be of non-combustible materials.
5. Combustibles must be kept away from heating equipment or where flames are present.
6. Proper check and maintenance of electrical equipment and wiring should be carried out.
7. Automatic fire-alarm systems should be installed in fire-prone areas.
8. Fire extinguishers and fire fighting equipment must be installed and maintained regularly.
9. Avoid careless use of matches, blow torches, Bunsen burners or smoking.

### **19.12.5 FIRE DUE TO CHEMICALS**

1. Sodium Chlorite, being used for odour control in waterworks becomes explosive and a fire hazard in presence of organic matter. Even a spark or sunlight can set it off. When spilled on a wooden floor, fire is caused with the scuff of a shoe. Spillage on clothes has resulted in locker fires. Fires can be controlled by soda ash or sand— never water. It should be stored by itself far removed from organics, sulphur or acid.
2. Activated carbon is another fire hazard and has been discussed in 18.11- Safety in Chemical Handling – Powders.

## **19.13 SAFETY FROM ELECTRICAL HAZARDS**

Refer to Chapter 11 para 11.8.2 – Safety practices in Electrical works

### **19.13.1 GENERAL RULES**

1. Only trained and qualified persons should be allowed to operate and maintain electrical equipment.
2. When servicing any electrical appliance, kill, lockout and tag all power coming to it.

3. Be sure of proper footing so that you don't fall onto a live wire. Always make sure that the wire is not live. Use a pencil type tester.
4. Hand tools must have insulated handles. Insulated mats must be provided before electrical controls.
5. Ensure that all electrical systems, equipment etc. are properly grounded.
6. Remove metallic rings, watches, eye glasses. Don't use metallic tape measures or metal ladders.
7. Always mount and protect wires and cables to prevent tripping by persons.
8. Electrical controls should be in good working order, easy to reach and plainly identified.
9. Be sure there is someone to help in case of emergency. Don't become careless or overconfident.

### **19.13.2 ELECTRICAL FIRST AID**

1. Immediately free the victim from the live conductor by use of a dry wooden stick, (such as a broom or shovel handle), piece of rubber hose or plastic pipe, or other nonconductor. Never grab the victim or the wire with bare hands, or you will suffer the same consequences.
2. If unconscious or not breathing, artificial respiration should be started immediately and continued until relieved by doctors or professional. Please refer to 9.8.3.1 in Chapter 9.
3. Protect from shock by keeping the victim warm and quiet.

## **19.14 SAFETY IN THE LABORATORY**

Safety in handling and storage of chemicals has already been discussed in the preceding sections — Hazards in Chemical Handling 19.9 to 19.11 Operators do not experience a great deal of exposure to hazardous laboratory conditions. However proper practices must be followed to avoid accidents.

### **19.14.1 SAMPLING SAFETY**

1. Never take field samples with bare hands. Always wear gloves.
2. Do not climb over or go inside guardrails. Use poles, ropes, dippers, or other long distance samplers.
3. When collecting gas samples, do not open tank cover completely. Install a sampling port, if needed.
4. Wear an effective gas mask when taking gas samples.

### **19.14.2 HOUSEKEEPING**

- General cleanliness and correct storage of chemicals and equipment are important for accuracy as well as safety in the laboratory. Basic rules include:

1. Follow a daily general clean up schedule in the laboratory. Dirty glassware or clothing can encourage infection. Put all chipped, cracked or broken glassware into containers marked 'Broken Glass only'.
2. Have a special spot for storing each piece of equipment. After each use, clean, disinfect, and return to its rack.
3. Never work in a poorly ventilated room. Keep the laboratory well lighted. Do not crowd the laboratory. Have plenty of room.
4. Always clean up and discard any spills at once.
5. All workbenches or tables should have chemical resistant tops, or be painted with chemical resistant paint frequently.
6. Do not store any other equipment in the laboratory.

### **19.14.3 SAFETY WITH CHEMICALS**

1. Keep working amounts of chemicals stored out in the lab to a minimum.
2. All bulk chemicals should be stored in original containers, in a separate fire proof store room. Larger bulk containers should always be on the floor.
3. Have individual bulk siphons to transfer chemicals from bulk storage to working stock bottles.
4. All chemicals storage jars should stand on wide shelves with retaining rails to prevent their accidentally being pulled or jarred off.
5. Strong and/or highly corrosive acid and base storage jars should stand in lead, plastic, or ceramic individual trays deep enough to contain the contents if the jar should break.
6. All chemical storage should be as low as possible and never more than shoulder height.
7. Clearly label all chemicals with common and chemical names, formula, strength, and date prepared or received. Replace these labels as needed to keep them legible.
8. Add red "Skull and Cross bones" labels to all containers of toxic chemicals.
9. Workers familiar with their properties must carefully dispose of used chemicals. They must not be flushed down the drain without due consideration of their effect on the sewer system.
10. Keep highly reactive chemicals stored far apart.
11. Perform all work that involves volatile acids, bases or solvents in a hood. Be very cautious with nitric acid. Do not add it to substances that are easily oxidised or nitrated. This can cause a fire or explosion. Other examples are: nitric acid with acetone; with benzene and toluene; with acetic acid.

### **19.14.4 SAFETY WITH EQUIPMENT**

1. Only trained experienced technicians should operate laboratory equipment, especially pressure units.
2. Exact, clear operating procedures, for autoclaves, water stills, and any other special pressure equipment will be permanently posted near same.

3. Valves and switches on such equipment shall be clearly numbered in their order of use. All electrical equipment must be well grounded. Inspect all electrical cords for wear or cracks in insulation, and replace as necessary.
4. Manufacturer's operations, warranty, service, and safety instructions shall be kept in a permanent file.
5. All equipment shall be set up away from gas and electric service switches or valves.

#### **19.14.5 SAFETY WITH GLASS**

1. Wear gloves any time you are working with glass.
2. Hold rod or tube in contact with stopper and twist to insert.
3. Wear full or wrap-around goggles or a face shield when working glass.
4. Always support glass units with several padded clamps firmly anchored.
5. Properly shatter and discard all chipped or cracked glassware.

#### **19.14.6 SAFETY IN LABORATORY PROCEDURES**

1. Never pipette by mouth. Always use a bulb.
2. Know your procedure and follow a check list.
3. Always wear safety glasses or goggles in the laboratory.
4. Never wear contact lenses in the lab.
5. Have a viewing window so visitors won't enter the laboratory.
6. Always wear a rubber apron when working with chemicals or running any reaction.

#### **19.14.7 FIRST AID AND FIRE PREVENTION IN THE LABORATORY**

1. Have an adequate supply of a good eyewash at all times.
2. Keep several fire blankets in an easily accessible location.
3. Special fire extinguishers, clearly labelled and checked for monthly charge, for chemical and electrical use should be openly mounted.
4. Emergency numbers for fire and medical help should be clearly and permanently posted above every phone.
5. All employees, and especially laboratory technicians, should have extensive, regularly refreshed, first aid training.

### **19.15 SAFETY PRACTICES DURING REPAIR AND OPERATION OF WATER MAINS**

#### **19.15.1 PLANNING**

A safety practice during construction and maintenance of the water distribution system has two major aspects — preparation and planning and operation. Usually previous methods are followed and these are revised on past experience. However, if we want to complete routine or special jobs successfully, we must plan them. This will eliminate possible hazards.



Proper maps of the system must be maintained and studied. A study of the character of the area in which the work is to be carried out is an accident prevention item.

### **19.15.2 TRAFFIC CONTROL**

1. Warning signs must be placed well ahead of the work area. Signs, barricades and used tyres can be used.
2. Vehicles can be parked between work area and the coming traffic.
3. Use red warning lights or flashers during the night.
4. Use a flag man for one way operation.
5. Traffic police must be informed and their help taken.

### **19.15.3 SAFETY PRACTICES IN REPAIR AND LAYING OF PIPES**

1. Excavations should be closely watched. Type of soil must be studied and necessary precautions taken to provide adequate side slopes or to shore up the trench. The proximity of poles and buildings must be taken into consideration.
2. All soil must be stacked at least three feet from the edge of the trench.
3. Repair of broken mains is a hand job. The ground is usually saturated or washed out. Care must be taken to protect other utilities especially electric cables which can be dangerous. Welding must be done in dry conditions.
4. The workmen must use safety hats and other protective equipment.
5. Only one trained and experienced man should give signals to a crane operator.
6. The inspection of the equipment to be used should be done before it is sent to the site. In case of a burst main, the advance crew should carry plans showing the location of valves to be closed, barricading equipment, signage, valve and chamber keys etc. Portable pumps to drain out the water should also be sent.
7. The pipe for replacement must be blocked to prevent it from rolling. Proper equipment should be used when lowering it into the trench. Sufficient men should also be engaged.
8. When the job is completed, cleaning up must be done to prevent hazards to others.

### **19.16 SAFETY IN VEHICLE OPERATION**

1. Make sure that the vehicle is in proper order including brakes etc.
2. Only licensed drivers should be engaged on the operation of vehicles. One or two drivers should preferably handle each vehicle only.
3. Simple forms should be used to report any unsafe condition by the driver.

### **19.17 FIRST AID**

1. The ideal goal is to have every person trained in First Aid and Cardiac Pulmonary Resuscitation (C.P.R.). A more realistic approach is to two persons in each crew and shift. This training can be imparted through the Red Cross, Fire departments or other organisations.

2. These crew medics can be made responsible for keeping all first-aid kits well stocked. They could serve as instructors for the rest of the fellow workers.
3. First-aid kits must be prominently displayed at various points at the plant and in the vehicles. Special attention must be given to the most hazardous areas like laboratories, workshops, chemical handling facilities etc.

### **19.18 CONCLUSION**

We must remember that everyone is responsible for safety. A Safety Programme is a must for the management. Many accidents occur due to the human factor. Ultimate responsibility may be that of management but the operator cannot also be relieved of his responsibility. The operators decision-making abilities and general behaviour (response time, sense of alarm etc.) are important. Be on the lookout for factors that disrupt the flow of action between the operator's natural senses and actions and the tools and machines.

The operator has a greater understanding of the operator-machine interface. The operator is the appropriate person to indicate the human factor involvement to the cause of accidents.

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## CHAPTER 20

# PUBLIC-PRIVATE PARTNERSHIP

### 20.1 INTRODUCTION

Providing safe drinking water is an essential basic service to be rendered by any civic body interested in ensuring quality of life of its residents. Predominant problems in Urban Water Supply Service are :

- Intermittent and irregular supply.
- Inefficient and inequitable utilization of resources (water, capital and human).
- High level of fiscal dependence.
- Supply and norm-based organisational and technical design of urban water systems.
- Low responsiveness to consumer needs and preferences.
- High costs to be borne by the consumer particularly by the poor.
- High levels of unaccounted water leading to only partial cost recovery of O&M cost and with no scope for capital investment.
- Huge money is to be invested by the municipalities for putting up/developing water treatment plants, water transmission and distribution networks.
- The water supply sector is both financially and operationally weak.

#### 20.1.1 PRESENT METHOD OF FINANCING

At present the government provides the finance to the municipalities for improving the water supply service. Due to paucity of funds the municipalities are often faced with lack of cash and high indebtedness and hence money has been the major constraint for the municipalities for improving /providing these basics services. A frank assessment of the time frame required for the local bodies to improve the basic services of water supply and with their meager budgetary provisions shows that there is a need for alternative options which can ensure sustainable services in much shorter times. As an alternative to traditional management and funding, most suitable option is to bring in private management and finance into provision and development of urban basic services including water supply with the objective of improving provision of these basic services.

#### 20.1.2 SCOPE FOR PRIVATE SECTOR PARTNERSHIP

A priority issue for most towns and cities will be first to improve the management and accountability of water distribution system through Private Sector Partnership (PSP) to make the service market oriented, efficient and demand responsive. Investment in other areas should

then be determined by the private operator who should have financial incentives for meeting desired service standards at least cost, ensuring that low cost rehabilitation, efficiency enhancement and demand management measures precede capital intensive source development, reservoirs, treatment plants or pumping stations.

## **20.2 NEED FOR REFORMS**

### **20.2.1 Need for Sector Reforms**

There is a need for a radical reform of urban infrastructure sector and particularly in water supply and sanitation sector to ensure that the quality of services in the urban areas, particularly to the urban poor is improved. Traditional mechanisms, relying on unreliable flows of insufficient public funds to finance piecemeal projects cannot fill the urban infrastructure gap. Hence reform of the urban water supply sector is particularly urgent because without such reform, fiscal resources will continue to be used sub-optimally and urban population will continue to spend significant portions of their time and income in coping with the costs of poor service, depriving themselves of their full economic and civic potential. The situation is also complex because :

- Water is an essential service.
- Water is a local issue with local solution, but failure to tackle them successfully can have regional and national implications.
- There is a need to introduce the reform agenda.
- The private sector can play a positive and long – lasting role, and
- Reforms must be properly sequenced and managed, applying key lessons from reforms in other sectors.

### **20.2.2 STATUS OF REFORMS**

While recognizing that urban reforms are state subjects, the Government of India (GOI ) through the Ministry of Urban Development and Poverty Alleviation is facilitating these reforms, including designing and disseminating among others, a model Municipal Act, important guidelines for private sector partnership in urban water and sanitation services and overall framework for GOI support. Within the framework, the ministry has proposed the “Urban Challenge Fund” and the “Pooled Finance Mechanism” to catalyse urban change through an active partnership with the states and their towns and cities through a combination of strategic engagements, capacity and regulatory support, and fiscal incentives. These will be further complemented by the “Urban Reform Incentive Fund” under the Ministry of Finance (GOI).

### **20.2.3 Constitutional Provisions**

The 74th Constitutional amendment encourages state governments to transfer responsibility for Water Supply Services (WSS) to Urban Local Bodies and gives them an opportunity to develop an Urban WSS sector policy to start far reaching reforms. Though the constitutional amendment empowers the people to manage their affairs and hence places the responsibility for provision and management of water supply services on the people,

the local bodies still depend on the governments for provision of funds for improving the water supply service.

#### **20.2.4 KEY PRINCIPLE FOR POLICY FRAMEWORK**

A publicly endorsed policy framework would give decision makers the mandate for systematic reform and private partnership. Various initiatives are required for creation of an enabling environment among all the stakeholders for private partnership as a viable alternative. To create such an environment there is a need to assure the under privileged and weaker sections of society of the continued government support (subsidies) and dispel the fears of retrenchment and salary cuts of the present employees even if the services are provided and managed by the private sector. The key principles for such reform policy framework are to :

- Introduce public service obligations, prudent financial constraints and accountability obligations for urban local bodies/service providers/water utilities.
- Commercialise service providers under transparent governance structures – professional management, insulation from political influence, revenue adequacy and suitable and auditable accounts and performance measures.
- Establish an autonomous and competent economic regulator when there is a clear demand for its services and the political will for its empowerment.
- Put in place specific incentives and regulations to improve services for the poor.
- Create a flexible demand – responsive industry structure.
- Encourage private sector partnership, prioritizing distribution system management, operation, maintenance and planning.
- Set service charges that reflect costs with better targeted public subsidies.
- Create an enabling legal, regulatory and institutional environment; delineate the roles of state and local regulatory agencies and establish an empowered Sector Reform Team to facilitate the reforms.
- Urban Local Bodies/Water Utilities would restructure the service providers, assess costs, tariff and subsidy requirements for better services, prepare for and execute the envisaged form of Private Sector Partnership and manage the Private Sector Partnership contract (with support from State institutions).

#### **20.3 SUITABILITY OF PRIVATE SECTOR PARTNERSHIP CONTRACTS**

Benefits from PSP will grow, as increasing responsibility and risks are transferred to the private partner. Hence simple service management contracts generate less benefits compared to performance based management contracts, leases, concessions and divestitures. Concession contracts are best suited for most urban areas as they mobilize capital and high quality human resources but may be unfeasible till market conditions are better developed. However management contracts can be expedient and cost effective if used as a leverage for a deeper form of private sector partnership. Hence the private partners in such contacts shall have sufficient rights and responsibilities to improve services and prepare for a deeper form of PSP.

Any form of PSP should contain a clear obligation to improve services to the poor. PSP transactions should be executed in a transparent and competent manner, with the assistance of qualified transaction advisers. Maximising competition from qualified bidders is one of the surest ways of assuring the best outcome to the consumers. Capacity must continue to be strengthened at the local and state levels so that utility performance is monitored effectively and the PSP contracts are managed efficiently to ensure quality of economic regulation.

## **20.4 LEGAL FRAMEWORK**

An act with legal provisions is required for creation of an authority for approval of private sector partnership projects, with specific authority to negotiate, accept or reject the PSP proposals submitted by the bidders. Any act shall also include provision for creation of a regulatory authority independent of private sector participants and the Government, not only for regulating the tariffs but also for ensuring that the private sector participants are discharging their obligations as per their contracts. This is also required to ensure expansion and upgradation of facility in future.

## **20.5 SUBSIDIES TO THE POOR**

The economically disadvantaged consumers may not be able to pay the full cost of the water. What is the minimum quantity required for sustaining and how much is spent for providing this quantity and what is the least amount that the poor/low use consumer will be able to pay and hence how much of the costs can be mobilised from the poorest and how much is to be shared by those who can afford to pay? There is a need for coming out with the policy for continuation of subsidies to the under privileged sections of society who require the support of the Government for getting drinking water supply service even if the service is managed by private firm.

## **20.6 COMPETITIVE BIDDING**

Due to the procedural formalities, often a lot of time and effort are spent on finding finances from international financial lending institutions. Since the funding is not focussed on privatization their grant processes are generally too slow to meet the requirements of fast track projects involving water supply service. Regulatory authority can compare the alternatives available for implementation of a project. If any utility desires to take up improvements to its water supply system to achieve increased coverage and better service levels, it has two alternatives namely traditional funding or private financing.

### **20.6.1 TARIFF CHARGES FOR TRADITIONAL FUNDING**

Any utility can approach the Government for funds by Plan provisions and/or procure loans from LIC, HUDCO and International and Bilateral funding agencies. Due to limited availability of such funds, the investment for improvement projects may spill over longer periods i.e. about 5 to 7 years. Accordingly the technical estimates and financial projections will be prepared for O&M costs and probable tariff charges to be recovered from users by the utility can be worked out to cater for meeting the O&M costs, debt servicing and depreciation plus some capital, reserve for extension of service .

### **20.6.2 TARIFFS FOR PRIVATE FINANCING**

As an alternative to traditional funding, a suitable option is to bring in private finance into provision and development of water supply. The utility can accept without bidding and by negotiation of proposals submitted by private firms if their tariffs are comparable with those from the alternative with traditional funding.

### **20.7 ADVANTAGES OF PRIVATE PARTNERSHIP**

- Investments by private firms may be quick and prompt and await shorter period as compared to traditional government funding, thus ensuring early completion of improvements in water supply.
- Through increased investment and greater focus on customer service the private firm will be able to ensure that they will provide adequate quantity of water of required quality with better service.
- With enormous potential for expansion of the facilities, the private firm may enhance the efficiency of service.
- Consumers are kept informed by publication of performance data.
- Private firms are more flexible in their approach to solve related problems.
- The private firm does not have the constraint of working within yearly budgetary allocations usually seen in public sector funding and hence can borrow money as required which they can spend efficiently and in a timely manner.
- It is possible that there could be a gradual change in work culture of the employees resulting in a more flexible structure that would allow individuals to show more initiative.

### **20.8 CONSTRAINTS OF PRIVATE PARTNERSHIP**

- In the process of private partnership there will be a natural aversion to change from the people themselves or from public representatives.
- The utility may be having fears of losing its clout where providing a water connection by the civic body is considered as their prerogative.
- The utility and the consumers/users may have fears that they will have no control over the pricing for the services to be provided by the private firm.
- It is inevitable that there are always those sections of the society who are less privileged for whom water supply service is either free or heavily subsidised by Govt. and hence may object to private partnership.
- The employees will have fears in respect of their existing benefits of Government employees like pension rights, retrenchment, salary cuts and more importantly the loss of the identity of a government servant or civic employee.
- The taking over of part of a public service by the private sector will require a well-defined contract in order to safe guard all parties, including government, but primarily the consumer who would be the main beneficiary. The hand-over process at the end

of a private sector arrangement needs to be defined, at least in outline, when the initial deal is made.

## **20.9 ISSUES FOR PRIVATE PARTNERSHIP**

- Since the utilities depend on the governments for provision of funds for improving the water supply service, the responsibility for providing this basic service has shifted from government to utility; this is a vital issue since the 74th Constitutional amendment which empowers the people to manage their affairs and hence places the responsibility for provision of these services on the local body.
- The utility shall give sufficient thought to all aspects and frankly assess as to how it is doing the job of providing the water supply and sewerage services and how soon it can improve the services with available/Government funds.
- The utility can also weigh the advantages and drawbacks of entrusting these services to a private firm as against management by the utility and then decide freely.
- It will also be necessary for the utility and Government to dispel the fears of the employees in respect of their existing benefits like pension rights, retrenchment, salary cuts and more importantly the loss of the identity of a Government servant or civic employee.

## **20.10 CONCLUSION**

- The decision as to whether private partnership is a viable option or not, or which solution will be the best for a specific utility can only be taken on a case by case basis considering the technical, environmental and economic conditions.
- It is important to note that the private firm despite having better resources can function effectively only on a sensible economy of scale.
- A routine customer satisfaction survey may be necessary to reveal whether majority of customers are willing to pay for an improved service and if they want better value for their money.



## ANNEXURE: 20.1

**KEY RESPONSIBILITIES UNDER VARIOUS PRIVATE SECTOR  
PARTNERSHIP OPTIONS**

Option	Asset Ownership	Operation & Maintenance	Capital Investment	Commercial Risk	Duration years	Remarks
Service contract	Public	Public & private	Public	Public	1-2	Specific activities like Meter installation or reading, monitoring losses, repairs to pipes or collection of bills
Management contract	Public	Private	Public	Public	3-5	Fixed fees based or combination of fees plus bonus; private operator may assume commercial risks associated with tariff collection from all or specific consumer groups and for reducing specific costs if provided with sufficient authority. Government must ensure timely access to capital.
Lease	Public	Private	Public/with limited private	Shared	8-15	Private operator assumes risks/rewards of efficiency and revenue improvements (and if given authority over key decisions). Private party finances working capital & limited rehabilitation, administratively as complex as concession contract. Typically suited where operating expertise and small capital investments can generate substantial efficiency gains.
Concession	Public	Private	Private	Private	25-30	Usually awarded to qualified bidder proposing the lowest tariff to operate the utility and meet performance targets. Require secure access to adequate water resources; high quality of technical,

						financial and market information needed to prepare a credible bid; administratively complex requiring competent & independent regulation.
BOT/BOO	Private & public	Private	Private	Private	20-30	Typically used for bulk water supply, water or wastewater treatment plants etc. 'Capital risk usually borne by the state government or state utility.
Divestiture	Private or private & public	Private	Private	Private	Indefinite (license may set term)	Regulation-intensive; however, reduced role of Government in asset ownership may justify higher costs of competent and fair regulation.

Build - Operate - Transfer and Build Own – Operate

Note : In practice, hybrids are also possible for example :

management contracts where the private operator takes on some commercial risks

leases in which private sector is responsible for some investments

Though not advisable, majority privately owned joint venture companies set up to operate and sometimes invest in the water utility under a lease or concession arrangement

## ANNEXURE : 20.2

### SUGGESTED ROAD MAP FOR PRIVATISATION

#### Type of Contracts : *Management Contract*

- Private Sector operator responsible for managing water service by providing Key management personnel.
- Water supply facilities/assets remain with utility.
- Existing Utility Employees are deputed to the operator for the duration of contract. Contract can be for 1 to 5 years and can be for whole services, specific functions such as distribution or in specific geographical areas.
- Private Sector operator is given authority and made responsible for the service delivery.
- Reimbursement to operator is through fixed fees plus incentive/penalty; fixed fees may include some future repairs/maintenance.
- In larger contracts an independent regulatory authority will be required to regulate the pricing and guide, mediate, control and settle the disputes between the public and private operators.
- Certain minimum collection revenue and total operating costs are agreed to, beyond which incentive/penalty applies.

- Amount collected is credited to the account of the utility.
- Private Sector operator is responsible for operation and normal repairs and maintenance, which are well defined, beyond which is classified as capital, and to account of the utility.
- To prevent deliberate avoidance of repairs and maintenance a Proportion of unspent normal repairs and maintenance amount is reimbursed to municipality at the end of contract or every year.

### **Advantages**

- Assets remain with utility.
- Technical know how is transferred from operator to utility.
- Management expertise is available.
- Short duration and gives flexibility to utility.

### **Disadvantages**

- No capital investment from operator.
- No working capital by operator, so commercial risk in billing & collection remains with utility.
- Operator performance is affected by municipality's inability to invest.
- Short duration and hence operator refuses to take long term view.
- No penalty if operator just walks away.

### **Delegated Management contract**

- Private Sector operator responsible for managing water & wastewater services including commercial risk in billing & collection.
- Water supply and wastewater facilities/assets remain with utility.
- Existing utility Employees are normally transferred to the operator for the duration of contract.
- Contract may be for about 10 years and usually covers the whole services in the entire geographical areas.
- Operator is given authority and made responsible for the service delivery of measurable levels of service.
- Operator relies on amount collected which is retained by the Operator.
- Operator injects working capital.
- Operator has to earn extra by maximising revenue and optimising costs.
- Profit sharing is agreed to beyond a financial return.
- Operator is not responsible for any capital investment.
- Capital expenditure is well defined as above a monetary value.

- Penalties for non compliance with agreed levels of service
- Utility sets the tariff including the operators expenses and capital investment
- Utility reviews tariffs periodically with changing legislation and priorities
- This contract is useful when:
  - Little capital is required
  - Utility must control capital costs
  - Utility has alternative financing options

### **Advantages**

- Assets remain with utility.
- Technical know how is transferred from operator to utility.
- Management expertise is available, real control is available due to operator's financial involvement.
- Long term planning is necessary since contracts are > 10 years.
- Duration gives flexibility to utility.
- Working capital provided by operator.
- Commercial risk in billing & collection remains with operator.
- Some financial penalty is at risk if operator just walks away.

### **Disadvantages**

- No capital investment from operator and hence all capital is to be found by the utility.
- Operator performance is affected by utility's inability to make capital investments.
- Utility's flexibility reduced due to long term contract.

### **Concession Contract**

- Private sector assumes responsibility for the complete provision of effective water services.
- Private sector provides all capital funding to meet existing and future demand for agreed levels of service.
- Water supply facilities/assets remain with utility.
- Existing utility Employees are transferred to the operator on agreed terms for the duration of contract.
- Due to greater financial involvement contract can be for 25 to 30 years.
- Usually covers the entire geographical areas supplied by utility and covers water service.
- Operator is given authority and made responsible for the service delivery of measurable levels of service.

- Operator relies on amount collected which is retained by the Operator.
- Operator uses the existing assets without heavy capital investments.
- Operator has to earn extra by maximising revenue and optimising costs.
- Profit sharing is agreed to beyond a financial return.
- Penalties for non compliance with agreed levels of service.
- Utility sets the tariff including the private sector investments and operators expenses.
- Utility reviews tariffs periodically with changing legislation/priorities.
- This contract is useful when:  
Superior levels of service are required at reduced cost to customers where previous service was at an economic tariff.

### **Advantages**

- Both existing and new assets remain with utility.
- Technical know how is transferred from operator to utility management, expertise is available, real control is available due to operator's large financial involvement.
- Working capital provided by operator.
- Commercial risk in billing & collection remains with operator.
- All capital investments are made by the private operator and as a result the performance also lies in his hands.
- A substantial financial penalty is incurred if private operator just walks away.
- Long term planning is essential as contracts are for more than 25 years.

### **Disadvantages**

- Utility's flexibility reduced due to long term contract.
- Very few operators would come forward to make such a huge investment.

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## ABBREVIATIONS

ARDC	–	Agriculture Refinance & Development Corporation
AUWSP	–	Accelerated Urban Water Supply Programme
BOOT	–	Build, Operate, Own and Transfer
CCCSC	–	Chamber of Commerce, Consumer Service Committee
CPR	–	Cardiac Pulmonary Resuscitation
CWR	–	Clear Water Reservoir
FCRI	–	Fluid Control Research Institute
GEC	–	Groundwater Estimation Committee
GIS	–	Geographic Information System
HDET	–	Hand held Data Entry Terminal
HUDCO	–	Housing and Urban Development Corporation
IEC	–	Information Education and Communication
IMD	–	Indian Meteorological Department
IPHE	–	Institution of Public Health Engineers
LIC	–	Life Insurance Corporation
NABARD	–	National Bank for Agriculture & Rural Development
NEERI	–	National Environmental Engineering Research Institute
NITIE	–	National Institute for Training in Industrial Engineering
NTU	–	Nephelometric Turbidity Unit
O&M	–	Operation & Maintenance
PHED	–	Public Health Engineering Department
PSP	–	Public Stand Posts
RILSG	–	Rajasthan Institute of Local Self Govt.
SCADA	–	Supervisory Control and Data Acquisition
UFW	–	Unaccounted for Water
WSSB	–	Water Supply & Sanitation Boards
VCCSC	–	Vigilance Committee, Consumer Service Committee