# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS



NEW DELHI, SEPTEMBER 25-27, 1996

## PROCEEDINGS

GOVERNMENT OF INDIA
MINISTRY OF URBAN AFFAIRS & EMPLOYMENT
IN COLLABORATION WITH THE
WORLD HEALTH ORGANISATION

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# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY & SANITATION SYSTEMS

## 25-27 SEPTEMBER, 1996
## VENUE: VIGYAN BHAWAN, NEW DELHI

## SCHEDULE

### 25TH SEPTEMBER 1996 (Wednesday)

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| 08.00-09.10 | **Registration** |
| 09.15-10.30 | **INAUGURATION** (Urban & Rural Sector) |
| 09.15 | Arrival of **Dr. U. Venkateswarlu,** Hon'ble Minister of State for Urban Affairs & Employment |
| 09 30 | Arrival of Chief Guest **Dr. K. Yerram Naidu,** Hon'ble Minister for Rural Areas & Employment |
| 09.40-09.50 | Presentation of Bouquets to dignitaries on dias, lighting of lamp by Chief Guest |
| 09.50-09.55 | Welcome Address by **Shri B.S. Minhas,** Jt Secretary, Ministry of Urban Affairs & Employment |
| 10.00-10.10 | Inaugural Address by **Dr. U. Venkateswarlu,** Hon'ble Minister of State for Urban Affairs & Employment |
| 10.15-10.25 | Address by the Chief Guest |
| 10.25-10.30 | Vote of Thanks by **Shri Vinay Shankar,** Secretary, Ministry of Rural Areas & Employment |
| 10.30-10.45 | **Tea** |
| 10.45-11.50 | **JOINT SESSION** (Urban & Rural Sector)<br>Chairperson **Shri Vinay Shankar,** Secretary, Ministry of Rural Areas & Employment |
| 10.45-10.55 | 1. Current developments in Water Supply & Sanitation (Collaborative Council, **Mr. R. Wirasinha)** |
| 11.00-11.10 | 2. Presentation of concepts of O&M (Collaborative Council, **Mr. Hueb)** |
| 11.15-11.25 | 3. Presentation of suggested Action Plan by O&M Working Group (Collaborative Council, **Mr. Hueb)** |
| 11.30-11.40 | 4. Presentation of Key issues and constraints for Urban Sector **(Shri B.S. Minhas,** Jt. Secretary, Ministry of Urban Affairs & Employment) |
| 11.40-11.50 | 5. Presentation of Key Issues and Constraints for Rural Sector **(Shri Palat Mohan Das,** Jt. Secretary, Ministry of Rural Areas & Employment) |

### WORKSHOP ON URBAN WSS

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|---|---|
| 11 50-13.00 | **Plenary Session**<br>Chairperson: **Shri B.S. Minhas,** Joint Secretary, Ministry of Urban Affairs & Employment<br>1. International perspective of O & M of Urban Water Supply & Sanitation Systems (Collaborative Council, **Mr. Costantini & Mr. Farley)** |

2. Status of Operation & Maintenance of Urban Water Supply & Sanitation Systems by **Dr. S.R. Shukla,** Adviser (PHEE), C.P.H.E.E.O.

3. Discussion

13.00-14.00 **Lunch**

14.00-15.00 **Plenary Session (contd.)**

Chairperson: **Dr. S.R. Shukla, Adviser (PHEE), CPHEEO**
Ministry of Urban Affairs & Employment Presentation of three case studies

15.00-15.40 **Formation of Groups, Briefing of Chairmen of Groups by the Facilitator and Presentation of theme papers**

Chairperson: **Dr. S.R. Shukla, Adviser (PHEE), CPHEEO**

1. Technical Issues (by **Dr. D.M. Mohan**)
2. Financial Issues (by **Shri S.S. Patwardhan**)
3. HRD & Institutional (by **Prof. V. Lakshmipathi**)
4. Community Participation (by **Smt. Sneha Palnitkar**)

15.40-16.00 **Tea**

16.00-17.30 **Working Group Session / Discussions**

## 26TH SEPTEMBER 1996 (Thursday)

09.00-10.30 Working Group Discussions (contd.)

10.30-10.45 **Tea**

10.45-13.00 Draft formulation of Recommendations by Groups

13.00-14.00 **Lunch**

14.00-15.30 **Working Group Session**
Finalization of recommendations by Groups

15.30-15.45 **Tea**

15.45-17.30 **Plenary Session**

**Chairperson: Shri B.S. Minhas, Joint Secretary (WA)**
Presentation of recommendations by each Group &
Inter-Group Discussions / Finalisation

## 27TH SEPTEMBER 1996 (Friday)

09.30-10.30 **Finalisation of Recommendations / Resolutions on O & M aspects of UWS&S** (by Core Group)

09.30-10.30 Leak Detection & Control and Training Package
**(By Mr. Farley)**

10.30-11.00 **Tea**

11.00-12.00 **Joint Concluding Session** (Urban and Rural Sector)

**Chairperson: Smt. Krishna Singh,** Adviser, Planning Commission

11.00-11.10 Welcome Address by **Shri Palat Mohan Das,** Joint Secretary,
(Ministry of Rural Areas & Employment)

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| 11.10-11.40 | **Adoption of Recommendations** |
| | Urban Sector by **Shri B.S. Minhas,** JS (WA), (Ministry of Urban Affairs & Employment) |
| | Rural Sector by **Shri Palat Mohan Das,** JS (TM), (Ministry of Rural Areas & Employment) |
| | Address by the Chairperson **Smt. Krishna Singh,** Adviser, Planning Commission |
| | Address by **Mr. J. Hueb,** Coordinator, O&M Working Group Collaborative Council |
| 11.40-11.55 | Valedictory Address by **Shri Chandradeo Prasad Verma,** (Hon'ble Minister of State for Rural Areas & Employment) |
| 11.55-12.00 | Vote of Thanks by **Shri B.S. Minhas,** Joint Secretary, (Ministry of Urban Affairs & Employment) |
| 12.00 | **Lunch** |

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS NEW DELHI: 25-27 SEPTEMBER, 1996

**The objectives of this workshop were to:**

- identify constraints and key issues affecting the performance of the water supply and sanitation sector
- present tools for O&M prepared by WHO
- exchange information and experience on O&M
- define options for O&M
- prepare an action plan for O&M, including O&M Manuals, Unaccounted For Water and Training
- make recommendations for implementation of action plan and
- evolve mechanisms for evaluation and monitoring of implementation of action plan.

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS, NEW DELHI: 25-27 SEPTEMBER, 1996

## ISSUES FOR DISCUSSION

### Technical Issues

1. There is a need to carry out a deficiency analysis of the O&M of WSS and prepare action plans and manuals for O&M to ensure sustainability of the systems.

2. Water conservation policies and practices including management of UFW have to be made an integral part of O&M activities of any system if the objective of providing a safe reliable and affordable water supply on full cost-recovery basis is to be achieved. An action plan for UFW may be prepared and implemented by each organisation.

3. A good MIS with information on service levels, service coverage, leakage levels, staff productivity and O&M costs is not readily available with several agencies.

   — It is necessary that a mechanism is in place for updation of all the maps and records of WSS to update the improvements in the systems.

   — a list of monitoring indicators may be prepared and frequency and source specified for each organisation.

4. For ensuring sustainability, the management has also to fulfil their obligations. Management is obliged to:

   — maintain the facilities in a reasonably efficient manner for which required funds are to be provided.

   — choose persons with aptitude to work in O&M

   — arrange to train them to carry out the actions that they are required to carry out

   — provide the required tools, spares and other consumables have to be arranged.

5. A systematic method of monitoring the redressal of consumer complaints has to be in place.

### Community participation

6. Enlisting the Cooperation between the agencies in-charge of WSS and communities may be achieved through the involvement of Non Governmental Organisations, Voluntary agencies.

7. **Privatization**

   — whether it may be limited to new water supply projects, till the performance of systems managed by local bodies and utilities is improved before considering any role to private sector.

   — An incremental approach may be adopted for privatization of WSS, by entrusting to private contractors certain functions such as O&M of treatment plants for water and sewage, pumping stations and transmission mains.

   — Meter reading, billing and collection is also one area to assign to private participation with possibility of improving the revenue collection.

### Financial Issues

8. The financial management of the WSS has to be streamlined. Separate accounts on commercial basis may be maintained. The revenue billing and collection procedures have to be monitored regularly to improve the recovery performance.

9. O&M of Water and Sanitation Systems shall enable the agencies to achieve a good financial performance by levying appropriate tariffs in order to provide sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works etc.

10. Agencies incharge of O&M have to review/revise periodically the tariffs keeping in view the increases in the staff and power costs and levy reasonable and affordable tariffs. Alternatively annual increases may be provided to cover the inflation in operating costs.

11. Agencies whose performance is better should be rewarded by increased investments for new projects.

**HRD and Institutional Issues**

12. A study of existing organisational structure of each agency is undertaken and modified to suit local conditions to ensure sustainable O&M of WSS.

    — In the case of large organisations a detailed study can be undertaken to define an optimum organisation required for O&M (as given in WHO guide)

13. With larger autonomy, it is possible to run the systems efficiently and profitably by paying realistic salaries relevant to the staff and offering better incentives & attractive careers to the staff based on their performance.

14. A study may be undertaken for each organization to identify training needs for ensuring sustainability of WSS and implement the training programmes In order to achieve the objectives of training, the training culture has to be inculcated by providing appropriate linkages between career advancement and performance of both in the job and during the training.

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

## PROCEEDINGS

There are no two opinions that Operation & Maintenance is the backbone of the utility services in general and water supply and sanitation systems in particular. Any lapse or mismanagement in the Operation & Maintenance of these systems may lead to a total collapse of the systems which have been created with huge capital investments. It has been observed that the important aspect of Operation & Maintenance has often been neglected and given low priority by several State agencies. Insufficient attention to this important aspect often leads to deterioration of the useful life of the systems by 50-65%, necessitating premature replacement of many system components. Some of the key issues contributing to the poor Operation & Maintenance are, lack of finances, inadequate data on Operation & Maintenance, improper and poor system designs, multiplicity of agencies and over-lapping of responsibilities, inadequate training of personnel, inadequate institutional capacity building and lesser attraction of maintenance jobs in career planning, lack of performance evaluation and regular monitoring, inadequate emphasis on defective maintenance, lack of operating manuals and finally the lack of appreciation and awareness of the importance of the facilities by the community.

The Ministry of Urban Affairs & Employment, Government of India felt it necessary to organize a National level Workshop with the following objectives by inviting sector specialists, managers and the administrators dealing with water supply and sanitation.

- identify constraints and key issues affecting the performance of the water supply and sanitation sector
- present tools for O&M prepared by WHO
- exchange information and experience on O&M
- define options for O&M
- prepare an action plan for O&M including O&M Manuals, Unaccounted for Water and Training
- make recommendations for implementation of action plan; and
- evolve mechanisms for evaluation and monitoring of implementation of action plan.

In the back-drop of above objectives, a 3 day National Workshop on Operation & Maintenance of Urban Water Supply and Sanitation systems was organized by the Ministry of Urban Affairs & Employment during 25-27 September,1996 at New Delhi in association with the Ministry of Rural Areas & Employment, Government of India and with the assistance of World Health Organization and UNDP/World Bank Regional Water Supply and Sanitation Group - South Asia.

Inaugural session was held in the morning of 25th Sept ,1996 which was chaired by Dr. K. Yerrannaidu, Hon'ble Minister for Rural Areas & Employment, Government of India and inaugurated by Dr. U.Venkateswarlu, Hon'ble Minister of State for Urban Affairs & Employment, Government of India. While welcoming the Hon'ble Ministers as well as national and international delegates to the workshop, Shri Minhas, Joint Secretary, Ministry of Urban Affairs & Employment traced the background of national water supply and sanitation programme which was launched by the Government of India in 1954 covering both urban and rural areas with a view to improve the health status of the people. The Government of India and the State Governments accorded top priority to this vital sector which resulted in the International Drinking Water Supply and Sanitation Decade Programme during 1981-91 He emphasized that while available resources had been used largely for design and construction of facilities, very little effort had gone into ensuring efficient Operation & Maintenance of the assets created as a result of which many system components had gone into disrepair. He further pinpointed the fact that poor Operation & Maintenance of water supply and sanitation systems would result in spreading epidemics. Emphasizing the importance of Operation & Maintenance aspects and focusing attention on sound Operation & Maintenance projects, Shri Minhas made it clear that adequate provision of funds for Operation & Maintenance activities should be allocated by the State Governments and Urban Local Bodies and at the same time, the available resources should be put

to optimum use in order to achieve sustainable performance improvements He had also focused the attention of technical experts, administrators and managers on data collection, development of utility maps, management information system, human resource development, etc. for effective Operation & Maintenance.

Dr. U. Venkateswarlu, Hon'ble Minister of State for Urban Affairs & Employment, Government of India delivered the inaugural address. While emphasizing the importance of Operation & Maintenance of water supply and sanitation systems, the Hon'ble Minister expressed his concern about the neglect of this important aspect by the concerned State Government Departments and Urban Local Bodies due to which even after creation of such assets by investing millions of rupees, the same are unable to provide the services for which they have been constructed as they remain defunct most of the time due to poor Operation & Maintenance He further added that the water supply and sewerage tariffs in the country are so low that they do not even cover the Operation & Maintenance cost, as such adequate resources must be set apart by the State Governments and Urban Local Bodies for effective Operation & Maintenance and to make the systems functional all the time. Referring to unaccounted for water, Dr.Venkateswarlu expressed his deep concern over the fact that the water losses in the distribution systems are of the order of 20-40% of the total flow in the systems. As such, he was of the strong opinion that a systematic approach towards wastage, leakage and preventive maintenance should form an integral part of Operation & Maintenance activity on a regular basis to save considerable quantity of water, prevent possible contamination, improve pressure in the distribution system and increase revenue to make the systems self-sufficient. He further added that the commercial losses due to illegal connections, non-functioning of water meters, improper billing and collection are on the increase in many cities. Lastly, he stressed the need for clear cut sector policies, legal framework and a clear demarcation of responsibilities and mandate within the water supply and sanitation sub-sector. In the light of the 74th Amendment of the Constitution, the role and responsibilities of Urban Local Bodies to deliver the services to the community have significantly increased. In his closing remarks, the Hon'ble Minister requested the State Governments and Urban Local Bodies to explore the possibility of privatisation of water supply and sanitation sector and advised them to strive hard to attain consumer satisfaction.

Dr. K. Yerramnaidu, Hon'ble Minister for Rural Areas and Employment, Government of India had delivered the Presidential Address. During his address, Dr.Naidu briefly explained the efforts made by the Government of India in providing water supply and sanitation facilities in the rural areas of the country due to which around 82% of the rural population could be provided with safe water supply facilities. Keeping in view the importance of Operation & Maintenance under the minimum needs programme as well as Accelerated Rural Water Supply Programme, he stressed that community must be sensitized to the importance of Operation & Maintenance to achieve sustainability of drinking water supply systems. Secondly, inter-sectoral coordination at the grassroot level could also be very much necessary to make the rural water supply and sanitation programme a people's movement. While concluding his address, the Hon'ble Minister had requested the State Governments to provide adequate financial resources to the Panchayats so as to enable them to properly operate and maintain the systems for the benefit of the community

At the end of the inaugural session, Shri Vinay Shankar, Secretary, Ministry of Rural Areas and Employment, Government of India proposed a hearty vote of thanks in which he thanked both the Ministers, representatives of the Government of India, State Governments, Urban Local Bodies and international experts for attending the 3 day Workshop.

The inaugural session was followed by the Joint Session for both Urban and Rural Sectors under the chairmanship of Shri Vinay Shankar. Shri R. Wira Sinha, Executive Secretary, Water & Sanitation Collaborative Council made a brief presentation of the current global developments in water supply and sanitation sector. Thereafter, Mr.Jose Hueb, Coordinator, Operation & Maintenance Working Group of the Collaborative Council made a presentation on the concepts of Operation & Maintenance and suggested action plan by the Operation & Maintenance Working Group of the Collaborative Council which met during 23-24 Sept.,1996 at New Delhi. This was followed by the presentation of Shri B.S.Minhas, Joint Secretary, Ministry of Urban Affairs & Employment in which the key national issues on Operation & Maintenance of urban water supply and sanitation systems were highlighted During his speech Shri Minhas pinpointed the fact that despite large investments and major technology inputs for construction and installation of water supply and sanitation systems, several of these systems had been found to be performing inefficiently, affecting the reliability of the services and often such investments had become unproductive due to neglect of Operation & Maintenance. As such, he suggested that a deficiency analysis of Operation & Maintenance of water supply and sanitation should be carried out and action plans and manuals prepared for Operation & Maintenance to ensure sustainability of the systems. Referring to the urgent need for preparation/upgradation of utility maps, he emphasized that a mechanism should be evolved for preparation/ upgradation of such maps and records as part of MIS. Similarly, the need for a study of existing organizational structure

of each agency dealing with water supply and sanitation sector was also emphasized. Finally, Shri Minhas requested the representatives of State Governments and Urban Local Bodies to make sincere attempts to achieve full cost recovery by reviewing the performance periodically to make the systems sustainable in the long run.

Shri Palat Mohan Das, Joint Secretary, Ministry of Rural Areas & Employment, Government of India had made a presentation on the key issues and constraints for rural sector.

Soon after the Joint Session of urban and rural sectors, the participants were requested to give their preferences as to which working group they would like to be associated with. On the basis of their choices, the delegates were divided into two separate groups representing urban and rural sectors. The Plenary Session for the urban sector Chaired by Shri Minhas was held between 11 50 AM to 1.00 PM. Mr Costantini and Mr. M. Farley of the Collaborative Council made a joint presentation on the international perspective of Operation & Maintenance of the urban water supply and sanitation systems. Soon after this, Dr. S.R. Shukla, Adviser (PHEE), C.P.H.E E.O. presented a paper on the status of Operation & Maintenance of Urban Water Supply & Sanitation Systems in India. During his presentation, Dr. Shukla identified the key constraints adversely affecting the Operation & Maintenance of water supply and sanitation systems in the country such as lack of reliability of the service delivery, defective performance, over-staffing, poor and ineffective management, lack of adequate funds, inefficient use of available resources and lack of enthusiasm among the Operation & Maintenance staff to keep the systems in good working conditions. He also briefly narrated the status of Operation & Maintenance of water supply and sanitation systems of a few cities which revealed that the unaccounted for water is about 20-50%, lack of updated maps of reservoirs, pumping stations, pipelines, distribution system, absence of updated records of assets and equipments and non-functioning of system components and instrumentation, inaccurate and malfunctioning consumer meters, lack of reliable meter repair facilities, incomplete and inaccurate revenue billing and accounting procedures leading to ineffective monitoring of the recovery performance, lack of systematic way of monitoring the redressal of complaints and consumer satisfaction and the need for comprehensive training plans and systematic organization of training requirements on the basis of job description and responsibilities. Finally, Dr. Shukla stressed the need for evolving strategy and action plans to address the problems in Operation & Maintenance and to ensure sustainability, management of unaccounted for water by reducing physical and revenue losses, full cost recovery, cost sharing arrangements and institutional strengthening.

The Post-lunch Plenary Session for the urban sector was chaired by Dr. S.R. Shukla, Adviser (PHEE), Ministry of Urban Affairs & Employment and the following three case studies were taken up:—

1. Unaccounted for Water Management Programme in Hyderabad
   — By Shri V Bhaskar, M.D., HMWSS Board, Hyderabad.
2. Operation & Maintenance of Water Supply & Sanitation Systems in Delhi.
   — By Shri Rakesh Mohan, Addl. Commissioner, DWS & SDU.
3. Operation & Maintenance of Water Supply & Sanitation Systems in Bangalore City.
   — By Shri M.N. Thippeswamy, S.E., BWS&S Board, Bangalore.

Shri V. Bhaskar during his presentation informed the group that the water losses in the transmission and distribution system were about 15% and 9% respectively. In addition, it was estimated that commercial loss was about 10% and about 82% of domestic meters were not working accurately as they were either physically damaged, removed by the consumers or reading inaccurately. Shri Bhaskar explained briefly about the action plan which was drawn up by the Hyderabad Metro Board for unaccounted for water management in the twin cities of Hyderabad and Secunderabad. As a part of action plan, the Board decided to install 71 bulk flow meters at strategic locations in the system, replacement of about 2.25 lakh domestic meters with water meters of ISI, EEC Standards, replacement of domestic service connections with MDPE pipes, testing, identification, repairs and replacement of leaking transmission and distribution mains and finally replacement of all bulk consumer meters in the system. The said action plan would be implemented in 4 years period (by 2000 AD) and the total investment required would be of the order of Rs. 98.70 crores. He was of the opinion that after implementation of the said action plan, the increase in revenue through reduction of commercial losses would be of the order of Rs. 5.00 crores per annum.

Shri Rakesh Mohan in his presentation traced the historical background of Delhi Water Supply and Sewage Disposal activity and the ever increasing population which is posing serious challenges to the public health engineers, administrators and managers dealing with water supply and sanitation sector. He mentioned that water production in

Delhi was about 600 Mgd as against the present demand of 750 Mgd. The gap between the demand and supply had been continuously widening since last decade and might likely to aggravate further by the turn of the century. Due to limited ground water potential in and around Delhi, the Municipal Corporation of Delhi had to depend on the neighbouring States for its water requirements. Despite a non-remunerative tariff of Rs.1.00 per Kl, on an average, against the production cost at the consumer's end of Rs.2.32 per Kl, a supply level of approximately 184 litres per capita per day was still being maintained in the entire MCD area. Shri Rakesh Mohan informed the group that the conveyance losses in Delhi were assessed at approximately 25%, not including the free public water hydrants to the economically weaker sections of the society and the water being supplied for fire-fighting purposes. The line losses were 25% which includes losses due to flushing. Unaccounted tappings and unauthorized connections accounts for 5% losses. Shri Rakesh Mohan explained the various steps taken by DWS&SDU for efficient management of the available resources such as recycling of filter backwash water, controlling illegal and unauthorized tappings, further exploration of ground water particularly in the out-skirts of Delhi, exchange of waste water and irrigation water with raw water, rationalization of distribution network, supply of unfiltered water for lawns and parks, prevention of leakage and wastage through effective unaccounted for water management and wastage of water through public stand-posts, demand management through imposition of realistic tariff for water used, etc.

In so far as sanitation system in Delhi is concerned, Shri Rakesh Mohan mentioned that the total installed capacity of sewage treatment plants in the MCD area was 280 Mgd and efforts would be made to increase the capacity of treatment plants by another 220 Mgd at 15 sites by the end of 1997, raising the total sewage treatment capacity in Delhi to about 500 Mgd. As regards Solid Waste/Garbage generation and collection, he mentioned that on an average 4500 MT of garbage was generated every day of which about 4170 MT was collected and transported through about 40,000 safai karamcharies. While concluding his talk, Shri Rakesh Mohan stated that the civic amenities did not match with the increased influx of population in Delhi. As such, he was of the opinion that a policy initiative towards planned development of Delhi would be needed.

Shri Thippeswamy, in his presentation, briefly explained the efforts made by the Bangalore Water Supply & Sewerage Board to provide basic amenities such as safe drinking water supply and hygienic sanitation facilities to the residents of Bangalore. The city gets 705 Mld of water, of which 80% is from the river Cauvery itself and a per-capita supply of 100 litres per day is being maintained as of now. There are many problems being encountered by the city Board in the Operation & Maintenance, such as replacement of old corroded pipes, reduction in the unaccounted for water in the system, energy audit for achieving optimum efficiency, utilization of revenue for water distributed, regularisation of unauthorized connections, etc. The production cost of every cubic metre of treated water delivered at Bangalore costs Rs. 8.00. Shri Swamy mentioned that the energy requirement for the Cauvery Water Supply Scheme, Stages-I to III would alone consume nearly 45 MW of electricity, due to which 68% of the revenue realized by the Bangalore Board would have to be incurred towards power charges. In so far as the city sewerage system is concerned, Shri Swamy mentioned that about 75% of the Bangalore Metro Area was covered with sewerage system and out of the 3 treatment plants, only one was functioning at secondary level and the other two were being upgraded to the secondary treatment level. The Bangalore Board was contemplating reuse of waste water by installing tertiary treatment plants at various locations. He made a mention of the OECF (Japan) assisted water supply and sewerage project and the mega city project being implemented in the city of Bangalore.

Soon after the aforesaid 3 presentations, the subject was thrown upon to the house for detailed discussion. The delegates took keen interest and sought clarifications, while a few made valuable suggestions.

Later, the following theme papers by the experts were presented:—

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| 1. | Technical Issues | By Dr. D.M. Mohan |
| 2. | Financial Issues | By Shri S.S. Patwardhan |
| 3. | HRD & Institutional Issues | By Prof. V. Laxmipathy |
| 4. | Community Participation | By Smt. Sneha Palnitkar |

All the 4 experts briefly explained the various issues coming in the way of effective Operation & Maintenance of water supply and sanitation activity on the basis of their experience. Full length papers of the aforesaid themes are annexured for ready reference. After the presentations by the authors, there was lively discussion on each presentation, which paved the way for further discussions in the sub-groups on the subsequent days.

The delegates were later requested to give their preferences as to which sub-group they would like to be associated with and on the basis ot their preferences 3 sub-groups were formed for further deliberations. The classification of sub-groups, Chairman and rapporteur of each group are as under:—

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|---|---|---|
| GROUP - I | Technical Issues | |
| | — Chairman | Shri V. Ranganathan |
| | — Rapporteur | Dr. D.M. Mohan |
| GROUP - II | Financial Issues | |
| | — Chairman | Dr. P.S. Rana |
| | — Rapporteur | Shri S.S. Patwardhan |
| GROUP - III | HRD, Institutional & Community Participation | |
| | — Chairman | Prof. V. Laxmipathy |
| | — Rapporteur | Shri Sukanta Kar |

After formation of the 3 sub-groups, Shri V. Venugopalan, National Facilitator and Mr. Tonino Zellweger, International Facilitator briefed the individual group Chairman and Resource Person about the modalities to be observed by each sub-group while discussing the issues strictly keeping in conformity with the objectives of the workshop and to arrive at practical recommendations and action plan within the stipulated period. The following suggestions were made by the facilitators for the purpose:—

1. The Resource Person shall be requested to make a brief presentation of the issues which will be followed by a discussion. The participants of the group may offer their suggestions to modify/add further issues. The list of issues as modified shall be provided to the participants of the group at the end of the session.

2. The participants of the group have to be requested to prioritize the issues and name the top 4 or 5 issues for detailed consideration by the entire group.

3. The prioritized issues only will be discussed by the group.

4. The Recommendations emerging out of the group discussions may be drafted jointly by the Chairperson and Rapporteur in conformity with the format provided to the Chairperson.

5. An action plan for each of the recommendation shall also be prepared jointly by the Chairperson and Rapporteur in the format provided to the Chairperson.

6. The recommendations and action plan finalized by each group may be presented by either the Chairperson or the Rapporteur at the Plenary Session for the inter-group discussions.

7. The final recommendations and action plan emerging out of the Plenary Session will be discussed by the core group at which both the Chairpersons and the Rapporteurs of all the groups have to be present.

All the 3 working groups discussed in detail the issues from 9.00 AM to 1.00 PM on 26th September,1996 and finalized the recommendations in the afternoon session on the 26th instant.

At 4.00 PM on 26th September,1996 the presentation of recommendations by the 3 groups were made at the Plenary Session chaired by Shri B.S. Minhas, Joint Secretary, Ministry of Urban Affairs & Employment which was followed by inter-group discussions on the draft recommendations.

On the morning of 27th September, the recommendations and action plan on the Operation & Maintenance aspects of urban water supply and sanitation were finalized by the core group consisting of Shri V. Venugopalan, National Facilitator, Shri B.S.Minhas, Joint Secretary, Dr. S.R. Shukla, Adviser (PHEE), Shri V.B. Rama Prasad, Deputy Adviser (PHE), Shri R. Sethuraman, Deputy Adviser (PHE), Shri Yogendra Tripathi, Deputy Secretary, Ministry of Urban Affairs & Employment and the Chairmen and Rapporteurs of the 3 sub-groups.

While the core group was finalizing the recommendations, the remaining delegates were given a presentation on Leak Detection and Control and Training package by Mr. Farley of Collaborative Council, which was highly appreciated by the delegates.

A Joint Concluding Session for both urban and rural sectors was held and Smt. Krishna Singh, Adviser (HUD&WS), Planning Commission was in the Chair. Shri Chandradeo Prasad Verma, Hon'ble Minister of State for Rural Areas & Employment was the Chief Guest for the function. Shri Palat Mohan Das, Joint Secretary (TM) delivered the welcome address and then final recommendations of both urban and rural sectors were adopted by the house. Smt.Krishna Singh, Adviser, Planning Commission then addressed the gathering and conveyed the assessment of the Planning Commission regarding the likely availability of financial resources for the water supply and sanitation sector during the Ninth Five Year Plan. She also informed the members about the decisions taken in the Chief Ministers Conference relating to Water Supply & Sanitation Sector. This was followed by valedictory address by the Chief Guest. The Hon'ble Minister traced the background of the sector development over the years and the progress made by the country during the successive five year plans for providing safe water supply and sanitation facilities to urban and rural population of the country. While highlighting some of the critical issues relating to Operation & Maintenance, the Hon'ble Minister emphasized that issues such as proper design of the schemes, effective execution were very important. At the same time, proper attention should be given to the needs of vulnerable sections of the society and those residing in inaccessible and difficult areas. He further added that due to lack of adequate funds, Operation & Maintenance of the schemes were affected adversely. Yet another important issue raised by the Hon'ble Minister was regarding the decentralization of Operation & Maintenance activity. As such he suggested that to make the system more effective, the responsibility for Operation & Maintenance of the system should be given to the Gram Panchayats and Zila Parishads by providing adequate financial and administrative powers so that these local agencies would be in a position to carry out the day-to-day operation works on their own without looking to the State Government for necessary assistance. While concluding his speech, Shri Verma expressed the hope that the recommendations, action plan and strategies arrived at after long deliberations by the national and international experts would go a long way in helping the country in the effective management of Operation & Maintenance of water supply and sanitation systems.

Shri B.S. Minhas, Joint Secretary, Ministry of Urban Affairs & Employment proposed a vote of thanks and expressed his gratitude to the Hon'ble Ministers, representatives of Central and State Governments, Local Bodies and other national and international experts for participating in the workshop and making it a grand success.

# RECOMMENDATIONS ADOPTED IN THE NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

## NEW DELHI: 25—27 SEPTEMBER 1996

### TECHNICAL ISSUES

1. There is a need to create awareness among civic officials and non officials and State Level officials so as to improve O&M of WSS and to motivate them.
2. In order to identify deficiencies in the existing system. It is necessary to undertake data collection on equipment, maps, water treatment plants, water supply distribution system, sewerage and sewage treatment system, service levels, coverage, reservoir levels, water quality and visible leakages.
3. There is a pressing need for deficiency analysis, action plans and O&M manuals. This is expected to result in improvement of construction practices, debottlenecking of schemes and better O&M practices.
4. It is important to undertake water conservation measures and steps for reduction of UFW.
5. In order to monitor and evaluate the implementation of various recommendations pertaining to O&M, a Task force should be established by the Min. of Urban Affairs & Employment, Govt. of India. Assistance of the Water Supply and Sanitation Collaborative Council may be obtained in this regard.
6. It is vitally important for the agencies running these schemes to:
   (i) provide requisite funds for maintaining the facilities in a reasonable manner.
   (ii) appoint persons in the O&M sector with aptitude for the work.
   (iii) arrange to train O&M personnel for effective performance.
   (iv) provide adequate spares, consumables and the standard tools in the form of tool kits.

### FINANCIAL ISSUES

1. The financial management of the WSS needs to be streamlined. Separate accounts on commercial basis may be maintained. The revenue billing and collection procedures have to be monitored regularly to improve the revenue collection.
2. O&M of Water and Sanitation Systems should enable the agencies to achieve a good financial performance by levying appropriate tariffs in order to cover its operating expenses, debt services, depreciation, cost of capital works, etc.
3. Agencies incharge of O&M have to review/revise periodically the tariffs keeping in view the increase in the staff and power costs and levy reasonable and affordable tariffs. Alternatively annual increases may be provided to cover the inflation in operating costs.
4. Agencies whose performance is better should be rewarded by increased investments for new projects.

### HRD AND COMMUNITY PARTICIPATION ISSUES

1. The existing institutional structures for community action under UBSP and other poverty alleviation programmes may be evaluated for generating user involvement in the management of water and sanitation sector at local level.
2. The community participation oriented organisations operating in various sectors should be identified and appropriate network created for making the sector user-demand responsive through ward committees and the statutory committees of the municipal councils at the city/town levels. Such committees may also furnish information regarding leakages in the distribution system, wastage, low pressure, poor quality of water, pilferage of system components, malfunctioning of the water meters, payment of bills etc.
3. The role of women and children should be recognised and their needs reflected in planning for O&M as well as extension of the service coverage specially in low income communities.

4. There is a need for effecting paradigm shift in respect of employee training including incentives for inservice training.

5. Studies should be carried out to identify areas amenable to private sector participation. In the meantime, contracting out of individual services can be considered to increase efficiency and reduce cost. It is necessary to develop standardised models for ensuing appropriate control system over private sector participation in water and sanitation sector.

6. Certificate (training) courses should be promoted.

# ANNEXURES

ANNEXURE — I

# WELCOME ADDRESS
# BY SHRI B.S. MINHAS

It is my privilege and pleasure to welcome the Hon'ble Minister for Rural Areas and Employment, Minister of State for Urban Affairs & Employment as well as the international and national delegates to the National Workshop on Operation and Maintenance of Water Supply and Sanitation Systems.

National Water Supply and Sanitation Programme was launched by the Government of India in 1954 covering both Urban and Rural Areas as an essential step towards improving health status of the people. The development of Water Supply and Sanitation Systems had been assigned a priority during the subsequent five year plan periods and reached a peak during the International Drinking Water Supply and Sanitation Decade Programme (1981—91).

The available resources have been used largely for design and construction of facilities, but very little effort has gone into ensuring efficient operation and maintenance of the created facilities. As a result of this, many systems implemented have gone into disrepair and sizeable quantity of water is unaccounted for. I will not be wrong if I say that operation and maintenance of water supply and sanitation facilities in the country have been neglected so far resulting in expensive facilities not performing as intended and failing to provide the expected services to the communities.

Poor operation and maintenance practices in water supply and sanitation systems have important health implications leading to spread of epidemics. In many urban areas we have witnessed spread of diseases like typhoid, cholera, diarrhoea, infectious hepatitis, etc., which can be attributed directly to ill maintained and damaged distribution pipelines with intermittent water supply resulting in contamination of treated water.

It is gratifying to note that of late, policy makers and technocrats are now becoming more conscious of the direct links between O&M practices and effectiveness and sustainability of water supply and sanitation services.

The National and International funding agencies are also emphasising the importance of O&M aspects and focussing attention on sound operation and maintenance of projects, once the projects are implemented. It is imperative that adequate provision of funds for O&M activities should be allocated to achieve sustainable performance improvements.

I am of the opinion that while there is no dearth of technical manpower in India to improve the O&M and thus optimise the efficiency of water supply and sanitation services, we need to focus our attention on data collection, development of utility maps and building management, information system needed for the control of operation and maintainance, providing training to staff in the production and use of information and periodical monitoring and evaluation of O&M.

I would also like to lay stress on the need for in-service training to be imparted to field engineers and on the job training for technicians for achieving optimal results from O&M. In practice it has been noticed that preference is given for construction rather than to O&M by the practising engineers which must be discouraged. While expansion of drinking water and sewerage facilities should be welcomed, but it need not be at the cost of existing facilities. Special cash and other incentives for the O&M staff should be introduced to attract capable engineers and technicians to play vital roles in O&M management sector.

Necessary budget provisions should be made by the sector agencies to meet the cost of MIS and training of staff engaged in O&M activities. Operation certification programme needs to be development and implemented. A programme of Employee Award or recognition of outstanding performance in O&M activities should be developed and implemented which will help in enhancing the Public image of the agencies and its staff thereby gaining public support.

I am confident that during the coming three days, with the participation of the experts in the field of Water Supply and Sanitation in this workshop, some practical suggestions will come out which would help in maintaining our existing water supply and sanitation facilities in a better and more efficient way.

ANNEXURE — 2

# NATIONAL WORKSHOP
# ON
# OPERATION AND MAINTENANCE
# OF
# WATER SUPPLY AND SANITATION SYSTEMS
# 25—27 SEPTEMBER 1996

## INAUGURAL ADDRESS
## BY
## DR. U. VENKATESWARLU,
## HONOURABLE MINISTER OF STATE FOR
## URBAN AFFAIRS & EMPLOYMENT
## GOVERNMENT OF INDIA

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS

## 25—27 SEPTEMBER 1996

It gives me immense pleasure to invite you all to this three day workshop on Operation and Maintenance of Water Supply & Sanitation systems. There are no two opinions that Operations & Maintenance is the backbone of the entire water supply and sanitation systems. As such any lapse or mismanagement in the Operation & Maintenance activity may lead to total collapse of such systems. By and large, the responsibility of Operation & Maintenance and revenue collection is vested with the elected Urban Local Bodies, while the specialized bodies such as Public Health Engineering Departments and Water Supply and Sewerage Boards are engaged in the planning, designing and construction of new systems. However, Low Cost Sanitation systems are either maintained by the respective Urban Local Bodies or the individual house-holds, as the case may be.

The Urban Local Bodies in general suffer from inadequate finances and more particularly from lack of qualified technical personnel. Therefore, inspite of the technical guidance provided by the specialized departments like PHE Departments and Water Supply & Sewerage Boards, the local bodies, especially the smaller ones, have not been able to operate and maintain the systems with the desired efficiency. It has been observed that the important aspect of Operation & Maintenance has often been neglected and given low priority in several States. In attention to this critical aspect often leads to the deterioration of the useful life of the systems by 50 to 65%, necessitating premature replacement of many system components. As such, even after creating such assets by investing millions of rupees, the same are unable to provide the services for which they have been constructed as they remain defunct most of the time.

Some of the key issues contributing to the poor Operation & Maintenance have identified as lack of finances, inadequate data on Operation & Maintenance; inappropriate system designs; Multiplicity of agencies and overlapping responsibilities; inadequate training of personnel and lesser attraction of maintenance jobs in career planning; lack of performance evaluation and regular monitoring; inadequate emphasis on preventive maintenance and lack of operation manuals; and finally the lack of appreciation of the importance of facilities by the community, etc.

From the Indian experience, it has been observed that by and large 30 to 50% of the total annual Operation & Maintenance cost goes towards the personnel (Operation & Maintenance Staff), 30 to 40% of the cost is incurred on power charges and the balance is utilized for consumables, repairs and replacement of parts and machinery and miscellaneous charges.

In most of the cities in India, the tariffs are so low that they do not even cover the Operation & Maintenance cost. In the mega cities, namely Bombay, Calcutta, Delhi, Madras, Hyderabad and Bangalore have operating ratios of about 0.66, 1.11, 1.52, 1.89, 0.85 and 1.2 respectively.

Several pilot studies conducted in the country have shown water losses in the distribution systems alone to be of the order of 20 to 40% of the total flow in the systems. It has been noticed that maximum leakage occurs in the house service connections. In addition, losses do occur at the source, in transmission, treatment plant and service reservoirs, which may add up to another 10% of the total output. In India where water supply is by and large intermittent (supply hours ranging from 3 to 10 hours), during non-supply hours when the system is not under pressure, the external pollution may get sucked into the system through points of leak, causing health hazards. Therefore, a systematic approach towards wastage, leakage and preventive maintenance should form an integral part of Operation & Maintenance on a regular basis to save considerable quantity of water, prevent possible contamination, improve pressures in the distribution system and increase the revenues to make the systems self-sufficient. If such measures are taken up by the various water supply agencies in the country, there may not be any immediate need to take up augmentation schemes. Another important aspect is non-availability of good quality/precise electric leak detection equipment indigenously.

There are no two opinions that metering of water supply is desirable to minimize wastage and to maintain economic pricing of water. In this country, though most of the important towns have been provided with domestic and bulk

water meters, over the years it has been observed that 20 to 50% of the installed meters remain defunct due to their poor quality. Sometimes tampering of the meters by the owners has also been noticed. Moreover, the infrastructure and repair facilities for water meters are not adequate in most of the Urban Local Bodies and Water Supply Boards which delays their repairs and early reinstallation. In the absence of working meters, billing for water consumed is often estimated either on average basis or on flat-rate, as the case may be. Though a couple of Indian companies are, of late, manufacturing water meters for domestic use, it is necessary to get domestic and bulk water meters of the desired quality and precision manufactured within the country in collaboration with some reputed foreign companies as a joint-venture for Indian market. As per the prevailing practice, the domestic meters are owned by the consumers. As such, they have direct access to the meters. However, it is perhaps worthwhile to explore the possibility of owning such meters by the respective water supply agencies and local bodies themselves to ensure that the consumers do not have direct access to the meters so as to avoid tampering of the meters.

Premature rehabilitation of water supply and sanitation schemes is the result of poor and ineffective Operation & Maintenance of the system components. In the core areas of many cities water supply mains and sewers which were laid about 50 years back are in a very bad condition and as such need rehabilitation/renovation at the earliest by providing suitable lining so that their useful life could be further increased and total replacement postponed by some more years.

Insufficient funding has been identified as the major contributor to poor Operation & Maintenance performance. In India, the expenditure on Operation & Maintenance is met from Non-Plan Funds and many of the water supply and sanitation authorities and Urban Local Bodies are unable to provide adequate funds for the purpose in their annual budgets. Lack of sufficient funds affects the proper operation and maintenance of water supply and sanitation facilities. Most of the water supply authorities do not have sufficient funds to purchase the required spare-parts, chemicals or to properly train the O&M staff and provide competitive salaries to attract the competent personnel. It is a fact that external support agencies are not keen to finance Operation & Maintenance activities, though such agencies are showing interest in financing rehabilitation schemes. It is reiterated that rehabilitation of water supply and sewerage systems is the extreme form of Operation & Maintenance activity which would not be required or would have been postponed if regular maintenance had taken place. As such, the water supply and sanitation agencies and Urban Local Bodies must mobilize adequate financial resources for effective and efficient Operation & Maintenace of the existing systems to ensure the sustainability of water supply and sanitation investments.

There are no two opinions that poor Operation & Maintenance has resulted in unaccounted for water which is reported to be more than 50% of the produced water in many large cities in the developing countries. In these cities, wastage is also very high because the tariffs are often subsidized. Sometimes it has been observed that inefficient use of available funds rather than lack of adequate funds contributes to the poor Operation & Maintenance. The poor management of the system facilities results in wastage of precious financial resources which eventually reduces the viability of the systems. Losses of revenue from unaccounted for water has been a problem for quite sometime. Though it is very difficult to define what is the acceptable level of unaccounted for water, to begin with, an appropriate figure of around 15% may be targetted to achieve. Other factors that lead to unaccounted for water include large scale illegal connections, free supplies, inadequate and faulty metering, wastage of water in public places, inefficient and ineffective billing and collection procedures, which ultimately leads to recurring losses and consequent poor service to the consumers.

There is also a need for clear cut sector policies and legal framework and a clear demarcation of responsibilities and mandates within the water supply and sanitation sub-sector. Quite often, multiplicity and over-lapping of responsibilities of various agencies is considered to be a bottleneck for ineffective and poor performance of Operation & Maintenance.

In the light of the 74th Amendment to the Constitution, the role and the responsibilities of Urban Local Bodies have increased significantly to provide these basic facilities to the community on a sustainable basis. The new amendment has enabled the Urban Local Bodies to become financially and technically sound to provide these basic civic amenities to the community. Though certain degree of cross-subsidy is inevitable in respect of the economically weaker sections of the society, it is very necessary to run water supply and sanitation systems on commercial principles realizing the fact that water is an economic good and as such it should no longer be considered as a free commodity. Therefore, imposition of realistic tariffs for various beneficiaries and its effective realization is the key to the success of water supply and sanitation sector performance including that of Operation & Maintenance. Of late, it has also been observed that even the poor are willing to contribute some percentage of the user charges for such facilities provided uninterrupted and reliable service is ensured by the water supply and sanitation authorities and Urban Local Bodies.

Apart from providing minimum required quantity of drinking water to the people, the Operation & Maintenance authorities should always bear in mind that its quality is maintained at all times to safeguard the health of the community. City level consumer forums may be set-up to keep a vigil on the water sources to prevent possible contamination and make periodical reporting to the Operation & Maintenance agencies for appropriate action well in advance. At the same time, awareness programmes on water conservation, wastage prevention, water quality, personal hygiene etc. may have to be designed and implemented with the help of NGOs and neighbourhood committees.

Consumer satisfaction should be the top-most priority of the Operation & Maintenance agencies and as such complaints/suggestion cells may be set-up in the Operation & Maintenance agencies to enable the consumers to lodge complaints on aspects such as leakage and wastage of water, supply at low pressure at the consumer's end, contamination/poor quality of water, pilferage of system components, malfunctioning of water meters, problems related to meter reading, payment of bills, etc. and suggestions, if any, for better performance of the system. At the same time, all such complaints received by the Operation & Maintenance agencies should be attended to within a reasonable time-frame so as to win the confidence of the consumers.

Though privatisation of water supply and sanitation sector could not make significant progress as of now, there is substantial potential and urgent need for the same in near future. Perhaps, it could be introduced in phases either on build, operate and own (BOO ) or build, operate, own and transfer (BOOT) basis. Primarily, it is possible in 2 ways i.e., privatisation of the existing water supply and sewerage systems and secondly, privatisation of systems in newly developed townships, housing colonies, business and commercial complexes etc. There are some inherent problems due to which privatisation could not be introduced in the existing water supply and sewerage systems. For instance, most local bodies and water supply departments which are responsible at the local level for the operation and maintenance of such systems are unable to recover even the O&M cost from the beneficiaries. By and large, tariff rates being charged from the consumers are very low and there is a general reluctance for enhancing the same. Under the circumstances, without aiming at full cost recovery, privatisation cannot be a successful proposition. It is felt that it would be easier and convenient to introduce privatisation in new areas where the private companies will have a free hand to take up the task of planning, designing, execution, operation and maintenance, billing and collection including tapping of raw water from the selected source either on BOO or BOOT basis.

Even in the existing systems, operation such as tapping of raw water, its conveyance, treatment and supply in bulk to the local bodies, treatment of waste water, its reuse for various beneficial purposes, maintenance of pump houses, collection, transportation and hygienic disposal of municipal solid waste etc., can be entrusted to private agencies.

These are the few critical aspects which I thought I would like to place before this specialist group consisting of practising Internationally renowned Public Health Engineers, Consultants, Administrators and Managers who are responsible for the sector activities and I am sure that in the coming three days, indepth discussions will be held on various aspects of Operation & Maintenance of water supply and sanitation systems and the working groups will come out with useful recommendations/guidelines in this regard which will help the urban local bodies and other agencies dealing with Operation & Maintenance of water supply and sanitation systems to provide better and reliable service to the consumers.

I wish the workshop a grand success.

ANNEXURE — 3

# EXTRACTS FROM THE PRESIDENTIAL ADDRESS BY THE CHIEF GUEST, DR. YERRAM NAIDU, HON'BLE UNION MINISTER FOR RURAL AREAS AND EMPLOYMENT

The Government of India has provided necessary funds and support for implementation of Nationwide Water Supply and Sanitation Programme over the last 4 decades under the 5 year plans. Around 82% of the population living in Rural areas have been covered with Water Supply drawn from surface and ground water sources. 2.6 Million deep tube well hand pumps and several thousand piped water supply schemes have been installed in the rural areas. During the last decade detailed guidelines were made available to the states in respect of Operation & Maintenance of created facilities in the Water Supply and Sanitation Sector. 10% of the funds under the plan were earmarked for Operation & Maintenance under the minimum needs programme as well as accelerated Rural Water Supply Programme apart from provision under non-plan for O&M.

Out of the total of 13.19 Lakhs of Rural habitations, 9.21 Lakhs habitations have been fully covered by protected Water Supply. 72,000 habitations are yet to be provided with Water Supply which the Government proposes to cover by the year 1997-98. 3.26 lakhs partially covered habitations will be tackled to achieve the target of fully covering them by the year 2000. It has been observed that an average of 10 to 12% of Water Supply Systems remain dis-functional due to lack of improved O&M facilities. This leads to the people resorting to old sources, which are by and large polluted.

Issue of O&M has multi-dimensional problems right from the level of planning, design and execution of systems. The O&M problems are also linked to institutional reforms, availability of training personnel at operational levels and adequate financial resources. Community has to be sensitised to the importance of O&M to achieve sustainability of drinking water systems.

The Government of India has launched in 65 districts in the country, a programme to achieve inter-sectoral co-ordination at the grass root level with a view to make Rural Water and Sanitation Programme a people's movement. The 73rd constitutional amendment provides for transfer of facilities including the responsibility of O&M to the Panchayats. It would be worth while that Water Supply and Sanitation Committee is set up at each village level with a view to look after the Operation & Maintenance of the systems and to ensure sustainability of the systems. The State Governments will have to provide financial resources to the Panchayats to enable them to properly operate and maintain the systems for the benefit of the common people.

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS

THEME PAPER

# NATIONAL ISSUES ON

## OPERATION & MAINTENANCE OF WATER SUPPLY & SANITATION

ANNEXURE — 4

# NATIONAL WORKSHOP ON OPERATIONS AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS NEW DELHI: 25-27 SEP. 96

## NATIONAL ISSUES ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

**Mr. B S Minhas, Joint Secretary, Ministry of Urban Affairs and Employment, Govt. of India**

I am glad to share with you the issues affecting the Sustainability of Urban Water and Sanitation Systems in this National Workshop is being organised jointly by Govt. of India-Ministry of Urban Affairs and Employment, Ministry of Rural Areas and Employment and WHO, UNDP-WORLD BANK-RWSG-SA.

Provision of water supply and sanitation systems is essential for the health of the community on which the national productivity and wealth depend. About 25.7% of India's population is living in urban areas which was about 217 million in 1991 and is projected to increase to around 300 million by 2001. It is expected that about 85% and 50% of the urban population will be provided with safe and adequate drinking water and sanitation facilities respectively by March 1997 i.e. by the end of eighth-five year plan.

With increasing urbanization the investment costs for providing water and sanitation facilities are rising. In order to achieve the benefits for which these investments are made the Water Supply and Sanitation systems must function continuously, efficiently and to full capacity inconformity with acceptable standards of quantity and quality.

Large investments and major technology inputs are provided for construction and installation of water supply and sanitation systems. However several urban Water and Sanitation Systems have been found to be performing inefficiently, affecting the reliability of the service thus failing to achieve the objectives for which these investments are made. The main reason for this, is poor maintenance. Often these investments become unproductive, due to negligence of O&M leading either to their premature failure before their projected life span or inefficient operation requiring large investments to replace or rebuild the system components. Such a situation results in poor and unreliable service and high operating and rehabilitation costs.

Reliability of service delivery is found to be affected not only due to the breakdown of equipment as a result of poor O&M but also due to inadequate planning, inaccurate designs and defective construction/installation. Further the technology adopted may not be relevant to local conditions making it difficult to operate and maintain the systems efficiently. Often erratic power supply and power interruptions also affect the reliability of several WSS.

Equipment inventory and updated infrastructure maps are not available. Routine operations and effective preventive maintenance procedures are not systematically documented and quite often the required skilled staff, tools and spares are also not available for the preventive maintenance. At present there is no organised method for evaluation and control of performance of the WSS.

Most systems are overstaffed. In spite of overstaffing and a highly efficient Engineers, the quality and quantity standards are not met due to lack of skill on the part of "hands on" operating staff. The defective installations/ construction coupled with inefficient operations and insufficient maintenance has also resulted in very high leakage levels (as high as 49% in some cities). High leakage rates coupled with low tariffs and high subsidies are affecting the financial performance of several WSS.

Management of WSS usually receives relatively lower priority. Lack of funds coupled with lack of motivation among the O&M staff are responsible for keeping the systems in working condition, lack of training and lack of motivation among the staff may be the reasons for the present status of the WSS.

The defective performance of most Water and Sanitation Systems (WSS) is mainly on account of failure to recognize the importance of a well organised O&M and consequent lack of attention to O&M. **There is a need to carry out a deficiency analysis of the O&M of WSS and prepare action plans and manuals for O&M to ensure sustainability of the systems.**

In several systems the amount of water lost by way of physical leakages through transmission, distribution systems, storage structures and water treatment plants is not known. There are non physical losses of water which affect the revenue of several systems due to unregistered connections, inaccurate or non functioning consumer meters and inaccurate (inadvertent or delibrate) meter reading. **Water conservation policies and practices including management of UFW have to be made an integral part of O&M activities of any system if the objective of providing a safe, reliable and affordable water supply on full cost-recovery basis is to be achieved.**

A comprehensive set of records and maps/drawings of the water supply an sanitation systems including intakes, transmission, treatment, storage, pumping and distribution including valves for water supply and sewer manholes, SPS and STPs for sewerage will be required for operation, planning and exercising leakage control, maintenance management and planning purposes. **Hence it is necessary that a mechanism is in place for updation of all the maps and records of WSS to update the improvements in the systems.**

Some of the organisations lack autonomy to run the systems efficiently and profitably. In some instances responsibility for WSS has been found to be with multiple agencies often with overlapping responsibility for O&M. Any WSS organisation shall strive to become performance effective and financially viable in providing water supply and sewerage services. It is not possible to prescribe any rigid staffing pattern for O&M. The organizational structure has to be designed for each agency to ensure sustainable O&M of WSS. **It is necessary that a study of existing organisational structure of each agency is undertaken and modified to suit local conditions to ensure sustainable O&M of WSS.**

For ensuring sustainability the management has also to fulfil their obligations. Management is obliged to maintain the facilites in a reasonably efficient manner for which required funds are to be provided. Persons with aptitude must be chosen to work in O&M with the available facilities and arrange to train them to carry out the actions that they are required to carry out. The required tools, spares and other consumables have to be arranged.

A good and reliable **MIS** is an essential requirement to enable decision making and evaluation. The information on service levels, service coverage, leakage levels, staff productivity and O&M costs is not readily available with several agencies. A good MIS will enable improvement in the operational efficiency and maintenance. **A good MIS shall be in place and a list of monitoring indicators may be prepared with frequency and source specified for each organisation.**

Co-operation between the agencies in-charge of WSS and communities may be achieved through the involvement of Non-Governmental Organisation, Voluntary agencies and private sector agencies. **Privatization as such may be limited to new water supply projects,** till the performance of systems managed by local bodies and public utilities is improved before considering any role to private sector. An incremental approach may be adopted for privatization of WSS, by entrusting to private contractors certain functions such as O&M of treatment plants for water and sewage, pumping stations and transmission mains. Meter reading, billing and collection is also one area to assign to private agency with possibility of improving the revenue collection.

Only a few agencies in-charge of O&M of Water and sanitation systems are able to achieve a good financial performance. Often the agencies are unable to levy tariffs in order to generate sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works etc. Some agencies are incurring losses, mainly because they are having low tariff rates which are not reviewed/revised in spite of increases in the staff and power costs. **It is possible that attempts to achieve full cost recovery encounter resistance from the users. However there is no alternative to this if the WSS are to be sustainable, other than to review the tariffs periodically and levy reasonable and affordable tariffs.**

The systems are often overstaffed, staff whose performance is poor are not penalised which assures them security of employment where as good work by competent staff often goes unrecognised. Despite overstaffing there is often shortage of staff with hands-on experience. With larger autonomy, it is possible to run the systems efficiently and profitably by paying realistic salaries relevant to the staff and offering better incentives & attractive careers to the staff based on their performance. **A study may be undertaken for each organization to identify training needs for ensuring sustainability of WSS and implement the training programmes.** In order to achieve the objectives of training, the training culture has to be inculcated by providing appropriate linkages between career advancement and performance of both in the job and in training.

I hope this national workshop will deliberate upon these issues and come up with action plans for O&M of urban water and sanitation systems to ensure their sustainability.

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS 25-27 SEPTEMBER 1996 NEW DELHI

# STATUS OF OPERATION & MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS


BY

**DR. S.R. SHUKLA**

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MINISTRY OF URBAN AFFAIRS & EMPLOYMENT

GOVERNMENT OF INDIA


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ANNEXURE — 5

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS NEW DELHI : 25-27 SEP. 96

# STATUS OF OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

**Dr. S.R. Shukla, Adviser (PHEE), C.P.H.E.E.O. Ministry of Urban Affairs and Employment, Govt. of India, New Delhi.**

## 1. INTRODUCTION:

As you all know the Water Supply and Sanitation Collaborative Council has recently met in New Delhi and conducted a Working Group on Operation and Maintenance on Urban and Rural Water Supply and Sanitation Systems. The main objective of the said Working Group was to develop new strategies, concepts and tools dealing with the sustainability of water supply and sanitation systems and their applications. As a follow up action to identify constraints and key issues affecting the performance of water supply and sanitation sector and suggest a suitable action plan for improving Operation and Maintenance efficiency, this Regional Workshop is being organised. The main objectives of this workshop are to:

— identify constraints and key issues affecting the performance of the water supply and sanitation sector

— present tools for O&M prepared by WHO

— exchange information and experience on O&M

— define options for O&M

— prepare an action plan for O&M

— make recommendations for implementation of action plan and

— evolve mechanisms for evaluation and monitoring of implementation of action plan

### 1.1 Scope of the paper

This paper presents the status of O&M of Water Supply and Sanitation Systems in India and identifies the costraints for O&M of Water Supply and Sanitation Systems.

### 1.2 Status of WSS

1.2.1 Development of water supply and sanitation systems is essential for the health of the community on which the national productivity and wealth depend. About 25.7% of India's population is living in 3768 towns which is about 217 million in 1991 and is expected to increase to around 300 million by 2001. It has been estimated that about 85% and 50% of the urban population is likely to be covered with water supply and sanitation facilitues by March, 1997 i.e. by the end of 8th Five Year Plan

1.2.2 With increasing urbanization the per capita investment costs are rising. The current estimates of CPHEEO for water supply are ranging between Rs. 1000 to 2000 per capita. Similar costs for sewerage are ranging between Rs. 1500 to 2000 per capita. The O&M per capita cost varies from sysem to system. The average annual investment on O&M of water supply and sanitation systems may be about Rs. 23870 million (for a population of 217 million at Rs. 110 per capita). In order to achieve the benefits for which these investments are made the Water Supply and Sanitation systems must function continuously, efficiently and to full capacity in conformity with acceptable standards of quantity and quality.

1.2.3 However; in spite of the large investments and major technology inputs provided for construction and installation

of water supply and sanitation systems, several urban Water and Sanitation Systems (WSS) have been found to be performing inefficiently, affecting the reliability of the service thus failing to achieve the objectives for which these investments are made mainly on account of poor maintenance. Often these investments become unproductive, due to negligence of O&M leading either to their premature failure before their projected life span or inefficient operation requiring large investments to replace or rebuild the system components. Such a situation results in poor and unreliable service and high O&M costs.

1.2.4 Reliability of the service delivery is found to be affected not only due to the breakdown of equipment as a result of poor O&M but also due to inadequate planning, inaccurate designs and defective construction/installation. Further the technology adopted may not be relevant to local conditions making it difficult to operate and maintain the systems efficiently. Often erratic power supply and power interruptions also affect the reliability of several WSS.

1.2.5 The defective performance of most WSS is mainly on account of failure to recognize the importance of a well organised O&M and consequent lack of attention to O&M. Equipment inventory and updated infrastructure maps are not available. Routine operations and effective preventive maintenance procedures are not systematically documented and quite often the required skilled staff, tools and spares are also not available for the preventive maintenance. At present there is no organised method for evaluation and control of performance of the WSS.

1.2.6 Most systems are overstaffed. In spite of overstaffing and a highly efficient management, the quality and quantity standards are not met due to lack of skill on the part of "hands on" operating staff. The defective installation/construction coupled with inefficient operations and insufficient maintenance has also resulted in very high leakage levels (as high as 49% in some cities). High leakage rates coupled with low tariffs and high subsidies are affecting the financial performance of several WSS.

1.2.7 Management of WSS usually receives relatively lower priority. Lack of funds coupled with lack of enthusiasm among the O&M staff to keep the systems in working condition, lack of training and lack of motivation among the staff may be the reasons for the present status of the WSS.

## 2. STATUS OF SELECTED URBAN WSS

2.1 The status of urban WSS in India has been assessed on the basis of data furnished by the agencies incharge of these systems. The WHO guide contains a list of management indicators to enable evaluation and decision by management to achieve an efficient O&M. These indicators are modified to suit the prevailing conditions and formats have been prepared to collect the relevant data to assess the status of the systems. CPHEEO has circulated these formats to the O&M agencies in several states and requested them to furnish the data on O&M of WSS.

### 2.2 Status of O&M of Water Supply systems:

The data received from the various agencies is presented in Annexure I. Consultants have prepared a base document for O&M of water supply systems for the Govt. of India in a study sponsored by the WHO. The O&M of water supply systems of four cities (Indore, Thane, Bangalore and Hyderabad) was covered in this study. Analysis of the data now collected and the information available in the base document on O&M of water supply systems brings out the constraints in O&M of Water Supply Systems which are presented below:

* Most of the systems suffer from high leakage rates and result in Unaccounted for Water (UFW) of about 20 to 50%.
* The storage capacity of most of the reservoirs is getting reduced due to heavy silting.
* Though most of the sources are free from pollution, they are becoming susceptible for pollution due to emerging changes in land use pattern of the catchment areas.
* Procedures for systematic sanitary survey of the water supply sources are either lacking or are not followed.
* Updated maps of reservoirs, pumping stations, pipelines and distribution system are not readily available.
* Absence of Updated record of the assets and historic record of the equipment.
* In most of the WTPs, the Alum/chemical dosers, chlorination equipments, rate of flow indicators and loss of head gauges are not functional.
* In spite of a well equipped laboratory at the WTPs, the required tests for control of chemical dosing or control of water quality are scarcely done.

* The instrumentation such as flow meters, pressure gauges, level indicators and electrical measuring instruments in WTPs and on pipelines in several systems are not working
* Regular testing and calibration of instruments by competent and trained service agencies is lacking and enough spares are not maintained to ensure that these instruments are functional.
* Incomplete/inaccurate record of consumers such as number of connections, quantity consumed, billed collected etc.
* Inaccurate/malfunctioning of consumer meters and non availability of reliable meter repair facilities.
* Inability to produce an authentic record of water produced, billed and sold and hence assess quantum of UFW, particularly due to absence of reliable metering.
* Absence of systematic material management and stores inventory procedures.
* Incomplete and inaccurate revenue billing and accounting procedures leading to ineffective monitoring of the recovery performance.
* The consumer complaints cover a wide range of issues such as inadequate supply/pressure of water, irregular supply timings, leakages/ chockages, pollution, staff misdeeds, excessive billing and meters not working. Though the consumer complaint cells are well organized, there is no systematic way of monitoring the redresal of complaints and consumer satisfaction.
* The organizational set up of most systems is complex with diverse work cultures, service conditions, job nomenclatures, reporting relationships, scales of pay etc. There is a possibility that some of them are overstaffed. Job descriptions and responsibilities for O&M staff are not well documented.
* Except in some organizations where comprehensive training plans are being implemented, there is no systematic assessment of training requirements on the basis of job descriptions and responsibilities. There are also no specific training programs to improve the performance skills of the hands-on O&M personnel.

### 2.3 Status of O&M of Sewerage Systems:

The performance of the sewerage systems is affected by frequent clogging, siltation, corrosion, erosion and deterioration leading to reduction in capacity of the sewers. The common problems are:

* Excessive grit is leading to siltation of sewers.
* Lack of systematic preventive sewer cleaning procedures leading to frequent sewer blockages.
* Abuse of sanitary sewers by connecting rain water leading to blockages and overflows.
* Corrosion of sewers due to uncontrolled discharge of industrial effluent.
* Absence of segregation of solid waste especially in hotels and hospitals.
* Lack of sewer cleaning equipment.
* Absence of safety procedures and equipment.

### 2.4 Status of O&M of Sewage Treatment Plants (STP) and Sewage Pumping Stations

NEERI has carried out a performance evaluation (1994) of about 20 STPs spread all over the country. The problems in O&M of STPs as noted in the above study are summarized below:

i) The methods of treatment adopted do not have a bearing on local conditions such as climate, availability of equipment and skilled O&M personnel.

ii) The sewage pumping stations have often resulted in surcharged conditions of the sewers due to backing up of the sewage up-stream of the SPS.

iii) At most of the plants manual cleaning of the screens is practiced. Even where mechanical screen removal devices are provided, most of the times they are found to be non functional.

(iv) In majority of the STPs a reliable system of measuring the plant inflow is absent or where provided is defunct and found to be non functional, leading to unequal distribution of plant inflows among the various units.

(v) Though the primary clarifiers are functioning satisfactorily, some plants are hydraulically overloaded.

(vi) Most of the plants using any of the secondary process are not able to produce treated effluent of acceptable quality due to one or more units being out of order, hydraulic and organic overloading, inadequate oxygenation, poor operating conditins, improper desludging, frequent power interruptions etc.

(vii) Disposal of treated effluent and dewatered sludge is unsatisfactory and gas recovered from digestion units is not used because of leaks in digestors and gas collection domes mostly due to corrosion.

(viii) Maintenance is mostly after breakdowns and not done as preventive maintenance which is further aggravated by lack of relevant information and records of the plants.

(ix) The facilities for laboratory control are either non existent or under utilised.

(x) Most of the plants are overstaffed with an acute shortage of hands-on operating staff thus leading to lack of technical skill and knowledge.

(xi) In most of the plants, neither safety equipment is available nor any safety procedures are followed.

(xii) A major constraint in effective O&M of STPs is lack of adequate resources.

### 2.5 Financial Performance

Only a few agencies incharge of O&M of WSS are able to achieve a good financial performance. Often the agencies are unable to levy tariffs in order to provide sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works etc. Some agencies are incurring losses, mainly because they are having low tariff rates which are not reviewed/revised in spite of increases in the staff and power costs. Separate financial statements are also not maintained for O&M of WSS in several organisations

### 2.6 Status of Organisation:

2.6.1 Most of the systems have got good organizational setup. The technical and financial performance of these institutions is gradually improving, especially in organizations implementing external aided projects. The culture of commitment to work is slowly percolating to middle and lower levels of management. However some of the systems are complex, with different work cultures, job nomenclatures, reporting relationships, scales of pay etc.

2.6.2 The systems are often overstaffed, staff whose performance is poor are not penalized which assures them security of employment whereas good work by competent staff often goes unrecognized and career advancement/promotions are given only by following seniority in several organisations. Some of the organizations lack sufficient autonomy to run the systems efficiently and profitably. In some instances responsibility for WSS has been found to be with multiple agencies often with overlapping responsibility for O&M.

2.6.3 Most of the organizations did not have the opportunity to plan for a sustained training program. Training efforts are often ad-hoc and sporadic. The topics and venues of training were the criteria for attending training programs instead of attending training courses necessary for the individual or the organization even for which no record is available to show the number trained, subject or period of training.

## 3. CONCLUSIONS:

The information on the O&M of Water and Sanitation Systems such as service levels, service coverage, leakage levels, staff productivity and operation & revenue costs is not readily available with most agencies now incharge of O&M. There is a need for building up a good Management Information System (MIS). There is also a need for evolving a strategy and action plan to address the problems in O&M and ensure sustainability of the urban Water Supply and Sanitation Systems, Management of unaccounted water by reducing the physical and revenue losses, reducing O&M costs, community participation, full cost recovery and cost sharing arrangements and institutional strengthening are some of the issues to be addressed while evolving a strategy.

## REFERENCES

1. WHO—"A guide for Managers of O&M of Water Supply & Sanitation Systems"—1995

2. D.M. Mohan & S.K. Tasgaonkar—"Base document for O&M of Water Supply Systems", CPHEEO, Ministry of Urban Development, Govt. of India, New Delhi. - 1995

3. National Environmental Engineering Research Institute, Nagpur, "Performance"

# ANNEXURE-I

## PERFORMANCE INDICATORS OF O&M OF WATER SUPPLY & SANITATION SYSTEMS FOR A FEW CITIES

| Sl.No. | INDICATOR | RAJKOT | JALAN-DHAR | BHUVAN-ESHWAR | AMRITSAR | INDORE | TRIVAN-DRUM | COCHIN | CALICUT | AMARA-VATHI | BHOPAL | KANPUR | PATNA | JAIPUR | BANG-LORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | PERCENT AREA SERVED WITH WATER SUPPLY | 94 | 70 | 86 | 100 | 92 | 96 | — | 100 | 80 | 79 | 38 | 80 | 75 | 80 |
| 02 | PERCENT AREA SERVED WITH SANITATION SERVICE | 78 | 60 | 39 | 90 | 42 | Nil | — | NA | Nil | 63 | 32 | 30 | 35 | 64 |
| 03 | PERCENT POPULATION SERVED WITH WATER SUPPLY | 100 | 70 | 76 | 95 | 90 | 95 | 80.5 | 74 | 100 | 100 | 72 | 75 | 82 | 80 |
| 04 | PERCENT POPULATION SERVED WITH SANITATION | 12 | 60 | 55 | 76 | 42 | Nil | 70 | NA | Nil | 75 | 60 | 49 | 44 | 64 |
| 05 | PERCENT AREA SERVED WITH STORM WATER DRAINS | 5 | 15 | NA | 18 | 58 | NA | 50 | 60 | 100 | 71 | 11 | 60 | 40 | NA |
| 06 | PERCENT AREA COVERED WITH OPEN DRAINS FOR SULLAGE WATER | — | — | 12.70 | — | 60 | NA | 50 | 60 | 100 | 25 | 11 | 70 | 60 | 20 |
| 07 | PER CAPITA SUPPLY OF NET WATER (lped) | 125 | 83 | 346 | 304 | 105 | 196 | 222 | 159 | 183 | 136 | 128 | 137 | 120 | 121 |
| 08 | PERCENT OF UFW | 10 | 44 | 15 | 18.38 | NA | NA | — | 14 | 11 | 72 | 40 | 10 | 31 | 325 |
| 09 | CONSUMPTION OF ENERGY UNITS PER KL OF WATER PRODUCED | 0.54 | 0.29 | 0 43 | 0.22 | NA | 0 21 | 0.32 | 0 46 | 2.90 | 0 9 | 0 28 | 0.58 | NA | 1.53 |
| 10 | PERCAPITA CONTRIBUTION OF SOLID WASTE COLLECTED Kgs. | 0.56 | 0 46 | 0 70 | 1 14 | 0 14 | — | 0.54 | NA | — | 0.34 | 0 48 | 0 63 | 0 15 | NA |
| 11 | POPULATION SERVED BY ONE DUST BIN | 12.50 | 2631 | 526 | 5000 | 4167 | — | 486 | 943 | NA | 1790 | 1832 | 7494 | NA | NA |
| 12 | PERCENT WATER TERATED IN STP | 52 | NA | NA | 100 | 5 8 | NA | 4.5 | — | NA | 8 | 12 | 32 | 11 | 48.3 |
| 13 | PERCAPITA O&M COST FOR WATER SUPPLY Rs | 128 00 | 33 00 | 92.00 | 200 00 | 273 | 3100 | 112.00 | 32.00 | NA | 109 | 64 | 50 | 94 00 | NA |
| 14 | PERCAPITA O&M COST FOR SANITATION Rs | 40.00 | 26.00 | 19 00 | 91 00 | NA | NA | 7 10 | NA | NA | 0.5 | 23 00 | 264 00 | NA | NA |
| 15 | OPERATING RATIO FOR WS&S | 0.24 | 0 99 | 0 48 | 0 41 | 0 11 | 4 77 | 1.07 | 2.48 | 0 61 | 0.23 | 0 60 | 0.28 | 0 99 | NA |
| 16 | PERCAPITA COST OF SOLID WASTE COLLECTION Rs | 104 00 | 2.44 | NA | 0 92 | 0.13 | — | 125 00 | NA | — | 11 | 14 | 95 | NA | NA |
| 17 | POPULATION SERVED BY ONE EMPLOYEE | 1470 | 581 | 384 | 204 | 456 | 2046 | 507 | 1154 | 1792 | 338 | 600 | 241 | NA | 1045 |
| 18 | No OF CONNECTIONS SERVED BY ONE EMPLOYEE | 256 | 150 | 50 | 58 | 49 | 330 | 67 | 95 | 108 | 33 | 38 | 25 | 104 | 165 |
| 19 | PERCENT HOURS OF SUPPLY LOST DUE TO LEAKAGES/POWER FAILURES | Negligible | 1 | 3 | 5.5 | 40 | 7 1 | 3.5 | 25 | NA | 33 4 | 31 | 6.25 | 2.5 | 25 |
| 20 | COMPLAINTS RECEIVED RELATED TO CONNECTIONS | 1/11000 | 1/1080 | 1/189 | 1/1856 | 1/424 | 1/4545 | 1/1925 | 1/2603 | 1/1000 | 1/453 | 1/11300 | 1/8523 | 1/1153 | 1/1329 |

*NA NOT AVAILABLE/NOT APPLICABLE

ANNEXURE — 6

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

## HYDERABAD METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD

## CASE STUDY ON THE UNACCOUNTED FOR WATER PROGRAM

**V. Bhaskar**[1]
**&**
**V. Lakshmipathy**[2]

### 1. INTRODUCTION :

This case study attempts to share the experience of the Hyderabad Metropolitan Water Supply and Sewerage Board in reducing unaccounted for water during the past one year.

A preliminary study on water conservation and leakage control was commissioned by HMWSSB in 1993. The results indicated:

1. A transmission loss of about approx 15%.The Board has three water supply systems and approx 550 Kms of transmission and trunk distribution mains. The system includes PSC, RCC, CI and M3 pipelines and masonry conduits. It also incorporates storage and balancing reservoirs. Transmission losses have been defined as all losses incurred after the water treatment plant.
2. A distribution loss of about 9%. This was mainly attributed to (a) leakages in the RCC/AC distribution mains; and (b) leakages on consumer points-ferrule, connecting pipe and meter glands.
3. A commercial loss of about 10%. It was estimated that about 82% of domestic meters were not working accurately. These meters were either physically damaged, removed by the consumer or reading inaccurately.
4. Water Audit can be effective only after installation of bulk flow meters in strategic locations in the transmission and distribution system. These locations should be selected so as to (a) identify leakages in transmission mains at regular distances to facilitate rectification, (b) identify leakages in reservoirs; and (c) measure water supplied to individual water districts to facilitate comparison with the revenue earned.

### 2. UFW OBJECTIVES AND ACTION PLAN:

*(a) An Action Plan was drawn up with the following objectives:*

(i) Facilitating increase of supply through quantification of physical and commercial losses by way of scientific metering.

(ii) Improve systemic capability and contain physical losses through selective replacement of RCC/AC pipes and replacement of leaking consumer connections.

(iii) Reduce the incidence of pollution by identifying and replacing vulnerable portions of the distribution network.

(iv) Improve revenue by installation of accurate consumer meters-bulk as well as domestic.

(v) Implement a computerised revenue billing system, determine the quantity billed at regular intervals and by correlating this with the bulk flow meter readings, pinpointing the geographical areas of leakage.

*(b) Goals and Budget for the Action Plan:*

(i) Installation of 71 bulk flow meters at strategic locataions in the system.

(ii) Replacement of 2,24,000 domestic meters with meters of ISO/EEC standards with stop taps. Replacement of domestic service connections with MDPE pipes.

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(iii) Testing, identification, repairs and replacement of leaking transmission and distribution mains.

(iv) Replacement of all bulk consumer meters in the system.

The plan will be implemented over a four year period ending 2000. The total investment required will be Rs. 98.70 crores of which Rs. 39.10 crores will be spent by 31.3.98.

We expect increase in revenue through reduction of commercial loss to the extent of Rs. 5 crores per annum (Rs. 4 crores through the installation of 244 bulk consumer meters and Rs. 1 crore through installation of 70,000 consumer meters and replacement of domestic service connections). This does not include benefits from increased availability of water through rectification of physical leakages.

## 3. WATER AUDIT:

### *(a) Organisational Response:*

A UFW division with one Executive Engineer, two Deputy Executive Engineers and twenty one Managers with supporting staff has been created. This division is directly responsible for the implementation of the Action Plan. An Unaccounted For Water Committee was formed with the functional Directors of the Board as its members. The committee reviews the progress made in the implementation of the Action Plan. In addition, the progress is also reviewed fortnightly by the MD in a meeting where O&M Officers are also present. The interface with maintenance staff is essential to maintain the credibility of the program and emphasise the importance management attaches to it.

### *(b) Selection, Procurement and Installation of Bulk Flow Meters:*

71 Insertion turbine flow meters were imported from the USA. Initially 18 units were installed in October 1994, and their performance was studied. The meter chambers were susceptible to water logging, resulting in the meters performing poorly. The manufacturer redesigned the meters to provide for a water proof enclosure with a threaded cover and an O ring seal. These meters are now stated to be water proof to a 3 meter depth. So far 60 such meters have been installed in the system.

### *(c) Collection and analysis of data on a regular basis:*

This is essential for the programme to succeed. We are still working on the software required for the analysis. This will provide for appropriate linkages between water supplied and billed at every distribution unit, which will be identified as a cost centre.

## 4. BREAKDOWN OF UFW IMPLEMENTATION PROGRAMME:

### *(a) Physical leakages:*

(i) Visible leakages:

* These are identified by visual inspection at regular intervals. Immediate repair of visible leakages is to be undertaken.

* A 4 Km stretch of PSC pumping main which has a large number of leakages is being replaced with an MS line.

(ii) Non-visible Leakages:

* Leak detection equipment is being used to identify non visible leakages. The progress of this work is slow and not very rewarding.

### *(b) Commercial Leakages:*

(i) Inaccurately metered connections:

* The Board has decided to replace meters of all bulk consumers. Intitially 113 consumers were identified whose demand is more than Rs. 1 lakh per month. So far, 87 meters have been installed.By March 1998, 244 meters will be installed. Replacement of consumer meters on a time bound basis is also being done. Already 6000 meters have been installed. We propose to install another 70,000 meters by 1998.

* The Computerised revenue billing system enables a comparison to be made between the number of units actually billed as against the number of units supplied as read from the bulk flow meters. This identifies locations of excessive consumption and leakages.

(ii) Illegal Connections:

* A computerised data base of all water supply connections as per the Board's payment ledgers has been prepared. A physical survey is now being undertaken correlating the results with the data base. Initially, this exercise is being confined to commercial, industrial and multi-storied building connections (which yield a higher revenue than domestic connections).

* First level functionaries are being sensitised to the need for prompt detection of such connections and initiating corrective action Institutional support in this drive is being provided including police to ensure staff security and protection against law breakers. The Board is planning to employ a small police contingent for its exclusive use in such attempts.

* Implementing amnesty programs and imposition of stringent penalties, alternately, supported by an appropriate public relations campaign during both these phases appears to yield the best results. An amnesty was declared in july 1995 and 8200 connections were regularised. Since the last four months, a punitive drive has been undertaken and 1003 connections regularised.

* Enhancing and sustaining effectiveness of the Vigilance Divison through on line monitoring of consumer complaints is essential.

## 5. PROBLEMS TESTING EQUIPMENT, TOOLS, SYSTEMS AND PERSONNEL

*(a) Operational Staff resistance to introduction of Bulk Flow Meters:*

* Explicit accountability of maintenance staff based upon objective parameters introduced for the first time in the Board.

* Submission of weekly meter readings by O & M staff to UFW Division — Delays encountered.

* Questioning the credibility of the meter readings.

*(b) Motivation of UFW Staff:*

* Political leadership and top level management must be extremely committed to the UFW programme. The management and UFW team must be accountable for results in this area. Compared to O & M functions where the power of patronage exists, and construction functions where there is visibility of work done, UFW work does not provide any motivating factors.

* For the above reasons, quantification of benefits of work done by UFW staff and relating it to revenue increases is necessary. We are examining whether performance could be rewarded with monetary benefits linked to increased revenue generated.

* In addition, training programms and study tours for UFW staff are being organised as recognition of the importance management attaches to this programme.

*(c) Consumer resistance:*

* 82% of meters not working, reading inaccurately, damaged etc. Replacement of these meters is proceeding slowly because of resistance from consumers who question the credibility of the meter readings.

* Complaints from consumers are being received that where new meters have been installed, the meters readings are very high compared to the previous billings. In one pollution prone area, after replacing the AC distribution pipes with CI pipes, the consumers resisted installation of new meters. While we are verifying the meters at our test laboratory wherever complaints are received, on site verification of meters for consumers acceptance is probably necesary.

*(d) Flow Meters Problems:*

* Power cuts, water logging, calibration, clogging.

* Air in the pipelines. Meter designed for cotinuous supply. Arrangements for trapping water in the line to be made. Air bleeding arrangements?

* Leak detection equipment not as reliable on the transmission mains as they are on the distribution mains.

## 6. LESSONS LEARNT:

### *(a) Commercial leakages can be detected and arrested dramatically in the initial stages when compared to physical leakages:*

Accuracy and reliability of meters is essential for this. 87 bulk conusmer meters have so far been installed. An increase in 361.26 million litres per month billed resulted in an increased billing of Rs. 16.70 lakhs per months. Annual increase in revenue is Rs. 200.38 lakhs. There has been a decrease in billing in some cases too. In these cases, the old meters were reading more than the new meters. Over the next one year, the Board proposes to install a total of 244 bulk consumer meters. All consumers with billings more than Rs. 20,000 per months will be covered.

### *(b) Addressing Transmission leakages is more rewarding than distribution leakages:*

Distribution leakage control is a slow process during which co-ordination with municiapl bodies, traffic police, telephones and electricity departments is required as road cutting and disruption to traffic and other services is involved. It also leads to adverse publicity if not concluded promptly. Transmission leakages are relatively fewer in number with a higher per unit leakage. Other organisations are not involved in the testing and repair process as the major portion of the line is in the outskirts of the city.

### *(c) High dependence on data reliability and quality of repairs:*

1. Sustaining meter accuracy, reliability and replaceability specially on the transmission mains is essential for the susccess of the program. Failure through power breakdown should be reduced by using alternate power sources if necessary.

2. A standard technical operating procedure for effecting repairs of pipelines aimed at reducing repair duration, increasing reliability of repair, and prevention of ingress of foreign material during such repair is essential.

### *(d) Political support for implementing the UFW program is available:*

1. Despite this being a low visibility programme when constrasted to a new facility which creates additional capacity and extends services to new areas, political support for this programme can be garnered provided the political leadership is sensitised to the urgency of the problem. In an environment of low service provision and capital shortages the prospect of obtaining additional water by reducing leakages rather than new (and increasingly expensive) projects is extremely attractive.

2. Support for removing illegal connections is also available provided prompt steps are taken to regularise these connections or suitable alterations are made in the distribution system in these areas to facilitate access. Such support may sometimes be in the form of non interference in such actions. Tacit rather than explicit support is to be expected.

### *(e) Amnesty Programs have a limited role to play:*

Such programs alone cannot be effective until the utility displays a will to root out illegal connections, taking recourse to punitive measures if necessary. Punitive drives operated in tandem with annesty programs succeed better.

### *(f) Community involvement and Participation is essential for success:*

Improving public awareness regarding the program is essential. This may include demonstration of the new units, open discussion of the problems, facilitating consensus on work content as well as design. Instead of an adversarial relationship with consumers, a participative one should be strived for. Preliminary identification of locations for replacing RCC/AC lines with CI lines is being done based upon reports of pollution. Subsequntly, pamphlets are distributed in these areas explaining the proposed works and a community meeting held. The local MLA's are involved. The new meters proposed to be installed are shown to them.

Only after they agree to the program, does the work start.

*(g) Legal Framework may require amendment:*

As per the Board Act, the ownership of the meter and connection pipe vests with the Consumer Leakages in the connection pipe are a loss to the Board and are not metered. The consumer is neither in a position to nor is be adequately motivated to repair defective meters. In some cases, if supply is large, a defective meter may actually lead to a lower bill. Though adequate provision exists in the Act to direct the consumer to repair his meter, such a process is time consuming.

Accordingly, the Board Act is being amended to provide for Board ownership of the connection pipe and the meter. Since the scope of UFW stops at the consumer meter, such a provision will be adequate for implementing the programme.

## 7. ACKNOWLEDGEMENTS:

The HMWSSB wishes to thank the World Bank for its advice, support and encouragement in implementing this project. We also wlecome suggestions and sharing of experiences in tackling UFW, from sister agencies. All letters may be addressed to V. Bhaskar, Managing Director, Hyderabad Metropolitan Water supply and Sowerage Board, Khanatabad, Hyderabad 500 044. Telephone 40-394402 Fax: 40-394610.

ANNEXURE — 7

# OPERATION & MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEM DELHI

RAKESH MOHAN
Additional Commissioner (W)
DWS & SDU

## HISTORICAL BACKGROUND

Delhi's antiquity is seeped in history. Starting from Indra Prastha, Delhi of today has developed around pockets of Suraj Kund, Qila Lal Kot, Qutab Minar area, Mehrauli, Siri area, Tughlakabad, Adilabad, Firuzabad & Shahjahanabad, to the present New Delhi. Most of these developments have occured on the banks of river Yamuna or near well established tanks. Over 50 years ago, Delhi was a city of two towns — Old Delhi and New Delhi. But with the passage of time various townships, Nagars and Nagris, Pura and Puris, Enclaves and Extensions have developed. Old Delhi has lost its dignity to commercialisation and most of the original residents have gravitated to South Delhi. From the temporary camps and tenemented accommodation, Delhi has now grown into pucca buildings, with a rapidly increasing population.

From times immemorial Delhi has attracted refugees. First it was Uganda, then Afghanistan and then Kashmir not to forget the silent influx of immigrants from U.P., Haryana, Bihar & Bengal and as far as from Bangla Desh. The first spurt of population in Delhi started with the arrival of over 2 lac refugees in 1947, who started occupying areas like Baba Kharag Singh Marg, Punchkuin Road, Lajpat Rai Market, Kingsway Camp, Kalkaji, Malviya Nagar, Nizamuddin, Rajinder Nagar etc. Lutyen's Delhi has lost its charm and even Old Delhi has become over crowded. Nearly a third of the labour force in Delhi is engaged in industrial activities with another large majority being self-employed, indicating the pace of industrialisation in Delhi. Delhi's population, already 1.2 crores, will probably double to 2.15 crore by 2001 A.D, with a substantial population which has no grasss roots in this city. The job opportunities offered by this megapolis and the attraction of city lights has ensured a regular influx and Delhi has been running into two directions — Authorised & Unauthorised; with the unauthorised areas slowly overtaking the authorised. A sad consequence has been unplanned growth and haphazard expansion, lack of warmth evident as public insensitivity to the problems of their next door brethren and a resultant severe strain on the existing civic services. The genesis of the problems of poor civis services thus lies in uncontrolled influx and the rapid growth in construction activites.

### In Perspective

Historically, the water supply to Delhi grew from the first percolating wells, constructed in two lots 1892 and 1894. The yield at that time was only 610 thousand gallons per day. Around 1900 A.D., settling tanks and filters were provided to raise the availability of potable water to approximately 1700 thousands gallons per day, for a population of 2 lac people. The capital of India shifted from Calcutta to Delhi in 1912 and spurred a scheme for an intake well near Wazirabad, upstream of Najafgarh Nalla, which was completed in 1926. Another well was added in 1946 but no one had anticipated the problems for potable water, which the proximity of the Najafgarh Nalla would create in future. From a meagre population of 9.2 lac in 1941, Delhi has now over 110 lac people. The capacity of treatment in Delhi, with the growth of population, has been augmented in different years as below.—

| Year | Approx. Population (in lacs) | Production of Water (MGD) |
|---|---|---|
| 1889 | 4 00 | 1.75 |
| 1926 | 5 50 | 10.00 |
| 1941 | 9.18 | 30.00 (1946) |
| 1961 | 26.58 | 97.00 |
| 1971 | 40.66 | 190.00 |
| 1981 | 62.22 | 303.00 |
| 1991 | 90.00 | 470.00 |
| 1996 | 110.00 | 600.00* |

*includes 65 MGD tapped through Ranney Wells and tubewells.

Delhi started spreading to the west and the Najafgarh Drain was confined for storm and waste water conveyance. However, the planned development of urban infrastructure was still in its infancy and the approach was still unwieldy. The urgency of planning became focused after the epidemic of 1955, when the sullage of Najafgarh passing next to the Wazirabad Water Works, spilt filth into the supply system. The barrage at Wazirabad was a result of this carnage. The cholera of 1988 gave a thrust to planned development, by high-lighting the spread of slums and resettlement colonies and the prevailing insanitary conditions with total lack of amenities.

Delhi became a Union Territory in November '1956 and Delhi Development Authority, as a Central Planning Authority, came into being in December '1957.

Delhi is depending on surface sources for 90% of its water requirements with Yamuna being the main source, followed by Ganga Canal and ground water constribution. There are 4 Water treatment Plants at Chandrawal, Wazirabad, Haiderpur and Bhagirathi, with a total treatment capacity of 510 MGD. This is supplemented by 65 MGD of ground water tappings through Ranney Wells and Tubewells. The capacity of 575 MGD is optimised to produce, on an average, 600 MGD of water every day. It is assessed that Delhi's supply falls short by 150 MGD, against the current demand. The gap between the demand and supply has been continuosly widening in the last decade and is likely to aggravate further by the turn of the century. A major reason for this is Delhi's over dependence on its neighbouring states, for its drinking water requirements.

Delhi geo-hydrologically has limited ground water availability due to:—

(1) Paucity of good acquifer with depth

(2) Wide spread chemical quality problems, vertically and laterally.

The areas which have limited fresh ground water sources are Alipur, Kanjhawala, Najafgarh, Shahadara and Mehrauli all experiencing growing population pressures.

Comparisions are odious, but necessary to place the problem in its proper perspective. There are over 11.5 lac water connections in Delhi and by that standard, we can compare Delhi with cities like Karachi, Bangkok, Beijing, Seoul and Hongkong. The water availability, in terms of hours of supply per day, is better in Delhi than many other metropolitan cities. The per capita consumption of water in Delhi is much higher than in the cities mentioned above and in terms of percentage "unaccounted for" water, Delhi is no worse off than areas like Karachi, Bangkok, Seoul etc.

It is also significant that per capita availability in Delhi has gradually increased from 1971, when it was 190 litres per day to almost 230 litres per day in 1995. The unit production cost of water, in Delhi, is much lower than the metropolitan cities and the average tariff charged is also quite low.

**Population and Density**

| Zone | Area Km. | Major Population (in lacs) | | | % age increase | Density of Population | | |
|---|---|---|---|---|---|---|---|---|
| | | '71 | '81 | '91 | | '71 | '81 | '91 |
| MCD (Urban) | 614.5 | 32.9 | 54.1 | 80.4 | 48.6 | 649 | 3547 | 16,643 |
| MCD | 752.8 | — | 4.5 | 9.4 | 108.6 | 578 | 11183 | — |
| NDMC | 42.7 | 3.0 | 2.7 | 3.0 | 7.7 | 7,061 | 6,368 | 6,882 |
| Cantt. | 43.0 | 5700 | 85000 | 94000 | 10.8 | 1,334 | 1,982 | 2,195 |
| | 1483.0 | 36.5 | 62.2 | 93.7 | 50.6 | 8,172 | 4,194 | 619 |

**ASSETS**

Delhi has come a long way from 1892 when the total supply of potable water was only 1.7 million gallons a day. We have a vast net work of nearly 12,000 kms. of pumping mains, peripheral mains and distribution mains. Nearly 384 booster pumping stations have been constructed to pump the water to the different parts of the city. Despite a non-remunarative tariff of only Re. 1 Per Kl, on an average, against a production cost at the consumer's end of Rs. 2.32 per Kl, a supply of approximately 184 litres, per capita, per day is still being maintained in the entire MCD area. There is no doubt that in the trans-Yamuna area, the average per capita supply may be less than in the other areas.

The total number of water connections, by June '96, stood at a phenomenal 11.75 lacs. Water is being supplied through one mode or the other, to nearly 567 unauthorised/regularised colonies, 1080 JJ clusters, 44 Resettlement Colonies, 413 Harijan Basties and 220 rural villages. The different modes of supply include piped water supply, tubewells, deep bore hand pumps, tankers/trailers etc. The rural belts of Mehrauli and Najafgarh have a stream of 1100 deep tubewells.

The major maintenance work includes flushing of all the underground reservoirs and overhead tanks, once every year, immediate restoration work in case of leakages and bursts of pipes, active policy of checking leakages and provision of "filling point" facility in all the zones, to immediately supply water during break down/shortage etc.

It is assessed that nearly half the population of Delhi is living in unauthorised/regularised colonies, JJ clusters, resettlement colonies & urban villages. Migrant squatters, uprooted villagers and other homeless people continue to come and occupy the sites of resettlement colonies in Delhi. It is also an accepted fact that the consumption of water for commercial and industrial uses, has increased, although water for domestic use still occupies priority position.

There is no doubt that the localities close to the Water Treatment plants, located in North Delhi & East Delhi, draw more water at a good pressure, resulting in localities at the tail-end getting lesser water. A policy of rationalising the distribution system has been adopted, to construct underground tanks and booster pumping stations. This will help distribute the water more equitably in Trans-yamuna area, in the coming years. The effort is not to aim at supply of water, throughout the day, but to manage supply during the peak demand times, morning and evening, in each area.

There is an effective surveillance system to test quality of water at all points, starting from the raw water stage upto the consumer end. The water supplied at the consumers end is free from pathogenic organisms, clear, potable and also free from undesirable taste and odour.

From 1985, when the length of distribution mains was only 3742 Kms. the length has more than doubled to 7400 Kms. in 1996. Almost 20 MGD of supply of water in Delhi is free, through public water hydrants and supply in JJ clusters. If we compare the present per capita supply of water, even with that in other cities of India, Delhi does not compare unfavourably with cities like Mumbai, Calcutta & Hyderabad.

In order to control contamination, a time bound programme has been taken up to replace approx. 85 Kms. of corroded & broken pipes. Nearly 5 Kms. have already been replaced, with the balance works in progress. Most of lines laid in the congested areas of Walled City, S.P. Zone, old areas of Karol Bagh, Rajender Nagar, Patel Nagar, Ramesh Nagar, Subhash Nagar, Moti Nagar etc. have outlived their life. It is assessed that over 4.5 lac service connections require replacement. Action has already been taken to replace over 71,000 of such connections and the consumers are being encouraged to replace the lines, to avoid contamination.

It also needs mention that internationally, the accepted standard of conveyance losses is around 20%. Against this, the conveyance losses in Delhi are assessed at approx. 25%, not including the free public water hydrants, to the economically weaker sections and the water being supplied for fire fighting purposes. Line losses, per so, are only 25%, which include losses due to flushing. Unaccounted tappings and unauthorised connections account for 5% losses. Effectively, billing in Delhi is restricted to only 65% of the water produced, making the cost of production prohibitive against recovery. Notwithstanding this, the efforts are afoot to recycle the water lost in filter backwash and to reduce the line losses through a Remote Sensing and Monitoring Network.

To ensure that supply of water is need based, there is a conscious policy to rotate the hours of supply, particularly in the outlying areas of Delhi. In order to efficiently manage the available water, Under Ground Reservoirs and Overhead Tanks shall be built, even in areas close to the water treatment plants, so as to discourage illegal and unauthorised tappings on rising mains.

## WORKING WITH CONSTRAINTS

(a) Substantial quantities of water are presently being lost by leakage in the existing water distribution system. The remodelling of the distribution system, to cut down the leakages, will not only save this precious commodity but would also make available additional quantities of water for drinking purposes.

(b) With a continuous rise in the standard of living in the country as a whole, and particularly in Delhi, the per-capita consumption is bound to see an upward trend. Aspirations and demand will continue to outstrip the supply.

(c) The location of embassies of various countreis and the residences of the diplomatic corps in Delhi requires a per capita supply at a much higher rate than the average per capita supply to others. It is an accepted fact that the per capita supply of water to the areas where these institutions are located, is of the order of 400 LPCD. In many other advanced countreis of the world also, the per capita supply varies from 270 LPCD to 450 LPCD. It deserves mention that in 1974-75, the average per capita supply, in the MCD area, was approximately 200 LPCD, while it was 375 LPCD in NDMC and 444 LPCD in Delhi Cantonment area. If we deduct the supply to Shahdara Zone and Rural Zone, the per capita supply in the other zones of MCD was 245 LPCD, to an estimated population of 29 lacs. Even in 1996, DWS & SDU has been able to maintain a supply of about 190 LPCD & if we take out the Trans Yamuna area, the rest of MCD area gets around 225 LPCD, even to day.

(d) In the last two decades, floating population of tourists as well as visitors to the capital has increased. No separate consumption of this population has been estimated. But this requirement has to be included in the average per capita supply.

(e) The regular influx of population into Delhi will continue to create large pockets of squatters & slums and a gradual but continuous increase in the density of population, per sq. kilometer of the capital city. The demand for water will need immediate attention.

There is also an increasing trend towards commercialisation and denisfication. Houses built for residential purposes have increased areas & much larger occupancy & the evil of unrestricted unauthorised construction continues, unabated. This has not only strained the existing system, which was built only to provide water pressure upto 30 ft., above the ground level, but has also resulted in unknown illegal tappings as well as widespread installation of booster pumps, on the main lines.

(f) With the growth of industrial and commercial establishments in Delhi, the requirements of this sector have arisen. It has also resulted in a proportionate increase in the water requirements for fire fighting.

(g) The maintenance of kitchen gardens, attached to individual houses, is still a luxury being enjoyed by many in the capital. For the time being, a high percentage of people still use potable water for this requirement.

## PRESENT MANAGEMENT TECHNIQUES

*(a) Exploitation of Ground Water*

On account of limitations on the surface water availability, the possibility of utilising the ground water potential, in a scientific manner, is being explored seriously particularly in the outlying areas of Delhi. Even where the water was considered unfit for drinking, because it was uneconomic to treat it, may require to be cycled for drinking purposes after treatment. What was uneconomic a decade ago, will become a necessity for the future.

*(b) Exchange of Waste water and Irrigation water with Raw water*

The possibility of exchanging the waste water from the storm water drains, as well as the treated effluent from the storage treatment plants, with raw water which can be used for treatment is actively under consideration. The raw water being utilised for irrigation could thus be spared for diverting towards drinking purposes.

*(c) Rationalisation of Distribution*

Rationalisation of the distribution net work through construction of udnerground reservoirs and booster pumping stations, in order to regulate the hours of supply & provide water at a good pressure.

*(d) Unfiltered Water for Lawns & Parks*

The merits of continuing use of unfiltered water supply for irrigation of lawns/gardens and parks, will have to be reviewed. While the use of filtered water for this purpose will have to be banned totally, unfiltered water, which can possibly be used for potable purposes after treatement, will also have to be progressively diverted from its present use for these activites. Alternative sources for irrigating the lawns/parks/gardens etc. will have to be explored, from the treated effluent coming out of the Sewage Teatement plants.

*(e) Prevention of leakage and wastage*

Studies have revealed that despite availability of proven technology, considerable amount of preventable wastage/ leakage of water takes place, both in the treatment plants and in the distribution system. This is presently as high as 25%, which would amount to wastage of approximately 100 MGD of potable water, which could easily be saved and pumped into the system.

While a certain percentage of leakages are inherent in any treatment and distribution system, vigorous efforts need to be made to install a Remote Sensing and Monitoring System, which will reduce the detection & response time for leakages, bursts etc.

*(f) Wastage of water through Public Stand Posts*

With water becoming a costly scarce commodity, the wastage of water through free public water hydrants will have to be drastically controlled. Such hydrants will have to be drastically controlled. Such hydrants provided to religious institutions would require to be metered and the continuation of the existing public water hydrants, keeping in view its misuse by sections of the society for whom it is not intended, will have to be reduced. Free public water hydrants for the weaker sections of the society will have to be effectively maintained and monitored.

*(g) Removal of unauthorised tappings and connections*

There is need for greater vigilance against unauthorised connections, existing both in private premises as well as in industries. There is also unauthorised use of potable water in construction activities, presently proliferating in the capital. The enforcement machinery will have to be strengthened to detect and cut off such connections, diverting it to essential & priority use areas.

*(h) Demand management through Tariff/Rotation of Supply Hours*

There is a felt need for the consumers to be sensitized towards & made contributers to the cost of providing potable water in the houses. The heavy subsidy on water, for domestic consumption, will have to be phased out, in order to introduce consciousness amongst the consumers and also to enforce economy in its use. Rationalisation in supply hours will ensure that use of water in restricted to essential requirements.

*(i) Lining of the Water Carrier System*

The present water carrier system of Western Jamuna Canal involves over 30% losses, due to seepage and surface evaporation. It is proposed to build a lined carrier channel in order to save almost 300 cusecs of water, which will become available for consumption after treatment.

**Success Stories of Water Managment**

Water Management now deserves to be a focal issue in the overall frame work of urban development and management of urban services. There have been a few success stories where the consumers have themselves mobilised opinion & action amongst themselves to restrict the misuse of this resource.

(1) Sarvpriya Apartments, in Sarvpriya Vihar of South Delhi, have 86 flats in 4 wings. It is understood that they have developed dual water supply system. Municipal water supply, which is received in a sump, is pumped into an overhead tank for the entire building and this drinking water supply is given through a tap in the kitchen for each flat. A separate system exists for the ground water supply, from the tubewells, collected in a separate sump and pumped into other overhead tanks. This water is use for all other purposes except drinking purposes. This not only ensures regular supply of potable water at good pressure but also encourages demand management.

(2) Azad Apartments, in Hauz Khas, has 7 blocks with each block having 24 flats. These flats also have dual water supply system. The municipal water supply is pumped for drinking purposes & the ground water supply from the tubewells is pumped into a separate overhead tank for all the water requirements, other than drinking.

There is also need for creating greater awareness amongst people for restricting the use of water even for essential purposes like shaving, brushing, washing of hands, bathing, cleaning of utensils etc. Individual efforts may be small, but the collective impact of the individual savings is likely to save substantial quantities of potable water.

## SANITATION SYSTEM IN DELHI

The two major issues of sanitation in the capital relate to, Solid Waste Disposal and liquid Waste Disposal. Solid Waste Disposal involves garbage collected by MCD from its bins and transported to the Sanitary Land Fills. The Liquid Waste is received in sewers, which are annually desilted and maintained, and progresses to the STPs.

The Consevancy & Sanitation Engineering Department of MCD was established in 1977, primarily to co-ordinate the activities of Liquid Waste Disposal and Solid Waste Disposal. Its present workload includes maintenance of sewers, including desilting and maintenance, as well as Solid Waste Management.

The planned development of the Sewerage System in Delhi started with the establishment of a Sewage treatment Farm near Kilokri. This capacity has been progressively augmented and the progress of setting up additional capacities, at various Plants, is as follows:—

| year | Population (lacs) | Installed capacity of Sewage treatement Plant (MGD) |
|---|---|---|
| 1938 | — | 82 MLD |
| 1951 | 17.4 | 10 MGD |
| 1961 | 26.6 | 67 " |
| 1971 | 40.7 | 97 " |
| 1981 | 62.2 | 130 " |
| 1985 | — | 152 " |
| 1991 | 93.7 | 250 " |
| 1996 | 110.0 | 280 " |

Efforts are already on to commission an additional capacity of 220 MGD of Sewage Treatment at 15 sites, by the end of 1947, raising the sewage treatment capacity in Delhi to 500 MGD.

On the basis of the current figures of water production, as 600 MGD, only 60% of this water is expected to go back into the system as sewage, with the balance 40% being consumed. We therefore, are required to put into effect a treatment capacity, with the associated conveyance network, of 360 MGD. It deserves mention that there are 154 Sewage Pumping Stations in the Capital, which assist in the conveyance of sewage to the Sewage Treatment Plants.

There are 18 major drains in Delhi, discharging sewage into River Yamuna. Out of these drains, 8 are fully trapped, 4 are partially trapped and 6 are yet to be trapped. Over 200 ancillary works, relating to Sewage pumping Stations, Rising mains, peripheral mains and internal sewers have been taken up by various authorities in order to cover the untapped command areas in the capital and to convey the sewage from these to the new Sewage Treatment Plants, being put up.

There has been an enormous increase in the garbage generated, due to growth of population, Industrialisation and urbanization. There are 1300 unauthorised colonies now, with no civic services and approximately 4.8 lac Jhuggies, with a population of over 20 lacs, living in Shanties. There are also Resettlement colonies and Slums, which create their own garbage. Even the strength of over 38,000 Safai Karamcharies are, therefore, inadequate to deal with this task.

In order to view the problem in its perspective, we must look at the growth of the system. In 1985, there were 86 nallas of 642 Kms. length. There are now 737 nallas, with a length of 859 kms. The length of Storm Water Drains is 1960 kms. and the length of sewers is approximately 4300 Kms. There are over 1400 Septic Tanks and 46000 Water Closets, which need cleaning regularly.

In 1981 there were 1423 dustbins/dhalaos, in the MCD area and the number is 1850 in 1996. An additional 1000 dhalaos are being constructed. The strength of Safai Karamcharies is approximately 40,000. To collect and transport the Solid Waste, MCD has increased the number of vehicles from 211, in 1981 to 752, in 1996.

In 1995 the total Solid Waste transported was 3450 MT per day and in the first 5 months of 1996, the collection and transportation, on an average, has been of the order of 4170 MT per day. The enormity of the problem can be appreciated by the fact that in 1989-90, the garbage collected was 9.8 lac MT, this rose to 11.25 lac MT in 1992-93 rising to 13.2 lac MT in 1994-95 and is likely to touch 15 lac MT in 1996-97. This does not include silt, which is approximately 2 lac MT per year and is also being removed. In 1977, only 1500 MT of Solid Waste was being generated every day by a population of approximately 50 lacs; in 1996, a population of 110 lacs is generating approximately 4,500 MT of garbage, every day

The CSE department and the DWS & SDU has 154 Sewage Pumping Stations and a vast criss-crossing network of sewers, of various sizes. The system is old and passing through heavily congested areas, built up areas and areas under continuously moving traffic. The existing manpower and the strength of sewer cleaning machines and jetting machines is very inadequate to regularly maintain the sewers. Similarly, the machinary available for cleaning, picking and transportation of Solid Waste is also inadequate.

Efforts to collect and remove garbage have focussed on increasing the manpower and increasing the machinary. The arrangements for taking care of surcharged sewers is to put the pumps for dewatering. These efforts are localised, with temporary impact.

## CONSTRAINTS

With the increased influx of population in Delhi, there has been unplanned growth in the capital. In 1951 there was only 13,000 Jhuggies, the number rose to 1.42 lacs in 1973 and is currently estimated at 20 lacs. The same has been the pattern in case of resettlement colonies and slums.

The single common factor underlying all these areas, is total lack of civic amenities, required for urban residential settlements. There is no filtered water, sewerage connceection or garbage removal facility Even after regularisation, these colonies continue without civic amenities. The heavy illegal construction activities continue to be a hinderance to planned development. A policy initiative towards this crucial aspect, insulated from the vagaries of the system, needs to be adopted so that there is transparency in the directives which will guide the action of those entrusted with checking such growth and also of the planners.

The sewerage system in Delhi was laid decades back. With the increase in sewerage, the system needs to be refurbished and augmented. In many cases the sewers have settled, broken down or have missing links.

(a) Densification of population, un-controlled construction activities and illegal and unauthorised extensions, in existing constructions, have made it impossible to maintain or clean the existing system.

(b) The existence of dairy colonies, JJ clusters and unauthorised colonies, result in the throwing of garbage outside the homes, shops and establishments. In certain portions of the City there is no separate system for storm water and sewage disposal. The existing system is therefore strained. Solid Waste is being indiscriminately disposed off in the drains.

(c) There is a problem of extensive use of polythene bags, thrown into sewers, including the disposal of building materials, fly-ash, hazardous waste and toxic wastes. This has caused problems of blockage and heavy siltage and has also resulted in heavy siltation, in the absence of selfcleansing velocity in the sewage flow.

(d) In the walled city, there is no space for the sewage system to be maintained. The existing system is heavily choked, with no outfall. The behaviourial patterns of people living in congested areas, Slums, JJ clusters, RSC etc. does not promote moral responsibility of individuals for keeping the neighbourhood clean.

(e) The present Solid Waste Disposal system is extremely inadequate. The dhalaos are stinking and are controlled by mafia, because of the recycleable materials available in the garbage. The transportation is through open trucks, to eight Sanitary Land Fill sites. In the absence of adequate vehicles, the dhalaos are over filling and rotting with garbage during peak hours.

(f) In a large number of areas, the sewage system has been covered and constructed upon. Annual maintenance is thus impossible, reducing the carrying capacity of the system.

(g) Public awarness to this problem is woefully inadequate. People are averse to their involvement in sanitation of their surroundings, restrictions being imposed on use of plastic bags and even in the use of plastic bags, for collecting their domestic garbage. The process of night cleaning of garbage is possible, provided adequate mechanisation is done to allow quick and repeated removal of garbage and its fast transportation to the SLF sides.

(h) In a number of places the dhalaos have been unauthorisedly occupied by residence & for various activities. MCD has to waste manpower to guard the dhalaos against illegal occupation/squatting.

(i) There is a need for immediate augmentation of the capacity of the sewer carrying system in Delhi, through novel techniques which can avoid road cutting and inconvenience to traffic.

(j) Delhi has become the centre of regular rallies, political or otherwise, religious gatherings, festivals and melas throughout the year. This adds to the burden on water supply as wells as on sanitation.

ANNEXURE — 8

# OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEM OF BANGALORE CITY-A CASE STUDY

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**"WATER IS LIFE: LIFE DEPENDS ON PURE WATER WITHOUT IT COMMUNITIES CANNOT SURVIVE AND PROSPER, AND THEY FORM THE SOCIAL AND ECONOMIC FABRIC OF EVERY NATION. COMMUNITIES CARE FOR THEIR ENVIRONMENT-CLEAN ENVIRONMENT IS HEALTHY".**

**"LIFE AND HEALTH NO LESS ARE WHAT BANGALORE WATER SUPPLY AND SEWERAGE BOARD IS ABOUT".**

## 1.0 INTRODUCTION

Bangalore City is one of the fastest growing Metropolis in India. The present population has almost corssed 5 Million spreading over an area of 300 sq. km. Providing basic infra-structure for growing population is a gigantic task. Bangalore Water Supply and Sewerage Board (BWSSB) which is responsible for providing potable water and smooth disposal of sewage is doing yeoman service to the Citizens of Bangalore.

Bangalore City is situated in a plateau at an elevation of 950 M above the mean sea level. All the water sources are located at low levels and thus every drop of water needs to be pumped incurring huge electricity charges. Nearly 80% of the water received is from river Cauvery which is about 120 Km away from Bangalore City. The production cost of every cum of treated water delivered at Bangalore costs Rs. 8/-, which is highest in India when compared to any other Metropolis and also compared to any City in South East Asia. The Cauvery Water Schemes (Stages. I, II and III) alone consume nearly 45 Mega Watts of Electricity, thus causing 68% revenue realized which will have to be paid for power charges.

Under ideal conditions, Bangalore City gets 705 MLD from all the three sources-80% is from Cauvery source and rest 20% from Arkavathi source through Hessaraghatta and Chama Raja Sagar (CRS) Schemes. With the present receipts, the per capita supply is approximately 100 litres per day, which is very much below the national standards. There are many problems in operation and maintenance of water supply in the City, such as old corroded pipes replacement, reducing the unaccounted for water in the system, energy audit for using optimum efficiency, realization of revenue for the distributed water, regularizing unauthorized connections, etc.

Nearly 75% of the City is provided with sewerage system. The sewerage system in the old City is about seventy five years old. Since the topography of the City provides natural drainage by gravity, the entire City is divided into four zones and five minor valley sewage treatment plants are constructed for treating the sewage produced in these valleys. However, out of three plants, one plant is already functioning for Secondary treatment and other two are in final stages of completion. There are many problems in sewerage systems mainly on conveyance system. The designed flow is not reaching the plants since sewers are tampered with for different uses. BWSSB is also contemplating reuse of water by installing tertiary treatment plants at all three locations where there is sufficient demand for recycled water. In addition, installation of power generation plant using digestor Methane gas is also contemplated.

## 1.1 TOPOGRAPHY, CLIMATE AND SOIL CHARACTER

Bangalore is situated on the watershed of two principal river basins. They are Arkavathi on the West and South Pennar in the East. Bangalore is at an elevation of 850 to 950 M above mean sea level. The topography of the City is characterized by well defined valleys. The temperature varies from about 13 Degree C in Winter to 36 Degree C in summer. Mean annual temperature is about 24 Degree C. Bangalore receives about 900 mm mean annual rainfall, from both South West and North East Monsoons.

The prevailing rock formation underlying the top soil is granite with veins of pegmatite areas at higher elevations and have rock out crops. Areas of relatively lower elevation are covered with a thick layer of red loamy soil. Weathered rock is frequently encountered within 2 M below the ground level, which may extend up to 10 M below the ground level.

## 1.2 BWSSB AND ITS FUNCTIONS

Bangalore Water Supply and Sewerage Board (BWSSB) was constituted under the Act of State Legislature and started functioning from December 1964. The Primary functions of the Board are:

(a) To ascertain the sufficiency and wholesomeness of Water supply within Bangalore Metropolitan limits.

(b) To prepare and carryout schemes for supplying wholesome water for domestic purpose in the Bangalore Metropolitan Area.

(c) To prepare and carryout schemes for proper sewage disposal and treatment within the Bangalore Metropolitan limits.

## 2.0 HISTORY AND PRESENT WATER SUPPLY SCHEMES

The City of Bangalore was founded by Kempegowda in the year 1537. Till 1896 it depended on Kalyanis (Shell wells) and tanks for water supply

The first dependable source was identified for growing needs of Bangalore from Hessaragatta Reservior which is 18 km North West of Bangalore City. The scheme of supplying potable water was commissioned on 7th August 1896, which is just 100 years old now.

Due to increase in the population and a need for additional water supply another scheme 40 km down stream of Hessaragatta reservoir was identified at Thippagondanahalli under the able guidance and leadership of Sir M. Viswesvaraya, an eminent Engineer and a Statesman. This is about 30 km West of Bangalore City. The first phase of scheme was completed during March 1933 for supplying 28 MLD. Subsequently, the abstraction increased in phases to 140 MLD by providing additional infrastructure such as increasing the capacity of the dam, providing additional treatment facility pumping capacity and parallel mains. There are totally three mains of 24", 27" and 36" dia; the former two pipelines are single stage pumping and the latter one with two stage pumping.

The growth of population during the last two decades (especially between 1961—71 and 1971—81) was enormous and additional quantum of water was necessary to augment the water supply.

Cauvery Water supply scheme stage I (CWSS I) was taken up to draw water from river Cauvery near Shiva anicut through the existing power channel up to Netkal Balancing Reservoir (NBR). A gravity pipeline from NBR to Thorekadanahalli was laid where the raw water is treated as per potable standards with conventional treatment process, and pumped to Bangalore with three stage pumping with a head of 160-170 M at each stage. The scheme envisaged bringing 135 MLD of water and was completed in 1974. Soon this quantum of water was inadequate for growing population and CWSS II was taken up during 1979 for bringing an additional 135 MLD from the same source with duplication of same components. This scheme was completed in 1982. Similarly CWSS III was also taken up during 1985 for bringing 270 MLD of water from river Cauvery to Bangalore and was completed during May 93. Table-1 presents the details of each scheme.

**TABLE-1: DETAILS OF EACH SCHEME**

| SL. No. | Name of Scheme | Full Potential | Present Drawal | Remarks |
|---|---|---|---|---|
| 1. | Hessarghatta Scheme | 36 MLD | 6 MLD | Partial drawal due to inadequate rains in the catchment |
| 2. | CRS Water Supply Scheme | 140 MLD | 36 MLD | -Do- |
| 3. | CWSS I | 135 MLD | 135 MLD | |
| 4. | CWSS II | 135 MLD | 135 MLD | |
| 5. | CWSS III | 270 MLD | 270 MLD | |

## 2.1 PRESENT WATER SUPPLY AND DEMAND

(a) Population Projection

Bangalore Development Authority (BDA) has projected the population of Bangalore City as 7 Million by 2011. This indicates that the decadal growth as 35 per cent.

(b) Water Demand

The CPHEEO manual on water supply specified that for a City's population more than 5,00,000 the rate of water supply per capita per day shall be in the range of 150 litres to 200 litres. But as on today the supply in the City is about 100 litres per capita per day including losses. Taking into account of all the receipts from different sources such as Arkavathi. Cauvery and even after considering the losses in distribution system are brought down to bear minimum of 12 to 15% still there is a deficit of 400 MLD and will be 100 MLD after implementation of phases I and II of CWSS IV.

## 2.2 DISTRIBUTION SYSTEM

The City distribution system exists since 1889 and is being remodelled from time to time. The water from Arkavathi river namely Hessaraghatta and T.G. Halli supplies to North of the City. Cauvery Water is supplied to the Southern part of the City. Now, the two zones are interlinked between combined Jewel filters and High ground reservoir.

The City has undulating profile with a difference of nearly 100 M. In order to supply equitably, 38 GLRs have been identified at strategic points of capacities varying from 4.5 MLD to 62 MLD. In addition about 48 over head tanks with 40' and 60' staging have been constructed to supply water to ridge areas of the City.

Since entire water to Bangalore City is by pumping, in order to accommodate frequent power failures, 22 hour storage capacity has been provided. This is relatively higher by any standards.

Majority of water supply is from ground level reservoirs and over head reservoirs. But in a few cases only it is by direct transmission mains or trunk mains. At present supply to domestic consumers is about 4 hours per day. For industries, it is about 12 to 18 hours. There are about 2.60 lakhs metered connections of domestic, non-domestic and industrial.

## 2.3 WATER TREATMENT PLANTS

To treat water for potable standards as per CPHEEO/IS standards, treatment plants have been installed at T.G. Halli and T.K. Halli. Treatment plant at T.G. Halli is installed to treat raw water in the reservoir and for treating raw water from river Cauvery at T.K. Halli. In both places the unit process and unit operation are the same. They are (a) Pre-chlorination (b) Coagulation (c) Flocculation (d) Sedimentation (e) Filtration and (f) Post chlorination or disinfection. Generally, alum (Aluminium sulphate) is used for coagulation and lime is used in a proper dosage as determined in the laboratory for $P^H$ correction.

The final treated water is tested for physical, chemical, biological and bacteriological quality. After satisfying the CPHEEO standards, it is pumped to the City.

## 2.4 WATER QUALITY SURVEILLANCE IN DISTRIBUTION

The treated water from the treatment plant which meets the CPHEEO standards should reach all the consumers with the same standards. As it flows through many conduits, there is every possibility of water getting polluted. Hence, it is necessary to collect regular water samples to confirm the bacteriological quality. As per W H.O standards, for a population of more than 1,00,000 one sample for every 10,000 population needs to be collected. Since the population of Bangalore is 5 million, 500 samples have to be collected. But BWSSB has 52 service stations and 12 samples are collected each month from each service station. In addition, about 250 water samples are collected through the mobile testing laboratory. Thus quality of water is monitored very scrupulously. The water quality in the distribution system is tested in the Central Water Testing Laboratory established for this purpose.

## 3.0 SEWERAGE SYSTEM

Sewerage system in Bangalore has been in existence since 1922. Earlier it was confined to densely populated areas in the heart of the old City Although a gradual extension took place since then, it was not until 1950 that a major sewerage construction programme was commenced. As on today about 75% of the area of Bangalore Metropolitan limits is provided with sewerage system.

The waste water is suitably conveyed by gravity through four major valleys, namely , Koramangala, Challagatta, Vrishabhavathi and Hebbal Valley. The Koramangala and Challaghatta valley zones are conveniently joined at their Southern extremities in the form of one disposal point. Therefore, presently three disposal points for sewage treatment are provided.

## 3.1 WASTE WATER TREATMENT AND DISPOSAL

Presently there are two major waste water treatment plants serving Bangalore City, viz. K & C Valley zone and V. Valley zone. A sewage treatment plant for Hebbal drainage zone is presently under construction. The details with respect to the treatment plants viz., the area occupied, the year of commissioning, the type of treatment provided are presented in Table-2. The existing sewage treatment plants are being upgraded by providing secondary treatment capability.

**TABLE-2 DETAILS OF SEWAGE TREATMENT PLANTS**

| Sl. No. | Name of the Plant | Treatment Plant-Present Capacity (MLD) | Treatment Plant-Ultimate Capacity (MLD) | Process Adopted | Remarks |
|---|---|---|---|---|---|
| 1. | Kormanagala, Chellaghatta valley (K&C valley) | 163 | 218 | Activated Sludge Process | At present secondary treatment plant is functioning |
| 2. | Vrishabhavathi valley (V valley) | 123 | 180 | High rate Trickling filters | Only primary treatment is functioning and last phase of secondary treatment are under construction |
| 3. | Hebbal valley (H valley) | 60 | 90 | Activated Sludge Process | Both primary and secondary treatment works are under progress |

To enable satisfactory handling of the waste water flows generated in the area beyond the existing drainage zone, number of sewage treatment plants will be suitably designed in the future to meet the effluent standards of BOD 20 mg/l and suspended solids-30mg/l.

## 3.2 K & C VALLEY SEWAGE TREATMENT PLANT

The Koramangala and Chellaghatta sewage treatment plant lies to the south east of the City on the northern edge of Bellandur Tank. The land available for future expansion is approximately 40 acres. The treatment plant has been designed for an average flow of 163 MLD to serve an estimated population of 13.78 lakhs. The treatment units have been designed as modules of 54.33 MLD in order to ensure its optimum usage. This can be further be augmented to treat 218 MLD of sewage.

The type of treatment provided includes primary treatment followed by conventional Activated Sludge process. Anaerobic digesters are also provided. The treatment objective is to produce an effluent quality confirming to IS 4764 1973. The treated effluent is discharged into Bellandur tank located downstream of K & C Valley.

The average results of sewage influent and effluent analysis from secondary treatment indicate about 85% of both BOD and suspended solids removal. The treatment efficiency can be increased by providing alternative power supply arrangement and better operation & maintenance.

The rehabilitation work of existing Anaerobic Digesters is being carried out at present. It is noted that the sewage flow received at the plant is less than the available treatment capacity. The reasons for the shortfall in receipt of sewage are:

(a) lack of proper connections of the sewers to the STP sites;

(b) absence of sewers in isolated/slum areas;

(c) insufficient carrying capacity of the sewers to handle the present flow;

(d) damaged sewers; and

(e) choking of sewers due to siltation.

### 3.3 V. VALLEY SEWAGE TREATMENT PLANT

The Vrishabhavathi Valley treatment plant serve the existing V. Valley drainage zone and is located to the South West of the City. The plant premises has an extent of 92 Ha area of which about 37 Ha is available for future expansion. At present only primary treatment is provided, which is designed for an average flow of 123 MLD. Upgradation works for treating the estimated future waste water flow of 180 MLD are under progress.

The data regarding the present population, and the targeted population for which the ultimate treatment capacity of 180 MLD is being provided are not available.

The type of treatment envisaged includes primary treatment followed by secondary treatment with primary and secondary Biofilters. Anaerobic Digesters are also provided to tap Methane gas. The treatment objective is to produce an effluent quality conforming to IS 4764-1972. The treated effluent will be discharged into Vrishabhavathi river though nearby valley.

The average results of sewage influent and effluent analysis from primary treatment indicates about 40% BOD reduction and 65% SS removal.

### 3.4 HEBBAL SEWAGE TREATMENT PLANT

The Hebbal sewage treatment plant is under construction. It is located at approximately 1.5 km from Hebbal village, adjacent to Nagavara tank. The waste water flow from the Hebbal zone will be handled by this treatment plant. Presently treatment plant for an average flow of 60 MLD is under construction. This treatment capacity can be further augmented to 90 MLD in the near future. Necessary land has already been acquired. The total area acquired is approximately 45 acres which includes provision for future expansion. The treatment plant has been designed for an estimated population of 8.3 lakhs in the year 2011.

The treatment units have been designed in modules of 30 MLD capacity each. Thus for a design capacity of 60 MLD there will be two modules, and for a future flow of 90 MLD one more module will be provided. The type of treatment envisaged includes a primary treatment followed by secondary treatment with conventional Activated Sludge Process. Anaerobic Digesters have been proposed to tap the Methane gas, which can be used as a source of energy. The treated effluent will be discharged into Nagavara tank.

## 4.0 NEW SCHEMES

Bangalore Water Supply and Sewerage Board has availed Overseas Economic Co-operative Fund (OECF) loan of Government of Japan for executing CWSS IV Stage Phase I for bringing an additional 270 MLD of Water from river Cauvery to Bangalore. The total cost of the Project as approved by M/s. OECF is Rs. 1342.00 Crores, which Rs. 985.00 crores is the share of Government of Japan. The balance amount is shared by Government of Karnataka, Bangalore City Corporation, Bangalore Development Authority and Bangalore Water Supply and Sewerage Board.

The scheme envisages drawing 300 MLD of raw water by gravity upto Thorekadanahalli and treating for potable standards. Then pumping 270 MLD treated water in three stage pumping from T.K. Halli, Harohalli and Tataguni at a head of 160-170 M at each stage. The treated water is distributed in seven storage reservoirs in the City and supplied through feeder mains and distribution mains to consumers.

The waste water generated in this new area will be conveyed to the treatment plants partly by gravity and partly by pumping and sewage will be treated to IS standards and discharged into natural valley.

### 4.1 ARKAVATHY REHABILITATION SCHEME

A scheme to rehabilitate 60 years old pumping machineries and pipelines at CRS Water works supplying 135 MLD water to City is taken under HUDCO and Government of Karnataka funding. The total cost of this project is Rs. 30.00crores.

The scheme includes:

(a) Replacement of 1000 HP and 2000 HP old pump sets which are currently being used for pumping water directly to Bangalore using 24" dia and 27" dia rising mains.

(b) Replacing 24" and 27" dia old pipes lines for a length of 10 Km by a 1000 mm MS pipe with CM lining inside and guniting outside and converting it into two stage pumping.

(c) Providing additional capacity treatment plant of 36 MLD at CRS water work including storage reservoir.

The above work is almost completed. After implementation of this scheme 36 MLD additional water can be pumped to the City if there is enough storage in CRS reservoir.

## 4.2 MEGA CITY PROJECT

There are about 6 components under Mega City Project which is funded by Urban Infrastructure Finances and also HUDCO. The liaison agency B.M.R D.A. is arranging funds through the above institution.

The projects which are mainly for improving the distribution system are as follows.

(i) Providing Ground Level reservoir and booster pumping station where there is additional water demand when compared to the existing storage.

(ii) Installation of captive power plants at critical pumping stations within the City.

(iii) Re-designing transformer to meet the low incoming voltage and supply designed voltage for smooth functioning of pumps and to discharge rated quanity.

(iv) Providing and laying new pipelines where it is absolutely necessary to meet the additional demand.

(v) Procurement of flow meters for measuring receipt of water from different sources and also to measure the quantity of water received in each reservoir.

(vi) Replacement of corroded old (about 100 years) pipelines in the City.

However the loan is yet to be materialized. Meanwhile action has already been initiated for calling tenders pending receipt of funds.

## 4.3 OPERATION AND MAINTENANCE PROBLEMS

(1) Bangalore Water Supply and Sewerage Board is a heavy energy consuming service sector. Nearly 60 MW of power is required for smooth operation of pumps. But generally the power available at pumping station is not for designed parameters, thus consuming less power. There is also a possibility of the pumpsets getting damaged. Even failure of power for a fractiom of a minute hampers the entire sequential operation at all three pumping stations of Cauvery Water supply which requires 45 minutes to restore back to normal operating condition, thereby reducing the receipt of water to the City. Frequency variation and untimely load shedding, further reduce the water supply in the distribution. Installation of captive power is very costly and would be a burden to public in terms of tariff.

(2) Leakages and unaccounted for water are considerable. This increase has almost reached 35% BWSSB cannot afford to lose 35% of water as the cost of production and conveyance of water is very high. Leakages are both physical and non physical. There is great scope for reduction of unaccounted for water in the system. However, BWSSB has already tied up with NEERI for assistance in this connection.

3) Many old areas of Bangalore City have very old and small dia distribution pipes causing potential areas for inadequate supply and also leakage in the system. There is hence an urgent need for replacement of such pipes, wherever required and large size feeder and trunk mains are also neccessry.

(4) Water quality surveillance and rehabilitation of the distribution system is another important task There are about 20 rehabilitation units in the City for giving booster dosage. But still the quality of water is not good in remote areas because of possible pollution for different reasons. Regular independent mobile water testing unit with most modern facilities to measure all the parameters. Similarly spot injection chlorinators are also very essential for immediate action.

(5) The sewerage system in the old City requires remodelling and rehabilitation because of increase in flow and also damage to the old sewers.

(6) Nearly 25% of the area in the City comprising of Revenue pocket, slum area etc., is yet to be sewered. Developing authorities such as B.D.A., K.S.C.B, B.C.C., etc., should provide fund for laying sewers and proper sewage disposal.

(7) Rehabilitation of sewers, especially the main sewers and outfall sewers, should be taken up on warfooting. Otherwise the sewers get collapsed because of crown corrosion causing further disruption of service.

(8) Suitable legislation should be brought about for removing unauthorized occupants on the main sewers and outfall sewers which is causing problems for BWSSB to take up any repairs and maintenance works.

(9) Immediate action needs to be taken up to divert entire sewage to treatment plants wherever it is naturally draining into natural valley. Plants should be made to function for the designed flow.

(10) The by-product methane gas has to be used for generating electrical power with which the entire plant can be self-sufficient with the power requirement.

(11) Water reuse potentials have to be identified through demand surveys for different usage and tertiary treatment plants to be installed at all the three treatment plant locations.

(12) Possibilities of privatization of different sectors of water supply and sewage treatment have to be identified and taken up.

(13) Geographic information system (GIS) has to be implemented including SCADA for providing better services to the public.

(14) Suitable legislation for regulating the extraction of under ground water should be brought out since the water table is depleting at an alarming proportion.

ANNEXURE — 9

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS

THEME PAPERS

# NATIONAL ISSUES ON

## OPERATION & MAINTENANCE OF WATER SUPPLY & SANITATION

BY

DR. D.M. MOHAN

NEW DELHI
25-27 SEPTEMBER 1996

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS NEW DELHI: 25-27 SEP. 96

# NATIONAL ISSUES ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

**Dr. D.M. Mohan, Consultant, UNDP-World Bank, RWSG-SA, New Delhi.**

## 1. INTRODUCTION:

A national workshop is being organised jointly by WHO, UNDP-WORLD BANK-RWSG-SA, Govt. of India, Ministry of Urban Affairs and Ministry of Rural Development for developing methodologies for formulation, implementation, monitoring and evaluation of programs for improvement of Operation and Maintenance (O&M) in order to optimize the efficiency of water supply and sanitation services.

### 1.1. Scope of the paper:

This paper identifies the key issues affecting the performance of the Water Supply and Sanitation Systems for discussion in the National Workshop on O&M of Water and Sanitation Systems.

## 2. Technical Issues:

### 2.1 Preparation of O&M manuals:

The defective performance of most Water and Sanitation Systems (WSS) is mainly on account of failure to recognize the importance of a well organised O&M and consequent lack of attention to O&M. **There is a need to carry out a deficiency analysis of the O&M of WSS and prepare action plans and manuals for sustainable O&M.**

### 2.2 Management of UFW

In several systems the amount of water lost by way of physical leakages through transmission, distribution systems, storage structures and water treatment plants is not known. In addition, there are non physical losses of water which affect the revenue of several systems due to unregistered connections, inaccurate or non functioning consumer meters inaccurate (inadvertent or deliberate) meter reading. **Water conservation policies and practices including management of UFW have to be made an integral part of O&M activities of any system if the objective of providing a safe reliable and affordable water supply on full cost-recovery basis is to be achieved.**

### 2.3 Updation of system maps and records:

A comprehensive set of records and maps/drawings of the water supply and sanitation systems including intakes, transmission, treatment, storage, pumping and distribution including valves for water supply and sewer manholes, SPS and STPs for sewerage will be required for operation, planning and exercising leakage control, maintenance management and planning purposes. **Hence it is neccessary that a mechanism is in place for updation of all the maps and records of was to update the improvements in the systems.**

## 3. Management Issues:

### 3.1 Organizational Structure:

The aim of any WSS organisation shall be to strive to become performance effective and financially viable in providing water supply and sewerage services and hence the organizational structure has to be designed to ensure sustainable O&M of WSS. **It is recommended that a study of existing organisational structure is undertaken and modified to suit local conditions to ensure sustainable O&M of WSS.**

### 3.2 Obligations of the Management:

The management has to fulfil the following obligations:

* Management is obliged to maintain the facilities in a reasonably efficient manner for which required funds are to be provided.

* Persons with aptitude must be chosen to work in O&M with the available facilities.
* Management must arrange for training for such persons.
* They should be trained and supervised to carry out the actions.
* Management has to arrange tools, spares and other consumables.
* A good and reliable MIS is to be built-up to enable decision making and evaluation.

### 3.3 Management Information System for Monitoring of O&M:

A good MIS will be an essential requirement to enable improvement in the operational efficiency and maintenance. **A good MIS shall be in place and a list of monitoring indicators may be prepared and frequency and source specified for each organisation.**

### 3.4 Private Participation:

Co-operation between the agencies incharge of WSS and communities may be achieved through the involvement of private sector agencies. **Privatization may be limited to new water supply projects,** till the performance of WAS managed by local bodies and public utilities is improved before considering any role to private sector. An incremental approach may be adopted for privatization of WSS, by entrusting to private contractors certain functions such as O&M of WTPs, STPs. Pumping stations and transmission mains. Meter reading, billing and collection is also one area to assign to private participation with possibility of improving the revenue collection of the WAS.

## 4 Financial Issues:

Only a few agencies incharge of O&M of WSS are able to achieve a good financial performance. Often the agencies are unable to levy tariffs in order to provide sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works etc. Some agencies are incurring losses, mainly because they are having low tariff rates which are not reviewed/revised inspite of increases in the staff and power costs. **Even though attempts to achieve full cost recovery encounter resistance from the users, it is still necessary that the agencies review the tariffs periodcally and levey reasonable and affordable tariffs.**

## 5. Institutional development and capacity building:

With larger autonomy, it is possible to run the systems efficiently and profitably by paying realistic salaries and offering better incentives & attractive careers to the staff based on their performance. **A training study may be undertaken for each organization, identify training needs and implement the training programmes.** In order to achieve the objectives of training, the training culture has to be inculcated by providing appropriate linkages between career advancement and performance of both in the job and in training.

## 6. CONCLUSIONS

The following key issues are identified for ensuring sustainable O&M:

There is a need to carry out a deficiency analysis of the O&M of WSS and prepare action plans and manuals for sustainable O&M.

Water conservation policies and practices including management of UFW have to be made an integral part of O&M activities of any system if the objective of providing a safe reliable and affordable water supply on full cost-recovery basis is to be achieved.

It is necessary that a mechanism is in place for updation of all the maps and records of WSS to update the improvements in the systems.

A study of existing organisational structure of the agencies incharge of O&M of WAS has to be undertaken and modified to suit local conditions to ensure sustainable O&M of WSS.

Management is obliged to maintain the facilities in a reasonably efficient manner for which required funds are to be provided and the managements' obligations have to be fulfilled.

A good MIS shall be in place and a list of monitoring indicators may be perpared and frequency and source specified for each organisation.

Privatization may be limited to new water supply and sanitation projects.

Even though attempts to achieve full cost recovery encounter resistance from the users, it is still necessary that the agencies review the tariffs periodically and levy reasonable and affordable tariffs.

A training study has to be undertaken for each organization, identify training needs and implement the training programmes to ensure sustainable O&M of WSS.

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS, NEW DELHI: 25-27 SEP. 96

## THEME PAPER
## SUSTAINABILITY OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

**Dr. D.M. Mohan, Consultant, UNDP-World Bank, RWSG-SA, New Delhi.**

### 1. INTRODUCTION:

A National workshop is being organised jointly by WHO, UNDP-WORLD BANK-RWSG-SA, Govt. of India-Ministry of Urban Affairs and Ministry of Rural Development. The objectives of this workshop are to:

- identify constraints and key issues affecting the performance of the water supply and sanitation sector
- present tools for O & M prepared by WHO
- exchange information and experience on O & M
- define options for O & M
- prepare an action plan for O & M
- make recommendations for implementation of action plan
- evolve mechanisms for evaluation and monitoring of implementation of action plan

### 1.1 Theme Papers:

Sustainability of Urban Water Supply and Sanitation Systems, Human Resources Development, Community participation, Finance and Full cost recovery were prioritised as themes for the proposed workshop. This theme paper is prepared for Sustainability of Urban Water Supply and Sanitation Systems.

### 1.2 Scope of the theme paper:

Scope of this theme paper is to

* identify the issues that affect the sustainability of Water and Sanitation Systems (WSS)
* present an action plan for Operation and Maintenance of WSS to ensure sustainability.
* make recommendations for implementing of action plan and
* present a mechanism for evaluation of the Operation and Maintenance.

### 1.3 Issues affecting sustainability:

The following technical issues are identified as affecting sustainability of WSS.

Management of System
Management of Unaccounted for water (UFW)
Participation by Community
Private Participation
Financial Cost Sharing
Institutional, Capacity Building and HRD issues

The strategy recommended herein addresses the above technical issues.

### 2. PROPOSED STRATEGY AND ACTION PLAN

### 2.1 Management of System:

#### 2.1.1 Application of WHO guidelines on O & M:

The Govt. of India Ministry of Urban Affairs and Employment has published Manuals on Water Supply and Treatment and on Sewerage and Sewage Treatment for use by practicing engineers. Though these manuals contain O & M procedures, the emphasis in these manuals is mainly on planning and installation of new systems.

2.1.2 The WHO's guide for Managers of O & M of water supply and sanitation systems can be used by the water supply and sanitation agencies in formulating programs and implementing activities aimed at improving the efficiencies and effectiveness of O & M of WSS. These guidelines can be used as a concept and complemented to draw up O & M programs to suit varying situations.

2.1.3 The WHO guide also contains programs for loss control, control of water quality and control over sewage collection and disposal. The guide recommends simulation studies for large cities having complicated distribution networks. Installation of permanent measuring devices for flow and pressures are suggested to provide essential data for evaluating trends of consumption, consumption coefficients per connection and most importantly assess the UFW.

**2.1.4 Modification of the guidelines for individual systems:**

Though the programs given by the WHO guide contain exhaustive list of activities it is necessary that each organization prepares action plans for implementation of these O & M programs.

**2.1.5 Minimum requirements for an action plan on O & M are:**

(i) Preparation of a plan for O & M
(ii) Providing required personnel for O & M
(iii) Document the job descriptions of all O & M personnel linked to the O & M plan
(iv) Identify the training needs of O & M personnel to perform their assigned duties and provide the required training
(v) Availability of spares and tools for routine operation and preventive maintenance
(vi) Monitoring system for UFW
(vii) Monitoring system for water quality at various stages upto the consumer
(viii) Prepare and update the system maps and records including the inventory of the equipments, costs, life etc.
(ix) Prepare a MIS and provide monitoring indicators for decision making and performance evaluation of O & M
(x) Provide a system for interface with consumer/community for prompt redressal of grievances and enhancing the user sensitivity on the part of O & M staff for improving the service delivery
(xi) Streamline financial management and accounting systems to achieve cost recovery

**2.1.6 Preparation of a Plan for O & M of a WSS:**

A program or a plan has to be prepared for routine operation and preventive maintenance of individual units of the system. The overall O & M plan of a system is made up of collection of O & M programs of various individual units.

**2.1.7 Plan for routine operation shall:**

* Contain a step by step procedure for operation of each piece of equipment to include starting, running and stopping
* Ensure availability of consumables and tools for routine operations
* Identify situations arising in the equipment when operators should refrain from further operation
* Identify persons to whom the operators have to report in such a situation

**2.1.8 Plan for Preventive Maintenance:**

The plan has to contain procedures for routine tasks, checks and inspections at intervals viz. daily, weekly, monthly etc.

* Each unit must have a plan to fix responsibility, timing of action, ways and means of achieving the completion of action and contain what objectives are meant to be achieved by this action
* Nature of maintenance to be done can be described in a separate manual and it may briefly contain:
  - what actions are required
  - when these actions are to be taken
  - who has to take these actions
  - how these actions are to be achieved
  - why these actions are required

* Preparation of check lists for use by the supervisory staff or inspecting officers to monitor the performance of these actions to ensure that the O & M plan is implemented promptly and properly

  Check lists can be designed to provide a list of activities to be performed and monitored for ensuring the effective performance of WSS. These check lists may contain the activities and suggested frequency of performing the activities. The job descriptions of the respective staff shall also contain the relevant duties.

**2.1.9 Management Information System for Monitoring of O & M**

A good MIS will be an essential requirement to enable improvement in the operational efficiency and maintenance. The WHO guide has proposed a separate system for MIS and contains a list of management indicators to enable evaluation and decision by management to achieve an efficient O & M. This list also contains source and frequency of generation of data. This list of monitoring indicators may be modified and frequency and source specified for each organisation. A set of performance indicators for O & M of WSS is given in Annexure I.

**2.1.10 Updation of system maps:**

A comprehensive set of records and maps/drawings of the water supply and sanitation systems including intakes, transmission, treatment, storage, pumping and distribution including valves for water supply and sewer manholes, SPS and STPs for sewerage will be required for operation, planning and exercising leakage control, maintenance management and planning purposes. Field surveys may be required for collection of details and marked on the base maps for preparation of infrastructure maps. If the base maps are digitized updation will be easier. Even otherwise it is necessary that a mechanism is in place for updation of all the maps and records to include the improvements in the systems.

**2.1.11 Updation of System Data:**

Records of previous years maintenance of the equipment regarding the date of installation, normal life, cost incurred for repairs etc. will be required for preparation of budgets for O & M.

Essential information for ensuring an efficient O & M of Equipment:

* Name and location of equipment
* Number available/installed
* Serial No. type, class
* Date/year of procurement/installation
* Cost of procurement/installation
* Name of manufacturer/dealer with address, telephone no. etc.
* Name of servicing firm with address, telephone no. etc.
* Technical manuals, operation manuals and service manuals provided by the supplier
* Major over hauls, date, nature, cost etc.
* When next over haul is due
* Details of repairs and replacements with date, type, cost etc.
* Cost of spares and cost of labour for repairs

**2.1.12 Obligations of Management:**

The aim of any WSS organisation shall be to strive to become performance effective and financially viable in providing water supply and sewerage services. The management has to fulfil the following obligations:

* Management is obliged to maintain the facilities in a reasonably efficient manner for which required funds are to be provided
* Persons with aptitude must be chosen to work in O & M with the available facilities
* Management must arrange for training for such persons
* They should be trained and supervised to carry out the actions
* Management has to arrange tools, spares and other consumables
* A good and MIS is to be built-up to enable decision making and evaluation

## 2.2 Management of UFW

2.2.1 In several systems the amount of water lost by way of physical leakages through transmission, distribution systems, storage structures and water treatment plants is not known. In addition, there are non physical losses of water which affect the revenue of several systems due to unregistered connections, inaccurate or non functioning consumer meters, inaccurate (inadvertent or deliberate) meter reading which remains uncontrolled by internal audit and personnel management policies and practices and wastage at public taps because of defective or missing taps or failure to turn off taps when not in use.

Water conservation policies and practices have to be made an integral part of O & M activities of any system to achieve the objective of providing a safe, reliable and affordable water supply on full cost-recovery basis.

2.2.2 Review of case studies has brought out that the following issues are relevant for managing of Unaccounted for Water (UFW):

* Design deficiencies coupled with poor quality control during construction/installation has resulted in leaking reservoirs, transmission mains and distribution system.
* Absence of bulk flow meters or non functioning of bulk flow meters which deters an overall water audit
* About 85% of consumer meters are found to be either non functional or inaccurate
* About 80% of physical losses are occurring through corroded GI consumer connections

2.2.3 The WHO guide describes water loss control projects to be adopted in the agency's operational system, commercial system, HRD and Admin. support system. It is advisable that this integrated approach is adopted at least by large agencies. An action plan has to be prepared for each organisation listing the activities with a time bound programme of inputs required and outputs expected. The objectives of such an action plan may include the following:

* Quantify the UFW problem
* Reduce physical losses
* Reduce non physical losses
* Achieve improvement in service levels by way of increase in quantity and pressure of supply and improvement in quality of water
* Reduce the risk of pollution of supplies
* Achieve an increase in revenues leading to sustainability

**2.2.4 The following works may have to be undertaken to achieve the objectives**

* A base line survey may be required to document the status of metering, billing and collection as a preliminary activity for assessing the non physical losses of UFW.
* Updation of distribution system maps may be undertaken if found necessary.
* Leakage studies have to be undertaken in order to reduce the losses in the system, to quantify the effect of the leakage and wastage in the entire system by having records and flow metering systems which permit the continuous monitoring of UFW
* Undertake a leakage detection and rectification program in the entire system to bring down the physical losses
* Identify and control unregistered connections and improve the performance of functioning and reading of consumer meters and have in place a meter reading, billing and collection, surveillance and audit

**2.2.5 The work plan shall also contain the following processes:**

* Pursue rigid quality control over materials and work in the construction/ installation of reservoirs, pumping installations and pipelines so as to avoid physical losses of water
* Procuring and installing bulk flow and consumer meters which have a proven record of performance and have rigid quality control over procurement of these meters
* Changing all the leaking corroded GI consumer connections with non corrodible pipes (preferably MDPE) and adopting correct plumbing practices while connecting the consumer pipe
* Attend to rectification of all visible physical leakages and have a leak detection program for detection and rectification of all invisible leaks.

2.2.6 The action plan shall have the cost and time estimates with a rationale for such investments. The methodology to be adopted for implementation of the work plan shall have a procurement plan and schedule and describe how liaison with other utility agencies and community will be maintained for implementation of the plan. The plan shall also contain the staff inputs required and outputs proposed to be generated such as water audit reports, performance of bulk and consumer meters, leakage detection and rectification reports and reports on improvement in levels of service, water quality and reduction in incidence of pollution.

2.2.7 The training plan for the staff of the organization shall contain a subject on management of UFW highlighting the rationable, objectives, scope of work, methodology and monitoring of UFW. Specifically the staff of the organization have to be trained in the use of leak detection equipment and assessment of physical leakages. Training may also be provided in reading and maintaining of the bulk and consumer meters.

2.2.8 The success of the management of UFW may be gauged by monitoring during implementation. The following monitoring indicators are suggested:

(i) physical quantification of reduction in UFW (MLD)

(ii) improvement in revenues (Rs)

(iii) percentage of consumer meters working

(iv) increase in hours of supply or increase in pressures in the area under study

(v) improvement in quality of water (due to reduction in leakages) in pollution affected/prone areas

**2.3 Community participation:**

2.3.1 Inspite of the problems in enlisting community participation initiative by community through user and neighbour-hood committees can still play a vital role in developing and O & M of water supply and sanitation projects. The problems in achieving an active community participation can be overcome by closer and more effective cooperation between the agencies and communities. Experience has shown that though it is often difficult to achieve such cooperation it is desirable that efforts are continuously made in this direction.

**2.4 Private Sector Participation**

2.4.1 It may be possible to achieve efficient performance by involving private participation in O & M of WSS; additionally such an involvement may stimulate greater consumer awareness. Cooperation betweeen the agencies incharge of WSS and communities may be achieved through the involvement of private sector agencies. However privatization may be opposed by some agencies and labour unions.

2.4.2 In view of the poor performance, uncertainties and risks involved it may not always be possible to induce a private operator to take over O & M of an existing system. Hence privatization may be limited to new water supply projects, till the performance of WSS managed by local bodies and public utilities is improved before considering any role to private sector.

2.4.3 An incremental approach may be adopted for privatization of WSS, by entrusting to private contractors certain functions such as O & M of WTPs, STPs, Pumping stations and transmission mains. Meter reading, billing and collection is also one area to assign to private participation with possibility of improving the revenue collection of the WSS.

**2.5 Financial Cost sharing arrangements:**

2.5.1 Water supply and Sanitation Projects have been traditionally implemented with a high level of subsidy and cost recovery was not considered as a major issue. With the reduction in subsidies and increasing pressure to enforce financial discipline, the agencies are now slowly turing to the cost recovery option. However such attempts to achieve full cost recovery encounter resistance from users resulting in poor financial performance.

2.5.2 Some of the constraints in full cost recovery are : inadequate tariffs, lack of autonomy to set realistic tariffs, limited ability to pay, general unwillingness to pay especially for sanitation service, limited commitment on the part of staff for effecting cost recovery etc.

2.5.3 Though everyone shall contribute to the cost, it is necessary to ensure that tariffs are affordable. It may be prudent to levy the minimum for the urban poor/privileged class and suggest higher rates to others who can afford. At this point it will be helpful to convince the consumers to pay more by improving the quality of service and perhaps with the involvement of the community in service maintenance. Better maintenance to reduce wastage and leakages in the system and a review of free supplies through public taps may be required. Cost recovery can also be ensured by reducing

costs of O & M. A deliberately designed programme may be taken up to enhance public awareness of the need to pay coupled with user sensitive service system.

**2.6 Institutional development and capacity building:**

2.6.1 There is a need to build local capacity and to develop skills for ensuring that the systems are sustainable. Management capacity building programs are required to increase the effectiveness of organisations at all levels and increase their ability to more effectively manage their physical and human resources. If urban utilities are to perform efficiently the assets must be managed by qualified and motivated staff. With larger autonomy, it is possible to run the systems efficiently and profitably. Where the utilities/agencies are not bound by Govt. rules they may be able to pay realistic salaries, offer better incentives & attractive careers to the staff based on their performance.

2.6.2 The concept of institutional strengthening and capacity upgradation through a continuation training is yet to catch on in several organizations. It is recommended that a training study be undertaken for each organization to enhance the performance skill of the staff, identify training needs and implement the training programmes. In order to achieve the objectives of training, the training culture has to be inculcated by providing appropriate linkages between career advancement and performance of both in the job and in training.

## 3. FUTURE ACTIONS & LIMITATIONS

### 3.1 Long Term Actions:

#### 3.1.1 Preparation of O & M Manuals:

Large undertakings may carry out studies for system O & M with the following objectives:

* to review the existing operational practices
* to carryout an O & M deficiency analysis having regard to cost benefit principles
* to prepare guidelines and operation manuals for efficient O & M of the systems

The smaller installations can prepare O & M manuals by referring to WHO guide.

These manuals shall contain

* a brief description of the components of the system
* duties, powers and responsibilities of each employee of the O & M for routine operations, preventive maintenance and in emergencies
* a list of Do's and Dont's for the O & M staff
* a list of daily operations including formats for daily record of operations
* preventive maintenance procedures with schedules for inspection of machinery, lubrication schedule with type of lubricant, place, frequency and instruction for lubrication
* inventory of spare parts and consumables
* list of safety measures
* formats for a good records system
* data for MIS and monitoring indicators
* action plan for UFW
* action plan for Training

#### 3.1.2 Restructuring the Organization:

A detailed study can be undertaken to define an optimum organization required for O & M (for example the structure given in WHO guide) and work towards achievement of that, whenever there is opportunity available to reorganize. It may be desirable to try the recommended strategy with success in smaller organisations and in utilities which are not overstaffed.

**3.2 Immediate Actions:**

3.2.1 Even in the absence of funds for O & M the following actions can be initiated to achieve short term results:

* take-up good house keeping
* routine maintenance and minor adjustments which can be attended by O & M staff
* rectification of visible leakages and reducing wastage
* adoption of correct plumbing practices to reduce the leakages.
* enhance revenues by prompt meter reading, issue & collection of bills
* detect and formalize the unregistered connections to improve the revenues
* sensitize the staff (especially those who occupy the first point of contact with the consumers) to improve the service delivery

3.2.2 Immediate action to repair/replace the consumer meters with more reliable meters. If this is to the account of the consumers there is no need to wait for funds

3.2.3 Updation of system maps and records may be also taken up which may require only small investments

**3.3 Limitations:**

i) It may take a long time for the change in management orientation to become service oriented and run on commercial basis. While in most of the cities, a large work force has already been created over a number of years and is being used for O & M of the systems, the suitability of their skills and experience has not necessarily been tested. At the same time a radical change in the setup is also not possible in a short period.

ii) Most of the large undertakings are overstaffed, it may not be possible to reduce or redeploy the staff.

iii) Though an awareness can be created for preparation of O & M manuals it will not be easy to initiate action to start writing down the O & M procedures, the foremost reason for this being the lack of reliable records which results in manuals based on guess work instead of on the basis of reliable records.

iv) Lack of funds will be a common constraint to take up any systematic O & M.

v) In most undertakings a large proportion of the consumer meters are not working or are working inaccurately. The consumers may not evince any interest in repairing of the meters and the meter repair facilities are also not well established.

vi) In some instances the equipment might have outlived its life or out of previous neglect or misuse has reached a stage at which replacement is the only alternative.

vii) The utilities are so diverse that simple training methods are not sufficient and it may be difficult to find well motivated personnel to come forward for training or even some of them may not be amenable for training. In some instances trained personnel to undertake the maintenance of complicated/out-dated equipment may not be available.

viii) A weak organisation which is not ready to change its management attitude to run the utility as a financially viable commercial organisation and unmotivated staff will also be some of the limitations to move ahead with the strategy.

**References**

1. **WHO "A guide for Managers of O & M of Water Supply Systems" 1995**

# ANNEXURE I

## Performance Indicators for assessment of Status of Operation and Maintenance of Water Supply and Sanitation Systems

**Service coverage-Area**

1 Percent area served with water supply
2 Percent area provided with sanitation service
3 Percent area covered with storm water drains
4 Percent area covered with open drains for sullage water

**Service coverage-Population**

5 Percent population served with water supply
6 Percent population provided with sanitation
7 Percapita supply of net water available
8 Percapita contribution of solid waste

**Unaccounted Water**

9 Unaccounted water as Percent of total installed capacity
(Volume invoiced/Volume produced)
10 Water supplied free as Percent of total water produced
(Volume through public taps/volume produced)
11 Functional meters as percent of total consumer meters

**Staff productivity**

12 No of Connections (both water supply and sanitation) served by one employee
13 No of population served by one employee

**Capacity utilization**

14 Actual water treated as percent of total installed capacity
15 Installed capacity of sewage treatment as percent of installed capacity of water treatment/produced
16 Actual sewage treated as percent of total installed capacity

**Reliability of Service delivery**

17 Interruptions in water supply as percent of hours of service
18 Complaints attended for water supply as percent of total complaints
19 Complaints attended for sanitation as percent of total complaints

**Financial performance**

20 Percapita O&M cost of water supply
21 Percapita O&M cost of sanitation
22 Per capita cost of solid waste collection and disposal
23 Operating ratio for water supply and sanitation
(operating revenue/expenses)

ANNEXURE — 10

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

THEME PAPERS

# FINANCIAL & COST SHARING OF URBAN WATER SUPPLY & SANITATION SYSTEMS

BY
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# THEME PAPER ON FINANCIAL AND COST SHARING ARRANGEMENTS FOR URBAN WATER SUPPLY SCHEMES FOR THE NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY & SANITATION SYSTEMS

*S. S. PATWARDHAN

## 1. INTRODUCTION

With the accelerated urbanisation in the country in the recent years the demand for water supply and sewerage has increased at very high rate. However the augmentation of the facilities could not keep up the required pace. The launching of the Water Supply Development Decade Programme 1981-90 is the land mark event. No doubt that it has given a new impetus and helped to promote a wider appreciation of the growth needs of the water supply sector, but lot of work is yet to be done. The problem is becoming more serious and number of cities are getting the water on alternate days and for few cities, once a week.

1.1 Even the metropolitan capital cities are suffering from acute shortage of water. The city of Madras is a typical example.

1.2 Eventhough there are number of hurdles in implementing the water supply schemes, right from the source itself, but the most significant hurdle is that of adequate fund flow for capital works and as well as for maintenance.

## 2. PRESENT POLICY OF FINANCING WATER SUPPLY SCHEMES

2.1 The most of the Urban Water Supply Schemes are managed by the respective local bodies and in some cities, by the State Boards/State Governments. The financial position of the most of the local bodies/State Boards, is not sound and therefore they have to depend upon Government, for the Government grant in aid (subsidy) as well as for loan for execution of capital projects. It is, therefore, essential to know the financing pattern of Urban Water Supply Schemes so as to enable to understand the principles of fixing of tariff structure. The pattern of grant in aid to the municipal bodies is not the same in all the State Governments. The Water tariff structure is completely dependent on the pattern of financial assistance. Therefore for a water supply scheme, estimated to cost roughly the same amount, for two different towns, water tariff may differ substantially if the grant in aid pattern is not the same.

## 3. CAPITAL EXPENDITURE AND OPERATION AND MAINTENANCE EXPENDITURE

3.1 For running of water supply schemes the local bodies/State Boards have to consider both the costs i.e. the financial burden due to capital expenditure and as well as the day to day operating costs. In addition to these requirements, the local bodies are supposed to generate surplus funds to undertake the capital works in future.

3.2 As the Urban population is increasing at a very fast rate, the water supplies of the cities need frequent augmentation, even say after a period of 10 years eventhough the scheme might have been designed for a period of 15 to 30 years. Thus in short the financial burden of capital cost can not be ignored.

## 4. LOANS FOR WATER SUPPLY AND SANITATION SCHEMES

4.1 As the local bodies are not in a position to finance the augmentation schemes from their own resources, they have to approach various financial institutions for securing loans.

The various financial institutions who are presently rendering the facilities of loans to local bodies and their terms and conditions of payment of interest and capital repayment are indicated in the Table no. I.

* Retired Member Secretary of Maharashtra Water Supply & Sewerage Board.
Working with Kirloskar Consultants Ltd. Pune as an Advisor.

**TABLE NO. I**

| Name of Institute | Yearly Rate of Int. | Period of Repayment | More-torium Period | Terms of Payment | | Remarks |
|---|---|---|---|---|---|---|
| | | | | Int. | Capital | |
| Life Insurance Corp. | 13% | 25 Yrs. | 3 Yrs. | Half yearly on outstanding balance | 22 equal instalments | Loan is on a sliding scale & it works out to about 30% of the cost of the scheme for most of the Urban schemes. |
| HUDCO | 14% | 15 Yrs. | 3 to 4 Yrs. (construn. period) | Quarterly on outstanding balance | 12 equal instalments | Max. 70% of the cost of the scheme. |
| OPEN MARKET BORROWINGS | 14% | 20 Yrs. | 3 Yrs. | Int. & capital to be paid in equated annual instalments. | | |

4.2 Most of the financial institutions insist on technical scrutiny of the schemes by State/Central Governments or authorities in addition to technical scrutiny by their own experts. In addition all loans are to be guaranteed by the respective State Government. This condition itself indicates that the financial positions of the most of the municipal towns is not satisfactory. Therefore without the assistance of Government, no local body is in a position to procure loans for capital works.

4.3 The interest is also to be paid on the outstanding balance of the loan. Therefore the interest burden is very high in the initial stages. A typical example of Solapur water supply is illustrated in Annexure I.

## 5.0 TARIFF FIXING AUTHORITY

5.1 The tariff is fixed by the respective municipalities. The municipalities have the full authority to revise the tariff from time to time. However the experience is that the tariff is not revised frequently due to the various considerations. Some of the considerations are discussed below.

### 5.2 Political consideration

This is a well known fact that the elected representatives are not willing to raise the existing tariff. Some of the basic reasons as pleaded by the politicians are as follows.

(a) Level of Service:—

The level of service rendered in the most of the towns is not satisfactory. There is always a lag between the demand and the supply. Particularly in summer when the water need is quite high the supply is invariably less. There are certain towns (even in Karnataka) where the supply is once in three to four days. Under such circumstances, it is difficult to justify for the politicians to increase the water tariff.

(b) Lack of Planning Considerations:—

The general experience noticed that there is limited thinking on the part of elected representatives. In local bodies most of the elected representatives are only looking to the services in their ward i.e. the area from where they have been elected. Hardly you find any one who is discussing or taking interest in planning for the future. Of course, there may be certain exceptions. If there is acute shortage, then some interest is shown by the elected representatives in the augmentation schemes.

(c) Tendencies to Default the Payments:—

If the water tariff is not increased and if there is a deficit in the revenue generated and the actual expenditure, the gap has to be met to keep the essential service running. This is done by defaulting the payments of loans, electricity bills, payments to the various State authorities like Boards/State Government etc.

Because of the political considerations no action is taken against the local bodies and at the most the local bodies are dissolved. But the experience of the Administrator is also not satisfactory, in taking the responsibility of payment of dues. His important weapon in continuing the non payment is "that of the mess created by the previous administration".

**5.3 (d) RATIONAL POLICIES FOR TARIFF BY GOVERNMENT:—**

5.3.1 There is no initiation from the Government in general, to go in depth and analyse how the schemes can be made self supporting. For capital works in some States subsidy is given and in some States loans are given. These loans are usually not refunded by the local bodies. Some portions of the outstanding dues are recovered from the Government grants given to the Urban local bodies. There are number of municipalities, who are not able to pay the salary of the staff regularly. Hardly any action can be taken by Government against such municipalities for recovery of outstanding loans.

**5.4 Interest and loan repayment for capital works:—**

5.4.1 The interest on the loan and the repayment of capital, can not be balanced from the expected revenue. There is no doubt that the water tariff has to be increased, but one has to consider the limitations of the same. This can be seen from the case study of an augmentation scheme of Solapur Municipal Corporation, Maharashtra State (See Annexure I). The scheme is expected to be commissioned in the year 1997. Considering the actual operating and maintenance charges and the liabilities of repayment of interest the total production rate works out as shown in Table no. II.

**TABLE NO. II**

*Total production rate of water per cum. for Solapur Water Supply Scheme.*

RATE IN Rs. PER CUM

| YEAR | PRODUCTION RATE DUE TO O & M CHARGES | PRODUCTION RATES DUE TO INTEREST & LOAN LIABILITY | TOTAL PRODUCTION RATES |
|---|---|---|---|
| 1997 | 2.85 | 18.91 | 21.76 |
| 1998 | 2.86 | 15.41 | 18.27 |
| 1999 | 2.89 | 12.79 | 15.68 |
| 2000 | 2.94 | 10.71 | 13.65 |
| 2001 | 3.01 | 8.99 | 12.00 |
| 2002 | 3.09 | 7.60 | 10.69 |
| 2003 | 3.18 | 6.42 | 9.60 |
| 2004 | 3.28 | 5.41 | 8.69 |
| 2005 | 3.40 | 4.53 | 7.93 |
| 2006 | 3.53 | 3.78 | 7.31 |
| 2007 | 3.66 | 3.12 | 6.78 |
| 2008 | 3.81 | 0 | 3.81 |
| 2011 | 4.31 | 0 | 4.31 |

**Note:—**

The present water tariff charged by Solapur Corporation is Rs. 1.75 per Cu.m. for domestic consumptions and Rs. 8.50 per cubic meter is for non domestic consumption.

Therefore to make the scheme self supporting becomes a very difficult task without the assistance of Government. While enhancing the tariff one has to take into consideration the present water tariff also.

**6.0 WILLINGNESS TO PAY:—**

6.1 Willingness to pay is dependent on the following factors.

a. Level of Service

b. Family Status/Income

c. Recovery Administrations

d. Some compulsive factors

**(a) level of service**

It is generally noticed that if the level of service is satisfactory, there is general willingness for payment of water charges. If the level of service remains the same or is deteriorating and at the same time if the water tariff is increased naturally there is much resistance for payment.

Many times keeping the level of service as the same, water tariff has to be increased substantially by the authorities only because the power tariff has increased The expenditure on power tariff is to the tune of 45 to 50% of the total expenditure on Operation & Maintenance of the system.

But in general it can be assumed that if the level of service is the better people do not mind spending a little more.

**(b) Family Status/Income:—**

Willingness to pay also depends upon the status and income of the family. However it is noticed that where the family status is backed by political status, there is reluctance to pay.

**(c) Recovery Administration:—**

Willingness to pay has also got a direct relationship with the recovery administration. If the recovery administration is competent and strict and has provided adequate facilities for payment of the bills, the people are willing to pay or alternatively it can be said that there is less resistance for payment. Penal actions for delayed payment also improves the recovery.

**(d) Some compulsive factors:—**

Where there is acute shortage of water, people are willing to pay higher charges for water supply if it is made available. This is noticed in Vasai and Virar areas near Mumbai, where the people are getting water through tankers and each family is spending about Rs. 300/-to 400/-per month only for water supply.

## 7.0 COST DETERMINATION:—

7.1 Cost according to generally accepted definition, denotes the expenditure required to carryout a given task/ activity by optimally employing the inputs. Cost determination is the first step in the price fixation exercise.

7.2 Presently urban water supply is managed by different agencies in different ways. The broad classifications are indicated in Table no. III.

**TABLE NO. III**

| MODEL NO. | AGENCY & FINANCIAL RESPONSIBILITY | CASES |
|---|---|---|
| I. | A specialist agency is responsible for all stages of water supply operations starting from design and execution of the capital facilities to the management of distribution system including collection of revenue, from the consumers. | Maharashtra Water Supply and Sewerage Board for some limited towns.<br>Hyderabad Water Supply and Sewerage Board.<br>Bangalore Water Supply Sewerage Board.<br>Rajasthan Public Health Engineering Department. |
| II. | Specialist agency's responsibilities are limited to bulk water supply to Municipal Towns and Internal distribution and management including cost recovery, is with the Municipal Council. | |
| | Approach @ Location wise: | Karnataka Water Supply and Sewerage Board.<br>Maharashtra Water Supply and Sewerage Board. |
| III. | City level specialist agency has the overall responsibility for water supply functions but it is dependent on the State Agency for design and execution of the capital facilities. | (a) Lucknow Jal Sansthan.<br>(b) Jhansi (Banda) Jal Sansthan. |
| IV. | City Municipality has the overall responsibility for the water supply functions but it is dependent on State agency for the design and execution of the capital facilities. | Municipalities/Corporations in various states. |

7.3 In the case of Specialist Agency responsible for fixing of water tariff & also for recovery from the consumers, there is some rational approach in price determination. These agencies have sufficient freedom to fix the water tariff as well as to revise the same from time to time. Maharashtra water supply sewerage board is revising the tariff every year. However situation differs from State to State.

7.4 In case of model No. II the responsibility of supply of water in bulk upto the service reservoirs point is with the specialist agency. The tariff, for supply of water in bulk is also decided by the specialist agency and revised from time to time. The bulk consumers are the urban local bodies. They get the following advantages.

1. The supply of good quality of water at their doorstep is assured.
2. The payment can be delayed to any extent as the quantity of water can not be reduced or stopped by the specialist agency even if the payments are not made.
3. For individual consumers to whom water is supplied by the local bodies, the tariff structure is kept low.
4. Adequate funds are collected from the consumers even with the low tariff, for the payment to the staff in charge of maintenance of distribution sytstem.
5. Surplus cash is available (due to non payment of bulk water charges) from which improvement works such as laying of additional lines, etc. can be undertaken.
6. Consumers are quite happy as the water tariff is not revised for a couple of years.

7.5 In the case of model No. III, the main disadvantage is that of augmentation schemes to be planned in time and executed by specialist agencies.

In case of model No. IV, the agencies i.e. the local Urban bodies are managing the complete affairs of the distribution system, including fixing of tariff, recovery from consumers etc. Only for augmentation schemes they have to depend upon the State Government for administrative approval, loans etc.

7.6 Majority of the Municipal bodies are covered under Model No. IV.—More attention is needed for these categories, where even the level of service is not to the desired standards, the tariffs is low, the recovery is poor, and even the technical staff (if any) employed by the local bodies is not qualified nor experienced in the profession.

## 8. FIXING OF TARIFF:—

8.1 Number of models can be worked out for fixing of tariff. Most commonly followed is the charging the non domestic consumers at a much higher rates i.e. 5 to 6 times the domestic rates and at the same time charging differential tariff to the consumers using more quantity of water. This is indirectly subsidising the tariff of the major consumers. However, the water tariff should cover:—

**(A) Variable charges (Direct charges)**

1. Operation and maintenance expenditures (salaries, wages, electricity bills, chemicals, including attending leaks, repairs etc.)
2. Expenditure on billing, collection of revenue, maintenance of accounts etc.
3. Depreciation charges on the capital cost, of pumping machinery, and other civil and mechanical works.
4. Royalty charges to State Governments for the raw water charges for drawal of waters from the rivers and canals etc.
5. Absorption of losses of the previous years.

**(B) Fixed charges (Indirect charges)**

i. Payment of interest on the various loans obtained from State Government/Financial Institutions.

ii Repayment of loans in the fixed or predetermined instalments.

8.2 We have already seen that the fixed charges (indirect charges) make the water supply tariff structure extremely unviable (see Table No. II).

## 9. OBSERVATIONS

9.1 Functioning of the Urban administration in general is not satisfactory and there is general unwillingness to increase the tariffs.

9.2 The overall level of service is not satisfactory.

9.3 The local bodies are not in a position to raise the tariff frequently.

9.4 The loan and interest liability of capital works of water supply and sanitation schemes, can not be met from water supply revenue.

## 10. PRIVATISATION

10.1 As the water supply and sanitation sector is a highly subsidised one, there is not much attraction for the private sector to come forward on their own account to share the responsibility. Few attempts have been made by some authorities for entrusting the work of complete system on Boot (Build, own, operate and transfer) system. The outcome of such proposals are yet to be know. The present price structure is so low as compared to the actual cost of production, private sector is not going to be attracted.

10.2 Secondly the private sector can undertake only the Augumentation scheme i.e. bringing the water upto the service reservoir points. They may not be interested in taking over the complete system as a whole since in the most of the cities, the existing distribution systems are quite old.

10.3 Thirdly the private sector has to sell the water in bulk to the Municipal Towns. When the Private sector is aware about the financial status and also of financial administration of Urban Local Bodies, they are not sure of the recovery of the water bills. They are aware of the outstanding arrears of the bills of water supply authorities.

10.4 However if the State and Central Government, takes keen interest and encourage privatisation by giving concessions in tax, guarantee for payment etc., the private sector may come forward.

10.5 As an initial stage the operation and maintenance activities like running of pumps, maintenance of pumping mains, etc. can be entrusted to private sector. Such activitiy has been already started by Maharashtra Water Supply and Sewerage Board, about 6 years back and it is working smoothly.

10.6 Similarly the activity of water billing and also collection of revenue can be undertaken by private sector. This is bound to increase the revenue recovery.

## 11. CONCLUSION

11.1 For day to day operations there should not be any subsidy and by act it should be compulsion on the local bodies to recover the O&M cost from the consumer by revising the tariff.

11.2 The water tariff should be increased by modifying the Municipal Act, by minimum 15% on 1st of April each year.

11.3 The grant in aid to be given to the capital works should have a direct relation to the cost of production.

11.4 The problem is more acute with municipal bodies having present population less than 5 lakhs and more attention is needed to study the existing price structure.

11.5 As the number of non domestic users is very limited, in middle class towns; the cross subsidization of domestic water tariff can not be effectively utilised.

11.6 To increase participation of private sector high power committee, consisting of Central and State Government officials, experts from water supply sectors, financial and technical experts from Private sectors, learned elected representatives, should be formed. Unless some effective slops are taken it is likely that private participation will remain as a subject of discussions only.

11.7 Financial Institutions should evolve repayment structure in such a way that in the initial stages of commissioning the financial burden on local bodies is less and should be increased gradually.

## ANNEXURE I

### 1. CASE STUDY OF SOLAPUR WATER SUPPLY SCHEME:

Solapur Municipal Corporation has a population of @8.16 lakh in 1996 and the scheme under execution is designed for production of 150 mld in the year 2026. The source of water is Ujani Dam and is located at a distance of 100 Km,. The diameter of the pumping main in 1016 mm O.D., 10 mm thick, M.S. Pipeline of 45 Km. and remaining length is of 1100 mm PSC pipeline. The works of all the components of the scheme are in full swing, including the treatment plant, pumping stations etc. and the scheme is expected to be commissioned in April 1997.

### 2. FINANCIAL PATTERN OF THE SCHEME:

The scheme has been approved by Government prior to the revised pattern of finance i.e. in 1993, as detailed below.

Total cost of the scheme Rs. 745.40 Millions.

(a) Grant in Aid by Government — 23.33% i.e. Rs. 173.90 Million

(b) Loan from Housing & Urban Development Corpn. — 66% i.e. Rs. 496.96 Million

(c) Solapur Municipal Corpn. Own Finance— 10% i.e. Rs. 74.54 Million

The loan to be obtained from Housing and Urban Development Corpn. (HUDCO) would be @Rs. 497.00 million, with 14% interest and repayment period of 15 years with moratorium period of 4 years (construction period).

### 3. WATER DEMAND:

The present water supply to the Solapur Town from different sources is @112 MLD. Therefore the utilisation of water from the new source is indicated in Table No. I below.

**TABLE NO. I**

| Year | Total Demand in MLD | Water Supply from existing source in MLD | Water supply from New Source | | |
|---|---|---|---|---|---|
| | | | Domestic MLD | Industrial MLD | Total MLD |
| 1997 | 134.84 | 112.50 | 16.64 | 5.70 | 22.34 |
| 2002 | 151.89 | 112.50 | 29.34 | 10.05 | 39.39 |
| 2007 | 168.94 | 112.50 | 42.04 | 14.40 | 56.44 |
| 2011 | 182.50 | 112.50 | 52.14 | 17.86 | 70.00 |

Industrial Demand is assumed as @25% of total demand.

### 4. OPERATION & MAINTENANCE CHARGES:

The direct charges or the actual operation and maintenance charges for the new source will include the energy charges, required to operate the pumps, cost of chemicals and the salaries etc. of the operating persons. The estimated actual O&M (direct) charges and the corresponding operating rates have been indicated in Table No. II below.

**TABLE NO. II**

| Year | Total O&M charges Rs. Million | Corresponding Production rate per cum |
|---|---|---|
| 1997 | 23.39 | 2.85 |
| 2002 | 44.40 | 3.09 |
| 2007 | 75.44 | 3.66 |
| 2011 | 110.07 | 4.31 |

**Note:** While working out energy and other charges, 5% price rise has been considered. It will be seen from the above Table No. IV that the actual O&M cost is fairly reasonable.

## 5. IMPACT OF LOAN AND INTEREST ON THE WATER RATE:

As per terms and conditions of loan sanctioned by HUDCO, the interest rate is 14% per annum and is to be paid half yearly and the capital is to be repaid in 11 equal installments, with four years (constrcution period) as moratorium period. Table No. III shows the amount to be paid each year including interest and capital repayment. The interest for the first four years has been capitalised.

**TABLE NO. III**

Net loan Amount Rs. 497.00 million

| Sr. No. | Year | Capital | Instalment | Interest | Total | Remarks |
|---|---|---|---|---|---|---|
| 1. | 1993 | 45.70 | | 6.40 | 6.40 | Int. from |
| 2. | 1994 | 237.00 | | 33.18 | 33.18 | 1993 to |
| 3. | 1995 | 441.00 | | 61.74 | 61.74 | 1996 has |
| 4. | 1996 | 497.00 | | 69.58 | 69.58 | been capita- |
| | Capitalised int. | 209.78 | | | | lised |
| | | 706.78 | | | | at 14% |
| 5. | 1997 | 642.53 | 64.25 | 89.95 | 154.21 | |
| 6. | 1998 | 578.28 | 64.25 | 80.96 | 145.21 | |
| 7. | 1999 | 514.02 | 64.25 | 71.96 | 136.22 | |
| 8. | 2000 | 449.77 | 64.25 | 62.97 | 127.22 | |
| 9. | 2001 | 385.52 | 64.25 | 53.97 | 118.23 | |
| 10. | 2002 | 321.26 | 64.25 | 44.98 | 109.23 | |
| 11. | 2003 | 257.01 | 64.25 | 35.98 | 100.23 | |
| 12. | 2004 | 192.76 | 64.25 | 26.99 | 91.24 | |
| 13. | 2005 | 128.51 | 64.25 | 17.99 | 82.24 | |
| 14. | 2006 | 64.25 | 64.25 | 9.00 | 73.25 | |
| 15. | 2007 | 0.00 | 64.25 | 0.00 | 64.25 | |

The loan repayment liability will be completed by year 2007 and after that the production cost would reflect only the operation and maintenance cost.

## 6. TOTAL PRODUCTION RATE

While fixing the water rate, one has to consider, the fixed costs and the variable costs as indicated above. Table No. IV, shows the production rate due to actual O & M charges (Direct charges) and due to indirect charges (i.e. due to interest and repayment of loan).

**TABLE NO. IV**

**FINAL PRODUCTION RATE PER CUM**

Rate in Rs. Per Cum

| Year | Production rate due O & M charges | Production rate due to interest & loan liability | Total production rate | Remarks |
|---|---|---|---|---|
| 1997 | 2.85 | 18.91 | 21.76 | |
| 1998 | 2.86 | 15.41 | 18.27 | |
| 1999 | 2.89 | 12.79 | 15.68 | |
| 2000 | 2.94 | 10.71 | 13.65 | |
| 2001 | 3.01 | 8.99 | 12.00 | |
| 2002 | 3.09 | 7.60 | 10.69 | |
| 2003 | 3.18 | 6.42 | 9.60 | |
| 2004 | 3.28 | 5.41 | 8.69 | |
| 2005 | 3.40 | 4.53 | 7.93 | |
| 2006 | 3.53 | 3.78 | 7.31 | |
| 2007 | 3.66 | 3.12 | 6.18 | |
| 2008 | 3.81 | 0.00 | 3.81 | Full repayment of loan & int. |
| 2011 | 4.31 | 0.00 | 4.31 | |

## 7. POINTS FOR CONSIDERATION:

(1) The water tariff charged to the consumer by Solapur Municipal Corporation in 1995-96 is Rs. 1.75 per cum. Whether it be increased by 12.50 times to make the scheme self supporting & to suit the loan repayment structure?

(2) Is the interest and the loan repayment schedule makes the scheme financially viable?

## 8. NEW POLICY OF GOVERNMENT OF MAHARASHTRA:

As per the new policy of financing the water supply schemes, by Government of Maharashtra, which is applicable from 15.09.1994, the cost of the scheme upto a distance of 8 Km. from the city area will be borne by Government. This policy is not applicable to Solapur Water Supply Scheme as the schemes was sanctioned in 1993. If this new policy is made applicable to Solapur W.S.Scheme, the financing pattern of the scheme would be as follows:

| | | | |
|---|---|---|---|
| (1) | Total cost of the scheme | — | Rs.745.40 million |
| (2) | Cost of the scheme beyond 8 Km. of city limit which is to be borne by Government (or subsidised) | — | Rs. 535.10 million |
| (3) | Cost of the scheme of Solapur Municipal Corpn. for normal financing pattern. | — | Rs. 210.30 million |
| (4) | Grant in AID by Government at 33.33% | — | Rs. 49.06 million |
| (5) | Loan by HUDCO for 77.66% | — | 161.24 million |
| (6) | Total grant in Aid by Govt. (i.e. 538.10 49.06) | — | Rs. 584.16 million |

Thus the liability of Government to pay grant in aid in the old financing pattern was Rs. 173.90 million would be increased to Rs. 410.26 million and that the loan component of Solapur Municipal Corporation would be decreased from Rs. 497.00 million to Rs. 161.24 million.

The production rate with the new policy would be as indicated in Table No. V.

**TABLE NO. V**

Loan Amount Rs. 161.24 millions
Rate per Cum.

| Year | Production rate due to O&M charges | Prod. rate due interest and loan liability | Total production rate | Ramark |
|---|---|---|---|---|
| 1997 | 2.85 | 5.70 | 8.55 | |
| 1998 | 2.86 | 4.65 | 7.51 | |
| 1999 | 2.89 | 3.86 | 6.75 | |
| 2000 | 2.94 | 3.23 | 6.17 | |
| 2001 | 3.01 | 2.71 | 5.72 | |
| 2002 | 3.09 | 2.29 | 5.38 | |
| 2003 | 3.18 | 1.94 | 5.12 | |
| 2004 | 3.28 | 1.63 | 4.91 | |
| 2005 | 3.40 | 1.36 | 4.76 | |
| 2006 | 3.53 | 1.14 | 4.67 | |
| 2007 | 3.66 | 0.94 | 4.60 | Full repayment |
| 2008 | 3.81 | 0.00 | 3.81 | of loan & int. |
| 2011 | 4.31 | 0.00 | 4.31 | |

## 9. PRIVATISATION:

Because of the cost of the scheme being highly subsidised there are less chances of private enterprisers to enter into this field. Assuming the whole scheme is financed by HUDCO on the same terms and conditions to the private party, the production rate would work out as indicated in Table No. VI.

## TABLE NO. VI

Total loan Rs. 745.40 million
Rate of interest 14%
100% loan

| Year | Production rate due to O&M charges | Prod. rate due to interest and loan liability | Total production rate | Ramarks |
|---|---|---|---|---|
| 1997 | 2.85 | 28.98 | 31.81 | |
| 1998 | 2.86 | 23.60 | 26.46 | |
| 1999 | 2.89 | 19.59 | 22.48 | |
| 2000 | 2.94 | 16.41 | 19.35 | |
| 2001 | 3.01 | 13.77 | 16.78 | |
| 2002 | 3.09 | 11.64 | 14.73 | |
| 2003 | 3.18 | 9.84 | 13.02 | |
| 2004 | 3.28 | 8.28 | 11.56 | |
| 2005 | 3.40 | 6.13 | 10.33 | |
| 2006 | 3.53 | 5.79 | 9.32 | |
| 2007 | 3.66 | 4.78 | 8.44 | Full repayment of loan & interest. |
| 2008 | 3.81 | 0 | 3.81 | |
| 2011 | 4.31 | 0 | 4.31 | |

It will be seen from the above Table No. VI that the actual production rate to the private enterpriser works out to Rs. 31.80 say Rs. 32/per cum in 1997 as against the present water rate or Rs. 1.75 per cum charged to public by Solarpur Municipal Corporation.

The private enterprisers profit, losses in distribution system etc. have not been taken into consideration for the present.

Therefore the chances of complete privatisation of urban water sector on BOOT (BUILD OWN OPERATE AND TRANSFER) system are not very remote, if the present policy of financing is continued by Government.

Comparison of rates due to different financial pattern is indicated in Table No. VII.

## TABLE NO. VII

### FINAL PRODUCTION RATE PER CUM WITH DIFFERENT PATTERN OF FINANCE

| Year | As per sanctioned schemes i.e. 23 1/3% G.I.A. | As per new pattern i.e. 100% GIA upto 8 Km. | 100% loan & No. GIA | Ramark |
|---|---|---|---|---|
| 1997 | 21.76 | 8.55 | 31.81 | |
| 1998 | 18.27 | 7.51 | 26.46 | |
| 1999 | 15.68 | 6.75 | 22.48 | |
| 2000 | 13.65 | 6.17 | 19.35 | |
| 2001 | 12.00 | 5.72 | 16.78 | |
| 2002 | 10.69 | 5.38 | 14.73 | |
| 2003 | 9.60 | 5.12 | 13.02 | |
| 2004 | 8.69 | 4.91 | 11.56 | |
| 2005 | 7.93 | 4.76 | 10.33 | |
| 2006 | 7.31 | 4.67 | 9.32 | |
| 2007 | 6.78 | 4.60 | 8.44 | Full repayment of loan |
| 2008 | 3.81 | 3.81 | 3.81 | Rate are same for all the three pattern |
| 2011 | 4.31 | 4.31 | 4.31 | |

## 10. CONSTRAINTS OF WATER INDUSTRY:

It is very essential to know the constraints on water supply industry in comparison with the other industries.

(1) After completion of any industry and even before commencement, more efforts are made to sale the product and book the capacity to the maximum extent. While in water supply industry, we want to conserve water and limit the supply in proportion to the population and reach the designed capacity at the end of the designed period.

(2) The returns from the sale of water increase at a very slow rate (or in proportion to the population increase rate).

(3) Because of the typical conditions of financial institutions to pay interest on outstanding balance there is too much burden in the initial stage, when the producion of water is on a limited scale. Therefore the actual production rate is very high in the beginning and goes on reducing, gradually and there is a substantial reduction in rate after complete repayment of loan.

(4) For improving the distribution system, substantial amount of investment is essential. For instance in case of Solapur W.S. Scheme the scheme of Augmentation of distribution system is estimated to cost @Rs. 40 million which may work out to 50% of the estimated cost of the source augmentaion scheme. Such schemes add only the financial burden on the Municipal council without increase in the quantum of water. The grant in aid allowed is limited to only 23 1/3% for distribution schemes.

## 11. FIELD REALITIES:

The existing water supply is managed by Solapur Municipal Corporation. The rate of domestic water supply is Rs. 1.75 per Cum in 1996 and that of non domestic is Rs. 8.50 per Cum. The revenue and expenditure figures for the year 1995-96 as obtained from Solapur Municipal Corporation are as follows:

**TABLE NO. VIII**

| Head of Account | Year 1995-96 Amount in Rs. Million |
|---|---|
| Expenditure on | |
| (1) Salary | 11.06 |
| (2) Chemicals | 4.80 |
| (3) Repairs & Maintenance | 5.68 |
| (4) Power | 5.30 |
| (5) Raw water charges | 8.00 |
| Total O & M cost | 85.50 |
| (6) Interest & loan liabilities | 25.10 |
| (7) Total expenditure M.W.S. | 110.68 |
| (8) Total revenue | 60.00 |
| (9) Deficit | 50.68 |

The present water rate is very low and there is a deficit of Rs. 25.5% millions in revenue & actual expenditure. Thus the water rate is further subsidised by the Solapur Municipal Corporation, from their own sources of income.

## 12. RECOMMENDATIONS:

(1) To boost the urban water supply it is essential for other state governments also to change the policy of financing and should follow up the policy of the State of Maharashtra.

(2) The financial institutions should have soft terms and conditions of financing for water supply schemes, (being a social sector) so as to keep down the production rate within an affordable limit.

(3) Governmnent should issue directives to all local authorities to increase the water rates at minimum 15% each year to meet the price increase. Kerala Government has implemented this recommendation.

(4) Water rates should be increased gradually each year during the construction period of the scheme and this should be treated as a prerequisite for sanctioning the loan.

(5) To encourage private sector participation, Govt. has to step in, to see that the water rate is within the affordable limit. Normally it is presumed that the water produced by the private enterpriser would be sold in bulk to Solapur Municipal Corporation. In such case Solapur Municipal Corporation may not agree to purchase the water even at an average rate of initial five years of Rs. 24.00 per cum.

As stated above by entrusting the work to a private enterpriser Govt. is saving Rs. 584.16 million, which Govt. would have given as grant in aid to Solapur Municipal Corpn. It should be considered whether the interest that would have been earned by Govt. could be given to Solapur Municipal Corporation for first few years to afford the Corporation to purchase the water from the private enterprises. This needs further financial analysis and in depth special study.

ANNEXURE — II

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

## NEW DELHI

**25-27 September, 1996**

## HUMAN RESOURCE DEVELOPMENT

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**HYDERABAD METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD**

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# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS
# NEW DELHI

## 25-27 September, 1996

## Theme: HUMAN RESOURCE DEVELOPMENT


## V. LAKSHMIPATHY* & V. BHASKAR**


### I. THE WATER AND SANITATION SECTOR IN INDIA

Water constitutes one of the most crucial resources in planning for developing, maintaining and improving the health of citizens. Investments in enhancing the effectiveness of managing water resouces can be among the most fruitful that a country can make for its future. As the country prepares itself to enter the 21 century, efforts to develop, conserve, utilise and manage this all-important resource have to be guided by national perspectives. [1]Development efforts inexorably boost-up the demand for water from almost all sectors of economy-domestic, industry, agriculture, power generation, transportation, tourism etc. The importance of water is reflected in the Globally accepted norms for measuring status of development of a country where-in, the percapita consumption of water is treated as an important indicator of the state of development.

The country has witnessed a marked acceleration in urbanisation over the past two decades. Presently urban population, constitutes over 31% (307 of 1007 million) of the total population and as the trends indicate may rise to 34% (364 of 1086 million) by the turn of the century. The Eighth Plan targets for providing drinking water and sanitation service in the rural and urban areas, stand at 82% (251 of 307 million) and 60% (185 of 307 million) respectively and by the end of the Ninth Plan, the entire urban population (100%) is estimated to be brought under the umbrella of protected water supply. In addition to the onerous task, augmentation and rehabilitation facilities would be have to be provided to the population already covered. It can be easily seen that extension of the service even at the minimum level for the size of population envisaged under the plan, entails massive investment in the development of the resource in addition to enhancing the technical and management skills in the sector.[2]

In India, the primary responsibility for both water supply and sanitation and for local government the main channel for urban management rests with the state governments. However, the central government wield considerable influence in the process of according approval for state development plans and through the central institutions dispersed in all the states. The ministry of Urban Affairs and Employment[3] was the nodal agency for this sector at the beginning of the Seventh Plan. Subsequently, rural water and sanitation have been transferred to the department of Rural Development, while the administration of urban water supply and sanitation continues to be retained with MUA&E. Rural water supply is also an important constituent of the state sector-Minimum Needs Program (MNP).

In 1986, the National Drinking Water Mission (NDWM), popular as the "Technology Mission" was launched in order to provide scientific and cost-effective content to the Centrally Sponsored Accelerated Rural Water Supply (ARWSP). A portion of the funds made available under the rural employment Programme and the Indira Awas Yojna, was to be earmarked for rural sanitation. Rural sanitation was also added to the State sector MNP from 1987-88 through the newly launched Centrally Sponsored Rural Sanitation Programme (CRSP). In the later half of the Seventh Plan, the UNICEF came forward to support Government efforts for provision of rural sanitation in certain States.[4]

The wide band of efforts and allocations indicate a pronounced stress on improving the rural water supply and sanitation sector (RWSSS) and the urban counterpart, as the plan allocations indicate, is left with no choice other than either to perform under decreasing plan outlays, or search and secure funds for investment on its own. The paradigm shift is reflective of the country's agenda on inter sector priorities.


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1. National water Policy, Government of India, Ministry of water resources, New Delhi, 1987.
2. Eighth five year plan, 1992—1997. GoI, Planning Commission, New Delhi.
3. Formerly Ministry of Urban Development, GoI.
4. *Ibid.*

The National Approach to the Water Supply and Sanitation Sector also recognises, by the inclusion of the guidelines set-out in the New Delhi Declaration, adopted by the U.N. General Assembly in 1990:[5]

* Protection of the environment and safe guarding of health through the integrated management of water resources and liquid and solid wastes;
* Organisational reforms, promoting an integrated approach and including changes in procedures, attitudes and behaviour and the full participation of women at all levels;
* Community managment of services, backed by measures to stregthen local institutions in implementing and sustaining water and sanitation programs; and
* Sound financial practices, achieved through better management of existing assets and extensive use of appropriate technologies.

The strategy approach enunciated some important guidelines for improving the mangement of water resources:[6]

- Water has to be managed exactly the same way as any other economic good;
- Supply of water should normally be based on the principle of meeting effective demand and to the standard of services, that the users are willing to maintain, operate and finance;
- Urban local bodies should be encouraged to levy and collect appropriate user-charges, whereby, at least the operation and maintenance costs, if not further development, becomes self sustaining;
- Levying of water tariff may not be feasible in all places in the rural sector. However, where house-service connections are provided, it may be appropriate to levy water-tariff and realise revenue to render operation and maintenance self-sustaining to the extent possible;
- Private sector efforts for construction and maintenance of drinking water projects should be encouraged and investments from the credit market should be mobilised to the maximum extent feasible;
- Local bodies, whether in rural or urban areas, should be saddled with the responsibility of managing the operations and maintenace of the system installed, on their own-with technical guidance from government agencies; and
- Appropriate links should be forged between water supply and environmental sanitation (solid and liquid waste management) in planning of new programs.

In pursuance of the Policy Approach and the Plan Strategy, the water supply and sanitation sector was provided with a budgetary support of Rs. 16711 Crores in the Eighth Plan. However, a mid-plan performance evaluation of the WSS sector revealed the following achievements and disappointments:[7]

- Performance of the Centrally Sponsored Accelerated Rural Water Supply Program and national Drinking Water Mission was less than satisfactory;
- The concept of "total environmental sanitation" was not clearly understood. Programs of rural sanitation, primary health care, access to water, removal of illetracy and women welfare were not appropriately integrated;
- Sanitation, quite often was treated as mere construction of latrines rather than an integral component of the total package of public health service;
- In actual implementation of water supply schemes, the needs of backward and poorer sections have not received priority commensurate with the plan agenda;
- There was a wide gap between the installed capacities of safe disposal of waste water and drinking water supply in urban areas;
- Pricing of water to reflect cost of production in real terms, billing and collection of tariff revealed scope for considerable improvement;
- Wastage and leakage of water were substantial and needed corrective action;
- Sensitivity to cost-effectiveness in the development of programs and efforts at coupling it with similar programs were found lagging behind the requirements; and
- Operations and maintenance of the installed systems showed blight resulting in huge pileup of backlog operations and slippage in the time frame in completing new projects.

5. *Ibid.*
6. *Ibid.*
7. *Ibid.*

The spirit of the observations of the analysis finds an echo in the technical leterature published by the World Bank.[8] "Among the major impediments to meeting the IDWSSD goals are a scarcity of expertise for planning good projects and the lack of globally accepted project preparation standards."[9].

"Within the sector, essential conditions are missing for adopting a structural approach commensurate with the long term corporate policy.., Such a policy should imply quite some institutional consequences for which the actual climate in the sector is not sufficiently receptive"

The human and financial resources in the sector could have been used more efficiently if water and sanitation projects had initally been prepared in accordance with the "standards" to meet the norms and stipulations of the approving authorities and financing agencies.[10] The term 'Standards' implies, both the set of rules specifically those governing water development and use and the organisational arrangements involved in the formulation and implementation of laws, policies, strategies, and programs relating to water resources. Together, these rules form the "enabling environment" for water resource management. Developing responsive changes in the rules as well as the organisational arrangements and enhancing the effectiveness of human resource utilisation would be the primary requisites for translating the national policies on water resources management into action programs. The changes should help in accelerating the implementation of policies and should provide incentives for improved performance in the sector. *The strategy formulation process should include an apportunity to evaluate whether institutions and human resources programs effectively serve in achieving the goals.*[11]

The thematic foci of the present paper being Human Resource Development in the water and sanitation sector, it is proposed to recapitulate the agenda of the sector goals related to the theme, analyse the function and role of human resource in achieving the goals, scan for identifying the current status of the resource management, diagnose for locating the constraints on the improvement efforts and finally develop a framework for improvement efforts.

Provision of access to good quality and scale of water and sanitation service to the community, followed by ensuring sustainability-known as the "old and the new agenda", constitute the sector goals. The "Old agenda" pertains to provision of household water and sanitation services to large number of people and the "new agenda", requires sustainable, environmentally sensitive use of water resources. The challenge facing developing countries and the multilateral agencies that support their development efforts-is to attend to the new agenda even while continuing to address forcefully the uncompleted old one.[12]

Interventions-national and even international to improve the sector, very often have remained sub-optimal in their achievements, despite the wide realisation that water is an increasingly scarce resource requiring careful economic and environmental management and the human resource plays a vital role in achieving the goal. The situation continues to be exacerbated by rapid population growth and uncontrollable urbanisation. The competition between various sectors of economy for water is already severe and the engineering and environmental costs for scaling-up the quantities or for augmenting the existing water sources, are escalating with equal rapidity.

New challenges technological, financial, social and cultural are emerging rapidly. They need to be addressed apriori, if the sector has to demonstrate the resolve to achieve the set goals. The emerging challenges, which also operate as constraints on the sector operations can be grouped into three categories:

1. **Physical and Technical Constraints:**
   a. Location of user settlements on difficult sites and terrain leading to complicated layouts, incompatibility between design standards and actual operations;
   b. Increasing distances between source and delivery points;
   c. Over reliance on conventional technology and service-delivery systems;
   d. Lack of awareness of the need to encourage conjunctive use of the resource;
   e. Fragmented management of water resources; and
   f. Lack of clarity in the methods and procedures for transferring the developments, in thechnology and management.

8. John M. Kalbermatten, in the foreword to "Water Supply and Sanitation Project Preparation Handbook", by Bria Grover, world Bank Technical Paper Number 12, Washington DC. 1983.

9. Staff appraisal report, World Bank, 1990.

10. "Urban policy and Economic Development", World Bank Policy Paper, IBRD, Washington, 1991.

11 Guy le Moigne ct at. editors, "A guide to the formulation of water resources strategy", World Bank technical paper number 263, Washington DC, 1994.

12. Ismail Serageldin, "Water supply, sanitation and environmental sustainability"—the financing challenge, the World Bank, Washington, D.C. 1994.

**Economic and Financial Constraints:**

a. Inadequate concern to the increases in the cost of development and delivery;

b. Rising cost of water and sanitation services against static real incomes;

c. Lack of reliable land records and increasing cost of land procurement;

d. Emigration of crowding out of the capital from the sector;

e. Absence of dynamic debt market;

f. Reticent attitude of the sector towards the concept of cost recovery;

g. Poor financial rate of return; and

h. Growing inter sector competition for budgetary support and the resultant decline in the allocations to the sector.

3. **Institutional and Personnel Constraints:**

a. Lack of sensitivity on the part of the sector personnel to the dynamic nature of issues involved in the management of urban water supply and sanitation sector, leading to severe technological institutional and managerial obsolescence;

b. Complicated and over extended administrative systems and weak organisational structures and severly outdated personnel pratices;

c. Lack of consumer sensitivity, pronounced preference for perpetuating the status, safety, security and anonymity latent in pulbic bureaucracies;

d. Preference to perpetuate grant dependent, supply management oriented systems as against demand driven, financially self reliant and sustainable service systems;

e. Lack of appreciation of the role and importance of personnel management or equating it with "establishment", leading to systemic haziness and distortions in the functions and procedures of manpower planning, procurement, retention and career advancement as well as management succession;

f. Absence of scientific job analyses, the resultant overlap or clash in responsibilities, authority and erosion of accountability, lack of job specifications and over staffing in unskilled or semi skilled levels;

g. Paucity of training opportunities to facilitate transfer of knowledge and skills and enhancement of staff caliber;

h. Lack of professional skills in problem identification, analysis and solving; and

j. Lack of scientifically structured decision support systems-covering the tendem of responsibility, authority and accountability.

Most of constraints are a legacy of the past, when sources of supply were abundant in the range as well as quantities. The water supply and sanitation systems used to be conceived and evaluated only on the technical or engineering implications and advantages. Populations to be served were modest in size, the governments were comparatively light in respect of the load of investments on social services and the employees enjoyed the benefits of status and authority. Provision of the service in slums and squatter settlements was a non issue as the population there-in was expected to wait for the state benevolence rather than demand it as a right. The concept of consumer participation in the delivery of service was conspicuous more by absence and at times as a gesture of good will on the part of the provider.

As against the comfortable' scenario of the past, the present has changed radically. Sources of supply are increasingly becoming scarce, inadequate and subject to competing demands from agriculture as well as industry. Uncontrolled development in the river basins as well as watersheds, has become the order of the day. Un-restrained practices of letting untreated and hazardous effluents into water courses are a rule rather than exception. The governments State as well as Central-are increasingly becoming reluctant to extend financial support to the urban sector, which is understandable especially in the light of the dominance of rural segments in the legislatures. Internally, the water supply and distribution

systems are known to be aging far beyond their legitimate life spans and vulnerable to high levels of physical leaks and pilferage. Un-planned developments have wrought havoc on the quality of water and scale of service. The citizens are becoming increasingly strident in their demand for better level and quality of service. They are appearing equally averse to accept tariff revisions, which they perceive as attempts to "fob-off" the cost of an inefficient system on its users.

The sector professionals need to appreciate the fact that the environment for "Change" has set-in and can neither be altered or reversed. The direction and pace of the change, the magnitude, and the complexity have increased-both on the scale as well the composition-significantly during the last decade and the forecast is for no less in the years ahead! Organisational survival can no more be dependent merely on state patronage alone!!

Sector organisations, in order to survive need to develop a new stance and attitude, whereby respeonse time to the consumer demands needs to be hived rapidly. The erstwhile complacence on abundance and state of perpetuity need to be replaced with a growing incisiveness to manage the demand rather than supply. Since water has to be treated as any other resource, sector specific, techniques to improve financial viability, reliability and profitability are to be identified, disseminated and implemented. Scientific techniques in detecting and arresting Unaccounted For Water and for monitoring and sustaining water quality have become unassailable needs of the day. Techniques to encourge conjuntive use of water or conservation are to be identified and implemented on priority.

In all these efforts, which have the potential of improving the sector effectiveness and efficiency, competitive advantage can be derived through enhancing the qualaity of human resource and organisational systems and to adapt them to exploit the use of technology, rather than ownership per-se of technologies. The argument, in essence, is that a good strategy poorly implemented would soon be useless where as, the effectiveness of a qualitatively deficient strategy can be improved by efficient implementation.

The "New approaches", incorporated in the World Bank policy paper serve as a useful threshold for determining the direction and the content of Human Resource Development and Management Programs in the sector.

**The New Approaches:**

- Conceptualisation and application of an analytical framework incorporating cross-sectoral and environmental issues leading to integrated management of the river basin;
- Placing greater emphasis on incentives for efficeincy, financial accountability and profitability.
- Decentralising water service delivery,
- Prescribing and encouraging the participation of consumers in action planning for the improvement of supply and distribution systems
- Protecting, enhancing and restoring water quality and water dependent systems.
- Assigning greater priority to the provision of adequate services for the poor,
- Supporting research, development and adoption of low-cost technologies to conserve water and to enhance its quality.[13]

The Concept of Human Resource Development and Management, is presented in brief prior to exploring for its application in the sector.

## II. HUMAN RESOURCE DEVELOPMENT—CONCEPTS AND RELEVANCE.

Experience shows that the sector professionals enjoy high intellectual reputation and are extremely conscious of the need to improve the efficiency and effectiveness of the operations towards enhancing the level and qualaity of service. There is enormous enthusiasm to achieve higher profitability, customer satisfaction and competitiveness.[14] In translating the objectives in to goals-in-turn as clear tasks, jobs and activities, the sector managers attempt to achieve the following:

- Reduction in direct as well as indirect costs, lead times for operations and maintenance, customer complaints, energy consumption and usage of consumables,
- Increase in productivity, efficiency, reliability and predictability,
- Enhance the quality, flexibility and safety of operations, and

13. Water Resources Management. A World Bank Policy Paper IBRD working from 1993.

14. HRD Domestic Workshop. Summaries of Objectives and Action Plan RCUES-OU 1991.

15. "Human Resource Development:-The Field"- R.Wayne Pace, Philip C. Smith and Gordan E. Mills, Prentice Hall, New Jersey-1991

- Enhancing customer satisfaction as well as profitability.

The resource inputs and operations for achieving these goals, involve personnel, technology, and finance with appropriate competence in the management of operations—technical, personnel and finance and accounts, material, and tools and techniques for identifying, analysing, and solving problems in each of the activity areas. The strategy for implementation and the effectiveness may vary depending upon individual's grasp of the sector realities, knowledge and skills in managing all the elements cited. In the absence of management knowledge base or appropriate exposure through training, the sector managers either tend to be overly employee oriented or task oriented and both the approaches are known to fail in the long run. They need to be assisted in searching and securing the appropriate convergence of the two coordinates of effective management. Exposure to the knowledge and skills of HRD & M may help them in achieving the skill. As can be seen, the matrix for improvement has three coordinates: the people, the organisation and the technologies. While the later two are inanimate, the first one operates as a catalyst. The effectiveness of the catalyst is an important determinant of the efficiency of the other two HRDM primarily aims at improving the quality of the catalyst and by that the utilisation of other two resources and the convergence between the three HRD thus, aims at integrating the three important dimensions of Organisational Performance: Organisational Development, Individual Development and Career Development to maximize productivity, quality, opportunity to accomplish the goals of the organisation.[15] HRDM is an eclectic science and theory drawing from organised knowledge of sociology, psychology, clinical experience, mathematics, decision theories and cybernetics. The analysis takes into account three levels—Individual, Group and the Organisation. Anchored very wide, its orientation and practices involve certain cardinal assumptions on employees, organisation and performance. The assumptions, often taken as granted have much deeper implications.

**HRD ASSUMPTIONS:**

1. **EVERY EMPLOYEE HAS AN INHERENT WORTH**
2. **EMPLOYEES ARE RESOURCES**
3. **QUALITY OF WORK ENVIRONMENT IS A DETERMINANT OF PERFORMANCE**
4. **EMPLOYEES HAVE A RIGHT TO SATISFACTION**
5. **THE NEED FOR KNOWLEDGE & LEARNING IS CONTINUOUS**
6. **TRANSPARENT STRATEGY CREATES PROACTIVE STANCE TOWARDS CHANGE**
7. **HRD CONSTITUTES MORE THAN TRAINING**

- **Inherent Worth of the Individual:** Employees, on their own constitute an important asset. Individual worth, however, goes beyond this seemingly simple assumption. Organisational image for quality performance, reliability and sustainability are determined by the willingness on the part of the organisation to recognise the individual's contribution and taken into account in the work situation.

- **Employee is a Resource:** Employees, regardless of their position in the hierchy, have the potential to meet the present and future human resource needs of the organisation. A pool of skilled employees, engaged on a continuous basis in acquiring new skills, learning new ideas and preparing to occupy new positions in the organisation must always be available.

- **Quality of Work Environment:** The quality of work life is a legitimate and valuable concern. Employees have a right to safe, clean and pleasant surroundings in which they work. A development approach to employee relations means that organizations should constantly seek to improve the quality of their work environments.

- **Employee Satisfaction:** Employees have a right to be satisfied and feel good about the ways in which they contribute to the organisaiton. Fulfillment on the job comes from a deep seated satisfaction with the work entrusted. Organisation should constantly seek to redesign work, suited more to mature human beings than for robots. Jobs should have the potential to provide intrinsic work satisfaction so that a person's work provides adequate scope for appropriate fit between technology and talent.

- **The Need for Learning is Continuous:** Training and Development of employees can not be relegated to the status of sporadic occurrence Individuals do not enter the organisation in possession of the entire range of the knowledge and skills they need to fulfill every demand placed upon them. Although employees are selected on the basis of their proven competence to work at specific jobs, their knowledge, talents and skills must be refined and adapted and new competencies must be imparted and acquired to prepare them for handling responsibilities of higher order likely to arise in future. Any organisation that fails to help its employees prepare for the future, may not have future for itself!
- **Change Opportunities:** Transparency & Prepartion: Changing conditions, operating environment-user demand, resource availability, technology, legislative, political, strategic and economic limitations—necessitate continual prepartions of the employees to assume difference positions even of the same level in the organisation.
- **HRD constitutes more than Training:** The field involves an understanding of human behaviour, how people respond and relate to one another and how they contribute to organisation's productivity as well as to their own well-being. The implication is that employees need to have more than work specific knowledge.

**HRD IS A PROCESS OF IMPROVING THE SYSTEMIC PERFORMANCE THROUGH:—**

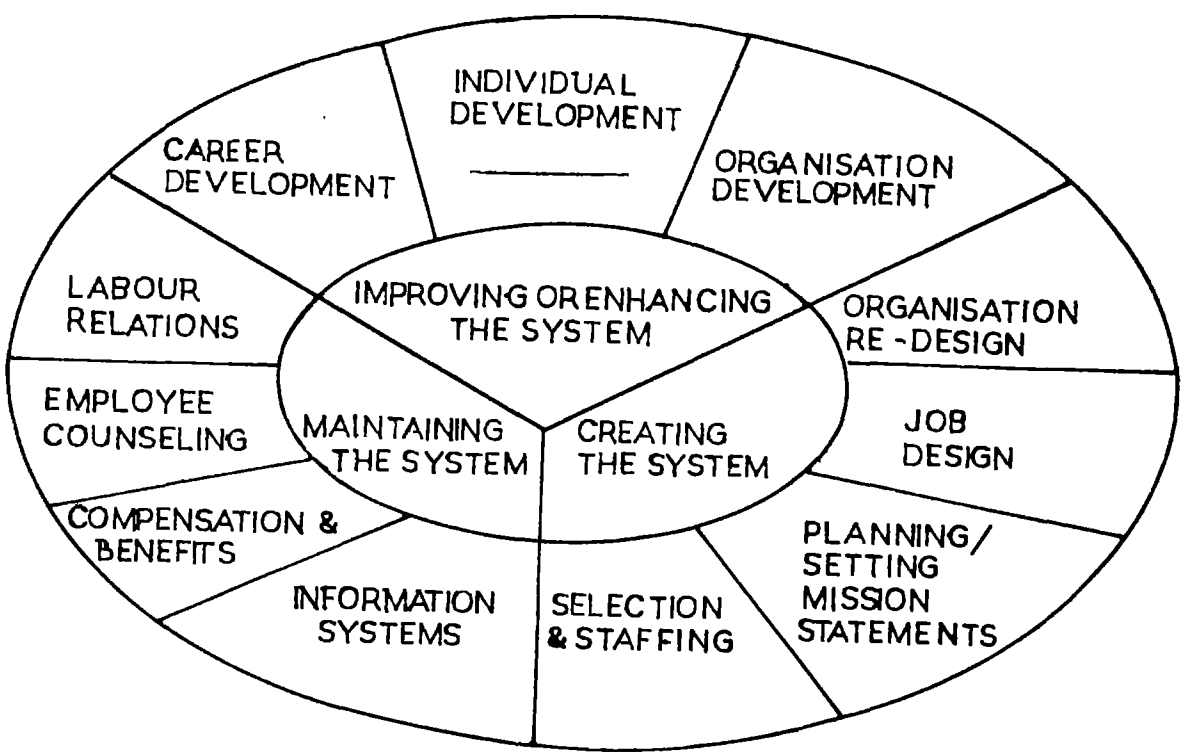
**HELPING EMPLOYES TO PERFORM CURRENT JOBS EFFECTIVELY**

**PREPARE THEM TO PERFORM DIFFERENT JOBS IN THE ORGANISATION: AND**

**MOVE UP TO HIGHER LEVELS OF GREATER COMPLEXITY AND RESPONSIBILITY.**

The concept and the related functions in organisations is schematically presented below:

**HUMAN RESOURCE DEVELOPMENT[16]**




16. Diagnostic Workshop Proceedings, 1993, RCUES-OU, HWSSP Task group.

As can be seen, Human Resource Development is primarily an approach to improve and sustain individual, Group and organisational effectiveness. Its application involves the integrated use of methods for individual development, career development, and organisation development, to converge into a performance improvement strategy.

**Individual Development (ID):** Involves helping employees indentify their strengths and weaknesses, build on those strengths, work at correcting their weaknesses and use their full potential to contribute to the effectiveness of the organization while achieving their own personal goals. Individual development is achieved through the skillful implementation of several functions—Job definition, Analysis learning needs, Program Designing and Action Planning and Training/Facilitating.

**Organisation Development (OD):** Focuses primarily on re-engineering the system—its structure, functions, reporting relationships endowment of responsibility, authority and accountability—and the processes of change that produce effective intra as well as inter unit dependencies. It is a processs of deliberate and reasoned introduction/reinforcement, establishment/sustaining the proactive change in Knowledge, Attitudes, Behaviour and Performance, to achieve the organisation's mission and improve it's effectiveness and health. Thus, OD emerges as a process of facilitating appropriate FIT between the various components of the performance loop in organisations:—

**Structure-Task-Group-Leader-Individual-Environment-Information-Structure.**

**Career Development (CD):** Focuses primarily on the match between the individual and the job and how the employee performs and shapes work roles and positions. The individual career development counseling makes CD a vital force in the organisation and contributes immensely to the development of its human resources.

The three principal operating systems of HRD and their implications also need to be appreciated to gain a comprehensive view on the role and functions of HRD:

**Creating the System:** The sub-elements are, Organisation Design, Job Design-content, specification, standards—Manpower Planning, Selection, Staffing and Induction. The term design connotes the process of planning for performance and includes exploration to identify the differentials in the job and position characteristics—the nature, content and level of complexity of work, tasks, role and standars, working conditions, primacy or importance of the job relative to other jobs as well as the unit performance—and the differentials between the various Organisational units and sub-units. The template of people-purpose-place-process, must be constantly used to define the requirements, such as task complexity, level of competence, scope for interaction with others etc. of each of the work station. The data base can further be analysed to define job content, man power requirements, position empowerment, definitions on accountability and compensation, etc.

**Improving/Enhancing the System:** Involves, the sub-elements of Career Development, Individual Development, and Organisation Development. The focus is on identification of the constraints on the present job tracks and the contributing factors, evaluation of the same with reference to their implications on the staff morale and levels of motivation, their instrumentality in enhancing employee commitment to organisational mission, their amenability to objective measurement, process of measurement/evaluation, transparency in recording and verifiability etc. The task stream includes defining the standards of efficiency and effectiveness pertaining each of the activity, congruence of reporting relationships amongst functions and positions and the scope for gang-planning where necessary.

**Maintaining the System:** Comprises of the sub-elements of Documentation, Labour Relations, Employee Assistance Grievance handling procedures, Compensation and Benefit Packages, Information Systems and finally labour relations-dedicated to maintaining and active work force and sharing a common base in sustaining the system.

As can be seen, the HRD scheme for applications, reveals emphasis on capacity development through knowledge or skill inputs and that is one of the reasons why most often HRD is oversimplified as the activity related to conducting training programs. There is also the justification for the misunderstanding—the other components of the HRD process, in a comparative sense, require enormous inputs in terms of physical, intellectual and financial efforts, longer lead times for demonstrable results to emerge, and may even stipulate active participation and support from the highest levels of decision making. Training, on the other hand is the easiest of all the activities. With the abundance of training institutions and opportunities as well as the topics for training—not all of them professionally competent organisations indulge in the ritual of sending people for training (the number of employees sent for training, the training days recorded, the cost incurred—all add up to impressive records!) possibly expecting the employees to utilise the newly acquired skills or knowledge without reservation. Such an approach—naive as it is, may even prove counter active to the organisational

mission. Training alone can never be attributed with the all encompassing role of solving all the organisational problems. Viewed fromt he HRD perspective, training by opening up the various vistas of personnel management, can sensities the personnel to the process of creating and sustaining efficiency and effectiveness in managing the employees. The knowledge inputs in turn tend to activate the managerial attention to the other components of effective management.

As it happens the decision making level personnel in the WSS sector, similar to the other sectors of economy, have to have gone through the mill of formal education—engineering, commerce, economics, public administration. But the theoretical emphasis—normal in academic programs does not equip them in tackling the problems arising as part of the field operations. Under the circumstances, the seniors are expected to guide and support the juniors in analysing the emergent problems. Knowledge being power, two types of deviations usually occur in the process; One—the seniors in order to perpetuate personal 'control' on the juniors, withhold the transmission of operations specific knowledge, and Two—the seniors having grown in a learning environment of trial and error assimilate some 'Short-Cut' methods or tips to identify or to solve the problems. These methods may be weak against of logic or theory. The scope for their replication therefore, tends to be extremely narrow and their receptivity automatically gets limited. Nobody, let alone the seniors, would like to stake their 'position power' and thus expect blind compliance which the juniors may not be ready to render. Under such circumstances, the autocratic style of leadership becomes inevitable!

Improving the skills and capabilities of employees through systematically structured continuity training can be one of the factors of success in the increasingly exploited and fragmented sector such as water supply and sanitation. Investing in employees can boost the technical caliber and performance standards, which in turn improve the stature of the organisation in the employment market, the resultant expansion in scope, opportunities, rise in productivity, attractiveness for capital investment and increase in the earning power. But, unsatiated rise in expectations borne of haphazard training can lead to a false sense of confidence, which may cause high levels of frustration in the employees. it is often found that the employees as well as those in-charge of imparting training lose faith in the synergetic role that training can play in improving the organisation work climate.

Training for work exhibits a positive relationship with productivity. Enterprise-based training has been associated with a significant rise in output per worker, with the largest gains realised in organisations that invest simultaneously in training and technology. As in the case of green revolution, human capital can bear an especially right return in the water and sanitation sector also, when the opportunity to take advantage of new ideas is made available.

Productive learning does not end with school. Most individuals continue to build their skills throughout their working lives, through training on the job and informal training centres. Training is an investment from the perspective of both workers and employers. Employees often willingly incur fees for competence building training courses, or accept lower wages than they would receive if not engaged in on-the-job training, in return for higher wages in the future.

Organisations have an incentive to invest in their employees' training because they frequently need to have a bank of competent workers with certain job specific skills. Neither side may be completely sure, that it will be able to appropriate fully the returns on its investment: workers may quit and transfer the gains to another employer, or may lose their jobs and find the skills they have acquired are not transferable. Employees as well as employers have found ways to work around this problem so that both sides can still gain: Employers provide job security to reduce turnover and employees may agree to training contracts whereby they repay the employer if they leave before the employer's investment has been recouped and both can share the productivity gains associated with training spin-off.

If training is in the interest of both employees and employers, and takes place in market economies in response to underlying economic circumstances, who should take the lead in institutionalizing the concept? Is it appropriate for governments to get involved?

Government should intervene only when the institutions set-up for training fail to impart training effectively or pursue goals other than those on the agenda of client agencies. As with general education, individuals may under-invest in training because of lack of information or credit market failures or because spill-over effects likely to drive a wedge between private and social returns. However, atleast in the case of in-house training, many of these problems may be secondary to constraints that inhibit organisations from investing in improving employee skills. Experience reveals that when the level of skills is low in the employment market is low, organisations tend to invest too little in training despite prospective returns that would justify the investment, for fear that their employees, once trained, will find other employment. Where returns to training have been high, organisations invested in training despite employee turnover reaching

the level of 5 of 6 percent of the work force. "The magnitude of this complex assumption is not fully studied! It is time that the Ministry of Urban Affairs and Employment, sponsor such studies through the Regional Centres for Urban and Environment studies or the CPHEEO.

Based on the assumption that HRD is a profession and whose major goal is to develop the skills of employees at all organisational levels, the ideal solution would be to remove the institutional constraints on sponsoring training by the sector organisations.

Lack of information about what sector specific skills are in demand and the scale of economies involved in imparting purposive training are other grounds for the ministry's involvement. Short term training in general-wherever it is available, may be sufficient for perpetuating current activities, but lack of knowledge about new technologies and general business skills may constrain the operations and maintenance of the installed systems. Training targeted at imparting skills for sustaining the service levels and quality as well as for diagnosing, identifying and correcting the indentified deficiencies have proved to be most successful.[18] The scope for replicating the expanding such programs, however, is limited. For many public utilities the costs appear to be disproportionately high in comparison to the perceived returns.

Enterprise-specific training is usually the most cost-effective means of developing employee skills. By comparison, training delivery service in state-sponsored training institutions has proved fairly cost-effctive and often succeed in providing the trainees with suitable skills at reasonable costs. But, ways and means must be found to reorient the public training institutions to respond to consumer and market demands. One-way could be to shift public financing from providers of training (Governments) to demand side of the market, enabling targeted orsanisations to bear the cost of training within a competitive environment of alternative sources of training. But then the organisations may simply relegate it to a position of an avoidable alternative to paying overtime allowance!

## III. WATER SUPPLY AND SANITATION SECTOR: TRAINING NEEDS.

Level and Quality of Service. The major need for training in the sector relates to defining the level of service, which has several aspects.

- Quantity of water to be made available to consumers-forecasting techniques.
- The vulnerability of the supply to drought conditions-evaluation techniques;
- The provision of intermittent service, with its implications on water quality;
- Inadequate Sanitary Sewerage System capacity—low cost technology;
- Sanitary Sewerage System Under utilisation—Marketing for user development;
- Regulation of Sewer Use-designing, construction and cleaning techniques;
- Operation and Maintenace—Lay-out mapping, monitoring and evaluation.

The provision of intermittent service, its implications on the reliability of water quality, detection and reduction of leaks from the supply or distribution systems, the complexity of managing these functions and the problems as they arise present abundant scope for training in the following activities:

- System Leak Detection and Repair;
- Unaccounted-for-water management;
- Operation and Maintenance of Supply and distribution systems;
- Financial Management:
- Capital Financing, Financing Water Supply and Sewerage Systems—by and large is grant dependent, though institutional financing through LIC & HUDCO is available in certain states. With the dominantly grant-financing mechanism, the principle of capital cost recovery remains over looked.
- Operation and Maintenance Financing: Most of the Urban WSS Systems in the country, are not in a position to meet even the cost of O & M. This has been mainly the result of low tariffs coupled with abysmally low level of collection.

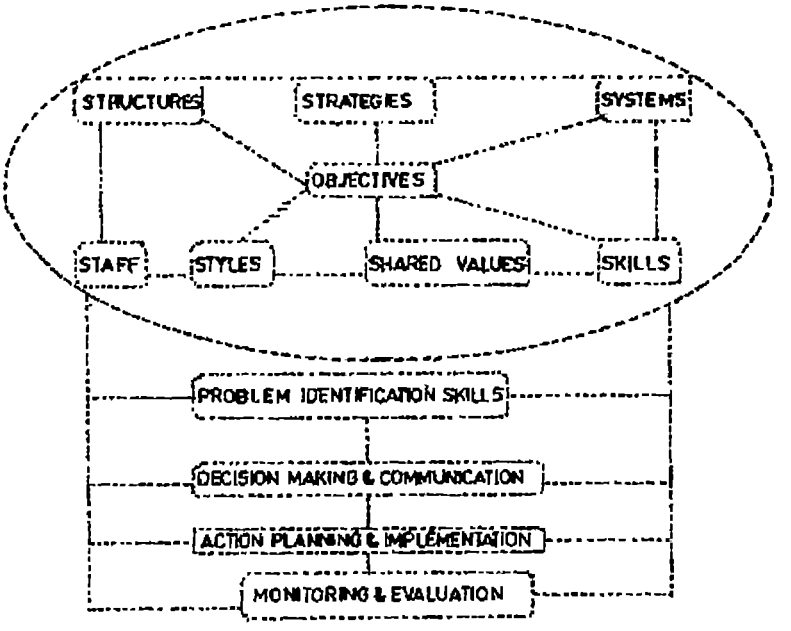
The issue can be integrated to develop the learning need scenario in the sector. For instance: What capacity is available in the sector related to project formulation-conceptualisation, feasibility studies, socio-economic studies, cost-

benefit studies, studies on compability with environment, project financing, technology definition, forecasting of future demands, personnel management, financial management, material management and inventory control, community participation, service convergence, identification of the needs of the poor, public relations, technology management including removal of obsolescence, transfer or upgradation, definition of standards, monitoring and evaluation, management information systems, etc. The list is only illustrative and no attempt is made nor necessary to extend it.[18]

The sector training needs can be classified into three groups

- Management Development Group to sensitise the sector personnel to the elements of business management-business planning, strategy formulation, demand forecasting, population studies, personnel, finance, materials, law and legal studies, etc.
- Technology Development Group Technology definition, identification, upgradation, transfer, formulation of standards, monitoring and control, inventory control, production planning and control, computer applications, etc.
- Support Activity Group: Interface with the consumers and stake holders: public relations, consumer surveys, grienvace handling, complaint redress systems, use of public media.

The issue of determining the scale and level of training appropriate to address the organisational or individual specific learning needs, cannot be resolved easily. However, a position-content-performance template which can be used for assessing the organisational needs as well as for conceiving a training programe is presented. The template represents a combination of the well known Seven S Frame work of Mckinsey[20] and crafting the strategy model of mintzberg.[21] The Seven elements arranged within the ellipse, perform the anchor role for the organisational policies. Every organisation contains varying degrees of competence in each of elements, and any assessment should aim at indentifying inter-element discrepancies, conflict or deficiencies. The next step would be to identify the causative factors-attributable to systemic or structural incongruencies or lack of knowledge/skills on the part of employees. It may slso be necessary to evaluate the public policy implications if the deficiencies are traced to state priorities or practices. This should be followed by identifying appropriate corrective inputs, either in the form effecting changes in the structures or systems where necessary or transfer/upgradation of knowledge or skills on the part of employees. The next phase would involve defining the content, pace, and magnitude of the targeted change.[22]




ORGANISATION ANALYSIS & TRAINING-DESIGN : TEMPLATE

20. "In search of Excellance." J. Peters and Waterman Jr, Harper & Row, New York, 1981.
21. "The Nature of Management Work," Henry Mintzberg, Harper & Row, New York, 1973.
22. "Training Action Plan," RCUES-OU & HMWSSB, 1992

The Template served as a frame of reference for organisational assessment by the employees themselves. Experience shows that the assessments arrived through employee participation command a higher level of acceptance by the organisations and their nodal agencies. The World Bank Aided Hyderabad Water Supply and Sanitation Project (HWSSP), has amply demonstrated the effectiveness of the employee participatory approach. Under the component 6, of the Project, the composite research team of RCUES-OU and HMWSSB have achieved the following:

- A new Corporate Charter, befitting the status of an independent and autonomous business organisation-Board-in the sector;
- Re-Engineering the structure leading to a new organisation design, clarifying the reporting relationships;
- A new nomenclature of jobs, reflecting the change towards management of the services;
- A manual on job definitions and specifications, position classification and descriptions, function differentiation,
- A comprehensive Training Action Plan—covering the entire organisational hierarchy, Training content matched with individual needs—Technology, Management and Support groups of subjects, levels of exposure, duration and methodologies;
- Establishment of a full-fledged staff training Centre, totally manned by the personnel of the Metro Board;
- Draft designs of formats for documenting public complaints, lead time for repairs, durability of repairs, manhole repairs, inventory control, data on billing and revenue collection including arrears, overtime payments, energy consumption, use of consumables, deployment of tankers, productivity of work groups at the field level, status of progress on works and the financial releases, procurement of chemicals, status of bore wells, etc.
- Draft designs of formats for employee employees performance appraisal;
- A detailed Action Plan to meet the contingencies during the drought period;
- A bench mark study on consumer satisfaction—level and quality of service;
- A study on Un-Accounted For Water in select localities;
- Consumer contact programs in ill served and un-served localities on an experimental basis;
- Empowerment of first level managers, whereby the felt needs of the public are attended at a single point.

It can be seen that the out put is in broad agreement with the Performance categories conceptualised by the Water and Sanitation for Health Project (WASH), for inclusion in the organisational assessment procedures.[23]

- **Organisational Autonomy;**
- **Leadership;**
- **Management and administration;**
- **Commercial Orientation;**
- **Consumer Orientation;**
- **Technical Capability;**
- **Development and Maintenance of Staff;**
- **Organisational Culture; and**
- **Inter actions with Key External Institutions.**

The institutional collaboration and the scope for participation has found its extensions in the actual planning and organising of the training programs. The senior managers are afforded with the opportunity to serve as resource persons. The field research is always carried out jointly. The chief executive participates in all the programs—on the first and last

23 .. Guidelines for Institutional assessment Water and Sanitation Institutions", Donald Cullivan et.al. WASH Technical Report #37, Bureau for Science and Technology, USAID, Washington, D.C. 1988.

days. The first day is utilised to familiarise the participants with the corporate objectives of the Board and on the last day the employees have a free discussions—personal problems, grievances, suggestions, potential areas for immediate correction, gender related issues, etc. It has been found that these sessions have been instrumental in building rapport between the top and operating level personnel—Engineering and Administration and have proved extremely popular, because of rapid follow-up actions initiated on the suggestions and in resolving the grievances. The reliability of the follow-up actions generated high levels of trust, for example some employees have confessed irregularities in writing, seeking punitive action on the part the Board and an assurance to abide by the decisions of the chief executive.

Should there be a need for greater demonstration of trust and justification of the proactive influence of a systematically implemented HRD program?

A few issues of interest relating to the enhancing the efficiency and effectiveness of sector organisations raised in the agenda for discussion need to be addressed. These are framed as questions for want of space.

1. Is there a need for reorienting the sector orientation from Engineering to Management?
2. How to motivate the staff to perform better?
3. Is there a need to invest the sector organisations with operational autonomy and accountability?
4. Are the investments in developing the institutional capacity serve any useful purpose?
5. How to sustain the Programme continuity and effectiveness?
6. Can there be a typical organisation model, which can be replicated in all the sector entities?
7. Is there a model for carrying out training need analysis uniformly in the sector entities?
8. Is there a model for action planning for addressing the identified training needs?
9. How to monitor the effectiveness of the training programs?
10. How to inculcate the training culture amongst the employees?
11. Can incentives tied to the performance at training be valid to motivate employees to participate in training?
12. Can there be a career advancement scheme based on merit/performance at training/work stations?

It may not be necessary to address all the issues individually as most of them have already been analysed in the paper. However, the few of those not specifically mentioned are taken up for analysis.

Motivation—contrary to the general understanding that motivation is an instrument to improve performance, it is more a state of mind. More importantly, it is the attitude reflective of awareness of the importance of self as well as others Viewed from this angle, motivation need not be relegated to the position of a mere instrument to leverage higher performance! On the other hand the felt satisfaction with performance itself can heighten the level of motivation. Employees require to appreciate the mission, objectives and the goals of the organisation and the role of their contribution to achieve the same. The management's prerogative in this case would be to clarify the value of the employee's contribution rather than dismissing it as an output of monetary gratification.

The leadership styles and the management climate are but two of the windows for organisational analysis. The template and the performance categories suggested for organisational analysis, amply demonstrate the scope for inclusion of the knowledge and skills in the process of analysis as well as a content in the management development programs.

Organisational Autonomy and Accountability: The issue is as old as the bureaucracies themselves! The reference perhaps is aimed at financial autonomy, which has become a point of intense debate among the sector professionals. "Organisational autonomy is the institution's degree of independence from the national or state governments or other governmental or regulatory bodies. While not unrestrained, this independence must exist to the extent that the institution is able to conduct its affairs and meet its responsibilities in an effective manner with minimum interference and controls by other entities."[24]

Viewed from this angle, autonomy is no more a distant ideal. The sector management—irrespective of the form of their nodal agencies, is endowed with autonomy related to choice of technology, materials, and utilisation of funds already sanctioned. So long as the tendencies to operate as grant dependent entities, state control cannot be wished away.

24 WASH Technical Report #37.

"The one who pays calls the tune also". Our sector organisations have not demonstrated even an inclination let alone the willingness to improve the profitability, efficiency and effectivencess of operations. The traditional comforts of job security, career advancement by seniority, the official status of belonging to the cadre of public civil service, labrinthian procedures for detecting unethical practices, are entrenched in the system[25]. Overstaffing on account of authority for appointment of unskilled/semi skilled levels, high levels of machine and material obsolescence on account of paucity of appropriate technical and management skills, low levels of durability and reliability of the O & M systems are causing erosion of public confidence, in turn the confidence of the nodal agencies. "Autonomy calls for entrepreneurship and is earned and not sought and the moment it is given it ceases to be autonomy". And there is the rub!! A good share of reluctance against the reorganizing grant dependent entities into independent and autonomous organisations is due to the fact that it demands self reliance also. Thus, it is no more a discretion left to be exercised by the nodal agencies but a goal to be achieved by the sector organisations.

Sustainability of Training Programs: The employee acceptance of a program is the greatest insurance against its discontinuity. Even under the conditions of financial abundance training programs are known to have suffered blight Employee confidence in the program is the result of its utilitarian value. A scientifically structured and organised program, with a potential to enrich the participant employee, will certainly gain their confidence.

Career advancement by merit: While no body can be against the concept, the confusion revolves around the definition of merit, the methods of assessing it, and the transparency and verifiability of the procedures. There is no dearth of organisations in the private sector, which have already adopted the concept and research insights are necessary to design for adoption in the WSS sector.

25 Weberian model of bureaucracy

ANNEXURE — 12

# NATIONAL WORKSHOP ON OPERATION & MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS

THEME PAPER

# INVOLVING PARTICIPATION OF COMMUNITY

BY

SMT. SNEHA PALNITKAR

NEW DELHI

25—27 SEPTEMBER 1996

# INVOLVING PARTICIPATION OF COMMUNITY

## NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY & SANITATION SYSTEMS

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**By**

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## INTRODUCTION

Rapid urbanisation and urban growth are causing deterioration in the physical environment and quality of life in urban centres on account of widening gap between demand and supply of essential services, such as, safe drinking water supply and sanitation.

The National Water Supply and Sanitation Programme was launched in India in 1954. Since then, provisions for water supply and sanitation in the successive five year plans have witnessed steady increase. As per the NSS only 20% of urban households have access to sewerage system, 14 per cent of the households have access to waterborne toilets connected to septic tanks. Nearly, 37 per cent of the urban households is served by bucket privies. Remaining 33 per cent have no facilities whatsoever. On account of high installation costs, even the targets for the International Drinking Water Supply and Sanitation Decade of the country restricts sewerage to class I cities and envisage overall coverage of only 80 per cent of all urban areas with either sewerage or sanitary toilets. Septic tanks with proper effluent disposal could be an alternative, but these require periodic safe removal and treatment of the accumulated liquid sludge, a service which have often proved unreliable. The problem of sanitation and environmental hygiene has assumed a new dimension under the impact of rapid urbanisation and proliferation of slums.

Inadequate coverage of the population to be served, operational inefficiencies and financial constraints are the main problems seen in most municipal solid waste management in most of the urban centres. In a city, the municipal service picks up only 30 to 70 per cent of the refuse generated and serves less than 50 per cent of the city's population. The low income areas usually belong to the unserved population. Generally, since not even operation costs of the garbage collection services are covered by adequate fees or charges the waste generated by the rapidly expanding cities grow beyond the collection capacity and financial limitations of most of the municipal corporations.

Water Supply and Sanitation (WSS) by the local authorities, without the involvement of the local communities have resulted in a complete alienation of the people from WSS system, which were preceived as project of government/ municipal bodies and people consequently failed to maintain these system in urban areas. A number of studies have brought out the relationships between infant and child mortality and quality and access to water and sanitation. On the solid waste front, about half of the population get the benefits of garbage collection, transportation and disposal. If we prepare a situational analysis, it is seen that the importance to WSS management is not sufficiently appreciated in the context of shortage and total effectiveness. These services indicate signs of stress and at times a total absence, particularly in low income settlements. The part of these problems are attributed to haphazard growth, inadequate infrastructural facilities, indifference of municipal bodies to come out with any innovative alternatives.

In recent times, an influential approach has emerged advocating a strong case for peoples' participation in WSS, which enables the people to voice their demands, which reflect the actual needs of people, attempt to help, encourage acceptance and collaboration at the local level. Experiences at various places have clearly revealed that community approach is the most feasible, efficient and cost-effective approach to sustain water and sanitation programmes by empowering people by ensuring their participation. The potential of community participation is beginning to gain the recognition. It is realised that development usually comes about not through external intervention but through people working collectively to meet their felt needs.

In Japan, there is a system of community management of local services, such as street sweeping, garbage collection, maintenance of environmentally important areas, gardens, parks etc. Different tasks are assigned to every family living in a specific locality and one can observe the roads being looked after by few households, roadside planters being looked after by another group of people and garbage disposal by yet another group. (Buch, 1995). In India we have yet to develop such kind of community participation.

## EXPERIENCES OF COMMUNITY PARTICIPATION IN ENSURING SUSTAINABILITY OF WSS SYSTEM:—

The role of women in the context of water is of importance because women have traditionally been source of the information relating to conserving water and providing safe water. Inspite of changing situation they remain an influential force in adopting practices in WSS.

Today the need to involve women in water supply system has gained more recognition. Socio-Economic Units set up in Kerala State to work jointly with the Kerala Water Authority to strengthen collaboration, coordination and exchange between all those involved in the rural water supply and sanitation scheme, entails communication awareness, education, community mobilisation, intersectoral coordination, human resource development. The focus concentrates not only in community involvement, but on the specific involvement of women for site selection and standposts, opera-

tion and maintenance. These units also assist in the formation of women's organisations, where they do not exist, in addition to strengthening the existing organisations.

Not only community participation but specially women's participation is taking place in Banaskantha village through the formation of Pani Panchayats. Where these committees are active and women have taken the lead, village standposts are neatly maintained, no spillage is allowed to make the surroundings dirty and taps are usually in working order.

**PANI PANCHAYAT—A NEW APPROACH FOR WSS INITIATED BY AN NGO :**

The movement of "Pani Panchayat' was initiated by "Gram Gaurav Pratishthan' in Maharashtra State under the leadership of Mr. Vilasrao Salunke. It is being implemented in draught prone area of Purandhar Taluka of Maharashtra State, Gram Pratishthan encouraged by success at various water and soil conservation measures, Gram Pratishthan decided to extend its activities throughout Purandhar Taluka. Core of these activities was water conservation measures on village level and using the increased water through such measures for protective irrigation. Various projects were implemented for this. Underlying for these activities was formation of "Pani Panchayat' (water committee). Salient features of Pani Panchayat' movement is equitable distribution of water. Principle adopted was water will be distributed in proportion in number of persons in a household. Experiment of Pani Panchayat showed that half acre land gives sufficient income to satisfy maximum requirements of a person under the specified set of conditions. Villagers participating in lift irrigation scheme of Pani Panchayat have to follow following rules :

1) Water will be made available in proportion of half acre per person.
2) A scheme will be prepared for a community and not for a single private person.
3) Crops having high water requirements and of one year period won't be taken.
4) Beneficiaries should contribute 20% of total expenditure for a scheme.
5) "water Committee' of a scheme will be responsible for implementation, operations, maintenance and repairs.
6) Landless villagers, too would have a right on water.

The case of "Gopi Cheruvu' shows that the determination of people to protect water bodies in their vicinity can be a step towards framing policies against land-grabbing, real estate agents. Gopi Cheruvu, located in Sen Lingampally village and mandal of Ranga Reddy District forms part of the proposed mega city of Hyderabad. Gopi Cheruvu is the only perennial tank in this micro-region. With the rapid urbanisation in the vicinity of Gopi Cheruvu saw sprawling new housing and institutional development. Gopi Cheruvu cater to the needs of cattle, sheep, goat and often provides a source of drinking water for the neighbourhood in the lean seasons, open wells in the surrounding localities get-dried up, and ground water level goes to a depth of about 150 feet. This has been aggravated during last few year due to vast construction activities taking place both down and up stream of the tank. The construction companies started to occupy the tank by breading the bund. The youth, villagers who could visualise the consequences formed Gopi Cheruvu Porta Samithi. Actually, threat to the survival of lake begun with the construction of two phases of lake side Township by the Doyens Constructions. The construction activity of third phase of township almost occupied certain parts of lake area and resulted in an attempt to break the very tank bed twice by the Doyens in order to drain the water. It was at this juncture the communities started the protest and mobilised people. The people activities continued with peaceful agitation. After long battle finally, the district administration responded positively on the issue. The builder was served with the show cause notice and ordered to pay penalty. Later people under the active leadership of the Samithi repaired the breached tank through " shramadan".

The case of "Gopi Cheruvu' clearly demonstrated the peoples' participation in protecting water sources and how the peoples' action can pressurise the administrative machinery to take appropriate steps in the interest of the people.

**NEW CULTURE OF URBAN SANITATION I — CORO IN MUMBAI**

In Mumbai, the CORO Pay toilet project provides community run sanitary facilities in the city's low income settlements. In 1992, CORO, a leteracy NGO, took over municipal toilet projects in several locations throughout the city. Local groups manage the toilets on a cooperative basis, providing monthly pay for 500 workers. CORO began as loosely formed groups of different activities from several voluntary agencies in Mumbai. It took some time for CORO to break down the barriers of mishust and establish links with local community workers, CORO was gradually able to generate community enthusiasm for literacy and reading. Young community workers were helpful in this process of mobilizing

residents and they become enthusiastic about the idea of promoting literacy. Through CORO"S initiatives communities supported efforts to abolish illiteracy. The concept of roving libraries (Savitri Vachanalaya) grew out of a need for a literacy network and in response to a lack of reading material in the city slums. To form a library, a CORO activist consult with local contacts and recruits librarian, mostly school children, adolescent school dropouts and unemployed youth, but occasionally newly literate adults. Today, 80 libraries have become operational and provide at least one book every week to each one of the 10,000 households covered by CORO. CORO developed in an interest in hygiene in the city slums through their observation of conditions in the slums settlements where they were doing literacy work.

Though its literacy programme, roving libraries and management of pay-and-use toilets CORO has provided essential services to previously undeserved communities and begun to lay the foundation for improved awareness of health and sanitation issues and a new culture of cleanliness and responsibility in city of Mumbai.

By maintaining clean public toilets honestly and efficiently, CORO has provided a viable and affordable alternative to filthy, unhygienic free latrines or open spaces near homes. CORO-run toilets have been well received and are heavily used demonstrating that slum residents are willing to pay for suitable services. Widely used latrines have also resulted in a noticeably cleaner and healthier environment in the slums, with less human waste in streets and other open spaces.

For women, clean public latrines have provided a way to relieve themselves in privacy, avoiding the humiliation of using public, open spaces and the danger to their health and personal safety resulting from waiting until dark to relieve themselves.

By enlisting local residents to serve as maintenance workers and SUVIDHA cooperative members, CORO provides employment and income in low income settlements. Maintenance workers and cooperative members, gain valuable work and organisational experience. Use of local labour also ensures greater accountability and community participation; as community members, the maintenance workers are trusted, can raise community concerns during cooperative meetings and cater service to community needs.

Community workers also given valuable experience in CORO's literacy campaign and working as librarians for the roving libraries. They have been able to enlist the support of slum residents and to recruit library members. There are now 80 functioning libraries providing over 10,000 households with reading materials in the slums of Mumbai.

Taken together, CORO's literacy campaign and its management of pay-and-use municipal toilets have helped to lay the groundwork for more substantial changes in the attitude and culture of Mumbai's poor. Through literacy classes, reading, and the efforts of local latrine workers, community residents are learning about the importance of sanitation hygiene, and the environment. Latrine workers have begun to provide an alternative to the increasingly unworkable system of cleaning and maintenance based on the caste system, and have begun to demonstrate that individuals and communities can take care of their own human waste problems. Maintenance workers, literacy advocates, and librarians have ceased to be passive recipients, and are taking an active role in improving conditions in their neighbourhood. Residents have shown a willingness to pay for service instead of demanding service for free and placing an even greater strain on an already overextended municipal corporation. By combining libraries with latrines, CORO can serve communities, create a springboard for community efforts centered on other important issues and extend their network's reach into more homes. CORO has to overcome several obstacles in order to achieve success in literacy training, distributing reading material, and running pay and use toilets. Attitudes take a long time to change, and there is still a considerable amount of resistance to the kind of change CORO envisions in Mumbai slums, as well as continuing problems of a more mundane and technical nature.

CORO has had difficulty getting children to use the public toilets, despite not charging them and even going out into the neighbourhood in order to bring children used to defecating outdoors to the toilets. A major problem lies in the toilet design, which is too large for small children. CORO is working on possible new designs to be used in new toilet complexes.

There was continued resistance to pay-and-use toilets among many residents, especially at Malwani slums where the destruction of a free alternative, the actions of local politicians, and the initial experience with unsatisfactory service and inefficient, created resentment among some residents. CORO's effective management and the cleanliness of the latrines themselves gradually eroding this resistance, and residents are becoming more willing to pay in order to use clean toilets.

Initially, CORO had difficulties within the management units. Staff members felt that cleaning toilets was degrading work, beneath their station as educated citizens. After discussion and experience managing the toilets, workers began to feel that they were not engaged in demeaning work, but in cooperative self-development. They were beginning to make a difference in their communities and were fulfilling an essential role in a collective undertaking in which they had an important say.

Groups had problems with inefficient workers and dishonestly. They set up internal vigilance groups and even fired some workers who were not working. This was extremely diffficult for the units to do, but it was essential in order to maintain standards. It represented a change in attitudes, one in which labour and honest were rewarded and workers were held accountable for their behaviour. Groups had trouble with expensive repairs to the toilets especially when they had to depend on outside repairmen. They were able to cut down on this expense by finding their own repair people from among CORO community literacy activists.

CORO also had trouble at the beginning of their literacy campaign. CORO activists had little experience with literacy training and the programme suffered from ineffective teachers and poor training courses. Men were especially difficult to teach, as they were inwilling to admit to illiteracy, and had little free time to learn because of long commutes to work. They also often discouraged their wives and daughters from learning how to read, further undermining CORO's efforts.

In all of CORO's efforts entrenched attitudes and cultural mores continue to cause problems. Most Indians slum dwellers retain rural customs, and are unused to using toilets or reserving space for them when planning homes or communities. Such habits are difficult to change. Also centuries of a rigid caste system has trained people to leave much essential work to others; they are forbidden by caste rules and custom to engage in a host of necessary activities. This has produced a culture of resignation and robbed many people of initiative; they do not see it as their responsibility to improve their lot, clean their toilet or any number of other things. CORO faces a constant challenge in motivating residents to fulfill roles and do jobs to which they are not accustomed and which they might find objectionable. Recently CORO has been entrusted to undertake construction and maintenance of some more pay-use-toilets by Brihan Mumbai Mahanagarpalika.

**RALEGOAN SHINDI — DEVELOPMENT ERFFORTS INITIATED BY AN INDIVIDUAL IN MAHARASHTRA STATE**

On rural scene, experiment of Ralegoan Shindi is regarded as one of the most successful and pioneeing in India. For holistic development of a village through Community Participation. Initiator and mode of transformation of Ralegoan Shindi from a typical backward village to as progressive village is Mr. Anna Hazare. After 13 years of active service in Indian Army he returned to his village in 1975. Prior to 1975, it was typical backward village ladden with various problems related to land, water disease etc. But Relegoan Shindi saw seachange through efforts of Mr. Hazare. Upto 1994, entire watershed at Ralegoan was developed.

There are four lakh trees of different species, forestation on 250 acres of land, 44 nallah bundings have been constructed, five check dams and three underground checkdams are built. Pasture grass raising has been done on 400 acres of land in Ralegoan.

Farmers' were motivated to come together in groups of 10 to 25 to dig public wells. an independent cooperative water supply society for each of the wells was registered. There are 7 such registered water supply cooperatives in Relegan. A "water ration card' was given to each farmer. Accordingly water is distributed turn by turn to the people. Water charges are being recovered on yearly basis and people are appointed for distributing water.

Due to water shed development and water planning, 1100 to 1200 acres of land at Ralegoan is being irrigated. Per household income went up from Rs. 270/= per annum in 1975 to Rs. 2250/= per annum in 1985.

"Self help" has become customory in Relegoan. It is a non-written rule that one person per household will contribute his/her labour for all community works. A fine of Rs. 50/- is charged if a family don't participate in self help programme. Various village bodies are formed to undertake various development work in the village.

Integrated Sanitation, Water Guineaworm control and Community Health-project by Government of Rajasthan in 1986 is an example of a project that innovates on traditional sources of water, and also ensures women's participation. Although, integrated water supply and sanitation was the focus, guineaworm control was used as an entry point as the area which was infested with this disease transmitted through drinking water. This innovation has been working towards

educating the villagers on health aspects and innovating on traditional sources to prevent contamination of water. Women are also involved extensively as animators, who initiate and mobilise community support for project activities. This activity also serves as an income generating source, as each animator is compensated.

**THE ORANGI PROJECT : INNOVATIVE SEWERAGE PROGRAMME IN KARACHI, PAKISTAN :—**

A small amount of core external funding started the Orangi Pilot Project (OPP) in 1980. The purpose of the OPP was to promote community self-help and the provision of affordable sewerage system in Karachi's squatter settlements and to develop organisations that could provide and operate the systems. Coupled with an elimination of corruption and the provision of labour by community members, the costs (in house sanitary latrine and house sewer on the plot, and underground sewers in the lanes and streets) are less than $70 a household. The OPP staff has played a catalytic role by explaining the benefits of sanitation and the technical possibilities to residents and by conducting research and providing technical assistance. The OPP staff never handled the community's finances. The household's responsibilities inculded financing their share of the costs, particularly in construction, and electing a ""lane manager", who typically represents about fifteen households. The lane committees, in turn, elect members of neighbourhood committees (typically around 600 houses) who manage the secondary sewers. Although the OPP concept includes municipal government subsidy and later cost recovery for sewer trunks and treatment plants, the state is financing these facilities without cost recovery. The OPP's early successes created a ""snowball" effect, in part because of increases in the value of property where lands had been installed. As the power of the OPP related organisations increased, they were able to bring pressure on the municipality to provide municipal funds for the construction of primary and secondary sewers. Sewerage has now been provided to more than 600,000 poor people in Karachi and several progressive municipal development authorities in Pakistan have attempted to follow the OPP method. The OPP approach of community involvement and responsibility has been adapted in Cairo, Egypt, where the Zabbaleen community, with support from the Ford Foundation and the World Bank, have developed a successful waste recycling enterprise that has spun off into several entrepreneurial efforts.

NGO Forum for Drinking water supply and sanitation is nation wide networking organisation of 350 local NGO and engaged in safe water and environmental sanitation activities in Bangladesh. The forum developed a programme of mutual interactions amongst all the actors on scene and developed skills of target beneficiaries to repair and maintain the latrines tubewells and make people share its financial burden and to continue to carry out the promotional, motivation and training activities.

Mozambique, developed a programme of sanitary education with a strong belief that peoples' involvement was key in solving many micro-level problems. The government developed an approach of interaction with local communities to prioritise their needs and the possible ways of improving their living conditions. As most of the local inhabitants had no access to toilet and bath facilities, community sanitation emerged as one of the main problems. The sanitation programme identified types of latrine that were durable and cost-effective, adopted technologies that would require minimum external inputs and maximum use of labour and locally available building materials by neighbourhood groups which developed into a small cooperatives Self sufficiency in covering operating costs becomes a goal for the cooperative. Public opinion was influenced in various ways, such as, through community groups and most effectively through puppet theatre. The programme responded to the needs of those concerned, and provided a fair degree of citizens participation from the start.

**PHILIPPINES: PROMOTING DEMAND FOR SANITATION:—**

The first Rural Water Supply and Sanitation project consisted of the installation of low-cost water sealed toilet bowls, health education, technical and financial assistance. The greatest challenge in this programme was to motivate families to improve their toilet facilities. The participation was garnered through personal association between official debts of gratitude. This was added personnel and local residents by appealing to traditions called by promotional campains tailored to local circumstances Participating household constructed toilets on a self-help basis and handled subsequent maintenance and cleaning of toilets.

**A WATER SOCIETY IN KENYA:—**

In Kenya, seven small community groups in Meru District existed with the aim of providing a water supply through gravity systems. The community groups decided to join together as individually they lacked a large membership to develop the extensive infrastructure for piped water system. They were inexperienced in project management, financial accounting and lacked the ability to mobilise their communities beyond initial fund raising. The groups formed Water Society, which developed links between the self help groups and helped to form a common consensus on the

objectives and long term goals of the Society. The Ministry of Water Development helped the Society to approach NGO for assistance in funding and management training. The Society achieved a great deal in setting up a workable administrative structure which reconciled the accounts and records. The Society assisted the engineers from the Ministry of Water Development in designing gravity system, helped to collect user fees. The Society is run in a business like manner. This Water Society provides a good example of a group of communities coming together with a objective of self help and being assisted in key areas of finance and training in which they were deficient by outside agencies. These agencies have committed a considerable investment in this Society to allow representatives of the community to take major management decisions. Societies become more able to run its affairs in the best interests of its community members in a more independent way.

**COMMUNITY PROVISION OF LOW-COST SANITATION: COMMUNITY BASED MANAGEMENT IN NORTHEAST BRAZIL:—**

In the cities of northeastern Brazil, communities have been managing condominial sewerage systems that connect inexpensively to a block of houses. Success depends on residents jointly allowing the system to be built on their land. Thus the term condominial is used. Instead of digging under the streets in front of the houses (an expensive undertaking), a short grid of small, shallow "feeder" sewers are run though backyards. These innovation cut construction costs by 20-30 percent. Residents choose their level of service, and are responsible for operating and maintaining the feeder. Residents can choose: (i) to continue with their current sanitation system; (ii) to connect to a conventional water-borne system; or (iii) to connect to a condominial system. Families are free to continue with their current system (which usually means a holding tank discharging into an open street drain). In most cases, however, those families who initially choose not to connect eventually end up connecting. Either they succumb to heavy pressure from their neighbours or find the build-up of waste water in and around their houses intolerable once the connected neighbours fill in the rest of the open drain.

Many of such examples can be quoted from all over the world, especially from developing countries. An ignorance of or indifference towards the vital "Community' factor whom the system is to be implemented carries a high opportunity cost with it. Even though these kind of efforts are a step in the required direction, their achievement are quite often limited in terms of actually empowering the urban communities. Majority of the projects in the developing countries are planned with "Top Down' approach barring a few with the "Bottom Up' approach. Finance, political preferences, social attitudes are major constraints in "Bottom Up' projects, which consideres views and potential contributions of community members. Communities can make vital contribution in various forms like cash, or other material help, labour, low cost local options, maintenance of assets etc. Community Participation is an essential and most important precondition to ensure programme sustanability, which becomes very crucial in case of urban as well as rural WSS projects.

**URBAN COMMUNITIES:—**

In Urban Communities, one notices a very high level of diversity in people's social compostion. People are divided by race, religion, caste, tribe which cause socio-cultural obstacles. In cities improving the effectiveness of urban services require sustained participation by a diverse cast of actors.

Past experience at developmental efforts for these urban communities show that in such situations, centrally managed schemes are difficult to implement, operate and maintain. Against this, locally management systems are comparatively more sustainable. This fact also underlines the importance of community participation in urban areas.

**IMPORTANCE OF COMMUNITY PARTICIPATION (CP) FOR UWSS:—**

The degree of external versus internal support in a RWSS projects significantly affects its sustainability (Yohalem and Warner, 1988). The emphasis in externally initiated and supported WSS projects are usually on technology and system coverage. Project Staff formulate, projects and the major concern is to meet construction schedules. As against this, community supported water and sanitation projects stress on capacity building and organisation development. They are designed to improve the problem solving capacity of the community as measured by behavioural change. The project preparation may take considerably greater time with such approach as it is involved community orientation and training. However, human resources development is a top priority which imbibes a sense of responsibility and commitment towards the project in minds of beneficiaries. For effective project development, a blend of both internal and external support is necessary so as to integrate them in complementory manner. The potential of peoples participation is beginning to gain the recognition.

**ORGIN OF CONCEPT OF COMMUNITY PARTICIPATION (CP):—**

The origin of concept of CP can be traced to fifth decade of this century in the community development movement in the late colonial era in parts of Africa & Asia. Late 1960s and early 1970s saw a widespread disenchantment with the top down bureaucratic approach in development and its failure in redistributive benefits. During this period community participation usally implied "self labour' though it was referred to as "voluntary'. This resulted into development of a general feeling of disfavour towards initial concept of community participation. Since then, the governments of developing countries and external support agencies began to show their willingness towards community participation. This was mainly due to greater democratization in community development programmes. NGO's and other agencies active in rural and urban development poverty alleviation basic service delivery system also gave major thrust to drive home community participation related strategies. Thus, most development agencies formally supported the idea of CP by mid 1980s.

But real inclusion of this concept in project formulation, development and implementation in various programmes remains a quastionable issue. CP took various versions as perceived by different individuals and organisations, from self help animation and user choice to local participation and participatory democracy. Based on experiences of World Bank with CP, the definition emerged as: Community Participation is an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits (Paul, 1986). The "CP's is a process rather than a product. As an active process, CP may consist of technically feasible combinations of various objectives, levels of intensity and instruments. The same process is advocated by UBSP which is based on the community initiative and participation in order to build capacities of the community to respond to basic needs. Over the years the concept has been considerably scaled up both in terms of geographical coverage and components. Neighbourhood Committee—a community approach of UBSP ensures maximum involvement of people. Is it possible to adopt this concept in the management of WSS services in urban areas?

In urban areas, for improving the effectiveness of urban service delivery, we require sustained participation by a diverse cast of actors. What is the ground reality? Are we preparing our urban communities in "visioning'? It is essential to ask people to imagine their area, city or urban neighbourhood in fifteen years time. These visions can differ a lot from what people say, they want and they actively participate. The case for community participation in many fields of urban development is now well recognised. Technical paper on community participation in Water and Sanitation, WHO International Reference Centre for Community Water Supply (1981) summarises:

i) "CP' guarantes that a felt need is involved—There might be a difference in perception regarding urban problems and priority of needs between a community and the implementing agency. If such differences are ignored by the agency, it is a sure receipe for failure as people simply won't use the facilities which don't cater the quantum of finance pumped in.

ii) "CP' leads to cinscientization—CP helps people to understand the constraints which hinder their escape from poverty. They learn how to make more effective demands on government or acquire a new resolve to change a situation of oppression in which they find themselves.

iii) "CP' ensures acceptance of the systems developed by the community—The mere fact that a person is given say at his/her needs carries a lot of intrinsic value for that person. It catalyses the cohesion of the person towards the development project.

iv) "CP' uses valuable indigenous knowledge—There are various examples which indicate that locally developed solutions are most suitable from a technological financial or social point of view. Some typical examples are; the development of a bamboo suction handpump and piped water supply system in Vientiance (versteag), use of shredded coconut husks and burnt rice husks for water filteration (Frankel and Yomre, 1977), indigenous plants for water disinfection (Langley) use of green bamboo for reinforced concrete in latrine construction (Felciann and Flavier, 1967).

v) "CP' acts as a catalyst for further development—empowerment of the beneficiaries through CP enables urban communities to chalk out and articulate their own future.

vi) "CP' reduces dependence of the community on outsiders and their skills: Through CP process it is possible for people to travel to optimum self sufficiency and lead to a drastic decrease in susceptibility of the community to exploitation.

vii) 'CP' develops a sence of responsibility in the community when beneficiaries of WSS project are groomed as potential owners of the projects, it leads to in a sense of ownership and responsibility of the services.

**Stages of accrual of benefits of 'CP'—**

i) *Immediate Behavioural Changes*

— Adoption of improved hygienic practices

— Short term improvement in system performance

— Greater community support for system maintenance.

ii) *Changes in support mechanism*

— Sustainable upgradation of local resources

— Community investments.

iii) *Long-term Impacts*

— Anticipated effects

— Environmental quality change

— Social and economic well being

— Improved capacity of community to manage basic services.

**THE FORMS OF COMMUNITY PARTICIPATION:—**

Various forms of CP can be listed in development projects—

i) Consultation

ii) A financial contribution by the community

iii) Self help projects by groups of beneficiaries

iv) Self help projects involving the whole community

v) Community specialised workers

vi) Mass mobilisation of opinion and action

vii) Collective committment to behaviour change

viii) Endegenous development

ix) Autonomous community projects

x) 'CP' for self sufficiency

xi) Government projects in collaboration with NGOs CBOs and communities.

Preconditions for a successful UWSS project through 'CP'. The main question arises as how to seek peoples participation in WSS? What are the preconditions in WSS projects? Main factors to be considered are—

i) Water and sanitation needs of the community.

ii) Social and Economic conditions of the people.

iii) Technological choices suitable for the urban community.

iv) Support structure-comprising of available resources, complementary investments and project induced charges.

v) The expected outcomes and benefits.

vi) Motivation for communities and project functionaries.

Based on these factors, following preconditions can be put forward:

i) Community demand for an improved WSS system.

ii) The relevant information required to make informed decisions must be available to the urban community.

iii) Technologies and levels of service must be commensurate with the community needs and capacity to finance, manage and maintain.

iv) The community must understand its options and be willing to take responsibility for the system.

v) The community must be willing to invest in capital and recurrent costs.

vi) The community must be empowered to make decisions to control the system.

vii) The community should have the institutional capacity to manage the development and operation of the system.

viii) Human Resource Development for communities.

ix) There should be a policy framework to permit and support community management.

x) Effective external support services must be available from governments, municipal bodies, the private sector, (training, technical advice, credit, construction, contractors etc.)

**COMMUNITY PARTICIPATION ACTIVITIES INVOLVED IN WSS:**

The following activities are involved in 'CP' in urban areas—

i) Community mobilization and organisation.

ii) Understanding community preference and types of services required by communities.

iii) Formal bargaining on issues such as project design, implementation, community contribution and external assistance.

iv) Committee formation and orientation.

v) Training for people and project functionaries.

vi) Hygience and user education.

vii) Cost recovery.

viii) Operation and Maintenance.

**WOMENS' INVOLVEMENT IN URBAN WATER AND SANITATION PROGRAMMES:**

Women from the urban as well as rural areas have traditional participation in WSS. Not only have they been main carriers of water, but decide how much water to be collected, from where to be collected, where and how much to use. According to UNICEF (1990) even currently the principal collectors of water in Indian households are women. Women choose the water source based on their own criteria of access, time, effort, water quantity, quality and reliability. Their interpersonal dialogue amongst them carries much learning about WSS. Thus opinions and needs of women have important consequence for the acceptance, use and readiness to maintain new WSS for ultimate health impact on communities. Problems relating to water supply for household arise not only on account to inadequate water, but management of community water sources which totally ignore women's needs. Scarcity of water affects women as much in an urban environment as in a rural areas. Inspite of urbanisation, technological changes and social transformation, the role of women in WSS remained the same and therefore it is essential to involve women in any WSS initiated by local authorities & by NGOs.

Despite women's traditional knowledge and role in water collection and management, they are preceived as main beneficiaries of WSS programmes and not partners in planning or managing them. Recent studies have thrown light on the comprehensiveness of women's role in maintenance and management of community water supplies. Their involvement has included communal efforts and user agreements, agreements by women or women groups for the upkeep of shared facilities.

Women's role in WSS is visualised as (i) WSS services caretaker, (ii) health and sanitation education (iii) maintenance of services and (iv) utility mechanics e.g. handpump care etc. As a service caretaker, women in rural as well as in urban areas can keep all the handpumps or standposts and surroundings clean and observe any breakdowns. Similary in urban areas, women can report breakdown in municipal water supplies or bore wells. As health and sanitation they can mobilise community opinion on clean handling of water, cleanliness, garbage disposal, sanitation, health care and diseases in the area. Infact, the child who is an integral part of the community can be used as an agent of change in the community. The idea of child-to-child i.e. elder child to younger child can be gradually expanded to child-to-his peer,

child-to-family and child-to his environment and community. As a maintenance team women can check minor operational aspects of handpumps or water taps. Similarly, in sanitation, demand for privacy of women is a determining factor in latrine acceptance by men and women alike, particularly in densely settled communities. Women can maintain latrines, supervise cleanliness, take care of excreta disposal, hygine of young children and assist to educate children in proper use of sanitation facilities.

With increasing emphasis on the necessity to associate women in WSS, for assigning a role in WSS management, some efforts are undertaken by Socio-Economic Units set up in Kerala Water Authority, Kerala and SWACH in Rajasthan, to involve women as partners in implementation of the WSS programmes and decision making. At several places, not only CP, but specially women's participation is taking place, through formation of Pani Panchayats. In Karachi, Pakistan, a public sponsored squatter improvement programme paid off by investing in women's participation. A soakpit latrine pilot project in the low income settlements of Baldia empowered women by teaching them that better sanitation (through community labour and supervision) could improve family health and living conditions. Due to its initial success, the project progressed beyond building latrines to the provision of other community services. (Water and Sanitation for Health Project, 1993).

**BENEFITS OF IMPROVED WSS VIS-A-VIS WOMEN**

**HEALTH BENEFITS:—**

Water and Sanitation related diseases are responsible for most of the morbidity and mortality in developing countries. The use of more water of improved quality and safe methods of sanitation, adequate public toilets and use, personal hygiene, food hygiene by all members of the community, proper garbage disposal can lead to significant reduction in these diseases. This eventually leads to considerable decrease in the economic cost of these diseases and their treatment for individual households and for governments and municipal government. This process involves key role for women because traditionally they manage domestic water use, household hygiene, education and care for young children, provide health care in their households and often also in their community and make decisions on use and to some extent maintenance of WSS facilities. Thus, these are obviously "Health benefits' for not only women but all.

**ECONOMIC BENEFITS:—**

Improved WSS will lead in decreasing time spent by women on water collection and garbage disposal. Time and energy gains can be productively utilised for other economic activities.

**SOCIAL BENEFITS:—**

In urban, as well as, in rural areas, it is well accepted fact that women work more on expenditure saving work than men. Women also spend less time in personal care. Women may use their recovered time due to improved WSS for community development and educational activities.

**PROJECT BENEFITS (WSS):—**

Traditional roles of women in WSS make it necessary that they should be associated in introduction of improvements in WSS and in subsequent systems of O and M and health education. The following are some illustrations about how their role can be useful in WSS.

i) As prime beneficiaries, they promote the interest and willingness of men to contribute to improving WSS and installation of latrines and its maintenance.

ii) In identification of reliable water source of acceptable quality, sufficient quantity and easy accessibility.

iii) Adoptation of the design of equipment for improved operation and socially acceptable arrangements for sharing facilities.

Following table illustrates interdependency of project objectives and the potential contribution and benefits to women and the urban community.

**TABLE 1**

**Interdependency of project objectives and the potential contribution of and benefits to women and the community**

| Project objectives | Potential contribution | Potential benefits |
|---|---|---|
| 1. Maximum coverage at Minimum cost | Voluntary contributions to construction work | More households can be served |
| | Motivation of community contributions | |
| | Local knowledge for appropriate design | Avoidance of design mistakes |
| | Support for self reliant improvement of traditional water supply and sanitation | |
| 2. Continued functioning of facilities | Local knowledge for appropriate design | Avoidance of design mistakes |
| | Participation in maintenance and management | More control over service |
| | | Better functioning of facilities |
| | | Recognition of traditional roles in modern functions |
| 3. Public health impact | General acceptance of facilities | Better health for users and their families |
| | Exclusive and safe use of facilities | Improved public health |
| | More time and water for hygiene, child care, and food production | Reduction in health costs |
| | Elimination of local transmission routes of water and sanitation related disease | |
| 4. Socio-economic development | Economic use-of time and energy gains | Income generation<br>Food production |
| | Economic use of water, including grey water | Increased time for women's organizations, household tasks, child care, education |
| | Economic use of waste (compost, biogas) | Enhancement of the status of women |
| 5. Equitable distribution of contributions and benefits | Local knowledge of needs and capacities | Access for all<br>Contributions according to capacity<br>Employment of poor women |

## PLANNING ISSUES RELATED TO SPECIAL NEEDS AND KNOWLEDGE OF WOMEN IN URBAN COMMUNITITES

Even though several efforts are initiated in the required direction, their achievements are often limited in terms of actually empowering women. If womens' real say in the urban planning process is traced, the experience demonstrates

that this process neither helps in strengthening their articulation or their effective participation. Experiences of most WSS projects have shown that projects are seen as technical/engineering projects and not user friendly. There is inadequate involvement of women and insufficient emphasis on health care and community education.

How to obtain participation of people in project planning at the commuity level. The following may serve as checklist for women as planners and users of urban services.

(i) Do women and men have a felt need for WSS services? What are their priorities and expectations?

(ii) Are the women in community willing to participate in WSS services?

(iii) What forms of control have women over functioning of WSS facilities in their localities?

(iv) Are the WSS services acceptable for all categories in the community

- water quality, quantity and reliability
- access to water supply points, latrines, garbage collection
- ease of use, upkeep and maintenance
- cultural acceptability
- economic implications

(v) Are additional WSS facilities required by women for

- washing
- bathing
- toilets
- overal cleanliness
- watering

If yes, who should be responsible?

- design, planning
- construction
- maintenance
- management (community and local authority)

(vi) Are any conflict likely to occur over use of WSS facilities between and within groups and households?

(vii) Do women require any kind of support?, and, If yes, what kind of support?

The objective for involving women in a particular activity relating to UWSS is not because the projects will not function without them but because women need to be empowered by giving them control over a resource. This can happen by 'community planning' in such a way that key decisions are made by women in urban communities.

## ROLE OF LOW INCOME USER COMMITTEES IN THE PROVISION OF LOCAL SANITATION SERVICES SUCH AS THE CONVEYANCE AND DISPOSAL OF WASTE WATER AND SOLID WASTES BEYOND THEIR HOUSEHOLDS

If we analyse the various scales and actors involved in community participation, the majority of the people consider the local municipal body as the main authority that can facilitate WSS improvement in their communities. Even people who are on private land and often denied an official permit feel that the local municipality is the ultimate manager of urban environment including water pipes, drainage, garbage disposal and toilets. Under such circumstances, it is not surprising that low income communities look at the 'municipal body' first before they take stock of their own needs, capacities, and weakness. In many big cities, environment management and 'CP' has not yet taken any shape in governmental intervention in the problems facing low income communities. Nor has any WSS programmes. So far attempted to strengthen the internal community organisation to enhance community potential for better environment management.

Involving people or user committees in intra community WSS Programmes could perhaps be most efficient approach in solving various problems. If we observe, in the communities, the socio-cultural and behavioural attitudes have

remained unchanged. It is extremely difficult to bring changes in daily practices in terms of solid waste disposal or waste water disposal especially in a community irrespective of its size. This requires extensive community involvement, acceptance and participation.

The 'User Committee' can oversee following work areas in urban areas (i) supervision of repair teams, tap committees and system care takers, (ii) raise funds for WSS system maintenance, (iii) organise self-help labour when needed, (iv) organising on-the-job training in urban communities, (v) interaction and constant rapport with municipal administration and NGOs, (vi) organising hygiene education, (vii) operation and maintenance. Infact, urban committee in association with NGO can undertake cluster development to undertake a communal development within low income settlements.

**IN BRIFF :**

In urban areas, many low income areas live in unplanned and unauthorised areas. The role of user committees in low income areas is relevant in different ways, including,

— identify and solving local community problems and development of services.

— delivery of services by community based management organisations/user committees.

— supervision and performance control in provided services.

Recommendations for community participation creating awareness among the consumers for achieving a proactive public vigilance on the status of maintenance (leakages, chockages, theft/collapse of manholes or covers, taps etc.)

Although at the policy level a need for 'CP' is recognised, the mechanisms for translating this into action have not been adequately identified. Firstly for all levels of people involved there should be a uniformity of understanding of CP and its substantiability. This is illustrated in following diagram:

**ROLE OF USER COMMITTEES WITH INTERMEDIATION OF NGOs TO FACILITATE CONSUMER AWARENESS NOT ONLY ON THEIR GRIEVANCES BUT ALSO IN ISSUES LIKE WATER CONSERVATION AND WILLINGNESS TO PAY FOR THE SERVICES**

One important aspect of achieving the aims and objectives of development agencies in WSS is the introduction of the self-help concept based on the formation of 'User Committees', whose role is visualised in the form of (i) planning and implementation (ii) caretakers (iii) health educators (iv) maintenance team (v) skill development in communities, and (vi) self-help concept. 'User Committees' are described as counterpart of municipal governments at community level, which can encourage the men and women in low income areas to sit together discuss WSS issues and clarify roles and responsibilities which could be achieved in the community. These User Committees can play an important role in various stages in UWSS, viz. (i) Planning (ii) Design consideration and participatory levels (iii) Construction phase and (iv) O & M. 'User Committees' can determine the level of services to be provided with beneficiaries, discuss the detailed design of the scheme with beneficiaries (all aspects of location and other scheme components and construction phase). The 'User Committees' can also take the full responsibility for the operating and maintaining the scheme and from Sub-Committees to plan their contribution to the construction and women's committees for public health facilities.

**ROLE OF USER COMMITTEE WITH INTERMEDIATION OF NGOs TO FACILITATE CONSUMER AWARENESS NOT ONLY ON THEIR GRIEVANCES BUT ALSO ON ISSUES LIKE WATER CONSERVATION AND WILLINGNESS TO PAY FOR SERVICES**

User Committees in a collaboration with NGO in a limited geographical area may be in a very good position to build up a knowledge of the needs and aspirations of various section of the population in communities. NGOs are often in a better position than local authorities to achieve a full depth of participation among all sections of the communities where they work. User Committees can take help of NGOs to mobilise communities to adopt self-sufficient solutions to the problems, such as, those of water and sanitation. User Committees in communities can take help of NGOs to overcome the class divisions in communities and political interference in the programmes, and also establishing close work rapport with local authorities. NGOs may have a more 'human Touch' for implementation through their grass-root contacts. NGO can provide a common platform for sharing of experiences. They may act as pressure groups for urban communities for modifying and directing policies. NGO can give access to critical information to committees so as to reduce the pressure of information gathering and promote their role more in terms of education. An awareness building at the community level to maximise community participation. Partnership with NGO will provide for more effective

execution of the educational role.

User committees in collaboration with NGO can be helpful not only to awareness raising but;

i. plan to meet the community's requirements,
ii. creation of communal water and sanitation facilities,
iii. facilitate implementation through community partucipation,
iv. preventive maintenance,
v. community health education to establish an understanding of various aspects of water use, hygiene and sanitation practices. Community can and should be change in the interests of health.
vi. training to user committees,
vii. preparing alternative schemes and helping communities to choose between them,
vii. Helping user committees to ensure that costs and benefits are farely shared,
ix. provide follow-up and complementary development activities.
x. encourage the community to set-up their own system of self-government.

In brief, user committees can utilise NGOs as facilitating agencies. NGOs tend to implement a broad range of projects across several sectors. Thus, Committees that establishes a good working relationships with NGO may benefit from follow-up activities.

In urban areas, many committees or communities clearly prefer to approach NGOs for assistance. They pursue NGOs as being more responsive and flexible then local government and less encumbered by bureaucratic and other operational constraints.

Concern communities and CBOs whose opinion leaders are acutely aware of the impacts of WSS problems at the household and neighbourhood level. However, the question arises whether these groups get sufficient opportunities to participate? Here, NGOs can be effective agents for building local awareness, for mobilising community action, and for voicing local concerns about WSS concerned authorities. The participation of community groups and the NGOs that support them, is a powerful instrument for bringing about necessary political commitment an implementing affordable solutions.

As NGOs move to fill the gap, created by the local authorities, there has been an increasing growth of expectation at all level, leading to a set of objectives. If NGOs are make their performance beneficial for communities then government agencies must benefits from their effectiveness. The focus then become one of improving the efficiency of both the government and NGOs in provision of services to the communities. It is clear that while complementaries are often recognised between these two sectors for less thought has gone into practicle modalities of creating sustainable linkages.

In general, there has been less attention paid to the question of building alliances sharing of dicision making process and implementation of projects. The issues is therefore not one of whether or not governments and NGOs might work together, but how? The question then becomes one of examining the types of relationship that are possible under prevailing circumstances in urban as well as rural areas and its implication for communities.

User communitites with support from NGO can undertaken the following work areas:

i. Assist communities and municipalities in need assessment.
ii. Preparation of detailed project report.
iii. Motivation and dissemination of information.
iv. seeking community participation
v. Health and hygiene education
vi. Skill development training
vii. Construction and maintenance of community latrines.
viii. Educating the beneficiaries on proper use, maintenance and up keep of toilets.
ix. Operating a cell to attend complaints of community people.
x. Collection of user charges.

xi. Interaction with municipal authorities.

xii. Personal approach to individual beneficiaries.

xiii. Health and sanitation education campaign.

xiv. Audio-visual media handling.

Problems faced by the community through user and neighbourhood committees for achieving an active community participation.

It is often, observed that the problem in community participation is for consultation to take place with the entire community. In most of the cases, the problem is that a user committees and neighbourhood committees, community's formal leader even when elected, often represent the inches of a certain groups in community. It can not necessarily assumed that they represent the views of the whole community. This committees many times, do not consultations with the whole community. Some times, the political structure of the community reflect the dominance of one group in user or neighbourhood committees and under such circumstances how are the interest of the others to be protected?

In smaller communities, the committees have more interaction with people and an atmosphere is created in which any member of the community is able to speak in committees. However, this more difficult in larger communities, where it may be difficult for poor people, dependent as individuals on the favour of powerful committee members to raise questions which challange their interest and some times, user committees may not put forward the actual needs of that section.

Another important factor related to role of user committees is that meetings of committee are dominated in practice by representatives of dominent sections or politically powerful members, so that others feel unable to challange their view. On the other hand, if a committee does the challange the views of politically dominent sections, there is a danger of more open conflict or hinderance, perhaps, leading to the failure of any kind of participatory element in WSS. Sometimes, it is possible that members of committees may control the services to their own benefits and there is danger of favouring the certain section of population in the communities.

But experience suggests that User Committees often do not function as expected. Many times Committees are formed but never meet or not active. Why is this so? This mostly happens with government implemented systems, which communities assume that government will rectify its breaks down. Many times, Committees have no real power to act, unless Chairman of the Committee is an active member of the community.

We must have a fresh look at the necessity of 'User Committees'. We need to go deeper into existing community structures and determine the role of 'User Committees'. Can we have Neighbourhood Group/Committee concept propogated under UBSP concept and a Resident Community Volunter (RCV) through community consensus or election or any other democratic process and to support planning implementation and monitoring of activities at the neighbourhood level and foster and encourage participation in community improvement. Eventually it is hoped that these 'User Committees' will be able to run their WSS projects.

**CONCLUDING:**

Although at the policy level a need for CP is recognised, the mechanisms for translating this into action have not been adequately identified. Firstly for all levels of people involved there should be a uniformity of understanding of CP and its substantiability. This is illustrated in following diagram.

| CP INPUTS | CP BEHAVIOUR |
|---|---|
| — Awareness raising & motivation | — Membership/User/Participation. |
| — Capacity building (community and institutions) | — Decision making |
| — Resources | — Leadership |
| — Interaction (with all action on scene) | — Mobility broad support |
| — Planning, Implementation & Monitory (WSS) | — Stimulate peoples involvement in WSS |
| — Community education | |
| — Stimulate grass-root efforts to improve WSS | — Substantially |
| — Building local capacity | |

**CP OUTPUTS**

- — User Committees
- — Improved facilities
- — Daily caretaking
- — Maintenance
- — Environmental and Hygiene Improvements
- — Users willingness and ability and inclination to pay.

For initiating 'CP' in WSS the following checklist may be considered—

- — Felt need of the community for WSS services and priority setting.
- — Willingness of community to participate in WSS
- — selection of sources
- — selection of WSS technology
- — level of services
- — selection of water points/sanitary facilities
- — design, cost, construction,
- — timing factor—suitable timings
- — O & M
- — division of work.
- — Responsibilities set people local authority, NGOs and CBOs.
- — Willingness to participate by all socio-economic groups within the community in WSS programmes.

**LEADERSHIP ASPECTS:**

- * How are they selected?
- * How the leadership emerges?
- * How representative are they?
- * How long do they remain community leaders and mobilise opinions?

**Support**

- * Level of awareness among people
- * Agreement/disagreement
- * Attitudes
- * Willingness to participate in WSS functions.

**CREATION OF BASIC COMMUNITY LEVEL ORGANISATION:—**

There are certain areas in which local participation may be the best method of delivery of basic services such as water and sanitation. However, the local bodies must first create such community unit of the people living in a locality which can take on the responsibility of looking after these services. Some urban managers advocate that the municipal share of the cost should be transferred to the community which would then be responsible for their upkeep. Here, if the community leaders misapply the funds, in few localities, let them account for their failure to the community. Infact, community leaders would place themselves at personal risk with the people in the community if they do not do O & M. This kind of experiment may be tried in involving community.

**74TH AMENDMENT AND CITIZEN VITALITY**

It is observed that the citizen's role in WSS has been played down to the point of some ritual. However, the 74th Amendment to the Constitution seeks change this condition permanently. The 74th Amendment provides for the consti-

tution and composition of ward committees. The requirement calls for opportunities of the citizens to participate in decisions for neighbourhood services. In the smaller towns, there may be a few wards comprising the municipality, in the larger towns there may be more of the same, and of a larger size too. The creation of ward committees in the larger 'municipalities' would hopefully provide for citizens access to an involvement in municipal neighbourhood services. It may be necessary to make this mandatory for all the 'municipalities' in the coming years. The Ward Committee will be helpful in the maintenance of sanitation, water supply, health care, and garbage disposal. We have made a beginning to articulate some of the possibilities, problems and potentials in developing the roles and responsibilities of the Wards Committee. No doubt, the Wards Committee will and ought to go a long way in the process of decentralisation and democratic interaction with the citizens.

ANNEXURE — 13

# RECOMMENDATIONS OF GROUP I (TECHNICAL ISSUES) NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY SANITATION SYSTEMS

**RECOMMENDATIONS AS FOLLOWS:**

1. There is a need to create awareness among civic officials and non officials and State Level officials so as to improve O&M of WSS and to motivate them.

This is expected to generate demand for improvement in O&M of WSS Activities involved are:

provide publicity material, training packages, O&M tools, etc. by the Govt. of India for dissemination.

The State level agencies would then prepare a programme to visit the local bodies and make presentations to civic officials and non officials.

The local bodies will agree for the presentation by the State Level Agencies on the need for the local body to:

(i) Give priority to O&M

(ii) Reduce UFW

(iii) Improve revenue recovery and

(iv) Achieve full cost recovery

The awareness campaign should be executed within a period of 6 months.

2. It is necessary to undertake data collection on equipment, maps, water treatement plants, water Supply Distribution System, Sewage and Sewerage Treatment System, service levels, coverage, reservoir levels and visible leakages. This is expected to result in identification of deficiencies.

The collection of information from existing records is to be done by the agency running this scheme. The Govt. of India would in consultation with CPHEEO, State Govts. and Local Bodies fix the format for collection of information within a period of 3 months. The State agency incharge of water supply and sanitation should call a meeting of municipalities in small groups explain to them the significance of the task, circulate the format and obtain the data from the local body and analyse it.

As far as performance related data is concerned, National Task Force would formulate a check list and forward it to the State/Local Body within 3 months. The State agencies would in turn visit the municipal body and collect the data. The data collection should be completed within a period of 6 months. No new scheme for water supply/sanitation of any local body should be considered till the data collection is completed.

A good MIS with information on service levels, service coverage, leakage levels, staff productivity and O&M costs is not readily available with several agencies shall be in place.

— It is necessary that a mechanism is in place for updation of all the maps and records of WSS to update the improvements in the systems.

— a list of monitoring indicators may be prepared and frequency and source specified for each organisation.

3. There is a pressing need for deficiency analysis, action plans and O&M manuals. This is expected to result in improvement of construction practices, debottlenecking of schemes and better O&M practices.

A 3rd party (consultant/engineering institutions/research institutions) should carry out deficiency analysis and suggest improvements in quality of materials and workmanship. This has to be done with the assistance of the State agencies within a period of six months after data collection.

The State water agency should implement decisions on construction quality management including participative designing, interaction with the local body at all stage of executions and joint trial runs with local bodies for a period of

3 months after completion. After deficiency analysis is carried out, action plans will be prepared to address the deficiencies. Reliability and not cost alone should be the criteria for selection of pipes and equipment. O&M Manuals will be prepared for routine Operation and Preventive Maintenance. This should be completed in a period of 3 months time from the time of identifying deficiencies.

4. It is important to undertake water conservation measures and steps for reduction of UFW. This would result in improvement in availability and better utilisation of the systems.

For safeguarding of the source of water supply, the State Govt. should impose appropriate legislation wherever necessary. The State level agencies will monitor the execution of measures for safeguarding the source and interact with the appropriate authorities from time to time. This is expected to be completed within a period of one year.

Measures should be initiated by the agency running the scheme on a continuing basis to prevent wastage of water.

The agency running the scheme should take steps for recycling and reuse of water. To begin with the following 3 items may be impelemented:

(i) Use of back water from filters

(ii) Use of waste water for industrial purposes & cooling

(iii) use of sea water for flushing.

It is necessary to quantify the extent of UFW. It is realistic to expect such quantification be done by 20% of the agencies running these schemes within a period of one year and all the remaining agencies in the State which are running water supply schemes within a period of 4 years. Following the quantification steps have to be taken to reduce physical losses and non physical losses within a period of 5 years.

5. It is of utmost importance to establish a mechanism for monitoring and evaluation of the recommendations on O&M. It is necessary to ensure that concrete results are achieved within the time frame and are sustained.

For achieveing the above objective it is necessary for the Ministry of UA&E in consultation with O&M Working Group of the Collaborative Council to set up a Tast Force. The Task Force may, *inter-alia*, include some engineers with long field experience, representatives from State Deptts., representatives from State agencies and local bodies. The Task Force may be constituted within a period of 3 months.

Each State level agency should moninate a liaison officer to interact with the Task Force and to interact with local bodies within a period of 3 months. Wherever the State Govt. feels it necessary, a Task Force may also be set up at the State level.

The roles of various organisations would as per Annex.

6. It is vitally important for the agencies running these scheme to:

(i) To provide requisite funds for maintaining the facilities in a resonable manner.

(ii) appoint persons in the O&M sector with aptitude for the work.

(iii) To arrange to train O&M personnel for effective performance.

(iv) To provide the required tools in the forms of standard tool kits, spares and consumables. This is expected to result in improved performance of the scheme and boost staff morale. This is to be achieved through the awareness createness programmes made in recommendation.

**Role of O&M WG (Collaborative Council)**

1. Provide publicity materials, training packages, O&M tools etc. for dissemination.

2. Support short term national initiatives to Govt. of India to organise a country level TASK FORCE and to draft TOR for activities 3 & 4 below.

3. Facilitate funds for consultant or agency inputs/efforts to

— disseminate the O&M workshop recommendations

— to convince the local bodies incharge of O&M to:

(i) Give priority to O&M

(ii) To control/reduce physical losses

(iii) To improve revenues

(iv) Agree for full cost recovery.

(v) To undertake training programmes for O&M personnel to improve the performance.

4. Facilitate funding for consultant studies for local bodies to prepare:

(i) Deficiency analysis/document status of O & M.

(ii) O&M Manuals

(iii) UFW Plan

(iv) Training plan

**Role of Govt of India**

1. Ministry of Urban Affairs & Employment (MoUA&E) will constitute a O&M TF with JS (MoUAE). CPHEED and other nominees. MoUA&E may request for consultant assistance to organise country level Task Force and to draft TOR for consultant studies below:

(i) Disseminate the information about the national workshops recommendations and the tools etc. (provided by O&M WG)

(ii) Contact State level agencies to organise consultant studies/visits to local agencies incharge of O&M, in order to convince them to give priority to control UFW, improve revenues, achieve full cost recovery, organise training of O&M personnel, etc.

(iii) Conduct regular meetings to review, monitor and evaluate the implementation of recommendations, action plan for O&M and visit the States from time to time.

2. The O&M Task Force may seek support and facilitation of financial assistance for the above activities from O&M WG Collaborative Council.

3. Govt of India can allocate extra funds to WSS projects of local agencies who have achieved better performance by way of full cost recovery.

**Role of State Level Agencies**

1. They should undertake awareness campaigns among the agencies in charge of O&M to convince them of the need to:

(i) Give priority to O&M

(ii) Control UFW

(iii) Improve revenues

(iv) Achieve full cost recovery

(v) Organise training for O&M Personnel

2. State Level Agencies may nominate their own officials to undertake the above campaign by using the information and tools provided by O&M Task Force. If they find it necessary to avail of the assistance of a consultant to undertake the above campaign, they may appoint consultants locally available or request the GOI for such assistance.

3. State Level agencies should nominate a liaison official to laise between the GOI, O&M Task Force, consultant, and local agencies incharge of O&M.

4. State Level agencies may in consultation with local agencies prepare a programme for their officials or consultants to visit the local bodies and make presentations in 1 above. The audience for their presentation shall be the civic officials, non officials, Municipal Chairman, Councillors etc.

**Role of local agencies:**

1. Agree for a presentation by official of State agency/consultant to be made to the civic officials and non officials of the local body on the need for the local body to give:

(i) priority to O&M

(ii) Reduce UFW

(iii) Improve revenues

(iv) Achieve full cost recovery

(v) Organise training for O&M personnel

2. Local agencies can start updating the data on maps and records of their facilities with their own funds since these data are required for further studies.

3. Local agencies shall streamline financial management of WSS, maintain separate accounts for WSS and improve revenue billing and collection procedures.

4. Local agencies can undertake a campaign to formalise illegal connections.

5. Local agencies can enlist the cooperation of voluntary agencies for improving the service delivery, implement actions on 4 above and finally achieve full cost recovery.

## WORKING GROUP-I
## (TECHNICAL)

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Resource Person — Dr. D.M. Mohan, UNDP Consultant.

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16. Mr. S. Ray.
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23. Mr. H.L. Chauhan, C.E., PHED, Kota.
24. Mr. S.C. Basu Roy, NDMC, New Delhi.
25. Mr. S. Prakash, Consultant, New Delhi.
26. Mr. V.K. Anand, Director, NBCC, New Delhi.

# NATIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS NEW DELHI : 25—27 SEPTEMBER, 96.

FINANCE GROUP

The Group discussed the financial issues and decided the order of priority as under:—

1. The financial management of the WSS has to be streamlined. Separate accounts on commercial basis may be maintained. The revenue billing and collection procedures have to be monitored regularly to improve the revenue collection.
2. O&M of Water and sanitation systems shall enable the agencies to achieve a good financial performance by levying appropriate tariffs in order to provide sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works, etc.
3. Agencies incharge of O&M have to review/revise periodically the tariffs keeping in view the increase in the staff and power costs and levy reasonable and affordable tariffs. Alternatively annual increases may be provided to cover the inflation in operating costs.
4. Agencies whose performance is better shall be rewarded by increased investments for new projects.

Thereafter each issue was deliberated in detail and the following action plan is proposed:—

**Action Plan**

1. The financial management of the WSS has to be streamlined. Separate accounts on commercial basis may be maintained. The revenue billing and collection procedures have to be monitored regularly to improve the revenue collection.

| | Activity | Who/By whom | Time frame |
|---|---|---|---|
| 1.1 | Introduction of Commercial accounting including auditing of the accounts to be made mandatory and should be backed by legal framework. | By Central/State Government. Local body and Agencies. | Within 3 years. |
| 1.2 | Agency should develop a proper data base including periodical updating of their recoveries for efficient billing and collection systems with the assistance from in-house or outside agencies. | Agency incharge of O&M | within 3 years. |
| 1.3 | Innovative methods of collection be introduced with active cooperation of NGOs, Banks, CBOs (community based organisations) and the private agencies. | Agencies incharge of O&M and in collaboration other agencies included in the activity. | 2 years. |
| 1.4 | Regular monitoring of recoveries including penalty for delayed payments and incentives for regular payments to the consumers for effective collection. | The O&M agency and Consumers. | 1 year. |
| 1.5 | Effective management systems need to be introduced by the agencies for cost optimisation of their operations including manpower productivity, energy audit, unaccounted for water and cost of billing and recovery. | O&M agencies. | 1 year. |
| 2. | O&M of Water and sanitation systems shall enable the agencies to achieve a good financial performance by levying appropriate tariffs in order to provide sufficient revenues to cover its operating expenses, debt services, depreciation, cost of capital works, etc. | | |

| | Activity | Who/By whom | Time frame |
|---|---|---|---|
| 2.1 | The minimum tariffs to cover O&M costs should be made mandatory. | Central/State Govt. and concerned agencies. | 1 year. |
| 2.2 | Appropriate tariffs to achieve total cost recovery including O&M costs, debt services, depreciation, cost of capital works etc. should be introduced in a phased manner. | .Central/State Govt. and concerned agencies. | 3 years. |
| 2.3 | In case of debt repayments the repayment schedule including interest and principles should be scheduled to reduce the initial concentrated burden. | Central/State, Financial Institutions and agencies. | 1 year. |
| 2.4 | Rate structure should be devised such that a minimum need of the consumers is met within affordable levels. However progressive rates should be charged for higher slabs to achieve full cost recovery and water conservation.<br>Till the full cost recovery is achieved a transparent subsidy from other clearly identified sources can be given to fill the gap between the total cost and revenues.<br>It also need to be clarified that the total cost include cost of water management including disposal as the water supply is the nearest measure to indicate the utilisation of sanitation services. | Central/State and concerned agencies. | 1 year. |
| 3. | Agencies incharge of O&M have to review/revise periodically the tariffs keeping in view the increase in the staff and power costs and levy reasonable and affordable tariffs. Alternatively annual increases may be provided to cover the inflation in operating costs. | | |
| 3.1 | Annual increase in water rates on 1st April should be taken up to cover the annual inflation. This increase can be higher in the initial years. The annual increase should be a minimum of 15% till the full cost recovery achieved. | State Govts., O&M Agencies. | 1 year |
| 3.2 | Rate revision may also be taken up in case of sudden revision of power tariffs or staff wages to meet the increased cost due to these reasons. | State Govts., O&M Agencies. | 1 year |
| 4. | Agencies whose performance is better shall be rewarded by increased investments for new projects. | | |
| 4.1 | A suitable criteria should be evolved for comparison of performance of various O&M agencies. | Central/State Govts. and O&M agencies. | 2 years. |
| 4.2. | Fast track appraisal system should be introduced for sanctioning loan by the Financial institutions/ Government for sanctioning loans to the agencies fulfilling the performance criteria discussed in the earlier issues. | Central/State Govts. and FIs | 1 year. |
| 4.3 | To provide adequate incentives to introduce the issues discussed in 1, 2 & 3 above. The funds should be made available only to those agencies who are committed to implement these issues. | Central Govt. State Govts. and FIs. | 1 year |

| | Activity | Who/By whom | Time frame |
|---|---|---|---|
| 4.4 | Initial financial assistance may be made available to the agencies who are willing to introduce 1, 2 & 3 above. | Central Government and State Govts. | 1 year. |
| 4.5 | Incentives may be given to effective introduce management system for cost minimisation. | Central Government, State Govts and FIs | 3 year. |

ANNEXURE — 15

# RECOMMENDATION OF THE WORKING GROUP ON HRD & COMMUNITY PARTICIPATION

1 To establish appropriate measures to improve user awareness and to encourage the involvement of the community in sustaining the level and quality of service and other issues such as pricing, revision, conservation, recycling, reuse, conservative use of water related to O&M

2. To create a sense of ownership amongst the dependents on public delivery facilities.

3. To conduct an information campaign on to deal with efficient use of water at the household level.

4. To educate the users on measures for ensuring the supply of quality water-need to detect and arrest leakages within the consumer's premises, contamination, unauthorised methods for drawing water.

5. To prepare and provide Information, Education and Communication materials on the role and importance of O&M

6. To develop a wide band of models for public participation at various compatable levels of the community-access to management levels (decision making).

7. To develop appropriate mechanisms for implementing the models which have been designed.

8. The existing institutional structures for community action under UBSP and other poverty alleviation programmes can be evaluated for generating user involvement in the management of water and sanitation sector at local level.

9. The various community participation oriented organisations operating in other sectors can be identified and appropriate network can be created first for making the sector user-demand responsive. The networks can be broad based beginning at user level, community level as ward committee as well as the statutory committees of the municipal councils at the city/town levels stretching upto the apex level of State Government and Central Government.

10. The role of women and children as the ultimate user should be recognised and their needs must be reflected in planning for O&M as well as extension of the service coverage specially in low income communities.

11. The efforts to study the water and sanitation sector organisations in various on a broad matrix of comparable condition should be undertaken on a systematic basis. These studies should be broad based and issue specific dynamics such as size, scale and complexity of operation. The sector studies should also include methods of determining level and quality of service, water conservation and efficient use of the services. While there is a wide varity of studies and research materials available, access to such documentation is still not within the reach of operating levels. Efforts are required to disseminate the documentation amongst operating personnel to reduce obsolence.

12. The WSS sector is undergoing a radical change in terms of scale of orientations, principles of service delivery and technology The change merits of scientific reorganisational studies covering the entire gamut of service delivery strategies.

13. There is a need for effecting paradigm shift in respect of employee training. It is imperative to sponsor and carry out organisational specific training need analysis compatable with job content, task complexities responsibilities and local conditions. This must be followed by appropriate efforts to develop learning material in local languages. It is also desirable to set up a network of the training with scope for specialization in different areas related to the sector. These training institutions can also be networked to serve the regional needs to make training cost sensitive. First level operating personnel such as the technicians, artisians, skilled and semi-skilled workers also need to be exposed to skill improvement techniques through graduated training programme.

14. There is a need for diagnogistic studies to identify areas amniable to private sector participation. By nature the studies must be local specific rather than being broad based. Presently the norms, standards, methods for contracting, monitoring and evaluation and techniques for ensuring effective control over private sector operation are not in tune with the demand. It, therefore, becomes necessary to develop standardised models for ensuring appropriate control system over private sector operation in water and sanitation sector.

15. Certificate (training) course for the O&M staff

16. Organisational autonomy is a consequence of financial self reliance It is, therefore, necessary to encourage organisation to operate on selfsufficiency basis. For this purpose the revenue functions such as billing collection and financial management in the sector needs to be analysed and improved. The sector personnel should be sensitised to the need for learning and deploying modern techniques involving sound financial management.

## Chairmen & Rapporteurs

| | | | |
|---|---|---|---|
| 1 | Croup-I (Technical) | | |
| | Chairman | | Mr. V. Ranganathan<br>Principal Secretary (WS)<br>Govt of Maharashtra |
| | Rapporteur | | Dr D.M Mohan |
| 2. | Group-II (Financial) | | |
| | Chairman | . | Dr. P.S. Rana<br>Executive Director<br>HUDCO, New Delhi. |
| | Rapporteur | : | Mr. S.S. Patwardhan |
| 3. | Group-III (HRD & Community Participation) | : | |
| | Chairman | . | Dr. V Lakshmipathy<br>Professor, Osmania University,<br>Hyderabad. |
| | Rapporteur | : | Mr. Sukanta Kar |

ANNEXURE — 16

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# (TECHNICAL)

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Rapporteur — Dr. D.M. Mohan, UNDP Consultant.

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3. Mr. A. Biswas, CE, DDA, New Delhi.
4. Mr. M.N. Thippeswamy, SE, BW&SSB, Bangalore.
5. Mr. K.R. Narayanan Iynger, BW&SSB, Bangalore.
6. Dr A.W. Deshpande, NEERI, Nagpur.
7. Dr. P. Pathak.
8. Dr. Bilquis Amei Haque, Bangladesh, O&M, Collaborative Council, (OMCC).
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15. Mr. S. Ray
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24. Mr. S. Prakash, Consultant, New Delhi.
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ANNEXURE — 17

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CHAIRMAN — DR. Rana, HUDCO
Rapporteur — MR. S.S. Patwardhan

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| 1. | Shri S. Ray |
| 2. | Shri M.M. Datta |
| 3. | Shri B.K. Sengupta |
| 4. | Shri R.K. De |
| 5. | Shri R. Ramanujam |
| 6. | Shri M.P. Singh, OECF |
| 7. | Shri S.K. Garg, SE, JAL NIGAM |
| 8. | Shri D.S. Gundevia, GM, ALLAHABAD |
| 9. | Shri C.K. Mohan |
| 10. | Mr. Francois Brikke, IRC. HAGUE |
| 11. | Shri R. Sethuraman DY. ADVISER |
| 12. | Shri N.N. Hotchantani ASST. ADVISER |
| 13. | Shri Yogendra Tripathi |

ANNEXURE-18

# WORKING GROUP ON HRD & COMMUNITY PARTICIPATION
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| 5. | Ms. M. Majumdar |
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| 7. | Shri S. Sarkar, W.B. |
| 8 | Mr. Jose A Hueb, W.H O. Collaborative Council |
| 9. | Mr. Ranjith Wirasinha, WHO Collaborative Council |
| 10. | Dr. T. Walia, WHO, INDIA |
| 11. | Shri Aung Chain, WHO Collaborative Council |
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| 13. | Shri Rakesh Mohan |
| 14. | Shri S.K. Chhabbra |
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| 16. | Shri Kanwarjit Singh |
| 17. | Shri Sukanta Kar, Scientific Officer, C P.H.E.E.O. |
| 18. | Mr. Bolliger Ernst, WHO Collaborative Council |
| 19. | Mr. Gianfrancesco Costantini, WHO Collaborative Council |
| 20. | Shri M.M. Dutta, WHO INDIA |
| 21. | Ms. Marty Rajandran, WHO Collaborative Council, UNICEF. |

ANNEXURE — 19

# CORE GROUP

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6. Mr. Yogendra Tripathi
Deputy Secretary (WS),
Ministry of Urban Affairs
& Employment,
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ANNEXURE — 20

# WELCOME ADDRESS BY SHRI PALAT MOHANDAS, JOINT SECRETARY, RAJIV GANDHI NATIONAL DRINKING WATER MISSION MINISTRY OF RURAL AREAS & EMPLOYMENT

It is a great pleasure to welcome the Hon'ble Minister Shri Chandradeo Prasad Verma, who has very kindly consented to give the valedictory address in spite of his busy schedule and Joint Secretary Ministry of Urban Affairs & Employment, Mr. Minhas, distinguished delegates and representatives from Central and State Government, World Collaborative Council, UNICEF, UNDP World Bank, WHO, bilateral agencies, and ladies & gentlemen.

I am happy to learn that experts in the field of Water Supply and Sanitation Sector have deliberated intensively on the issues pertaining to Operation & Maintenance and have come out not only with relevant recommendations but also with an action plan for effective implementation of measures to sustain systems installed in Rural & Urban Water Supply & Sanitation Sector.

This workshop has a special significance as it has been preceded by World Collaborative Council meeting on Operation & Maintenance aspects of Water Supply & Sanitation Systems, which suggested a national Operation & Maintenance forum of all participating institutions. The recommendations and action plans formulated at the national workshop define definite steps towards adoption of concrete measures for improving the crucial areas of Operation & Maintenance in the Water Supply and Sanitation Sector.

After these recommendations and action plans are adopted, they will provide useful guidelines for both the States and Central Government to effect across the board improvements in Operation & Maintenance of Water Supply & Sanitation.

I hope that the Central Government, State Governments, NGOs, experts and others present here, who have contributed towards formulation of a plan for future action will take speedy steps to operationalize the recommendations, action plans and the guidelines on a priority basis.

ANNEXURE — 21

# WATER SUPPLY AND SANITATION "COLLABORATIVE COUNCIL" MEETING OF THE OPERATION AND MAINTENANCE WORKING GROUP, NEW DELHI, 23-24TH SEPTEMBER, 1996

## BY MR. J. HUEB

## MEETING STATEMENT

During its deliberations, the Operation & Maintenance Working Group of the Water Supply & Sanitation Collaborative Council agreed that the Government of India should be commended for having acknowledged operation & maintenance as a high priority area in its long term policy development.

The Group also wishes to express its appreciation for the efforts exerted in the organising of such a prestigious national workshop and is honoured to have been invited to contribute.

The Operation & Maintenance Working Group would be pleased to forge links with national initiative to convert into reality the recommendations of the National Workshop on Operation & Maintenance of Urban & Rural Water Supply & Sanitation Systems.

It is suggested that the approaches to be adopted in the establishment of such linkages should be derived from discussion and agreement between national representative and WSSCC's Operation & Maintenance Group.

The Group expects that the outcome of this relationship will result in a synergetic partnership towards greater efficiency and effectiveness within the Water Supply & Sanitation Sector.

ANNEXURE — 22

# VALEDICTORY ADDRESS OF SHRI CHANDRADEO PRASAD VERMA HON. MINISTER OF STATE FOR RURAL AREAS & EMPLOYMENT

I am happy to learn that national and international experts participating in the National Workshop on Operation and Maintenance jointly organised by Government of India—Ministry of Urban Affairs & Employment and Ministry of Rural Areas & Employment, and supported by UN Agencies like WHO, UNICEF and UNDP—World Bank, have discussed in detail the various issues and aspects of operation and maintenance of Urban and Rural Water Supply and Sanitation systems and have come out with concrete recommendations and action plans backed by realistic strategies for implementation of the same.

2. Keeping in view the importance of safe drinking water and sanitation in ensuring a healthy life for all human beings , integrated attention has been given to the development of these sector since the first Five Year Plan and substantial progress has been achieved in this direction during the successive various Five Year Plans India was a signitory to the United Resolution on International Drinking Water Supply and Sanitation Decade Programme (1981-91). During this period, not only was the National Water Policy, 1987 evolved but also the Technology Mission for safe drinking water was launched. Consequently, as of now, 82% of the rural population, and 85% of the urban population has access to safe drinking water facilities. Although the overall progress is not too encouraging in the sanitation sector, very good work has been done in some States.

3. However, although on paper we have provided safe drinking water facilities to 85% population in urban areas and 82% in rural areas, the actual population benefited is much less primarily because of overall neglect of O & M of these schemes and systems, on the ground. There are many issues related to operation and maintenance. I want to drawn your attention to some of these issues:

(a) Operation and Maintenance is closely linked to planning, design and implementation of the schemes. If the design of a particular project is defective and proper material is not utilised in its implementation, there is not only difficulty in its operation and maintenance, but systems often go out of order resulting in ever increasing expenditure. For example, in rural areas it is generally noticed in the Handpump programme that the depth of drilling is reduced by 50 ft compared to the standard prescribed depth Consequently, during the summer season these handpumps go dry. Therefore, for effective management and operation and maintenance, the first and foremost condition is appropriate design of the projects and their honest implementation.

(b) Generally, it is seen that in the rular development works, the individual at the end of the social order is the last to get the benefit—which is also the least. This is equally applicable in the operation and maintenance of water supply and sanitation systems. If a handpump located in faraway areas away from the main road get out of order, it is not repaired for months on end. Therefore, while repairing the schemes for operation and maintenance, it is essential to give attention to the needs of vulnerable sections of the society and those residing in inaccessible and difficult areas.

(c) The expenditure on new project of water supply and sanitation is included in the Plan whereas the expenditure on their operation and maintenance is treated as non-Plan. Due to an acute financial resource crunch in many States, the provision for non-Plan expenditure too gets reduced. In some other States, the provisionis not adequate to meet salary and allowances. Consequently, due to lack of funds, operation and maintenance of the scheme is affected adversely. In this context, we should always keep in mind that while installation of a new handpump costs about Rs. 20,000/- the existing non-functional handpump can be repaired with less than Rs 500/- and made functional. This is equally applicable for urban water supply schemes and piped water supply schemes in rural areas.

(d) The fourth important issue of operation and maintenance is linked with decentralisation. In most of the States the responsibility of operation and maintenance of urban and rural water supply schemes rest with the Public Health Engineering Department. There is a centralised arrangement for supply of spares, tools and equipments used in the operation and maintenance schemes. In order to make the system effective, it is of paramount importance that the responsibility for operation and maintenance of the systems should be given

to the local panchayat and Zila Parishad. In order to enable them to carry out this responsibility, they should be given adequate financial and administrative powers so that they do not have to look to the State Capitals for the day to day operation and maintenance needs.

(e) Substantial outlay is earmarked for water supply and sanitation projects, especially piped water supply schemes and substantial expenditure is incurred on their operation and maintenance. A part of this expenditure should be borne by the users of these schemes. It is not possible for the State Governments and the Zila Parishads to bear the entire expenditure out of public funds. It is essential to bring about substantial improvement in our present system of water tariff, sending of bills and collection of bill amounts. Unless appropriate water tariff is levied on the beneficiaries according to their paying capacity for expenditure on operation and maintenance on a regular basis, it is not possible to ensure management of operation and maintenance of the scheme on sustainable and permanent basis.

4. I would have liked to share my views on a number of other issues related to this important subject of operation and maintenance. However, due to paucity of time, this has not been possible. I am not only hopeful but also confident that after extensive deliberations in the National Workshop, the recommendations, Action Plan and strategies arrived at after long deliberations by the national and international experts would go a long way in helping us in the management of operation and maintenance of the water supply and sanitation systems.

5. I thank you all for inviting me to the Concluding Function of the National Workshop and for your patient hearing of my views.

ANNEXURE - 23

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