



MANUAL ON

**OPERATION AND  
MAINTENANCE OF  
WATER SUPPLY  
SYSTEMS**

**CENTRAL PUBLIC HEALTH AND  
ENVIRONMENTAL ENGINEERING ORGANISATION**

MINISTRY OF URBAN DEVELOPMENT  
NEW DELHI



**WORLD HEALTH ORGANISATION**

JANUARY 2005

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## MESSAGE

The UPA Government attaches top-most priority to provide drinking water to all sections in urban and rural areas of the country and augmenting availability of drinking water sources. There is an imminent need to reduce water losses in the distribution system by way of reduction of unaccounted for water, non-revenue water and adoption of technologies for leakage detection and control. There is also need to put an end to the acute drinking water shortage in cities, especially in southern states, where desalination plants are proposed to be installed all along the Coromandel Coast starting with Chennai.

I am glad to know that an Expert Committee constituted by the Ministry of Urban Development has brought out a comprehensive Manual on Operation & Maintenance of Water Supply Systems. It has been a long felt need for the sector to the people. I congratulate all those who have been instrumental in bringing out this Manual, including the World Health Organization (WHO) for providing financial support.

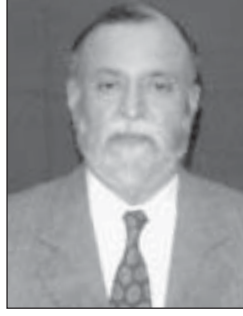
I recommend that all Public Health Engineering Departments and Water Boards in urban areas make full use of this Manual.

(GHULAM NABI AZAD)

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## FOREWORD

Safe and adequate drinking water is vital for sustaining the quality of life in urban areas. Provision of this facility to the burgeoning urban population is a challenging task for State Governments and Union Territories. Ministry of Urban Development has been assisting this sector through policy formulation, central financial assistance, human resource development, obtaining external assistance and preparation of manuals and guidelines.

One of the problem areas of the sector has been the absence of proper operation and maintenance of the water supply systems, resulting in wastages, leakages, high-energy consumption, etc. There has been a long-standing need for bringing out a comprehensive manual on the subject. Ministry of Urban Development, therefore, constituted an Expert Committee under the chairmanship of Adviser, Central Public Health & Environmental Engineering Organization (CPHEEO). The World Health Organization (WHO) provided financial assistance for the purpose.

The Manual was finalized by the Expert Committee after considerable deliberations and contributions by the Members, as well as feed back obtained from State Public Health Engineering Departments and Water Utilities during the National Workshop Organized at Thiruvananthapuram, Kerala from 19th to 21st June, 2003. The Manual covers all the aspects of operation and maintenance, including treatment of water from various sources, drinking water quality surveillance, water audit and leakage control, human resource development and public private partnerships.

I trust that the Manual would provide valuable guidance not only to the managers of water supply systems, but also to other key personnel, including grass-root level operators and technicians.

I am pleased to acknowledge the contribution made by the Members of the Expert Committee, invaluable comments/suggestions given by field level organizations and sector professionals and financial assistance provided by World Health Organization in the preparation of the Manual.

(ANIL BAIJAL)

# PREFACE

The Ministry of Urban Development and Poverty Alleviation had constituted an expert committee in February 2001 for the preparation of Manual on Operation and Maintenance of urban water supply systems to fulfill the long time demand of the field engineers working in the urban water supply and sanitation sector. The composition of the Committee was:

1. Shri V. B. Ramaprasad  
Adviser (PHEE) CPHEEO  
Ministry of Urban Development  
Government of India, New Delhi  
Chairman
2. Dr. D. M. Mohan  
Rtd. Chief Engineer  
Hyderabad Metropolitan  
Water Supply and Sewerage Board  
Non-Official Member
3. Shri N. R. Paunikar  
Rtd. Superintending Engineer  
Maharashtra Jeevan Pradhikaran  
Non-Official Member
4. Shri P. N. Gokhale  
Superintending Engineer  
Maharashtra Jeevan Pradhikaran  
Official Member
5. Shri D Cruz J.  
Rtd. Engineer in Chief  
Delhi Jal Board  
Non-Official Member
6. Shri M. M. Datta/  
Shri A. K. Sen Gupta  
National Professional Officer  
(Sanitary Engineer)  
WHO India Office  
Non-Official Member
7. Shri B. R. Nagendra  
Chief Engineer  
Bangalore Water Supply and  
Sewerage Board  
Official Member

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- |     |  |                                     |
|-----|--|-------------------------------------|
| 8.  | Shri T. R. Rane<br>Hydraulic Engineer<br>Greater Mumbai Municipal Corporation  | Official Member                     |
| 9.  | Shri Subal Chandara Bhowmik<br>Superintending Engineer<br>PHED, Government of Tripura                                  | Official Member                     |
| 10. | Shri R. Ramanujam<br>Managing Director<br>Kerala Water Authority   | Official Member                     |
| 11. | Shri R. N. Surya Narayana Singh<br>Engineering Director<br>Chennai Metropolitan<br>Water Supply and Sewerage Board     | Official Member                     |
| 12. | Shri M. N. Sharama<br>Rtd. Chief Engineer<br>PHED Govt. of Haryana   | Non-Official Member                 |
| 13. | Shri V. Subramaniam<br>Rtd. Superintending Engineer<br>TWAD Board  | Non-Official Member                 |
| 14. | Shri S. K. Kalra<br>Additional Chief Engineer (Rtd.)<br>PHED Govt. of Rajashtan  | Official Member                     |
| 15. | Shri D. S. Gundevia<br>General Manager and<br>Shri K. K. Shukla<br>Chief Water Analyst<br>Jal Sansthan, Kanpur         | Official Members                    |
| 16. | Shri M. Sankaranarayanan<br>Official Member-cum<br>Assistant Adviser (PHE)<br>CPHEEO,<br>Ministry of Urban Development | Official Member<br>cum Co-ordinator |
| 17. | Shri R. Sethuraman<br>Official Member cum<br>Joint Adviser (PHEE)<br>CPHEEO,<br>Ministry of Urban Development          | Member Secretary                    |
-

The Committee held nine meetings from June, 2001 to October, 2003 to deliberate & discuss various aspects related to O&M of Water Supply Systems and has drawn freely from all available literature in finalizing the manual. The Committee constituted three sub groups, which convened nine meetings in Mumbai, Chennai, Bangalore, Thiruvananthapuram and Delhi and deliberated/discussed the various aspects and also consulted some documents to incorporate in the draft chapters. The Committee also constituted an Editorial Sub-Committee with the following members for editing the Chapters.

1. Shri J. D'Cruz, Engineer-in-Chief (Rtd.), Delhi Jal Board
2. Shri M. N. Sharma, Chief Engineer (Rtd.) PHED, Govt. of Haryana
3. Shri V. Subramaniam, Superintending Engineer, TWAD Board
4. Dr. D. M. Mohan, Chief Engineer (Rtd.), Hyderabad Metropolitan Water Supply and Sewerage Board
5. Officials from CPHEEO

The Editorial Sub-Committee convened four meetings at Hyderabad and New Delhi and finalized the draft chapters of the Manual.

The Draft Manual was discussed thoroughly in the three day Workshop held at Thiruvananthapuram in June, 2003. The Workshop was attended by the officers of various water authorities, responsible for operation and maintenance of water supply systems. Later, the Expert Committee reviewed the suggestions made in the said Workshop and modified the Draft Manual accordingly.

The Committee places on record its thanks and deep appreciation to:

- The WHO for the financial support for the preparation of the manual as well as organizing the three day Workshop at Thiruvananthapuram.
- The Ministry of Urban Development for the necessary support and help in the preparation of the Manual.
- The Kerala Water Authority for its support and cooperation extended for organising the three day Workshop at Thiruvananthapuram.
- The PHE Departments, Water Boards, Urban Local Bodies, and individuals for their valuable suggestions on the draft manual.
- Shri R. Sethuraman, Joint Adviser (PHEE) and Shri M. Sankaranarayanan, Assistant Adviser (PHE), who in spite of their normal duties took care of all the logistics for holding the meetings which enabled the Committee to complete its work.

The contribution made by Shri B.B. Uppal, Deputy Adviser (PHE), Shri M. Dhinadhayan, Shri N. N. Hotchandani, Shri V. K. Chaurasia, Assistant Advisers (PHE) and Shri Sukanta Kar, Scientific Officer for enriching the contents of the Manual is very much appreciated.

Shri S. K. Gulati, Shri Ambuj Sharma, Shri R. Rajagopal, Shri Neeraj Kumar Kush, Shri S. Timothy, Ms Durga Rani Batra and Ms Ravi Rekha Bajaj have rendered commendable

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service to the Committee in the form of Secretarial assistance and Shri Chandra Singh & Ravinder Kumar for general assistance, which deserve appreciation.

The Committee also places on record its appreciation of the services rendered by the PHE Section of the Ministry without whose cooperation, the arduous task assigned to the Committee could not have been accomplished as per the time schedule.

**V. B. Ramaprasad**  
Chairman of the Committee &  
Adviser (PHEE), CPHEEO  
Ministry of Urban Development  
New Delhi

Date: 23rd October, 2003



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