1

NEERI 79

REPORT

NATIONAL WORKSHOP ON RESEARCH & DEVELOPMENT NEEDS IN WATER SUPPLY AND SANITATION DECADE (1981-1990) INDIA

NOVEMBER 21-22, 1979
NEERI, NAGPUR

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE
NAGPUR

WORLD HEALTH ORGANISATION SOUTH-EAST ASIA REGIONAL OFFICE
NEW DELHI

CENTRAL PUBLIC HEALTH & ENVIRONMENTAL ENGINEERING ORGANIZATION
NEW DELHI

R E P O R T

NATIONAL WORKSHOP ON RESEARCH & DEVELOPMENT NEEDS IN WATER SUPPLY AND SANITATION DECADE (1981 - 1990) INDIA

NOVEMBER 21-22, 1979
NEERI, NAGPUR

National Environmental Engineering Research Institute
Nagpur

World Health Organisation, South-East Asia Regional Office
New Delhi

Central Public Health & Environmental Engineering Organization
New Delhi

C O N T E N T S

ANNEXURES

1. INTRODUCTION

India is one of the signatory countries to the resolution of the United Nations Water Conference held at Mar del Plata, Argentina in March 1977, and hence committed to the objectives and goals as outlined in the resolution. Concerted efforts should be made to ensure reliable drinking water supply and provide basic sanitation facilities to all urban and rural communities during the decade 1981-1990. In this endeavour, research and development has to play a vital role in support of the decade programme, for which the objectives should be :

i) determination of technical and social feasibility of various options which are available for water supply and basic sanitation (human excreta disposal);

ii) evaluation of economic and environmental system effects of technologies which provide for conservation of water, reclamation and re-use of wastewater;

iii) development of devices to save energy and chemicals;

iv) technological innovations at intermediate technology levels to improve efficiency and enhance appropriateness; and

v) evaluation of social attitudes, cultural patterns and community participation to improve health benefits.

...2

A workshop was organised during November 21-22, 1979 on " R & D Needs for Water Supply and Sanitation Decade 1981-1990 " by National Environmental Engineering Research Institute, Nagpur, in collaboration with Central Public Health and Environmental Engineering Organisation, New Delhi and World Health Organisation, South-East Asia Regional Office, New Delhi. Field engineers, research engineers/scientists, consultants and university professors were invited to discuss, deliberate and identify R & D projects of national, regional and local importance, suggest methods of funding and linkages to be established between user departments and research institutions. The accent was more towards application and extension rather than solely on the development of new knowledge.

2. RESEARCH AND DEVELOPMENT SUPPORT FOR THE DECADE PROGRAMME

The workshop aimed at identifying the topics with a view to :

i) assess the realities of the situation as they exist or will exist during the decade;

ii) consider the technology strategy in the light of the social relevance, health benefit, cost effectiveness, managerial skills, administrative, information and planning aspects;

iii) provide guidelines for priorities, funding and institutional linkage; and

iv) emphasise the need for application and extension as related to the immediate objectives of the decade programme.

...3

3. CONDUCT OF THE WORKSHOP

The inaugural session of the workshop on November 21, 1979 was initiated by Dr. B.B. Sundaresan, Director, National Environmental Engineering Research Institute, Nagpur, India. The basic objectives of the workshop and the strategies governing R & D with reference to the decade programme were outlined. Prof. S. Subba Rao, Professor of Public Health Engineering, All India Institute of Hygiene and Public Health, Calcutta, was unanimously elected as the Chairman and Prof. V. Raman of NEERI, Nagpur, as the Technical Coordinator for the workshop. Subsequently, 14 working papers prepared by invited experts were presented in the three plenary sessions on 21st November. The list of papers and authors are shown in Annexure-I. The papers were grouped under three categories, viz.,

i. Planning and strategies, technology and methods.

ii. Professional development and manpower resources.

iii. Information system.

After the plenary sessions, four working groups were formed amongst the participants to discuss the allotted subject, identify topics for research in order of priority, resources required, identify institutions, assess manpower requirements and indicate methodology for linkage between State Public Health Engineering Departments/Boards, Local bodies, Consultants, Manufacturers, Universities, State Water Pollution Prevention & Control Boards and Research Institutions. Issues were discussed on the following basis under four subject areas of a) water, b) sanitation, c) manpower development and consultancy and d) information systems.

....4

i) identification of topics, institutions, resources, etc. taking into consideration the constraints of transfer of technology;

ii) criteria for setting up priorities; and

iii) national work plan with reference to subjects, strategies, materials, finance, institutions, etc.

4. DISCUSSIONS

The working papers highlighted the R & D support for the decade programme outlining the objectives, planning and strategies, methods and technology, manpower development and information systems and planning.

Maximum benefits should accrue from the limited resources allocated in the field of environmental health. Technology should be appropriate resulting in saving of capital and recurring costs with possible achievements of greater utilisation and impact. While science is universal, technology is regional and should be relevant to social, cultural and economic needs. The set of benefits as well as indicators of benefits should be identified and given weightage factors for the R & D projects to be accorded priority in tune with the National Water Supply and Sanitation programme.

Critical technology and social impact evaluation and assessment of completed rural water supply schemes is required for proper feed back to enhance benefits to society. Priority should be accorded for village level systems for the development of hand-pumps including field trials, simplified method of

.....5

collection, treatment and distribution of water and simplified field testing methods. Need for studies on the behavioural and community aspects of technology, and the impact on health of community arising out of sanitary interventions utilising professional researchers and villagers has been emphasised.

Optimisation techniques and mathematical modelling have great scope in arriving at the economic design of small and large water distribution systems and wastewater collection systems. Such methodologies would lead to reduction in costs and hence studies should be undertaken.

A rational, efficient and feasible method of management of water from the source to the user is needed with respect to quantity and quality. Special emphasis should be given to the assessment of water resources and their conservation, the prevention of pollution of water sources and distribution systems, and improvement in operation, preventive maintenance of facilities in water supply system including surveillance.

In urban and semi-urban wastewater collection systems, there is need for studies on improving the existing wastewater treatment units, techniques for acceleration of biological treatment processes, development of appropriate design criteria for various unit processes, recovery of backwash water from water treatment plants, use of substitute material as adsorbent in place of activated carbon, control of hydrogen sulphide formation, development of variable speed pumps and package treatment units.

...6

In urban fringe and rural areas, emphasis should also be given on development, operation and maintenance of individual/community sanitary facilities, integrated waste and wastewater treatment and utilisation, and simple low cost systems of wastewater collection and disposal systems.

The system of sewerage as prevalent in developed countries, has limited application due to the high cost. Alternate systems of collection through underground and surface drains, introduction of intermediate technology treatment systems like pit privies, septic tanks with secondary treatment and disposal systems in urban fringe and rural area should be considered. Studies need be undertaken to standardise the design criteria to meet regional requirements to reduce cost of construction and operation.

The need for adequate manpower and training facilities to support the decade programme is keenly felt. Consultancy services in the field of environmental engineering would play a notable role in programme implementation for which measures should be undertaken. Manpower planning depends on the ability of the planners to project the changing pattern of the demand and develop the right type of personnel required. The training of technical personnel in environmental engineering is needed at undergraduate and post-graduate level with specialised curricula giving emphasis on water supply and waste disposal, and rural problems with support from humanities and health sciences. In-service training and continuing education for professionals at all levels (including laboratory) in water supply and waste disposal projects are required. The curricula for such courses

should be dynamic and geared to the objectives of the decade programme

5 RECOMMENDATIONS

5.1 General

1) In order to coordinate and help the State efforts and formulate national policies and provide guidance, the organisational set-up at the national level is grossly inadequate. A strong organisation similar to the Central Water Commission should be created which might be designated ' National Commission for Water Supply and Sanitation '.

2) Work plan for water supply and sanitation should be taken on priority basis for completion during the decade.

3) Each State should have a research and development laboratory attached to the Public Health Engineering Departments/Boards and initiate programmes to meet the local needs.

4) CPHEEO, NEERI and other organisations at national level should coordinate the R & D Programmes with States, universities and engineering colleges to avoid duplication of efforts.

5) At least 2 per cent of the total investment for the projects in the decade programme should be earmarked for strengthening infrastructual facilities of research institutions and undertaking R & D programmes.

5.2 Topics for Research

The R & D topics identified for support during the decade have been grouped under

a) Water,
b) Sanitation,
c) Manpower Development, and
d) Information Systems Planning.

5.2.1 WATER

It is envisaged that the entire population of India should be provided with reliable water supply by 1991. Conventional approaches, systems and design criteria need be reviewed against the background of community participation and acceptance, and low cost technological options. The topics for research and development have been identified as indicated below in the order of priority :

1. Community Participation, Behavioural Pattern and Technology Transfer Aspects of Water Supply

   Study the effectiveness of various methods and techniques to involve the communities for effective participation and assess their impact on the people's knowledge, attitude and practice.

2. Evaluation and Assessment of Rural Water Supply Systems

   Evaluate critically and assess the design, construction, performance and operation of rural water supply schemes including the impact on health, social and economic status of community and suggest measures for improvement.

3. Optimum Number of Public Stand Posts vis-a-vis House Connections for Rural Water Supplies

Suggest guidelines for provision of number of standposts and house connections taking into account socio-economic conditions, financial constraints, community participation, etc.

4. Field Studies on Preventive Maintenance of Water Distribution Systems with reference to Leakages & Carrying Capacities of Mains

Assess the wastage of water in distribution system due to leakages, undertake projects for control of wastage and to assess the efficacy of control measures; to measure in the field the carrying capacity of mains as basic input data for design and operation, and evaluate errors associated with estimation thereof.

5. Hydraulic Analysis and Optimum Design of Water Distribution Systems

Develop indigenous electric pipe line network analysers, and follow optimisation techniques and systems approach (use of computers) for analysis and design of distribution systems.

6. Design Norms for Intermittent Water Supply

Work out norms for design and operation of systems with intermittent water supply.

7. Recharge of Groundwater and Conjunctive Use of Ground and Surface Waters

Undertake studies on feasibility of recharge

..... 10

of groundwater with surface runoff especially in water scarce regions.

8. Simple, Continuous and Effective Method(s) of Disinfection for Rural Water Supply

Study, assess and develop, if need be, the various simple disinfection devices suitable for small water supplies.

9. Extension of Rapid Bacteriological Techniques

Undertake field trials and inter-laboratory studies of some of the newly developed rapid techniques for bacteriological analysis.

10. Development of Springs for Water Supplies

Study and gather information on effective utilisation of springs.

11. Simple and Effective Water Treatment Methods for Surface Water

Develop systems without or with minimum use of chemicals and mechanical gadgets.

12. Use of Filters without Rate of Flow Controllers and other Sophisticated Equipment

Carry out field and pilot scale studies on design and operation of filters without gadgets and using alternative simple devices, if need be

13. Development and Field Testing of Methods for Residual Chlorine Determination

Compare various methods and develop suitable alternative methods to orthotolidine tests for determination of residual chlorine.

14. Development of Natural and Inorganic Coagulants

Identify and develop alternate materials for use as coagulants in place of conventional ones.

15. Use of Solar Energy in Rural Water Supply

Investigate the feasibility of using solar energy for rural water supply schemes especially with reference to removal of dissolved solids from brackish water and for pumping.

16. Use of Wind Mills

Carry out field studies on use of wind energy for pumping and for mixing.

17. Studies on Tube and Plate Settlers

Investigate application of tube/plate settlers to upgrade existing plants and develop compact units.

18. Handpumps, Strainers and Substitute Materials

Identify the components of handpumps that need attention, improve the performance, and use of alternate materials.

19. Alternate Materials for Pipes and Specials in Water Supply Systems (to suit different soil conditions to resist chemical action)

Prepare soil maps with reference to corrosivity in different cities and towns, identify materials to suit various soil conditions, and develop inexpensive protective coatings and linings and their field testing.

...12

20. Evaluation and Development of Reliable Rubber Ring Joints & Jointing Materials for Pipes

Develop standards for rubber ring and other jointing materials, and evaluate and assess the existing status of rubber ring and jointing materials with reference to leakages, effect on water quality, life, etc.

21. Infiltration Wells, Galleries and Intake Structures

Study the hydraulics of flow through porous media, and develop suitable designs and code of practice for infiltration galleries and wells.

22. Water Meters, Flow-rate and Water Level Measuring Devices

Develop simple, sturdy and reliable instruments for recording (without use of electricity).

23. Tube Well Construction and Development

Evolve proper rational designs for tube well, gravel filter pack and strainers, and methods for reconditioning derelict tube wells, and explore use of alternate materials for strainers.

24. Electronic Leak Detectors, Pipe Locators and Valve Box Locators

Develop simple devices including electronic methods for underground leak detection, location of buried pipes and valve box covers.

25. Hydraulic Rams for Rural Water Supply in Hilly Areas

Develop and standardise designs and materials

...13

of construction of hydraulic rams with respect to discharge and high heads for small population in hilly areas.

26. Reclamation of Backwash Water and Sludge Bleed from Water Treatment Plants

Carry out field studies on the feasibility of reclamation and reuse of backwash water and sludge bleed from filters and clarifiers respectively.

27. Reduction in Volume of Waste of Water from Water Treatment Plants

Evaluate the wastage from existing treatment units, and recommend measures for reduction of waste by proper operation and control.

28. Control of Evaporation and Seepage

Evolve practicable cost effective methods for reduction of losses in open storage reservoirs due to evaporation and seepage.

29. Water Quality Management with respect to Water Supply Systems

Assess, rationalise and manage the water quality in the water supply systems.

30. Development of Package Water Treatment Plants

Conduct studies on development of simple package type water treatment plants for hilly areas, and for removal of specific constituents like iron, fluorides, hardness, brackishness, etc.

5.2.2 SANITATION

The target set for the decade programme in India is to provide sanitary latrines to 50 per cent of the households. With high investment costs in conventional water carriage sewerage systems, it will be prudent to adopt low cost, low energy, simplified collection and treatment systems like pit privies, septic tank followed by secondary treatment/disposal units. Acceptance and active involvement of community essential for successful implementation of sanitation programmes. The topics for research and development have been identified under two categories, namely, Rural/Semi-Urban and Urban/ Urban fringe in the order of priority.

a) R u r a l

1. Development of Sanitary Latrines

Develop simple inexpensive techniques with different materials for W.C. pan and trap, superstructure, lining of pit, etc.

2. Operation and Maintenance of Individual/ Community Latrines

Study community attitude and engineering aspects regarding operation and maintenance of individual/community latrines.

3. Composting of Household Wastes and Night-soil

Develop simple and hygienic methods of making compost with household waste and night-soil.

4. Integrated Bio-gas System for Treatment of Excreta and Animal Wastes and Utilisation of Gas

Develop and undertake field studies on integrated approach for the treatment of excreta, use of biogas and utilisation of effluent for agriculture and aquaculture.

5. Low Cost Waste Water Collection & Disposal System

Evaluate and assess simplified collection and disposal system.

6. Package Wastewater Collection and Treatment Units for Small Communities

Develop low cost and simplified package wastewater collection and treatment systems for small communities.

7. Community Latrines Attached to Bio-gas Plants

Evaluate the performance of communical latrines directly connected to bio-gas plants.

8. Community Organisation Patterns

Study and develop sociological and health education methods for community acceptance and participation for maintenance and operation of sanitary facilities.

9. Sanitary Latrines Suitable for Rocky/ Impervious/Water Logged Areas

Evolve suitable sanitary pit type latrine or alternate devices suitable to rocky and water logged areas.

....16

10. Impact on Human Health

Epidemiological studies on the impact of sanitary facilities on human health.

11. Water Pollution due to Pit Privies

Make detailed field studies on travel of groundwater pollution due to pit privies for different soil conditions.

12. Mechanisms for Removal of Human Excreta/Sludge

Develop simple systems, vacuum tankers, etc. for cleaning cess pools and septic tank de-sludging.

13. Utilisation and Disposal of Sullage

Investigate and study inexpensive methods of collection, disposal of sullage by soak pits, dispersion trench, etc. and treatment by stabilisation ponds and utilisation for aqua-culture and agriculture.

b) U r b a n

14. Evaluation and Rational Design of Bio-Filters

Conduct pilot plant and field studies on evaluation and formulation of design models for bio-filters for secondary treatment of sewage.

15. Energy Consumption in Sewage Treatment and Collection System

Study and assess the energy consumption in sewage collection and treatment with a view to conserve energy.

....17

16. Package Treatment Unit and Innovative Treatment Systems

Carry out detailed pilot plant and field performance studies on biodisc or rotating biological contactor, anaerobic (upflow) filter followed by grass plot and aeration systems to evolve standard designs, design criteria, materials of construction, cost reduction, etc.

17. Reclamation of Domestic Sewage for Industrial and Agricultural Use

Undertake studies on treatment aspects for reuse of domestic sewage for various purpose.

18. Cost Aspects of Collection, Treatment and Disposal of Sewage

Cost analysis (capital and O & M) of collection, treatment and disposal of sewage for different sized communities under different systems.

19. Design, Development and Evaluation of Surface Aerators

Undertake model studies, develop and evaluate prototype units for their performance.

20. Performance of Polishing Ponds

Evaluate the polishing pond performance with reference to nutrient and pathogen removal.

21. Upgrading of Existing Treatment Plants for Increased Loads

Study the practicability of upgrading of the existing treatment plants to take up increased loads.

....18

22. Evaluation of Existing Sewage Treatment Plants

Critical evaluation and assessment of sewage treatment plants of different capacities.

23. Development of Suitable Mechanical Equipments for Collection and Treatment Works

Develop variable speed pumps, and equipments for sewage treatment plant from the point of view of ruggedness, simplicity of operation and economy.

24. Control and/or Removal of Hydrogen Sulphide

Evaluate critically and assess the extent of corrosion of sewers and sludge digesters and suggest methods of control and/or removal of hydrogen sulphide.

25. Water Hyacinths for Nutrient Removal

Explore the use of water hyacinths for removal of nutrients and metal ions from wastewaters.

26. Sludge Treatment and Disposal

Develop inexpensive and simple techniques for conditioning and dewatering of sludge.

27. Field Evaluation of Pipes and Ancillary Structures in Sewerage Systems

Field studies on the behaviour of various materials of pipes and ancillary structures with regard to sewage or combined sewage and industrial wastewaters.

28. Status Report on the Discharge of Industrial Wastes into Municipal Sewers

Prepare the status report regarding the discharge of industrial wastes into municipal sewers with reference to norms, charges, effects, etc.

29. Feasibility of Sludge Gas Utilisation

Carry out feasibility studies on the gas utilisation by digestion of sludge/night-soil for communities.

5.3 MANPOWER DEVELOPMENT

Research and development support by itself will not provide all the required information for the field engineers but it can be a valuable tool if the research institutions as well as engineering colleges involve themselves with implementing departments at the State level through proper linkage. The professional development and manpower needs for the decade programme to be provided from the teaching and research institutions need careful consideration. It has been estimated that about 2000 post-graduate and 40,000 graduate engineers and an equal number of diploma holders in environmental engineering would be required for the decade programme. There are sufficient number of engineering colleges and polytechnics in the country which can train engineers at under-graduate and diploma levels. However, all are trained basically as civil engineers, who need further re-training for one to two years.

The PHE departments rely essentially on the civil engineering graduate who is a generalist for all

practical purposes. It is desirable to embark upon environmental engineering as a specialised branch at the under-graduate level. The existing institutions offering Master's degree courses will not be able to provide all the post-graduates needed for the decade. The advances that have taken place in environmental sciences and engineering are so much that specialised training could be provided at the post-graduate level also. At the under-graduate level, it could be suitably oriented so that more subjects are covered and the degree is awarded in environmental engineering. The subjects to be included should have theory and design aspects in water supply and wastewater engineering, sanitary microbiology, sanitary chemistry, solid wastes management, liquid and gaseous industrial wastes and environmental sanitation. Other subjects which are not essential in environmental engineering practice should be replaced by the ones which are relevant. It will be prudent to train more environmental engineers at the end of 4 or 5 year under-graduate programme to meet the increasing demand.

A good stream of students could be diverted to environmental engineering through proper counselling at the under-graduate level as the country needs such a large number for the decade programme. A large number of them will be required in air and water pollution control programmes. Only one course in water supply and sanitation is being offered in bachelor's degree course in civil engineering. Academicians in engineering colleges and universities as well as field engineers should give a lead to let environmental engineering emerge as a professional discipline, backed up with solid under-graduate programme. It is heartening to note that several universities have already

.....21

started courses in environmental chemistry, environmental biology and microbiology to provide adequate professional support in environmental management.

The curriculum and the mechanics of conducting in-service training and continuing education for water and sewage works managers, supervisors, operators and laboratory personnel should be properly geared to the job requirements and job specifications with proper apportionment of theoretical, laboratory and field aspects. Mechanics, pump drivers, rig operators could be trained in the industrial training institutes. Specific professional categories such as financial analysts, hydrologists, geohydrologists, system analysts, etc. need be trained.

There is need for consultancy services for the planning and design of water and sanitation systems during the decade. Consultants should have proper competency, qualifications and experience in the field of environmental engineering.

5.4 INFORMATION SYSTEMS

Information services in environmental sciences and engineering being provided in the country to the field engineer as well as research worker are inadequate. Such a system is essential to have the right type of information at the right time; and helps reduce the gap between the generators and users of information. It is required primarily for selection of alternative technologies - technology available, case studies to show experiences on projects executed earlier, substitution of materials, impact of projects on society and community participation, directory of expertise,

and indicators of cost-effectiveness of the projects.

The tasks required for generation of information are listed below :

i) Identify sources of information in terms of organisations, expertise and users, both at the national and international levels.

ii) Create information sources and motivate them to generate relevant information.

iii) Document available information.

iv) Acquire useful data such as rainfall, water quality, water and wastewater treatment data, population trends, health statistics.

v) Prepare briefs of various documents.

It is desirable to have cells at the State and national levels for organising such activities with special emphasis on the following :

i. Information on assistance available from national and international organisations and procedures to be followed in this regard.

ii. Identifying experts for satisfying specific requirements of different member cells.

iii. Identifying the organisations who can arrange demonstration and extension

services for various technical innovations. It should disseminate information regarding the seminars, conferences and exhibitions organised within and outside the country in the field of water supply and sanitation.

It should also maintain directory of specialised personnel and inventory of important equipments available at different places and organisations in the country.

ANNEXURE - I

LIST OF WORKING PAPERS

1. Sundaresan, B.B.,

   R & D Strategy in Environmental Engineering and Sciences

2. Khare, S.T.,

   R & D Needs for the Decade Rural Water Supply

3. Desai, V.D.,

   R & D Support to Planning and Management of Urban Sewage Systems

4. Raman, V.,

   Conservation of Water with reference to National Water Supply and Sanitation Decade

5. Reyes, L. Wilfredo,

   Research in the Development of Appropriate Technology for the Improvement of Environmental Health at the Village Level in the WHO South-East Asia Region

6. Choudhari, Nilay,

   Water Quality Management in India - Problems, Approach and Areas of Investigation

7. Pitchai, R.,

   Use of Mathematical Models in Water Distribution System Design

8. Khanna, P.,

   Optimisation of Wastewater Collection Systems

...2

9. Patwardhan, S.V.,

Simplified Water Treatment Systems

10. Daivamani, S.,

Resources Development for City Water Supply

11. Subba Rao, S.,

Relevance of the Current Curricula for the Graduate and Post-graduate Training in Environmental Engineering Towards Research and Development Needs and Proposed Improvements

12. Bhole, A.G.,

In-service Training Needs for Water and Wastewater Engineering Personnel

13. Radhakrishna, G.N.,

Role of Consultants and their Contribution to R & D in Environmental Engineering

14. Bhat, S.G. and Kesarvani, S.K.,

Water Supply and Sanitation Information Bureau (WATSSIB) - An Outline

***

ANNEXURE - II

WORKSHOP PROGRAMME

NOVEMBER 21, 1979

0930 - 1115 Session I

1. R & D Strategy in Environmental Engineering & Sciences - Dr. B.B. Sundaresan

2. Research in the Development of Appropriate Technology for Improvement of Environmental Health at Village Level in the WHO SEARO Region - Dr. W L Reyes

3. R & D Needs for the Decade Rural Water Supply - Shri S.T. Khare

4. R & D Support to Planning & Management of Urban Sewerage System - Shri V.D. Desai

5. Conservation of Water with reference to National Water Supply and Sanitation Decade - Shri V. Raman

1115 - 1130 T E A

1130 - 1300 Session II

1. Water Quality Management in India - Problems, Approach and Areas of Investigation - Dr. Nilay Chaudhuri

2. Use of Mathematical Models in Water Distribution System Designs - Prof. R. Pitchai

3. Optimisation of Wastewater Collection System - Prof. P. Khanna

4. Simplified Water Treatment Systems Prof. S.V. Patwardhan

1300 - 1400 L U N C H

1400 - 1500 Session III

1. Relevance of the Current Curricula for the Graduate & Post-graduate Training in Environmental Engineering to R & D Needs and Proposed Improvement - Prof. S. Subba Rao

Contd :

2. In-service Training Needs for Water and Wastewater Engineering Personnel- Prof. A.G. Bhole

3. Role of Consultants and their Contribution to R & D in Environmental Engineering - Prof. G.N. Radhakrishna

1500 - 1515 Formation of following Working Groups :

1. Water
2. Sanitation
3. Professional Development
4. Information Systems

1515 - 1530 T E A

1530 - 1730 Meeting of the Working Groups

NOVEMBER 22, 1979

0900 - 1115 Meeting of the Working Groups continues

1115 - 1130 T E A

1130 - 1230 Meeting of the Working Groups continues

1230 - 1300 Formulation of draft recommendations by the Working Groups

1300 - 1400 L U N C H

1400 - 1515 Presentation of draft recommendations by the Chairmen of different Working Groups

1515 - 1530 T E A

1530 - 1730 Plenary Session - Finalisation of recommendations and discussions

***

ANNEXURE - III

LIST OF PARTICIPANTS

1. Algarsamy, S.R.
Engineer
Richardson & Cruddas
Madras

2. Arunachalam, P.
Chief Engineer, P.H.E.D.
Meghalaya P.W.D. Section
Arvinne, Upland Road
Shillong-793001

3. Amin, Shanti Bhai
Chairman
Gujrat Water Supply &
Sewerage Board
200, Sector 29
Gandhinagar (Gujrat)

4. Badrinath, S.D.
Scientist
NEERI
Nagpur

5. Bal, A.S.
Scientist
NEERI
Nagpur

6. Besa, A.A.
WHO Sanitary Engineer
C/o UNICEF
11, Jorbagh
New Delhi

7. Bhairavan, N.S.
Chief Engineer(PH) &
Additional Secretary
Kerala State
Trivandrum

8. Bhat, S.G.
Documentation Officer
NEERI
Nagpur

9. Bhasole, M.D.
Chief Engineer
Nagpur Municipal Corporation
Nagpur

10. Bhaskaran, T.R.
Geo Miller Co., Ltd.
91, Nehru Place
Bhandari House
New Delhi

11. Bhave, V.R.
Scientist
NEERI
Nagpur

12. Bhide, A.D.
Scientist
NEERI
Nagpur

13. Bhole, A.G.
Prof. of Civil Engineering
V.R.C.E.
Nagpur

14. Bodas, M.R.
Chief Engineer(Rural) &
Joint Secretary
U.D. & P.H. Deptt.
Room No. 401, Mantralaya
Bombay-400032

...2

15. Bulusu, K.R.
Deputy Director
Water Division
NEERI
Nagpur

16. Chaudhari, D.V.
Nagpur Water Works
Nagpur

17. Chaudhri, T.R.
Chief Engineer, P.H.E.D.
Tripura

18. Chaudhri, L.M.
Engineer-in-Chief
Haryana P.W.D.
(P.H. Branch)
Chandigarh

19. Chatterjee Pankaj
Adviser (PHE)
CPHEEO
Govt. of India
Ministry of Works & Housing
Nirman Bhavan
New Delhi

20. Dabadghao, S.B.
Asstt. Director
TILE Division
NEERI
Nagpur

21. Das, K.K.
Scientist
NEERI
Nagpur

22. Daivamani, S.
Chief Engineer
M.W.S.S. Board
Greams Road
(Metro Water)
Madras

23. Das Gupta Subir
C.E.I. PHE Directorate
1, KS Roy Road
6th Floor
Calcutta 700001

24. Desai, V.D.
Municipal Commissioner
of Greater Bombay
Mahapalika Marg
Bombay

25. Gadgil, J.S.
Scientist
NEERI
Nagpur

26. Gandhi, A.H.
Deputy Municipal
Commissioner
Ahmedabad Municipal
Corporation
Ahmedabad

27. Ganguli, P.L.
Officer on Special Duty
Monitoring Cell
I.& F.C. Deptt
Agartala, Tripura

28. Gaonkar
Engineering Manager
Tata Consulting Engineers
Bombay

29. Gupta, S.K.
Executive Engineer
Punjab Water Supply &
Sewerage Board
S.C.O., 1,2,3 Sect. 17-13
Chandigarh

30. Hofkes, E.H.H.
International Research
Centre for Water
Netherlands

...3

31. Jagannath Rao, D.R.
Public Health
Engineering Department
Bhopal

32. Jain, M.N.
Chief Engineer
Water Supply & Sewage
Disposal Undertaking
Link House
Mathura Road
New Delhi-110 002

33. Jaipal, N.
Superintending Engineer
C.P.M.C.
Bombay

34. Kachwah, M.S.
Executive Engineer
Public Health Engg. Dept.
Rajasthan
Jaipur

35. Kaul, P.N.
E.E. PHE Investigation-
cum-D.P. Division
J & K State
Karan Nagar
Srinagar (KMU)

36. Kalsi, N.S.
Executive Engineer
P.W.D. Public Health
(RWS) Branch
Patiala-147001

37. Kameron, AO.A.
Chief Engineer
P.W.D., Nagaland
Kohima

38. Kantawala, D.
Env. Engg. Consultants
96-97, Mittal Chamber
Nariman Point
Bombay

39. Kaul, S.N.
Scientist
NEERI
Nagpur

40. Khanna, P.
Environmental Science
Engineering Group
Civil Engg. Deptt.
Indian Institute of
Technology (IIT)
Bombay-400 076

41. Khare, S.T.
C.E. & Joint Secretary
U.D. & P.H. Deptt.
Fourth Floor, Mantralaya
Bombay-400 032

42. Khambati, G.F.
C.E., Sewerage Project
Bombay Municipal
Corporation
Bombay

43. Krishnaswamy, R.
Chief Engineer
TWAD Board, No. 807
Annasalai
Madras-600 002

44. Krishnamoorthi, K.P.
NEERI
Nagpur

45. Kulkarni, V.H.
Bombay Municipal
Corporation
Bombay

46. Madan
Chief Engineer
M/s Hindustan Construction
Co.
Construction House
Ballard Estate
Bombay

...4

47. Mirchandani, I.D.
Chief Engineer
Irrigation & P.H.
Himachal Pradesh, P.W.D.
U.S. Club
Simla-3

48. Mishra, A.B.
Joint Director
Environment & Ecology
Lucknow

49. Nanjundaswamy
Chief Engineer
Karnataka Urban Water
Supply & Drainage Board
Bangalore

50. Nanjundiah, Y.N.
Member Secretary
Gujrat Water Supply &
Sewerage Board
200, Sector 29
Gandhinagar(Gujrat)

51. Natarajan, R.
M/s Hindustan Dorr-
Oliver
Bombay

52. Nath, K.B.
Hyderabad Asbestos Ltd.
Hyderabad

53. Parthasarathy, M.R.
Deputy Adviser, CPHEEO
Ministry of Works &
Housing
Nirman Bhavan
New Delhi-110 011

54. Pampattiwar, V.L.
Scientist
NEERI
Nagpur

55. Parikh, Y.
Project Manager
Environmental Engg.
Consultant
96-97, Mittal Chamber
Nariman Point
Bombay

56. Patwardhan, S.V.
Head
Centre for Rural Development
Indian Institute of
Technology
Hous Khas
New Delhi-29

57. Pathak, B.N.
Scientist
NEERI
Nagpur

58. Phirke, P.M.
Scientist
NEERI
Nagpur

59. Poddar, A.K.
Chief Engineer
C.M.D.A.
PHE Directorate
New Secretariat Building
Govt. of West Bengal
1 K.S. Road
Calcutta

60. Prabhakar Rao, A.V.S.
Indian Institute of
Technology
Kanpur

61. Paramasivam, R.
Scientist
NEERI
Nagpur

...5

62. Parhad, N.M.
Scientist
NEERI
Nagpur

63. Patil, M.D.
Scientist
NEERI
Nagpur

64. Patil, S.K.
Executive Engineer
Nagpur Municipal
Corporation
Nagpur

65. Puri, H.S,
Chief Engineer
P.W.D.
Public Health Branch
Govt. of Punjab
Patiala

66. Radhakrishnan, G.N.
Visveswaraya Engineering
College
Bangalore

67. Raman, V.
Assistant Director
Sewage Treatment Division/
Environmental Engineering
Consultancy Division
NEERI
Nagpur

68. Ramkrishnan, K.S.
Sri Digvijay Cement
Corporation Ltd.
Shreenivas House,
Ground Floor
Hazarimal Somani Marg
Bombay-400 001

69. Rangarajan
Sales Manager
Chemical & Plastics
Wavin India Ltd.
Industrial Estate,Ambatur
Madras

70. Rao, C.E.S,
Hindustan Construction Ltd.
Construction House
Walchand Hirachand Marg
Ballard Estate
Bombay-400 038

71. Ravindran, R.
Asbestos Cement
Hyderabad

72. Reyes, W.L,
WHO Sanitary Engineer
WHO, South-East Asia
Regional Office
World Health House
Ring Road
New Delhi

73. Roy, S.K,
Chief Engineer & Secretary
Bengal Irrigation &
Flood Control Dept.
Tripura
Agartala-799 001

74. Salam, S.A.
Chief Engineer
Public Health Engg. Dept,
Jammu & Kashmir

75. Saliyan, M.L,
Superintending Engineer
PHE South Zone
Bangalore

....6

76. Sandhu, M.S.
Managing Director
Punjab Water Supply &
Sewerage Board
S.C.O. 1-2-3
Sector 17B
Chandigarh-160 017

77. Saraf, R.K.
Scientist
NEERI
Nagpur

78. Sheshsai
M/s Chemicals & Plastics
India Ltd.
Dhun Building
175/1, Mount Road
Madras-600 002

79. Shah, S.K.
Chief Engineer(PH) &
Joint Secretary
Health & Family Welfare
Department
Sachivalaya
Gandhinagar(Gujrat)

80. Shende, G.B.
Scientist
NEERI
Nagpur

81. Singh, B.K.
Chief Engineer
Public Health Deptt.
P.W.D. Compound
Manipur, Imphal

82. Singh Deo, D.N.,
Chief Engineer
Govt. of Orissa
Bhubaneswar-1

83. Saxena, K.L.
Scientist
NEERI
Nagpur

84. Skoda, J.D.
Senior Programme Officer
(Water)
UNICEF
11, Jorbagh
New Delhi

85. Srilal Agarwal
Hyderabad Asbestos
Hyderabad

86. Srinivasan, M.V.
Scientist
NEERI
Nagpur

87. Sivaramkrishnan, N.
Engineer
Chemicals & Plastics Ltd.
Madras

88. Subrahmaniam, D.V.
Regional Adviser in
Environmental Health
WHO South-East Asia
Regional Office
New Delhi

89. Subrahmanyam, P.V.R.
Asstt. Director
NEERI
Nagpur

90. Sundaresan, B.B.
Director
NEERI
Nagpur

...7

91. Subba Rao, S.
Prof. of Sanitary Engineering
Indian Institute of Hygiene & Public Health
110, Chittaranjan Avenue
Calcutta-700 073

92. Thergaonkar, V.P.
Scientist
NEERI
Nagpur

93. Swaminathan, R.
Scientist
NEERI
Nagpur

94. Vaidya, M.G.
C.E.(West Zone)
Public Health Engineering Division
Bhopal (M.P.)

95. Venugopalan, V.
Deputy Adviser(PHE)
CPHEEO
Government of India
Ministry of Works & Housing
Nirman Bhavan
New Delhi-110 011

96. Venkatesan, S.
Scientist
NEERI
Nagpur

97. Virendra Kumar
Superintending Engineer
U.P. Jal Nigam
Jhansi

98. Vittal Rao, M.
Scientist
NEERI
Nagpur

99. Yennawar, P.K.
Scientist
NEERI
Nagpur

***