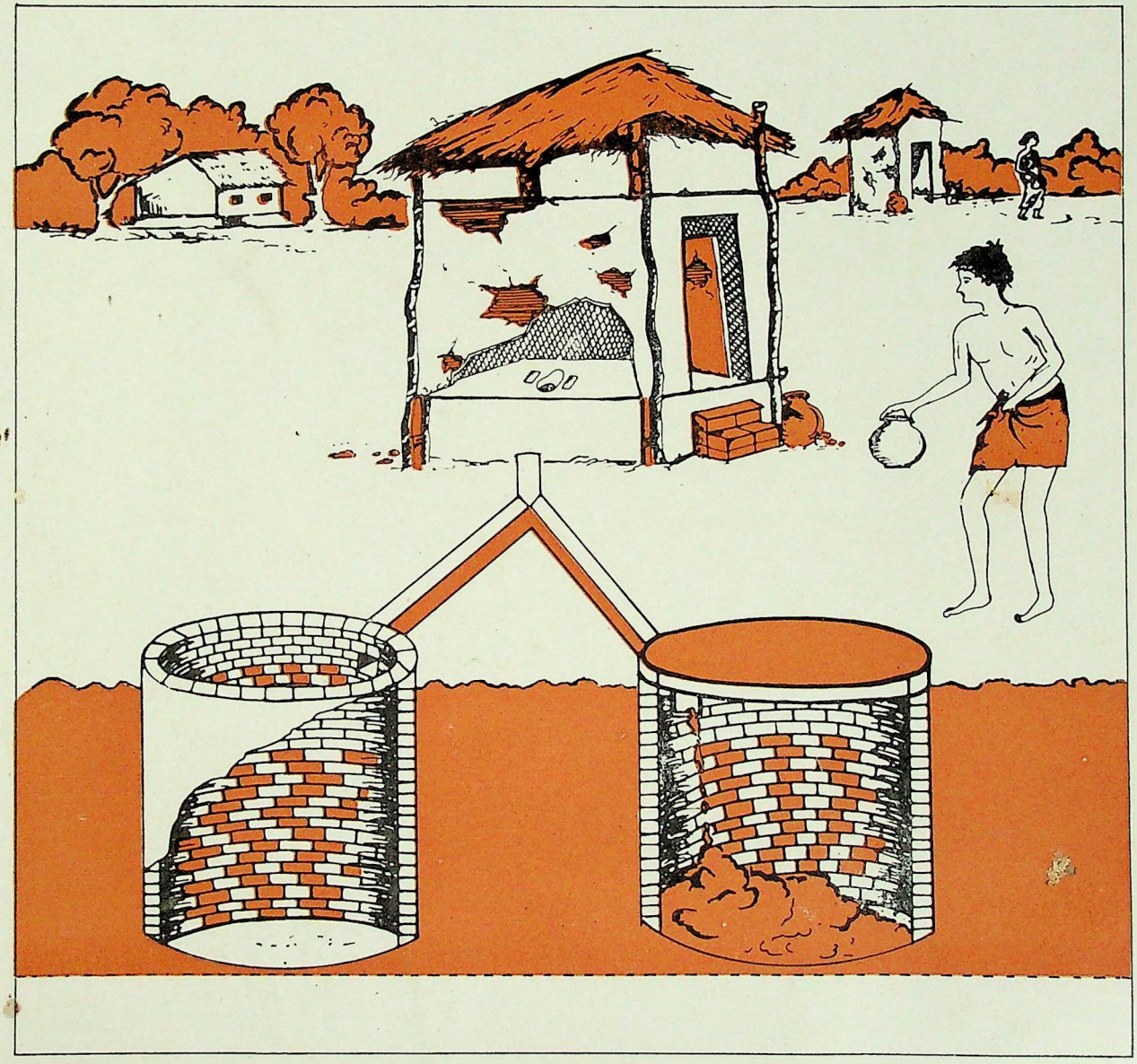
Government of India/UNICEF/UNDP RURAL Sanitation Project

Sanitation Project On Low Cost Waterseal Latrine



Technology Advisory Group.(India) New Delhi 1985.

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ACRONYMS AND ABBREVIATIONS

GRP	:	Fibre Glass reinforced polyester plastic
NGO	:	Non-Governmental Organisation
PRAI	:	Planning Research-cum-Action Institute, Lucknow
PVC	:	Polyvinyl chloride
RCA	:	Research-cum-Action
TAG	:	Technology Advisory Group of World Bank, Washington on Low Cost Water Supply and Sanitation
TAG (India)	:	Regional Group of TAG for South Asia based in Delhi
TCM	:	Technical Cooperation Mission
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UP	:	Uttar Pradesh (a State of India)
VIP	:	Ventilated Improved Pit
WHO	:	World Health Organisation

GOVERNMENT OF INDIA/UNICEF/UNDP RURAL SANITATION PROJECT

Introduction

1. According to the 1981 census, India's rural population is about 525 million residing in about 6 lakh* villages. Less than 1% of the rural population in India, it is estimated, has access to sanitary latrine facilities at present. The practice of defecating in the open is widely prevalent while its dangers are not widely known or appreciated. Yet, the practice is responsible for high mortality and morbidity rates, particularly among children. The most common excreta-related diseases are : diarrhoea, cholera, typhoid, hepatitis, worm infestation and dysentery. These deaths and diseases can be prevented, if sanitary latrines are used for defecation.

Government's Concern for Women's Needs

2. The need of women in the rural areas for latrines is being increasingly felt by women themselves. It has also attracted the attention of Government at the highest level. The fact that the village women can play an important role in every sphere of such a latrine programme from the stage of planning, construction, implementation, operation and maintenance, as well as in the field of health education, communication support and promotional work—is also being increasingly realised by many international and bilateral agencies and particularly by the Government of India and various state governments.

Prime Minister's Concern

3. The late Mrs. Indira Gandhi, former Prime Minister of India, stressed the necessity of latrines for the rural communities in India, particularly for women. In June 1982 she addressed a letter to the Chief Ministers of states mentioning "another problem is that of latrines in rural areas. With the consolidation of land holdings and expansion of towns as well as cultivated areas, people in villages have great difficulty in this regard. Women specially feel miserable. They can go out only at night time, which is not always safe. I have spoken on this matter to some Chief Ministers. The State Government should take up a programme of building latrines where these are not available or get local organisations to take an interest".

International Support

4. The United Nations Conference on Human Settlements (June 1976, Vancouver) emphasized the importance of providing safe drinking water supply and hygienic systems of waste disposal. This theme was reiterated in the United Nations water

* One lakh=100,000

Conference (March 1977, Mar del Plata, Argentina) in which almost all the developing countries participated. The Conference resolved that every person in the developing countries should be provided with potable water supply and safe and adequate sanitation facilities by 1990. The Conference urged that 1981-90 be declared as the International Drinking Water Supply and Sanitation Decade. The Decade was voted in the 34th meeting of the UN General Assembly in November, 1980.

5. The World Bank took the lead in preparing a field manual on "Appropriate Sanitation Alternatives". It reviewed the various practices all over the world and identified low cost alternatives for disposal of human wastes in different hydrogeological and socio-economic conditions which would reduce the massive investment necessary for a sewerage system.

6. Preliminary investigation indicates that there are many alternatives between the pit privy and the water carriage system. Their costs vary widely. However, it is necessary to determine the technical and economic feasibility of various options available for their efficient operation and replicability and acceptance in the developing countries. Considerable work has also been done in this direction.

India's Decade Programme

7. The International Drinking Water Supply and Sanitation Decade (1981-1990) declared by the United Nations seeks to focus the attention of member-nations and the world community on this problem. Plans and programmes of the members of the United Nations are to be accelerated during the Decade to deliver this essential facility to the community. India is also a signatory to the U.N. Resolution. The Government of India and the state governments have resolved at various conferences that attempts should be made to cover at least 25% of the rural population with hygienic sanitation facilities by the end of the Decade.

Historical Background

8. After enactment of the Government of India Act 1935, Government's efforts in rural latrine construction started in some of the states (then called provinces). This, however, could not be considered as a systematic latrine programme and in actual practice depended more on the initiative of the District Health Officers.

9. The Governments of the undivided provinces of Bengal, Bombay, Madras, Mysore, Punjab as also the provinces of Bihar and U.P. showed interest in rural latrine construction. Different types of latrines were developed for different regions, based on the socio-cultural and economic conditions. During 1940-45, construction activities were intensified in undivided Bengal with the assistance of the rural centre of the All India Institute of Hygiene and Public Health, Calcutta.

10. After independence, in the First and Second Five Year Plans, emphasis was laid more on research activities on rural latrines than on physical achievements. A research-cum-action project (RCA) was established in 1956 by the Union Ministry

of Health with the assistance of the Ford Foundation. Useful research work was done through the project in three centres at Poonamallee (Madras), Singur (West Bengal) and Najafgarh (Delhi). The Indian Council of Medical Research also sponsored research units in Kerala, West Bengal, Bombay and Punjab to study the types of latrines suitable for different regions. During 1958-62, the Planning Research-cum-Action Institute (PRAI), Lucknow (U.P.), took up a research project on rural latrines with the assistance of WHO, TCM and Ford Foundation.

11. Since 1958 research work carried out by several other organisations such as the American Friends Service at Ludhiana (Punjab), WHO (project at Ramanagaram, Mysore), Gandhigram Institute, Tamil Nadu, Central Public Health Engineering Research Institute (Nagpur), American Mission in Barpalli (Orissa) and the Kerala Government under the Norwegian and WHO project have made valuable contribution in this field. All these studies were primarily aimed at finding the most suitable technical solution which would be afforded and accepted by the rural population. The designs adopted were the pourflush system either with a single pit having a squatting pan on the pit or with double pits with one pit to be used at a time. The second pit was to be used when the first one was full.

12. In Najafgarh all the latrines under the RCA project were of the single pit system with the latrine cubicle over the pit. Very few were with two pits. Some of the pits collapsed due to flooding of the areas or use of too much water for flushing, and others got filled up with sludge. In most of the villages, no attempt was made to construct the second pit and the villagers—both men and women—reverted to the practice of open air defecation.

13. While research work on pour-flush latrines was being conducted by various institutions and organisations on several aspects of the problem. State Development Departments and the Government of India constructed a large number of these latrines in the villages in the late fifties and early sixties with the assistance of the Block Development administration and by subsidising the cost and availing of the participation of the community voluntarily in this development programme.

Present Position

14. Despite the several earlier projects and efforts at promoting latrines in the rural areas, the programme has not progressed to any significant extent. Less than 1% of the rural population is expected to have access to sanitary latrines by the end of the Sixth Five Year Plan (March 1985). On the other hand, the Government of India and the state governments have a goal of extending sanitary latrine facilities to 25% of the rural population by the end of the Water and Sanitation Decade (March 1991). Of late, UNICEF which has done commendable work in the rural water supply sector has been active in sanitation activities in several states and is keen to support a substantially larger programme of rural sanitation in the next five years.

The Present Project

15. A project on Rural Sanitation (Project No. IND/84/016; full title : Feasibility Study based on demonstration schemes for sanitary latrines in rural India) sponsored by

the Government of India and assisted by UNICEF and UNDP has commenced on June 1, 1984. The executing agency for the Project is the World Bank through its Technology Advisory Group (India). The immediate objective of the Project is to prepare a Master Plan Report including Preliminary Engineering and Feasibility Study for Low Cost Appropriate Sanitary Latrines with on-site disposal of human excreta in the rural areas of 13 states by undertaking a sanitary latrine construction programme on a demonstration basis as a prelude to a larger programme envisaged in the Decade Plan.

Operation of the Project

16. The Technology Advisory Group (TAG) established by the World Bank under the UNDP Global Project (GLO/78/006, now renumbered as INT/81/047) set up a special group called TAG (India) to prepare feasibility studies on low cost sanitation for 211 urban areas of 21 states. TAG (India), apart from its own experience in the field, has benefited from the research in low cost sanitation carried out by the World Bank, from the guidance given by the TAG Headquarters Staff in Washington, from exchanges with individual TAG staff working in various countries and from the contributions of UNICEF and numerous individuals and institutions both within India and overseas. To develop most economical and appropriate design of pour-flush latrines, various studies (listed in Annex I) were also carried out by TAG (India). TAG (India) has thus been able to accumulate knowledge and experience of many institutions and individuals and has developed unique expertise in this field.

17. Though feasibility studies have been conducted for mass implementation of the low cost pour-flush waterseal latrine programme in more than 200 representative urban areas by UNDP-TAG, separate feasibility studies on latrines for rural areas was considered inescapable for several reasons. The reasons, by and large, reflect the rural-urban differences in this sub-continent.

18. The income and affordability levels in the rural areas are generally considered to be lower than in the urban areas, warranting a search for even lower cost options necessitating change in engineering design and technology. The search will, no doubt, lead to investigating the possible use of locally available materials which, apart from being cheaper and more appropriate, are likely to blend with the rural environment and lower the dependence on production lines of far-flung urban centres except where absolutely necessary. In-situ or local manufacture of materials could also be attempted with advantage, to create employment opportunities in the rural areas and foster rural skills.

19. The rural communities, still characterised by primary inter-personal relationships, offer a congenial ground for attempting community participation, a key component of which is likely to be voluntary and free labour by the beneficiary, his family and associates, particularly during the periods when agricultural operations are slack. This component is generally absent, or at best limited, in the urban areas where the beneficiary tends to use hired labour.

20. The urban areas are more crowded than the rural areas. The slums and poorer quarters of towns and cities often present problems in the construction of individual latrines due to space constraints. A substantial section of the urban population consequently resorts to open air defecation almost involuntarily, much as they would like to avoid it, had individual latrines, or even well maintained community toilets, been available. In the rural areas, on the other hand, the space constraint is generally absent. All the same, open air defecation is practised, leading to the hypothesis that the practice is perhaps voluntary and even considered conducive to health. A related hypothesis is that a latrine within or close to the residence is branded as unclean and offensive, at least by some sections of the rural population. Inculcating the latrine habit and promoting the latrine programme in the rural community are, therefore, considered more difficult and challenging than in the urban areas. The feasibility study will attempt to confirm or disprove these hypotheses.

21. These and several other rural urban differences under-score the need for a different strategy to promote rural sanitation and, therefore, for a separate feasibility study to appreciate and focus on the factors peculiar to the rural situation.

22. The present Project of the Government of India assisted by UNICEF and UNDP proposes to utilise the expertise developed by TAG (India) and UNICEF to prepare feasibility studies based on demonstration schemes for selected rural communities and to develop expertise within the states themselves to enable them to replicate the projects in future.

23. The Project will undertake :

    a) Analysis of the existing institutional framework of the departments in the selected states responsible for rural latrine activities and of NGOs with potential for the implementation of such activities with a view to defining the optimal infrastructure necessary to fulfil the Decade objectives

    b) Study and evaluation of earlier and existing sanitation schemes in order to identify low cost appropriate technologies, approaches to enlist community participation, constraints/success and modalities of implementation, which would be suitable for a scaled up programme.

    c) Determination of the appropriate types of sanitary latrines in relation to cultural practices, hydrogeological conditions, socio-economic considerations and local resources.

    d) Evolving of alternative financial patterns for the promotion of sanitary latrine programme, giving due emphasis to community participation.

24. The study will include 3,600 villages in 13 states (list at Annex II).

25. About 37,000 demonstration latrines will be set up as a part of the Project in selected locations in the 13 states to (i) test their acceptability and technical viability; and (ii) investigate the feasibility of providing all the no-latrine households in a village with appropriate sanitary latrines. On an average 7 demonstration units are proposed to be constructed in each of the selected 3,600 villages, in addition to

the construction of at least 50 units in each of the 240 villages selected out of the Project villages for intensive coverage as discussed subsequently. Individual household latrines will be provided wherever possible. Where space is a constraint, community latrines (preferably shared latrines) will be considered. Appropriate community latrines will be considered where necessary, particularly for commuters or casual users including those congregating for periodical fairs, markets etc.

26. For the selection of the blocks/villages in the different states, the factors considered are :

    i) the villagers should enthusiastically come forward to help in the implementation of the programme;

    ii) they should broadly represent the varied situations obtaining in the state : (a) socio-economic, (b) socio-cultural, (c) the practice of anal cleansing, (d) soil structure (e.g. clayey, coarse or highly porous, rocky, hill slopes etc.), (e) hydrogeological condition (e.g. with high ground water level or liable to flooding or ponding for most of the time), (f) house structure, (g) population density, (h) local materials (particularly for the superstructure and pits);

    iii) they should preferably form part of (a) ICDS (Integrated Child Development Services), SIAD (Social Inputs in Area Development) or DWCRA (Development of Women and Children In Rural Areas) Blocks, or (b) areas of implementation of (1) NREP (National Rural Employment Programme), or (2) IRDP (Integrated Rural Development Programme), or (3) TRYSEM (Training of Rural Youth for Self Employment), or (4) SSF (Self Sufficiency Scheme), or (5) CADP (Command Area Development Programme) or (6) Rural Housing (particularly Economically Weaker Section (EWS) Programme), or (7) Areas where effective participation of non-governmental organisations (particularly women's organisations) is already available or expected; and

    iv) at least one group of villages selected in a state should have predominant scheduled caste/scheduled tribe population.

27. Demonstration units will be set up in each of the 3,600 selected villages. One unit each will be located in the Anganwadi, Rural Health Centre, Primary School and the Panchayat Office, wherever they exist. These units will be fully funded by UNICEF. Another three units, which will be constructed in the houses of the sanitation volunteers to be selected for the promotion of the programme. will also be assisted by UNICEF up to 40% of the total cost of the complete unit.* The sanitation volunteers will be selected from women, social workers, 'anganwadi' workers, health centre staff, school teachers, masons or other suitable and willing persons. The units will be constructed in their individual houses for demonstrating the actual construction and use. The balance cost of the above mentioned three units in the individual households will be borne by the state governments/beneficiaries.

28. Additionally, 240 villages, out of the stipulated 3,600 villages, will be selected for intensive coverage with at least 50 units per village or units for 25% of the total

* Unit with a cheap superstructure.

households to demonstrate and test the organisational, financial and legal infrastructure as well as the new non-formal education approaches for community involvement (e.g. participatory/educational approach, direct participatory approach, situational analysis and the resource identification dialogue with the community) which will be recommended by the Project for obtaining the minimum 25% Decade coverage. UNICEF will bear 40% of the total cost of these household latrines in 240 villages and the balance 60% will be shared by the beneficiaries and state governments. These 240 villages shall form the first phase of the Decade programme.

Technology

29. Technology adopted should be hygienically and environmentally safe, technically and scientifically appropriate, socially and culturally acceptable, economically affordable and should be simple in construction, operation and maintenance. Sewerage is an ideal solution for the disposal of human and other wastes but its cost is prohibitive Septic tank is another alternative but this is also beyond the reach of the people; moreover it has problems like periodic cleaning and disposal of liquid sludge creating health hazards. Pourflush waterseal latrine is the most appropriate technology (where water is used for ablution) for safe disposal of human waste. Construction of this type of latrine involves a technology which is well within the grasp of a mason having undertaken a short training; Leach pit configuration and materials can readily be varied to suit site conditions and availability. It conserves water as only 1.5 to 2 litres of water is required for flushing the excreta of one person.

30. Where water is not used for ablution, other suitable technologies like VIP latrines are proposed to be considered.

Pour-Flush Latrine

31. A pour-flush waterseal latrine with two leach pits should be appropriate for areas where adequate water is available. The latrine consists of a squatting pan of a special design (having a steep gradient at the bottom) and a trap having 20 mm waterseal. It is so designed that the excreta of one person can be flushed by pouring only 1.5 to 2 litres of water. The excreta are discharged into the leaching pits constructed in the house compound or where it is not possible to do so for lack of space, into the pits constructed under the foot-path or the street. The squatting pan is connected to the leaching pits through a pipe or covered drain. These pits are lined with honeycomb brick work or open-jointed stones, or with other suitable material, so as to allow the liquid in the pits to percolate and the gases to be dispersed into the soil and at the same time to prevent the pits from collapsing. The sludge gets digested and settles down gradually.

32. The pits are used alternately. When one pit is filled, its use is stopped and the excreta are diverted to the second pit. The filled up pit is left unused; and in about 1½ years its contents become rich organic humus, innocuous, free of smell and safe for handling. When convenient, it is emptied and the contents could be used as fertiliser. It is then ready to be put back into use when the second pit becomes full in its turn.

33. With simple care and cleaning by the household, the pourflush latrine is a very satisfactory and hygienic sanitation system. It can be located inside the house, since the waterseal prevents odour or insect nuisance.

Water Pollution

34. Extensive studies made in India and abroad substantiate that there is no risk of bacterial pollution if leaching pits are properly designed and due precautions are taken in their construction. For more details, see Annex III.

Maintenance

35. Maintenance of pour-flush latrines is very easy and simple. Day-to-day maintenance consists only of washing the latrine floor and cleaning the pan. No other maintenance is needed. The cost of cleaning the pits can be covered by sale of the humus obtained from the pits

Pan and Trap

36. The squatting pan and trap can be of ceramic, fibre glass reinforced polyester plastic (GRP), PVC or mosaic.

Cost

37. The cost of a pour-flush latrine with a superstructure like mud walls with thatch roof or bamboo or date palm matting walls with bamboo frame and thatch roof would vary from area to area ranging from Rs. 150 to 170 per capita. This is much cheaper than conventional water-borne sewerage and septic tanks.

Project Execution

38. The project will be implemented by the respective state governments. In all the states, Public Health Engineering Departments or Boards which are incharge of water supply and sanitation are the implementing agencies except in Tamil Nadu, where the Director of Rural Development has taken over this responsibility.

Communication Support

39. Construction of latrines is not the main objective of the Project. The people have to be educated to adopt the latrines and use and maintain them properly. Socio-cultural and traditional habits are to be changed to see that the people do not resort to open air defecation once the latrines are provided. Therefore information, motivation, health and sanitation education are essential inputs for the successful implementation of the programme. For this purpose, sanitation volunteers will be chosen in each village and training and education materials will be developed as a part of the Project.

Training and Sanitation Education

40. Training on the technology of pour-flush latrines as well as the activities to be undertaken for sanitation and health education will be given particular attention under the

Project. Appropriate orientation and training courses will be arranged for various categories of personnel connected with the Project, including masons and the promoters of sanitary latrines. The promoters or motivators will be trained to educate the people on the benefits of sanitary latrines, their proper use and maintenance and to obtain people's participation in general.

Inter-departmental Coordination

41. The subject of rural sanitation is of interest and concern to several departments of the state governments—Public Health Engineering, Health, Social Welfare, Education and Rural Development—besides non-governmental organisations, particularly voluntary agencies interested in the welfare of women and children. Close cooperation among them and active participation of their personnel in Project activities will be needed to make it a success.

Evaluation of Rural Latrine Programmes

42. Quick evaluation of past programmes of rural sanitation and that of on-going programmes, if any, of the following 7 states has been carried out :

1. Delhi (rural)
2. Gujarat
3. Kerala
4. Maharashtra
5. Tamil Nadu
6. Uttar Pradesh
7. West Bengal

Individuals as well as institutions connected with the rural sanitation or rural development programmes were entrusted to carry out the study in these states. The evaluation study of Tamil Nadu also includes the community latrines in the rural areas.

Finalisation of Design Requirements

43. An Expert Committee was constituted (Annex IV) to recommend the design requirements and specifications for pour-flush latrines in rural areas. The Committee has finalised the design requirements which are now generally being followed in the field.

Women's Participation

44. Realising the important role which women can play in a sanitation programme particularly in the rural areas, a study has been carried out on the role of women played in the 3 RCA projects at Najafgarh, Poonamallee and Singur and what role they can play in the future programme. These have been carried out by women involved in latrine projects in the rural areas.

Committee on Training Methodology

45. For developing sanitation education and training methodology, a Committee consisting of non-governmental organisations and institutions having experience in this field was constituted (Annex V). The Committee made suitable recommendations on the subject.

Further questions on the Project may be addressed to :

The Regional Manager,
Technology Advisory Group (India),
GOI/UNICEF/UNDP Project on Rural Sanitation,
5th floor, Archana Office Complex,
Greater Kailash-I,
New Delhi-110048.

ANNEX I

Studies carried out during the course of feasibility study for urban areas to develop the most economical and appropriate design of pour-flush waterseal latrines :

1. Evaluation of various latrine programmes in India;
2. Potential ground-water pollution by on-site disposal of human waste through leaching pits;
3. Evaluation of community latrines;
4. Scavenger rehabilitation;
5. Institutional, legal and financial study of local authorities;
6. Optimisation of design and construction aspects of pour-flush latrines;
7. Determination of effective thickness of sand envelope around leach pits to check water and soil pollution in different hydrogeological conditions;
8. Sludge accumulation rate in leaching pits in different hydrogeological conditions; and
9. Developing a low volume (1.5 litres) flushing cistern system.

ANNEX II

FEASIBILITY STUDY FOR RURAL SANITATION PROGRAMME

Distribution of Number of Villages

Name of the state	No of districts selected for the study by the state	No. of villages selected for the feasibility study	No. of villages selected for intensive coverage
1. Andhra Pradesh	11	320	21
2. Assam	3	265	20
3. Haryana	12	100	13
4. Kerala	14	110	7
5. Madhya Pradesh	24	510	34
6. Maharashtra	24	360	24
7. Manipur	8	15	2
8. Orissa	3	325	22
9. Punjab	6	115	8
10. Rajasthan	3	250	10
11. Tamil Nadu	8	230	15
12. Uttar Pradesh	17	650	40
13. West Bengal	4	350	24
Total	137	3600	240

Water Pollution Aspects

Proper information and investigation of hydrogeological conditions of the sites where the leach pits are to be located, are pre-requisites for the implementation of a latrine programme in order that the pollution risk to ground-water and water distribution pipes is minimal. Extensive pollution studies done in India, U.S.A. and elsewhere have confirmed that :

(a) There is little risk of bacterial pollution in locating pour-flush latrines with leaching pits (where the hydraulic loading on the pits is restricted to 50mm per day) in the alluvial soils with predominance of silt mixed with fine sand and the pit bottom is at least 2 metres above the maximum ground-water level provided safe distance of separation between the pit and drinking water source is maintained.

(b) Even under unfavourable hydrological conditions such as coarse sand with high ground-water velocity or where the pit bottom is submerged or less than 2 metres above the maximum ground-water level, this system can be used provided suitable modifications to the pit and latrine are made.

(c) Under unfavourable topographical conditions and conditions such as fissured rocks, chalk formations, old root channels etc., suitable modifications to pit and latrine or adoption of alternative systems of disposal may be necessary and need careful investigations.

To keep the water pollution risk minimal, following precautions should be taken keeping in view the hydrogeological conditions at site :

Distance between the bottom of the pit and the maximum ground water level	Effective size of the formation soil	Minimum horizontal distance of separation	Modification needed
1. $\geqslant$ 2m	$\leqslant$ 0.2mm (fine sand, clay and silt)	3 m	None
2. $\geqslant$ 2m	$>$ 0.2 mm (coarse sand)	3 m	Provide 500mm envelope of sand* and impermeable pit bottom
3. $<$ 2m	$\leqslant$ 0.2mm (fine sand, clay and silt)	10 m	None
4. $<$ 2m	$>$ 0.2mm (coarse sand)	10m	Provide 500mm thick sand envelope and impermeable pit bottom

* Sand of 0.2mm effective size.

ANNEX IV

Expert Committee on Design Requirements :

1. Mr. B.B. Rau,
   Adviser (PHEE),
   Ministry of Works and Housing,
   Govt. of India,
   New Delhi

2. Mr. R.C. Mangal,
   Deputy Director,
   Central Building Research Institute,
   Roorkee

3. Prof. K.J. Nath,
   Professor of Environmental Sanitation & Head of the Deptt. of Sanitary Engg.,
   All India Institute of Hygiene & Public Health,
   Calcutta

4. Mr. S.R. Kshirsagar,
   Scientist & Head, Technology Utilisation and Extension,
   National Environmental Engineering Research Institute,
   Nagpur

5. Prof. T.R. Bhaskaran.
   Consultant,
   Bangalore

6. Prof. N. Majumder,
   Consulting Engineer,
   Calcutta

7. UNICEF

8. TAG (India)

ANNEX V

Committee on Training Methodologies

*1. Mr. B. Pathak,
Chairman,
Sulabh International,
Patna

2. Mr. Ishwarbhai Patel,
Director and Principal, Safai Vidyalaya,
Ahmedabad

3. Mrs. Aloka Mitra,
Honorary Secretary,
Women's Coordinating Council,
Calcutta

4. Prof. K.J. Nath,
Professor of Environmental Sanitation & Head of the Department of Sanitary Engineering,
All India Institute of Hygiene and Public Health,
Calcutta

5. Mr. S.R. Kshirsagar,
Scientist and Head,
Technology Utilisation and Extension,
National Environmental Engineering Research Institute,
Nagpur

*6. Dr. S. Gopalkrishnan,
Assistant Director of Public Health & Preventive Medicine,
Institute of Public Health,
Poonamallee,
Madras

7. Technology Advisory Group (India)

* Could not attend.