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The India Village Water Supply Programme

Situation, Observations and Recommendations

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1 SUMMARY

The following report briefly covers the status of the India Village Water Supply Programme as of 15 December 1976. It also contains the outcome of discussions held and conclusions reached during the visit in India by Martin G. Beyer, Adviser, Drinking Water Programmes, and Hendrik Davelaar, Senior Officer, Drinking Water Programmes, UNICEF Headquarters, during the periods of 6-19 November and 24 November - 9 December 1976.

The programme so far has resulted in some 30,000 deep wells drilled in the hard rock areas of India, predominantly in the southern and central parts of the country. Some 20,000 of these wells are equipped with hand pumps, a smaller number with engine-powered or electrically-powered pumps.

UNICEF's assistance previously had been directed largely towards supplying drill rigs and accessories to the above areas. It is now being expanded to encompass other areas of the country: the mountain and hill tracts of the north, the river plains of Bihar and Bengal and some - geologically speaking - problem areas in central-eastern India.

One of the main problems to be solved is that of providing hand pumps to the villages, pumps sturdy enough to stand up to the handling by hundreds of villagers daily. The alarming fact that in many areas up to 70% or more of the hand pumps were out of order at any given time, caused a considerable shift in programme activities towards

a) providing a hand pump design that would be sturdy enough and at the same time need a minimum of maintenance. This has resulted in the "INDIA" hand pump, which presently is going into mass production. At the same time UNICEF is assisting the State Governments to establish means for the distribution and proper installation of this new pump.

b) Establishing a hand pump maintenance system on the village level through hand pump caretakers, selected and trained by the Block Development Officers, backed up by State Government pump inspectors and mobile repair teams (the "three-tier system").

c) Providing sanitary education, wherever possible, in the future linked with the introduction of sanitary excreta disposal.

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d) Support being given through Project Support Communication (PSC) activities from UNICEF's side, these to be strengthened and further consumer-oriented.

Training of national staff to increase and upgrade the implementation of the programme. This includes UNICEF assistance towards training drillers and mechanics for the water well drilling operations. A central course for training instructors is proposed. These instructors then should be organized state-wide in mobile teams, to be provided with vehicles and training materials. At the same time training courses for field hydrogeologists and geophysicists are proposed for ensuring more widely spread appropriate siting of water wells.

A review including the systematizing of the supply logistics is foreseen, especially as to the spare parts supply for the drilling operations. This pertains both to the central level as to the different States. It would include the training of national staff, particularly that of the Ministry of Works and Housing, in order to facilitate their complete takeover of responsibility for the Central Spare Parts Store in Bombay.

Monitoring and reporting needs to be systematized. A next phase of the programme evaluation is being planned. This will include a study of the impact of the programme on health and socio-economic conditions. An internal UNICEF audit of UNICEF assistance to this programme is foreseen for the end of 1977.

The UNICEF project support staff in the Water and Environmental Sanitation Section in New Delhi is to be brought back to adequate strength in view of the magnitude and complexity of the programme assistance. This includes the urgent consolidation of the organizational structure in order to meet the partly changed scope of the programme.

2 THE INDIA VILLAGE WATER SUPPLY PROGRAMME - SCOPE, POLICIES AND FUNDING

2.1 Scope and policies

The scope of the policies of domestic water supply in India is described, inter alia, in the WHO Report on Rural Water Supply in India from 1974. The area priorities are given by the Minimum Needs Programme, aiming at providing a minimum per capita supply of five gallons of drinking water per day. All scarcity areas with a total of 125,000 villages and hamlets are aimed at being supplied by 1984.

As to the mechanism for implementation, autonomous Water Supply Boards are being established in the States for taking full responsibility for the programme. Four such Boards are now set up in Uttar Pradesh, Karnataka, Tamil Nadu and Haryana.

There still remains to coordinate effectively the provision of water supply with the ICDS Blocks plan within the Fifth Plan framework. In general the policies are set, but with a great unevenness in the actual implementation. The Steering Committee for this programme, on Central Government level, with participation from UNICEF and WHO, is an important tool for promoting the Government policies, both on Central and State levels.

2.2 Funding

In addition to the regular UNICEF funds (Minimum Needs Funds) of approximately $3 million earmarked for 1977, there are $2.8 million available as a special contribution from The Netherlands and another $2.5 million from DANIDA, Denmark. The latter contribution is to be used for special types of drilling equipment, suited for the difficult conditions of the mountain regions of northernmost India and some parts of east-central India. This would make up for a total planned input in 1977 of $6.4 million. Furthermore, there was material in stock in India, as supplied by UNICEF to the approximate value of $1.25 million in December 1976.

3 SUPPLIES AND LOGISITICS

3.1 General observations

There seems to be a certain difficulty on the side of the Central Government and the State Governments to project the programme requirements, even two years ahead. There is a need for guidelines to be established, which possibly may be easier, after some of the new programme directions, now to be initiated, have been well established.

3.2 Drill rigs

Formerly these were the prime items on the UNICEF supply lists, the emphasis now being on spare parts, except for the provision of a few drill rigs of special types for certain problem areas. The total number of rapid compressed air (air hammer) drill rigs, presently employed in the programme all over India is around 300. The latest available figures as to the distribution of rig types is as follows:

	Atlas Copco	Halco	Ingersoll-Rand	Total
UNICEF-supplied	85	34	14	133
State-supplied	38	68	33	139
Total	123	102	47	272

An additional number of Atlas Copco COP-6 and Halco 425 rigs is estimated to bring up the total to the aforementioned 300.

There is a local manufacture among others of Halco Minor rigs, used in the tribal areas. Ingersoll-Rand may start up manufacture of the TM-3 rig within the next four years, mainly intended, however, for quarrying.

As a technical note, it should be mentioned that there was introduction to India the use of a heavy down-the-hole hammer rig from Chicago Pneumatic by the Canadian NGO Betul Ground Water Project. This rig, capable of drilling wells to 200 meters' depth with an initial diameter of 8", in five months' time drilled 200 wells in Tamil Nadu under a crash programme, before being transferred to its final destination, the State of Madhya Pradesh. It is a very efficient but heavy (about 35 tons) and costly machine with a cost of about $500,000.

3.3 Drill rig spare parts and ancillary material

A considerable part of the UNICEF assistance now consists of spare parts for all the hard rock drill rigs, operating under the programme, irrespective of whether they were provided by UNICEF or the States themselves. This is the most practical mode of keeping the operations going.

As to details on the drill rigs involved and the present supply of spare parts, see the explanatory notes to the corresponding Supply Lists, issued during the last months of 1976. A system of exchange unit schemes will be instigated for more rapid and efficient repairs of the drill rigs.

3.4 Logistics and the Central Store in Bombay

Presently all the supply of spare parts, provided from abroad through UNICEF goes through the Central Store in Bombay. Actually, this consists of two warehouses, managed by the agents of the drill rig manufacturers, Halco and Ingersoll-Rand on one side and Atlas Copco on the other. The spare parts are delivered directly from there to the warehouses under the responsibility of the Chief Engineers of each State.

As of 15 December 1976 there were spare parts to a value of $1.25 million in stock in Bombay, with another $1.5 million worth under order.

Until recently the orders for spare parts from the States were channelled through UNICEF, New Delhi. The handling costs have all the time been charged by the agents to the Government of India, amounting to 10% of the total value. The Government would like to have a warehouse of their own but there are no funds budgeted in the Five-Year Plan. Also there is no building space available in the Greater Bombay area.

Since last year there is a Government of India unit under the Ministry of Works and Housing installed in Bombay, which has taken over the responsibility for processing the spare parts. There are problems as yet, since this unit so far has only one engineer in charge, the Director of the unit, with the other posts foreseen not yet staffed. There is no supply specialist available on the Government side.

In order to keep up the continuity and thus ensure an unhampered flow of spare parts to the field operations, UNICEF will be phasing over the operation of the Central Store by providing both a consultant and a liaison officer, arranging for training and follow-up through specialist firms in India. A target date by April 1978 was set for this phasing-over to be completed.

There is also a need for an assessment of the logistics and warehouse procedures in the individual States. The best managed operations in this respect were reported from Madhya Pradesh, Karnataka and Tamil Nadu.

For the maintenance of the rigs in the field, mobile teams can take on three to four rigs per month each. There are certain gaps as to manpower in the State organizations, among others as to the Executive Engineers mostly being civil engineers and not mechanical engineers, except for Tamil Nadu.

3.5 Casing and screens

Seamless steel tubing and accessories are scarce in India, being provided from local sources. Steel casing is generally considered preferrable to PVC, which bends too easily. For the drilling operations planned for the mountain areas, large diameter casing will be needed. Fiberglass screens might be interesting to try out, especially where there is a risk of corrosive action or incrustations.

3.6 Pipes and fittings

For HDP pipes (High Density Polyethylene) there seem to be no supply problems with the manufacture by a licensee of

the German firm Hoechst in Bombay, which provides such pipes among others for the water supply programme in Nepal. Likewise there is reportedly no problem with standposts and similar fittings.

3.7 Hand pumps

Until recently all the hand pumps for the programme were provided by the Government. These were largely the products of local manufacturers of conventional design and qualities, foreseen for use only in single family households. Thus these pumps would not stand up to the wear and tear of hundreds of villagers, daily using them. This led in the end to over 70% of the hand pumps in many areas being out of order. Thus the outcome of the entire programme was seriously jeopardized. This became evident through the evaluation made in 1975 and led to concerted action between the Government of India and UNICEF.

Already at an earlier stage, recognizing the need for a sturdier hand pump that could be manufactured with nationally available materials in India, WHO had embarked upon the development of a hand pump including interesting elements of nylon components. During the years 1975-76 between the Government of India and UNICEF a new hand pump was developed, based on elements, particularly from the so-called "Sholapur" pump. The principles of this latter pump: steel construction, steel handle, on ball bearings/roller chain between handle and rods etc., had already been amply proven in the field during many years of service.

In close cooperation with the Government's technical research institute, MERADO, in Madras, the design of this new pump is now in its last stages of finalizing. Both laboratory and field tests of long duration have been carried out. A great number of design details have been modified or newly introduced. The design was recently registered with the India Standards Institute for providing strict norms for the manufacture.

The planned manufacture and distribution of this new pump, which now is officially baptised the "INDIA" Hand Pump, will eventually have to be seen in terms of the over-all needs of the country. The total of village hand pumps included in the programme variously has been estimated to some 40,000 cast iron pumps and 10,000 Sholapur pumps (steel) installed. Over the next five years, possibly some 150,000 pumps may have to be installed. The manufacture for the next two years, as promoted through UNICEF would be needed for some 20,000 units.

The price level for these pumps is an important factor. It has been estimated that for the entire structure above

ground and the cylinder together - this being a deep well pump for depths to water greater than 7 metres - would amount to no more than about $100. The total cost for the entire pump with 50 metres of rising main and rods thus could be estimaed to $200. This is little more than the cost for the least expensive hand pump, presently provided by UNICEF from overseas manufacturers.

To begin with, 1,000 "INDIA" hand pumps have been ordered (December 1976) from Richardson & Cruddas in Madras, a Government firm, specialising in steel manufacture and steel constructions. This firm already in the initial stages has been material in introducing additional improvements on the design, based on their manufacturing experience. The management of R&C take this task as their "social duty" and thus are intent to ensure a consequent quality standard of materials and manufacture in order to set a precedent for other manufacturers.

For later orders and an enlargement of the production of the "INDIA" hand pump, after a survey through India, five major firms have been selected for competitive bidding within the country. This would provide for a geographically better distribution and also a better chance for keeping control of the quality. The smaller manufacturers in some places previously have not been careful enough of the qualities and levels of their manufactures to the detriment of the pumps produced by them.

Since there is no patent on the pump design, quite probably, when the "INDIA" pump starts to spread throughout the country, the smaller manufacturers will follow suit and begin to produce this model for commercial distribution. This may eventually in such a case prove to the benefit of more local industries as well. However, the large scale needs for the Government programme can only be met by large scale manufacture, where, again quality control is of utmost importance on an equally large scale.

The time estimated needed for starting up the production at the manufacturers' might be about three to four months, including the establishment of supply lists, the procurement procedure and the setting up of jigs and other manufacturing facilities.

No allowance has been made for pump spares. Reserve heads and cylinders are in stock, and the entire design of the "INDIA" pump is based on easily replaceable service exchange units.

In this context it should be mentioned that a prominent feature of the "INDIA" pump is the top part of the three-part head, the so-called "conversion head", which separately can be placed on older pump pedestals, already installed over the wells. This conversion head replaces older worn-out mechanisms

and costs $40. The question of whether to set up only the conversion head on an older pump or whether to replace this latter one entirely, will have to depend on local judgement. Most desirable would be the complete replacement.

The quality control of the hand pumps thus to be manufactured will follow the above-mentioned ISI standards now being set up. The State Chief Engineers, who eventually are in charge of the procurement must buy accordingly. From UNICEF's side additional project staff will be set in for the entire question of quality control and follow-up on the appropriate installation of the new "INDIA" hand pumps. This project staff will include three national field officers, now under employment and two or three of the junior expatriate field staff, already working with different projects.

The distribution of the hand pumps from the manufacturers to the different States is by truck, chartered by the manufacturers but paid for by the State Governments. Sometimes there are said to be difficulties in retrieving this payment promptly enough, which may cause problems in arranging for such transports, since the trucking firms prefer other assignments.

3.8 Vehicles

Only some notes on the vehicles ordered for the pump distribution, installation and maintenance: A total of 65 Mahindra diesel pickups are being provided by UNICEF. These take a load of one ton and should be adequate for the task. As to motorbikes provided to some of the maintenance organizations, problems were reported from Tamil Nadu. There seems to be a difficulty for the mechanics to handle these motorbikes with accidents occurring during driving on rough roads - light vehicles said to be preferred. This may be a matter of providing training for driving, or, if financially and roadwise feasible, light vehicles of the type Renault-4.

3.9 Survey and field test equipment

Parallel to increasing the cadres of hydrogeologists and geophysicists, the number of survey instruments and field test kits will have to be increased. Especially for the mountain areas, but also for the other parts of India, certain topographical survey instruments are necessary. These would have to be completed with further earth resistivity meters, magnetometers and, for the water quality control, field test kits.

3.10 Educational equipment

In order to complete the account for an indication of

further needs for equipment under this programme, the training equipment for national technical staff and supplies for the villagers' education should be mentioned. As to the latter, there would be need for similar equipment as that used for health or nutrition education, but specialised on water supply, pump maintenance and sanitation. PSC certainly could assist in providing suggestions and lists of actual material but keeping this as unsophisticated as possible.

4 IMPLEMENTATION AND FIELD ASSISTANCE

4.1 General observations

With the above-mentioned diversification of the programme activities, in the following these are referred to under the different headings of "hard rock areas" and "other areas". The latter remain as yet to be more precisely formulated.

4.2 Hard rock areas

The over-all implementation is in the hands of the State Water Boards or, prior to such Boards being established, the Public Health Engineering organizations. Most frequently the work of these organizations still is carried out as a public works type of venture with relatively little or no relation to other programmes for community or rural development.

4.2.1 Hydrogeological exploration and well siting

The important improvement in percentage of "successful" wells and of average yields per well, wherever hydrogeological and geophysical exploration had been carried out, clearly was shown in the programme evaluation of 1975-76. There is a need for strengthening of manpower capacities in this field. The Tamil Nadu Water and Drainage Board during our recent meetings in Madras indicated that the Board would request technical expertise through UNICEF to provide training for the State hydrogeologists. A closer coordination in this field with the Central Ground Water Board of India seems recommendable.

4.2.1.1. Remote sensing

Even though it may seem somewhat academic at this stage, the old project of utilising remote sensing for locating water-bearing fissure zones in the hard rock areas would be worth taking up again. Around 1973-74, UNICEF financed some part of the work of an Indian specialist in the field of interpretation of satellite images. This specialist, who worked for the Government Institute of Agricultural Research, later transferred to other activities. His work thus never was concluded, although some interesting leads were given.

The end result would have been, and still would be, to verify whether water wells located on the basis of satellite imagery would be more "successful" and provide better yields than wells located at random, especially in areas difficult for other exploration methods.

Meanwhile, the Government of India is establishing a new organization for the utilisation primarily of data from the United States Geological Survey/NASA "EROS" programme, mainly based on the "LANDSAT" (formerly ERTS) satellites. This organization, the National Remote Sensing Agency, is headed by Wing Commander K.B. Rao, and will be located in Hyderabad and staff with some 60 specialists in different disciplines, including geology. During a recent discussion with Cmdr. Rao, he was interested in taking up this idea for UNICEF again. Thus it is proposed that UNICEF's staff during 1977 take up contact with the NRSA for further exploration of the possibilities to have a series of wells located by such methods.

4.2.1.2 Environmental concerns

The programme provides predominantly hand pumps. Thus the risk for depletion of water resources seems relatively remote, although no proper follow-up or checking has ever been carried out. Likewise, the risk for example, of overgrazing through cattle, following a sudden abundance of water, such as provided through the engine pumps of the Sahel in Senegal, seems to be less likely. Nevertheless, a word of caution and the need for a certain follow-up should be inserted. Possibly this might be a field of cooperation with UNEP.

The National Ground Water Board in cooperation with SIDA is now in full course with a comprehensive hydrological-hydrogeological study of the Coimbatore area in Tamil Nadu. The successive experiences and results from this study are of great interest, since they correspond to conditions in many other parts of India. The reason for this thorough basin study is the constant lowering during the last 10-15 years of the ground water table in this area to 40 feet or more below the original water level. This is due to overpumping in deep wells, drilled by private industries and larger farm owners, and provided with engine pumps of high capacity. This has resulted in many wells of lesser depth, providing domestic water supply to villages to run dry with ensuing great problems.

Part of the problem lies in the absence of any legislation as to ground water resources, although such legislation is being discussed now at the Central Government level. A continued contact with the above research is recommended for clues on risks for similar developments in other densely populated areas.

A great concern is that for appropriate control of water quality. This may be a matter of knowledge of the regional chemical qualities of the ground water. Many areas unfortunately have too high a content of fluoride, sulfates or other salts, iron or manganese. In other cases the protection of the individual well is deficient through absence of grouting, bad drainage around the pumps etc. The installation of a hand pump in a well with a bad taste of the water may be adverse to any attempt at health education.

Therefore, a better knowledge and control of the water quality is necessary, requiring more training, field kits with ingredients that can be replaced, compilation of regional water quality maps - another point in case for coordination with the National Ground Water Board and the State geological, agricultural and other institutions, which might possess quite a deal of information.

4.2.2 Drilling and development of wells

The efficient utilisation of the drilling equipment and the proper drilling and installation of wells is very much a matter of training, which is dealt with in a following chapter. A weak point seems to be the grouting of at least the topmost 3 meters in the hard rock wells with cement in order to prevent reinfiltration of polluted surface waters into the well.

4.2.3 Safety during drilling operations

There seems to be a need for more concern for the health and safety of the water well drillers. In many areas there is a risk of silicosis, especially where the rocks are rich in quartz. The fine silica dust, blowing up from the wells, accumulated in the lungs can cause irreparable damage and premature death. A simple counter-measure, requiring little costly additional equipment, is water injection in the air flush.

Other measures, which are not always taken as they should [illegible], are the wearing of hard hats, protective goggles for the [illegible]nding of drill bits and protective shoes.

4.[illegible].4 Hand pump installation

The responsibility for the hand pump installations lies en[illegible]rely with the Water Boards or corresponding organizations. Mo[illegible]ly these employ separate contractors to carry out the work to [illegible]stall and fit the pumps with mobile teams provided with UN[illegible]F-supplied vehicles, distributing the pumps as directed by [illegible]e State Chief Engineers.

[illegible] UNICEF will be monitoring this activity, among others

through consolidated reports from the Chief Engineers directly to UNICEF. UNICEF's field staff will participate in this monitoring activity, based on the following places:

Madras for Tamil Nadu and Karnataka

Hyderabad for Andhra Pradesh and Orissa

Bombay for Maharashtra and Gujarat

Delhi for Madhya Pradesh, Rajastan and Bihar

Proper platforms with drainages are a must around each pump. Often there presently are none. It is proposed to become the responsibility of the mobile pump installation teams with the assistance of local masons as contractors. Standard designs are being made up by the WHO Sanitary Engineer attached to WES in New Delhi. A chapter on proper platform and drainage construction is to be added to the handbook on pump installation, presently being prepared by WES and PSC. A follow-up through field surveys and evaluations is planned on UNICEF's side.

4.3 Other areas

The expansion of UNICEF assistance to other areas was very recently given considerable impetus through the DANIDA contribution of $2.5 million. The following action is foreseen:

4.3.1 Mountain and hill tracts of northern India

This would for the States and regions of Jammu, Kashmir, Himachal Pradesh, Uttar Pradesh and areas further east signify

a) Supply to State agencies of heavy drilling equipment, probably cable tool rigs with special tools for difficult boulder formations in mountain valleys.

b) Materials for piped gravity schemes from mountain streams and protected springs, similar to the projects in Nepal. This means mainly quantities of HDP pipe and fittings, possibly including hydraulic rams in some cases.

There remains much planning to be done between the State authorities and UNICEF in order to determine the type of input required and the over-all programming. UNICEF expertise from Nepal, Pakistan and Afghanistan should be consulted, and it was recommended during our meetings in New Delhi recently that one UNICEF Water Supply Officer should be assigned to this planning task, as liaison with the State authorities.

4.3.2 Lowland plains

This pertains particularly to those areas of eastern India, where the hydrogeological conditions are similar to those of Bangladesh, notably parts of Bihar and Bengal. This would imply the planning for a shallow-well hand pump programme similar to that of Bangladesh. Successively, when the outlines of such a programme are to be made up, expertise from the UNICEF Water Supply Section in Dacca should be sought.

From a supply point of view, this would mean the introduction of shallow-well hand pumps on a larger scale, as well as materials for the protection and disinfection of dug wells.

4.3.3 Special geological problem areas

Certain areas of India provide special problems for the drilling of water wells. This is the case of the eastern reaches of Andhra Pradesh, underlain by hard rocks with irregular valley fills and sedimentary covers. For the projects in this part of the State, procurement of some drillrigs for overburden drilling is planned.

5 MANPOWER AND TRAINING

5.1 Availability, needs and priorities

Throughout the past 8-10 years of the programme, there has been considerable development of manpower both in numbers and in skill. There is, however, a constantly growing demand on acceleration of the programme, with the corresponding increasing need for more trained staff and upgrading of the existent one. Especially on the level of engineers, possibly to some degree also among drillers, there is a certain drain of manpower to private enterprise. It may be noted that engineering skill from India increasingly is drawn to overseas projects, not the least in the Arab countries. Also the often relatively short assignments and successive transfers within the Indian Civil Service, tend to be somewhat counterproductive to the continuity of the work of experienced engineers.

Among the categories, for which more training is needed, the following should be mentioned:

Chief and Executive Engineers
Drillers and Mechanics
Hydrogeologists and geophysicists
Logistics Management staff

Training schemes could be assisted by UNICEF, jointly with other agencies, predominantly WHO and ILO. The latter was involved in discussions on this point during the visit of the ILO Adviser to UNICEF, Mr. P. Pooran, in India recently. The training on village and block levels of hand pump caretakers and Block Development Officers is discussed below.

5.2 Management training

This aspect was not discussed in any detail during our visit. It might be useful, however, to explore this question further. Some input has been done previously through UNICEF's financing of some of the seminars and workshops with Chief and Executive Engineers and through WHO fellowships being provided to some of the engineers on the State level.

5.3 Drillers and drill rig maintenance mechanics

During the last eight years UNICEF has had Master Driller/Instructors employed. For several years until some year ago there were three of them. Now they are down to one, and even he can only partially devote himself to this task, due to other urgent tasks, particularly for the development of the hand pump scheme.

The work of these instructors consisted largely of on-the-job training of drillers and drill rig maintenance mechanics, criss-crossing India on an ad hoc, trouble-shooting basis. They made a lasting contribution to the training of good drillers all over the country, but there was a difference in having three instructors for some 75 rigs then and only one half for 300 rigs now.

Some training, particularly for the maintenance of rigs, on a short-term basis, is occasionally being provided by the drill rig manufacturers, who partly have developed their own training methods, including audio-visual aids: pre-recorded cassettes in some of the national languages etc.

With quite a deal of relatively experienced national staff now available, it thus seems time to consider more planned training efforts. A major UNDP-financed project proposal for a drilling school (UNDP: IND/74/016), planned through WHO for a total UNDP input of $2.6 million, never was realized for a number of reasons, including lack of funds and a corresponding budgetary burden for the Government.

The existing schools for drilling personnel, such as the one of the Rajasthan Ground Water Board in Jodhpur and the Mining School in Orissa are not adequate for the present needs.

In order to avoid the pitfalls of too grandiose an organization for the training of drillers and maintenance mechanics for the drill rigs, a proposal was arrived at, which might be quite feasible within the present organizational setups in the States and with relatively modest means from UNICEF's side.

The proposal would imply that each State set up one Mobile Training Unit (MTU), which would provide on-the-job training in the field. Each unit could be provided with one vehicle, larger Landrover type, audio-visual equipment, including some for sanitary education (both for drillers and occasional local dignitaries and villagers) and certain material and equipment for maintenance instruction, which could be procured from the manufacturers. Such material including the vehicles could be provided by UNICEF.

These MTUs could each be manned by two or three instructors. These could be selected in each State from among existing experienced staff. They would, to begin with, be assigned to go through a course of, say one or two months at some central location in India - Hyderabad being a likely place, mentioned in our discussions. The curriculum for this course would consist of measures for upgrading the technical and mechanical skills, but mainly in teaching training and instruction methods. This curriculum should be worked out by UNICEF's staff together with Government of India specialists.

UNICEF should then provide the trainees with means for their travel and perdiems during the study time. The total number of trainees would comprise some 30-40 from all over India. Such a proposal, however, would require a preparation together with all the State organizations, particularly for the permanent arrangements for training State by State. As to the manning of such training posts by each State, we feel that with the relatively low present rate of utilisation of drill rigs, there always would remain some of the drilling staff who could be spared for these training purposes. It is, however, necessary to make the selection of trainers among the very best men.

5.4 Staff for exploration of ground water and siting of wells

The need for training of hydrogeologists and geophysicists has already been mentioned. The Osmania University of Hyderabad might be prepared to train such staff, given certain equipment for training and upgrading of the present teaching staff, with a partial re-orientation towards current methods for field-oriented applications of the geosciences.

5.5 Logistics management

The training needs were described under 3.4 above.

5.6 Hand pump installation

Training is foreseen for the hand pump installation teams, partly private contractors, in the States. Partly the UNICEF Field Officers would, as they do already now, initiate this training; partly it would be based on the particular handbook for this purpose being prepared by WES with PSC in New Delhi.

5.7 In-house training of UNICEF's project staff

Last but not least, the important question of in-house training of our own project support staff. This is a matter, which successively we hope to broach on a more global basis. In India, however, particularly, as well as in some other countries, such as Bangladesh, some of our project staff, both international and national, have been with the programmes for several years.

There is a need both for having the general as well as technical horizon widened, to keep abreast with newer developments and to see the more narrow sector of their "own" programme or project in a larger context. So far there are no established courses in "Rural Water Supply and Sanitation", the way the UNICEF-assisted Government programmes are being implemented, although there are some tentative efforts in some places in the world towards this end. What we very much would need are two- to three-month courses, including not only the technical aspects, but the socio-economic framework of rural development around these.

The general need for more systematic training in matters pertaining to UNICEF's over-all field and mode of work is not limited to Water Supply staff alone but should be mentioned as an important need also for the more specialised project staff.

In one or two cases preparations have already been made for individual training schedules, involving visits to manufacturers of drilling equipment, practice periods with water well contractors and similar exercises. Also such schemes are in need of more systematic arrangements.

6 COMMUNITY INVOLVEMENT AND HAND PUMP MAINTENANCE

6.1 Principles and policies

The Village Water Supply Programme in India some years ago was near failure, due to the fact that so many of the hand pumps rapidly went out of order.

This was partly due to

a) the hand pump designs not being adapted to village use (see 3.7);

b) no developed maintenance organizations on the part of the States;

c) lack of understanding and thus lack of interest on the side of the village populations.

It is a well-known fact and one of the guiding principles in UNICEF's assistance that water supply and sanitation are feasible only when the communities are fully involved in the planning, installation, operation and maintenance. At the same time, the installation of water supply is especially a leading edge in promoting community development with joint action by the villagers also in its other sectors.

In India this connexion has been established within the programme only during the last year or so but is now under development. This aims at organizing hand pump maintenance at the village level, linking it with appropriate support from the State Water Boards and by and by integrating it with other phases of the education of the villagers: environmental sanitation, health education and nutrition education, all to be backed up with the means provided through Project Support Communications (PSC).

6.2 Hand pump maintenance

The first State to implement a complete system of hand pump maintenance was Tamil Nadu. This started with a pilot project in two blocks in Tirunelveli District with the assistance of UNICEF through the Regional PSC Officer. After only six months of active field work, headed by a national Project Co-ordinator, this system is being introduced all over the State on Government Order through the Tamil Nadu Water and Drainage Board. A similar activity also has started in Maharashtra.

During a forthcoming meeting between the Chief Engineers from all the States and regions of India, arranged by the Ministry for Works and Housing, this system will be discussed and promoted for spreading also throughout the other parts of the country.

This maintenance system is called the "three-tier system", since it operates on three levels. It is based on one hand on a pump caretaker in each village, responsible for the immediate upkeep and care of the pump. He is selected and trained by the Block Development Officer (BDO).

The BDO in his turn is trained by staff from the Water Board. Interestingly enough we could during our visit in the south of India note that this activity on the part of the BDOs seemed to infuse their work with a new motivation. Asked whether this did not add to their workload, some of the BDOs stated that they and their work for the first time became really popular with the villagers. They felt that they were bringing something tangible and positive to the villages.

The uppermost tier in the system consists of the Water Board pump inspector, one foreseen for every 100 village pumps. He makes regular visits in the villages, inspects the pumps and reports on needs for major repairs, helping out with minor ones. Reporting for needs of major repairs also can be done by the caretaker on special preprinted postcards to the Water Board District Workshops. An additional task for the pump inspector might be to undertake some sanitary education, while he would be on his way through the villages anyway.

Major repairs would be carried out by mobile teams, one foreseen for every 1,000 hand pumps.

6.3 Environmental sanitation - latrine construction

Originally an element of sanitation was included in the Applied Nutrition Programmes, but there never was any follow-up on the field observations made. A detailed proposal for an environmental sanitation project is now being worked out by the WHO Sanitary Engineer attached to WES, Mr. A. Besa. This will be based on prior experiences in India and closely linked with health education. For getting a wider framework to our preliminary discussions in New Delhi, the Regional Advisers of the WHO SEARO were included in these discussions, with the aim of maintaining a close relationship with them during the planning and later implementation of this project.

It would be advantageous to have this project connected with an ongoing village water supply project and at the same time promote the coordination between the water supply and health as well as other relevant Government agencies.

In Tirunelveli District, Tamil Nadu, some health education activities connected with the village water and hand pump maintenance programme already had been started by the local Health Officers in August 1976. These Officers are also responsible for Family Planning. The caretakers are involved and so are the Women's Clubs with a minimum of 30 women from each block. Also the local radio stations are used for regularly bringing forth the message.

An interesting activity for promoting village sanitation, much in the spirit of Mahatma Gandhi, is being undertaken on individual initiative by Shri Krishnadas Shaha, Honorary Adviser to the Government of Maharashtra on Rural Health and Sanitation. Shri Krishnadas' methods of teaching and designs for different types of village latrines and similar installations are worthwhile to study for planning such activities elsewhere in the country, adapted as they seem to be to the perception of the villagers. Shri Krishnadas' approach seems to build much on personal charisma, patience and long hours in the villages, talking and teaching the people.

Another inroad might be made possible through a project, presently discussed between Professor Naik of the India Institute for Sociological Research and the UNICEF Regional Planning Officer, Mr. S. Prabasi, for a non-formal education scheme in Maharashtra. Another potential means of support to sanitary education efforts might be through the Nehru Youth Volunteers.

6.4 Project Support Communications (PSC)

Community involvement and hand pump maintenance since some year back are subject to supporting activities from the PSC Section at UNICEF's Regional Office in New Delhi.

The PSC field activities have shown their best effort in the Tirunelveli District with the initiation of the above-mentioned scheme for hand pump maintenance. The selection of the Project Co-ordinator, Mr. Francis, with his previous experience as Deputy Director for Rural Development of Tamil Nadu State, has proven a successful one, making it possible to promote this project in terms that are understandable both to Government officials and to the villagers.

The PSC Section in collaboration with WES simultaneously has been preparing a number of publications to assist in the hand pump installation and maintenance schemes:

a) Pump installation manual: for Junior Engineers of the Water Boards. A first version in English only to be published by March 1977. This will be tested in the field before issuing a final version. Entirely for the installation of the "INDIA" hand pump.

b) Guide for the Block Development Officers: English and Tamil, first versions were printed in January 1977.

c) Caretakers' manual: English and Tamil, printed in January 1977. An extended version to be issued for Pump Inspectors (mechanics).

d) Diploma for Caretakers. A small but encouraging measure to single out and honour the caretakers, once they have gone through their course and taken on their - unremunerated - work.

An observation for future activities in this context: We would recommend more use of outside consultants with professional experience from the country itself for editing such manuals. This would ensure an adequate wording, illustrations and layout, understandable to the groups of people aimed at. Production of printed matter, pamphlets etc. should be left in the hands of professionals.

7 COOPERATION WITH GOVERNMENT, WHO AND OTHER AGENCIES

There seems to be a good working relationship with the Government of India, principally through the Office of the Adviser to the Ministry of Works and Housing, in policy questions also with the Secretary and Joint Secretary of the Ministry. The frequent contacts and exchanges of information could even be somewhat broadened.

The activities and plans for the immediate continuation of UNICEF's assistance were discussed in depth and agreed upon by the above officials during our visit. In this context the likewise aforementioned Steering Committee also fills an important function as point of contact and reference.

With the State authorities there are, in most cases, close contacts. The frequency and efficiency of these much depend on the availability and mobility of UNICEF's project staff. Once this staff will have been brought up to adequate strength again, such contacts will prove even more helpful to assist in the implementation of the programme.

Through the attachment of a WHO Sanitary Engineer to WES, the relationship with WHO has become an active working partnership. This arrangement has created a precedent to what we hope successively could be applied to similar programmes in other parts of the world. The proximity in New Delhi to the WHO Regional Office for Southeast Asia also provides for close contacts with the Regional Sanitary Engineering Advisers, the Health Educators and specialists from other health sectors whose advice is helpful to the programme.

The need for continuous contacts with other Government of India agencies was mentioned above, such as the National Ground Water Board and others. The same is recommended and applicable with other UN Agencies, such as UNDP, IBRD, FAO and WFP, as well as those NGOs active with water supply and sanitation projects.

8 MONITORING, REPORTING AND EVALUATIONS

Monitoring and reporting through WES so far, due to many different factors, has been somewhat fragmentary and incomplete. This has depended on, among others, the sheer size of the programme and the programme areas with the distances, difficult communications, complexity of administrations and internal changes in organizations and staff involved.

On the Government side there are certain weak points in the communications, e.g. between the State Water Boards and the drilling teams, or between the Central Government and the State authorities, who work under a great deal of autonomy, needs be, only the funds being provided by the Central Government, but all the project management left to the States. A certain streamlining is needed. A WHO management consultant team is foreseen to make a study of the organizational setup, which may provide a basis for some simplification and a better flow of communication.

Within UNICEF we have felt for some time a need from Headquarters, from the Office of the Adviser for Drinking Water Programmes for a more regular flow of information on the programme and UNICEF's assistance. This serves not only for us to keep abreast with developments, but also to better serve the Programme Funding Office (PFO) in its efforts to assist in matters of staff management, namely to support WES in New Delhi in recruitment, transfer, training and similar questions.

Therefore, we discussed in New Delhi and agreed upon brief quarterly reports to be set up by WES and transmitted to Headquarters, summarily covering mainly the following points, whenever applicable:

a) Implementation of the programme (number of wells, pumps etc. installed etc.)

b) Policies and relations with the Government (including significant changes of Government staff)

c) Central Store and logistics

d) Hand pump manufacture and distribution

e) Operations on the State level

f) Training

g) Activities on community level, environmental sanitation and PSC

h) Inputs, finances and funding (Government, UNICEF and others)

i) WES administration and staff

j) Other organizations (UN Agencies, bilaterals, NGOs etc.)

k) Other relevant information (seminars, workshops, visits etc.)

For the evaluation of the programme as foreseen in the Plan of Operations, the Steering Committee is very important, as it provides the outlines and control of the actual evaluation work.

The first phase of the evaluation was carried out in 1975-76 in eight States by joint teams of the Government of India, the State Government, WHO and UNICEF officials. This mainly covered the technical performance of the drilling operations and to some degree the hand pump question. This latter part of the evaluation proved to be an important lever to bringing about the final decisions for the improvement of the entire hand pump scheme.

A second phase of the evaluation was to be discussed during the beginning of 1977 in the Steering Committee, where an outline as prepared by Professor Barnabas, the National Evaluation Co-ordinator, and Mrs. Padmini of the UNICEF Planning Section in New Delhi, was to be presented. This phase would contain an impact study of the health and other socio-economic effects of the programme. A pilot study might possibly be carried out in Tamil Nadu.

Also a fuller technical evaluation should be included with more complete data on the wells, with their diameters and depths (too large? too small? relation of dimensions to yield? yields in different aquifers? impact of scientific well-siting etc.), the quality of casing and grouting and the efficiency of the different types of equipment, drill rigs, vehicles etc. There should be a complete tie-in between the impact study and this technical evaluation.

Further, the organization, operation and training aspects should be included. In this context it should be mentioned that a UNICEF Internal Audit Service review of the UNICEF asistance to the programme is proposed to take place towards the end of 1977. This would be a timely measure, which may provide helpful clues both for the continued assistance in India and other project areas with similar scope of work.

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9 THE UNICEF WATER AND ENVIRONMENTAL SANITATION SECTION IN NEW DELHI - ORGANIZATION AND STAFFING

During the last two years WES was severely depleted in staff. Consequently, measures to strengthen the Section in its needs for well-defined management and new recruitment were discussed in New Delhi during our visit, and action initiated subsequently in cooperation with the Personnel Administration Division and other UNICEF units concerned in New York Headquarters. This strengthening of our project support staff is all the more necessary with the wide scope of programme support, funding, amount of UNICEF supplies involved and complexity of the operation.

The following main functions, each to be covered by one or several project staff members, were discerned for WES:

Management	Including administration and secretarial staff
Supplies	Including the phasing-over at the Central Store in Bombay, exclusive of hand pumps
Hand pumps	Development, procurement and installation
Drilling operations and training	
New project areas	Mountain regions, river plains
Environmental sanitation	Including sanitation education

A close co-ordination is to be maintained with PSC and other Sections within the UNICEF Regional Office.

As to the requirements and application of General Service staff within the Section, this would be undertaken by the Regional Office, entailing the establishment of proper job descriptions. Also the question of office space remains to be solved.

10 WORK PLANS

Once the activities on the different points outlined above and the organizational questions begin to take shape,

work plans should be established for a more rational approach and follow-up of the UNICEF/WHO assistance. Against this background the commendable wholehearted input on the side of the project staff can be even more fully utilised for an optimal effect on the implementation of the programme.

11 ITINERARY for visit by M. Beyer and H. Davelaar in India, November-December 1976

6 November	M. Beyer - Arrival in Delhi from Rangoon.
7 November	H. Davelaar - Arrival in Delhi from Abu Dhabi/Dubai
7 - 17 November	Delhi: In the UNICEF Regional Office for South Central Asia (SCARO) with the Regional Director and other UNICEF staff, with the Acting Adviser, CPHEEO of the Ministry of Works and Housing, DANIDA Representatives, WHO Southeast Asia Regional Office, UNDP Resident Representative, IBRD Representative, presentation of UNICEF's policies for drinking water and sanitation programmes at the Regional Meeting of WHO Representatives at SEARO on the kind invitation of the WHO Regional Director; meeting with Mr. Schonmeyr, UNICEF Representative, Dacca.
18 November	Air travel Delhi-Madras. Madras: Visits to the UNICEF Field Office, Tamil Nadu Water and Drainage Board (TWAD), MERADO (hand pump tests), Richardson & Cruddas (hand pump manufacturers). Departure by train for Tirunelveli.
19 November	Arrival at Tirunelveli: Meeting TWAD and Local Government staff. By car to Kovilpatti: Hand pump maintenance/PSC pilot project area. By car to Tiruchirappalli.
20 November	Tiruchirappalli: Meeting with TWAD engineers from Tiruchirappalli and Madurai. Departure by air for Colombo, Sri Lanka.
21 - 23 November	Visit to Sri Lanka.
24 November	Air travel from Colombo to Coimbatore: Meeting TWAD Chief Engineer.
25 November	Coimbatore area: Visit to villages with "INDIA" hand pump prototypes under field testing and to the National Ground Water Board/SIDA project for geohydrological studies of the Coimbatore region. Departure by air for Madras and Delhi.

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