WATER WORKSHOPS

REPORT ON THE WATER WORKSHOP HELD ON DACCA 25TH MAY TO 1ST JUNE 1976

UNITED NATIONS CHILDREN'S FUND (UNICEF)

Water Section

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21
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TABLE OF CONTENTS

401

1. INTRODUCTION

A UNICEF Water Workshop was held in Dacca, Bangladesh from 25 May through 1 June, 1976. It was attended by about 50 people of whom about a third came from outside Bangladesh. Most of them were from the South East Asia Region. A list of the papers is given in Annex I and a list of the Participants in Annex II.

1.1. Background

The idea of an informal meeting of UNICEF Programme Officers to meet and exchange experiences in rural water programmes first was mentioned in Dacca in mid 1973 during Dr. Egger's visit for the previews. In January 1976 John Shawcross revived the idea and suggested that Perry Hanson raise the possibility at the Representatives' meeting with the Regional Director in Manila in February. The response was quite enthusiastic. However, as things developed, with Perry Hanson, John Shawcross and R. Phillips all planning to leave Dacca around mid year, with the previews scheduled for mid April and the pressure of work the idea was nearly dropped. At the last minute it was decided to go ahead anyway, scheduling it as late as possible. The invitations were sent out by Perry Hanson on 19 March 1976. By 15 April only two countries had responded, but within the next two weeks a flood of acceptances came in so the Dacca Water Section began in earnest to make some preparations. By 6 May a provisional agenda had been set and circulated to the Participants. At the same time the documentation was expediously finalized so that all was ready for the opening of the workshop on the 25th May.

1.2. Purposes of this Report

The full list of papers received and materials distributed to the participants of the Workshop is given in Annex I. The main purposes of this report are: (i) to present

.....2/

a record of the verbal presentations made by some of the participants; (ii) to give some of the highlights of the discussions following presentations and (iii) to give information about papers presented by the participants which may serve as a guide to those who have access to the workshop documentation but were not able to participate and who may not have time or need to read all of the papers.

1.3. Acknowledgements

The Water Workshop held in Dacca, Bangladesh, May 25 through June 1, 1976 was organized by the UNICEF Dacca Water Supply Section under the direction of J. F. Shawcross and R. Phillips. The complete list of Participants is given in Annex II. This report is based on notes made by the UNICEF Bangladesh Divisional Liaison Officers I. Johnson, T. McDermott, K. Larsson and W. McKinney and on tape recordings and notes by Water Section staff. It was edited by J.D. Skoda with the help of R. Phillips and B. Mendis.

2. OPENING SESSION (Wednesday 26 May 1976)

2.1. Welcome by Water Section

The assembly was brought to order by Dacca, Water Programme Manager John F. Shawcross. He welcomed the participants and voiced the hope that the group would be able to extend its ideas on what UNICEF can and should be doing in its water programme. The size of the group and the diversity of experience represented would allow all a chance to be heard and an opportunity to learn. In closing he called attention to the provisional agenda with an invitation to the participants to suggest any desirable changes to it

2.2. Welcome by UNICEF and WHO Representatives

Then Perry O. Hanson, UNICEF Representative and Dr. E.S. Han, WHO Representative, gave brief addresses of welcome. P.O. Hanson cited the various studies done by WHO and UNICEF showing a wide acceptance in Bangladesh of the clean water being provided and showing a high percentage (86%) of the wells being kept in running order. He wryly noted that manually operated pumps require a greater degree of community and individual participation than more sophisticated pumps. He said the handpumps installed in rural areas will ensure pure drinking water and thus help curb the spread of diarrhoeal diseases among children. The handpump irrigation system on the other hand will boost production of vegetables and fruits and thus help increase supply of vitamins and proteins contributing to the better growth of children. Dr. E.S. Han closed his welcome by reminding the assembly that the common goal was the betterment of life in the countries where they serve.

2.3. Address by Chief Engineer

M.A. Hussain, the Chief Engineer of the Directorate of Public Health Engineering, Government of Bangladesh gave a speech of welcome (full text distributed to participants) in which he outlined the status of rural water supply and sanitation in Bangladesh. He recalled that in late 1972 the Directorate embarked on a UNICEF assisted programme to sink 160,000 handpump tubewells at an estimated cost of $12 million (UNICEF was to bear about half of this cost). This would more than double the 125,000 public wells existing in the country in 1972. Ultimately the programme cost more and UNICEF's contribution came to about $15 million. The Directorate was greatly expanded and by May 1976, a total of 154,000 wells had been completed (over 40,000 wells being sunk per year in recent years). The Government, UNICEF and WHO now stand ready to take

...../4

up a second programme of similar scope in which the beneficiaries will participate by payment of approximately $3 million towards installation costs and will also take over responsibility for well maintenance. As the Directorate of Public Health Engineering is also responsible for environmental sanitation Mr. Hussain mentioned the selling centres set up in Bangladesh to introduce and promote the use of sanitary latrines. He said that one fundamental difference between water supply and sanitation is that most people are willing to use a public water well but that each family would have to have its own latrine unit and this requires much more motivation, education and change of custom.

2.4. Address by Presidential Advisor

2.4.1. The main address of the Opening Ceremonies was given by Kazi Anwarul Huq of the President's Council of Advisors (full text included in the workshop documentation). He welcomed the participants and congratulated the organizers of the workshop. Bangladesh has an abundance of water in the monsoons, and a severe scarcity, in the dry months. The elusiveness of nature is complicated further by man-made difficulties, such as the sharing/of water of the Ganges with India.

2.4.2. He expressed the gratitude of the Government and the People of Bangladesh to UNICEF and WHO for their significant contribution, to the development of drinking water facilities, in Bangladesh. At the time of independence in 1971, Bangladesh had a modest system of piped water supply in cities and towns. In the rural areas of the country there were some tubewells for drinking water. The people largely used water from rivers, canals

and ponds for drinking. At the request of the Government, UNICEF agreed to support Bangladesh to resink 60,000 tubewells and install 100,000 new ones in three years from 1972. Now this is virtually complete. The next phase of 155,000 new wells in 1976 to 1978, is ready to commence now. Simultaneously, a research programme for development of pumps, is in progress. He noted that rural people have, by and large, taken to tubewells for drinking water. It is hoped, that by the end of the decade of seventy, about 80% of the people, will have access to tubewells for drinking water.

2.4.3. K.A. Huq also noted Bangladesh's valuable experience of small scale irrigation, for cropping in dry months of the year. A chain of activities, in agricultural modernization, diversification of crops, changes of crop-cycle, rural institution-building and so on is going on in which UNICEF has played the part of a pioneer. This has drawn attention, to the potentials of very elementary technology, in creating employment and increasing production, by small farmers and landless agricultural workers.

2.4.4. While development in the field of water has been impressive, progress in the field of sanitation has been very limited. Ideas, programmes and resources are needed in this field. Bangladesh could benefit by the thoughts and experience of neighbouring countries, passing through similar stages of socio-economic changes.

2.4.5. In conclusion he extended a hearty welcome, to the participants and formally inaugurated the International Workshop on Water Supply and Sanitation.

.....6/

3. FIRST WORKING SESSION (Wednesday 26th May 1976)

3.1. Opening

Shawcross* opened the first working session by encouraging all to candidly share their experiences be they successes or failures. Then each participant introduced himself, stating his present assignment and telling of his recent activities and interests in water supply and/or sanitation. Lannert asked all the participants to consider UNICEF's policy throughout the deliberations to see how it is practically applied and to make meaningful suggestions they thought would improve or clarify water policy. His working paper on "Village Water Supply and Environmental Sanitation Policy" containing excerpts from UNICEF's Executive Board Reports was circulated to aid in this.

3.2. The Evolution of A Partnership (Paper by Phillips)

Phillips presented his paper on the Bangladesh Rural Water Supply Programme. He traced early WHO involvement beginning in the mid-1950's and later USAID assistance in 1960's to water supply and sanitation. UNICEF's involvement began in the mid 1960's on a modest scale with a pilot programme for 7 small towns and 4 off-shore islands and for latrines and handpump tubewells. The UNICEF team was on the off-shore island of Sandwip following up the work when the cyclone of November 1970 struck. Following this disaster UNICEF accepted responsibility for the drinking water sector of the World Bank/IDA reconstruction programme. The traditional handpump was soon identified as a constraint because of frequent breakdowns. In January 1972 the new government requested a major programme of resinking, restoration and new drinking water wells and handpumps. This was taken on by UNICEF as part of the United Nations Relief Operations, Bangladesh. Thus UNICEF became a partner with the government in a

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* (Editors note: For the sake of brevity participants are generally referred to by last name only. Please see Annex II for the first names, initials and duty station of each)

major national drinking water programme. The programme was possible because of the existence of a nationwide agency solely responsible for the planning and execution of rural water supply (Directorate of Public Health Engineering) and because both UNICEF and government have greatly expanded their staff to meet the need. The key to the expansion of the programme is that UNICEF personnel were on the spot and ready to accept additional responsibility as the various crises dramatized the great need to the world. There then followed patient and persistent effort over a period of years to overcome all the technical, administrative and logistic difficulties that could have crippled the programme.

(As the discussion and questions generated by Phillips' paper were quite similar to those following Shawcross' paper the summary of discussions has been consolidated and given below the later paper).

3.3. Summary of Developments 1972 - 1976 (Paper by Shawcross)

3.3.1. Shawcross presented his paper on the Bangladesh Rural Water Supply Programme. He described the land surface of Bangladesh as recent alluvium - part of the active delta of the Ganges and Brahmaputra rivers. Other important facts are the high water table and the wide scattering of the rural population. These features combine to make Bangladesh exceptionally well suited to the handpump drinking water programme that has been successfully promoted. Another important factor is that one single government organization is responsible for both the construction and maintenance of drinking water supplies - that is the Directorate of Public Health Engineering. The numbers of their technical staff have doubled

..... 8/

during the time 1972-1976. For the construction of wells contracts are let out in each District to be supervised by the lower level technical and engineering staff of the government. Another organizational factor contributing to the success of the programme is that the DPHE falls within the Ministry of Local Government. This has enabled close cooperation with local government authorities at all levels, without which programme implementation would have been quite difficult. Ministerial complexities in other countries are often a bottleneck on progress.

3.3.2. The main types of tubewells used in Bangladesh have 1½-inch casing but some are shallow (up to 250 ft. sunk by sludger method), some are deep (250 ft. to 1200 ft. sunk by local jetting system), and some deep set pumps (in use where the static water table is more than about 25 ft. below the ground surface). Over the years many innovations have been made to the handpump. The improved UNICEF handpump tubewell now has a PVC bucket, PVC casing below 20 ft., a PVC well screen and the cast iron pump itself has been improved. The driving objective in the 1972-1975 period was to construct the maximum number of wells to serve the maximum number of people while improving the designs to give both wells and pumps a longer life with less maintenance. In order to implement the 1972 targets of 100,000 new wells and 60,000 resinkings UNICEF had to increase its own staff in key areas and to coordinate effectively with government at all levels, national, zonal and district. An important innovation in organization of the Bangladesh Water Programme was the formation of a technical committee where

..... 9/

Public Health Engineering, WHO and UNICEF are all represented. Many important issues can be raised and settled by this committee.

3.3.3. The four Zonal Review Committees, with the Government's Superintending Engineers and Executive Engineers from the districts along with UNICEF's Programme Officers, Divisional Liaison Officers and District Representatives is another forum where problems relating to the implementation of the programme are brought up and often resolved. With the water supply programme well on course and with the prospect of vast majority of rural Bangladesh having access to good drinking water by 1979, attention can now be turned to such matters as better maintenance, greater community responsibility for their wells, greater emphasis on sanitation and consideration of UNICEF withdrawal perhaps by 1982.

3.4. Discussions

3.4.1. Public Acceptance

The Chief Engineer, Public Health Engineering, Hussain, referred to early difficulties in getting the handpump tubewell programme accepted 25 years ago. Often people were reluctant to give up a part of their land for a tubewell site, because of the noise and inconvenience of having the public getting its water from near their house. Since then the situation is totally reversed. Tubewells are now very much demanded almost everywhere in Bangladesh. D'Silva mentioned that it may be possible to win an election by providing tubewells.

3.4.2. Water Quality

The discussion touched on various factors which could motivate people to use clean water. One important factor is the quality of the water especially as it affects taste. This is particularly true if alternate sources of water are available as people may prefer contaminated surface water to ground water high in iron, salt, hardness etc. It was also noted that the community will not take action to have a well repaired if the taste is not to their liking - thus quality affects maintenance. In Bangladesh the most serious water quality problems are excessive iron (in most of the country) and excessive chloride (in the coastal zone). Although the WHO standard is 1 ppm maximum for iron, in Bangladesh upto 5 ppm is accepted by the people and therefore considered marginally satisfactory.

3.4.3. Community Participation

Nayar pointed out that community participation might be possible in at least three ways: (1) Labour, (2) Kind, and (3) Finance. It has been found in India that community labour is not feasible if work is to proceed rapidly, especially if night work is required. Generally the community participates by contributing money for their facilities.

3.4.4. Demonstration Effect

Shawcross pointed out that a large programme, such as has been implemented in Bangladesh, has an important demonstration effect.

The demonstration effect has probably also stimulated the private sector in sinking

..... 11/

tubewells for individual use. People become aware of the tubewells, their benefits and learnt to accept them and use them partly because they have been spread so widely over the country. The question was raised as to whether UNICEF should try more intensive efforts in fewer countries rather than doing small projects in many countries.

3.4.5. Water with Sanitation

Lannert asked whether it is practical to attempt a water and sanitation programme simultaneously. Is it unrealistic or overambitious to attempt both at the same time ? Shawcross responded that at the outset of Bangladesh Programme it would not have been feasible to do both. Agencies that are competent to implement water programmes are not necessarily the best organizations to conduct sanitation programmes.

3.4.6. Convenience

Chulavachana stressed that the most important thing in sanitation is to change people's habits and the best way to do this is to make the facilities as convenient as possible. He also pointed out that the existing water sources may differ from village to village and this will affect the programme. Villages having no water or a very inadequate supply will respond more favourably to a new source than villages whose traditional source, though polluted, is adequate in quantity.

3.4.7. Question on PVC Pipe

Castillo said that there was some concern in the Philippines (articles published, etc.) about possible harmful effects from PVC - once it had

.....12/

aged to say about 5 years. The general response to this was that PVC was being closely monitored in the developed countries and that so far the known harmful effects are limited to the gases used in the factories and that after initial flushing of the new pipe any other health effects are negligible.

3.4.8. Economic Incentive

Medina pointed out that a sanitation programme might be more effective if an economic incentive could be added and that the collection and use of excreta for methane gas as by-product might provide such an incentive. Tun Aung said that ESCAP is studying this type of gas production.

3.5. India Programme (Presentation by Jagtiani)

The background paper on the India programme was that prepared by C.W. Bovee, WHO Consultant. Kumar focused on some of the highlights of the India programme.

3.5.1. Amongst other things the organizational complexity both at Federal and State level often delayed programme formulation and implementation. There are various arrangements for water programme at various levels. At the local, or bloc level the need for a multidisciplinary approach was evident.

3.5.2. Pump failure had been a major constraint in an otherwise successful well drilling programme. As many as 80% of the deep set well pumps were out of order. An estimated 50% of shallow well pumps being out of order at any one time prompted state governments to give up the idea of handpump programmes altogether in favour of more expensive piped water schemes.

..... 13/

3.5.3. Kumar discussed the R.C. factor (Resistance to Change). Considerable effort was spent by UNICEF to convince Central Government authorities on various aspects of the water programme. He mentioned for example the lack of interest by government officials to concern themselves with handpumps, especially to go out to the field to observe them. On the other hand, government seems to have developed a fascination for rigs, and was asking UNICEF to supply ever more of them.

3.6. Pakistan Country Paper (by Musanna)

3.6.1. Musanna gave highlights of the present programmes in Pakistan. Phillips added a few comments on the experience assisting piped schemes in the 1960's. Primarily the schemes were successfully constructed, but unforseen problems subsequently arose in the areas of drainage, operation and maintenance, financing, and very low utilization of constructed schemes. Drainage facilities were not constructed simultaneously with the water system. Pakistani villages tend to be rather flat, with little natural drainage. Pipe waste water therefore tended to stagnate causing sanitary and aesthatic problems.

3.6.2. The original piped schemes had been built with a skeleton distribution system designed to serve the public through a network of public taps, as well as to give service to schools and health centers (the original UNICEF assisted schemes had been linked to villages selected for construction of rural health centers). Subsequently however, this approach had to be abandoned by the government since purely public tap systems did not provide any revenues for operating costs. The government

..... 14/

closed off the public tapes in an effort to stimulate house connections. However, since there was only a skeleton distribution system to begin with, the long distance from each household to most water lines made the cost of taking a house connection prohibitive, since house lines were normally of G.I. pipe which was quite expensive. As a result, the utilized potential of most schemes was quite low. In some parts of the country many schemes shut down altogether.

3.6.3. The solution was based on extending the distribution network, which in turn made house connections less expensive. UNICEF 3" and 4" dia. PVC piping left over from the initial programme were used. Also considerable additional quantities of this pipe were made available to the government by UNICEF through reimbursable procurement.

3.6.4. These water systems were most successful in Sind Province. Here there is no alternative water source at all except raw irrigation canal water. Ground water is either excessively deep (100 meters or more) or too salty to drink. As a result people usually get their water from water sellers, who carry water from the canals by donkeys or camals. Usually this water is untreated.

3.6.5. Water systems in this area are slow sand filtration schemes, pumped up into high service reservoirs and then distributed by gravity. These systems were heavily utilized by the people. Some schemes were so successful that they were actually earning surplus revenue for the town committees. These towns were able to finance with their own funds several extensions of the distribution systems.

..... 15/

3.6.6. In Baluchistan some of the piped water systems were also successful, but of a rather different sort. People often have to travel as far as 10-15 miles to fetch drinking water. With UNICEF piping schemes were installed based on a protected catchment area, and then bringing water by gravity to strategically located public standpoints often extending over a network of 25 miles of piping.

3.6.7. Another approach being taken in Baluchistan is the Integrated Basin Development Programme. Effects are being made to improve recharge of basins by reforestation, earthworks, small dams, etc. in effort to make more efficient use of the precious annual rainfall. Handpumps are to be installed at the foot of these drainage areas.

3.7. Drilling Methods in Bangladesh (Talk by Akhter)

This presentation served to introduce the field trip the next day. By means of blackboard sketches he explained the sludger and other methods being used here.

4. SECOND DAY : THURSDAY 27 MAY

The participants drove to a rural area north of Dacca and viewed the following:

4.1. Dug Well at Savar

Depth:	27 feet	
Material requirement:	27 pcs burnt mud rings, 2-foot dia.	
Labour:	12 man-days	
Cost: Material	Tk.10x27 rings	= Tk.270.00
Labour	Tk. 8x12	= Tk. 96.00
	Total:	Tk.366.00 = US $24.50

a) Water reported good by local people.
b) UNICEF is not sponsoring this scheme.

.... 16/

4.2. Process of Well Sinking by Sludger Method

Caretaker : Mr. Lal Miah
Village : Konabari
District : Dacca
Thana : Savar
Depth : 91'-6"

Materials Used	Cost of Materials (Tk.15.00 = US $ 1.00)
G.I. pipe - 20'-0"	Tk. 200.00
PVC pipe - 52'-0"	520.00
PVC strainer - 2 pcs @ 6'-6" each	200.00
PVC sand trap - 6'-6"	65.00
Pump	230.00
Cement (1 bag)	70.00
Platform construction cost including cost of khoa (aggregate made of broken bricks) and sand	140.00
Carrying cost - lump sum	150.00
Drilling charge @ Tk.5/ft.	457.50
Grand Total (Materials and Labour)	Tk. 2,032.50

Time required for drilling 11 hrs.
Time required for construction of platform 4 hrs.

Labour engaged for drilling:

Skilled - 2 men
Unskilled - 3 men

Labour engaged for construction of platform:

Skilled - 1 man
Unskilled - 1 man

..... 17/

4.3. Demonstration Programme at Public Health Engineering Stores, Tongi

4.3.1. Water Jet System of Drilling

Drilling by this method was demonstrated. The rig consists of 4" inclined poles made of bamboo meeting at the top about 25' high with several cross bamboo pieces tied with ropes. At the bottom, poles are placed in the ground about 10' apart. In some cases 4" dia. steel pipes or betel nut trees (available locally) may be used. A double cylinder force pump called a donkey pump (cylinders made of 4" dia. cast iron or steel pipe 15" long in the vertical) with $1\frac{1}{2}$" dia. rubber hose pipe, swivel, rope and pulley is used. The pistons in the cylinders are wrapped with rags made from cotton, jute or coir. A $3\frac{1}{2}$" dia. steel fish-tail drilling bit is used at the bottom. It is basically a rotary system of drilling with the difference that all motive power being supplied by manpower - no power driven machines are used. A slurry pit 5'x5'x4' is dug and drilling mud is made with water mixed with clay and cow-dung. The method is most suited to the alluvial deltaic area of Bangladesh and is the only one used in installation of deep tubewells (300 - 1200 feet deep) in Bangladesh. An average drilling team consisting of 10-15 men is able to complete a well 800'-1000' deep in about 8-12 days. However, this method is not suitable for drilling through hard rocks, stones or boulders.

4.3.2. Resinking

A demonstration was given of pulling up a choked-up well by side-boring or ring-boring. Ring-boring is most suitable for pulling up PVC cased wells.

..... 18/

A steel ring (just sufficient to pass freely through the outside of the well pipe) is welded to a 1½" dia. steel socket attached to drill pipe (1½-inch). The sludger method of drilling is used keeping the well pipe within the ring which loosens the soil around the well pipe.

4.3.3. Deep Set Pump Assemblies

Different types of cylinders such as brass cylinders, PVC cylinders, cast iron cylinders with brass lining inside, 4" dia. PVC casing pipes and the entire assembly of a typical deep set pump well used in Bangladesh were shown to the group.

4.3.4. Pig Iron, Coke

The stock of pig iron, coke, PVC pipe, etc. imported for the water programme were shown.

4.4. PVC Pipe Production (Lira Industrial Enterprise)

Annual Capacity:	900 m/tons on 3 shifts
Machinery:	3 extruders
Labour:	10 each shift
Office staff:	12

4.5. Production of 1½" G.I. Pipe (National Tubes)

(This is an enterprise of the Government of Bangladesh, Engineering and Shipbuilding Corporation)

In this factory the group saw steel strips being rolled into tubes, machine welded and then galvanized by dipping in molten zinc.

Daily capacity:	150,000 feet
Labour:	120 each shift
Office staff:	100

.....19/

4.6. Hard Rock Drilling in India (presentation by Talbot)

4.6.1. Film and Slides

Talbot gave a talk on hard rock drilling in India. He began by showing the film Patal Ganga which gave the participants the opportunity to see one UNICEF supplied drilling rig in action in Andhra Pradesh. This was followed by a series of slides in which he demonstrated the range of different rigs UNICEF has brought into India and provided an opportunity to explain the principles of 'down-the-hole hammer' high speed percussion drilling in hard rock. He also mentioned cable percussion and up-hole hammer drilling. In up-hole hammer drilling the shock is dissipated as it travels through the drill string and hence drilling efficiency is less as you go deeper. Whereas in down - the-hole hammer drilling the efficiency remains unchanged until you go below water and the back pressure of the water reduces the effective pressure. In India the well yield in the hard rock areas is typically about 500 gallons/hour (though one yield of 10,000 gallons/hour was recorded). Usually the down-the-hole hammer bits can go 100 ft. between sharpening, but in a high silica sandstone formations sharpening sometimes had to be done after only 5 ft. (A new bit costs about $700).

4.6.2. Main Lessons

In outlining what has been learned from the Indian experience with hard rock drilling he made several points:

(a) Overburden - the casing of the overburden layer down to the first hard rock is essential both to protect against the contamination of the aquifer and to prevent collapse of well

..... 20/

walls. There is a need to establish standards of minimum casing requirements for drillers as each provides casing on individual judgement presently.

(b) Reporting - a much improved system of reporting is needed. Drillers are not very interested in filling out complicated forms, so present reports are seldom filed. Forms should be simplified.

(c) Equipment - there is no need to again import to India the same equipment. State governments have already doubled the present fleet with their own purchases. From the experience gained it is clear that future equipment must be reliable and simple with high capacity. To the surprise of some, the hydraulic components have worked very well. Speed and complexity should not be of high priority. Future equipment requirements include greater manoeuverability and greater overburden capacity. Combination of air flush and rotary capacity is desirable. Foam injection drilling which is now popular in the West may be introduced.

(d) Reliability - reliability is the major criteria for selection of drilling equipment in India. A rig which is out of order saves no money. Equipment must be simple, maintainable, dependable.

(e) Transportability - rigs must be highly mobile to be of any use in India. Hard rock areas where wells are must needed tend to have difficult access routes.

..... 21/

(f) Drilling Crew Size - as a rule one man per inch. That is, four men for a 4" dia. well.

4.7. Discussions - Questions Focused on Costs

4.7.1. A 4-inch well averages 30 Rupees per foot (drilling costs). A 6-inch well averages 50 Rupees per foot (drilling costs). Increased costs are faced when drilling in high silica rock.

4.7.2. Rig costs - for 6-inch holes - US $ 125,000
4-inch holes - US $ 43,000 - 50,000

They would like to standardize on 5-inch diameter wells. The Halco Tiger cost only $31,000; is considered in many ways the best concept of type of rig needed as it is lighter, shorter and more manoeuverable (perhaps a bit on the delicate side), but it is no longer manufactured. Rig output has average of about 100 wells per year per rig.

4.7.3. Completed cost per recipient - a completed 4" handpump well for about 200' of hard rock will cost about 5,000 Rupees. Per recipient costs work out to about 30 Rupees for a 4-inch well with handpump.

4.7.4. Inflation impact - even though a normal drilling team utilizes only one jeep and one rig truck still fuel costs have a direct effect on operating costs. The rise in petrol costs has tripled per foot operating costs from 10 Rupees to 30 Rupees.

4.7.5. Training of personnel - the rapidly growing fleets of rigs both by UNICEF donation and government purchases have put pressure on a limited supply of trained drillers. An operator can be trained quickly to push the buttons. A skilled driller

.....22/

however must be able to sense what is happening deep down in the hole and take action accordingly. This requires several years of experience.

4.8. Rig Selection Criteria

C.K. Stapleton, Regional Water Supply Officer of the Nairobi Office led a discussion on the criteria for selection of drilling rigs. He suggested that an outline of points to be considered in choosing equipment for a particular situation might be as follows (in rough order of priority):

4.8.1. Objectives of programme - measured as the quantity (gallons per day or m^3 per day) of water required. Calculated by multiplying population to be served by gallons per capita per day desired.

4.8.2. Composition of formation - hydrogeological survey data, depths to be drilled, aquifer characteristics, static water levels - all indicating "drillability".

4.8.3. Routes of access - A : Major considerations. Main and secondary roads, bridges, clearance, other types of river crossings, bad weather situations, etc. B : Micro-location considerations; terrain, bearing pressures of the land. All leading to an indication of "tonnage per wheel" figure for maximum weight, maximum heights, etc.

4.8.4. Workshop support - consider service personnel available; is on-site servicing possible ? If equipment could be serviced by an agency (dealer) this would be the first choice.

4.8.5. Availability of personnel - what level of training for operators, service personnel. The technology should be adopted to the level of the personnel.

..... 23/

4.8.6. Survey of other related equipment - this is often overlooked. Avoid one-of-a-kind machines. Consider interchangeable equipment/personnel - standardize for ease of stocking spare parts, drilling tools, etc.

4.8.7. Rig capacity/performance - what is available against needs set out in first 6 points (size, weight, manoeuverability, horsepower).

4.8.8. Financial considerations - you may have to compromise after seeing the bill. Perhaps you can trim 10 or 20 percent off by economizing here of there, but beware of trying to compromise too much. It is much better to say it cannot be afforded if that is the fact.

4.9. Discussions

4.9.1. Priorities of Criteria

Several participants felt that financial considerations should be the first rather than the last place. After an extensive survey of equipment needs one later found that funds were not available to purchase the equipment required - obviously a frustrating and wasteful exercise. Bailey suggested that one might usefully consider these as points on a wheel rather than as a vertical set of priorities. One could start with financial considerations and end with financial reconsiderations. A Programme Officer should not specify use of a certain technique within some fixed budget. Financial considerations in many ways permeate all the 7 points. Nayar pointed out that the amortization period is very important. A consideration of equipment must include hidden

..... 24/

costs of maintenance, personnel, etc. There must also be a consideration given to the possible higher long term costs of utilizing initially cheaper equipment. (A rig out of order saves no money at all).

4.9.2. Costs

Discussions again turned to questions of costs. Stapleton mentioned that the high capacity rigs recently sent to Ethiopia each cost about $120,000 but that drillers' salaries, support, equipment, spare parts, large diameter well casing, etc. drove the cost estimates for first 2 years operation up to $750,000 per rig (excluding fuel and local labour). Initially the rigs have produced 1 well per week about 80 to 90 meters deep. Ultimately these rigs will be used to drill wells 400 meters deep, telescoping from 18" to 6". The shallower wells are being drilled first to train the crews and run in the equipment. This pointed up the great differences in costs for water supply in various countries. Skoda mentioned that from his experience with Government of Ethiopia per capita costs for rural water schemes were often as high as 20 U.S. dollars. Shawcross raised the question of whether UNICEF should only work where per capita costs are very low (of the order of say 1.00 U.S. dollar per capita).

4.9.3. Complicating Factors

Obviously, the situation can vary considerably. Measures taken during an emergency, airfreighting rigs to India for example, would never be considered during a normal programme. Much depends upon the urgency of the situation and the acuteness of the

.... 25/

demand for water, donor support may be another factor. Donors for some special assistance projects may be willing to fund higher per capita cost projects than UNICEF would normally consider.

4.9.4. Replicability and Speed

The impact of replicability seems to vary whether the project is focusing on long term or short term goals. For example, if the primary concern is to provide water as a short term goal, a quite sophisticated rig can be used, because local institutionalization of the rig itself is not a major programme objective. Talbot remarked that in India for example, rapid progress made in drilling proved to be offset by the fact that handpump design and maintenance programmes lagged far behind. In an emergency of course, speed may become the main objective.

4.10. Afghanistan Country Paper (by Bertoni)

4.10.1. The water programme in Afghanistan utilizes a remarkably close cooperation between government and UNICEF. UNICEF and WHO advisors actually sit as members of the Environmental Sanitation Section's rural water team. UNICEF maintains direct stores control over issue of UNICEF donated supplies. The programme relies on 4 small rigs drilling small 4" lined wells for communities of less than 2,000 population. Import of a further 4 rigs is planned. Each weighs 1.5 tons, sits on a small trailer but is generally truck transported; can drill 150 ft.

..... 26/

4.10.2. To date about 400 handpump wells have been sunk and about 36-40 community piped systems constructed utilizing deeper wells. Four zonal offices and stores control field installations. Control and record keeping is remarkably complete. Samples of the records kept were passed out. Each site is carefully surveyed before sinking. After completing the well a report with photographs is made. Eight maintenance men have been trained. In zonal offices each man has a car and regularly visits the wells under his control. Power pump installations (centrifugal, and electric submersible) have been more difficult to look after and trained personnel are not yet available. Bacteriological testing has not been done up to now but personnel are being trained for testing (with the help from WHO).

4.11. Discussions (on Costs)

4.11.1. The programme has remained small intentionally to keep standards high. Quality is seen to be more important than speed or quantity. Handpumps - both Dempster ($202) and Mono ($600) pumps have been used with good results. About 80 Mono pumps had been installed as part of an emergency project since 1972. These pumps are rather expensive ($600) but exceptionally reliable, running 5 years or more without repair or breakdown.

4.11.2. The less expensive ($202) Dempster Deep Set Well Pump is being used where water table is 50-60' deep. Spares are imported from Dempster (USA). Although the Mono pumps are expensive they have operated without failure. Beneficiaries are about 300 per handpump. Attempts to install handpumps in open

..... 27/

wells proved unsuccessful due to poor maintenance. Jangalak pump seemed to be a good design, but poor materials used in initial batch of 180 caused a high failure rate (60%).

4.11.3. In addition to handpumps, some power installations have been installed as well. A diesel operated pump of 1.5 cubic liters per second discharge was installed at $2500. A 10 cubic liter per second pump at $7,500. Since then (1973) the cost has gone up, but as these are made in UK where the pound has gone down since 1973, prices may be more or less the same.

4.12. Rural Water Supply in Thailand (by Chulavachana)

UNICEF assistance started in 1968 to support piped water schemes. At the national level seven Departments of four Ministries directly or indirectly get involved in rural water supply. Many of the technical, operational and administrative constraints have been identified (for example the time of readiness of community participation does not coincide with the government's fiscal year). One of the attractions of the treated water is that taste and odour are good; whereas, untreated water in these areas has terrible taste and odour. UNICEF's future commitments are to supply transport and equipment for a training programme for mechanics working in the Northeast.

4.13. Discussions

4.13.1. Costs

Per capita costs of piped water schemes vary from 8.7 to 14.5 US $. Per capita costs of handpump supplies vary from 2.5 to 8.0 US $ (assuming 250 people use each unit). It was felt that piped

..... 28/

systems can be maintained by communities of 3,000 to 5,000 minimum population. Small wells and surface treatment for communities down to 1000 population are possible without piped distribution.

4.13.2. Some discussion was devoted to the Thai experience with the merits of the various small treatment systems. Infiltration galleries received great attention from WHO/UNICEF but have not proven successful. Treatment of direct drawn surface water and deep well water has been more successful.

5. THIRD DAY : FRIDAY 28 MAY 1976

5.1. Handpumps in Bangladesh 1972-1976 (paper by Phillips)

Previous to UNICEF involvement others had pointed out various weaknesses and problems in the traditional handpump. UNICEF was able to get the government and the manufacturers to agree to design changes only because of the leverage, that a large number (at least 100,000) of pumps would be ordered. It would be a mistake to hold up a programme while one attempts to design the ideal pump. It is better to modify the existing pumps to get the programme started and to try to continue your research and development as necessary. The hiring of a foundry technician helped in many ways especially in communication with the foundries and in understanding their problems. It was found that no testing machine can replicate the type of use and abuse that a pump gets from the people and the children in the villages. Development work should go on as close as possible to the locality where the pump will be used.

..... 29/

5.2. Discussions

5.2.1. Exportability of Bangladesh Handpump

Lannert asked to what degree the Bangladesh handpump was exportable. Phillips replied that it could be used where the water table was within say 30 feet of the ground surface. River delta areas would be good. In Pakistan the water table has been found to vary considerably between points in close proximity. Therefore a pump with a flexible piston setting was needed. De Silva noted that the Bangladesh foundries are supplying pumps faster than they are needed. It was explained that at the moment one programme is ending and the next has not started, but that in the new year installation should speed up. Jagtiani commented that WHO has assisted handpump studies in India at Nagpur (Central Public Health Engineering Research Institute) and elsewhere. In response to a question Shawcross said Bangladesh handpump costs about US $20. Although it is for shallow wells, it is being used for deep set wells even though it is not ideal.

5.2.2. Local Production

Medina asked whether in a country of extreme shortages it would be useful to encourage other countries to donate in kind. In other words how practical is local pump production in countries of extreme shortages. Phillips responded that he still favoured local production of as many components as possible. This would be especially important in large public handpump programmes in order that spares would be readily available. In the event that a UNICEF country office should decide to go in for local production, a third document was passed out which might be useful. "Documents for Local

..... 30/

Procurement of Cast Iron Handpumps" contains specimen of forms and specifications used by the Dacca office in its pump procurement. The latest drawings of the New No. 6 pump were also distributed to each participant.

5.3. An Outline of Choices Associated with Handpump Tubewell Programmes and Handpump Design (paper by Phillips)

This type of decision making is covered in this second paper written by R. Phillips, for which there was not time to present. It attempts to log out in a systematic way some of the decisions and options encountered in setting up a handpump programme. Whether or not to go for local production is covered specifically on page 9, sections 13 and 14.

5.4. Handpumps in India (presentation by Talbot)

5.4.1. Background

The big difference between India and Bangladesh is that most of the wells in India are deep. Typically a deep well pump in India will have a working depth of 200 or more feet below the ground surface. As there are about 250 drilling rigs in India putting down about 10 wells each month, the requirement for handpumps is quite large. A pump which was in widespread use in India is the Patel Cieco. This design is perhaps 100 years' old and the pump has 12 bearing surfaces on the head - generally not lubricated. About 80% of the failures occur in the part above the ground. It was determined in about 1969 that this pump was o.k. for family use but not suitable for community installations.

5.4.2. New Pumps

Therefore new pumps were designed. These pumps have various names such as the Jalna Pump, Jalvad

..... 31/

Pump, Sholapur Pump and Bangalore Pump. The basic idea in the improved design is to provide a single pivot with a sealed bearing. A chain riding over a quadrant is used to keep piston vertically aligned. The Government had to be convinced that a design change was necessary. A conversion head was made which could be installed in the field on the old cast iron pedestal of the well head. Radda Barnen took this on in a project and 400 of these new heads were installed by the end of last year.

5.4.3. Design and Production

As in Bangladesh the programme in India aims to have as many companies producing the same pump as possible. For reasons of avoiding brittle failures during transportation over rough roads Indian pump was made from steel rather than cast iron. The ball bearings at the single pivot are lubricated and sealed for life which is expected to be about 5 years. The heavy duty roller chains (1" pitch) chains connecting the lever to the pump rod are available all over India. Because of difficulties in quality control when pipe is bent, the decision was made to cut the pieces and weld them. Good welding is possible throughout the country.

5.4.4. Summary of priority pump design criteria used for deep well pump.

(1) Reliability. The main objective was to reduce the maintenance problem to manageable proportions.

(2) Simplicity of installation.

(3) Inter-changeability.

..... 32/

(4) Standardization - Items (3) and (4) implied fine tolerances in manufacture.

(5) Transportable, light, not prone to breakage.

(6) Fewer pivot points

(7) Suited to widely available workshop technology.

5.4.5. Casing and Platforms

Another problem in reactivating old wells is that the casing pipe, which is supposed to be drilled down to bed rock and grouted, is seldom done properly. Furthermore inferior platforms create problems. So the platforms had to be rebuilt for the 400 wells project. In order to achieve sanitation in the hard-rock areas a larger platform is used in India than in Bangladesh. So it was a surprise to see that the size of the platform had been reduced in Bangladesh. The new pedestal is sprag-mounted and set in place in the concrete platform to produce a high degree of rigidity. The quality control of the concrete in the platform has been a problem.

5.4.6. Research

Below the ground the pump cylinder is of brass with leather buckets and ball valves which last about 1 year. Research is being conducted in Madras on a plastic cylinder design with neoprene buckets - these will be field-tested soon. Field-tests are essential because the regular stroke used in laboratory tests cannot compare to the use the pump will get in the village. Furthermore, in some localities there will be varying amounts of sand in the water.

.... 33/

3.4.7. Maintenance Organization

Talbot observed that if pumps require maintenance more frequently than every six months, it becomes virtually impossible for a maintenance organization to cope with the high rate of breakdowns. This is the reason why pump designs should be improved as much as possible, as soon as possible. However, even after the design of the pump has been substantially improved, there will still be a need for an effective maintenance organization. Improved pump design makes the maintenance problem manageable, rather than eliminating it altogether.

5.5. Visit to Local Foundry

After the presentation all the delegates were taken to visit of the Eastern Foundry & Metal Works in Dacca where they observed casting, moulding, machining, etc. if New No.6 pumps being made for the UNICEF programme.

The main observation was that about 1000 pumps per month of relatively good quality were being produced with rather humble, labor intensive technology at a price of less than $20 per pump.

5.6. Visit to UNICEF Vehicle Workshop - Tejgaon

Philipe Heffinck, Workshop & Spare Parts Manager gave the participants a brief tour of the workshop. Explanations were given of the various aspects of work, such as spare parts distribution for all UNICEF vehicles in the country, assembling and making roadready all UNICEF provided motorcycles, servicing of the UNICEF Dacca transport fleet. A full set of documents used by the workshop and transport section was passed out to the participants.

..... 34/

5.7. Supply Matters (led by De Bock)

5.7.1. Supply Planning (De Bock)

a) A need is felt for a regional supply workshop or series of workshops to help in training UNICEF personnel in supply operations. This has been tried successfully elsewhere (SCARO Delhi and Nairobi).

b) Programme Officers must maintain close contact with projects with a view to evaluating and selecting better or cheaper supplies, where possible substituting local procurement items for foreign.

c) Careful attention must be given to imports of sophisticated equipment - are trained operators available?

d) Programme Officers should draw on advice of Supply Officers early - in programme design.

e) Realistic delivery dates (TADs) must be used - the word 'urgent' is too lightly used when the reason is faulty planning or the Programme Officer's failure to raise his call forward on time.

5.7.2. The BAL (Wright)

a) The BAL provides a basic budget framework of our financial commitments. It must cover all elements of our assistance over the full period in question. The BAL is meant to serve as a tool of programme management for monitoring implementation. A realistic phasing of call forwards should be given.

..... 35/

b) Special assistance/noted projects are more complex as amendments must be constantly made to keep the amounts committed on the BAL equal to the actual amounts firmly pledged. The Bangladesh situation is particularly complicated as new funds are continuously being received.

c) Discussions centered on the question of whether special assistance funds should be covered on a completely separate BAL. Some saw problems arising in the inevitable mixing of funds which comes from showing general resources and special assistance funds on the same BAL. Others believed the use of a single BAL offers good flexibility in allowing us to shift funds according to immediate demands for programme implementation. The handling of several separate BAL's could become a cumbersome paper exercise.

The demands of donors for reports on special assistance funds are generally handled by NYHQ - it was felt that donors must be urged to accept a very general type of report on the use of their contribution rather than a report tied to a collection of payment vouchers. Reports for Bangladesh donors are generally based on the two tier system - NYHQ comptroller makes financial reports direct to donors (accounts of money spent, copies of purchase orders, lists of equipment, etc.)

From Dacca reports are made on general programme, progress and development. This is a fairly effective division of labor.

..... 36/

For this, we arranged for Donors to "adopt" a particular area. at a flat rate of X dollars per well, apportioning the number of wells in relation to their contribution. Visitors were taken on trips to their particular area and given reports on that area in detail, as well as on the overall project. This seemed to work out quite well.

5.7.3. OLGA Guide List (De Bock and Skoda)

De Bock gave a general explanation of the role of UNICEF Guide List. Skoda commented that OLGA is written in such a way that anyone using it to order supplies should be able to steer clear of materials inappropriate to any particular water supply application. Despite the disclaimer in OLGA that it is not a handbook, it contains such useful information in its text, tables, annexes, etc. that it is in fact better than some of the popular handbooks on the market. Furthermore almost every chapter has a bibliography; so one can go further into the subject if necessary.

5.7.4. Local Procurement (De Bock)

De Bock noted the considerable recent increases in local procurement - up from $10 million in 1974 to $14.5 million in 1975. Local procurement has many obvious advantages but one must not overlook items already with UNIPAC. He suggested more use of contingency funds available at each office ($2,500 per year per BAL) in which case supply lists and shipping reports are not needed on small items. Procurement over $100 is always covered on a supply list in Dacca. Several countries have built in contingency cash and supply lists into their BAL to allow quick solutions to bottlenecks.

..... 37/

5.7.5. Contract Review Committees (De Bock)

There seemed to be much support for De Bock's position that present bidding practices are outdated and should be modified. The field manual section on local procurement has not been revised since 1962. Large order purchases where the vendor and price have been already approved by HQ should not have to be reviewed once again by a local Contract Review Committee. Continuous purchase items should be on open-ended contracts (or negotiated prices) rather than the present bid/set price contract system. Public advertisements should be avoided - they often serve to raise prices and to attract unreliable bidders. A need is felt to develop long term working relations with a limited number of reliable suppliers rather than constantly returning to the market for each new procurement.

5.7.6. Inventory Stock Control (M. Akhter)

The Bangladesh system of control over UNICEF stocks in Government hands was thoroughly described. The Superintending Engineer of Public Health Engineering's Stores Circle prepares a monthly consolidated stock report showing the countrywide stock position in 3 Divisional and 61 Subdivisional stores throughout Bangladesh. Four UNICEF Stores Assistants do field checks of stock ledgers against physical stocks. Discovery of major discrepancies is not so common but often small errors are found in which UNICEF supplies have been utilized for non-UNICEF projects. This is the greatest source of friction between Government and UNICEF.

.....38/

The major problems are:

a) UNICEF keeps no real control over internal supply movements.

b) Government reporting remains slow so that excesses or shortages are slow to be seen. Future plans are to place UNICEF Stores Assistants in all Divisional Stores to give UNICEF more direct control over supply movements and give more rapid reporting.

Discussions included the question of how active a role UNICEF should play in controlling supplies and whether we might not better concentrate on building the government's own storekeeping and reporting capabilities. Progress has been made in having a separate stores organization established within Public Health Engineering. Much work on physical facilities, report forms and training remains. Administrative aspects need to be given more careful attention as an integral part of our project implementation. Any country providing good examples of a good stores and warehouse system should be brought to the attention of others so that they can learn how it can be done.

5.8. Use of PVC Casing Pipe and PVC Well Screen in Bangladesh (paper by Shawcross)

The first PVC casings were installed in 1968/69 and are still operating well. In the present programme about 90,000 PVC wells are operating. The main advantages of PVC are its lower cost and its freedom from corrosion. The main disadvantages are that it is not suitable to be used for drill pipe and withdrawal of a choked up well would be

..... 39/

considerably more difficult (side borings) as PVC is not as strong as galvanized iron or steel. G.I. pipe is still used in the top 20 feet of the well up through the platform to the connection with the pump Solvent cement joints (versus threaded) allowed further savings through reduced wall thickness. The "tooth paste" type tube for the solvent cement has proved very convenient.

5.9. Piped Water Supply Systems (paper by Shawcross)

A personal interpretation is made of the various factors and choices one must confront in deciding whether and how to get involved in water supply in general and piped schemes in particulars. The main factors in favour of UNICEF involvement would be low per capita cost (including maintenance costs), to further interests of mother and children in schemes funded by others, possibility of demonstration to catalyze action, as part of a package of basic services, to upgrade an existing system and in hardship cases. The seven town water supply scheme in Bangladesh was a failure because the towns could not fund and run the systems. His paper also list preferences in choosing among water sources and equipment for small rural systems e.g. ground water preferred over surface water, slow diesel engines preferred to fast petrol, etc.

5.10. Discussions

The discussion which followed centered on different types of equipment that could be considered. Wooden storage tanks, have been used successfully in some countries. Hydraulic rams (which are covered in OLGA) were mentioned as they don't need fuel. In response to a question from Medina about air lift pumps Stapleton noted that their popularity stemed from the fact that the working parts (air compressor, etc.) are above the ground where they can easily be serviced; however, the efficiency is very low. Bertoni added that

....40/

the air lift pump causes a lot of turbulence in the well and thus one gets more sand, etc. coming through the well screen and into the water supply; therefore, not recommended for supply of pure water. Windmills were briefly discussed. Their high initial cost and the possibility of damage from high winds were noted as big disadvantages (newer models have speed controls to prevent high wind damage). At the end of the discussion Lannert expressed the view that such a paper and list of preferences was very good and should be expanded and backed up by the facts and reasons behind the preferences to make it even more valuable for programme officers.

5.11. Ground Water and Construction of Tubewells as Related to the Rural Water Supply Programme in Bangladesh (Paper by Awal)

Water must have acceptable tastes, color and odor - lack of these even where water meets health requirements may drive people to dangerous but better tasteing water sources. Bangladesh routinely accepts iron and chloride levels well beyond normal world standards because people find the water acceptable. Villagers faced by high iron levels often use simple overnight settling to reduce the levels. As most water utilized in Bangladesh is ground water no need has been felt up to now for extensive coloform bacteriological testing.

5.12. An Exercise in the Use of UPVC 12 ins. Nominal Bore Pipes for Well Casing (paper by Stapleton)

This describes how a test well in Surinam was cased down to 32 meters depth with this casing. Corrosive ground water was destroying steel casing in 5 years or less time. UPVC (Unplasticised Polyvinyl Chloride) has a high resistance to corrosion and the exclusion of plasticisers obviates the risk of age embrittlement. Each of the pipes had a socket on one end and was inserted in the hole (male end upwards)

..... 41/

and joined to the piece by applying first cleaning fluid then solvent cement and three self tapping stainless steel screws (as an additional safeguard). The bottom of the string was reinforced with a specially designed "shoe" which also had centralizers to keep the string in the middle of the borehole. A pressure head was fabricated locally and secured to the top of the string of pipe. It was then used to circulate mud through the annular space between the casings and the hole and eventually to place cement slurry in the lower half of the annular space. A plywood plug was used to separate the cement slurry from the following fluid (water). When the cement had set but not completely hardened the wooden plug and cement in the bottom of the UPVC pipe was drilled out. The top part of the annular space was filled with gravel with concrete in the top two meters. The water bearing sand was then drilled and reamed and a screen string of 6-inch internal diameter topped by a plastic reducer with a rubber packing ring was jetted into place and the borehole developed.

6. FOURTH DAY : SATURDAY 29 MAY 1976

6.1. Training Programme for Rural Water Supply Personnel in Bangladesh (paper by M. Akhter)

6.1.1. UNICEF Bangladesh sponsored a number of short-term training programmes for the middle and lower ranking technical personnel (Asstt. Engineers, Sub-Asstt. Engineers and Tubewell Mechanics) of the Directorate of Public Health Engineering, Government of Bangladesh. In the absence of training facilities within the Directorate, UNICEF initiated all of these programmes and took active part in planning, coordination and actual conducting the courses. UNICEF also contributed the cost of running the programmes. The objectives

.... 42/

of the programmes were to improve technical capabilities of Government personnel in well drilling, use of new PVC well construction materials and attain self reliance in training of personnel.

6.1.2. The training programmes were held between 1974 and 1976. About 120 Sub-Assistant Engineers received training in 4 batches in 5-day courses which included class-room lectures and field demonstrations on the different aspects of water quality, ground water development and well drilling. A six-day training programme was arranged for Assistant Engineers which included class-room lectures on Rural and Urban Water Supply Programmes and Field Demonstration of well drilling.

6.1.3. About 1600 mechanics attended 3-day training courses in 60 training centres in which mechanics received training on basic concepts tubewell drilling, health education, repair and maintenance of wells.

6.1.4. UNICEF should continue its efforts in training Government personnel with more active participation on their part with the ultimate objective of setting up permanent training facilities within the Directorate.

6.2. Training in India (presentation by Talbot)

By the end of 1976, there will be something like 300 hard rock drilling machines in India. Each rig can drill 10 wells per month or about 12,000 feet per year. The performance of the machines falls off after the end of first year. It is felt that the three main items of the training should

..... 43/

be to: (1) help the trainees improve their operational efficiency, (2) help to improve maintenance and (3) to achieve effective use of spare parts. If all of these points are taken care of then only bad management or poor logistic support will cause failure of the programme. As few people are well-acquainted with down-the-hole hammer drilling, it is hard to find enough good instructors. There are about 500 drillers in the country. Talbot was employed as Master Driller to give in-service training. The main types of training were:

1. Pre-service training
2. In-service training
3. Programmed instructions (these were specially good for drillers without much formal education).
4. Short-term seminars

6.3. Motivation of Pump Operation and Maintenance Training Programme for Rural Water Supplies in Kenya (paper by Stapleton)

This programme attempts to reach the humble people in the villages. First of all it was necessary to get the cooperation of the Ministry of Health and the new Ministry of Water Development as well as the Ministry of Housing and Social Services (the cooperation needed was not only cooperation with UNICEF but cooperation among the Ministries themselves). The Ministry of Health, Ministry of Water Development are supplying the instructors for the training and the Ministry of Housing and Social Services providing the venue. In the training for power pump operators the trainees are bused to the nearest Farmer Training Center. UNICEF is paying the stipends, bus fares and providing tool kits and transport of instructional equipment. Also there is a similar training programme for handpump caretakers.

..... 44/

6.4. Training in Afghanistan (presentation by Bertoni)

It is hard to find people willing to be trained because they must be taken away from their daily tasks. The Government will not pay people just for the sake of training. There are two training courses: The first is for drillers and mechanics. Each driller teaching 8 people and each mechanic teaching 4 people. Secondly, there is training for Sanitarians. There are about 130 Sanitarians scattered all over the country. They are brought into Kabul and UNICEF pays stipends for a refresher course. It is desired to increase training this year. More teachers should be sent into the field to train them.

6.5. Discussions

6.5.1. Castillo asked whether they would test, questionnaires etc. Do trainees evaluate the programme they have taken? What incentives are there for the trainees? Talbot said that incentives for the trainees are very important and that in India the travel to and from the training centre is in itself a big incentive. Furthermore giving a respectable title to the graduates is often considered as important as money. Jagtiani asked whether Public Health Engineering in Bangladesh has any Mechanical Engineers and was told that there are mechanics but not Mechanical Engineers. There is a separate Mechanical Division which may have a few Mechanical Engineers. But they do not have any direct involvement in the handpump programme. In Bangladesh trainees were tested and gave their comments.

6.5.2. In response to a question from Lannert regarding the maintenance tasks at the village level in Kenya, Stapleton replied that the main maintenance problem for handpumps is the replacement of the leather cup or washer. Two people are selected by

..... 45/

villages elders and are sent for training and then held responsible for pump maintenance. For power units major maintenance cannot be done in the village; however, the engine can be lubricated by the villagers and they can see that the engine house is kept clean and that the fuel does not get contaminated. The handpump caretakers are trained for 5 days (5 villages sending 2 people each and thus 10 people are trained at a time). The power pump operators are given 10 days of training.

6.5.3. Talbot said that in India the pump caretakers mainly report breakdowns to the proper authority. With the older type of pump the caretakers can lubricate, tighten nuts and bolts and perhaps perform some platform repairs. But with the new Bangalore pump, it is constructed to prevent people from making repair, so as not to damage the working mechanism. Skilled mechanics will attend the new pumps when repairs are needed.

6.5.4. Medina pointed out that technical instruction is a discipline in itself and asked whether any effort has been made to involve the Ministry of Education. Lannert mentioned that in Zambia there was a maintenance problem of equipment in the health programme. Drivers of Government vehicles were given simple training and as they generally had tool kits and lubricating oil in their vehicles and spare time while waiting for the officials they drive for, this minor maintenance work was done free of charge.

6.5.5. Griffith pointed out that the objectives of the training should be clearly defined, and feed back on the effectiveness of the training is very important; otherwise, poor maintenance will be discovered too late.

..... 46/

6.6. Maintenance Management (presentation by Medina)

This was based on Medina's booklet "A Guide for Planning of Maintenance Management". Maintenance management aims at the best utilization of money, material and (most important) manpower. People are the key to any maintenance organization. In planning and maintenance the following should be taken into consideration: Planning, Organizing, Motivating, Executing and Evaluation. Organization is needed whenever more than one person is engaged to attain a common goal. The organization should be a reflection of the goal. Planning can be defined generally as conceiving an image of the future. It is a changing situation - a drilling rig is not the same rig the second year as it was in the first year. It is important to make a distinction between repair and maintenance. Maintenance should be objective oriented. That is why training is so important. He mentioned the great explorer who was asked about his adventures - the explorer replied that he had had very few adventures because proper planning eliminates adventures. Training is highly motivational. In motivating the trainees incentives other than money need to be considered. Good supervision is not having a long index figure and a loud voice. In motivating the supervisors it is critical to create a positive image in his mind of what a good supervision should be. Peer recognition is vital to all supervision efforts.

In managing a large complex scheme, where you cannot digest all of the data, you should manage by exception. At this point the information system becomes critical. The reporting information system should in itself be periodically evaluated to see if it is appropriately serving its intended purpose. An information system can be productive, unproductive or counter-productive. An example of the latter is the collection of vast amounts of useless information which occupies a lot of staff time and money, but which does very

.... 47/

little good. Hence it is absolutely essential to have well defined objectives to begin with, and tasks related to these objectives. These must be clearly defined both within a work plan and at implementor level.

6.7. Discussions

Talbot agreed on the importance of motivation of supervisors but asked what other than money and status could motivate some people. Bertoni felt that there should be more training in Afghanistan but staff did not have time to do more in this area. Various people discussed ways of motivating. Shawcross pointed out that in Bangladesh successful trainees receive certificates and that important government political figures are brought in to give speeches. Jagtiani warned that certificates have a negative effect if people possessing them feel too important to go back to the village and do their duty. Skoda mentioned that in some cases cutting red tape and improving logistics can serve to motivate and encourage people doing maintenance. It was especially important for example to see that mechanics are paid salary and per diem on time and have adequate tools and spare parts. Medina concluded the discussions with the reminder that the organization should be geared to the task and not other way around. In any maintenance organization, the manager is the key. Also, a three tier organization can be set up (1) village level mechanic; (2) mobile workshop; (3) base workshop. In planning, the hours required per equipment should be worked out. In relation to each equipment, each person's function and man-hours should be worked out.

6.8. Maintenance of Handpumps in Bangladesh (presentation by M. Akhter)

He said the best leather buckets were found to last about 6 months and the worst last only 15 days. PVC buckets last about twice as long. The check valves last from 6 months to 1 year. Piston rod used to last only about 3-6 months,

.... 48/

but now hopefully, last 8-12 months before replacement. Plunger threads wear out in about 4 years. The handle may wear out at the bearing surface or break - a good handle could last 20 years. The pump barrel could conceiveably last 30 years. Public Health Engineering estimates 50 taka per year will be required for pump maintenance (approximately 3 U.S. $). As there will be about 500,000 wells in Bangladesh the money to maintain and the logistics of spare parts could create quite a problem. On a national scale, this would be 25 million taka per year. But at village level it is only 0.50 taka per person per year, based on an average of 100 persons per well. Therefore, this is a social management problem rather than a financial one.

There is to be one mechanic per 200 wells generally spread over about 20 sq. miles. During 1972-74 UNICEF supplied all of these spares then they phased out and now supply only a few spares. The WHO in their small pox survey looked at maintenance of handpumps in Bangladesh. UNICEF confirmed the WHO results by an independent survey. It was found that on an average less than 20% of the handpump tubewells were out of order at any given time.

6.9. Discussions

Talbot pointed out that in India a government agency drills the well, contractors install pump and perform platform construction. Mobile maintenance teams then are to take care of their installation. Stapleton said that although community participation in maintenance should be maximised, there are limitations especially for major maintenance of power pumps. Nevertheless sooner or later the community will have to take over. In response to questions by Tun Aung: 1) UNICEF Bangladesh provides bicycles for the pump mechanics, 2) problem of cracking barrels in Bangladesh handpump is not great as it occurs only very rarely. Lannert asked how caretakers are selected.

..... 49/

In Bangladesh the owner of the land adjacent to house is usually selected as caretaker.

6.10. Maintenance in India (presentation by Talbot)

6.10.1. He mentioned that the most difficult job of all was to convince the government that there was a problem. It was finally agreed desirable and necessary to introduce a new type of pump which was more maintainable. Radda Barnen (Swedish Save the Children Fund) supported the handpump maintenance aspect of the UNICEF programme.

6.10.2. In Rajasthan where guinea worm is a problem, interest in maintenance was high, and results were rather good. District based mobile teams equipped to pull up the pump cylinder, were sent out to maintain the wells. In Tamil Nadu, in response to a drought 2400 wells were installed, so maintenance was crucial. Here again, district based teams were set up.

6.10.3. In Bihar the government had become disillusioned with handpump programmes because of the maintenance problem. UNICEF attempted to restore confidence in handpumps by a three ways:

1) deeper, more productive wells
2) more reliable pumps
3) mobile maintenance teams

Success in this effort is considered to be a real breakthrough.

6.10.4. In setting up the 3-tier maintenance system for the new pump, the village caretaker has been all but phased out, with little more do to than operate and lubricate the pump. At block level, mobile

..... 50/

teams equipped with simple tools can make minor repairs, but are not supposed to open up the pump top. Finally, major overhauls are done at the district workshop.

6.10.5. Regarding Harrijans in India, they are refused access to public handpump wells. If a well is put in the Harijan area others won't use it. Therefore two wells are usually put in such a village. Awal pointed out that the location of a well has a bearing on maintenance and that it has been found that wells producing small quantity or poor quality water will not be well maintained.

6.11. Piped Water Supply Schemes (paper by Shawcross)

In Bangladesh maintenance of piped water systems has not been good. Here Public Health Engineering install and Municipalities are supposed to maintain, but this has not worked out well. Main points in maintenance of piped water are: Maps should be kept up to date, showing location of valves, pipes, washouts, connections. This is especially important for information of new staff. Valves should be opened and closed every 6 months. Washouts should be included in all systems. Inspectors must walk along pipeline looking for leaks, overflowing roof tanks and illegal connections or disconnection. Daily flows should be recorded so that problems can be noticed at once. Meters need periodic check/repair. Steel water tanks must be emptied, scrapped & painted every two or three years. Fencing must be kept in good repair.

Most important of all, there must be a responsible person, in charge of maintenance.

..... 51/

6.12. Discussions

Several questions were raised regarding taps. Shawcross said that public stand pipes are undesirable as spring taps or waste-not taps do not work too well and theft or vandalism is a problem. Usually taps are brass or galvanized steel. Stapleton asked about the Fordilla valve which gives a metered amount of water no matter how long you try to keep it flowing. The reply was that people sometimes saw them off. Medina asked about PVC valves - apparently there are some rigid PVC ball cocks with teflon balls being made. Nobody present seems to have had any experience with these.

6.13. Discussion Paper for Communications (Bouhafa)

Bouhafa noted that UNICEF involvement in water programmes requires communications to explain how clean water benefits children and then to change water use habits. Research must be done to determine the peoples habits and attitudes concerning water and hygiene. Following this one can develope a programme to teach the villagers how they can participate and benefit from the improvements. Various programme implementors may need specialized training. National press, radio, TV etc. may also be used. In Bangladesh much of the water programme communication was done verbally by the frequent contact between UNICEF staff in Dacca and in the field with Government workers, caretakers and villagers. The caretakers booklet that has been developed will reach into every village. At the national level articles by local journalists were commissioned for special newspaper features on water.

6.14. Discussions on Health Education and Community Participation

6.14.1. Community participation should be given priority, as a supplement to existing government structures, the choice should not be people or government but people and government, i.e. community participation in

... 52/

maintenance and health education can strengthen governments efforts. All participants agreed that community participation and health education components of a Water Supply System are extremely difficult tasks to implement. Jagtiani seemed to voice the views of many when he said they dreaded the thought of going into a massive health education programme without really knowing more about the villagers ideas, attitudes and what kind of information they need.

6.14.2. Community participation in maintenance of rural water supply programmes is feasible in cases where:

(a) Government maintenance structure is weak.
(b) Technical tasks required are simple.
(c) Communities are motivated to feel the need for potable water supply.

In the 2nd Bangladesh water programme for 155,000 wells, an increase in community participation is envisaged. Communities will contribute towards the sinking of the well and thus develope a sense of ownership and responsibility towards the well (50% of sinking costs for shallow wells and 25% for deep wells). Some pilot maintenance projects which tried to assess the villagers not only for spare parts but for the mechanics salary had failed. This was because the villagers quickly noted that the parts were cheaper in the market and because neighboring areas (outside pilot project) were still getting free parts and installation.

6.14.3. Community participation/health education may not be a necessary pre-requisite for a good rural water supply programme. Indeed, the question was raised "Is health education necessary?" Evidence would

.... 53/

indicate that people will utilise the most convenient (in terms of taste, location, availability) water source. It could, therefore, be argued that our efforts should be made towards technological improvements in potability, site selection, etc. which in turn, will encourage the people to use the water. Musanna noted that a health education programme in Pakistan had resulted in lots of requests for house connections. Many felt that health education community participation was jargon for some magic missing ingredient which could be blamed when projects fail.

6.14.4. Improvements in techniques of programme communication support activities are important as possible channels for health education. Important areas may be:

(a) Simple health education films
(b) Posters, visual aid charts etc.
(c) Manuals, booklets for communities and unit level workers.
(d) Increasing use of mass communication techniques, particularly radio. The timing of motivation health education should be such that it preceeds the water supply but not by such a long time as to make the people lose interest and/or hope.

Nayar pointed out that it would be wrong to assume that health education can only be transmitted by magazines, TV, radio etc., rather everyone should spend 5 minutes per day trying to convince someone to adopt better ways.

6.15. Fund Raising, Public Relations, Reporting (talk by Wright)

Water programmes' present particular advantages and disadvantages when it comes to fund raising:

Advantages: They are popular with donors in that something tangible is produced. Most water projects can be broken down into smaller units.

..... 54/

Disadvantages: They are technically complex and hence require a long time to get started. There seem to be more complications in procuring and scheduling supplies than in other projects.

Many governmental donors are becoming more knowledgable about the technical aspects of such projects and the maintenance and other problems that ensue. Some donors have very explicit ideas about what they think a country needs. NYHQ handles the formal requests and reporting but they must rely on the field offices for the basic information and support.

6.16. Discussions

Jagtiani pointed out that some donors don't like to receive a big reception in the field. Shawcross asked why we can't get around the long time delay by implementing projects and then raise the money later like Australian Food for the Hungry. Bouhafa noted that our donors are often our best advertisement. He also stressed putting good candid photos in reports.

6.17. Bangladesh Field Structure (talk by McKinney)

McKinney gave a brief description of the Bangladesh field structure. UNICEF maintains a District Representative in each of the 19 districts. Divisional Liaisons Officers (such as McKinney) are posted in each of the 4 divisions and each oversee UNICEF programmes in 4 or 5 districts. Water Programme Field Technicians work under the UNICEF District Representatives in most of the districts. Such a structure is essential for a countrywide programmes such as the UNICEF assisted water programme in Bangladesh in order to develope, assist, monitor and evaluate such an undertaking.

..... 55/

6.18. Evaluation (discussions led by Lamnert and Phillips with special reference to USAID Logical Framework Approach)

6.18.1. Evaluation is built into good programmes at three stages:

(1) Before: Project design and preparation
(2) During: Monitoring implementation
(3) After: Retrospective evaluation

6.18.2. One of the main problems has been that we give inputs as though they were objectives but the real objective is better health and nutrition of children and lower mortality. Another is that the objectives are not quantifiable so its impossible to come back later and evaluate. Often there is no time frame built into the statement of objectives. Fuzzy language with words such as "strengthen", "augment", "integrate" etc. in place of explicit plans, numbers etc.

6.18.3. In a programme such as the Bangladesh rural water supply programme which has been in progress for some time, these three types of evaluation might be going on simultaneously. Also, in the context of the Bangladesh rural water situation, evaluation might be organized on a multi-level basis, with the most appropriate ministry or agency responsible for different evaluative functions. For example:

Input ..... materials, finances level Output ..... well installed level materials used, etc.		Public Health Engineering is most well suited for others, and it might be unrealistic to expect this of it.
Purpose or outcome	No. of beneficiaries, water use patterns	Ministry of Social Welfare
Goal	Impact on health and economy	Ministry of Health, Planning Commission

..... 56/

The Ministry of Health with its network of multi-purpose workers is especially well equipped to evaluate certain aspects of the water programme. Choosing the most appropriate Ministry should take into account the objective for which the agency or Ministry was established how it is organized and the main interest of its staff.

6.18.4. Azizul Huq stressed the importance of baseline studies in evaluation, Phillips underlined the need to choose the right partner in Government when advocating and doing evaluation. Lannert said that although real life situations may make an ideal evaluation impossible one must strive to do better and include as much of the ideal as possible. Medina added that all of the management tools that had been discussed would never provide a substitute for good judgement.

7. FIFTH DAY (EXTRA SESSION) : SUNDAY 30 MAY 1976

A special session was held on Sunday morning to discuss the following questions raised by Lannert of NYHQ:

a) What types of information are essential for planning rural water supply projects?

b) What types of information are essential for monitoring rural water supply projects?

c) How can UNICEF help strengthen Government capacity for evaluation of village water supply projects?

Shawcross asked that the participants relate any experiences in which evaluation was useful for future programming.

The conference reassembled into small working groups to study these questions.

..... 57/

The following reports were developed by the working groups on Sunday (they were typed up and presented to the participants on Monday):

7.1. Group A Report

Function

Goal - Must be clearly defined, e.g. "to reduce infant mortality to .....% by 197...." "to reduce feacal-born diseases to .....% by 198....."

Objectives - Must be clearly numerically defined, e.g. "to supply ..... (No.) people with potable water (sanitary latrines) by 197 ...."

Outputs (tasks) - Must be clearly defined, e.g. "to construct .... (No.) wells within .... time schedule".

Inputs - Numerically defined.

7.1.1. Base-line data, e.g. present infant mortality present disease rates.

Linkage between objective and goal. Design acceptability in respect of behavioural factors.

Demographic data. Define "potable". Present water supply data. Hydro-geological data.

Design alternatives and cost comparisons.

Hydro-geological data. Economic support capability at village/national infrastructure. Specifications, bills of quantity.

Local/foreign inputs. Community/institutional inputs. Personnel? Skills? Supplies and equipment.

.... 58/

7.1.2. Information for Monitoring

Measure, quantity. Constraints. Confirm linkage.

Measure population per well etc. Constraints.

Progress vs schedule. Constraints. Quality control, testing.

Progress vs schedule. Training. Constraints.

7.1.3. Information for Evaluation

Quantify reduction of mortality etc. by: Before/after comparison, or by: Control group comparison. Define constraints etc.

7.1.4. Information for Strengthening Govt.'s capacity for Monitoring and Evaluation:

a. Investigate and appraise.
b. Convince Govt./officers of desirability of adopting, monitoring and evaluation.
c. Training
d. Technical assistance
e. Management
f. Engg. capability

7.2. Group B Report

1. Types of information required for Planning Village Water Supply and Environmental Sanitation Programmes

(i) Physical data. Topographical, geological, hydrological, meterological. This information would be used for example to guide the siting of water supply installations, the selection of drilling equipment level technology and transport.

.... 59/

(ii) Design criteria. Criteria about the level of objectives to be set (input, output, outcome, goal); and the degree of quantification would influence the type of information generally to be collected. Need, therefore to collect information early about design criteria.

(iii) Existing Village Water and Environmental Sanitation Situation. Information on traditional water sources (surface, wells, rivers). Data of this kind might illuminate alternative choices, e.g. disinfecting and protecting existing water sources; not installing new and additional source of water.

(iv) Socio-cultural, political factors relating to water supply and environmental sanitation at village level. Information about customs, habits, water laws; traditional usage of water e.g. some ponds reserved for drinking, others for washing and animals; traditional criteria for siting wells, e.g. by caste, taste, preferences e.g. tolerance for hard water, salts, iron content. Also effects of water on other living habits (washing in hard water takes more soap; some traditional breads do not rise properly with hard water). This type of information would influence well sitings; warrant consideration of test drillings.

(v) Information an Existing Resources

(a) Materials: e.g. piping, pumps, cement, construction equipment, surveying equipment.

..... 60/

(b) Personnel. Numbers of different levels and categories; distribution at national and sub-national level; administrative and technical skills; supervising capacity.

(c) Stores and workshop capacity.

(d) Communication. Road conditions; accessibility to problem areas.

(e) Economic condition. Village level; income estimates, affects, feasibility of sinking and maintaining water system.

(f) Data. Topographic and geologic maps; geophysical surveys; meterological data. Deficiencies in data might influence decisions to support efforts aimed at producing this data.

(g) Financial resources. Governmental and private resources allocated to development of village water supply. Resources also provided by international and bilateral aid agencies; non-governmental organisations.

(h) Use of existing and past resources. Information about previous performance in implementing village water schemes; info and results.

(vi) Demographic data. Age group magnitude; existing population size and projections; population distribution, including rural-urban; migration patterns.

.... 61/

(vii) Health and Nutrition Data. Information about type, magnitude and distribution of disease related to poor water (cholera, typhoid, dysentery, guinea warm). Medical facilities available. Scope, magnitude and distribution of malnutrition.

(viii) National Development Plan priorities and Division of Sector Responsibilities for Village Water and Environmental Sanitation. Information about where priorities are placed village vs urban water systems; power and irrigation vs drinking water; plan distribution of resources among regions. Information on number of sectors embracing water projects; number of departments responsible for water and sanitation; crossover and duplication of services.

(ix) Procedural Problems. Information on critical procedural problems affecting programme implementation, e.g. warehousing; recruitment of personnel; reporting/evaluation; supply procurement; distribution of funds.

2. Types of Information required to monitor village Water and Environmental Sanitation Programme.

Information obtained through monitoring should indicate critical problems and bottlenecks and be decision oriented.

(i) Movement and installation of personnel, materials and transport within a time frame. Physical progress of work. Information on procedures (govt. + UNICEF) hampering movement and installation.

(ii) Stores Position. Flow of supplies and equipment in and out; shortages in some areas; excess in others.

.....62/

(iii) Number of water systems installed and working.

(iv) Number of water systems used.

(v) Transport situation. Use, condition, maintenance, distribution.

(vi) Costs. Unit costs as anticipated or higher/lower.

3. How to Support Governments Strengthen Machinery for Evaluative Activities.

(i) Increase UNICEF's capacity in this area.

(ii) Preparation of guidelines on how to undertake different evaluative activities.

(iii) Advocasy of importance of programme preparation work - appraisals; dev. good design.

(iv) Support inservice training - workshops; etc.

Edward Lannert
Programme & Planning
Officer, UNICEF, New York

7.3. Group C Report

The group elected Mr. Nayar Chairman and the undersigned as reporter.

It was decided first of all to assume that in this instance, water was the priority need in the area to be served. We also assumed that the programme involved the provision of drinking water, with family farm aspects being a secondary consideration. (In the event of the latter, additional information other than that shown below on agricultural practices, crop cycles etc. may be necessary).

....63/

Question 1 : What types of information are essential for planning rural water supply projects?

There are initially the socio-economic factors, e.g. populations (numbers and density), culture, religion (possible inhibiting factors therein), the political set-up both locally and nationally, and the occupations of the group to be served.

Then, there are the physical factors - location of project area, type of soil, existing sources of water supply in and out of area, rainfall, water-table etc. Separately discussed were health conditions and institutions - ablution, garbage facilities, toilets etc. The group thought that it should be determined if there was already an ongoing health education programme in the target area.

Next, the formal government infrastructures which might have a useful role to play in the project; schools, health centres or aide posts. This would include surveying and listing the methods of communication - roads, telephones, police posts, hospitals, markets. In discussing these, we would also determine what resources the government could commit to the project over the long term.

Next, the private sector was listed. This grouping included number and location of religious institutions (since the temple or mosque is normally a good place to locate a water supply), and the number and location of workshops that can serve as manufacturing or source points.

The group felt that the previous or present involvement of the government and other donor agencies (international and bilateral) needs to be surveyed.

.... 64/

When all the above is collected, it can be determined what is the additional quantity of water needed. The scope and extent of community participation can be determined. Group C felt it was important to assess the government's own capability to monitor, evaluate and replicate the project. These points are to be included in the project workplan and other relevant documentation.

Question 2 : What types of information are essential for monitoring rural water supply projects? The following questions must be asked:

A. What is the status of procurement and supply?

B. Is trained manpower on sits both locally and nationally?

C. Has proper site selection been made?

D. Is installation of necessary equipment proceeding according to the agreed upon schedule?

E. What is the quantity and quality of the additional water being provided?

F. Is there a useful information reporting system, and is it working?

G. What is the functional efficiency of the units provided? Percentage broken down at any time, and length of breakdown.

These are tangible factors. There follow some intangibles.

H. What is the health impact? What is the extent of use of the system? If equipment is underused, determine why through epidemiological surveys.

.... 65/

I. Is there a use of the water other than for drinking e.g. laundry, irrigation, animal husbandry.

Question 3 : How can UNICEF help strengthen government capacity for evaluation? The following points were taken up:

A. Encourage government to draft project reports, and formats for engineering, financial and other details of project. It was hoped that these would be useful too in future projects.

B. Urge government to open a statistical bureau if none exists, or UNICEF would offer to equip existing one.

C. Underwrite training courses for local personnel who are to monitor and evaluate.

D. Clearly articulate questions on evaluation/monitoring.

E. Provide overseas fellowships and terms for appropriate project personnel.

F. Interest the national planning body in water supply.

Question 4 : Give experiences in which evaluation was useful for future planning was briefly considered. Some examples cited were: Counting health planning studies, joint UNICEF/WHO studies on primary health care and alternative Delivery of Health Systems, and the 1970 WHO study of Water Supply and Sanitation in seventy developing countries.

GROUP C PARTICIPANTS

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A. Huq, V.P.N. Nayar, P. Bailey,
A.R. Khan, S.E. Akhter

Respectfully submitted,

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.... 66/

8. SIXTH DAY : MONDAY 31 MAY 1976

8.1. Micro Irrigation for Family Food Production (paper by Griffith and Karim)

8.1.1. Bangladesh faces an acute food crisis generated recently by population growth. Agricultural production has failed to respond rapidly enough under the new constraint of limiting land resources, but the potential for more intensive production is great. Recently, the Government has adopted this objective, and has created a demand for the green revolution inputs and for irrigation. Water resources are abundant, but the means of exploitation are immature. Power pumps and tubewells are highly capital-intensive yet they are poorly utilized. Manual irrigation methods are spreading and the newest is the Manually Operated Shallow Tubewell for Irrigation (MOSTI).

8.1.2. About 40,000 MOSTI are in use. It is an appropriate indigenous technology offering greatest benefits to the small cultivator, and absorbing surplus man-power for very low investment. There is a need for credit to make MOSTI available to the smallest landowners. The ultimate number of MOSTI feasible is large but limited by hydrological and cost factors. Technical innovation to reduce cost could expand the feasible zones.

8.1.3. UNICEF has made a commitment to undertake monitoring, research and development, and to supply MOSTI through IRDP, a rural cooperative credit institution. Emphasis in this programme is given to improving nutrition, and to spreading MOSTI to new areas across the country. A national survey of MOSTI users has been carried out, and the 1976 pilot programme which sold 5,000 MOSTI will be expanded.

.... 67/

8.2. Discussions

Tun Aung commented that in a country such as Bangladesh with such a high percentage of fertile land already under cultivation the only alternative remedy is to increase the production through intensive cultivation and therefore the Micro-Irrigation Project is very important. Kristoferrson asked whether the figure Tk.280.00 handpump cost includes transport cost and was told that this was the actual cost in the bazar. Actually UNICEF pumps were made available at Tk.250.00 each. (The casing and strainer cost approximately Tk.500.00). Kristoffersson then asked if Laos could import such a pump from Bangladesh. Phillips replied that the Maldive Islands are going to take 100 pumps from Bangladesh at the request of UNICEF office in Sri Lanka and with New York HQ's approval. If the exports are to expand it may be necessary to look at Governmental export rules, procedures etc. to see whether or not they could be streamlined. Shawcross cautioned that a careful check of the suitability of the Bangladesh pump is necessary before plunging into such a process. Lannert asked how long it takes to produce a crop and was told that it is about 4 months.

Shawcross pointed out that one pump can enable a farmer to irrigate crops to annually produce above 1 ton of rice or similar crop. Lannert asked why micro-irrigation is so popular in certain districts such as Bogra and Mymensingh. Griffith replied that the handpump irrigation was first introduced in that area and there is a good aquifer at relatively shallow depth. Shawcross felt another factor was that crop failure may have influenced the farmers to see the need for irrigation. M.A. Hussain pointed out that no surface water is available in these areas during dry season and therefore irrigation water must come from below the ground. Hannah asked whether credit for handpump irrigation was really necessary. He noted that it seems to be spreading rapidly any way. Griffith replied that

.... 68/

might be too early to jump to that conclusion. Shawcross pointed out that the objective of the programme was not only to increase the use of handpumps for irrigation but also to introduce new crops and thus improve the families' nutrition. With this in mind training classes will be given to people to teach them to grow other vegetables. Seeds will be distributed with the pumps.

De Silva and Azizul Huq pointed out that dhal (lentils) are available in many different varieties - the price varies with the type and not all types are necessarily cheaper than rice indicating that there is in fact a good demand for lentils of the right type. Sunawang asked whether fertilizer was subsidized in Bangladesh and was told that UNICEF does not make the contribution but that the Government provides fertilizers, pesticides and seeds available at subsidized rates.

Inasmuch as the handpump irrigation programme is not adding another layer of bureaucracy it is an excellent programme. Talbot asked whether or not the life of the handpump would be reduced when used for irrigation. Griffith replied that it would definitely have a shorter life. Talbot noted that more systematic operation might make some parts last longer than those subjected to the various uses and abuses of a community drinking water pump. Skoda pointed out that efforts will be made to get the farmers to lubricate the wearing points and this will also affect the life of the pump. Lannert commented that the amount of pumping required to irrigate the land is fairly large. He asked whether the reaction to such hard work was different in hard-hit areas when compared to other parts of the country. Shawcross pointed out that the pump may be used more in hard areas and hard times and it was thus providing a resilence to disaster. Chulavachana asked about surface water irrigation and was told that one difficulty in Bangladesh is that

.... 69/

the low gradients do not provide many good surface water storage sites. Azizul Huq pointed out that prices are very high following any disaster affecting agriculture and thus almost any agricultural investment will look good on paper at such a time. What is necessary in the long term is that supporting steps be made to provide incentives so that all the necessary crops will be grown. This unfortunately was not provided for in the past therefore the shortages of oil seeds, etc.

8.3. Laos Country Paper (by Kristoffersson)

He noted that he had been able to take a few trips just before coming to Water Workshop and he found that almost every house had its own water source and latrine. Because of this it may be necessary to change the programme and concentrate more on maintenance and repair of wells. The Government does not desire sophisticated technological solutions. Previously 1000 handpumps had been distributed through assistance. However, in some cases the ground water was not of good quality (too much salt and too much iron). By now some of these pumps may need repair and UNICEF has made provision for this. UNICEF will provide materials such as pipes, cement, etc. and villagers will dig their own wells and make the rings. Originally open wells were seen but now WHO thought these should be covered. Most of the dug wells are of maximum depth of 15 meters. In areas where rock is harder they are drilling wells of about 40 meters depth with 6" casing. In a sanitation programme pit latrines are provided without any water source or water seal. Dirty water in some of the water seal latrines was attracting flies. Therefore ordinary latrines will be provided without water seal.

..... 70/

8.4. Discussions

Stapleton asked about UNICEF's import of transportation. Kristofersson replied that transport is a problem and UNICEF may have to assist in this. Shawcross asked about the depth of the wells. He was told that the water table in the dug wells is 4 to 15 meters below the surface. At one time handpumps were considered for placing on the dug wells but this was rejected. The villages to receive wells are selected at the central level. Various questions were asked about community wells and community latrines. Apparently this has been proposed by the previous government and UNICEF is looking into this matter further before making the final decision.

8.5. Village Sanitation in Bangladesh - Problems and Prospects (paper by M. Akhter)

M. Akhter reviewed the recent history of sanitation in Bangladesh. A sanitary slab programme was once done in late 60's. Unfortunately the sanitarians were not receiving proper pay, benefits etc. and as such they were unwilling workers, community acceptance and participation was not good. At present there are selling centres where sanitary slabs can be obtained and this seems to be fairly successful.

8.6. Discussions

O'Reilly mentioned the proposal for putting sanitary slabs in the schools as it will promote latrine use. Lannert asked what the people in the community see as problem or what objection they raise to using latrines. M. Akhter replied no study as to why people do not use the latrine has been made. O'Reilly suggested UNICEF/PHE/WHO should consider doing such study. A. Huq commented that it seems we are trying to evaluate a programme that has not been tried. At present the people of Bangladesh generally carry

.... 71/

a small amount of water with them to be used to clean themselves. If a water seal slab is provided one will have to carry two cans of water, one for ablution and one to flush and clean the latrine slab. This means that you almost need running water to make the water seal slab functioning properly. Nayar said that this is not necessary as considerable work in South East Asia has gone into this design. In a modern flush toilet about 3 gallons water is required whereas a sanitary water seal slab requires only 1 gallon. Even this may be reduced, plastic will flush easier also if slab is wet prior to use then less water will be required to flush. Tun Aung commented that if water is required it should be easier to introduce in Bangladesh where the people already use water for ablution than it would be in other countries where water is not generally used for ablution. Lannert asked if there is a more simple latrine. Nayar replied that a big difficulty in other types of latrine (open pit etc.) is that flies and odor are not eliminated. Therefore the water seal latrine is considered best. Kristoffersson asked about the cost of a plastic water seal. Nayar replied so far he only has models. Tun Aung mentioned that something like 10,000 have been purchased in Malaysia at 5.80 US $ each. Shawcross pointed out that in the WHO Guide to control of enteric disease several methods other than water seal slabs are mentioned as being considerably better than no latrines at all. Nayar said that we must do something substantial about sanitation and that the sanitary latrine with water flush has been accepted by the Government. Kristoffersson said that in Laos they are going to train Sanitary Agents for a few months and these agents will visit each village every 3 to 4 months. Medina asked what could induce someone who knows nothing about germs to use a latrine. Nayar replied that a latrine must be convenient. M.A. Hussain pointed out that latrines should be placed near to homes

.....72/

and have adequate privacy. Jagtiani noted that latrine programmes had not been very successful in India. The lack of water is a problem in most parts of the country (unlike Bangladesh). However, the more affluent people do accept them. In any event one should be very careful before committing oneself to a large latrine programme.

8.7. Village Sanitation (presentation by Nayar)

8.7.1. At present less than 5% (may be even less than 2 or 3%) of the villagers of South East Asia use latrines. It is apparent that no government in this area ever gave the desirable priority to sanitation programmes. Thailand is the number one country in South East Asia in this type of sanitation especially the northern part of the country where the economy is strong. Where the educational level (literacy) is high more use is made of latrines. For example the Indian State of Karala has higher utilisation. Sri Lanka has also done relatively well; perhaps 18% of the people have latrines. The WHO Development Decade target was for 50% of the people to have latrines by the end of the decade. Now it is felt that perhaps 15% would be a more feasible target and even this may not be achieved.

8.7.2. Failure is in large part due to lack of internal financial support. For the future, sustained education and motivation of school children is essential. A sanitation programme requires much more dedication and effort than a drinking water project. Nevertheless we must go on attempting. Health Education in the past has been mainly concerned with curative aspects rather than prevention - this must be changed.

.... 73/

8.8. Discussions

Tun Aung noted that many Governments give lip service to the idea of placing sanitation on a high priority basis. Parkinson stressed that action is urgently needed in this area and that therefore further research, discussions etc. is somewhat of a luxury at this point. He also pointed out that people tried to measure success in too short period of time; whereas, in fact we should not expect a change of attitude immediately. It is necessary to continue to work along lines which we know will eventually produce good results. T. McDermott stated that we must be satisfied with interim techniques as no ideal solution is feasible. He mentioned the use of hand trowels in some rural areas to cover feces. Shawcross stated that we must go ahead with what is feasible as rapidly as possible but that research is still necessary to find what will be successful in Bangladesh. Nayar mentioned some of the trials that had been done in Bangladesh. Regarding costs of the rings that prevent the pit from collapsing each cost Taka 10.00 and the water seal slab costs Taka 50.00.

9. SEVENTH DAY : 1 JUNE 1976

9.1. Rural Water Supply Systems in Indonesia (paper by Sunawang and Karim)

Cholera is endemic to the whole of Indonesia 80% of whom live in rural areas. The main sources of water are springs in the hills, shallow aquifers in the lowlands and rain-water collection from roofs. UNICEF has assisted with small numbers of handpumps, piping and vehicles. Local Government expenditure on water is three times that of the Central Government. One major constraint is lack of manpower to design the systems.

9.2. Discussions

De Silva pointed out that the Districts are fairly autonomous though they get large subsidies from the center. In

.... 74/

1974 the subsidies for rural water was increased by a factor of 20. Headman of the village controls the tap on the 50 m^3 rainwater storage reservoirs. People tap springs and bring it down in bamboo pipes. UNICEF has supplied G.I. and PVC pipe for this. Shawcross pointed out that in Darjeeling, India many small springs are tapped and fed into a small canal which brings it to the population.

9.3. Philippines Country Paper (by Castillo and Bailey)

About 70% of the people live in rural areas and of these only 20% have good access to water supply. The incidence of diseases attributal to unsanitary environmental conditions seemed to be going up (according to a Deptt. of Health Report of 1973). At present UNICEF is engaged in water supply for school gardens and in domestic water supply (including chlorination) and health education. In the future environmental sanitation may be taken up depending on evaluation to be done by early 1977. At first UNICEF over rated the government's implementation capacity - the Deptt. of Health and Deptt. of Local Government and Community Development now have a fairly ambitious five year plan for rural water supply. WHO has suggested that more attention be given to health education, staff training and involvement of all appropriate government agencies. Procurement problems and delays must also be overcome.

9.4. Discussions

In the discussions Skoda pointed out that in order to keep per capita cost low one should attempt to provide facilities where people are most concentrated. This amounts to servicing the most urbanised of the rural people. Each country has its own ideas and standards of what is an urban community and what is a rural community. Therefore rural water supply in a community of 5,000 in Thailand might be considered as urban water supply in some other

.... 75/

part of the world. Castillo suggested that UNICEF Country Offices might benefit by receiving assistance from experienced personnel in neighbouring countries. Skoda pointed out that a short-term visit or consultancy required some well defined objectives and advance preparation of background information.

9.5. Nepal and Bhutan Water Programme (presentation by Goulet)

At one point in time, a tubewell programme was considered in the narrow (15 mile wide) strip of lowland in South Nepal; however, Government priorities are in the hills where gravity piped systems are better. It was found that helicopters could deliver HDP pipes for half the cost of human porters. The Government has specified certain areas where they wish to concentrate development actively. Main constraint has been lack of technical manpower due to lack of training facilities and also due to fact that once people are trained they prefer not to go back to the villages. As the infrustructure is weak it is sometimes difficult to use all of the benevolent funds. UNICEF inputs are in material (mainly pipe) transportation and training. There is a plan to use ex Ghurkas to help implement water schemes. Most of these men are now retired from the British/Indian Army. In the noted Swiss/Netherland Projects three expert engineers and two Nepalese counterparts will be used.

The Bhutan Programme is similar to that in Nepal (gravity feed with PVC pipe), but it is concentrated in one area. The difficulties encountered are that some of the people are migrant/herdsmen and a village exists only a political unit. Per capita costs are high. UNICEF is trying to encourage use of standardized fittings as some villagers go out and buy pipe and do their own system. Now UNICEF is providing information on what is available.

..... 76/

9.6. Discussions

There have been lots of problems in purchasing through HQ. Now field staff insist that samples be airfreighted before the whole order is shipped. HDP pipe has been a problem, HDP pipe is adulterated with sand and also it could be exposed to sunlight in storage or transit. Shawcross asked why HDP was used. WHO suggested HDP because it is more flexible and it can expand more if the water freezes. The whole system consists of an intake pipeline, main reservoir and tap stands (200 people each and within 250 meters of the furthest house). Shawcross asked how important (necessary) the systems are. In remote rural areas one would expect few diseases. Goulet replied that some people have to go 5 or 6 hrs. to buy water and when travelling in the country side people may offer you milk free of charge but not water as it is too scarce. Typically per capita costs are about Rs.90.00 of which UNICEF spend about 60%, villages 20% and the Government 20%.

9.7. Pure Water Projects in Ghana and Nigeria (paper by McDermott)

Although not presented this paper was circulated among the participants. It clearly points out the problems which can arise if rural water supply is attempted along the same lines as city water systems. The different technologies, logistics and economics required in rural schemes require different skills and a different type of organization. Local manpower and funds need to be mobilized. The paper presents a list of 14 critical factors for study when selecting among rural water supply schemes for implementation. Our major goals must be to leave behind stronger governmental water institutions which interact well with local communities and sufficient local production capacity of parts needed for maintenance.

.... 77/

9.8. Experiments on Simple Water Supplies (talk by McDermott)

He described with the help of pictures various experimental projects going on regarding the filtration of tank water. Polluted surface water can in principle be filtered by providing a sand layer between the pond (or tank) and a screen and pump. This is being tried in some districts of Bangladesh. Bacteriological testing is needed to confirm the effectiveness of the filtration. He also described how 3 clay pots can be placed one above the other in a tripod such that water flowing through each is filtered. Progressively finer filtering material is in each pot (starting with sand at the top and ending with charcoal).

9.9. Water Supply in Semi Arid Areas (talk by Skoda)

He mentioned the use of granitic domes and other exposed rock surfaces for collection of rain water. This has been done in East Africa and on some of the Carribean Islands. Concrete guttering can be made along the base of the rock surface and funnelled into a reservoir. He also called the attention of the group to the sub-surface dam which has been used successfully in ephemeral stream beds in East Africa. Referring to the work of G.A. Classen of Kenya's Ministry of Water Development, he outlined the conditions where this may be used. The main requirements are a river bed containing sand or gravel (sand mixed with silt or clay will have only a very small storage capacity) and bed rock or an impermeable layer not too far below the surface. If the ideal geologic conditions do not exist a sub-soil dam may still succeed in storing water and locally raise the water table. However, leakage below and around the dam should be as small as possible. One of the main attractions of sub-soil dam implementation in East Africa has been higher community participation. The major expense of the dam is the excavation and the backfilling required, and this has generally been done by the local community. The main government inputs are

.... 78/

technical advice, supervision and supply of some cement. If clay is available locally the construction of the dam can be made of this - thus minimizing the use of cement; otherwise, concrete blocks or bricks may be necessary.

The water stored in the sand behind the dam can be removed by means of a dug well or a shallow tubewell. Generally it would be advisable to provide a good sand and gravel filter around the well as pollution is much more likely from ground water in a stream bed. An alternate means of tapping the water is to bury a 50-gallon perforated oil drum packed with a sand/gravel filter connected to a pipeline. The main problem in such cases is flood damage to the pipeline. Therefore it must be deeply entrenched or protected by concrete or rip-rap.

10. EVALUATION AND EPILOGUE

10.1. Evaluation of the Workshop

Skoda suggested that the working groups were valuable and that a good scheme might be to alternate working group sessions with plennary sessions also to organize the agenda as much as possible by discipline. Jagtiani and Kristoffersson said it would have been desirable to have more time following the invitation to allow for preparation of papers. Medina noted that as so many people felt there was not enough time during the workshop to discuss all the problems this indicates that it was an excellent workshop. Stapleton said that the workshop was well organized - the magnitude and complexity of problems is clear. We should follow it up with meetings on the various disciplines as necessary. Lannert stated that the substantive communication among programme officers and technical staff which was very impressive. Bertoni asked whether counterparts could be invited to such meetings. Shawcross replied that this had been somewhat discouraged in order to prevent the group from becoming

.... 79/

too large and in order to allow frank expression of problems. Lannert suggested that experiments with nationals from local institute, universities etc. might be good even if the interaction produces some sparks. Castillo said that speaking for the Phillipines attendants that they had learned a lot and hoped that there would be more such meetings in the future.

10.2. Epilogue

Some time after the close of the workshop a paper was received from Otto F. Joklik, UNDO Industrial Adviser, who had wanted to attend, but was detained on another assignment in the region. His paper is titled Water Filtration and Sterilization by a Combined Ultraviolet -- Ozone Treatment. The cost of imported components for one water sterilizer with a design capacity of 500 1/hr. is approx. US $40.00. Such a sterilizer requires 8 watts of power (either AC or DC). Also sufficient water pressure is needed for it to function at full capacity. A 1000 1/hr. model requires 15 watts and 2000 1/hr. one needs 30 watts. Electric wiring, casing etc. will require another US $10.00. The production cost for one water sterilizer will be in the range of US $ 50.00 to 60.00. Assuming a wholewale or export price of US $120.00, this means a gross profit of US $60.00 per piece. (A similar water sterilizer in the USA is being sold at approx. US $450.00). Assuming a yearly production of 500 water sterilizers this means a gross annual profit of US $30.00. As there is practically no capital investment necessary to start this activity the project in question will have no additional expenses for depreciation of equipment or for capital interest. From this point of view the yearly gross profit of US $30.00 to the local enterprise would be quite interesting. The second step would be the local manufacture of water filters to be combined with the water sterilizers. The

..... 80/

viability of local manufacture of such sterilizers in a developing country has been proven in the Lao People's Democratic Republic. Anyone interested in further information on this should contact Mr. Joklik at UNIDO Headquarters in Vienna, Austria.

JDS/psb
15.10.76

Encl:

A N N E X U R E

ANNEX - I

LIST OF PAPERS PRESENTED AND MATERIALS DISTRIBUTED

Country	Author	Title	Total no. of pages
Afghanistan	F. Bertoni	Afghanistan Country Paper	3
Bangladesh	A. Awal	Ground Water and Construction of Tubewells as related to the Rural Water Supply Programme in Bangladesh	11
	A. Awal	Installation of 1½" dia. Shallow Handpump Tubewells (New) - Technical Specification	17
	A. J. Griffith	Specification for 1½" dia. Brass Strainer	5
	A.J. Griffith & Z. Karim	Micro-Irrigation for Family Food Production	14
	J. F. Shawcross	Handpump Tubewells in Bangladesh - Distribution and Use	22
	J. F. Shawcross	Piped Water Supply Systems	9
	J. F. Shawcross	Preview for UNICEF 1977 Board Meeting	19
	J. F. Shawcross	Plan of Operations - Rural Water Supply Programme	78
	J. F. Shawcross	Plan of Operations - MOSTI	22
	J. F. Shawcross	Summary of Developments 1972-1976	10
	J.F. Shawcross	Use of PVC Casing Pipe and PVC Well Screen in Bangladesh 1½" dia. Handpump Tubewell	5
	J. F. Shawcross	Handpump Tubewells for Irrigation Purposes - Current Development and Recommended Actions	17
	J. F. Shawcross	Proposed Extension Project for Manually Operated Shallow Tubewell for Irrigation for Increased Food Production	10
	J. F. Shawcross	Specifications for 1½" dia. Tubewell Materials	11
	Kazi Anwarul Huq	Inaugural Speech	4
	M. Akhter	Training Programme for Rural Water Supply Personnel in Bangladesh	10
	M. Akhter	Village Sanitation in Bangladesh - Problems and Prospects	7
	M. A. Hussain	Address of Welcome	3
	M. A. Hussain	Critical Path Schedule	1
	Moncef M. Bouhafa	Discussion Paper for Communication (PSC), PI	5
		- Annexures: PI/DOC/15	5
		: PI/DOC/26	5

...../2

Country	Author	Title	Total no. of pages
Bangladesh	R. Phillips	An Outline of Choices Associated with Handpump Tubewell Programmes and Handpump Design	20
	R. Phillips	Documents for Local Procurement of Cast Iron Handpumps	39
	R. Phillips	Handpumps in Bangladesh 1972-1976	35
	R. Phillips	The Evolution of A Partnership	9
	R. Phillips	Shallow Handpump Design : Summary	
Ghana and Nigeria	T. McDermott	Pure Water Projects in Ghana and Nigeria	6
India	WHO Consultant, C. W. Bovee	India - Rural Water Supply	11
Indonesia	R. Sunawang H.A. Karim	Rural Water Supply Systems in Indonesia	12
Laos	Ulf T. Kristoffersson	Laos Country Paper	4
Nairobi, EARO	C.K. "Roger" Stapleton	An Exercise in the use of uPVC(Unplasticised Polyvinyl Chloride) 12 ins. nominal bore pipes for well casing	11
	C.K. "Roger" Stapleton	Motivation of pump operation and maintenance training programme for rural water supplies in Kenya	
New York	Edward J. Lannert	Village Water Supply and Environmental Sanitation Policy	3
Pakistan	S. A. Musanna	Pakistan Country Paper	8
Phillppines	Wilfredo Castillo Peter Bailey	Philippines Country Paper	6
Thailand	Pricha Chulavachana	Rural Water Supply Programme in Thailand	10

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Other Documents

Author	Title	Total paper no.
UNICEF Programme Committee	Criteria for Programme Appraisal Monitoring & Evaluation E/ICEF/P/L.1628	17
Heino E. Wittrin	SUPDIR-29 - October 24, 1975	20
UNICEF-NEW YORK	UNICEF Field Manual - PART VI-1 - Procurement Procedures	24
Robert W. Nachtrieb USAID/CDD	Report on Analysis of Handpump Tubewell Survey conducted January 1976 - 26 February 1976	11
Dr. Md. Fozez Uddin Miah	The Ways to Give Safe Community Water Supply	13
UNICEF, Dacca	DPHE Tubewell Mechanics Training Course (in Bengali Language)	18
USAID	Evaluation Handbook (2nd Edition)	113
USAID	Project Evaluation Guidelines (3rd Edition)	79
Philippe Heffinck	Annual Report - 1975 Spare Parts Section (Automotive)	

Excerpts

UNICEF Asia Region	UNICEF Water Supply and Sanitation Projects	5
World Bank	Village Water Supply	3

Press Clippings

Source	Subject	
Press Release ICEF/1145 dt. 12 December 1972	Denmark Contribution 7 million Kroner to UNICEF for Bangladesh Water Rehabilitation Programme.	1
Newspaper, "Bangladesh Times", dt. 27 May 1976, Dacca, Bangladesh	"Pure drinking water for rural areas by '80"	1

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ANNEX II

LIST OF PARTICIPANTS

II-A : PARTICIPANTS FROM ABROAD

1. Aung, Tun
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15. Stapleton, C.K. (Roger)
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