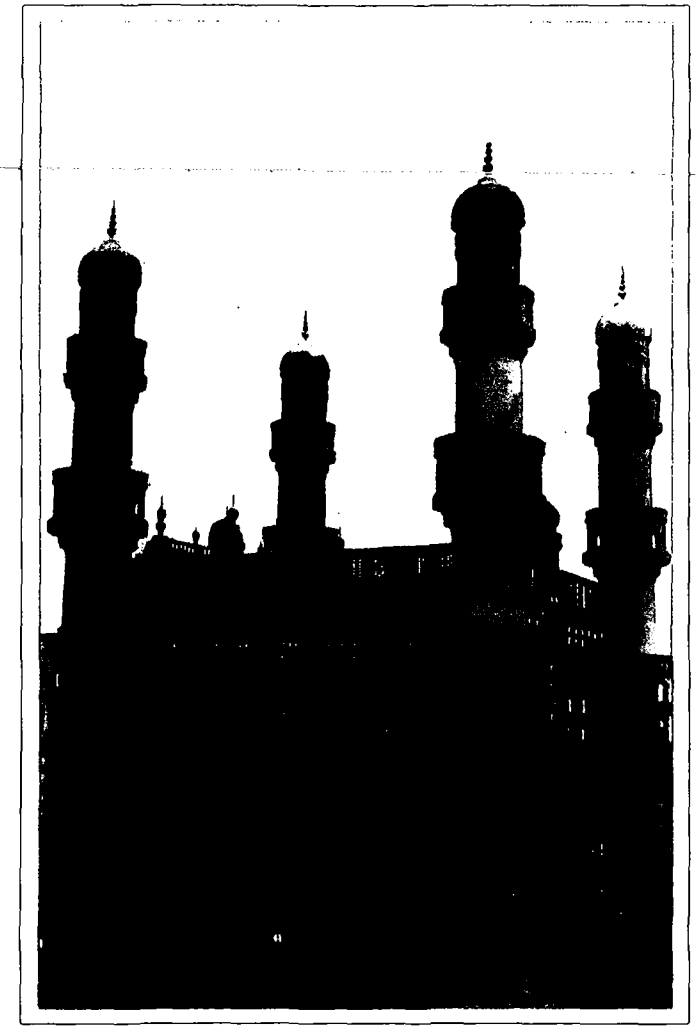
SOUVENIR

WORK SHOP ON
ROLE OF TECHNOLOGY
IN
RURAL WATER SUPPLY

31st March – 2nd April 1987 **HYDERABAD.**



Panchayati Raj Engineering Dep
Government of Andhra Pradesh

Step well Akkampalli Cause for Guineaworm.

Technological Mission in action, Geophysical Survey
at R. K. Puram, Kurnool Dist.

WORKSHOP ON

ROLE OF TECHNOLOGY

IN

RURAL WATER SUPPLY

31st MARCH - 2nd APRIL 1987

JUBILEE HALL, PUBLIC GARDENS, HYDERABAD

Conducted by

NAGARJUNA RURAL ENGINEERING TRAINING CENTRE

Panchayati Raj Engineering Department

ANDHRA PRADESH

Co-sponsored by

Department of Rural Development

GOVERNMENT OF INDIA

Workshop on Role of Technology in Rural Water Supply

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Superintending Engineer (PR), Hyderabad

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Executive Engineer

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2. Sri G. Satyanarayana Rao, DEE
3. Sri D. Bala Kishan, DEE
4. Sri Rama Mohan Rao, DEE
5. Sri M. A. Qadeer, AEE
6. Sri Ramgopal Reddy, AEE

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1. Sri S. V. Narayan Reddy, SE
2. Sri S. S. Naidu, EE
3. Sri Sampath Kumar, DEE
4. Sri R. P. Nanda, AEE
5. Sri Pratap Reddy, AEE

Catering :

1. Sri G. Narayana Reddy, EE
2. Sri Laxma Reddy, DEE
3. Sri Shekar Reddy
4. Sri Badruddin, AE
5. Sri Qamruddin, AE
6. Sri Prakash Rao, AE
7. Sri Kumar Swamy, AE
8. Sri Ambaji, AE
9. Sri Yadava Reddy, AE
10. Sri Anjan Reddy, AE

Invitations :

1. Sri Laxma Reddy, DEE
2. Sri B. N. Amarnath, AE
3. Sri Subash, D'Man.
4. Sri Bhaskar Rao, VDO
5. Sri Janga Reddy, SIRD

Exhibition :

1. Sri N. Suryanarayana,
   Superintendent, W/S, Hyderabad
2. Sri Narsing Rao, AEE
3. Sri H. S. C. Kumar, AEE
4. Sri R. P. Nanda, AEE
5. Sri Bhaskar, AEE

KUMUD JOSHI
Governor Andhra Pradesh

RAJ BHAVAN
HYDERABAD.

27th March, 1987

Message

I am happy to know that the Panchayati Raj Engineering Department in collaboration with the Department of Rural Development, Government of India, is organising a Workshop on the Role of Technology in Rural Water Supply and that a Souvenir is being brought out to mark the event during the month of March/ April, 1987.

2. Technology is a very important factor in rural water supply, including maintenance of sources, equipment and management of water. I am sure, the Workshop will lay emphasis on these various aspects and come out with practicable suggestions to give an appropriate interpretation to the concept of rural water supply. I send my best wishes for the success of the Seminar.

Sd/-
(KUMUD JOSHI)

N. T. Rama Rao
Chief Minister

HYDERABAD.

Date : 27-3-1987

Message

I am glad to learn that Panchayat Raj Engineering Department is conducting a workshop on **"Role of Technology in Rural Water Supply"** and bringing out a souvenir to commemorate the occasion.

In this context, I would like to remind that there would be no meaning if the technological tests and results are confined to laboratories and workshops only. The fruits of technology should reach the common man and help better his standard of life and conditions of living. This workshop gains special significance in view of the fact that provision of drinking water in urban and rural areas became a challenging responsibility which has to be accepted with the limited resources at our disposal and all other constraints encountered by us.

I congratulate the Organizers for their meaningful efforts and wish the Workshop all success with rewarding results.

(N. T. Rama Rao)

HYDERABAD

Date 24-3-1987

Karanam Ramachandra Rao
Minister for Panchayati Raj
and
Rural Development

Message

It gives me immense pleasure to note that a Workshop on "Role of Technology in Rural Water Supply" is being held from 31st March - 2nd April, 1987 at Jubilee Hall, Public Gardens, Hyderabad.

I am also happy to know that about 40 papers on various technical and other aspects connected with Rural Water Supply Schemes will be presented and discussed during the Workshop.

I am sure the Workshop will discuss the various areas on the subject and will come-out with constructive and practical suggestions for a more effective implementation of the Rural Water Supply Programme with optimum utilisation of resources.

I wish the Workshop a grand success.

Sd/-
(K. Ramachandra Rao)

K. E. Krishna Murthy
Minister for Major and
Medium Irrigation

Hyderabad

Dated 30-3-1987

Message

I am very happy to learn that the Panchayati Raj Engineering Department, Rural Water Supply, is conducting a Workshop on Role of Technology in Rural Water Supply.

I hope that this Workshop will provide appropriate technological solutions to different drinking water problems of Rural areas in general and in Kurnool District in particular.

I wish the organisers of the Workshop all success in their endeavour.

Sd/-

K. E. Krishna Murthy

Shravan Kumar, I.A.S.
Chief Secretary to Govt.

HYDERABAD-500 022.

Dated 25-3-1987

Message

I am glad that the Panchayati Raj Engineering Department is organising a workshop on "Role of Technology in Rural Water Supply" from 31st March to 2nd April, 1987.

The importance of providing protected water supply to the urban and rural areas in our country need not be over-emphasized. Whatever steps are taken in this direction either by adopting suitable technologies or by involving the beneficiaries would go a long way in achieving the mission. I trust the workshop would provide a good opportunity to the participants to consider various aspects and suggest plan of action in achieving the objective.

I wish the deliberations all success.

Sd/-
(Shravan Kumar)

WELCOME ADDRESS

The Hon'ble Minister for Panchayat Raj & Rural Development, Sri Karanam Ramchandra Rao, the Hon'ble Minister for Major & Medium Irrigation, Sri K.E.Krishna Murthy, the Mission Director, Mr.G. Ghosh, distinguished guests and dear delegates,

It is my privilege and pleasure to welcome all of you on my behalf and on behalf of Panchayati Raj Engineering Department, on the occasion of conducting "Workshop on Role of Technology in Rural Water Supply". This workshop is being conducted under the aegis of the Nagarjuna Rural Engineering Training Centre which was instituted in March, 1986 by the Government of Andhra Pradesh with matching assistance from Government of India. The basic aim being providing training facilities to the field staff of Panchayati Raj Engineering Department, the motto being "better knowledge better service". During the last one year, this institute has conducted 7 courses on varioius subjects and provided training to 187 candidates.

One of the objectives of the Technology Mission set up by the Government of India for Rural Water Supply is to promote awareness through regional Seminars among the implementing agencies. The present workshop is designed to fulfil this objective, and to help speed up the working of the implementing agencies towards faster achievement of the main objectives of the Technology Mission.

The workshop, apart from the inaugural session, will have technical sessions covering the aims and objectives of Technology Mission for the first two days followed by concluding sessioin, and an open session on 2nd April, 1987. In the technical sessions, the experts from various research institutes and faculties will speak upon important issues related to various aims of Technology Mission. The open session is primarily designed to provide an impetus to the Panchayati Raj Engineering Department delegates to make them to react to the present day technologies and also to create a forum for expressing their views and to enhance their professional competence which is the basic requirement for the present day professional-oriented working. Besides the technical sessions, an exhibition is also arranged to demonstrate various improved technologies in the field of rural water supply and rural sanitation programmes.

At this stage, I would like to submit that the Government of Andhra Pradesh, has taken effective steps to solve the drinking water problem in the rural areas. At the end of VIth Five Year Plan, we could be able to achieve the targets laid down at the national level. During the first two years of the VIIth Five Year Plan, decks are cleared for smooth sailing towards achievement of not only the Decade goals but also towards achieving the broad objectives and aims of the Technology Mission for Rural Water Supply. The State has already established

a lead in the country in the field of implementation of the Technology Mission activities in Kurnool district. It has fostered a sense of coordinated approach among all the implementing agencies for the preparation of the Detailed Project Reports and for identification of the schemes. These schemes costing Rs.400.00 lakhs has since been sanctio ned and started. In addition to this, we have also taken lead in organising the present workshop with more than 250 delegates from various organisatioins. For any programme of this nature and magnitude some snags may develop. There is also possibility of some undercurrents. But, our missionary zeal to fulfil the main commitment to the public to provide safe drinking water will definitely help us overcome all such abstacles.

I seek guidance from elders and experts who are kind enough to grace this occasion. I need cooperation from all of you for the success of this workshop and Technology Mission.

I am thankful to Mr. K.E. Krishna Murthy, Hon'ble Minister for Major & Medium Irrigation and Mr. K.Ramachandra Rao, Hon'ble Minister for Panchayati Raj and Rural Development who were kind enough to be with us this morning to preside and to inaugurate the workshop on the "Role of Technology in Rural Water Supply".

I am also thankful to Mr. G. Ghosh and Mr. Iyyangar, whose presence and blessings have boosted the very completion of the workshop.

Thanking you All

MOHD.INAMUL HAQ
Chief Engineer
Rural Water Supply
Hyderabad

INAUGURAL ADDRESS

Dear Chairman and Delegates,

I am happy to inaugurate the workshop on "Role of Technology in Rural Water Supply". I am told that the main purpose of the workshop is to discuss and share the experiences and views of various technologists for the successful implementatin of Rural Water Supply programme. The seminar will also discuss the matter pertaining to water related management, maintenance of systems and community participation. Truely, all these issues are of vital importance to promote health of the people by providing safe drinking water.

As you all know, we are passing through an era in which the seasonal conditions are unpredictable. Due to prevalence of adverse seasonal conditions, the drinking water problem is posing a big challenge to all of us. Right now, in our State drought conditions are prevailing in almost all the regions. The Government is taking all the possible steps to see that the supply of drinking water is maintained in the rural areas at any cost.

With a view to integrate rural water supply programmes with ongoing rural development programmes like irrigation etc., a perspective plan for rural water supply has been prepared for conservation/augmentation and effective management of available water resources, both surface and ground water. Artificial recharge of ground water is also contemplated by constructing checkdams, percolation tanks, and notifying certain minor irrigation sources as percolation tanks. The State Govern-nment has already issued orders vide G.O.Ms.No.24 dated 21.1.81 to make required provision for drinking water while formulating any irrigation project. The issue of enacting legislation for conjunctive use of ground water is also under processing.

The modified approach for the Technology Mission i.e.,setting up of sub-Missions for villages facing problems on account of guineaworm, excess fluorides, brackishness and excess iron simultaneously along with the Mini-Technology Missions is appreciated. It will definitely accelerate the process of providing safe drinking water to these villages.

Based on the aims of Technology Mission, the exercise is already done for covering 15723 problem villages in the coming 3 years of VIIth Five Year Plan with dependable sources. A detailed study of the villages having guineaorm, excess fluoride

and excess salinity is being takenup in light of the sub-Mission documents. Exercise is also being made to ensure 40 lpcd of drinking water atleast to those villages where P.W.S.schemes are now being provided by providing remedial measures.

At this juncture, I want to discuss certain issues in connection with application of various technologies. Our experience with the pilot desalination plants that have been set up at Penumerru, Kattuvapally and Gelladupadu shows that the successful transfer of any technology to the rural areas, require users acceptance in preference to its imposition. As such, utmost care of this aspect should be taken before any technology is adopted.

Once the plants are set up, their operation and maintenance plays an important role in the acceptance of the technology by the community. The quality of operation and maintenance should not slide down, which ultimately may result in the rejection of the technology itself by the people.

The personnel who would be in charge of these plants be imparted training in advance, in operation and maintenance. Selection of local youth for this purpose will further reinforce our efforts.

Besides operation and maintenance, periodical monitoring and evaluation of the system is inevitable and shall continue even after completion of the Mission's progtramme for fruitful use of the assets created by the Mission.

The introduction of latest technologies may not result in neglecting existing systems/assets of water supply, already created and should be continued as a parallel system since the supplies from the plants will be limited to drinkig and culinery requirements only.

I strongly feel that the covering of problem villages and implementation of sub-Missions for various health hazards perhaps be taken up concurrently. It is not necessary that the villages which are suffering on account of quality need necessarily be one among the list of problem-villages which is being tackled. To facilitate analysis, the State Government has ordered for setting up of laboratories exclusively for R.W.S. schemes. They are basically meant for quality monitoring of drinking water, such as to carry out testing at the consumer and. Similarly, to provide any facilities to the personnel of P.R.E.D., the State Government has set up a training centre under whose aegis the present workshop is being conducted.

I earnestly hope that the deliberations of this workshop will be useful and will create awareness and preparedness among the delegates to face the challenge to provide safe and adequate drinking water to people.

I thank you for inviting to inaugurate this workshop.

K. RAMACHANDRA RAO
Hon'ble Minister for Panchayati Raj &
Rural Development Government of A.P.

PRESIDENTIAL ADDRESS

BY

MR. K. E. KRISHNA MURTHY,

HON'BLE MINISTER FOR MAJOR AND MEDIUM IRRIGATION, ANDHRA PRADESH

Dear Chief Guest and delegates,

It gives me great pleasure to get myself associated with inauguration of this "Workshop on Role of Technology in Rural Water Supply". At the moment, there is an acute scarcity of drinking water through out the State. This is due to adverse seasonal conditions consecutively for the past 3 to 4 years. I hope that this workshop would equip itself to find solution for providing permanent source for every individual Rural Water Supply system.

It will not be out of place to mention that the State Government has drawn up an ambitious programme for providing permanent source to all the villages for drinking water by tapping either surface water or ground water. The idea is that the source of drinking water supply scheme should be either from a perennial river or an irrigation canal or pond. For this, a master plan is prepared and it is being implemented.

The introduction of Technology Mission and Sub-Missions have definitely given a fillip to the Rural Water Supply programme.

I am happy that kurnool district in Andhra Pradesh is taken up under Technology Mission by the Government of India for providing safe drinking water to all the villages in the district. There are 13 Taluks comprising of 892 revenue villages and 572 hamlets apart from 6 major Gram Panchayats. The total rural population is 19.29 lakhs (as per 1981 census). Till now, 449 villages and 349 hamlets (with a population of 8.19 lakhs) are covered with drinking water facilities either fully or partially. The existing facilities are 320 P.W.S.Schemes and 7,559 borewells fitted with handpumps.

During the survey conducted in the month of November, 1986 the Panchayati Raj Engineering Department has identified 499 habitations with a population of 8.64 lakhs as problem villages. Out of these, 87 villages are guineaworm affected, 36 villages are having excess fluorides, 168 villages are having salinity and 208 villages are facing scarcity conditions. To cover up the above 499 habitations, a detailed project report has been prepared for Rs.25.00 crores and submitted to Government of India for approval. Out of these 499 habitations, it is planned to cover 100 habitations by the Technology Mission in phase-I

at an estimated cost of Rs.4.00 crores in the coming two years; 245 are planned to be covered in II phase under Technology Mission, the remaining 150 being covered by ongoing plan schemes

For the purpose of identification of 100 villages under the Technology Mission phase I, the criterion adopted is that, scarcity villages are such villages where no source is existing and where water is being transported and also such villages suffering on account of health hazards like guineworm, excess salinity and fluorides.

I am given to understand that the detailed investigation is in progress Kurnool district for scientific location of drilling points in hard core areas. I hope that the efforst of the authorities cocerned with the locating ground water may prove successful and the drinking water problem in the villages is solved. It is also stated that Desalination and defluoridation plants are also being put up to provide treatment to the water affected by excers salinity and excess fluorides respectively.

In an attempt to fill up the resource gap, in addition to ongoing Netherlands assisted Projects in Prakasham and other districts. For 171 fluoride affected villages (4) new projects covering 225 villages at an estimated cost of Rs.28.84 crores have been cleared by Royal Netherlands Government. These projects are located in Kurnool, Prakasham and Mahboobnagar districts.

I feel that to fulfil the objectives of the Technology Mission and the action plan as summarised during the Minister's conference at New Delhi on 12th and 13th February, 1987 perhaps there is need for better planning, monitoring and sense of participation by creating awareness among the implementing agencies.

I sincerely hope that the deliberations of this workshop would help in promoting a sense of acceptance of objectives of Technology Mission among delegates. I am thankful to the organisers of this function for inviting me to chair this fuction.

Thanking you

TECHNICAL SESSION - I

INTEGRATED SCIENTIFIC MANAGEMENT OF WATER RESOURCES : A KEY TO MITIGATE DRINKING WATER SCARCITY

by

Dr. C.P. Gupta *

Introduction

About 2.27 lakh villages in the country have been identified as having problems of scarcity and/or contamination of drinking water. Though exact number and quantum of problems need more authentic assessment through village-wise surveys, the order of magnitude and nature of problem may be invariant. This implies that about half of the country's population does not have even a meagre quantity of 40 litres of drinking water for each person per day. There are a large number of villages, which do not have a safe drinking water source even within a radius of one kilometer. A recent document on Technology Mission on Drinking Water in Villages and Related Water Management indicates that in about 1.54 lakh villages additional sources of safe drinking water are to be found. The problem may, at its face, appear to be gigantic but it is not really so, if only country's vast water resources could be properly managed and utilized.

The total requirement of drinking water for the present population of the country at the rate of 40 lpcd is only about 1.1 million hectare-meter (m ha-m) and it may be only about 40 per cent of the total requirement i.e. 0.44 m ha-m which need to be additionally harnessed. This quantity is really insignificant when compared to the average annual renewable water resource comprising 400 m ha-m of rainfall which in turn generates surface water potential of about 60-65 m ha-m and 25-40 m ha-m of groundwater resources. It is, thus, paradoxical that in spite of so much water potential, the most basic need viz an adequate quantity of safe drinking water is not available to rural population even after 40 years of our independence. It is not that we have not made efforts to tackle this vital problem. The VII Five Year Plan envisages to invest about Rs.4000 crores to implement

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* National Geophysical Research Institute, Hyderabad-500007

various programs related to drinking water supply besides huge non-plan expenditure and private sector outlays.

What, perhaps, has been wanting is an appreciation of imperatives for a scientific assessment and management of this renewable resource in each watershed. This comprehensive activity essentially encompasses both the routine day-to-day aspects as well as long term considerations relating to future water demands, potential sources of supply, economics, social parameters etc. It is only through such an approach that this frontier problem can be solved.

Wide Spatio-Temporal Variations in the Availability of Water

One of the main difficulties in making water available at times and places of need is a highly non-uniform spatio-temporal distribution of the various utilizable components of the hydrological cycle viz the rainfall, surface water, and ground water. The spatial variation of the rainfall in the country ranges from Jaisalmer (10 cm of average annual rainfall) to Cherapunji (1070 cm of average annual rainfall). In the time domain, we have recurrent droughts and sometimes abnormal rainfall due to vagaries of monsoon. Even during years of normal rainfall, there are, on an average, about 120-130 rainy days in a year. Out of these, about 75 days receive a rainfall of less than 2.5 mm. This small precipitation does not contribute anything to either surface water or groundwater resources and the whole of it is lost to the atmosphere through evaporation. Thus, even during a normal rainfall year, there are effectively only 45-55 rainy days. It is this rain water which is received during a short period of less than 2 months that has to be used for the remaining part of the year.

The occurrence of surface water and groundwater also has wide spatio-temporal variations due to diverse topographical, soil, hydrogeological, and hydro-meteorological conditions. It is primarily because of these spatio-temporal variations in the availability of water, that the problem of drinking water cannot be solved on a permanent basis without resorting to a scientific management of this renewable resource.

Aspects of Water Management

A water management program, in general, involves

i) quantitative assessment of the utilizable components of the dynamic water system,

ii) quantification of interlinkages between these components, and

iii) maximisation of the utilizable water through proper manipulation of these interlinkages.

The objective of water management is to increase the residence time of water on land by efficient and cost-effective storage during and at places of abundance to be used during and at places of scarcity. The salient activities for a scientific water management in a watershed are as follows:

I. Preliminary studies

Collection, compilation and analysis of the available literature/information/ data on

i) topography, geomorphology, geology, hydrogeology, rainfall, evaporation, surface hydrology, and

ii) potential of different water resources, requirements and shortfalls.

II. Basin-wise reconnaissance

i) collection, compilation and processing of additional data on geohydrological set-up including geomorphology, geology, land-use pattern, soil, watershed characteristics etc.

ii) assessment of water potential and village-wise surveys for a realistic assessment of requirements.

III. Data collection

for quantification of different utilizable components of hydrological cycle; appropriate spatial density of observation network and frequency of observations to be decided depending upon the scale of operations:

i) Rainfall

a) establishment of rainguaging station

b) establishment of comprehensive multi-parameter hydrometeorological stations

c) collection of data

ii) Surface water

a) establishment of stream gauging stations

b) collection of hydrological data on streams/tanks/ ponds/reservoirs etc.

iii) Groundwater

a) drilling of exploratory borewells

b) estimation of hydrogeological parameters

c) estimation of inputs (recharge, sub-surface inflow, seepage from surface water bodies etc.) and output (abstraction, sub-surface outflow, effluence to streams etc.)

IV. Conceptualization of the total water regime in spatio-temporal domain

i) Quantification of different components of hydrological cycle and their interlinkages

ii) Identification of the geometry of the aquifer system

iii) Quantification of the boundary conditions

V. Preparation of mathematical models of aquifers

simulation of flows and interlinkages between different components of the hydrological cycle, validation of models through comparison of field observations with model computations; sensitivity analysis.

VI. Prognosis

of the response of water system to probable schemes of water utilization and inputs with error bounds.

VII. Evolving schemes for optimal utilization

of rainwater, surface water and groundwater resources in a conjunctive manner keeping in view various physical, environmental, technological, economic and social constraints.

VIII. Designing a real time monitoring and decision making set-up

with built-in corrective mechanisms for management of this highly dynamic and variable system.

Increasing Safe Storage of Water

An accurate assessment of the available water resources can help design and implement schemes for their augmentation. Some of the measures for augmentation of water resources would include the following:

i) Rainwater harvesting :

Suitable structures including traditional ones such as farm ponds, tankas in Rajasthan etc. as well as the ferro-cement tanks recently developed by the Structural Engineering Research Institute could be used for storing rain water during periods of availability and thereby reduce its loss as run-off and evaporation.

ii) Augmented recharge to aquifers :

Besides natural recharge to the ground water regime, artificial methods of recharge to the aquifers should be deployed. Sub-surface storage of water has obvious advantages such as being less expensive, less susceptible to pollution, devoid of environmental hazards besides being more protected against evaporation losses. The methods for artificial recharge include use of percolation tanks, injection wells with appropriate filter-beds and use of trenches. Spreading/ponding of water may not be very rewarding in our climatic conditions. The exact technique and its feasibility, of course, could be decided depending upon the topography, soil, geology, rainfall, and other climatic conditions.

iii) Reduction of evaporation losses :

A broad estimate indicates that in our country every year about 60-70 m ha-m evaporates out of the total precipitation, about 60-70 m ha-m is evaporated from the soil zone, and about 6-7 m ha-m from surface water bodies besides evapotranspiration losses from groundwater regime. Use of polymer films, alcohol films etc. may significantly retard evaporation losses in ponds, storage tanks etc.

iv. *Reduction of run-off losses :*

Appropriate surface contour bunding and sub-surface dams have been successfully used to reduce surface and sub-surface run-off losses. Detailed topographical and bed-rock investigations are, however, necessary to resort to these measures.

Associated Activities

The land use pattern has an important bearing upon the interlinkages between the surface and groundwater resources, evaporation losses etc. and thereby on the quantity of utilizable water resources. The land use management has to be

necessarily integrated with the water management. Proper irrigation practices should also be an integral part of the Water Management. As is well known, the total water required for drinking purposes is hardly about 5-7 per cent of that used for irrigation. In most of the areas, the drinking water needs could be met through proper management of irrigation systems.

Concluding Remarks

An integrated and scientific management of water resources, however, needs a reliable and adequate data base. A large number of parameters, particularly those characterising a groundwater regime, are not directly measurable and can only be estimated through indirect procedures. These estimates usually involve a number of simplifying assumptions. A lot of interpolation/extrapolation of data is also unavoidable. Suitable simulation strategies are, therefore, necessary for validation of the inferred characterisation of the total water system as also to evolve a compatible set of parameters for a given situation. However, with the aid of high speed powerful computers which are easily accessible these days, development of a computerised data base for a perspective management of water resources in a scientific manner has become quite within reach. This could also form an objective basis for enactment of suitable legislation for utilization of water resources and for real time monitoring and management of this dynamic resource.

TECHNICAL SESSION - II

Workshop on Role of Technology
in Rural Water Supply
31st March - 2nd April 1987, Hyderabad

NEED FOR ESTABLISHING A DEPENDABLE GROUND WATER SOURCE IN HARD ROCKS

K.C.B.Raju,Director, Central Ground Water Board

Introduction

Ground water unlike other natural resources is replenishable one and forms a part of the unending hydrological cycle wherein water is continuously recycled in response to the forces exerted primarily by the solar energy and earths' gravity. It is estimated that annually about 3891 milliard cubic metres of water is evaporated from the oceans and the surface of the earth. All the evaporated water returns back as precipitation of which 1024 milliard cubic metre falls on the land surface. Though three fourths of our planet earth is occupied by water, only five percent of the total water in the hydrosphere is fresh water. Even this five percent is distributed in such a way that nearly 80 percent of it is frozen and only 20 percent of it occurs in liquid form. It is interesting and significant to note that 19.7 percent of this fresh liquid occurs in underground reservoirs.

Ground water, though one of the earth's most widely distributed renewable resource, is not distributed uniformally all over the Country due to wide variation in climatic conditions, physiographic features and hydrogeological environments. Its importance as a dependable source for irrigation has been accepted by one and all which could be seen from that, it accounts for nearly 40 percent of the total irrigation in the country.

Ground water development through open dug wells dates back to early civilization viz. Harappa and Mohanjadaro. The open wells which were easy to construct and cheaper hitherto has become costlier due to increase in depth of excavation due to decline of water levels and increase in the cost of labour.

In the first half of the present century ground water development gained momentum in the alluvial tracts of Ganga basin. Even the surveys and exploration was confined during the period to the alluvial and sedimentary tract of the country. It is only from the second half of the century that attention is being given to the areas underlain by the hard rocks. The advent of high yielding variety of seeds, availability of power to pump sets and advent of fast drilling Air Rotary down-the-hole hammer rigs suitable for hard rock drilling, further accelerated the ground water development even in the semi arid tracts underlain by hard rocks.

There has been considerable advances both in methodology and technology for the exploration and exploitation of ground water resources during the last two decades. The integrated approach of employing of various exploratory techniques has increased substantially the success ratio of water wells drilled in the most complex geological environment where the possibility of striking ground water and its development were considered remote till recently.

Hydrogeological problems of hard rocks

Nearly seventy percent of the Indian Sub-Continent is occupied by the hard rocks. Wide variations in climatic conditions, physiographic features and rock types in the lhard rock areas make the hydrogeological setting complicated and problematic.

Geologically, Southern India presents a broad spectrum of rock types belonging to various formations ranging in age from Archaean to Recent. However, it is predominently underlain by the Archaean crystalline complex with wide range of rock types of different metamorphic grades. These rocks have been tectonised and deformed in many ways including deep erosion over a great span of geological time. The distribution of rock types in Southern India is given in the table below:

Table

Sl. No.	Rock types	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu
1.	Geographical area in sq.km.	276,814	191,773	38,864	130,069
2.	Uncosolidated rocks	25,500	3,000	3,672	21,908
3.	Semi-consolidated rocks	19,200	-	9,573	12,772
4.	Hard rocks	232,114	188,773	25,619	93,389

These hard rocks are devoid of primary porosity but have developed secondary porosity during the tectonic deformation. The degree of fracturing varies from rock to rock and from place to place. The weathering process during the long geological history has also played a significant role in developing the porous mantle and at times filling the open fractures with weathered products making it impermeable.

In hard rocks, the occurrence and movement of ground water is controlled by the fractures system and the weatered mantle. Some of the fracture systems developed during the tectonic activity are not only deep but extend over long distances. Especially the tensile open joints form the major conduits for transmitting ground water in copious quantity over long distances.

Water bearing properties of hard rocks

Depending on the chemical constituent of the minerals, the intrusive rocks can be grouped into two, acidic and basic.

Acidic intrusives such as granites, granodiorites, aplites and pegmatites are generally brittle and have a high storativity. In fine grained rocks, the fractures are closely spaced making the rock more permeable. Granite areas exhibit a characteristic fracture system, dividing plateau like granite areas into mosaic plinths. The fracture zones between the plinth have reasonably good storativity than the fractures within the plinyh. The basic rocks are generally massive but along the contact between the country rock and basic intrusives is highly fractured and form good aquifer zones.

In metamorphic rocks, fracturing depends on the grade of metamorphism they have undergone. Intensity of fracturing is more in low grade metamorphic rock. Generally the metamorphic rocks have low storativity compared to intrusive rocks. However the rocks which have been highly fractured due to tectonic deformation, yield copious quantities of water. The fractures produced in the low grade metamorphic rocks, extended to considerable depth making them moderately permeable.

Volcanic rocks exhibit a horizontal disposition. The thickness of the individual flows vary from a metre to tens of metres. During the process of cooling of the lava flow, joint s, fractures and vesicular and non-vesicular flows may occur alternatively or sometimes seperated by intertrappean sediments. Vesicular flows generally form good aquifers.

Flow through fracture system

A fractured system consists of interconnected net work of fractures surrounding the rock blocks. It is therefore possible to define and distinguish the hydraulic properties of the net work of fractures and those of the blocks. The hydraulic conductivity and storativity of the net work of fractures blocks will depend on:

Fractures

a) the width of the fracture
b) the properties of the porous material filling the fractures
c) the frequency of the fracture
d) the dist ribution of fracture width in the system which determines the homogeneity
e) the orientation of lthe fracture system and fracture width which determines the anisotropy

Blocks

a) Practically impervious and the properties of the fractured medium are determined by the properties of the net work of fractures i.e. single permeability storativity system
b) pervious due to secondary system of fractures or grannular porosity, the properties of such medium are determined by the properties of both fractures and blocks i.e. double permeability - storativity system

Aquifers

The hard rock area aquifers can be grouped into two namely granular aquifer and fractured rock aquifers. Granular aquifer is mostly outwashed material ocurring in the intermontane valleys or along the river courses.

Fractcured rock aquifers are a medium made of irregular and highly permeable material occurring at certain depths and along certain linear zones. These aquifers can be divided into three types.

i) Low to moderately permeable, partly weathered and fractured rock aquifer which is generally under phreatic condition unless it is overlain by alluvium and colluvium when it will be under semiconfined conditions.

ii) Highly permeable, intensely fractured rock occurring all along well defined linear, vertical to sub-vertical zones. These aquifers extend down to great depths, as deep as 200 m or more

depending on the tectonic deformation the area has been subjected. Generally these aquifers are under phreatic conditions but when they are overlain by colluvium or the fractures are seperated by impervious plinths, this indicate the semi-confined condition.

iii) Moderately permeable, horizontal to subhorizontal fracture zones occurring between blocks of massive rocks. The fracture zones are fairly continuous, areally extensive and form semiconfined to confined aquifers.

Prospecting techniques

It could be seen from the above that, the hydrogeological setting in an hard rock terrain is as complex as the rock types and as intricate as the deformation these rocks have undergone. Though there is no significant change in the rock parameters within short distances, there will be wide variation in the aquifer parameters. Prospecting and drilling techniques employed differ from those used in sedimentary areas.

The methodology adopted to estimate the ground water potential of the complex situation is of multi disciplinary one involving studies on geology, photogeology, geophysics, hydrogeology, hydrology, hydrometeorology, hydrochemistry and water use followed by exploratory drilling and pumping tests. Radiation techniques like gamma ray, and neutron logging neutron probe for soil moisture studies, Radio Isotopo studies to ascertain the age and recharge source are being employed. The Geophysics plays a crucial role in establishing the thickness of the weathered mantle, disposition of fracture system with depth, width and extent of major lineaments, associated fracture system, their openness and the formation water quality. The type of survey employed include electrical resisitivity, seismic, magnetic and electromagnetic which depends on the terrain and the information required to be obtained as these are carried out in areas where surface geological data are inadequate to infer the subsurface geological framework.

Kurnool District

Let us take stock of the ground water resources of Kurnool district which the Technology Mission has taken up to provide safe drinking water to the Rural Population.

Geology

Geologically the district is underlain by the formations belonging to Archaean gneissic complex and Pre-Cambrian sediments locally known as Cuddapah formations (Middle Proterozoic) and Kurnool formations (Late Proterozoic).

Hydrogeology

The western part of the Kurnool district is occupied by granites and gneisses. The weathered and fractured portions of the granite gneissic complex constitute the secondary porosity and these ones form considerably good aquifers under phreatic and semiconfined conditions. The weathered portions generally extending down to 15 m form phreatic aquifer and most of the dugwells in the area tap ground water from this zone. In a few localities especially in shear zones weathering extends down to 25 metres. The dipping shear fractures and vertical to near vertical tensional fracture form deeper aquifer system under semiconfined conditions with vertical leakage from the weathered zone. These fracture systems extend down to an explored depth of 45 m and beyond. Ground water occurs under water table and semiconfined conditions in the weathered fractures and the depth to water var ies from 1 m to 13.5 m. Boreholes drilled for irrigation and rural water supply to the depths of 45 m have given yields ranging from 0.5 lps to 6 lps in favourable locations. Most of the boreholes drilled along the major lineaments have given good yields.

Most of the district in the eastern part is occupied by Kurnool formations compared to Cuddapah formations. The Cuddapah and Kurnool formations consists mostly of (i)quartzites (ii)shales (iii)limestones irrespective of their geological ages. Of these the quartzites form the ridges and the hills covered by thick forests. Villages are few in this area and as such there is very little ground water development. On the /hand shales and limestones occupy the plateau tops /other and there are many villages. The weathered and fractured zones form very good aquifers in this area. Ground water occurs under water table and semiconfined to confined conditions in the weatherd fractued and cavernous zones of the Cuddapah and Kurnool formations. The depth to water varies from 0.2 to 23 m below ground level. Boreholes for irrigation and drinking wat er supplies are drilled down to the depths

of 80 m, and the yields range generally from 1.5 lps to 20 lps for drawdowns less than 10 m in most of the wells. The success rate is also good. The limestones are karstified in most of the area and form very good aquifers with borehole yields varying from 8 lps to 20 lps with drawdowns varying from 2.17 m to 9.10 m. The range of transmissivity of the limestone aquifers vary from 29 to 69 m^2/d. The karstification is more prominent in Narji limestones having very large and interconnected caves at many places. The famous cave in the area is Bilam with three openings and traced for a distasnce of 2 km. Perennial springs are seen at the contact of limestone with shales and some of them have discharges upto 15 lps. Many of the villages around these springs get their water supplies from these sources. Apart from the limestones even the Nandyal and Owk shales also contain fairly good aquifers owing to their fragile and calcareous nature. The yields in these aquifers range from 1.5 lps to 20 lps with transmissivity ranging from 20 m^2/d to 200 m^2/day.

Ground water resources and development

Ground water is developed in this district mostly through dug wells and dug-cum-boreholes. The recent trend is to go for boreholes wherever feasible. The drinking water supplies in most of the villages are drawn t hrough boreholes fitted with hand pumps. The villages having population of more than 5000 have water supply schemes through pipe line drawn from the tubewells drilled at favourable points around the villages fitted with submersible pumps. The ground water utilisation has been gaining momentum in addition to the major and medium irrigation project in vgiew of the increase in institutional financing. . In order to keep up with the pace of development estimation of ground water resources are being carried out from time to time as per the recommendations of the Ground Water Estimation Committee. In 1976-77, there were 50,665 ground water extraction structures and during 1984-85 it has gone upto 74,441. The taluk wise estimations for 1984-85 are given in the Annexure-1. As per the estimation, the total utilisable ground water resources of the district is of the order of 1356 MCM and the net draft is 118 MCM leaving a balance of 1238 MCM

for further development.

Status of Studies

The entire Kurnool district has been covered by systematic hydrogeological studies till March 1987.

Monitoring

Ground water level is being monitored from 1969 onwards in the district with the establishment of 2 stations which have been increased subsequently to 15. The monitoring has indicated that the water level fluctuations occur in response to recharge and draft seasonally and also annually. The annual fluctuation ranges from less than a metre to more than 4.50 m with the average flucuation around 1 to 2.5 m. In recent years there has been declining trends in water levels observed in the south-western part of the district falling in parts of Adoni, Alur and Dhone taluks. This is mainly attributed to below normal rainfall received during the last 2 to 3 years and consequent increase in water demands being met from ground water sources.

Ground Water Exploration

Central Ground water Board carried out ground water exploration under the Vedavati River Basin Project studies falling in parts of Alur taluk. Three exploratory wells have been drilled covering an area of 929 sq.km down to a depth of 40 to 52 m bgl and the yields from these wells varied from 75 to 900 lpm for drawdowns varying from 1.7 to 80 m. Pumping tests carried out on these wells have given transmissivity values varying from 585.55 m^2/d to 13.70 m^2/d.

Chemical quality of ground water

The quality of ground water from wells tapping the crystalline formations is generally good and suitable both for irrigation and domestic purposes. The pH varies from 7.1 to 8.8. The Electrical Conductivity varies from 515 to 4412 micromhos/cm at 25°C. The total hardness as $CaCO_3$ in general varies from 120 to 1300 ppm and the chloride content varies from 67 to 790 ppm. There are pockets of high E.C. which can be attributed to local conditions only. The quality of water in Cuddapah formations is generally good both for domestic

and irrigation purposes. However, there are some saline pockets in Kurnool formations. The pH of ground water in Kurnool formations generally ranges from 7.0 to 8.6. Higher pH is seen in areas with poor drainage and thick black cotton soils. The E.C. varies from 203 to 6780 micromhos/cm at 25°C. A high degree of mineralisation is seen in areas underlain by Nandyal shales along the Kunderu river, while it is 500 to 1000 micromhos/cm at 25°C in areas underlain by Tadpatri shales, Paniam quartzites and Koilkuntla limestones. The total hardness as $CaCO_3$ vary from 90 to 1440 ppm. Ground water in Nandyal shales is characterised by permanent hardness. The chloride content varies from 18 to 1144 ppm. The fluoride concentration in the ground waters of Kurnool district is slightly high ranging in concentration from 1.70 to 2.30 ppm which can be treated easily and used for human consumption.

Problem encountered in Rural and Urban Water Supplies

Eventhough, there is wide scope for further development, the availability of the ground water at every place in the district cannot be assured and there has to be a proper approach for prospecting, well siting and development of ground water to meet the drinking water needs first and then irrigational requirements. The favourable zones have to be identified with the help of photogeological and geophysical methods and then demarcated for drilling to increase the percentage of success and minimise failure.

In Kurnool district, there are 893 villages out of which 391 villages have been identified as problematic villages by the state government from the drinking water point of view. These villages more or less fall in 8 taluks.

Out of this 391 villages, 118 have been identified as scarcity villages (potable source not available within a distance of 1.5 km), 88 villages having guinea worm problems, 152 villages having quality problem where ground water has E.C. more than 3000 micromhos/cm at 25°C and chloride more than 300 mg/l and 20 villages with high fluoride problem. So in trying to meet the needs of the drinking water requirements in these parts, the above problems have to be kept in mind. Government of India has launched a Technology Mission on drinking water in villages under the 20 Point

Programme and it is planned to locate a potable source of at least 40 lpd per capita consumption to meet the needs by 1999. This will be achieved by providing low cost and effective solutions to identify problems, associated with the supply of safe drinking water in rural areas, through the application of available scientific and technology inputs from selected scientific and research organisations in the country.

The Central Ground Water Board as one of the Co-ordinator of the Technology Mission will be utilising appropriate technology for locating the potable ground water source by adopting proper well siting methodology in hard rocks. Basinwise ground water potential available in this district will be evaluated for planning proper development of the resource to supply potable water to the villages throughout the year. CGWB has already developed and tested the methodology successfully in the several water balance projects executed in the hard rock areas by it. Several successful wells have been drilled by CGWB in the neighbouring Anantapur district which range in depth from 88 to 200 m and have given yields varying from 2.5 to 12 lps. Some of these wells are being used for rural and urban water supply. Sites for 50 villages have been pinpointed for carrying out geophysical surveys and it is informed that the results are very encouraging. In areas where the ground water is polluted, attempts have to be made to locate the potable source away from the village to avoid pollution. However, where the formation water is brackish or saline and there is no other fresh water source, desalination of the existing source nearby may be considered. In areas where the ground water having high fluoride of more than 1.5 mg/l and alternate surface sources are not available, the defluoridation is to be adopted. In areas served by the canal command, and where the ground water is mineralised, a certain quantity of water can be drawn from the canals to meet the drinking water needs of the villages falling in the canal command (Tungabhadra Low Level and K.C. Canal). However the real problem in these canal command areas is when the canals are closed after February there will not be any water for nearly 4 months till the onset of the monsoon and these four months are the summer months when the need for water is more and the availabel ground water is brackish.

In such a situation, the quality of ground water can be improved by mixing ground water with canal by pumping when the canal is in operation, so that the water table is depressed and the salts accumulated in the phreatic aquifers are flushed out so that the ground water quality improves with the recharge during the monsoon and then this ground water can be tapped for rural water supply.

In areas where the water levels are deep and show declining trends artificial recharge methods like construction of percolation ponds, check weirs to arrest the flash floods to increase recharge to ground water should be undertaken. In the areas, underlain by limestone the solution channels and caves can also be used for artificial recharge. The springs occurring in the area may be properly harnessed to get the maximum benefit.

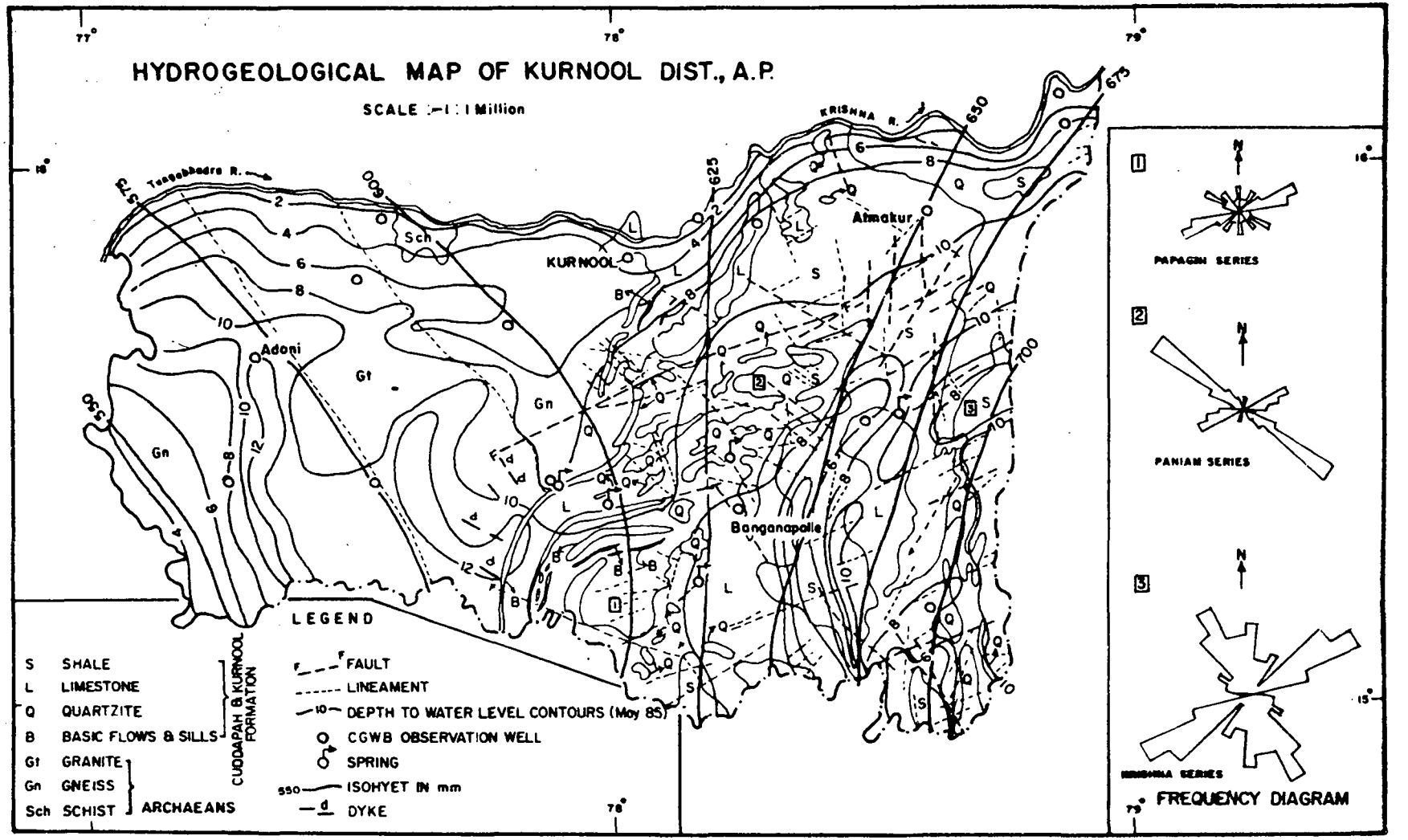
Estimated Ground Water Potential and Ground Water (Net) for Kurnool District (1984-85)

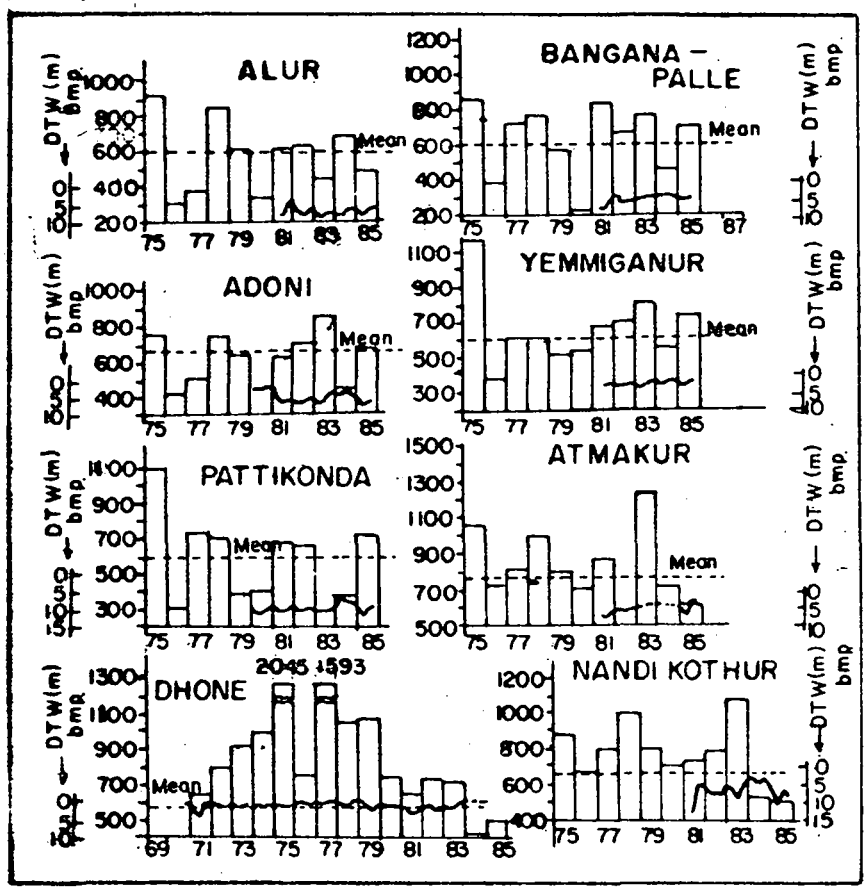
Sl. No.	Name of taluk	Estimated utilisable Ground Water Potential (MCM)	* Estimated Ground Water Draft (Net) (MCM)	Balance available for development (MCM)	Stage of Ground Water Development	
					Present %	At year 5 %
1.	2.	3.	4.	5.	6.	7.
1	Alur	76.2	4.0	72.2	7	7.2
2	Yemiganur	68,8	8.0	60.8	12	13
3	Nandyal	220.0	11.0	209.0	5	6
4	Atmakur	115.0	10.0	105.0	9	10
5	Koilkuntla	95.6	7.0	88.6	8	9
6	Allagadda	153.0	10.0	143.0	6	7
7	Adoni	72.0	8.0	64.0	11	12
8	Pattikonda	100.0	14.0	86.0	14	15
9	Nandikotkur	82.0	10.0	72.0	12	13
10	Kurnool	113.2	8.0	105.2	8	9
11	Banganapally	30.0	8.0	22.0	27	30
12	Dhone	115.0	11.0	104.0	10	11
13	Kodumuru	115.0	9.0	106.0	8	9
		1355.8	118.0	1237.8	9	10

* (Data based on Bureau of Economics and Statistics, Govt. of A.P. 1984-85)

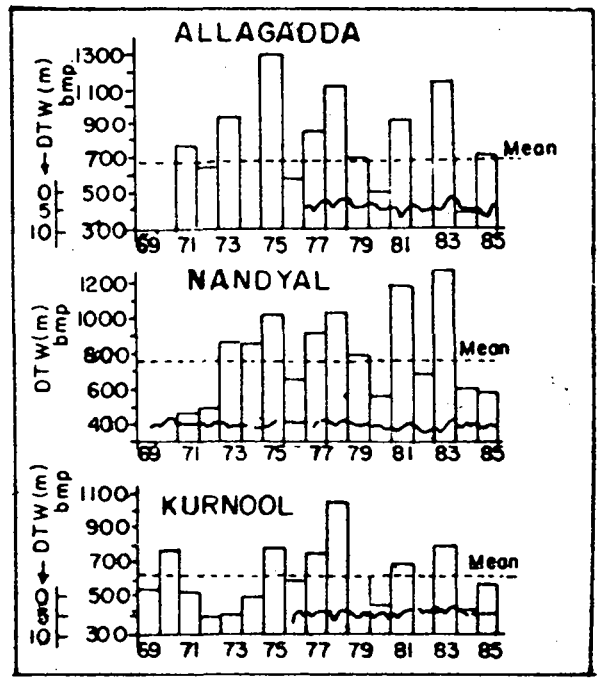
HYDROGEOLOGICAL MAP OF KURNOOL DIST., A.P.

SCALE :- 1 : 1 Million





RAINFALL Vs WATER LEVELS OF OBSERVATION WELLS LOCATED IN KURNOOL DISTRICT.



TECHNICAL SESSION - III

EXPERIENCES OUT OF KURNOOL PILOT PROJECT

Mohd.Inamul Haq*

TECHNOLOGY MISSION IN PRACTICE

1. The R.W.S.Programme is under implementation from the last three decades, started with open well/dug well/deep well/ bore well followed by piped water supply schemes. It is not correct to say that nothing is done during last three decades. In Andhra Pradesh alone at the begining of VI Five Year Plan there were 8206 villages where not even one source of water could exist. Now, except in 544 villages, rest of the villages have since been covered at least with one source of drinking water.

2. The following programmes are implemented under R.W.S. and sanitation sector is Rural areas to provide safe drinking water and to improve health conditions.

i) Open wells and bore wells.
ii) Mini P.W.S.Schemes/PWS schemes individual and comprehensive.
iii) Community and individual latrines.

Based on the guide lines issued by Government of India two surveys were conducted one in the year 1972 and the other in 1980. 12,269 problem villages were identified in the State as follows.

List-I (1972)	6133
List-II(1980)	6136
	12269

upto end of Fifth Plan 4063 problem villages were covered and during Sixth Plan period 8094 problem villages were covered leaving behind 112 villages. The total investments made under R.W.S.sector during Sixth Plan period:

a)	M.N.P.State Plan.	Rs.90.04 crores
b)	A.R.W.S.(G.O.I.)	Rs.33.23 "
		123.27 Crores

Thus Rs.123.27 crores is utilised and 88,106 spot sources and 2052 PWS/MPWS schemes are completed during 6th Plan period.

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*Chief Engineer,Rural Water Supply,Hyderabad.

3. Seventh Plan period

The International Decade of drinking water and Sanitation (1981-90) aims at coverage of 100% rural population with safe drinking water facilities.

Government of India issued instructions during April 1985 to prepare village-wise inventory of drinking water provisions to arrive at quantum of the work to be done for 100% coverage of population by the end of International Decade.

A List-III village have been identified after village wise inventory, approved by the State Government and sent to Government of india. The position is as follows as on 1.4.1986.

	VILLAGES	HAMLETS
1) No.of settlements.	27,379	37864
2) Population.	311.43 lakhs	116.52lakhs
3) Coverage of villages		
a) Full coverage.	11,545	21,277
b) Partial coverage.	13608	10,838
c) Not covered at all.	2,226	5,749

4)Coverage of population. (Vilalges + hamlets)

a)Fully covered.	121.30 lakhs
b)Partially covered.	171.56 lakhs.
c)Not covered.	135.00 lakhs

The coverage in respect of S.C.& S.T.locality is as follows:

	SCs	STs
a) No.of localities.	24,399	17,652
b) Population.	70.84 lakhs	30.48 lakhs
c) Fully covered localities.	12,489	8,594
d) Partially covered localities.	7,526	4,043
e) Not covered localities.	4,384	5,015

Population coverage

a)Fully covered.	31.97 lakhs.
b)Partially covered.	39.52 lakhs
c)Not covered.	29.83 lakhs
	101.32 lakhs.

The working group recommonded an outlay of Rs.406 crores for covering the problem villages. A provision of Rs.200 crores

is tentatively finalished for 7th Plan, under R.W.S.programme.

1985-86 Amounts provided

M.N.P.State plan.	Rs.1494.00 lakhs.
ARWS (G.O.I.)	Rs.1581.44 lakhs.
	3075.44 lakhs

977 not covered village/hamlets and 1718 partially covered villages/hamlets are covered.

1986-87 Amounts provided

M.N.P.State Plan.	Rs.1760.00 lakhs
A.R.W.S. (G.O.I)	Rs.1760.00 lakhs.

The programme for 1986-87 is to cover 1618 villages (705 villages and 913 hamlets)

4. It is a facts that emphasis was on providing water for drinking purpose without paying proper attention about the quality of water. Though most of the schemes are designed to supply of Drinking Water at the rate of 40 lpcd, but the same could not be ensured in the field due to following reasons:

1. Erratic power supply
2. Reduced yield in sources.
3. Inadequate capacity of storage systems.
4. Poor maintenance.

Further so far as quality of water is concerned except in case of P.W.S.Schemes the water quality analysis for bore wells were not conducted. Besides this no emphasis was given to activities like peoples' participation, health education, creating a sense of responsibility among the people about the very need of the systm.

5. To sum up, the following deficiencies are noticed in the present systems.

1. Failure of source (i.e.,reduced yield, overdrawal, improper location).
2. Poor maintenance (multiple of agencies, lack of finances and lack of skill).
3. Absence of peoples' participation, lack of health health education and lack of sense of responsibility.
4. Lack of awareness and required skill among the personnel incharge of implementation of RWS programe
5. Lack of water testing facilities to know the quality of water.

6. Rigidity among the field staff towards conventional practices and systems.

6. Preparation of D.P.R.

The department is conversent with the preparation of Project report for water supply projects. The preparation of DPR under Technology Mission found to be altogether different. In this case not only water supply but also related water management activities were tobe considered. Further we have to also ensure the quality of water. For this purpose a firm base line data supporte by water analysis has to be made available.

i. The exercise of preparation of DPR had shown that in the begining Technology Mission is considered by the field staff just like any other project with the conception that there is nothing new in it and that some more money will be provided for water supply.

ii. It has taken the department more than 3 months to convince the field staff about the very aims of the Technology Mission particularly the concept use of technologies for water treatment and geophysical locations.

iii. The data was available with the department in the shape of inventory has to be made use of at the begining. But this data was of not very much useful due to the reasons that it has no qualitative aspect. As such it was not quite helpful for the preparation of DPR.

iv. The involvement of the participating agencies i.e., NEERI, CGWB, SGWD and NGRI has to be established in the minds of field staff. Further the concept of co-ordinative approach for the preparation of such report instead of individual conventional approach has to be made to understand to all the staff members.

v. The above mentioned factors are such, which would definitely cause a sort of embrassment particularly to the Executive Director and to the Chief Engineer, if the things are not taken into their correct perspective. This is one of the basic approach which has to be adopted for the success of the T.M. It is encouraging to note that all the field staff, the

representatives of the implementing agencies have acted in a most coordinated manner which has enabled us to formulate the DPR in time and submit it to Government of India.

7. Authority for preparation of DPR

For the purpose of preparation of DPR there is one coordinating officer to assist the Executive Director or Chief Engineer. This itself has caused some delay in preparation of DPR in the initial stages till the entire concept of TM is clearly understood by all the implementing agencies. The DPR is since submitted to Government of India for Rs.25.60 crores. Now the NIRD is entrusted with the work of preparation of DPR. This activity has not yet started by the NIRD. In the absence of this it has become difficult for the department to lay down certain procedure to avoid delay.

8. Panchayati Raj Engineering Department

Coming to the Panchayati Raj Engineering Department on account of its long association with the conventional systems and with the public it has taken a long time for the department to make them to understand the use of various technologies such as Defluoridation, Desalination and also about the very quality of water. The approach of the Panchayati Raj Engineering Department is basically altogether different towards the problems when compared to the approach of the R&D authorities. There is large difference in the approach of PRED and R&D authorities towards a particular problem, it is but for the simple reason that there was no chance of interaction earlier in shape of joint discussion, joint tour and a desire to have a common approach towards a particular problem, more so to a problem which is related to drinking water. It is due to launching of T.M.it is nice to see that there is now coordinated and joint approach towards drinking water supply.

9. The Technology Mission has since been set up. One has to take care in advocating technological solutions for drinking water in haste. It should not carry out such activities which may lead to a situation from where it will be difficult for us to retreat. The things may be even worst than the conventional systems.

10. The Technology Mission has provided a chance to the department to have a free and frank evaluation of the inventories maintained in the department about the water supply activities in villages, their quality of water, their conditions and the solution needed for them to ensure both quality and quantity as per standards. Rather it can be said that the Technology Mission is an Eye-opener for the personnel in the field to get them educated about the basic

11. It is interesting to note that after the submission of DPR for 499 villages we are asked to take up the implementation of the programme in a phased manner costing Rs.400 lakhs for 100 villages. The selection of these 100 villages on priority has given tough time for the department due to;

i. The field staff is caught for its inability to fixup the priority due tomultiplicity of problems.

ii. There was a gap in the information available with the department and the iforation in the field.

iii, The approach towards adoption of desalination and defluoridation were not properly understood in the field.

iv. The hydrogeological and geophysical investigations were carried on broad lines area wise.

v. The field staff were not quite hopeful about the availability of ground water due to their past experience

vi. To have a better planning and Monitoring of the Technological know how it is quite necessary that a base line data has to be prepared preferably by an outside agency. The authorities concerned should also get themselves aquinted with the upto date field data.

12. There is no dispute about the utility of related water management. The department is also can appreciate the concept of rain water harvesting water conservation and artificial recharge, etc.,. This is more or less in practice we have to do it in a more scientific manner with reference to geological formation and hydro-geological conditions.l What is bothering the department is the application of desalination and deflouridation technologies. The concerned R&D institutions have made it clear that it is the last resort. For setting up a desalination/defluoridation plant the following exercise is to be carriedout.

While dealing with the SUB-MISSIONS the following guide lines are to be adopted.

a) For the villages water samples testing is tobe carried out for all the existing departmental sources i.e.,Bore wells, PWS schemes etc.

b) Identify suitable sources which are having acceptable limits of Flourides, TDS, and free from guineaworm.

c) Carry out yield test for sources identified.

d) If no source provide acceptable water then examine avial-ability of water near by stream or canal or ground water free from Hazards.

e) If no alternate source is available let-us go for either Deflourination or Desalination processes as the case may be.

13. The action plan is to be prepared for the covered villages on the following lines.

A. 1. Main villages should be taken as an unit for the purpose of coverage.
2. The Plan of action should for entire balance population and should cover all the habitations as per prescribed norms.
3. The estimate should have provision for water treatment if needed.

B. The second aim of preparation of plan of action is implementationin 5 SUB-MISSIONS. Each SUB-MISSION should deal with one of the following hazards.

1. Erradication of guineaworm
2. Control of fluorosis
3. Controle of brackishness.
4. Removal of excess Iron.
5. Source finding.

C. To ensure 40 L.P.C.D.supply, the present system may not be in a position due to following reasons.

1. Insufficient yeild in source.
2. Erratic supply of power.
3. Inadequate storage capacity.
4. Defective management in distribution system with special reference to private connections.

The above factors have to be taken into consideration for preparation of project documents.

RURAL WATER SUPPLY : THE NEED FOR MICRO-LEVEL PLANNING

* Prof. G. HARAGOPAL.

The concept of planning has assumed considerable importance in modern times. At one time planning from above for the total economy was considered necessary and important. It may, however, be suitable to an advanced industrial economy with a homogeneous social structure, but not to the agrarian societies where there are wide variations physical, economic, social, cultural and historical. In such societies planning from above is bound to be ineffective as it cannot take into account variations that exist at the local level. As a result the concept of development from below is gaining increasing importance in the field of planning. Further, this approach by necessity encourages public participation and decentralization of political power. In addition, it would help in mobilising the local resources and harness them for rapid development of the local people. However, in certain sectors such as major irrigation, heavy industries,power and communications, centralised planning may become unavoidable. Therefore, the approach should include planning from above in those sections where it is absolutely necessary and planning from below in all the other sectors as a matter of conviction. It is observed that in most of the third world countries which opted for planned development, there has been a strong propensity for centralised planning in all sectors. And the record of development has been quite dismal. This trend needs to be reverted through conscious efforts. For these reasons micro-level planning need to be encouraged and accepted as an instrument for rapid development. After passing through several five-year plans it has been realised that the planning exclusively at micro-level cannot yield the desired results. Therefore, it is conceded that one of the major lapses of Indian Planning has been the gross negligence of micro-level planning. This is realised in the late 70s which led to the appointment of a committee under the chairmanship of Prof. Dantwala to examine the feasibility and desirability of Block Level Planning. This can be considered as an indication of the growing importance being attached to micro-level planning.This also indicates that India reached a stage in its experience with planned development where it cannot ignore the need for planning from below, if it has to achieve the plan objectives.

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There is no other more important aspect in rural development deserving micro-level planning that rural drinking water programmes. This deserves a detailed grassroot planning not only because it is an essential requirement but also because of its complexity. The variations from village to village - soil, water, potential, rainfall, quality of water, peoples habits - are so wide that it would not be possible for any government to anticipate or imagine all the problems from the headquarters. Further, the participation of the people in the detailed micro-level planning for rural water supply would not only result in better planning but it would also create the necessary environment for effective mobilisation of local resources and proper implementation of the scheme. In this context, people's participation in the planning and its implementation should be considered as an integral part of micro-level planning. They are the subject and object of development. No scheme and much less a scheme like water supply can be successful without peoples involvement and higher level of civic consiciousness. It is, often argued that people are not responsible. It is widely believed that any responsibility given to them lead to abuse. This stems from the belief that they are incapable of maintaining an asset like drinking water scheme. Assuming that all these arguments are true, what are the available alternatives to micro-level approach. Taking decision making level far away from the people is no solution. Handing it over to the bureaucracy also cannot help the situation much. In the absence of better alternatives we have to build peoples organisations at the grassroots level. In the absence of this approach the rural water supply scheme is bound to face innumerable problems.

Despite planned intervention and development about 80 per cent of people living in the rural regions of the developing world in general and India in particular have no access to safe-water. The non-availability of safe drinking water has direct bearing on the working condition and levels of health of the people and their capacity for fruitful production. It is pointed out that lack of safe drinking water supply is responsible for many water-borne and water-related diseases accounting for 50 to 60 per cent of diseases in India. It is estimated that more

than 20 lakh deaths occur annually from water-borne diseases and over 5 crore persons are partially incapacitated by these aliments in India. Traditionally, water potentialities of water as a carrier of infection are not fully appreciated by the people. Emphasising the importance of safe drinking water, the World Health Organisation declared the decade of 1981-90 as 'International Drinking Water and Santitation Decade' with a call to provide protected water to all the people in the world by the end of 1990.

According to a survey carried out in 1972-73(which is the first systematic study undertaken to collect the statistics) of the 5,76,000 villages in India, 1,13,000 have no safe water for drinking purposes within a radious of one mile, 1,85,000 have unprotected water open to the risk of pollution; and another 2,14,000 are dependent on wells, tanks, ponds and stream sources which are also unsafe. Only sixty four thousand villages in the country have been provided with safe water supply and the population of these villages account for 10 per cent of the total rural population. This indicates the magnitude of the problem and the need for a fresh look at the total scheme.

The problem did not receive attention as it tends to ber of seasonal nature. Indifference of the politicians, officials and people leaves little room for optimism. Attempts 'to dig the well only when we are thirsty' is an indication of inadequate and improper planning. Administration and people respond only to crisis and failure to foresee the problem lead to erratic functioning. Undue haste in the execution gives way to distortions which cannot be effectively checked in view of urgency of the tasks. To make best utilisation of the resources proper phasing of programmes throughout the year should be done.Exessive strain on the administrative machinery during summer and idleness during other seasons can be avoided by better phasing of the programmes. A well-integrated planning of men, material and methods is a pre-requisite for the successful functioning of these schemes.

Government of Andhra Pradesh for instance has taken up the programme of drilling borewells from the year 1968. Generally sarpanchas make representations to the Panchayat Samithi for borewells in their respective villages. The Panchayat Samithi transmits the representations to the

dictrict collector (Planning) for the sanction of bore-well points. Based on the priorities or pressures from various quarters, the district collector would accord administrative sanction to different villages, sometimes specifying the localities and communities such as the Scheduled Castes and the Scheduled Tribes to be served. It is also reported from several quarters that decisions are taken in an haphazard and unsystematic fashion.Several villages which required urgent attention hardly received any attention while certain other villages received "VIP" TREATMENT. Interior villages with poor communication facilities did not receive sufficient attention.It is observed that the borewell digging programme is taken up only in summer or during the drought seasons. No surveys are being conducted and no assessment if being made about the intensity of the problem and future requirements.Programmes are formulated on the basis of funds, which are generally available under drought schemes and no proper and adequate budgetary allotments are made to meet the requirements under normal conditions. This is one consequence of planning from above.

Another consequence of planning from above is the alienation of the people from both the plan ' process and its implementation with the result even a small aspect like maintenance of rigs become a problem. At the village level no one accepts the responsibility for maintenance of rigs. For every minor repair, the village has to look towards the Panchayat Samithi. The maintenance and repairs are carried out by the mechanics placed under the administrative control of the Block Development Officer. Each Panchayat Samithi has one or two machines who have to look after around 150 to 200 borewells, covering 50 to 100 villages spread over an area of 40 to 80 kilometers. The mechanics are provided with conveyance allowance. The Block Development Officer chalks out a programme of the mechanics based on the complaints received from the Sarpanchas. Mechanics have to travel long distances to undertake repairs and generally interior villages receive lesser attention. The mechanics also expressed their inability to cover all the villages since it is physically impossible for them to attend to all sorts of work.Such problems can be well tackled by the villagers themselves. We can think of 'bare-foot mechanics'. Some of youth in the villages can acquire this sill, which is not difficult. This attitude and preparedness, however, is linked with the question of their sense of involvement.

Community awareness and participation is an essential prerequisite for success of the programme. Villagers generally do not feel any responsibility to maintain the bores properly. Their lack of awareness is also responsible for the problem. Generally it is observed that children and elders apply a lot of physical force on hand pumps. As a result the body of the pump loses its grip. Further proper checks should be made on the installation. And repairs should be undertaken without any delay. Otherwise borewells cannot function successfully and the purpose for which they are set up would get defeated. The community should be properly educated about the bore-wells and their usage. Community education can form an important part of micro-level planning, Raising consiousness level thus, assumes crucial significance even in a programme like rural water supply.

In the case of protected water supply several of them have been implemented without taking into account the population increase in the village. Further, projections were not made to ensure adequate water supply to meet the growing needs. Hence, the schemes could only partially serve the needs of the people. This is also because once the scheme is implemented, further extension would not be possible, the Panchayats require more finances which, in most of the cases, they do not have. The Government alos cannot sanction additional funds as it has many other commitments in regard to 'unserved' villages, on the one hand and the budgetary allocations do not match the needs. With the result they are not able to replace the old machanery or equipment over the years. In some cases it is found that pipes have to be replaced as they have become old and leak. Financial difficulties do not permit the Panchayats to spend the required amount for the replacement of old machinery. Thus the basic problem is the problem of revenue mobilisation. This needs into one important question viz. whether the scarcity fo funds is a result of failure to mobilise the community resources or community itself does not have the resource. If community has no resource, it is linked with the basic question of productivity and levels of production. If it is a failure to mobilise the resource, which is the case in a number of instances, then it is a question of people's involvement and participation. Macro-level planning from the above can never be able to satisfactorily tackle this question.

TECHNICAL SESSION - IV

THE ANATOMY OF A RURAL WATER SUPPLY SYSTEM

By

K. NARAM,*

It is unwise to treat a rural water supply system as a miniature urban system; just as a child needs the attention of a Pediatrician when sick, the rural system requires expertise of one who has specialised in it. Three-fourths of the Country's polupation depends on it. Yet enough attention has not been paid so far to the problems of providing safedrinking water for those who live in villages. The situation may be improving now. The people also have learnt to demand the supply of potable water. They want to put an end to the misery they had endured for so long. Part of the failure in meeting their basic need, is due to the lack of understanding of the various factors that distinguish a village water supply scheme from any other. It may be said, a rural water supply system has a personality of its own. It has its strong points and also many vulnerable ones. The morbidity and morality rate among the rural people is relatively high, so it the case with the rural water supply schemes. The derelict systems one comes across are monuments to the misconceptions the have erept into their planning, execution and maintenance. Unfortunately some of them still persist.

The technical and socialogical aspects of a rural water supply system differ greatly from thouse of an urban system. Even the requirements of a rural people are not the same as those of their urban counterparts. In fact, there are not many rural schemes that are designed to provide water directly to each individual house--hold. The per capita rate of supply is usually a fourth of the urban supply. A village can not absorb mere. Economic considerations and the lack of drainage facilities also limit the quantity supplied. The time and duration of supply should suit the convenience of the village women. The time spent and the distance travelled to obtain a day's requirement are incredibly long forcing a restriction on the quantity of water drawn. Even if more water is procured, there is often no arrangement within the house to store it. Hygienic storage is almost non-existent. By increasing the number of public stand posts, it

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is feared there will be more wastage and the distribution system has to be bigger adding to its cost. Further there may be more leakages leading to increased contamination of water. The problem of disposing the waste-water at the stand posts also has to be tackled. But in reducing the number of stand posts, there is the risk of people obtaining their requirements from nearby polluted sources. Survey have revealed that the incidence of water-borne diseases has not come down appreciably in villages with very few stand posts. It is therefore, incumbent on the planner to study the layout of the village thoroughly and locate the stand posts on the basis of the dispersal of its population. This should invariably be done after consultations with the prospective users. The system will not be fully effective where sociological considerations are ignored. It is also imperative to see that the affluent sections of the village population do not get the major benefit out of a scheme leaving little for the less privileged. It should be understood that when unhygienic conditions are allowed to develop in areas inhabited by the poor, the diseases arising there will spread through out the village sparing no one regardless of his social standing.

The strength of a chain is that of its weakest link. Financial resources are being mobilised at the Central, State and local level to instal rural water supply chemes and highly trained personnel of various disciplines are engaged in their planning and execution. No wonder then that a rural water supply schme when completed and commissioned appears to the village people as the panacea for all the ills they were heir to. But their exhultation is often short lived. Sophisticated equipment incorporated in the system causes break-downs in one component or the other. Disinfection is usually the first casualty. As a result, there is neith or the initial destruction of pathogenic organisms present in the water at the source not is there any residual chlorine to deal with the subsequent contamination in the supply system. An important safe-guard against spread of water-borne diseases is the residual chlorine in water. One can always witness the manner in which the water is collected at the public stand post, how the pitchers are placed on the ground, then one over the other and carried, all leading to contamination. At some places arrangements are made to automatically activate the pumps. Neither the Panchayat can always get them attended to when they fail nor do they have the necessary wherewithal. In the case of an urban system, technical skill and preventive maintenance facilities are

always available. Break-downs in rural water supply systems are often so frequent that they are now being taken for granted. If this be the case, it is hard to belive that water supply systems really ensure protection against water-borne diseases which constitute the major cause of sickness in the country. There has been no systamatic water quality monitoring done anywhere.

Many water supply schemes depend on irrigation canals requiring expensive storage facilities for the canal closure period. This water has to be filtered. For ease in operation, slow sand filters are preferred. In urban areas, mechanical filters are under constant supervision. The SS filters in village schemes donot receive much attention under the mistaken notion, they do not need any. The results are often disastrons,when they get choked, they are bypassed. Luxurious growth of alge is generally found in them which lends undesirable tastes and odour to the water.

Water supply is considered to be the Cinderella among all engineering services. The rural back-ground does not attract many senior personnel to it. Then there is the question of local politics that plays an important role in the execution and operation of rural water supply schmes. The engineer should be able to understand the Socio-Economic aspects of the project he handles. His repport with the local population is of utmost importance. This job is an urban setting is largely impersonal. It is necessary for his to understand the political, Socio-cultural and financial implications of whatever he does in the case of a village scheme.

Excess flouride and brackishness in water assume special importance in the case of rural water supplies. Such sources are eliminated altogether in the case of large urban supplies. Treatment versus selection of alternate sources, is determined on cost considerations. The trend is towards finding a commen source for a group of villages which may even be separated by long distances. Operation and maintenance of these shcmes pose their own problems, an important one among them being the sharing of costs.

In some cases, the villages contribute labour and certain types of material which are easily available to them. This besides reducing the cost burden on the part of the local body or the State Government, creates a sense of pride among the villagers who are the ultimate beneficiaries. This feeling of ownership incidentally reduces the risk of vandalism. This practice must therefore, be encouraged. The monay saved can be utilised for providing this essential amenity in more villages.

Of all the mysteries that nag the planner of rural water supply systems, the most important one relates to the assessment of the actual benefit accruing to the people.½ Besides being a convenience, the water supply is meant to reduce sickness and the consequent suffering. But unfortunately there is seldom any attempt made to evaluate how far the incidence of water-borne diseases has come down after installation of the system leaving a reasonable interval of time. It is not difficult even to assess the reduction in absenteism due to sickness and may be, the financial saving due to decreased expenditure on curative medicine can also be appraised. The onus of solving their problems should largely rest on the people themselves.. It should be the responsibility of the government however to buildup the needed expertise and offer it freely to those who want to engage themselves in installing safe water supply systems. If every thing has to come from above, our targets of providing drinking water to all can never be achieved. It may not even be possible to meet the demands of the population increase that takes place between the Five-Year Plans. And the myth that a rural water supply system is all a matter of pipes and pumps should be erased from people's mind. Unless clothed with flesh and blood, it can never be a living organism created and allowed to grow in order to serve the people who are toiling hard to produce food for us.

NEED FOR COORDINATED APPROACH FOR OPERATION AND MAINTENANCE OF RURAL WATER SUPPLY SCHEMES

Mohd.Inamul Haq*

1. INTRODUCTION:

1.1 Since Independence, there have been earnest efforts by the Centre and the State Governments to provide basic amenities of water supply and sanitation facilities to rural masses. During the earlier plans, funds were provided in the State sector for implementing the schemes in rural areas and there has been substential increase in the allocation of funds for these programmes in the recent plans. Viewed from the point of investment made and investment going to be made, it becomes obvious that the assets created, have to be operated and maintained properly. Once the task of creating water supply system is completed, the aspects which will have to be given the utmost priority is the operation and maintenance of the system. Instances of poor operation and maintenance practices have, on many occasions, largely contributed to decreased utility or even to an early failure of newly constructed drinking water facilities.

1.2 Any shortcoming in the operation and maintenance of facilities would not only allow for the deterioration of the system, thereby causing heavy loss of investment made; but also exposes the people to the risk of water-borne diseases, on account of supply of water not confirming to prescribed standards. Thus, the health and social benefits for which the facilities have been created would not be realised; capital investments would be wholly partially lost; and scarce resources are expended on the premature replacement of the equipment or for the restoration facilities before they are in operation for the full span of their useful lives. Therefore, proper operation and maintenance is the only answer for deriving the benefits continuously from the investments made.

1.3 Under these circumstances, the aspect of operation and maintenance needs to be given a high priority, as high as the implementation of the schemes for providing these facilities. For such activity, participation of all agencies and the community at all stages, from conception to realisation is a must.

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1.4 In view of the reasons mentioned above, the issue of the maintenance of these P.W.S.Schemes, is since gaining importance both at the Center and the State. Further, it has been emphasised and agreed to by one and all at various forums that there is a need of making sufficient provisions in the Budgets for maintenance. Government of India have since agreed for utilising ten percent of plan funds for maintenance of R.W.S.systems.

2. STATE POSITION:

2.1 i. In Andhra Pradesh the Panchayati Raj Engineering Department is dealing with implementation of Rural Water Supply programme. There are 27,379 revenue villages and 140 urban panchayats in the rural sector to be provided with safe drinking water and sanitation facilities. So far the department has executed 3,500 P.W.S.Schemes and about 1,20,000 hand pumps fitted with I.M.II pumps.

ii. The maintenance of hand pumps is fully taken care by State Government. For this there is a budget provision of Rs.3.627 Crores for 1986-87 to meet the cost of maintenance. The permissible cost of maintenance. The permissible of maintenance per hand pump is Rs.360/- per annum. This includes the cost of spares, maintenance of mobile teams and salaries of pump mechanics. 50% of this allocation is being reimbursed (by at-source deduction) from out of Gram Panchayat cess payable to them by the Government; i.e.,50% of the cost of maintenance is borne by concerned Gram Panchayat.

iii. The maintenance of individual P.W.S.Scheme is being attended to by concerned Gram Panchayat totally (there is no Government share).

iv. The maintenance of regional schemes is being done by the Government. However, it is expected that in this case also there should be 50% contribution from Gram Panchayat to be deducted at source from out of local cess payable to them. But it is not done. That means Government alone is meeting the cost of maintenance in the Budget. For 1986-87 there is a provision of Rs.66.26 lakhs.

3. COST OF MAINTENANCE:

3.1 The cost of operation and maintenance varies from scheme to scheme for the same population depending on the source and the type of treatment plant used etc. As per the report of Working Group on Operation and Maintenance of Drinking water supply schemes, the per capita cost of operation and maintenance varies from Rs.8/- to Rs.14/- per annum depending on type of source for water supply schemes in rural areas.

3.2 Basically any operation and maintenance estimates will have provision for the following three items:-

a) Provision for electrical consumption charges;
b) Provision for the salaries of the operation staff;and
c) Provision for the annual maintenance of the system.

3.3 For item a), electrical consumption charges will have to be paid depending on consumption. However, for the purpose of preparation of typical estimate, an average of 5 H.P.Motor is considered and a power tariff of Re.0.50 per unit is adopted. Accordingly electrical consumption charges work out to Rs.10,820/- for 16 hours pumping for a village having population between 3000 - 5000.

3.4 For item (b), taking operational staff as per the norms prescribed with an average pay of Rs.700/- per month; the provision towards provident fund, pension, etc.,should also form part of the estimate. the norms are; at least one Fitter and one Electrician or Helper as per recommendation of the Working Group on Operation and Maintenance of Drinking Water Supply Schemes constituted by CPHEEO. At this rate, the cost establishment will be Rs.20,000/- per year.

3.5 For item (c), annual maintenance which covers items such as overhauling of motors, pumps, repairs to electrical fittings, arresting the leakages in valves and pipe lines, white washing and painting of OHSRs, GLSRs, pump houses and site clearence at headworks, etc., a minimum amount of Rs.5,000/- per year is considered reasonable. The annual maintenance has to be carried out a least once a year. Otherwise, the life of the machinery and electrical fittings and other equipment may depreciate and the scheme may become defunct.

3.6 Therefore, the operation and maintenance estimate (a+b+c) prepared considering the accepted norms as above comes to (Rs.11,000+20,000+5,000) Rs.36,000/- for a population of 3,000 to 5,000.

3.7 This amount roughly tallies with the **per capita** cost cost of Rs.8/- to Rs.14/- per annum for operation and maintenance charges, indicated by the Working Group o n Operation and Maintenance of Drinking Water Supply Schemes. The break-up would be:

a)	Cost of power.	Rs.10,820	
b)	Cost of staff.	Rs.20,000	
c)	Cost of maintenance.	Rs. 5,000	
		Rs.35,820	Say Rs.36,000/-

4. NEED FOR WATER TARIFF:

4.1 Ours is a welfare State and it is the responsibility of Government to provide safe and potable drinking water to all its citizens. There cannot be any dispute about it.

ii. Earlier seminars and at varioius forums it is generally advocated that drinking water should be made available without any tax, because it is a basic need.

iii. There is another group of people who advocate that there should be people's involvement by way of payment of tariff to make the schemes viable and to make the people share the responsibility, which will go a long way in proper up-keep of the system.

iv. Whatever may be the version, the fact remains that it is the responsibility of the Government to provide potable drinking water to the people and to mobilise resources to make the systems successful.

v. Mobilisation of resources should be either by Budget allocation by State (Expenditure head) of its resources or by making the people to pay water tariff.

4.2 The National Seminar on Operation and Maintenance of Rural Water Supply and Sanitation systems held at Hyderabad in the month of February 1984 has made the following recommendations:

4.2.1 TAX TO BE LEVIED FOR RURAL WATER SUPPLY SYSTEMS:

4.2.1 In case of rural water supply schemes, either with dispersed source or piped water supply schemes through public

stand posts only, no direct tariff should be levied on beneficiaries. However, in order to augument the resources of the agencies responsible for maintenance, it is recommended that water cess should be levied to recoup at least 50% of the operation and maintenance cost and it should be recovered along with the house tax. The balance 50% of the operation and maintenance cost should be borne by the State Government initially and in stages by the beneficiaries themselves.

4.2.3 In case of piped water supply schemes where private connections are permitted, the water charges should be levied at a flat rate ranging from a minimum of Rs.5/- and a maximum of Rs.10/- per tap with Rs.2/- per additional tap per month. This should be suitably raised to meet the maintenance cost in the course of time. The size of ferrule connection should be restricted to a minimum.

4.2.4 Suitable bye-laws should be formulated by the concerned agencies in this respect. The water charges so levied should be collected by the same agency which is responsible for the maintenance of the scheme.

4.3. The Brazilian planning system seems to be similar in a way with our system - "PLANASA" is set up with five year targets based on apprisal of achivements of previous period - similar in nature with our Five Year Plans. The objectives being eliminatioin of deficit between supply and demand and attainment of financial self-support in water supply (Sanitation) sector at State level.

4.3.1 Further, it is said that adjustment of water rates and severage rates may be linked to the users paying capacity, as to achieve "balance between revenue and overall costs". In this context, it is to state that if the rates of service are adjusted to "users paying capacity", a balance between revenue and overall costs may not be possible.

4.3.2 Federal legislation has been enacted for rates of water and sewerage facilities confirming to economic and financial feasibility and social feasibility. The 'act' envisages that the operational income must be sufficient to pay for operational expenses. Further, the basic necessities of water and the coresponding sewerage facilities must be made available to commensurate with the purchasing power of people served.

4.3.3 In this context, it can be stated that if the financial feasibility is considered many of the villages now served have to be dispensed with water supply/sanitation facilities. The water supply and sanitation facilities, being social necissities, have to be continued to be provided even if they are not economically feasible.

4.3.4 The tariff rates lavied in Brazil attract some attention. Largest consumption (by volume) is being subjected to higher rates under graduated "slab rates", whereby users of higher income and larger consumption have to pay more. It is also aimed at 100% metering of supplies made.

4.4 The case study of two P.W.S.Schemes i.e.,P.W.S.scheme at Kamareddy and to P.W.S.Scheme at Kaikalur is carried out to know the actual working of the schemes. Statement-I will provide the details of population, number of connection, cost of production, etc. The salient features of these two schemes are also kept at statement-II. Some of the other important features are given below:-

4.4.1 Sources of revenue: In both the case, the source of maintenance of the schemes is collection of water tax from the households having private connections. Collection is made at Rs.5.00 per tap at Kamareddy and Rs.4.00 at Kaikalur. In addition to this, in both the Panchayats 10% of the property tax is collected as water tax for the maintenance of P.W.S.Schemes. There is no metering system.

4.4.2 The annual operation and maintenance cost for these schemes is high compared to the revenue generated. There is a deficit of about Rs.1.20 lakhs in case of Kamareddy and an average deficit of Rs.0.89 lakh in case of Kamareddy and an average deficit of Rs.0.89 lakh in case of Kaikalur.

4.4.3 The operation and maintenance is not upto the mark. The reasons being:

i. Inadequate finances with the Gram Panchayat.
ii. lack of trained personnel.
iii. Improper management and
iv. Multiplicity of agencies.

4.4.4 It is also noticed that:

i. The rate of supply now being given is limited and for below the daily demand. The OHSRs are filled once and water is being released. The water is given for an hour and half to 2 hours in the morning and an hour and half to 2 hours in the evening;

ii. Unauthorised handling of valves is common and it is resulting in leakage of valves and causing pollution of the drinking water;

iii. There is no daily checking of residual chlorine;

iv. Public stand posts are in a damaged condition. Only delivery is there without taps;

v. Private house connections are indiscripminate and the Gram Panchayats are giving too many number of house connections regardless of the effect it will have on the supply position for common public and on the scheme as a whole;

vi. Lastly, the most surprising factor is that the field staff totally ignorant of all these things. They are under the impression that it is not their look out to bother about the schemes once the schemes are handed over to the Panchayats for operation and maintenance.

WATER SUPPLY SCHEMES - COST ECONOMICS:

By :

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1. BACKGROUND:

In Panchayati Raj Department all the individual schemes are supposed to be maintained by the concerned Gram Panchayats. Schems serving more than oneGram Panchayat, popularly known as comprehensive water supply scheme, will be maintained by the Panchayati Raj Engineering Department, duly collecting water rates from the individual consumers having private connections. In some way or the other, in case of major comprehensive protected water supplyscheme, the maintenance is being provided by the Government. As regards the bore wells the maintenance is being done by the Panchayati Raj Engineering Department only, and the maintenance grant will be released by the Government duly collecting 50% of the amount from the concerned Gram Panchayat from the cess due to the Panchayat by deduction at the source itself.

There is Government order that whenever the Gram Panchayat fails to maintain the scheme, the scheme should be taken over by the Panchayati Raj Engineering Department subject to the condition that an amount equal to permit statutory levy's for water supply by such Gram Panchayats is deducted from the amounts to be released by the Government to the Gram Panchayats, the balance cost of maintenance being borne by the Government.

A. However, there is every need for a rural water supply scheme to be self-supporting (i.e.,) the cost of production of a unit quantity (1000 lts.)of water shall be balanced by the tariff enforced by the water supply agency; in this case the Gram Panchayat which is entrusted with the operation and meintenance of the scheme. The self-sufficiency of the water supply scheme can be achieved when the tariff levied takes into account the expenditure on -

(1) capital cost ;
(2) Operation and Maintenance ; and
(3) Debt service requirement.

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In case of Andhra Pradesh, it is an encouraging feature that the community participation in capital recource mobilisation is prevallant, based on the income of the local body.

As mentioned earlier, the operation and maintenance of the individual schemes is the responsibility of the local body and it is empowered to levy and tariff towards water supply charges. It is also observed that the production cost of water is much more than actual revenue generated with the Panchayat either by way of water tax by that rate per connection or both.

2. CASE STUDY :

(B) For the purpose of establishing the factual relationship between the cost of production and generation of revenue, the case of P.W.S. Scheme of Kaikalur Panchayat has been taken up as reported in the paper presented by Mr. Mohd. Inamul Haq, "atel" at the National Seminar on Water & Sewerage Tariff at Srinagar, 1986. Cost of production of water is evaluated by considering only the following parameters for simplicity and much of the capital cost of the shcme has been largely subsidised by the Government.

i) Establishment costs.
ii) Energy costs.
iii) Cost of chemicals, and
iv) Occasional maintenance/replacement of pumpsets, etc.,

The financial position of the schme for the year 1981-82 to 1985-86 has been considered. The study revealed that the cost of production fluctuated from a minimum of 31 paise per thousand litres of water produced to a maximum of 100 paise per thousand litres and followed a downward trend to reach a low of 43 paise per thousand litres of water produced. This sudden upward and downward trend of the cost of production is mainly due to improper maintenance which has caused the replacement/addition of components of the scheme. Over the five years, under scrunity, the average cost of production is Rs. 0.73 per thousand litres and the average revenue at Rs. 0.58 per thousand litres of water produced. Thus, the gap between cost of production and revenue generated is Rs. 0.15 per thousand litres.

3. OPTIONS :

The study of the graph shown for making the scheme at Kaikalur self-sufficient, the following options are possible either individually or in compination.

i) Increasing revenue generated,
ii) reducing the cost of production by proper opertion and maintenance procedures, and
iii) by achieving the supply position of designed capacity.

Execersing the second and third options simultaneously may still find the gap in cost of production and revenue generated. As such, in general, the tariff shall be adequate.

The revenue generation depends on :

i) Willingness of the consumer to pay,
ii) the adequancy,
iii) simplicity of tariff, and
iv) Enforcebility.

i) Willing of the consumer to pay :

The success of water tariffing and revenue generation mainly depends on the willingness of the consumer to pay. Even in United kingdom the North - West Water Authority is facing a situating in North-West area, where the voluntary metering is available only 1% of households had meters though 75% were aware of the option 1 (In Brazil, the water and sewerage rates are adjusted to the " users paying capacity. 2.

ii) The tariff shall be such that it just balances the cost of Operation and Maintenance and is not profit-oriented.

iii) Simplicity of tariff :

At present, many of the Gram Panchayats practise collection of upto 25% of house tax as water tax from their citizens in addition to Rs.8.00 to Rs.12.00 per private connection per month.

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1 World Water - Monitor pp.13, May 1986.
2 "Plansa" Brafilian system of planning-a report.

This system is simple and enforcible and hence be continued. However, based on the house tax, the water tax to be paid may be systamatized under a suitable slab system. The slab system is fair as an affluent household having private connection consumes more water when compared to not so affluent and poor households, who draw their water from public stand posts.

If, even under reasonable slab system, the cost economics (i.e.,) balance between cost of production and revenue from the scheme is not struck at, either the tap fee per month of a private connection may be raised or the Government may subsidise the deficit or both options may be used.

4. OBSERVATIONS FROM CASE STUDIES :

Thus, the cost economics of water supply schemes involves

- capital resource mobilisation
- generation of post-commissioning revenue for self-suffiency by imposition of sufficient water taxes/ tariff to balance the cost of production of potable water.

ANNEXURE

DATA ON URBAN WATER SUPPLY IN PARTICULAR REFERENCE TO TARRIF

Sl. No.	Name of Town	District	Population as per 1981 census.	No. of house holds.	No. of water supply connections						Per capita rate of supply (l pcd)	
					Domestic house service connection (HSC)		Non-Domestic connection.		Stand posts			
					Metered.	Un-metered.	Metered.	Un-metered.	Metered	Un-metered.	Domestic HSC	Stand posts
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	Kaikalur	Krishna	13226	2847	-	459	-	10	-	80	100	15-25
2.	Kamareddy	Nizamabad	33053	5509	-	946	-	47	-	120	100	15-25

Total non domestic supply per day (mld)	Average cost of water production per 1000 liters. Rs.	Annual operating & Financing cost Rs. in lakhs			Annual Revenue Rs. in lakhs	
		O&M Cost.	Debt service	Depreciation	Assessed	Realised.
14.	15.	16.	17.	18.	19.	20.
0.32	0.73	0.49	-	-	84,337	83,223
0.56	0.88	1.84	-	-	2,10,000	63,012

Current Tarrif (Rs. in lakhs)				Stand post water tax.	Industrial use.	Commercial use.
Effective since.	Domestic HSC Metered	Un-metered per tap.	Water tax.			
21.	22.	23.	24.	25.	26.	27.
1980	-	5	10% of H.T.	-	Covered in item No. 24	Rs. 40.00 P.M.
1974	-	4	10% of H.T.	-		Rs. 30.00 P.M.

STATEMENT

IF THE SYSTEM IS PUT TO FULL USE

	Kamareddy.		Kakailur	
	Present.	Full.	Present.	Full.
Demand (in litres)	1322120	1322120	529048	529040
Present supply. (in litres)	567500	1322120	315000	529040
Population.	33053	33053	13226	13226
Establishment. (per annum)	Rs.1,04,280	1,04,280	23,270	23,270
Power.	Rs. 73,526	1,71,295	23,100	38,796
Contingencies.	5,750	13,396	2,568	4,313
Total cost per annum.	1,83,556	2,88,971	48,938	66,379
Cost/1000 litres.	Rs.0.88	0.60	0.43	0.34

OBSERVATION: By going in for full supply, the cost of production can be reduced by 20 - 30% of present cost of production.

IV-2-6

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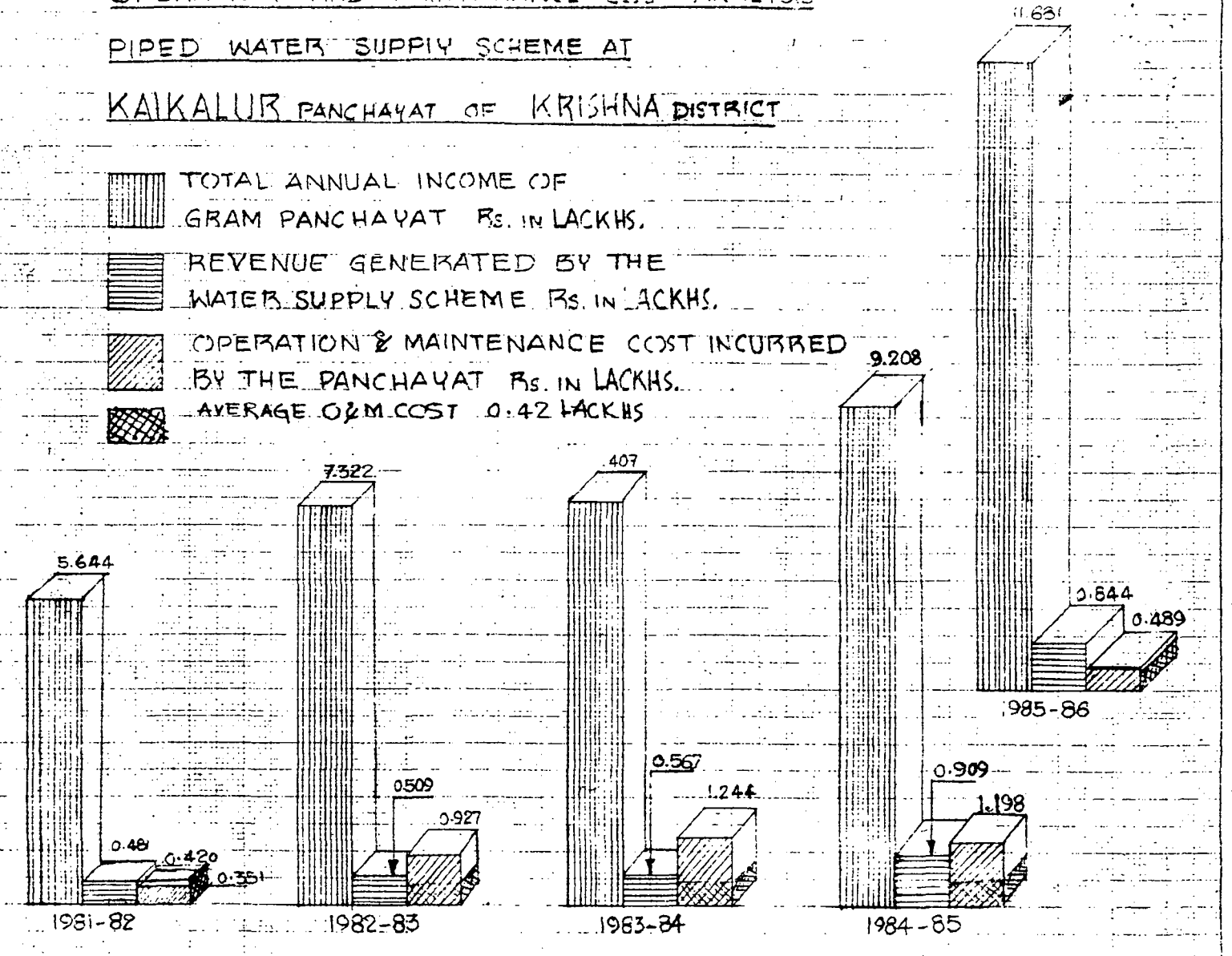
OPERATION AND MAINTENANCE - COST ANALYSIS

PIPED WATER SUPPLY SCHEME AT

KAIKALUR PANCHAYAT OF KRISHNA DISTRICT



Nanda

Graph-I

PWS Scheme at Kaikalur - Krishna dist. Andhra pradesh.

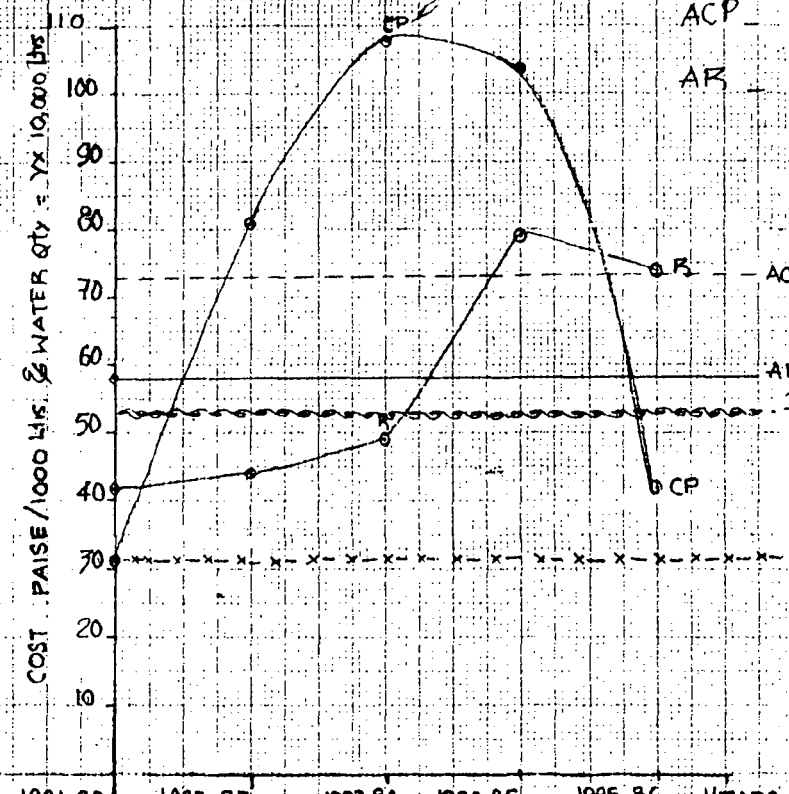
COST OF PRODUCTION Vs REVENUE

CP - Cost of production

R - Revenue Generated

ACP - Average Cost of Production

AR - Average Revenue Generated



Nanda.

ECONOMICAL DISINFECTION OF RURAL WATER SUPPLIES MAINTENANCE OF DISINFECTIOIN SYSTEMS

by

G.V.S.Rao*

The word disinfection clearly means dislodging the infectious bacteria from the water being consumed by us. Normally bacteria cannot be eliminated during the chemical treatment, It is only where the prechlorination is being done, the bacteria could be eliminated to great extent even before the water is subjected for chemical treatment. Otherwise the disinfection is only to the clear water and if necessary twice also as for the duration between first disinfection and consumption. The pathogenic water should be made safe water by using disinfectants even in excess quantities so that the free disinfectant can be found in water after utilisation for killing bacteria.

QUALITIES OF THE DISINFECTANTS

i) They must be able to destroy complete bacteria so that water becomes safe drinking water;

ii) At normal temperature conditions, they must kill the bacteria in limited and minimum time;

iii) The availability and the economical rate are considering factors;

iv) High skill and costly equipment should not be limiting factors;

v) The water should not be toxic and deodoring after treatment;

vi) The excess or less should easily be detected by simple apparatus; and

vii) The disinfectant must be available in residual condition after disinfection.

Now the disinfection can be done by various methods. They are:

a) Boiling and then cooling the water;
b) Passing the water through ultra violet rays;
c) By using iodine and Bronica solutions;
d) By mixing excess of lime and then fitting;
e) By dosing with ozone;
f) By using potassium permanganate; and
g) By chlorination.

When [illegible] r 10 to 15 minutes time the full bacteria die and the water after filteration becomes potable. But this is not possible for mass distribution systems as lot of manpower and heat energy are involved.

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Ultra voilet rays passing through the water stream of this nature is also foolproof system. But the equipment is costly and the system requires skilled labour. Normally this equipment is also usable for small quantities and is not practicable for various schemes in the rural areas.

Iodine and bronica are also considered to be one of the best disinfectants. But their storage, cost and handling become the reservations for their use and hence more care should be taken while handling these two chemicals.

Similarly the rare available ozone. This is not freely available in the market though it is very effective disinfectant. Because of its non-availability in the market and handling problems as well as the high skilled requirement, it became unpopular.

It is a known fact that the bacteria does not exist at PH value higher than 9.5. It is very easy to raise the PH value of water higher than 9.5 by using excess lime slurry or solution as the lime is a cheap chemical. But the alkaline waters are not suitable for human consumption. Hence again the PH value is to be brought down to normal limits because of which this method is not adopted.

Another familiar chemical used for disinfection is potassium permangante. This is freely available in the market but priced high because of the manufacturing costs. This has got only 95% efficiency as against requirement of 100% for water supply systems. Hence this could not become popular.

The last method of disinfection is by chlorination which is a universally adopted method because of its availability and easiness in equipment. This can be done continuously and number of permutations and combinations, materials are available for the chlorine availability. Depending upon the magnitude of the water supply system and the skilled labour, the equipment can be selected as there are number of equipments designed and used. More than 50% of pathogens in water will die within two days and 90% will survive for one week. But it was proved that some pathogens can live even as longer as two years, and hence disinfection has become essential. Chlorination has proved to be an ideal disinfectant. When chlorine is added to water it has an immediate and disastrous effect on most forms of microscopic life.

Chemistry of Chlorination

The reaction of chlorination is in two stages. One is Hydrolysis and the other is ionisation. Reactions are:

$Cl_2 + H_2O \quad Hocl + cl^- + H^+$ (Hydrolysis)

$Hocl \quad ocl^- + H^+$ (Ionisation)

Cl_2 = chlorine gas

H_2O = Water

Hocl = Hypochlorous acid

Ocl^- = Hypochlorite ion

H^+ = Hydrogen ion

Since chlorine in the form of hypochlorous acid is from 40 to 80 times more effective than hypochlorite ion, disinfection with chlorine gas is most effective at acid PH values.

Factors affecting Bacterial efficiency of Chlorine

The bacterial efficiency of chlorine under ideal conditions depends on:

i) Number of organisms: The higher the presence of organism the greater the percentage of destruction;

ii) The concentration: For the same concentration different disinfectants have proved different rate of efficiency;

iii) Time of contact: Experiments have proved that longer time decreases the death rate;

iv) Temperature of water: The rate of reaction increases with the temperature. Slight rise in temperature increases the efficiency of the disinfectant;

v) PH Value of water: At lower PH values, smaller contact period has proved sufficient for the same percentage of kill; and

vi) The presence of various chemicals: The inherent chemicals present in the water are also reasonable to most extent when the point of efficiency is considered.

Chemicals available in the Market:

i) Liquid chlorine is available in the market in 60 Kgs,100Kgs. and 1000 Kgs. cylinders under high pressures. The moment the liquid comes out, it is in gas form. This is dissolved in water and thus made to chlorine solution that the hypochlorous acid formed is used for the disinfection. The other materials which can evolve the free chlorine are ammonium chloride, sodium hypochloride and bleaching powder (calcium hypochlorite). Out of these chemicals, bleaching powder is very common chemical available and hence ink normal practice, chlorine or bleaching powder only became popular thus called as disinfectants.

When the water contains phenols, the addition of chlorine to water results in disagreeable tastes as there is formation of chlorophenol comounds. Under these circumstances, ammonia should be added so that the chloramins

are formed and thus the reactions of phenols are sidetracked to avoid unflavourable tastes. The reaction as chloramire is not immediate, but continues to fight with pathogens and thus require longer duration.

The chlorine dose can be determined by trial and error method by finding out the residual chlorine availability for certain dose of chlorine and the points are calculated. The second method is by calculating the ram water flow and for desired rate of residual chlorine.

Now, as we have discussed sufficiently regarding the disinfectants, varieties, advantages and disadvantages, a final conculusion could be arrived that chlorination is the effective and economical method. It is probably time for us to discuss the equipment involved in the chlorination of water. Depending upon the materials involved, the equipment is also chosen as one equipment cannot be used for the other.

I. Liquid and Gaseous forms of chlorine - Chloronomes are used. These chloromes are again in two forms: one - Injection type
two - gravity feed type

II. Self-Generating: Electrolytic process used for generating chlorine gas and then injected to water mains.

III. Bleach Powder: Displacement type of chlorinators.

Let us now study the equipment to come to a conclusion of economic way of chlorination.

Normally chlorine gas is used in medium and major water supply systems. The gas should never be directly injected into water flow systems. Concentrated chlorine water should be first prepared either by injecting type or by gravity feed type depending upon the water mains in which it is to be added. If it is a closed conduit of water supply system and high pressure lines, injector type equipment either pressure injection or vaccum chloronomes are used depending upon again on the line pressure. The chlorine gas should not be injected directly into the system for the following reasons:

i) Possibility of corrosion of the pipelines and pipe fittings because of the accumulation of the gas.

ii) Chlorine gas does not diffuse into water fully at a lower temperature and higher concentration; and

iii) Chlorine gas is compressed to high pressures into cylinders and the gas rushes out at the same pressure. Hence the gas should be reduced to lower pressure first which again can be done only through equipment, otherwise the gas bubbles out into the atmosphere making pollution problems and toxic nature of the gas leads to fatal accidents.

These gaseious equipments, because of the sophisticated nature and skill involved, cannot be chosen for rural water supply schemes. The spare parts availability, feasibility of transporting the chlorine cylinder, skilled labour availability, continuous vigilance on the equipment, the operations limitations are the considerations which may recommond for the elimination of these equipments for the rural water supply schemes. Even the cost of the equipment as well as the cylinders involve huge inventory and increase the cost of the scheme also.

The second type of equipment that can be considered is the electrolytic chlorinators. These are not new to the field as they were tried in Bombay and other Water Works as early as 1929 and many papers were even published. They were found okey but for the reasons and limitations as under:

i)Availability of the common salt - Its purity and storage.

ii)Electricity: As stable voltage and high power are required which are not available even for day to day running.

iii)Leakage: The chlorine gas tends to leak and pollute the neighbouring areas as much as possible depending upon the water jet conditions; and

iv)Disposal: Once the chlorine gas liberates from bine solution (or say salt solution) the left one is nothing but dilute caustic soda. Its application in the rural areas is to be first medicated otherwise disposal becomes a problem, as it is also a toxic one.

Because of the above limitations and the skill involved in the electrolytic chlorinators, they are not being considered for rural water supply schemes. Now the third and the last alternative is displacement type chlorinators which work with the raw material like Bleach powder and other water soluble disinfectants. In principle the description of the equipment is as under:

The unit is automatic bleach powder chlorinator working on the fundamental principle of differential pressure and is found simple, effective and economic means of chlorinator for the rural water supply schemes. It is sturdy in construction as it is made out of the mild steel plate and is a pressure vessel with a rubber bag hanging inside the vessel. These can be directly connected to the water, is fitted in between the two flanges so that the complete system provisions are made for filling the unit and for the solutioins to run from the unit to the main line.

Once the unit is made ready for operation, the needle valve provided at the side bottom of the unit is adjusted for one flone rate

for desired chlorine residual, it automatically becomes adjustable for other flows as the differential pressures are adjustable and the solution entry to the main line quantity wise is also automatic.

One orifice plate pipe is fixed in the main line with high pressure and low pressure tappings. The high pressure line is connected to the side bottom needle valve followed by cock-valve so that the water remains between rubber bag and the pressure vessel. The low pressure tapping is connected to the solution outlet fitted on the top of this equipment so that the solution runs into the main line and gets mixed with the water stream. The one tapping should be provided in the main line say ten feet away from the point of injection. The schematic diagram is also enclosed herewith.

ADVANTAGES OF THIS EQUIPMENT ARE

i) Wastage of the chemicals are prevented as the unit stops injecting chemical as soon as the pumping is stopped;

ii) The solution addition is automatic and even the variations;

iii) The concentration of the solution is never disturbed as no water can enter the unit;

iv) No possibility of leakage of chlorine as the system involved;

v) No electric power or any other form of energy is required;

vi) No special foundation or any other complicated structures are required for installation;

vii) The erection and commissioning is very simple and no skilled labour is required; and

viii) No constant attendance is required if once one does is adjusted.

The capacity of the units normally available are as follows:

Sl. No.	CAPACITY OF CHLORINATOR UNIT		QUANTITY OF WATER CHLOR:*	
	GALLONS.	LITRES	GALLONS	METER CUBE
1.	8	35	80,000	3 5 0
2.	16	70	1,60,000	7 0 0
3.	64	105	2,40,000	1050
4.	32	140	3,20,000	1 4 0 0
5.	48	210	4,80,000	2100

*The quantity of water that can be chlorinated is on the basis of dosage at the rate of ONE (1) ppm and is given per fill in the unit.

The erection and commissioning of the unit is as simple as follows and it is given step by step so that anyone can follow:

1. The chlorinator unit can be installed at any convenient point adjacent to the water mains and requires no such special foundations;
2. The orifice assembly can be included in the main line at any time, otherwise it can be asked even before the lines erected.
3. Connect chlorinator with the tappings of the orifice plate as above by PVC pipe lines as shown in the drawing; and
4. Provision must be given to drain water from the chlorinator shall either by pipeline or by a small drain but operator must be in a position to see the water flowing out.

As the erection is completed the operations sequences are as follows:

ERRECTION/COMMISSIONING

1. Cut the water mains at a point convenient for installation of the chlorinator unit and remove approximately 4' 6" of the pipe.
2. In case welding facilities are available at site, weld two falnges to the two free ends of the water mains, available after removing the 4' 6" length. These flanges are to to be provided by the purchaser.
3. In case welding facilities are not available at site, the flanges vide para 2 above will have to be screwed on to the two free ends.
4. Insert the pipe assembly supplied with the chlorinator unit, keeping in view the arrow indicating the direction of flow of water through the assembly and belt it with the flanges (newly welded/or screwed to the water mains after insertion of rubber gasket between two flanges. (The interconnecting pipelines/valves, etc., suplied with the chlorinator unit are as shown in the drawing enclosed herewith).
5. Make provision for leading away the drain water from the chlorinator shall.
6. The unit is now ready for filling of bleaching powder solutioin which is done as explained below:(Refer drawing No.CHL/1)

a) Close shut-off valves V2 first and then v4(*);

b) Open Air vent cock v6 and then valve V1;

c) Open drain cock v7 which will remove the displacement water from the previous run (This is required in case of subsequent filling operations only);

d) As soon as the shell is empty close drain cock v7;

e) Pour in the prepared bleaching powder solution;

f) Four in the prepared bleaching powder solution through the funnel until it comes out through the air vent; and

g) Close air vent cock v6 and then Valve v1.

7. The unit is now ready for service and is put into service as per details given below:

a) Open valve v4 first and then open Valve v2(*);

b) As soon as both the valves v2 and v4 are open, bleaching powder solution will start getting injected into the water mains;

c) Take a sample of the dosed water through the sampling Cock V5 and test for free chlorine. If it is as per desired requirements the setting of the needle valve v3 is in order;

d) If the dose has to be increased or decreased, open or close, respectively, the needle valve v3 by trial till the desired result is achieved;

(*)It is important to open/close these valves in the sequence given herein to prevent the possibility of bursting of the rubber bag.

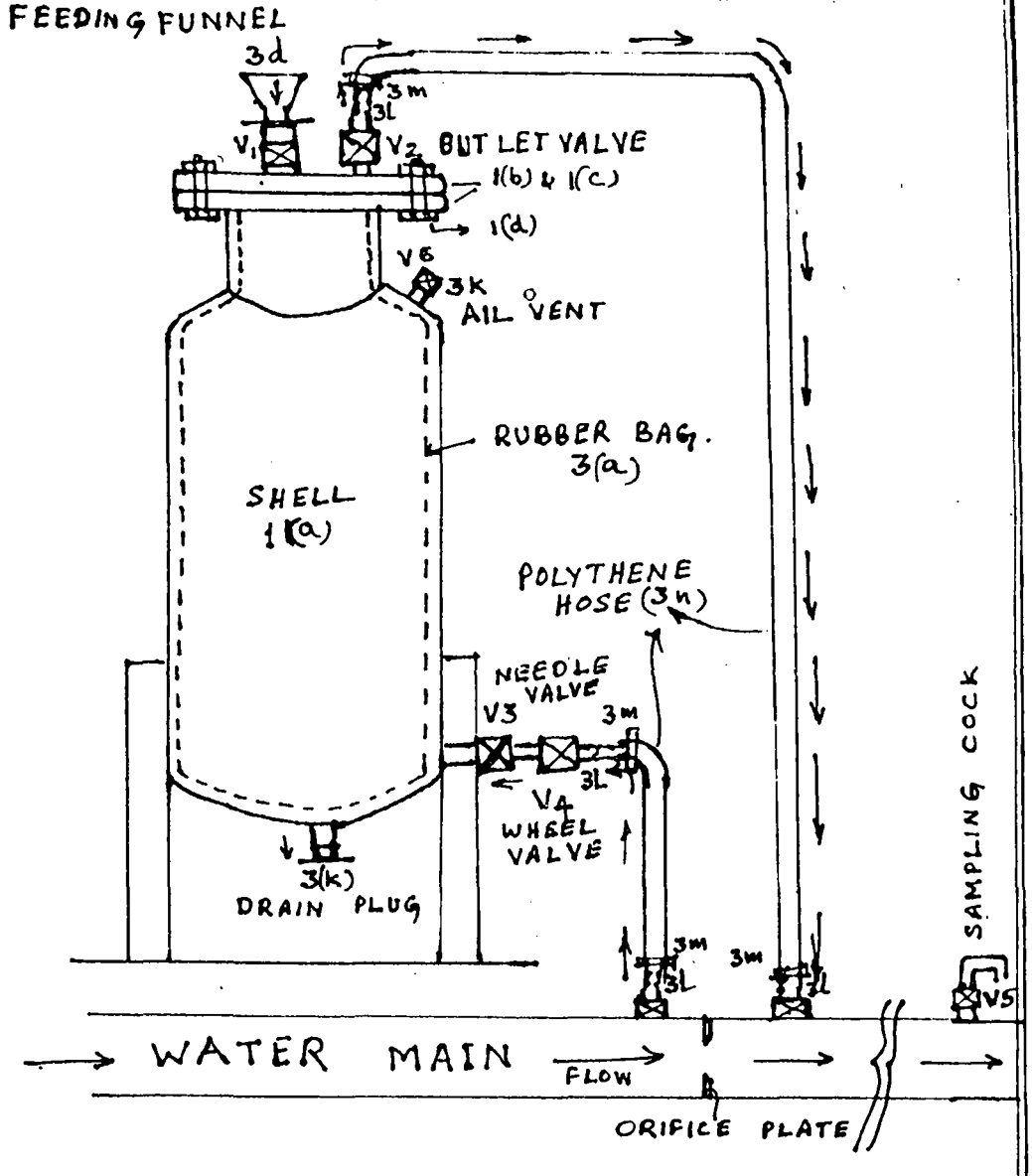
TESTING: Normal orthotoludin solution is used for testing the residual chlorinator. It is a simple comprative type and anyone can easily follow. By this time it is very clear that for rural water supply schemes there is no other equipment suitable except the bleaching powder chlorinator which is very very simple and easy and economical also.

Here storing of the bleaching powder is not a problem and can be purchased as and when necessary in any small quantities. It is readily avilable in the market.

RECOMMENDATION

From all the angles scientifically and technically discussed above, it can be proved that displacement type pressure feed automatic chlorinators working with bleaching powder are the best suited for rural water supply schemes.

E&C DISPLACEMENT TYPE CHLORINATOR



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TECHNICAL SESSION - V

HEALTH EDUCATION, AWARENESS AND PEOPLE'S PARTICIPATION ROLE OF VOLUNTARY AGENCIES

D. Rayanna*

Converting health workers into health educators may involve fostering a major attitude change on their part - the illness can and should be prevented, not just treated.

Voluntary agencies are those who are non-governmental organisations which are registered under Public Societies or Trusts Act who function as non-profit making private agencies. They have been existing since long in India and have taken several roles to play and especially in the areas of education, health and other services and relief activities. Today we have also a number of developmental agencies who work for an integrated development of the communities. There were voluntary agencies who started giving fish and later realised the importance of teaching the people how to fish-the whole arena of self reliance.

The conference has rightly chosen the theme as 'The role of Technology in Rural Water Supply' and providing an oppurtunity for various cagtegories of people working in the water schemes. It is also very much in the context of this decade "Water and Sanitation decade" from 1980 to 1990.

Health is not a priority for a common man. What he needs basically is food, water and a clean environment to live with dignity. Major role has been taken by the Government to provide safe drinking water to the rural areas with simple technologies that are available and whic could be achieved with cost effectiveness. It is in the implementation of Rural Water Supply schemes, that health education, awareness and peoples participation should be thought of.

Due to low levels of literacy rates, the inquisitiveness of the individual is less in knowing the problems in understanding the link between health and environment and thus not interested in any participation either in planning or in implementation. Today because of the tremendous scope of providing drinking water to the villages the task of education, awareness and participation have greater role to play.

Community participation

From the beginning of planning a project, the involvement of the people is essential. Schumacher says "Why care for people, because people are the primary and ultimate source of any wealth

*Executive Secretary, A.P.Voluntary Health Association.

what so ever if they are left out, if they are pushed around by self-styled experts and high handed planners, then nothing can ever yield fruit". Thus comunity participation should begin at the earliest and community leaders need to help. It is the comunity who can effectively collect the basic data and provide a community profile. If the community is participating effectively in planning and implementing the rural water supply scheme then they can benefit maximum by utilising the particular rural water scheme the purpose for which it has been provided or given.

Health Education

The second aspect of the theme - health education needs no elaboration. The problem here is how appropriate is the health message given to the common man. "Be clean; wash your hands" "take bath everyday", "Drink boiled cool water" etc. We must examine these and similar messages and see how inappropriate, or how appropriate they are. Can we also think of certain traditional experiences or knowledge which is good and helpful to promote. That part of education is to be provided by the grand parents to their children and grand children and if not such a valuable information is lost. This information can be effectively communicated through traditional cultural channels.

The third part of it is Awareness

Awareness brings responsibility for one's own health and helps one to create a healthy environment for one self and others. This includes water schemes, sanitation programmes, environmental aspects.

The improvement of peoples health may require that certain changes be made in the environment. Local conditions which contribute to the transmission of disease must be changed. Water supplies have to be protected, improved and treated. Different methods have to be used for sanitary disposal of wastes and educational programmes have to be organised to make people aware of the need for prevention of disease and teach them how to do so.

Role of Voluntary Agencies

1. Village water and sanitation committee should be formed with formal and informal leaders in every village which will look into various aspects of water and sanitation.

2. Some of the rural youth can be provided with training and make them responsible for hand pump maintenance, clean surroundings near water sources and spreading health messages among school age group.

3. The government must involve the voluntary agencies, youth groups mahila mandals as part of peoples development projects

in the initial phases of planning and later phases of actual implementation.

4. The voluntary agencies themselves can look for new avenues and participate-actively in the executive implementation of development schemes, especially that of Rural Water Supply schemes and involve people actively to benefit maximum from the schemes.

Women's participation at all phases, at all levels

Since women paly a vital role in home management, especially looking after food, water, environmental sanitation, they must be given enough oppurtunites for active participation. It will be possible and adviseble to set target levels for womens participation - numbers and proportions of women at the level of community councils and committees. It is also important to take up specific training orientation programmes related to Rural Water Supply.

The characteristic of a voluntary agency is that what ever programme it may take up, is accompanied with education, awareness and participation. Atleast the voluntary agency aims to achieve their goals through these means.

Voluntary agencies are generally involved in health care services health education, economic programmes, adult education, community organisation, housing etc.

Needs for training

Many of these voluntary organisations need orientation in Rural Water Supply programmes, sanitation and health aspects related to water and sanitation. Wherever possible involve them in a big way while planning such Rural Water Supply schemes as our government is rightly initiating several steps in this line.

Training also should be given for all teachers in primary and high schools. By involving peoples associations, voluntary agencies, we can get maximum participation and involvement of the common man, but should reach such innovative schemes every where.

It is the voluntary organisation that is willing to open, lead and sustains debate and to demand recognition of sensitive issues. It is this voluntary movement that interprets those issues in terms of human needs and serves as the public conscience when those needs remain unmet. A continuity of leadership education creates, as it where, a reservior of awareness and understanding on the part of national leadership.

Skills that can be taught to common man

- Care of diarrehoea - infant diarrhoea
  - oral rehydration
- Sock pits
- Getting the water from the source
- Storing of water
- Management of water
- Water and sanitatioin related diseases, simple steps for prevention

Need for training and education materials

Make available relevant health education materials including training materials eg. Charts, Leaflets, Slides, Video tapes etc.

Providing Resources

- Providing financial assistance to voluntary agencies willing to participate Rural water Supply schemes.
- Provide necessary technical guidance for the people through orientatioin and training.

Follow up

Regular follow up meeting with the department of P.R.E.D. and Rural Development and voluntary agencies including peoples representatives at various levels (Mandal level, District level and State level).

Conclusion

Community involvement in a water project is an important way for people to become aware of and select solutions to their own water and sanitation problems. It is essential that the community believes in the importance of improved water supply and sanitation and also understand link between health and water sanitation. It is in the collective participation and responsibility that the community can maintain their health and well being.

NEED FOR INTEGRATED APPROACH TOWARDS HEALTH EDUCATION & AWARENESS PROGRAMME

Dr. Venkata Reddy*

There is need to establish health education programme alongwith drinking water and sanitation programme.

In order that the huge investments that are made on rural water supply and sanitation programme become more effective it is necessary to create awareness, interest and motivate people to adopt, use and maintain the facilities provided for. Often it has been observed that good technical designs and properly executed schemes on rural water supply and sanitation have failed because of inadequate response from the people. The technology recommended should be such that it is acceptable to the people and it encourages use of local material and manpower. The health education programme in smaller comunities is very essential for the acceptance and proper use of rural water supply and sanitation facilities in smaller communities. The following are the steps to be taken for formulation and implementation of health education programme.

a) A report on the social, psychological and cultural factors involved in the acceptance, use and maintenance of of rural water supply and Sanitation systems embodying recommended strategies for health education intervention should be prepared.

b) Guidelines, based on the above, should be framed to be used in the formulated health education programme indicating successful approaches that might be replicated elsewhere;

c) A manual should be prepared for the use of workers in health educational methods and procedures as applied at village and community level;

d) Delivery of health education programme in selected communities on the basis of (a), (b) and (c).

e) An evaluation report on the impact of water and sanitation and health education interventions on the health status of the community should be prepared.

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Delivery of Health Education Programme

The health education programme should be undertaken to inform, motivate and adopt new understanding, new attitudes and new practices. The conventional methods of informing, motivating and enabling adoption, do not go far enough because of the following limitations:

a) Limited role of information and mass communication.
b) Lack of credibility of the media,
c) Lack of social support and opportunities to evaluate, trial and adopt.
d) Education is often equated with information. A-V aids and mass media are blamed for not being effective in diffusion of innovation. Table-I shows the appropriate methods in delivery of health education in order to create awareness, interest and to motivate for adoption of facilities.

Table-I

For	Awareness	Interest	Adoption
Method of Education	a) Individual. b) A.V.aids. c) Mass communication d) -- e) --	Individual A.V.Aids. Mass communication Group Interest. -- Exhibitioins.	Individual. A.V.Aids. Demonstration Group interest Community.

Evaluation of Health Education Programme

The following studies are conducted to evaluate the impact of health education programme on (i) the communities willingness to accept, use and maintain the rural water supply and sanitation facilities, and (ii) the impact of combined water supply and sanitation facilities and health education inputs on the health of the communities.

a) Study comprising use of water and sanitation facilities before and after the health education interventions, to determine whether the health education programme helped to promote desirable practices whether they hindered their development or whether they had discrenable effects whatsoever.

b) Epidemiological studies before and after the water supply and health education to evaluate their impact on the health community.

c) Socio-cultural study to evaluate the effect of the health education programme on water use behaviour. The results of the evaluation reports can be used in improving the future health education programme. These studies may also suggest the imporovements in technologies to the used for their maximum acceptance by the people. The evaluation studies also identify the human parameters in planning, implementation and operation and maintenance of rural water and sanitation facilities for their proper use by the communities.

School Health Programme

There are several onging interesting activities aiming to promote inputs particularly among school children. The outreach of the educational stream is relatively more expansive as the universalisation of primary education f alls within the major policies of the Government of India and the State Government. There are about 60 lakhs children in the age group 6-11 years in primary schools in Andhra Pradesh. The State runs about 41,291 primary schools, employing 81,700 primary teachers. Recognising the need to detect disease and disability in the initial stages of life, the State has decided to strengthen the existing school health services programme by streamlining it and introducing a proper system of documentation and computerisation. The programme was launched on October 2nd with a financial allocation of Rs.307.46 lakhs. The programme includes preliminary screening of all pupils and teachers for signs of gross abnormility, periodical (six-monthly) examination by medical officer, remedial measures and followup, immunisation, first aid through school teachers, referral facilities to district and regional hospitals and maintenance of school health cards with comprehensive information about the chiled and his/her family.

The data gathered from the above services will be computerised and findings of analysis utilised for planning improved services for the shealth of school population. Further, children of parents whose income is Rs.500/- or less, or who belong to the weaker sections of the community are given a shcool health card with a green cover, authorising them to free treatment on a priority basis. Other children have a yellow cover card.

Village Health Guides

As a part of the formal health care delivery system of the Government, health and sanitation inputs are provided by various grassroot functionaries. This includes the VHG's who, though not employed by the formal system, are the links with the system at the individual village level. There is a volunter worker designated as health guide for every 1,000 population and receives support of training, honorrium of Rs.50/- a month and some scheduled medicines. He-she is also supervised by the formal health functionaries.

Production of health education material:

On the other hand, two agencies are more active in this field. This is the State Council for Educational Research and training (SCERT) and the Andhra Pradesh Voluntary Health Association (APVHA). The former is responsible for preparation of text books and incorporates the inputs into school books. The APVHA is active in printing and distribution of material to various schools, health units and NGOs on their own as well as on demand.

Work Plan for Health Education

The following considerations have been kept in mind for formulation of the present strategy after field visits and review.

a) An increase in manpower inputs is not likely to have an appreciable increase in impact of health education. The emphasis is therefore on working for improved techniques - communication backed by appropriate and adequate material for distribution.

b) It is recognised that the impact of health education programmes without an accompanying hardware input have lower receptability. Therefore, the health education strategy is closely linked to provision of water and sanitation facilities.

c) Women when they are poor express a need for health education that is more adapted to the economic conditions of their family. In response to their needs the programme is linked to income-generating activities.[1] It is possible that inclusion of economic components in health education programmes is in the long term more cost-effective than the more conventional health education for total change in the enviuronment.

d) Investments in development are likely to yield better results when programmes are linked with ongoing activities particularly as supplements to existing Government efforts. Therefore, the strategy links up closely with the ongoing school health programme.

e) The mission also felt that in terms of attitudinal changes the older generation is in one since "a lost generation" and therefore emphasis should on drawing in the "New generation" in schools to concepts of health education.

f) A need for training inputs to technical staff on health has also been felt essential.

OBJECTIVES

- To use training of various categories of personnel as a progress for spread of the health education message.
- To use health education programmes as vehicle for conscientisation of the weaker sections of the community in the selected NAP villages where active non-government organisations are working with the people.
- To provide training in health education to the women Extension Supervisors working for the dairy project in order to link up the two programmes and work health education related to cattle rearing as well.
- To ensure that technically sound health education material is available to all participating agencies.

Special staff will be recruited and trained by APVHA for overall management of the programme. The health education content will be outlined by the project staff prior to starting all the other activities. While Planning the activities it should be kept in mind that the audience includes the following categories:

1. School children.
2. School teachers.
3. Paramedical health workers.
4. Informal readers.
5. Technical personnel.
6. Women Extension Supervisors.

IMPOTANCE OF COMMUNITY AND INTERNATIONAL AGENCIES' PARTICIPATION IN RURAL WATER SUPPLY PROGRAMMES

T.KANAGARAJAN

I would like to quote Mr. James Grant, Executive Director, UNICEF from the State of the World's children 1981-82 "probably only through community participation can progress in public hygiene, safe water supply and sanitation be made and maintained on the scale required to bring about significant improvements in the quality of life".

The "WHY" of water supply

Improved water supply and sanitation facilities make an important contribution to healthier populations, more productive economies and more vigourous societies. These are adequate, long-run reasons for national investment.

Economic Benefits

Water supply and sanitation facilities can be viewed as part of the essential infra-structure of a community without which economic developm ment will occur very rarely, if ever.

Improving village water supplies may be an essential step in the development of village and home industries like fish processing, fruit production, coir making, kitchen gardening, live stock, etc. This can increase the productivity of the villagers by decreasing the amount of time and energy that must be spent to fetch water and by increasing the people's output because of better health. Adequate water supply and sanitation could also help to slow down migration of villagers to the already over-crowded cities.

Social Benefits

To villagers the most important benefit of an improved water supply system is likely to be convenience. They might appreciate the health and economic effects once they are aware of them, but that is the end to the day's struggle to search and fetch water that is paramount. The second social benefit of water supply and sanitation projects is the opportunity it provides the community organisation and developmemt of leadership within the community. The community and country benefit from greater self-reliance and stronger leadership.

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*Project offier, water and environmetal sanitation, UNICEF.

Political Benefits

Although water and sanitation benefits are largely socio-economic, the decision to pursue these benefits through improved facilities are in the end, political. For several obvious reasons giving high priority to water and sanitation is a good political choice. Secondly, water supply and sanitation projects, if handled properly, receive great popular support. The people always appreciate the improvements in their lives, especially such as convenient water supply that can be enjoyed immediately. Thirdly, the benefits of water and environmental sanitation projects are immediately apparent to the community members which reinforces their confidence in the projects. Fourthly development of water and environmental sanitation system involves self-help by the community with the assistance of substantial funds from the national/State Governments and is thus convenient to disburse political rewards. The political leaders in governments can use village water supply as a means of showing their rural constituents their concern with rural development and progress.

Parameters and Constraints

The following parameters and constraints need consideration for Rural Water Supply programmes:

- Technology
- Quality of water
- Quantity of water
- Money
- Man Power
- Mobility
- Materials
- Management
- Operation and Maintenance
- Information, Education & Communication
- Health Education
- Training
- Community participation and role of women

Community Participation

Community Participation is one of the most important factors in determining the success or failure of a water supply and sanitation project. The ultimate test and success of any water supply and sanitation project is whether or not people use the facilities. However efficient the programme, appropriate the technology, superb the construction, smoother the operation and maintenance, it will all go waste if the community ignores the system. The villagers having some interest in a system will maintain it better, abuse it lesser and give it greater financial support. Successful community participation will take time, effort and planning. It will not just happen and it cannot be done as an afterthought or treated as a burden.

Social and cultural attitudes of the community will play a major role in determining whether the new facilities are used or not. To ensure that the facilities are used, it is absolutely essential that the community is involved in the planning and execution of all projects. Community participation is more than contributions of time, labour and money. A community must be given the opportunity to ask for from the authorities what they want. The local people's much useful information would contribute to the success of the project. Community participation gives an opportunity for community education which will help the villagers to effectively use these facilities. The National Water and Sanitation plan must have the community participation components, i.e. carefully designed and implemented. There are a number of techniques that may be used to achieve effective community involvement. The community participation strategy would make use of those most appropriate to a given country/community. The number of new facilities being provided is not the only way to measure the progress of water supply and sanitation programme. The more realistic and more useful measure is the number of people being served by reliable, viable, continuous, operative systems.

Role of International Agencies

UNICEF attempted to combine the technology/hardware under sociological/software one, making Government and UNICEF staff aware of the

problems and possible solutions to community motivation and participation. The two principles for material and health care are:

1. Education of the people in hygiene and health is an essential part of any programme.
2. Community participation should be obtained through all stages of the programme.

Community Participation and UNICEF

Community Participation for UNICEF is not to be isolated in the development and implementation of the programme. One of the conclusions of the assessment of the 1979 session of UNICEF Cooperation in Water and Sanitation was the need for greater involvement of communities. In an increasing number of programmes in which UNICEF cooperates, the approaches to village based systems for handpump maintenance through the selection and training of handpump caretakers. For example, Bangladesh, India and Southern Sudan. It is however recognised that involvement should be beyond the physical labour of digging wells, laying pipes or building pump platforms and maintenance to include understanding of benefits in health convenience and participation in the decision making process and the design of the installations. Community involvement is very relevant in the water and sanitation project, so that as a consequence, problems of operation and maintenance are minimised.

Women & Health Education

Most people will agree that it is impossible to discuss health education in water and sanitation programmes without looking closely at ways in which women can be more effectively involved in designing, implementing, maintaining and evaluating the programmes. The education of women and children, their literacy, and their knowledge about the aspects of water use and sanitation are important factors in the impact of water and sanitation services as they are for other child care services. Women must play larger roles in community decisions and participation in this field.

Providing water supply systems without sanitation and a support programme of health/hygiene education is not enough to bring about an

impact in health care. This certainly is an area where the women's involvement could have a potential impact. With an increasing of women repairing, maintaining handpumps, it has become necessary for us to try to ensure that women receive the necessary skills to perform these tasks.

Fetching water for the family has all along been the ordeal of the women folk. Women are not involved in maintaining the water supply systems provided for their benefit. I would like to quote our late Prime Minister - Mrs. Indira Gandhi, "Why do we want women to come forward? I believe that no society can go ahead if half of it is not given the opportunity. Women should be able to play a more positive, a more creative role in all spheres nationally and internationally.

Operation, Maintenance and Local Management

Women, as primary users and beneficiaries, can contribute greatly to adequate use and satisfactory functioning of water and sanitation facilities. Various forms of their involvement in local maintenance and management are:

Site management

- as individual users
- as members of user organisations

Caretaking

- as members of male-female teams with culturally appropriate division of tasks.
- as caretakers doing both technical and non-technical tasks.

Local administration

- as members of local management committees
- in parallel management committees for men and women

Self sufficient system

- services operated, managed and maintained by women.

Community Participation in Rural Water Supply

The rural water supply situation was very poor in seventies, i.e. 75% of the pumps used in those days were found to be out of order at any given time. But after a decade with the locally designed, developed India Mark-II handpump, the situation has greatly improved. A recent survey conducted by Operations Research Group in six states showed a very encouraging result, i.e. 80% of the India Mark-II pumps in working condition. This is a dramatic reversal of the situation that existed a decade back. The villagers gained confidence that India Mark-II pumps can provide safe drinking water round-the-year.

With the India Mark-II handpump as an 'entry point', it is possible to provide health facilities to the beneficiaries through the programme conceived by UNICEF, tested in Tamil Nadu and extended to Andhra Pradesh, Orissa, Karnataka and a few other states. The system in operation mainly helps villagers to inform pump breakdowns through reporting cards to the authorities promptly and have them repaired.

Selection and Training of Caretakers

The villagers are suggested by a team of Water Department Engineer, Block Development Officer, Medical Officer and Youth Coordinator to nominate a woman or man, observing certain criteria like young, living closer, user of the pump, literate and having the interest and independent means of support. The selected caretakers numbering about 60 are brought to the Block Head Quarters for a two-days training camp and they are taught about "how water is an instrument of health, immunization, preparation of ORT, nutrition, personal hygiene and sanitation. Through the handpump caretakers training programme, convergence of UNICEF assisted programmes has been taking place since inception. Women are given preference while selecting caretakers as they are the users and sufferers, if the pumps fail.

Thus, the message goes to the beneficiaries directly which facilitate easy dissemination of the message among rural women and their own community.

2500 trainers and 1,20,000 handpump caretakers have only been trained so far in selected programme districts/states. Presently, there are about 10,00,000 deepwell handpumps in India which means so many caretakers have to be trained which is a Herculean task.

The experiences on the participation by women as handpump caretakers in Tamilnadu, Andhra Pradesh and Orissa states have been very encouraging. This helps us to promote more and more community awareness supported by Information, Education and Communication materials to ultimately achieve Community Participation. The tremendous "Green Revolution" achieved by the Indian villagers gives us great hopes to achieve water and health revolution by a more complete community participation in Water and Sanitation programmes.

TECHNICAL SESSION - VI

KEY NOTE ADDRESS ON RURAL WATER SUPPLY

BY

T.S.Swamy

Development of Community water supplies is a measure of paramount importance, which reflects the index of civilization and culture of any community. No lasting development is possible without adequate safe water supplies, which is the basic need for the sound health of the community.

Water should be a material resource and in its uses drinking water should get the first priority. All the irrigation projects should plan for provision of drinking water as first change in all the respective command areas.

When we talk of water supplies to the community it should cover all aspects of water supply activity, starting from Developing Source Ttreatment Storage, Distribution of potable water to the community and collecting the waste water through sewage system and its proper treatment before it is discharged either on land or into water courses.

We are now mid way through the Internatioinal Water Supply and Sanitation Decade. We are committed to provide safe drinking water to all the rural areas in the country, particularly giving priority to problem and difficult areas.

Though fairly satisfactory position in urban water supply sector is achieved by nearly 80% of the urban population with safe piped water supplies there is need to provide in uncovered towns and also to constantly go on augmenting the existing systems to meet the increasing needs of already covered cities and towns due to increase in population, industrial needs and increase in per capita supply due to improved quality of life and effluence. The sewage facilities have not been kept at par with the pace of water supply position so far achieved. This situation has created worst environmental degradation in Indian towns.

Let us take a look at the safe drinking Water Supply situation in rural areas.l Nearly 5 out of 6 Indians live in rural areas.

Recent surveys indicated that hardly 15 to 20% of the "Rural population has access to safe, potable drinking water.

There is no doubt that higher priority in our future for this sector activity is very essential. Government have already initiated rural water supply programmes to give a fillip to this sector activity. The main factors to be considered for this sector activity development are:-

1. Financial Resources.
2. Manpower and Skill Requirements.
3. Material production and availability and;
4. Institutional Requirements.

1.FINANCIAL RESOURCES

We used to remark 'Do not spend money like water'. Now the converse is relevant 'Do not spend water like money'. Water is definitely more precious than money. So far financial resources have been limited to Government grants or loans provided in the plans which fell far short of requirements very little efforts have been made to mobilize the contribution from the benificiaries and the local authorities. LICs contribution has been marginal, though investment of LIC funds in the sector has a great relevance of promotion of health and increase the longevity of life.

International assistance could not be attracted to a greater extent for this sector for the reasons of deficiencies in organisational set-ups and other technical skills required to be developed specially at operational levels.

In all our urban areas, due to lack of evolving a firm policy and its implementation private individuals have been allowed to exploit by speculation the resources on purchase and sale of urban lands for the past three decades. Such increase in cost of urban land should have legitimately formed a major portion or resource to meet the infrastructure cost of water supply and sewage. In the rural sector for the past three decades Governments have been evincing great interest in resource mobilisation for this sector linked with agriculture incomes.

Thus we see that resource mobilization largely depends on political organisational patterns and their managerial capability.

Today every citizen is eager to contribute his mite to get safe drinking water. This should be exploited to mobilize necessary finances. It is essential to incorporate at national and State levels exclusive Banks for mobilising finances supporting the water supply activities.

2. MANPOWER AND SKILL REQUIREMENTS

Water supply management calls for specilization in several desciplines in managerial, financial and technical fields such as Public Health Engineering, Mechanical Engineering, Sanitary Chemistry and Bacterialogy, etc.

The recent survey indicated that though qualified personnel at design and construction levels are fairly available, there is great

shortage of middle level technocrats such as fitters, operators, water works supervisors and other equipment.

At present most of our existing water supply systems are not properly operated and maintained. The staff on the jobs are not fully conversant of the operating mechanism. Costly equipments are often thrown into disrepair. The problems of supplying of safe water in adequate quantity and pressure for distribution to the public does not end with the construction of water works. Many water-borne epidemics have been traced due to defects in the operating procedures used in water treatment plants and it is self evident that the level of operating skill and practice is of great public health significance.

There is need for water supply officials to work closely with water pollution Control Authorities to see that the natural water resources are not polluted to such an extent that self-purification and water treatment processes cannot produce potable water in a reliable and economic manner.

Water treatment involves physical, chemical and biological changes that transform raw water into potable waters.

Those who supervise plants frequently should have such complete facilities or the training and experience necessary for their proper use. More Technical and official control of the quality of water for public consumption should be provided by health departments having jurisdiction, as these agencies normally have more elaborate facilities necessary, staffed by chemists, Biologists and Engineers. This independent appraisal will ensure the quality of the water to be delivered.

The practice of supplying water for only a portion of a day because of shortage of water creates a serious menace to the health of consumer as well as inconvenience in operation. The zero or negative pressure produced by this practice, leads to the entry of pollution by sewage from the near-by sewers, cesspools etc., because no system is water tight, specially one that has been in use for many years.

The distribution system is the testing ground of effective supervision operation and the control being exercised from the source of supply to the consumers tap. For this there is a need for intensive in-service training. A few training courses conducted at National level by CPHEEO or NEERI alone are quite inadequate. Training in-service and certification for the jobs prior to appointment is to be extensively taken up at State and Municipal levels or by the Water Supply Boards. Water supply manuals, codes of operation and practice are already published at National level.

The monopoly of Investigation and Design by the Departments and Government agencies has often deprived comparative studies of

different alternative solutions and optimisation of costs. I feel there is a great need for allowing consultency to complement Government efforts in technical studies. The service conditions and emoluments are not commensurate with the nature of work for Water Supply. This is an essential utility service imposing great responsibility on the part of Water Works personnel. They are the custodians concerned with health and thereby lives of millions of people. One days interruption in supply would mean misery and hardship to the people. How sincere, how practical, how devoted should be their services cannot be over emphasised.

3. MATERIAL PRODUCTION AND AVAILABILITY

The essential material needed for this activity are pipes, specials, pumps, treatment and filteration equipment disinfecting equipments.

Indigenous technology is already developed for production of above material and equipment to the required level.

A judicious planning for casting of material, procurement and their utilization in time, are very essential specially when we operate on limited finances.

It is noticed that Water Supply Treatment plants in our country have not adopted the innovations and modifications in Treatment processes or methods, though lot of research and development has taken place around the world. There is good scope of increasing the capacities of the existing plants with minor structural alterations if studies in depth the working of these plants.

There is every need for the health services to be closely associated with the Water Supply programmes for effective quality monitoring. The job satisfaction in Water Supply Service is highest that one can realise in the form of public appreciation and grate fulness, which in itself is the greatest reward any Water Works professional should aspire for in life.

When you build monument you challenge nature to destroy it. When you dig a well for water you will be inviting the kind grace of nature to fill it.

4. INSTITUTIONAL REQUIREMENTS

Round the world in all the Developed countries water supply systems are properly and efficiently managed whereas in our country Water Supply systems are administered rather than managed.

Efficient Management Calls For:

1. Commonsense
2. Drive and initiative.
3. Intelligence.
4. Hard Work.
5. Emotional involvement.
6. Self confidence.
7. Basic knowledge and
8. Practical experience of the specialist service.

The application of scientific advances have significent impact on water management. In the present system of administration either at State level or at local level, the functions are overlapping, red tape is overriding and predominent procedures and formalities gain precedence over the objectivities.

The end product namely ineffictive management is evident. The administrative systems are not responsive to create conducive environment of either of resource mobilization or optimum power skills and materials.

This has been the reason for most of the international financing agencies to feel shy in making sizable investment in this sector. There is no single responsible agency to plan, investigate, design estimate, instal, operate, maintain, assess a realistic water rate to enforce it to collect the same and account for it. The accountability will have to take into account apart from the above activities, the capital reduction interest, service charges, depreciatioin, replacements preventive maintenance and reduction of waste by discouraging public stand posts. The Departmental approach and local administrations have not been able to bring forth the desired results.

In some States Water Supply and Sewage Boards are formed but there again half-hearted measures are adopted in entrusting full responsibilities and delegation of necessary authorities and powers to these boards.

Maximum efficiency requires the integration of different specilist activities, whereas maximum reliability needs the separation of professional activity from all other activities so that it is self-retrent.

These two opposing requirements operate in the Water Management at all levels and it is not yet evident that the right solutions have been found.

Here I cannot but make a remark about the overall implementation of Government machinery in the country, which also has a direct impact on this sector administration. The beaurocratic system of Government has remained unchanged even after independence. This system

of administratioin was designed by the British for colonial rule. The main aim then was the show of heavy Budgets whereas the implementation was almost nil. They were successful in achieving by introducing procedures, rules, organisations, checks, counterchecks, concentration of authorities multiplicity of authorities, diverging the responsibilities. The decision making in the system has been deliberately designed to cause delays beyond imagination due to the fact that this process involves hundreds and thousands of individuals, offices ad departments. And all of them work in isolation and cross purpose. This system has become immune to any change in policy or political setup. Net result is no plan can be realistically prepared and implemented and the real problems of people remain almost unsolved.

The remedy lies in dismantling the out-dated system of Governmental functioning and restructuring the same in a result-oriented system of getting together the responsibility and authority at the at the lowest possible level, eliminating complicated hierachy and multiplicity of the authorities.

Andhra Pradesh State Government has now set up Mandals. It should take this occassion to evolve right type or responsive machinery with specialised technical and skilled personnel provided at this level with full authority to plan and implement several developmental programmes and specially the rural water supply activity.

We find Government functioneries are in lakhs at National and State Capitals, in thousands in District Head Quarters and few dozens at Taluq or Block Headquarters.

Als, we do not find a single Government functionary stationed in a village to assess plan and attend to their needs as even the so called village level worker is also a touring officer for many villages.

This state of affairs needs to be tackled at the highest level without bringing self interests to paly into at political and administrative levels.

This change alone can bring forth real development in the rural areas in the shortest period.

(I) ROLE OF PANCHAYATI RAJ ENGINEERING DEPARTMENT

NEED FOR SEPERATE ORGANISATIONAL SET-UP FOR RURAL WATER SUPPLY

By: Sri. R. Kondalarao, BE
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Provision of safe and adequate drinking water supply is one of the Primary objectives of the Government. The International Drinking Water Supply and Sanitation Decade 1980-1990 aims at coverage of 100% rural population with drinking water and 25% with rural sanitation.

Andhra Pradesh with an area of 2.75 lakhs sq.Km has a rural population of 401.62 lakhs as per 1981 census. The population as per survey conducted in 4/85 is 427.95 lakhs in 27.379 villages and 37.684 hamlets. Out of the total settlements of 65,243 only 37,135 settlements are fully covered either with bore-wells or P.W.S. Schemes. Today there are 1,27,472 borewells and 4,463 PWS/NPWS Schemes in Andhra Pradesh in rural areas and another 3,286 PWS/MPWS schmes at a cost of Rs. 50.00 crores nearly are in progress.

Further, due to continous depletion of water table due to continuous droughts the borewells dug are also drying up and many sources provided for PWS schemes have become insufficient. It jis, therefore, felt necessary to have a master plan to cover the entire population with PWS schemes with a more reliable surface or ground water sources. A master plan is prepared to cover entire population with PWS schemes taking into account 2% growth rate at a cost of Rs.2200 crores. The master plan envisages entire coverage over a period of 25 years. Thus an investment of Rs. 50.00 crores per annum is to be utilised.

The bilateral assisted projects sanctioned by Royal Netherlands Government (at a cost of nearly Rs. 30.00 crores) and schemes under technology mission are also to be implemented with an annual investimates of Rs. 10.00 Crores.

Added to this the coverge of of 25% rural population with sanitation programme will cost above another Rs. 500.00 crores nearly. The entire programme is a challenging task before us.

The construction and maintenance of PWS schemes and drinking water schemes require special attention and concentrated efforts both at the time of investigation and execution stage unlike other works like roads or small buildings.

The Panchayati Raj Engineering Department which came into existence during 1960 is entrusted with the responsibility of execution of Rural Water Supply Schemes in addition to other rural development programmes like Roads, School buildings, Health Centres, Minor Irrigation schemes, etc. The present workload of the department is about 250 crores under various heads and thus each district has about Rs. 10.00 to Rs. 15.00 crores worth workload. Each district has 3 to 4 divisions now. With the multi farious works and control of too many institutions over the Engineering staff, the level of technical concentration expected is not forthcoming.

The Rural Water Supply schemes started with an annual investment of Rs. 2.00 crores have steeply gone upto level of Rs. 45.00 crores per annuam at present. As such it has become imperative to have a seperate organisation to take up the works under Rural Water Supply and Sanitation for the following reasons:

1. RWS schemes are more of technically complicated in nature and require special skill.
2. They require constant attention and frequent supervision.
3. The nature of works demands thorough investigation and full degree of quaslity control.
4. RWS requires thorough knowledge of ground water and surface water protentiality.
5. The maintenance of the schemes also demands special concentration as many Panchayats which do not have sufficient resources or technical skills are not able to maintain efficiently; and
6. To deal with foreign bilateral assisted projects, field staff must be readily available and if they are charged with other works, the time schedules cannot be kept up.

PAST CHANGES IN ORGANISATIONAL SET-UP AND ITS EXPERIENCE

The need for a seperate organisation was felt and a beginning was made with the creation of one circle with supporting staff for the entire State during February 1974. The P.W.S. staff have picked up good knowledge during that period and established that Panchayat Raj Engineering Department is no second to Public Health Engineering Department which is executing schemes in Urban areas i.e. Municipal areas. However, during October 1975 the circle was abolished but seperate divisions continued.

Again during 1979, seperate circles were created under Chief Engineer (Rural Water Supply) and started functioning and again in 1983 the entire organisation was merged with other Engineering divisions under Panchayati Raj Engineering Department and every Engineer is now charged with the responsiblity of Rural Water Supply schemes also along with other programmes. Only a seperate Chief Engineer for rural Water Supply is continuing.Although certain problems have been faced by the field staff during those periods, the overall performance can be graded as better. The Problems faced are the staff posted to P.W.S divisions used to feel that they are posted to P.W.S. Sections as they do not have sufficient pulls. This thinking has come in their minds broadly due to the following reasons.

1. The facilities provided to the staff sanctioned under RWS programme are less compared to the staff sanctioned for other programmes.

2. The nature of work to be carried out under RWS schemes is tough and there can be cases of failure of source, pipes or other items. This attracted lot of public criticism whereas such public criticism is mild in respect of other works like construction of roads or buildings where the question of falures normally do not occur; and

3. No special incentives were provided to them and they are treated at par when it is a question of consideration for higher elevations.

It is, therefore, necessary to take care of the above issues when we think of having a seperate organisation.

Further, even to fix up responsibility for completion of any scheme is becoming difficult now with powers of administrative sanction given to various institutions. The person charged with the responsibility of execution of a scheme should have full powers for sanctioning the schemes. In such cases responsibility can be fixed up for lapses.

Keeping all these factors in view it is necessary to have a separate organisation (department) for Rural Water Supply and Sanitation Programme with sufficient Administrative powers and sufficient funds.

MANAGEMENT INFORMATION SYSTEMS FOR COMMUNITY WATER SUPPLY

D.Bhaskara Rao*

INTRODUCTION

The first step in the establishment of management information systems for community water supply and sanitation is the inter-country workshop held in 1982 at Bangkok. Later the CPHEEO has organised a national workshop at Ahmedabad in September 1984 on this subject and reviewed the State of information systems as it existed in Water Supply Organisations in States and Union territories and has identified broad information that would be required for the management and be amenable for computerisation. The above national workshop recomended the development of a MIS, the training and strengthening the monitoring cells within the States, and recommen: nded studies in a few selected States by local personel with the aid of national experts. During the subsequent discussions by the CPHEEO with WHO and others, it was decided to convene a workshop at Bhopal during 1986 with representatives from six southern States. Accordingly a workshop was conducted at Bhopal which has made number of recommendations for establishing a MIS for Rural sector and as well as urban sectors.

The workshop at Bhopal has addressed itself to the following tasks:-

1. Decision to introduce computerised MIS
2. To identify the State of Madhya Pradesh to act as focal point for building a first system.
3. To prepare a definate plan of action for acomplishment of the above objectives.

Final recomendations of the Bhopal workshop are summerised below:-

1. There should be only two separate management information systems one each for urban and rural sectors, common to all States/Union territories.
2. Priorities for MIS development. The following priorities are recommended.

a)URBAN SECTOR ARE AS FOLLOWS:-

i. General information (including information of O&M on existing schemes)

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ii. Information on planning needs.

iii. Financial information and information required during preparatory and design stage.

iv. Industrial and adminstrative information.

vi. Construction and monitoring information.

vii. Operation and maintenance information.

viii. Public information.

The formats for collection of data for the priority items have to be developed at the pilot study level. (The states' information formats evolved by the CPHEEO were discussed and modified. These may be updated if necessary during the pilot study.)

b)RURAL SECTOR IS AS FOLLOWS:-

i. Rural Water Supply - Construction maintenance and quality survelliance. The format as prepared by Government of India (CPHEEO) should be considered for base-data;

ii. Inventory control to be excercised for few selected items important for water supply schemes. The procurement period, working period need suitable consideration depending upon the local conditions;

iii. Progress of schemes under execution;

iv. Management of personnel, organisation staffing and manpower;

v. Budgetary and financial control;

vi. Rural Sanitation and

vii. Water resources management.

3. For the collection of data from agencies outside the control of one department, the asistance of the Government shall be taken, if so required by the concerned department. There should preferably be only one MIS agency for both urban and rural sectors.

4. The responsibility for data collection has to be fixed by the appropriate authority for its timely and accurate collection and communication.

5. The cost benefit ratio cannot be worked out as the system has a number of indirect benefits. No correct and timely decision is possible without a proper information system. The Government of India should take a leading role in the effective promotion of the use of a Management Information systems in the water supply and sanitation sector at the national level and assist the State Government in this regard.

The Government of India should assist a few States initially during 1986-87 in designing and implementing MIS in a selected area with the assistance of experts and institution already involved in such activities in other sectors.

6. Short duration courses should be organised to create awareness and importance of MIS amongst the top managerial level officers. This should be finalised at the State and Government of India (CPHEEO) level.

   The Government of India may lay emphasis on manpower sdevelopment and organise training courses at some specialised institution to train State level officers in Management information systems approach.

   Training in data collection for the grassroot level personnel should be introduced immediately.

7. A pilot project should be taken up in one State viz. Madhya Pradesh to establish full-fledged MIS in due course. It should be possible to implement the pilot system within 12 months of the approval of the project.

8. A senior level officer should be in charge of MIS who should report directly and be responsible to the head of the organisation.

   The MIS Cell consisting of suitable staff i.e.Superintending Engineer, Executive Engineer, Assistant Engineer, Junior Engineer, Statistical Assistant, etc., as per the requirement of the State should be formed in each State to take the initial steps towards creating and using a MIS.

   Subsequently a working group was consistuted by the Ministry of Urban Development, Government of India in their order dated 14.10.1986 with (15) members with the following terms of reference.

   1. To check the MIS in water supply sector in use in Tamil Nadu and Gujarat States.
   2. Users system requirements specification investigation/ Design.
   3. Check specification for file size/power/print requirement and confirmation and specification.
   4. Hardware specification.

5. Develop training modules for management training and data collection training.

6. Identification of training Institute.

7. Development of soft ware.

8. Systems tests and recomendation for implementation.

In accordance with the above Ministry of Urban Development Order, the members of the MIS working group met at Bhopal during December 1956 and held extensive discussions within themselves and also with the local engineers of the Madhya Pradesh Government drawn from all levels to asses, the requirement of management information at various levels duly examining the MIS already existing in the State of Madhya Pradesh. It was also decided to re-examine the MIS as it existed in the States of Tamil Nadu and Gujrat. The working group has constituted two sub-groups and one sub-group is entrusted with the task of drafting the formats for planning, monitoring operation and maintenance. The second sub-grant is assigned with the task of design of preliminary draft system. Further, different members of the working group have been assigned different tasks like preparing formate for material management and human resources and also o training modules and identification of training institutes. The working group has also set before itself definate target dates for the different stages of the MIS development.

Now having briefly gone through the history of development of MIS and its present state of development let us now briefly examine what are the qualities of an effective MIS.

The MIS should aim at asessing whether the inputs are being delivered, are being used as intended, and are having the output as planed. Therefore, the whole ambit of MIS covers measuring, recording, collecting, processing and communicating information to assist management decision making.

An integrated system implies that all functional systems are linked together. Since data is generated from all sources and some information is required in all areas, an integrated MIS linking an integrated MIS linking all functional units will be more useful and effective.

A well applicable MIS should produce the following:-

a) A Data Bank.
b) Construction stage data.
c) Operation/Maintenance/stage data.
d) Performance data.
e) Financial and accounting information.

f) Organisation informatioin.
g) Store inventory.
h) Meteorological and hydrological informatioin.
i) Answering LAQ's by generating useful statistical data.
j) Be amenable for computerisation.

Observations on the inadequecies of existing information system and suggest the necessity to develop a MIS with the following key factors in mind.

a) Determinatioin of the information needs, the type of critical issues in which Management's attention is imperative for decision making.

b) The collection, formats and chanelling processes to be developed so as to speedily disseminate, evaluate and to present appropriate approaches on data and derived information relegating less important items, focussing attention on essential key activities that influence policy and Management decisions.

c) List activities and levels of performance at all levels of managerial roles with suitable training and understanding among personnel so that they can shoulder responsibility to support and achieve targets assigned.

d) Establishing an Institutional framework geared to cope up with the Management information system that is best suited to prevailing conditions, that could be modified or stage implemented with the least disruption to service effective action and decision making.

e) The methodology and appropriate techniques (such as levels of computerisation) that would facilitate rapid information flow to appropriate managerial groups to be incorporaged in to a well systematised management information process

f) The information system should attempt to attract attention to the important issues at a glance signaling to the Management the needd for urgent action, witthout being shrouded in a conglomeration of masses of information collected as a routine excercise mainly for record purpose.

g) The alternative approaches to the establishment of Management information systems to be closely examined in the context of the feasibility and applicability to organisation and the changes desirable to extract information that will be of worthwhile services.

h) The goal of providing a Management Information system should be related to the cost effectiveness of the anticipated product within the affordability of the Institutioin.

g) The formation Institutional Organisation should neither duplicate nor be repetitive, to create division of effort and energy nor be centrally oriented to channel decision making only at top management where certain decisions could be made at lower levels.

j) The study of experiences in this field by other countaries to assist in the formulation of an appropriate management information system adaptable to avert pitfalls and the problems ecountered on attempts made in other organisations.

MIS is a tool in decision making and it is necessary to identify these necessary which are critical to the success of operations. It is important to discover which decisions are important within our operations. Some of them may be options and the others may have to be chosen with certain criteria in view like money policy demands, tangible betterment and things nice to know.

METHODOLOGY

Initially it was decided to prepare various formats to be used in urban and rural water supply and sanitation programmes to cover the whole ambit of operations of the various departments involved in the water industry and to prepare suitable computer programmes for the same. Here it is essential to be specific about what information is required and at what level for effective decision making for an example all the officers at various levels may need all the information and hence it is necessary to define what information is required at various levels and at what intervals keeping in view the type of decisions to be made at each level. Further, it is equally important not to burden the field staff with the collection of non-essential information and unnecessarily store the same. While collecting and storing the information actually required for decision making at various levels it should be able to generate useful information for answering the possible LAQ's. Further, the system should be able to generate a data bank on the various water supply and sanitation systems available in the country so that at the press of a button one should be able to get a print out of the information we need for analysis and for future planning of the water supply and sanitation systems.

DESIGN OF A MICROCOMPUTER BASED RELATIONAL DATA BASE MANAGEMENT SYSTEM FOR RURAL WATER SUPPLY

Dr. M. Venkateshwarlu *

1. INTRODUCTION

The term computer was originally used to refer to any calculating device. To-day it is defined with reference to a system concept. A system is a group of intergrated parts that have the common purpose of achieving some objectives. A computer is a fast and accurate symbol manipulating system that is organized.

(a) to accept and store data
(b) to process data
(c) to produce output results

under the direction of a detailed step by step stored program of instructions. The modern computer has the ability to perform a long sequence of calculations without human intervention. It is this characteristic that distinguishes the modern digital computer from its predecessors.

Computers can process both numeric and nonnumeric information. In computers information is stored in memory devices which operates in a bistable manner. It is necessary to use coding and encoding techniques to represent the information both numeric and nonnumeric by the devices.

A computer system is made up of hardware and software. The hardware consists of the physical components that make up the computer system: transisters, integrated circuits, microprocessors, tape decks, disk drives, card reader, printers and the like. The software consists of the programs that computer executes. There are two kinds of software: system software and application software. Systems software consists of programs that help people write and execute other programs. Examples are translator programs, operating systems etc. Application software are programs that does the jobs on hand. Word processing, data processing, scientific calculations, picture processing, designs, spread sheets, are examples of application software. Computer is life less without software.

A program is a sequence of instructions. The digital computer has a memory and the program is stored in that. It is humans who prepare the program and place it in the memory. Both the program and the data, on which the program is to operate, reside in the memory. Consequently there is no need for human intervention and operations are carried out at electronic speeds. This stored program concept is a major innovation in the modern computers.

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A digital computer can be divided into five major parts: input devices, output devices, memory, arithematic element and control section. The input unit accepts the list of instructions (program) and data. The program, data, and intermediate results are stored in memory. Calculations are performed in the arithmetic unit. Output unit presents the results of calculations. The control unit interprets the instructions in the program stored in the memory and implements them. It activates input when data is to be read, allocates space in memory for storing data and commands arithmetic to do arithmetic and activates the output unit when results are to be outputted. It performs the executive function which humans do in manual problem solving.

2. PROGRAMMING LANGUAGES

A computer can interpret a program only when it is written in a machine code. The instructions that the computer actually performs are in what is called binary form. If we memorize the codes and know all the available memory boxes and their addresses we can write a series of machine language instructions for solving a problem. This is known as machine language program. However such a program is most unnatural to humans. Furthermore the codes differ from one machine to another.

To circumvent this difficulty, programs are written in a higher level language. The instructions in a higher level language resemable algebraic expressions. Symbolic names may be used to lable memory locations. Such languages are easy to learn and use.

With each higher level language an elaborate computer program is associated. It translates a higher level language program into a machine language. This translating program is called a compiler. The resulting machine language program is called the object program. The original program written in the higher language is called the source program. l Compilers are written by professional programmers. The higher level languages are machine independent languages.

To enable translation, the higher level language must be built upon a set of precise rules. They are called syntax rules of the language.

When a higher level language program is fed to a computer, the compiler analysis each instruction and determines if any syntax rules are violated. If there are no errors the program is successfully compiled and stored in the computer for execution.

If there are any syntax errors, then compiler prints out the list of statements which are wrong and indicates the probable mistakes made by the programmer. It does not execute the program.

It is essential to emphasize that compilers cannot diagonize errors in logic. They can detect only syntax errors.

The earliest known of all high level computer languages is FORTRAN, an acronym for FORmula TRANslation system. It is the most widely wirtten high level language and it came into existence in 1954.

There are many other high level languages. Only a handful have been used very much. Fortran is primarily intended for scientific and engineering calculations where a complex system of calculations is made over a small quantity of data. The next earlier language and the most widely used in business circles is COBOL (Common Business Oriented Language). It is more like English (MULTIPLY X BY Y AND ADD Z). Other high level language are BASIC, PASCAL, C, Ada, Modula II etc. It is easy to develop programs in BASIC and is widely used in schools. Pascal is a highly structured language and is widely used in teaching computer science.

3. COMPUTERS IN RWS PROGRAM

Computer applications in Rural Water Supply cover both scientific and data processing areas. The scientific applications may be mentioned as

1. Mathematical modelling of ground water.
2. Ground water hydrology studies.
3. Surface water bodies.
4. Optimization of pipe lines from distributory points and estimation of yields.
5. Treatment plant design and biological processes in water treatment plants.
6. Programming for the design of foul sewerage systems.
7. Micro-computer Modelling of flow conditions in pipe distribution systems.
8. Computer simulation of flow in a pipe network using data base of component and fitting losses.

Data Base Applications

1. Water quality data storage system
2. Surface water characteristics, checking of stream guage height and converting it into flow and calculation discharges.
3. Collection and processing of historical flood data.
4. Data base of rural population, water supply and sewerage system.
5. Multi departmental interactive computerised data management system for rural uplift.

4. DATA BASE MANAGEMENT SYSTEM

A data base is a pool of information stored as data. A data base management system (DBMS) is a group of programs that gives the user access to the data base. Typical applications for a DBMS in RWS are

ledger accounts
workshop abstracts
MAS accounts
inventroy control
budget.

Principles of design of a DBMS for the above applications are discussed in this paper.

Several data base managers are available to help the design of a DBMS. In some types of data base managers, the user writes the application programs in BASIC, FORTRAN, Pascal, C, or any other higher level language. Other data base managers use a language that is part of the data base management system, and no additional programming language is needed. Dbse III is one such data base manager. It is highly flexible. It facilitates interfacing the data with spread sheets and word processors.

Data base managers help reduce the duplication of data. For example a mandal and the standard information associated with it may come up in several formats. I With a data base management system, this information is stored only once avoiding the duplication of data that wastes disk space.

Data base managers also reduce program development time. They make programs shorter and improve reliability. Integration of data flow is automatic. Report creating is easy. There is no need to write such elaborate routines to extract the desired records, sort them to a desired order, and then print the report. The data base manager dbase III accomplishes this neatly and without much labour.

The data base management systems are of three types: hierarchical, network, and relational. In a relational data base management system, the data is stored in tables of rows and columnns without any particular relationship between items. The user determines the relationships to be used as the basis for accessing information. A relational system provides powerful tools for selecting, indexing, sorting, and reporting the data.

Dbase III is a relational data base management system. It has its own internal language. Each statement in a dbase III program represents many lines of code in most other languages.

The data base manager dbase III is used in this paper to describe the design of a data base management system for applications in RWS.

5. FIELDS, RECORDS, FILES, AND DATA BASES

Information is stored in files. All files are of two types. Program files and data files. In a good design, data is stored independently of the program using data. Program files are a collection of instructions that are to be performed on data. Data files contain the information used by programs. Files are generally stored by a computer on floppy or hard disks.

A record is a collection of data values, each of which occupies a designated position called a field. The fields of a record can be referred to individually by means of field variables. A record contains all the data about a particular item. A file is a collection of records treated as a unit. Each dbase III file has a name that consists of a primary name and an extension separated by a period.

Data is stored logically on a disk in records, files, and volumes. The data is stored physically on the disk in sectors, tracks, and cylinders. The user creates files. He reads or writes data to the files. The computer maintains actual physical storage of records. The user is concerned only about logical data storage (records and files).

To manage the relationship between physical and logical storage, the computer generally uses one or more buffers. These are temporary storage areas in the computer memory for moving the data from or to external pieces of equipment (floppy disk).

Data is stored outside the computer memory in files, and each file must be opened, before it can be used. When the file is opened, the operating system creates a buffer area in memory. It can then convert logical data flow to physical data flow for disk storage. When the file is no longer needed, it must be closed. Then, any data left in the buffer is moved to the disk, and the buffer area in computer memory is freed. This area can then be used by other files.

A data base is a collection of data organized to serve one or more specific applications. It refers to a collection of data files. A data base file is opened with the USE command. This also assigns the file to the current active work area. The user can move to any of the work areas with the SELECT command. For example:

```
SELECT      A
USE         account
SELECT      B
USE         batch
```

would open two files account and batch, leaving the user in the second work area. All data base files should be kept closed until they are actually needed.

6. VARIABLES, EXPRESSIONS, AND FUNCTIONS

In a computer progra, a variable is a label that refers to a defined memory location that is used to store data.

```
price = 400.25
```

price is a variable. It represents a memory location in the computer used to store information. Its present content (value) is 500.25. The equal sign is called an assignment operator.

Memory variables are of four types: numeric, character, logical, and data. All variables are initialized.

The variables, in a dbase III program, may be categorized as data field variables or memory variables. Data field variables are field names that are used as part of file records. Values are stored by REPLACE command. The command GET can alter memory or data field variables.

Memory variables reside in the program during execution. Upto 256 memory variables can be defined at one time.

Memory variables are of three types: public, hidden or private.

Private variables are available only to the program in which they are created and to programs called by the creating program. They are automatically deleted when the program has finished execution.

Public variables are available to all programs regardless of where and when they are created. They can be released only with a RELEASE or CLEAR ALL statement.

Hidden variables are variables that have previously been defined as public or private and have temporarily become unavailable to an executing program.

An expression is a series of operators and operands. It is evaluated and assigned to a single variable. For example,

```
mqty = 4 + 1
```

Strings can be concatenated with the + operator. For instance

```
q = "WA" + "TER"
?q
```

would dispaly WATER on the screen.

Functions perform specialized operations. For example

```
mqty = 5

? 'THE VALUE OF QTY IS' + STR (mqty,1)
```

A function has always one or more arguments. An argument is a variable that is used to pass data to or from the function. ? is a special operator that can be used to direct memory variables, text, numeric values, and data field variables to the next line on a screen or printer.

```
x = 4 + 1

? 'The result of calculation is' + STR (x,1).
```

For doing mathematical operations on data field variables, four commands are available: COUNT, SUM, TOTAL, and AVERAGE.

The COUNT command counts the number of records in a data base that meets a particular condition. The SUM command can be used to add data field variables that are numeric expressions or values. The AVERAGE command gives the average of data field variables that are numeric expressions or values. The TOTAL command is useful for compacting details transactions for a period to a single file that gives only summary totals.

7. PROGRAMS AND DESIGN CONCEPTS

A program is a sequence of instructions that are written and saved to a file which may be executed the desired number of times. For example, the following simple program may be written with a word processor.

```
mqty1 = 6
mqty2 = 1
mqty = mqty1 + mqty2
? mqty
```

This may be saved as TEST. PRG. This program can be executed by the command

```
Do test
```

This program can be edited by dbase III word processor

```
MODIFY COMMAND test
```

In the context of programming, a system is an integrated collection of programs and data files that act as a unit. The purpose

of this system is to process data. The data is input to the system. The output of system is information in the form of reports or dispaly screens.

The design process may be considered as compromising four phases: analysis, design, programming, and implementation. Even though this process looks linear, there can be a considerable amount of back tracking and redesign within any phase.

Programs are easier to understand and use if a structured approach is adopted in program design. The basic principles of a structured programming are:

1. Top-down design
2. Modular design
3. The modules should have a hierarchical relationship with each other.
4. Each module is an independent entity; it has one input and one output.
5. Each module should be documented
6. GOTO decision control should be avoided; the controls IF..THEN..ELSE, DO WHILE, DO UNTIL, and CASE ARE useful.
7. Indentation should be used with all decision controls.

A data flow diagram of the planned system greatly aids system design. It shows only functional blocks and system files, and how data flows between the files and functional blocks. It does not show procedural rules or decisions. In the diagram the source for all data and the destinatioin of each output are identified. In the design of a large system considerable time is spent in analyzing the problem and creating the dataflow diagrams. This is a prereguisite to programming.

8. DESIGNING AND CREATING A DATA BASE

The first step in developing a management information software system is to design the database. First the desired output information is identified. After the output is defined, one proceeds to define the input information needed to obtain this output. It is then also necessary to decide how to use files to organize data.

In a data base system each item is stored as a single record. Each record, in turn, is composed of one or more fields.

1.	Head of account	HOANO	C5
2.	estimate number	ESTNO	C5
3.	Description	DESC	C30
4.	A code (material or work)	TYPE	C1
5.	The total posted for the period	AMT	N 1 5 , 2
6.	the total posted for the year	YTD	N15,2
7.	Yearly budget	BYEAR	N 1 5 , 2

Once the file is designed, the data base can be created easily.

```
CREATE account
```

Each field is entered as shown above. Once the file is created, its structure can be displayed by the command DISPLAY STRUCTURE. The structure of a data base can be modified by the command MODIFY STRUCTURE.

There are three ways of retriewing the desired data from a file. Sequential access is used if data must be read or written lineraly. Random access uses the records that are all of the same length. To read any desired record in the file, it is only necessary to calculate the position of the record in the file and then request the computer to read the record at the particular postion. A third type of access for the desired information is indexed access. For the data file account dbf, an account index file can be created on a key field.

```
USE account
INDEX ON hoano To account
```

this will create an index on the head of account number. However if it is wished to create an index on hoano and estno.

```
USE account
INDEX On hoano + estno TO account
```

The primary step in designing data base files for a given application is the determination of exactly how many data base files are needed, and what fields should be in each file.

9. ENTERING, EDITING, AND LISTING DATA

Records can be added to a data base with the APPEND command

```
USE account
APPEND
```

The LIST command dispaly the data. It may be enhanced by adding one or more of the following

1. The fields to be listed
2. Selection criteria
3. The scope of the command
4. Record number suppression

```
LIST    estno, amt

LIST FOR hoano = '314CD'
LOCATE will search the data base file for a specified item
USE account
```

LOCATE for estno = 112
display estno, amt
The command FIND will search the index for a specified item.

```
USE account INDEX account
FIND                112
display hoano, estno, amt
```

10. CONCLUDING REMARKS

In this paper, a brief description of the computer organization and the higher level languages that are in use are discussed. Computers have potential application in serveral areas of RWS. One important application is in data processing. Several concepts relating to the design of a DEMS for application in RWS are discussed. A brief discription of the programming principles is given using the data base manager dbase III.

HUMAN RESOURCES DEVELOPMENT PLAN

S.V.Narayan Reddy*

INTRODUCTION

As a member country of the United Natioins, the Government of India has declared 1981-90 as "the International Drinking Water supply and sanitation decade". The goal of the decade programme is provide safe drinking water to 100% of its population and to provide appropriate sanitatioin facilities to 25% of the rural population. Huge amounts are required to fullfil the goals of the decade programme. In order to achieve better results with minimum cost, proper palnning is required. The planning not only in formulation of the projects and its implementation, but proper planning of human resources is also of utmost importance. In fact the first step in planning of any programme should be for better utilisation of human resources of our country.

Human resources development is systematic attempt or approach to develop the people needed to do a job properly. It involves a combined study of planning, training and management aspects.

The following diagram shows the steps required to prepare an effective man power development plan.

Step I	Inventory of existing Man power
Step II	Define base line service data
Step III	Define service targets and estimate Man power needs
Step IV	Compare the Man Power demand with the existing Man Power
Step V	Determine financial viability

STEP-I

Inventory of Existing Manpower

A man power inventory is a tabulation of human resources, placed by grade and by job classification and assigned to Headquarters and regional offices. This is an essential requirement in the process

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of manpower planning. It provides an indication of the distribution of manpower over the area of operation and is the basic data on which further development plans are to be prepared.

STEP II

Define baseline service data

Base line service data includes a summary of existing water supply and sanitation schemes and focuses on current coverage and levels of service provided. This information is required to review the current staffing patterns in relation to the various technologies employed and to use the data to develop new staffing patterns.

STEP III

Define service targets and estimate Manpower needs

Service targets represent the objectives of the Government/ organisation to extend or improve the quality of existing levels of service. This is required to study the aspects of utilisation of staff over a period of time, shortages of skilled staff and for identification of the priority job classifications.

STEP IV

Compare demand with the existing man power

Comparision of the demand of man power with the existing position will give the assessment of additional manpower requirements.

At this stage how to meet the gap in the manpower requirement is to be considered.

The various options would be:-

i) To adopt simpler technologies
ii) To reduce the service targets
iii) To impart training to the existing staff
iv) Recruiting the additional staff

STEP V

Determine financial viability

The costs for the manpower demand are worked out based on average salary figures and other allowances provision should also be made for the office accommodations, furniture, transport, scientific equipments and other tools and plants etc. as required.

The second aspect of the Human resources development plan is the "Training"

This will involve the identification of performance problems you are facing, and whether training should be a part of the solution for these problems. The training plan provides specific answers to the following questions.

1. Who needs it and how many?
2. What do they need? How much and in what form?
3. Where and when should it be done?
4. Who should do it?
5. What is the cost involvement?

The following method gives a systematic approach to the production of a Training plan.

1. Determine training needs.
2. Analyze tasks.
3. Select Trainees.
4. Determine the curriculum.
5. Prepare environmental support.
6. Conduct training.
7. Follow up training.
8. Evaluate and adjust training.

1.Determine training needs

It is a step to clarify what and how much training is needed and appropriate for the organisation and trainees. Analysis of performance deficiency will provide the clue to the **cause of** the problem to determine the **solution.**

Causes of deficiency may be divided into (3) major categories.

1. Lack of skill or knowledge
2. Environmental and /or management causes
3. Motivational incentive or attitude.

2.Analyze tasks

Training should be based on the job tasks involving skill, knowledge and attitude i.e.,we should analyze

i. What type of skills are involved in his job?
ii. What prior knowledge he should possess?
iii. What is the job description?

3.Select Trainees

A careful trainee selection is needed in order to ensure that

i. The Trainees are actually lacking in the skills or knowledge which will be taught in the proposed training course.

ii. The trainees have the necessary background and pre-requisites to benefit from the proposed training.

iii. The trainees will be assigned to work in an area where the skills/knowledge can be used.

4. Determine the curriculum

The guiding principle in selecting the type of training is to keep the training as job-related as possible. The type of training should provide ample opportunity for the trainees to acquire the necessary knowledge and to perform the skill. The trainees should not be subjected to long lecture type courses if their goal is to learn a skill. The duration of the training and the number of trainees are some of the factors to be kept in mind.

5. Prepare Enviornmental Support

This is with respect to the selection of the venue, the timing, the instructors and the equipment. The place of training should have

i) adequate space to accomodate the trainees
ii) Adequate lighting and ventilation
iii) Free from noisy crowds, machines and traffic
iv) Travel facilities and accomodation are within the reasonable limits.
v) Necessary equipments for demonstration are available.

6. Conduct training

It involves

i) Selection of the suitable lecturers
ii) fixing of time-table of various subjects and the trainers
iii) arranging field visits and practical classes
iv) arrange group discussions

7. Follow-up training

Training is not complete when the trainees leave the classroom. They should use the knowledge and skills at their work places. Organisational support should be provide to the employees to utilise their skills

and knowledge so acquired.

8. Evaluate and adjust training

Evaluation of the training course is necessary to take corrective actions for future courses. The following questions will determine the processes involved in it.

i) Whether the training was too long or too short?
ii) Whether it was relevant to the goals?
iii) Whether it was too complicated?
iv) Were there proper environmental conditions?
v) Proper selection of the trainees with respect to their pro-requisite qualifications and skills.
vi) Sufficient field training along with classroom knowledge has been provided.

Having looked into the above aspects the subsequent trainings can be suitably modified and updated.

MANAGEMENT

The eficiency with which any organisation can be operated will depend to a very considerable extent upon how effectively its personnel are managed. For effective management, the factors affecting the performance are to be kept in mind, which can be enumerated as follows:

1. Management - Personnel policies - Recruitment, wage structure etc. promotions, career development.
2. Motivation
3. Incentives
4. Working condition/Tools & equipment
5. Capacity/experience
6. Opportunity to perform
7. Training.
8. Feed back and information.

Now let us look at the following table and find out whether the individual or the management has got the key influence on each of the item.

Factors affecting Human performance	Key influence	
	Individual	Management/ Organisation
Skill and knowledge		
Attitude and ability		
Inventives		
Working conditions		
Tools and equipment		
Slupervision		
Standars & proceedure opportunity to perform		
Motivation		

From an analysis of the various factors mentioned above, it is evident that much lies on the management for the better performance of its employees.

TECHNICAL SESSION - VII

UNICEF'S ROLE IN INDIAN RURAL WATER SUPPLY(DRILLING) PROGRAMME

A.R.S. Sehmi*

In 1964, almost 40 years ago when UNICEF started its operations, primarily as an Emergency Fund, no one had dreamt that it would embark on such a massive rural water supply programme all over the world. The drought in eastern India led UNICEF almost accidentally into a whole new area of assistance - supply of clean, fresh, drinkable water for rural villages.

In the early summer of 1967 UNICEF airlifted 2 "HALCO TIGER" and 7 "HALCO MINOR" drilling rigs from England and within two months these rigs had pounded swiftly through soil and rock bringing water to 222 villages in North Bihar and Uttar Pradesh, whose thirsty inhabitants had been faced with imminent prospect of evacuation to relief camps.

This was the first attempt to apply modern hard-rock drilling techniques in the Indian sub-continent and it proved to be a great success. Prior to this, all the agencies responsible for drilling had been using conventional equipment, viz. cable tool, diamond and mud-rotary rigs, which took a considerable time to drill in hard rock areas as well and proved very costly.

The "Halco Tigers" imported by UNICEF at the request of the Indian Government used a technique known as "Down-the-hole drilling", which is now a very familiar term. These Halco rigs were very small and compact in size and could be taken to remote areas. Their capacity was to drill a 4" finished bore to a depth of 100-150 feet, which was good enough at that time to ensure a reliable water source. The entire operation was run with compressed air - 100 psi pressure, 250 cfm displacement.

The arrival of these high speed rigs was precipitated by drought and impending famine. Many thousands of villages in the hard-rock areas all over central and southern India were faced with similar problems. The modern technology of these rigs had offered a revolutionary answer to the problem. Inspired by the success in Bihar, the Indian Government approached UNICEF with a request to support a Rural Water Supply programme in other hard-rock, drought prone areas. UNICEF invited a specialist, Dr. Martin Beyer to assess the programme's viability. He and his team reported favourably and assistance was approved at the UNICEF 1970 Executive Board. UNICEF ordered 125 of the new air rotary/percussion rigs and shipped them to Indian over the course

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of the next four years. The cost of the rigs and other components to UNICEF was $ 5.9 millions, an extremely large and exciting investment by the standards of the time. No drinking water drilling programme of these dimensions had ever been undertaken anywhere else in the world before. The equipment ordered by UNICEF were of Halco, Atlas Copco and Ingersoll-Rand make, (names which are very common now), and varied in sizes and capacity. All of these were pneumatically operated and had certain limitatioins, eg. limited depth and only shallow over-burden drilling capacity.

It was necessary at the same time to give logistics support to these rigs, which UNICEF did for almost 18 years, which kept them going for so long. It is really amazing to note that some of these rigs are still in operation and in fairly good condition.

Civil conflict in East Pakistan in 1971 brought ten million refugees into India. The highest concentration of them being in West Bengal. The task of providing water to them besides other necessities was enormous. A US plane transported a Halco Tiger to Calcutta. The rig inevitably became known as the "Bengal Tiger".

Since the rigs and the technology was new to India, training in operation and maintenance was required. This was provided by UNICEF master drillers in the field. Stores and workshops were started and supported in many States.

Realising the potential of these types of rigs and looking at the growing demand, slowly but surely indigenous production of the DTH rigs and spares began in the country. UNICEF encouraged the local manufacturers, to ensure that a transfer of technology took place. The Water Development Society became the leader in indigenous production and by the end of the seventies, many manufacturers were in the field producing a wide range of machines and hundreds of rigs. The rural water supply programme received a major thrust and many thousands of problem villages received a protected water supply source. Since the pneumatically operated DTH rigs were now available locally and the State Governents could buy these rigs themselves, therefore it was no longer necessary for UNICEF to import such equipment.

In the second phase of UNICEF assistance by the late seventies problems of a falling water table, more overburdens to tackle and certain difficult drilling formations to drill, were reported all over India. Affected States, through the Government of India requested UNICEF to supply rigs of an appropriate type. Such rigs were not available locally. Around that time, considerable development in the western world had taken place, UNICEF explored the possibilities of importing such rigs in India, and in 1979 brought six hydraulically operated, high powered rigs manufactured by Hands England and Atlas Copco. Looking at the success of these rigs, more rigs of different makes were ordered

and by the end of 1986, 104 such rigs costing about $ 26 millions were imported and supplied in 19 needy States. A new chapter in the Indian Water Well industry had begun.

While rigs supplied between 1967 and 1978 (termed as old generation rigs) had their limitations due to pneumatic power, in contrast hydraulic rigs (termed as new generaction rigs) were much more powerful. Use of hydraulics gave great power, flexibility and reliability. High pressure modern compressors (screw type) gave faster penetration rate, lower maintenance costs and reliability. A new generation of down the hole hammers coupled to higher air powers also played an important role in giving faster drilling rates. Some of these rigs could drill upto 1000 feet in the most difficult conditions; could easily tackle heavy overburden and could use many speciall drilling attachments, vize. casing jhammers and odex. The rigs were suitably mounted on more rugged and reliable carriers and were categorised large (20 to 30 tons), medium (15-20 tons) and small (10-20 tons). Some of the rigs were mounted on two trucks to make them lighter and give better manoeuverability. Depending on the need and requests, these rigs were allocated to different states.

Where these new generation rigs were powerful and answered many solutions to problems, they were also sophisticated in their design. This required greater care in operation, maintenance and repairs. Adequate logistics support was of utmost importance. At this juncture a new breed of technicians began to join the UNICEF team. Besides monitoring performance, they embarked on a capacity building process - to train crews and supervisors to make the States self-reliant. . In the training process, they were fully aided by equipment suppliers and their agents in India. UNICEF started a service/training agreement with the equipment suppliers to protect these rigs from mishandling or abuse, to obtain feed-back on their performance, to reduce down-time by prompt repairs and of course to train the crew in all respects in the field itself. This was a unique and highly effective endeavour in the water well industry. Under this agreement company engineers visited the rigs in the field monthly and reported back in a prescribed format for systematic feed-back. As the personnel thus trained became self-reliant, the frequency of these visits was reduced to bi-monthly and it will eventually be phased out.

To date on the logistics front, with an annual expenditure of $ 2 million, 109 new generation rigs are supported in 19 States. This is complex and vast operation by any standards. 13 types of rigs, 10 types of rig carriers, 10 types of compressors, 26 types of engines, 8 types of hammers and finally an inventory of approximately 7000 components are handled. Initially all the spares were stocked and despatched from Bombay, but slowly decentralization is being effected and spares are now being stored in the State Central Stores for the efficient and quick availability of spares to the rigs.

During this period, UNICEF drilling engineers also started demonstrating and promoting special drilling techniques.

FOAM DRILLING - which was briefly started in the early seventies and had died a natural death was revived once again because this process was found very useful in tackling some of the more difficult formations, particularly collapsible over-burden, in the western world. Use of foam in India offered many solutions - as an alternative to mud in certain conditions and as an aid in other special drilling techniques. Foam drilling is gaining ground and is being widely used in almost all States. Looking at its usefulness and popularity, production of indigenous foam has been taken up by many manufacturers however, the quality of their product must rapidly improve.

ODEX DRILLING - a simultaneous casing method for collapsible formations was similarly revived once again. UNICEF imported many sets in the country, demonstrated its use, and trained crew to handle the equipment. This technique too is picking up fast and requests for more sets are being received. Once again, its local production has been started in the country.

CASING HAMMER DRILLING - another technique of simultaneous drilling and casing in boulders was demonstrated and crew trained. This equipment being heavier and a bit hazardous could be used only on selected rigs. Due to its limited use, this technique is used in specific areas only and local production has not been taken up in the country.

MUD-ROTARY - mud drilling equipment to suit top head drive rigs was also lintroduced and demonstrated in certain States, proving a valuable addition to a basic hydraulic rig.

In order to reduce the failure rate of wells drilled in the country, use of scientific instruments such as resistivity meters, seismic survey equipment and well loggers, etc., was widely promoted by UNICEF and many sets were supplied. Training geologists, geophysicists and hydrologists was taken up. The need for scientific surveys was adequately demonstrated resulting in States strengthening their geophysical wings and launching a scientific exploration process.

During the phase, 1981 to 1990 the "International Drinking Water and Sanitation Decade" was initiated to provide water to all. The Government of India launched a massive programme. To achieve this goal, many new generation rigs were needed. Looking at the success of UNICEF rigs and demand, the local manufacturers acted faster this time. They quickly started producing such types of rigs of improved quality. Thus, for the second time a transfer of modern technology in the water well drilling industry took place. Once again it will soon no longer be necessary for UNICEF to bring such rigs into the country.

The programme and the coverage in the country is so vast that UNICEF resources can easily vanish like a drop in the proverbial bucket. UNICEF believes that any project to be assisted must belong to the by now familiar conceptual category of "DEMONSTRATION" and "CATALYTIC". The UNICEF input would help establish a model for a much larger programme funded from the national budget or better endowed multilateral sources. In Indian Government with the support of UNICEF had succeeded in covering the majority of rural villages, but the areas which were inaccessible, where heavy equipment could not be taken due to hilly terrain or bad roads had remained unattended. People living in these areas were denied their right to clean water. Requests for lighter "tractor mounted" rigs were coming to UNICEF and realising the need UNICEF started exploring the possibility of procuring a rig which could be taken to such difficult areas. After a lot of thought and efforts HALCO once again offered the solution in the form of "Halco Tiger II". A light weight drilling rig mounted on a single short wheel base special carrier.

The carrier is a type of tractor, four wheel drive - four wheel steer. It can negotiate 25° gradient and can work under very arduous conditions. The drill module consists of a hydraulic power pack and a light mast with a pull/lifting capacity of 2650 Kgs, rotational torque of 250 KGM with 0-46 RPM variable rotation speed; a medium pressure compressor of 7/10 bar (100/150 psi) pressure - 435 cfm capacity; water/ foam injection pump with 20 lts./min flow at 200 psi pressure; welding set of 10-250 amp current to be used during odex drilling. The total weight of the rig is kept under 10 tons yet the rig has the capacity of drill 4"-5" diameter well to a depth of 140 metres (460 feet) and tackle collapsible overburden efficiently. The light weight of the unit with the special carrier allows it to be taken to very difficult acces areas, thereby giving it the name - ALL TERRAIN RIG.

UNICEF is importing four such rigs in 1987 at a total cost of $ 600,000. These rigs will be used initially in Bihar, Orissa, Madhya Pradesh and Uttar Pradesh. Depending on its success and the needs in other States, similar rigs are planned as UNICEF's future assistance. It is hoped that this type of rig will serve the areas yet uncovered and as is the experience, indigenous production will hopefully follow.

The supply of water and its use had long been well known to be critical to the health and welfare of children. In the past, UNICEF's preoccupation with this dimension of child health had been much more cautious and at a low key. A major change took place and UNICEF entered the world of water for this very specific reason: its impact on mothers and children. No one in the world wants to drink water that is dirty, but germs and worms too tiny to be seen are not self-evidently harmful to those who do not know that they are there. If the water from the well is clean, but the water pot is dirty, if hands are not washed, if food is not covered, if human ordure is not confined,

if village compounds are not swept, the water supply on its own will not transform the health of the children. The villagers might sing "Health is Wealth" but what good health truly consists of, and how it might best be provided to communities needs reappraisal. Community involvement and awareness building to the far-flung communities by all the agencies will be required to educate the end users. Some pioneer work in small-scale rural drinking water is undertaken by various voluntary and missionary organisations too, but such organisations do not have the resources for anything other than the micro-scale enterprise. The final results can be achieved by the people and its government. This aspect has greatly been proved in India. Many thousands, perhaps millions of borewells have already been drilled in the country but the main credit must go to the hydrogeologists, the engineers and drillers, without their hard work there would be no new sources of drinking water.

When UNICEF first began to become deeply involved in water, the most important task was the development of a low cost technological response to the drinking water problem. Today the latest buzz word is "appropriate" - "appropriate technologies". To manage the ground water resources in the country, the Government of India has now launched a pilot project under a technology mission in 10 districts in selected States for complete water management. This is indeed a vital phase for the nation.

UNICEF on its part will continue to support the programme in every possible manner. Nevertheless, emphasis will be on new uncovered areas and software, viz. awareness building and capacity building. Let us hope that we achieve the goal of providing safe drinking water to all by the year 1990.

INDIA AND INDIA MARK-II HANDPUMPS

T.KANAGARAJAN*

INTRODUCTION

Handpumps! These are not recent developments as some people think. Handpumps have been available for many years. In the Western world, they were common 100 years ago. At a certain period piped water supplies relegated the handpump to a comparatively less important position. During the severe drought in late sixties, UNICEF helped in air freighting fast drilling rigs and demonstrated to the Government that drilled borewell fitted with handpump is a fast viable dependable and low cost solution to tackle the drinking water problem. The piped water supply schemes originally designed for urban areas and adapted for village application were found to be comparatively too expensive to construct, operate and maintain on a nation-wide basis. Therefore, more and more developing countries have started implementing rural water programmes through drilled borewells fitted with handpumps.

HISTORY OF DEEP BOREWELL HANDPUMP

During the late sixties, we copied the 'Dempster' pump used in single families and farms in western countries 100 years ago and installed over deep borewells in Indian villages. These pumps could not serve the communities.

Hence, a slightly improved version of the Dempster cast iron pump called 'Double Guide' pump with few improvements was installed. This also failed frequently due to poor design, sub-standard materials, too many fast wearing parts in the top-end mechanism and poor fixing arrangement. These rendered maintenance impossible.

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Meanwhile, certain voluntary agencies like Sholapur Well Service, based in Maharashtra State had developed Sholapur pumps. Then 'Jalna' pump with little modifications over Sholapur pump was developed in Jalna.

Later the top end mechanism of the cast iron pump was replaced with a Sholapur 'Conversion Head' having a handle pivot with bearings and a chain linkage system. This concept of pivotal system was the backbone for India Mark-II handpump development. Meanwhile, Vadala Pump, Bangalore pump, etc., were also used.

AN IDEAL HANDPUMP

The ideal handpump, if not beyond reach, remained to be designed and manufactured so as to meet a number of requirements such as being very sturdy and wear-resistant with a small number of moving parts; adapted to local climatic and other environmental conditions and to the cultural habits of the population; corrosion resistant; capable of operating at reasonable depths (50 m); able to operate for atleast one year without major maintenance or overhaul and possible to manufacture in the country of use; lesser maintenance cost; simple enough to be serviced by unskilled personnel; may be pulled out and taken down using simple tools by villagers.

DEVELOPMENT OF INDIA MARK-II

During 1972, a survey on handpumps conducted in several Indian states revealed a very poor state of affairs , i.e. 75% of the pumps were not functioning at any given time. This posed a great challenge to the designers planners and programme implementators. Based on the result of the survey and on the request of the Prime Minister of India, UNICEF, in coordination with various voluntary agencies based in Maharashtra, tested an improved version of Sholapur pump, with an additional component water tank in Singhbum district of Bihar during 1975. This was the beginning of India Mark-II handpump development.

The outcome of this exercise encouraged UNICEF to extend the testing. UNICEF got manufactured twelve pre-production pumps through M/s Richardson & Cruddas (A Government of India Undertaking) based in Madras, installed in Coimbatore district of Tamilnadu during early 1976 through Tamilnadu Water Supply & Drainage Board. MERADO (CSIR Unit) an agency based in Madras helped in carrying out chemical analysis and tests of pump components. With continuous field testing, feedback and research by mid 1977, a sturdy deepwell handpump was developed which is now known as "India Mark-II". This went into production during end 1977.

ADVANTAGES OF INDIA MARK-II PUMP

The advantages of the pump are:

1. A pedestal that can be grouted into the concrete platform, independent of casing pipe which acts as sanitary seal to prevent percolation of stagnant water into the borewell.

2 The pump handle has a mechanical advantage of 1:8 fabricated with 32mm sq. mild steel bar which facilitates easy operation.

3. The pivot point of the handle has two grease packed ball bearings locked into place by the axle pin.

4. There is no fast wearing part in the pump and maintenance is viable/manageable.

5. With provision of sufficient threads to recognised standard and lock nuts, the connecting rods do not fail in operations for many years.

6. With improved brass lined cast iron cylinder, failures in cylinder are minimised and works for more than two years.

7. The components are standardised which facilitates interchangability.

INTRODUCTION OF MARK-II IN THE FIELD

UNICEF began procuring India Mark-II pumps for rejuvenating the existing borewells with broken down pumps. The purpose was to convince the State Governments that the India Mark-II was a better handpump and that by standardising one pump (firstly through rejuvenation, secondly installing on all new borewells) it would be possible to build up systems for maintenance of these handpumps.

Demand for mass production of the India Mark-II and the need to standardise on design resulted in bringing up 48 qualified manufacturers in India with an annual production capacity of 1,50,000 India Mark-II pumps to match the country's demand. This has facilitated "inter-changeability" of the pump components and thereby created a "manageable maintenance".

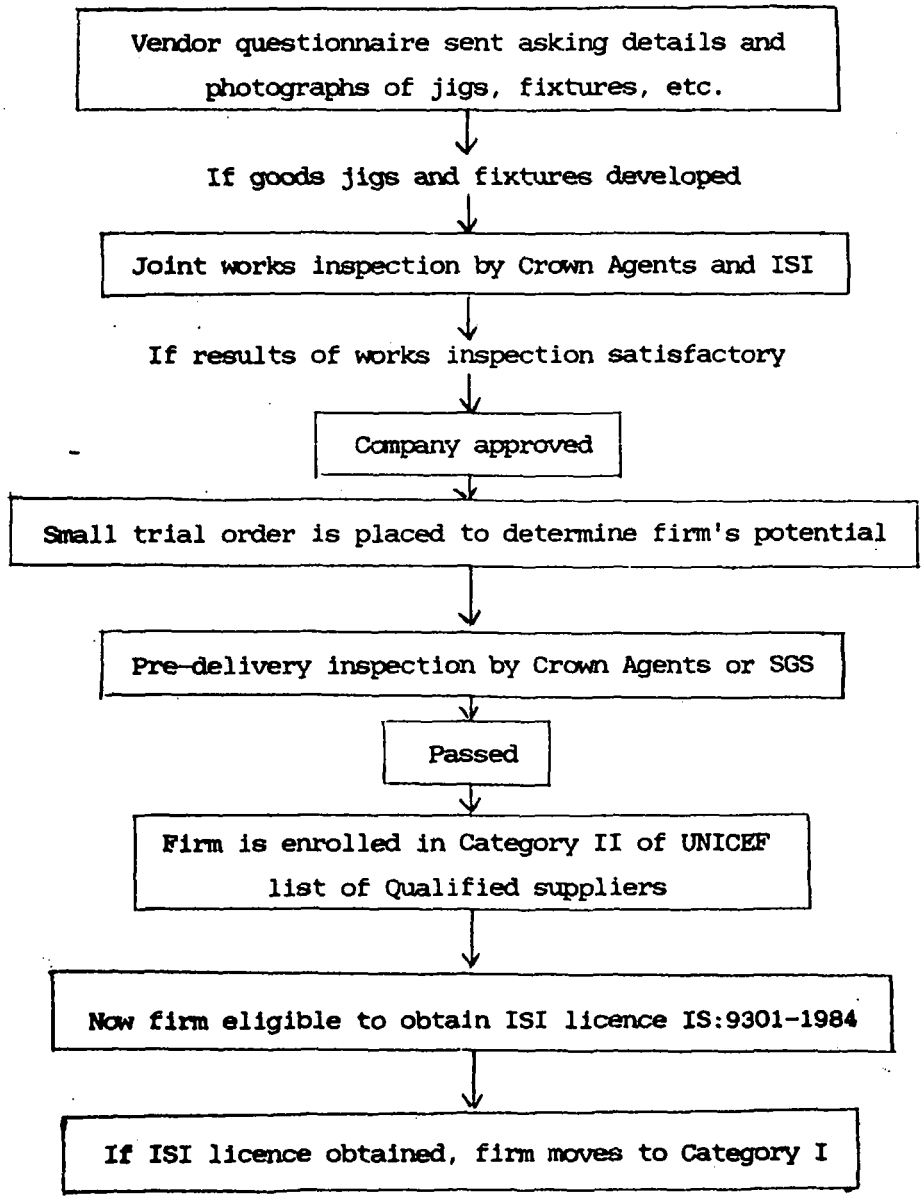
Indian Standards Institution (ISI) has accepted the design as the only deepwell pump - the India Mark-II, first in 1979 as IS 9301-1979 and then with improvements in 1984 as IS 9301-1984. All the State Governments procure India Mark-II pumps only from qualified suppliers with ISI mark and pre-delivery inspections by independent agencies like Crown Agents or SGS. Thus, we believe the "India Mark-II" has become the only "National Deepwell Handpump" in the world! These pumps designed, developed and produced in India are presently exported to 32 countries.

UNICEF INVOLVEMENT IN QUALITY CONTROL

In order to approve a new supplier to manufacture India Mark-II pumps and spare parts, a certain procedure is established and followed in the country.

The procedure to qualify a company to manufacture India Mark-II handpumps

New Supplier nor encouraged
(due excess in country capacity)



Presently Andhra Pradesh has 1,28,000 deepwell handpumps and all are India Mark-II. Karnataka has 1,05,000 Mark-IIs, Tamilnadu 68,000 Mark-IIs. Orissa 65,000 Mark-IIs. There are now over 10,00,000 India Mark-II pumps in India. The Rural Water Supply programme in our country in all aspects is the biggest in the world.

IMPORTANT ASPECTS OF HANDPUMP PROGRAMME

The Handpump programme must not be looked upon in isolation, as people often suppose. It should instead, be looked upon in totality,

- quality of pump.
- quality of installation.
- quality of maintenance.
- training to the people involved in the above aspects
- and most important of all.
- community participation.

PROGRAMME NEEDS

In our experience, the basic major six M's required for the success of Handpump Programme are:

Money
Management
Man Power (skilled, trained)
Mobility (for the teams/mechanics)
Materials (spares, standard & special tools and accessories)
Maintenance (Both 'preventive' and 'curative')

HANDPUMP INSTALLATION

The pump pedestal is designed to be installed independent of borewell casing pipe in concrete platform. Many pumps are installed properly, but still over 9000 Mark-II pumps in Andhra Pradesh need complete platform, drain and footstand, as per the design and in certain districts, even the new installations are done with only a small concrete pit, but without platform, drain, etc. While the drinking water problem

is being solved, an insanitary condition is created by not providing arrangements for disposal of excess water from the pump. It is high time that soakage pits are provided at the pump sites while installing the pump.

HANDPUMP MAINTENANCE

Maintenance of these created assets is the most important aspect for the long term success of Rural Drinking Water Programme.

People think 'maintenance' means repairing the pump only after it is broken down. Even a quality India Mark-II pump installed properly can fail, if it is not maintained periodically - both through 'preventive and curative'. In the National Conference conducted during July 1979 in Tamilnadu, in which representatives of the State Governments, Government of India and UNICEF participated, a "Three-Tier Handpump Maintenance System" was recommended. Though many states talked about having such a system, it is not fully implemented so far, anywhere in the country. During the course of the past 7 years, the programme has assumed greater proportions. Andhra Pradesh has established the First Tier of the Two-Tier System so far in atleast six districts. It is a proven system and therefore Government of Andhra Pradesh should implement the First Tier fully in all the districts of Andhra Pradesh and simultaneously the Second Tier.

SURVEY ON INDIA MARK-II HANDPUMP BY OPERATIONS RESEARCH GROUP

UNICEF assigned Operations Research Group (ORG) to carry out a survey on the installation, maintenance and functioning of India Mark-II handpumps. They carried out the survey during July to December 1985 in some selected districts of the states of Bihar, Uttar Pradesh, Rajasthan, Andhra Pradesh, Tamilnadu and Madhya Pradesh. Totally 4840 handpumps were surveyed in 154 villages spread over 18 districts in six states. The overall picture is encouraging, i.e. 80% of the pumps were found to be in working condition. This is a clear dramatic reversal of the situation that existed in 1972, when 75% of the handpumps were noted to be out of order.

On the positive side:

- 80% of the pumps were in working order.
- 80% pumps had firm pedestals.
- 84% pumps had platforms constructed.
- 92% pumps were with platforms and drains.
- 90-92% pumps were accepted as the source for drinking and cooking purposes.

On the negative side:

- 16% pumps were installed without a platform.
- 20-26% pumps without drains.
- Accumultion of water was around 69% of the pump sites.
- Community participation was lacking.
- 72% of reported failures were unattended for more than one month.
- 28% could not be repaired due to the absence of spare parts or special tools.
- The mobility for the teams and mechanics is lacking.
- Preventive maintenance did not exist anywhere despite the presence of handpump mechanics.
- Adequate quality tools and spare parts are not supplied.
- Though the caretakers had reported the failures, these were not attended to because sufficient number of teams and block mechanics were not available.

From the above analysis, you will appreciate that the maintenance systems, both 'preventive' and 'curative' should be geared up with the provision of basic facilities.

UNICEF ASSISTANCE UNDER HANDPUMP PROGRAMME

UNICEF, under handpump rejuvenation has been assisting various state governments to replace the non-India Mark-II pumps with quality India Mark-II pumps. UNICEF also supplied standard tools, special tools, shutterings, pipe stands and over 105 trucks for the mobile handpump teams to go to the villages speedily and carry out faster, safer and quality installations.

Thus, in Karnataka alone over 17,000 non-India Mark-II handpumps and in India over 1,00,000 non-India Mark-II handpumps have been replaced with UNICEF donated India Mark-II during the past ten years.

Above all, with the regular in-field training organised by UNICEF for Water Department engineers and mechanics supported by triaining materials, handpump installations have been greatly improved.

UNICEF has been producing manuals, leaflets, stickers, display boards, training materials, posters, blow-ups to support and promote the Drinking Water Programme.

INDIA MARK-II HANDPUMP DEVELOPMENT

Through an on-going monitoring by UNICEF field staff and feedback from state government personnel, weaknesses and shortcomings in the India Mark-II design are discovered and proposed improvements field tested and then incorporated into the IS specifications; the first revision of IS:9301 appeared in 1982 and incorporated the following improvements:

- Water tank gussets
- Thicker front cover
- Larger drain.
- Longer plunger rod 300 to 450mm.
- Hot dipped galvanizing of all above-ground assemblies.

The second revision was published in 1984 which contains the following further improvements:

- Stainless steel axle.
- Solid handle stop gussets.
- Larger diameter spout 40mm dia.
- Connecting rods with hex couplers at each end.
- Revised configuration for pedestal legs.

These changes are either to make the India Mark-II more durable, easier to install, and easier to maintain. Field monitoring also points

out areas in the manufacturing process which must be more closely checked during pre-delivery inspections at the factories.

MAINTENANCE BY VILLAGERS

The India Mark-II handpump has gained the confidence of millions of villagers and given them hope for a continuous supply of safe drinking water. If this is to become a long-term solution and all the benefits of safe drinking water are to accrue, then a higher density of handpumps will be needed along with other basic services, and villagers themselves will have to take on an increasing responsibility towards maintenance of the handpumps.

VILLAGE LEVEL OPERATION AND MAINTENANCE

UNICEF, in coordination with the World Bank, Tamilnadu Water Supply and Drainage Board and other agencies is testing the India Mark-II handpump with modifications and light below-ground components to develop it into a "VLOM pump" - village level operation and maintenance - to facilitate major repairs by the villagers themselves. But as long as the Rural Water Supply Programme is implemented, the involvement of Government Water Depart is a MUST.

INDIA MARK-II FAMILY

There is no end for development of any equipment. Therefore, based on the field experience and feedback, developments are taking place for India Mark-II handpump. The purpose of further development is to make it (i) still reliable and (ii) easily servicable. Our aim is to put into the field a pump which will make village level maintenance possible.

Based on the problems faced, attempts are made to develop a "Family of India Mark-IIs".

1. Extra Deepwell India Mark-II handpump.
2. Modified India Mark-II handpump.
3. Village level operation and maintenance India Mark-II handpump(VLOM India Mark-II).
4. Shallow well India Mark-II handpump.

5. Tools and equipments belonging to the India Mark-II family are:-

(i) Special tools.

(ii) Platform shutterings.

(iii) Pipe stands.

(iv) Fishing tools.

(v) Double Ended M17 x M19 spanners.

6. Software components of the family are:-

India Mark-II pump installation and maintenance manual, handpump caretakers hand book, master flip chart, guide to flip chart, text for flip chart, water is life - handout and other training materials for engineers, mechanics, Industrial Training Institute Instructors and other trainers.

1. Extra Deepwell Handpump

In areas where the static water table is very deep, standard India Mark-II pump is hard to operate beyond 140'. Therefore, the India Mark-II pump called Extra Deepwell pump is developed with counterweight, stainless steel connecting rod, 3 leather buckets, heavy duty bearings, 40mm square bar handle, 8mm flanges for pedestal, water tank and head. These are exported to Nigeria where the static water table is very deep. Currently some of the cost and inter-changeability factors are being sorted out so that these are introduced in selected needy areas in our country.

NOTE: It is also proposed to have smaller diameter cylinder/piston. This would be suitable even for the borewells having lesser yield and deeper static water levels.

2. Modified India Mark-II Handpump

(i) Head Assembly

An additional flange between the water tank and head assembly. This is to facilitate chain disconnection from the handle and allow chain to pass through an opening on the base of the head flange, the connecting rod being retained by a normal rod clamp installed on the extra flange.

The head assembly with handle can be removed and installed as one piece avoiding the need to disturb the factory assembled pivot mechanism.

(ii) Increased stroke length from 100mm to 127mm.

(iii) Increased handle bracket opening in the head from 100mm to 127mm. The longer stroke length will reduce the amount of hammering on the bottom handle top. This will increase the discharge and provide a wide range of user height and use of small strokes.

(iv) Handle assembly to have 60mm square bearing housing with bearing seatings internally ground. This is to reduce distortion due to welding of circular housing.

(v) The overall height of the head has been increased by 10mm to allow for the increased stroke length, i.e. the increased movement of the handle to avoid the possibility of striking the inspection cover bolt.

Water tank assembly

Height of water tank assembly to be increased by 25mm. This is to facilitate more storage of water and less likelihood of flooding the head, thereby reducing chain wetting.

Stand assembly

Height to be reduced by 75mm. This is to reduce still further the probability of hammering the bottom handle stop.

Cylinder assembly

(i) Nitrile rubber cup buckets. The performance is encouraging.

(ii) Two piece upper valve guide. This is to eliminate disconnection which is the cause of a small percentage of failures on the standard pump.

3. Village Level Operation and Maintenance

India Mark-II pump

The VLOm pump will conform to IS 9301-1984 in all respects except the following:

(a) Head assembly

(i) Pump head base to have 75mm dia hole instead of guide bush.

(ii) Handle bracket opening 127mm.

(iii) Additional flange similar between the head flange and water tank assembly.

(iv) Handle assembly to have 60mm square bearing housing with bearing seatings internally ground.

(b) Water tank assembly

(i) 2 1/2" nominal bore seamless coupler instead of 1 1/4" N.B. coupler.

(ii) Height of water tank assembly to be increased by 25mm.

(c) Stand assembly

(i) Height to be reduced by 75mm.

(d) Cylinder assembly

(i) Top cylinder cap to suit 2 1/2" N.B. riser pipe.

(ii) Bottom cap to have conical housing to receive pick up check valve. Other end thread to suit 2 1/2" N.B.

(iii) Nitrile rubber cup buckets.

(iv) Extended follower with threads to pick up check valve.

(v) Two piece upper valve guide.

(vi) Check valve assembly with two piece valve.

The VLOM pump will facilitate removal of piston without the need to remove the pipes and cylinder. Only the head assembly has to be removed, that too very easily. The piston connecting rod assembly can be pulled out from the watet tank coupling. This would mean lesser persons, tools, time and efforts. This would require revised training to villagers to carry out the maintenance by themselves with less tools, i.e. instead of training one, two persons could be trained.

4. Shallow well India Mark-II pump

The modification of the India Mark-II for shallow well application where the water table is within 15 metres of the ground surface.

Modified India Mark-II pumps with larger diameter cylinders set at shallow depths are being field tested with the intent of eventually standardising a design for inclusion in the ISI specifications.

5. Platform

An addition to the pump, the pump platform is also being modified.

(i) Bigger footstand to make it convenient to stand and operate the handle. The footstand size will be increased from 60cms square to 100cms square.

(ii) The centre of the platform would be the water tank spout instead of the pedestal. This is to reduce/avoid splashing of water outside the platform.

6. Tools and Equipments

Efforts are now on towards developing further standard and special tools with respect to the 'improved India Mark-II pump' and 'VLOM India Mark-II pump' so that a package approach to the pump, tools, equipments and training material would be developed simultaneously. It should be remembered that there is no merit in change for the sake of change. With India Mark-II, a single change means that:

(a) The jigs and fixtures at 48 manufacturers must be altered.

(b) Inter-changeability between new and old pumps might be affected as a result. Therefore any modification should be only incorporated if it:

  (i) does not affect inter-changeability of parts.

  (ii) increases the life of the pump.

  (iii) reduces the maintenance cost.

You will be glad to know that these two types of pumps modified and VLOM India Mark-II are going to be tested in Rangareddy district of Andhra Pradesh, West Bengal and Maharashtra during the current year. We hope one day we will come out with VLOM India Mark-II pump which will be a break-through in the Rural Water Supply Programme in India and in the world.

CONCLUSION

The Andhra Pradesh Panchayati Raj Engineering Department engineers, hydrogeologists, drilling crews, handpump mechanics, teams deserve great appreciation for implementing one of the biggest Rural Drinking Water Programmes in the country.

The India Mark-II pump has infused confidence in the minds of the villagers that this "petti pumpu" - box pump - as it is affectionately called by rural Andhras - ensures a continuous supply of safe drinking water. Thus, India Mark-II handpump has truly become the focal point for health improvement, the possibility of year-round safe drinking water to the rural areas. The excitement generated by a new borewell with India Mark-II handpump should be more systematically capitalised upon to help spread the Health messages. India Mark-II pump has played a vital role in providing safe drinking water especially during the International Drinking Water Supply and Sanitaton Decade (1981-1990) perhaps to provide "HEALTH FOR ALL" by 2000 A.D.

OPEN SESSIONS - I & II

RURAL WATER SUPPLY SYSTEMS IN SOUTH-EAST ASIAN COUNTRIES

C.N. SURESH*

I had been to a few South-East Asian countries during May, 1986 on World Health Organisation Fellow-ship nominated by Government of India. Along with me there were another 6 Engineers from others States. We went in a group the field of study was Rural Water Supply Systems.

I now present my observation in brief in South Korea as under.

SOUTH KOREA: The population of Republic of Korea is 41,209,000 as of 1985 while the Rural population is 12,745,000 (about 30% total population).

Administrative Sub-Division:

Under the jurisdiction of Central Government there are four special cities and 9 DO's. Do is equivalent to a province, and under its own jurisdiction there are a number of cities and 10 to 12 Guns. A Gun is equivalent to a country, and under its own jurisdiction there are usually one Eup, town-ship, and about 10 Myons. A Myon is finally composed of a substantial number of Ri which is a village or small community.

A city under the jurisdiction of Do is 50,000 or more in populationo size and Eup under Gun 20,000 or more.

Responsibility of Water Supply in Korea is divided primarily between two minitries i.e. the Ministry of Health & Social Affairs (MOHSA) and the Ministry of Construction (MOC). MOHSA looks after Rural Water Supply and MOC takes care of Urban Water Supply.

Water supply by different categories (Population in 1000) as of 1985.

A. TOTAL SUPPLY:

Total population 41,209 (100%)

Covered by Urban Water Works - 64%

Covered by Public Wells and Hand pumps - 20%

Covered by SPWS - 16%

* Deputy Chief Engineer, RWS, Hyderabad.

B. SUPPLY OF RURAL AREA:

Total Rural population 12,145 (100%)

67-85 covered by SPWS-53%

Covered by Public wells & Hand pumps - 45%

86-87 covered by SPWS - 2%

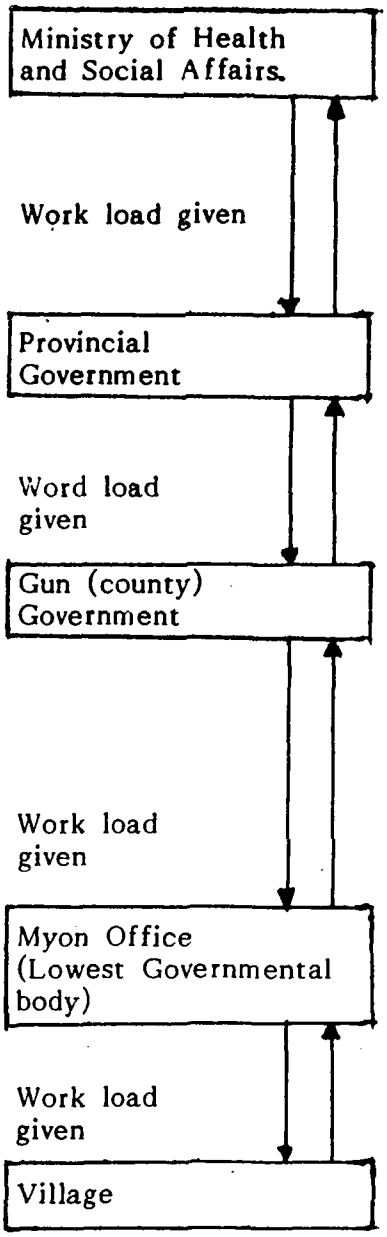
Villages provided with SPWS by 1986 are 34,651 covering a population of 6.896 million (55%). Most of the schemes rely on ground water from wells or springs.

Since the rural water systems are installed and operated as "self-help" project, no formal system of charges for rural systems has been established. The villagers are given the freedom to institute their own financial arrangements. Approximately 50% of the village collect a nominal sum on a regular monthly or bimonthly basis inteded to cover operating expenses and in some cases to build up a small reserve. Approximately 25% of the villages collect charges on an "as-needed" bases, either to pay electric bills for pump operation or for emergency system repairs or breakdown. In general, regular and orderly water charges are collected only those villages using electricity in the supply of water. Village with 100% natural gravity systems rarely improse water charges.

Village water systems are operated under the supervision of a village water supply management committee. Day to day operation is provided usually by the village leader or a designated village citizen. Only larger villages hire a full time operator.

In Korea rural village electification project was completed in 1978. Almost every household had electricity in every village in rural areas.

Administrative Set-up for the Implementation of Programme



1. Planning
2. Budgeting
3. Engineering Directory
4. Evaluation

Reporting

1. Planning in local level
2. Reallocation of budget (or material)
3. Engineering supervision in in local level.
4. Evaluation at local level.

Reporting

1. Site Selection(county level)
2. Break down of Budget or material. to Myon office.
3. Preparation & approval of Design.
4. Water Sampling.

Reporting

1. Site supervision & final inspection.

1. Site selection (Village level)
2. Break down of Budget or material to villages)
3. End-use accounting.

Reporting

1. Expression of wishes to have a priority.
2. Site construction except skilled works.
3. End-use accounting & Reporting to Myon office.
4. Other cooperative works with Myon office.

DESIGN AND CONSTRUCTION

Designs

Three major types of simple piped water supply system have so far been applied and will contineu to be applied. They are namely 1) gravity-fed system, 2) pumping system and 3) pressurized tank system. Most of the systems whidh have so far been conducted with simple and sand filter and chlorination. MOHSA has prepared and distributed guidelines and filed manuals on these designs, constructions and maintenances.

The gravity system exploits a hillsides spring or flow with sufficient water head. Being mountains country, Korea has many natural villages which are seated at the foot of a slope. A spring or smaller flow can be found in the hill or valley without much difficulty, though the quantity is frequently questionable. Water is stored in an intermediate storage tank and then allowed to flow through a main pipe downward to the village, where the pipe is connected to individual households.

In the pumping system water is elevated from a well by an electricity driven motor pump to a storage tank located in hillside or hilltop. The tank, mostly cast-in-place concrete structure, is covered by earth for protection. There water flows downward to the village by gravity.

The pressurized system is applied in flat area. There a pump equipped with pneumatic pressure provides adequate head for distribution. The water source is usually a ground well.

CONSTRUCTION

After the completion of design and project approval by Gun Government. Gun issues necessary cash or material through Myon office to the village. The necessary are such as PVC pipes, fittings, motors and pumps, electrical fittings, cement, steel bars and chlorinators.

Labour requirement for the construction is voluntarily contributed by the villagers. The voluntary participations are largely due to their own necessary or desire for modern convenience. The requirement for skilled labour, e.g., plumber and electrician, is sought and filled from nearby town by the expenses of the villagers.

The average cost of such simple piped water supply system is US $ 6,378 in 1980 (material costs only). Of the total construction cost, about 70% is furnished by the Government in the form of cash or materials. 30% by the villagers in the form of cash and villagers

provide unpaid labour. Villagers provide unpaid labour. The average construction cost per capita is around US $ 28 (labour costs are excluded). Villagers unpaid cost is estimated around US $ 3,180.

The construction usually lasts two to three months. Gun government and civil engineer stationed in Myon office provide technical supervision during and this period, on completion, conduct final inspection. The villager then takes over the starts operation and maintenance of the system.

OPERATIONAL AND MAINTENANCE

Although the Gun sanitation section provides guiding assistance to them, the operation and maintenance of a completed system is entirely left to the hands of villagers. Before taking over it villagers are exepcted to have organized a committee which will direct the management, operation and maintenance of the system. In any essence, the committee is expected to collect tariff which adequately cover the cost of operation and maintenance. Typical charges very from 500 won to 1,500 won per household per month depending on the type of system (gravity or pumping). The function of committee is: 1) maintenance of facilities include chlorination, 2) water sampling in cooperation with the Health center and sanitations in Gun Government, 3) Collection of maintenance fee, 4) keeping of necessary records and 5) reporting to the concerned authorities in case of the outbreak of waterborn diseases or similar emergency.

Although operational responsibility for implementation of the programme was assigned to provincial and local authorities, insitituions, guideline and technical support were provided by the project sraff. who were situated in MOHSA, Seoul. Initially, the project staff actively participated in such field activities as site selection, water source development,system design, construction supervision, and system operation and maintenance.

Standardized design manuals were prepared, and by 1976 the programme was firmly rooted. Each local (Gun) office had so much experience that routine project staff (Seoul office) involvement in field activities were reduced to periodic inspections or special advisory missions when so requested for unique local problems.

PHILIPPINES

There are 39107 Banangays (Villages) in Phillippines upto 79 only 33% of the rural house holds were served as follows.

1. Piped system - 8%
2. Artisan Wells - 14%
3. Springs - 11%

The rest of the 76% were unserved. Realising the importance of water supply and keeping in view of the poor achievements a RURAL WATER WORKS DEVELOPMENT CORPORATION was created in 1980 organisation chart.

There are three types of water supply systems in this country. They are :

1. Level I : Point source - A well or spring serving about 50 houses holds, where they are scattered.
2. Level II : Communal Fan set - A system composed of a source, pipe distribution net work and a fancet for every 4-6 house holds serving 100-150 houses.
3. Level III : Individual connection - A system composed of a source, pipe distribution net work and atleast a fancet in every house hold serving 250-600 house hold.

Training ; Project Tubig

Under a program called Project TUBIG (Training Utilisation to Boost Institutional Growth) started midway 1983, RWDC subsidizes standard educational programs in the provincial, municiapl and barangay levels, Project TUBIG has got both training and information components. The strategy is that trainors trained in the provincial level are to re-echo knowledge and skills gained from such learnings to the lower ladders - the municipalities and barangays. Necessary expenses arising from the conduct of the activities are shouldered by the Corporation coming out from a grant by the UNICEF. As an additional incentive, the Corporation also gives out tools and equipment for repair maintenance of water supply projects survey instruments and spare parts for jermatic pumps to participating provinces and municipalities.

REMARKS AND RECOMMENDATIONS:

1. We may insist 10% contribution from the users of Borewells as is being done in Philippines.

2. Similarly the element of contribution for all the P.W.S. schemes taken up either under MNP funds or ARWS funds may be fixed at a certain percentage of estimate cost irrespective of the income of the Gram Panchayat.

3. Training programmes in the Department Training Centre at Hyderabad for operation and maintenance of Borewells and PWS schemes may also be extended to the users who are really interested.

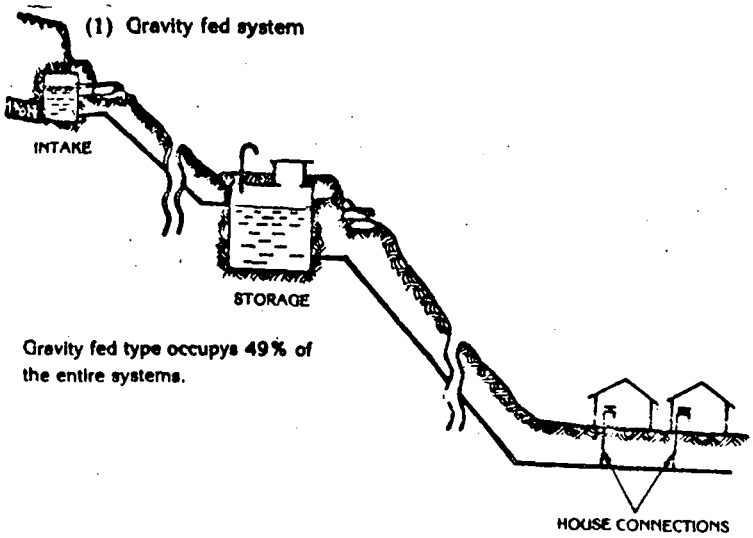
FUNDING SCHEME

Project	Government Share	Community share
Shallow wells Deep wells	90% Grant	10% local equity
Barangay Communal Faucet systems Poblacion systems	90% loan	10% local equity

NOTE: Local equity is either in cash or in kind (labour, materials etc.) Local terms, maximum of 4% interest per annum, 20 years repayment period.

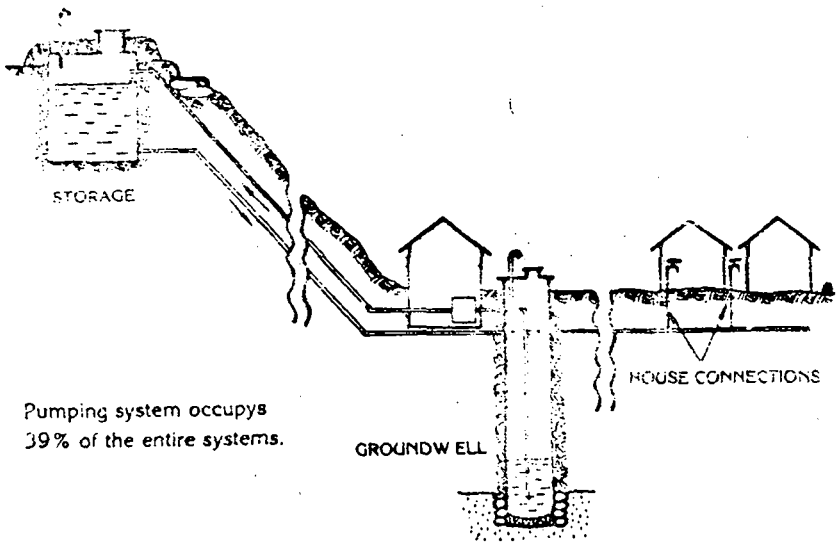
THE EXISTING SYSTEM CAN BE CATEGORIZED INTO THE FOLLOWING THREE (3) TYPES:

(1) Gravity fed system



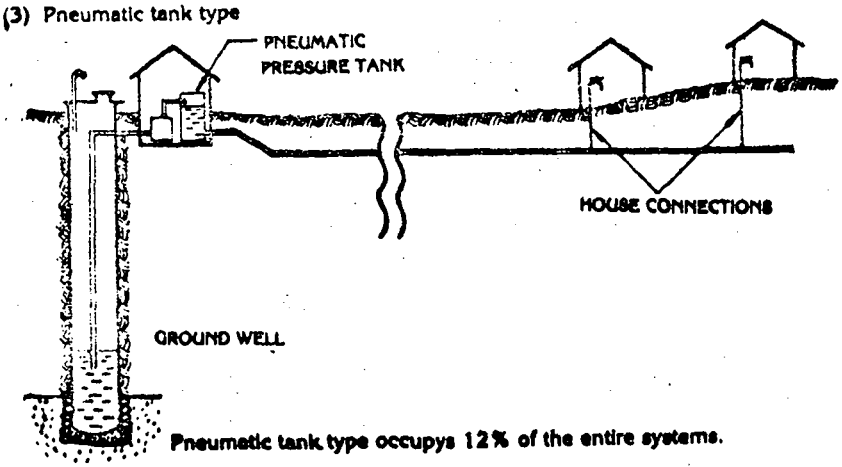
Gravity fed type occupys 49% of the entire systems.

(2) Pumping system



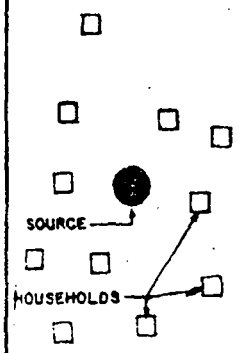
Pumping system occupys 39% of the entire systems.

(3) Pneumatic tank type



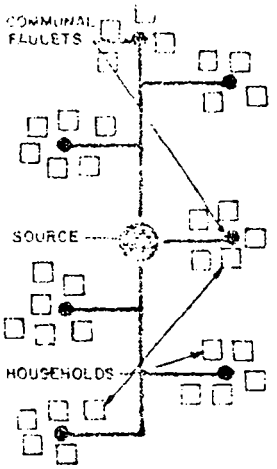
Pneumatic tank type occupys 12% of the entire systems.

Level I



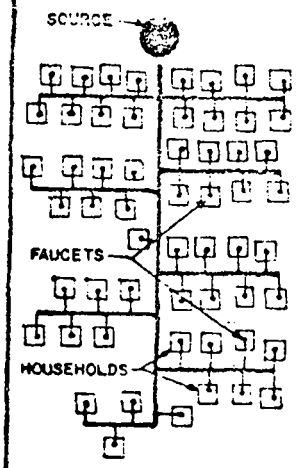
- Generally for rural areas where houses are scattered too thinly to justify a distridution system.
- 50 Households per system

Level II



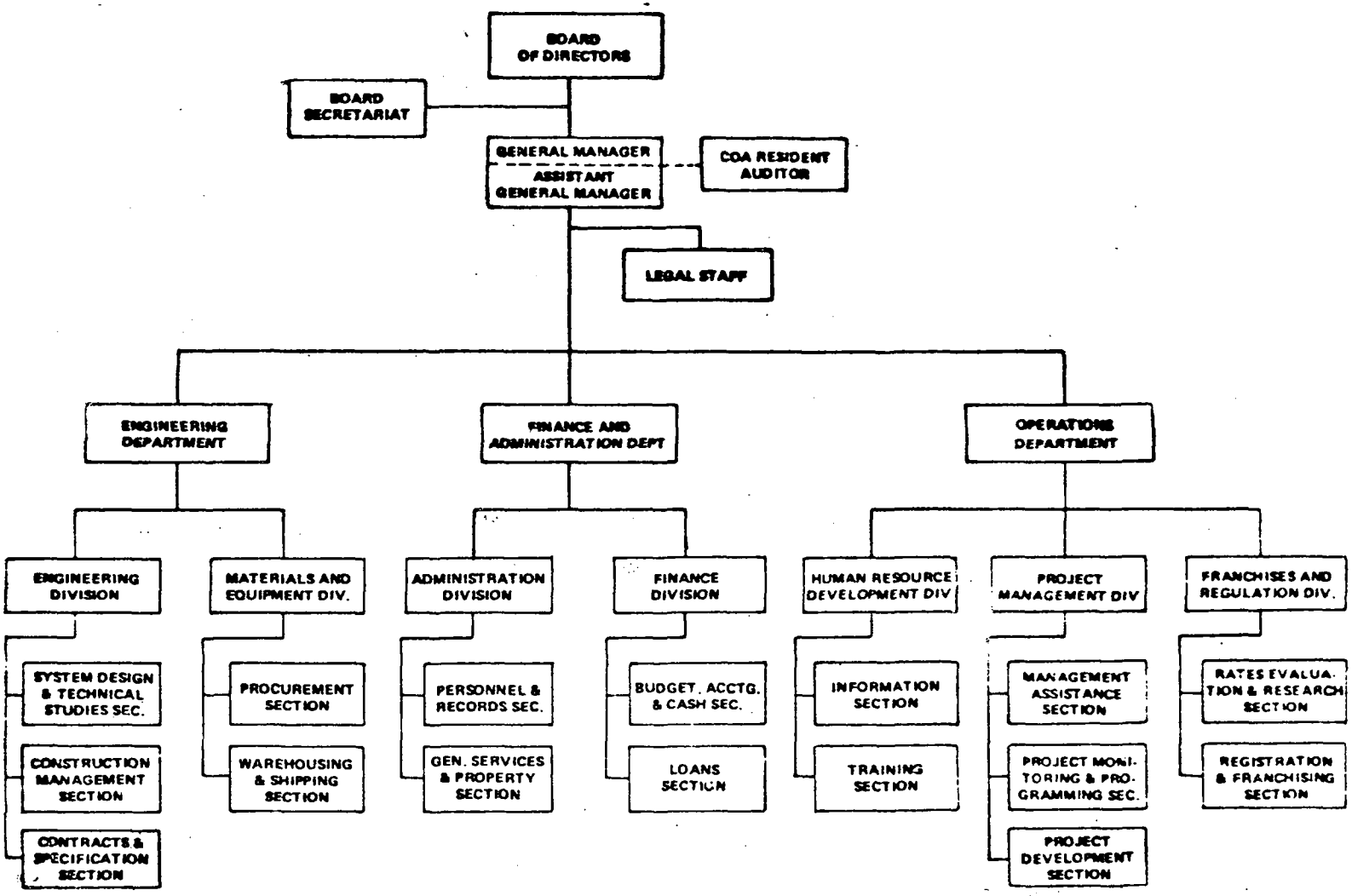
- Generally for rural areas where houses are clustered densely enough to justify a distribution system.
- 4-6 Households per faucet.
- 100 Households per system

Level III



- Generally for urban areas
- One or more faucets per Household
- 600 Households per system.

ORGANISATION CHART



SECTOR PLANNING & PROJECT APPRAISAL

G. KALYANI*
V. INDIRA*

SECTOR PLANNING :

Sector Planning is the stepping stone that links micro-planning and the subsequent Project Planning. Micro Plan specify, how much should be invested in the water supply and waste disposal sector over a period of time. But it is the Sector Plan that determines whether such investments are financially and economicall feasible. The Sector Plan determines which Geographical areas and population segments deserve priority. At the Project Planning stage, the individual projects are identified, investigated, and designed.

Planning is carried out in six steps :-

(1) Step-1 : Assess present service levels for both water supply and sanitation.

(2) Step-2 : Set service level targets.

(3) Step-3 : Calculate what resources are required to meet these targets.

(4) Step-4 : Identify constraints by comparing required resources to those available.

(5) Step-5 : Identify solutions to remove constraints.

(6) Step-6 : Set investment priorities and pre-identify projects.

Assessing present service levels :

Service levels comprise quantitative as well as qualitative aspects. The mere presence of a water supply system does not automatically mean that the population's need for satisfactory service is being met. The quality of that water must also be satisfactory. Otherwise, the population's health may suffer more than it would in the absence of a piped system. And if a water supply system is constructed with no attention to the safe disposal of waste water, the health situation may become worse than before.

*Dy. Executive Engineers, Panchayati Raj, O/o. The Chief Engineer, R.W.S., Hyderabad.

Set-up service level targets :

Targets should specify what the sector is expected to achieve by a certain year. Targets should not be fixed too low in a desire to be realistic, but rather should be ambitious enough to promote more vigorous sector development and to encourage sector institutions to take action. Service level targets should be specific, measurable, and achievable.

Resources required to meet these targets :

Analyze the financial, manpower and institutional requirements needed to meet the targets. These three requirements should consider the investments, operations and maintenance also. Operations and maintenance are, in fact, put as much a development tool as investments. There is no point in building new hopsitals if there is not enough medicine and food for the patients. We shoiuld compare what is required to what is available according to future development plans. We compare our requirements for the future with funding levels of past years. Such comparisons might identify a limited absorptive capacity in the sector, if actual investment volumes have consistantly fallen short of budgeted amounts.

In any event, we can begin to determine whether it is reasonable to expect that we will receive the financial resources we have calculated we would need. If we determine that financial requirements will be greater than projected available resources a financial constraint is likely, and then we switch on to solutions to require constraints.

Let us look at some alternative solutions that could be combined to over come financial constraints. Normally, the optimum investment mix can only be determined through a cost benefit analysis. However, since the benefits from water supply and sanitation system cannot be quantified with accuracy, a rigorous cost - benefit analysis becomes impracticable. Rather, one attempt to set reasonable service level that will spread scarce funds equitably over the entire populations needs.

Next we turn our attention to manpower feasibility. We need to determine whether we can meet our targets in light of the available number of staff with varying skills.

But in order to determine how much manpower we will need to meet future requirements, we must have a measures of what our water employees can now achieve, that is, a measure of their productivity.

Then compare what staff will be required in the target year

with what is available, and identify. Whether there are constraints in achieving this level staffing. Subsequently, this rough estimate can be referred to analyze the requirements and availability of different categories of staff.

One solution might be to execute training programmes to increase the productivity and skills of existing staff. Another solution might be to hire additional qualified staff.

Next comes to institutional feasibility. We begin by appraising existing institutional requirements in terms of the capacity to identify, prepare, appraise, implement, operate and maintain, evaluate and learn from projects. These elements make up what is known as the project cycle. After evaluating institutional strengths and weaknesses, it is possible to identify constraints in meeting targetted objectives. When constraints have been identified, it is necessary to then identify solutions for over coming them. This might mean stream-lining organizations or centralizing limited skilled staff. The institutional analysis described here is a function of the financial and manpower feasibility discussed earlier. that is,if you have financial constraints, you will probably not have goo institutions, since financial constraints often create weak institutions. Measures to overcome financial constraints will improve the quality of the institutions.

Like-wise, institutions may be weak because they lack skilled staff of sufficient numbers. Training programmes to overcome the manpower constraints will go a long way in improving the institutions.

Whether testing the financial, manpower or institutional feasibility of meeting targets, it is necessary to progress through the sequence of six planning steps that brings us to the final step of the process-setting investment priorities and identifying projects. Investment priorities should strike a balance between what is most needed and what is feasible.

Theoritically, there are two types of priorities to consider the first is area, specific in which are, should we invest. The second set of priorities should indicate what to invest in. These investment priorities might try to correct service level disparities or improve health conditions.

It is important in sector planning to consider all six steps described.

All in all, then, careful sector planning with attention to feasibility and action orientation will show us how to achieve the maximum impact with limited funding and meet the objectives of the Water Decade.

PROJECT APPRAISAL

Any project runs atleast four principle stages of activity namely-

1. *Identification*
2. *Preparation and formulation*
3. *Appraisal*
4. *Implementation and Management.*

The topic for this paper is project appraisal which is a third stage after which implementation os the project follows: What is project appraisal?

The Project appraisal consists of a comprehensive and systamatic review of all aspects of a project proposal.

Project appraisal should cover atleast the following seven aspects.

1. ***Technical*** *- This considers a variety of aspects including the capacity and reliability of the source and the adequacy of the civil engineering works to be constructed with respect to the population to be served through lifetime of the planned system.*

2. ***Financial and Economic Soundness*** *- Financial appraisal considers among other things the cost of the work to be done, the material to be supplied and operation and maintenance costs which is recurring expenditure. Economic appraisal is viewed as an attempt to establish the value of a project to its potential beneficiaries.*

3. ***Commercial*** *- How will the necessary inputs for the project be supplied and are the arrangements for the disposal of the produce (distribution of protected water in case of water supply system) are satisfactory.*

4. ***Financial or other incentive to project participants*** *- In Water supply project have all the participants namely the user, the project authority and the financier have financial gain or other benefits such as improved health etc.*

   This is necessary because the installation of water supply facility has the greatest potential for yielding health benefits in communities where illness and death from related deceased is high. Project appraisal should therefore consider the prevelant disease pattern in a community to ensure that communities with serious health problems are given priority attention and to ensure that the technical interventions are appropriate for combating the root causes of ill-health conditions.

5. **Economic and Social** - *This analysis would assign values to all benefits deriving from a project, for example better health, greater convenience, aesthetics and improved earnings capacity etc.*

6. ***Managerial*** *- Does the capacity exist for those who will be responsible for operating the project to do this satisfactorily and are they given sufficient power and scope to do what is required.*

7. ***Organisational*** *- Is the project organised internally and externally into units, contact points, institutions etc. so as to allow the proposals to be carried out properly and to allow for change as the project develops.*

There are to important factors involved in the appraisal.

1. ***Technical feasibility***

   a) *Forecasting the demand that the project must meet over its design period.*

   b) *Technical formulation of alternative schemes to meet the objectives and demand set for the project.*

   c) *Evaluation of the schemes to see that the project derives the objectives at least cost.*

2. ***Economic viability***

   For this the following factors are to be considered.

   Total present cost and the means of finance - After confirming the present cost and the means of financing the project, a further study to establish the viability has to be carried out. For this, the following techniques are applied.

   1. *Net present value*
   2. *Internal rate of return*
   3. *Cost benefit analysis.*

The project appraisal with reference to the water supply projects should take the following factors into consideration.

(i) The project has to be appraised from the angle of benefits to society.

(ii) The existing institutions are adequate to implement the project

and adequate training facilities are existing to train the staff to implement the projects.

(iii) Social/Political feasibility - The scheme must be acceptable to the values of the users and it must be distributive to the benefit of the population. The type of political support should certainly be appraised especially in rural areas so as to ascertain that the project will be executed without any interferences.

(iv) Environmental feasibility - It is possible that the installation of water supply facilities in a community may result in changed environmental conditions which are conducive to the breeding of insect vectors of disease. Project design, operation and maintenance of facilities can reduce this risk to negligible proportions.

(v) Health benefits - To determine whether there will be potential benefits to health, the proposed system should be appraised relative to the existing system in terms of the four indicators namely, Quantity, Convenience and Reliability.

Specific ill-health conditions should also be taken into account when conducting the appraisal.

For example, where schistosomiasis is a health problem, the new supply should provide a quantity and convenience that will discourage the use of traditional bathing and laundry places.

Improved convenience is a matter of imperative importance since it is probable that users will continue to use traditional sources that are more convenient than the withdrawal point of a new safe supply.

WATER SUPPLY SYSTEMS

J.V.Kanakalingeswara Rao*

Twenty one members participated in the WEDC water management course of 1985 at Loughborough University of technology, United Kingdom, The course was intended to show the members the water authorities like Seven Trent Water Authority, York-Shire Water Authority Tad Caster WPC works, Mono pumps of Monchestor, Treatment Plant at Glasgow, Water Research Centre for insitu cement mortor lining of pipes at Monchestor, Stanton starely pressure pipe factory for improved protection of ductile iron pipes, M/s William Halcrow Consultants, Swindon Wilts, Oxford for lectures, Kint Water Meter Factory, Thames Wat er Authority, Whale Tanker Builders, Stoneligh for cleaning septic tanks and sludge tanks, Leicustershire solor waste management, Leak detection institute at Durby, well logging and odex drilling, etc. All the lectures in the Loughborough University of Technology were followed by film shows and site inspections.

Water Authorities

All the water authorities are empowered to tackle the drinking water, industrial water, waste and pollution problems and the entire water problem including ground water. (1) The Water service will be around the clock(i.e.)24 hours. The difference in quantity between the intermittent supply and full time supply will not be more than 1.3 to 1.4 times. Hence the problem of storage and waste will not arise. The problem of suction of pollution through leakages also will not be there.

(2) All the water is ensured of best quality meant for potable standards.

(3) Even for Irrigation, the water Authorities are controlling authorities

(4) All the water let out (i.e.) Industrial Water or effluents should be treated properly to standards before letting into river. If there is any violation, the water authorities can penalise them. Hence the safety at the point of drawal before treatment is also maintained.

(5) All the drinking water is being tested at timely intervals at different stages by the water authority laboratories to ensure safety by adopting proper standards.

(6) Nobody can have their own source and tackle their water problem.

(7) Usage of proper water meters to charge according to consumption using saggugated tarrif including rural areas.

*Superintending Engineer,Panchayati Raj, Karimnagar.

(8) Nobody can let out the used water as per their will, except into Collection centres in a systematic way. Later they are being carried in plastic bags to avoid spillage of water. They are being dumped in low lying areas like quarry sites (aboundoned) to make level and use it as levelled site after some years of settling. This is being done in Leicestershire by levelling a ditch of 200' to 300' deep. Some times, a bore is also drilled into this levelled site to collect gas in cylinders which can be used for heating purposes. These solid waters are dumped and levelled by means of dumpers, earth movers and rollers without manual operation. Rest sites are used for park lands and adequate liners are provided to ensure leakage by percolation (either clay or plastic liners).

Slow sand filters and Conventional treatment

Even London City's 40% requirement is being met by slow sand filtration only. There will be problems like sand replacement; and algae growth due to sun rays. The problem with slow sand filters is (1)stand by filters are needed (2)Algae growth which can be avoided by prechlorination (3)more space. But we can ensure 99.9% safely. In Madras City also there are slow sand filters and sand cleaning machine instead of manual. These are still in use in addition to rapid gravity filtering. In rural water supply, the replacement of sand is to be educated as soon as the water head falls, as it is not being undertaken by the Panchayats properly.

CONCLUSION

(1) An integrated authority for proper water management is essential including pollution.

(2) In areas with Fluoride problems addition of Alum tablets with Sodium Aluminate as Catalyst, is the general solution.

(3) Energisation of hand pumps at a later stage.

(4) Forced effluent treatment and not allowing sewage to be letout.

(5) Sludge or septic tank cleaning by slurry treatment and by suction pumps to avoid manual lifting.

(6) Laboratory tests for filtered and served water at different stages.

(7) Economic studies using discount factors, amenity factor, Internal rate of return, present worth of benefit, benefit cost ratio, shadow exchange rate - For usage in world bank assisted schemes.

(8) Easy methods of testing chlorination of water served.

GUINEAWORM ERADICATION PROGRAMME

*E.K. SUBRAMANYAM, B.TECH.**

Introduction : Guineaworm disease is prevalent in many countries like Asia, Africa & South America. India is the first country in the world to undertake the programme. The disease causes considerable human sufferings to the poor community, mostly agriculturists in rural areas thus causing a considerable economic loss.

In India about 12.80 million people living in over 12000 villages of seven states are affected. In Andhra Pradesh about 1.20 million people of 6 districts were at risk due to guineaworm disease. The affected districts are Anantapur, Cuddapah, Kurnool, Mahaboob Nagar, West Godavari and Prakasam.

As per the reports of the Director of Health and Family Welfare, Hyderabad, 2384 cases are reported in 179 villages during the year 1985.

Transmission of Disease : The Guineaworm disease is caused by a thread like worm.

The actual germs that cause the disease are the millions of embryos discharged by the female adult worms. When a person with blister enters a step well or a tank or a pond for bringing drinking water or for washing or for bathing purposes, these little embryos find their way into the water. These are swallowed by tiny creatures called cyclopes, living in water. In the body of these cyclopse, the small embroyos grow into larvae.

When these infected cyclopes are swallowed along with water, the cyclopes get killed by gastric juice, setting free the guineaworm larvae which further grow in the human body.

From the time of drinking water containing infected cyclopes upto appearance of the adult guineaworm as a blister it takes about 10 to 14 months, usually one year. Cyclopes is the intermediate host for transmitting the guineaworm infection to man.

Epidemilogical features : The disease is entirely rural in its distribution. Areas with very low water table where ponds, tanks step wells form the Main drinking water sources are favourable for transmission of the disease. Epidemilogical features:-

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*Deputy Executive Engineer, (P.R.), Kurnool.

1. *It affects poor rural communities.*
2. *It is found in dry areas with lower water table.*
3. *The males are affected more frequently than females.*
4. *The disease is met with in all age groups except infants.*
5. *Multiple cases in a family may occur.*
6. *Summer months show the highest incidence of disease.*
7. *Man is the only reservoir of the disease.*

Factors favouring endemicity :

1. *Prevalence of guineaworm in a locality depends upon the presence of the vector and contamination of water supply.*

2. *The social customs of the inhabitants and insanitary conditions of the area determine the extent of disease transmission.*

The disease is generally confined to areas with low rainfall.

Economic effects of guineaworm disease : This is a disease exclusively of the rural poor and the maximum incidence is seen during the summer months, which is the season of intensive agricultural activity. Guineaworm affects mostly adult men. Thus it clearly presents a direct link between ill-health and inpaired agricultural activity.

On the basis of available data though limited in nature, rough estimate has been made of economic loss due to guineaworm. Total man days lost annually on account of this disease in economically productive population at the rate of 40 days per year is about 6.0 lakh mandays in Andhra Pradesh State.

Disease eradication programme : To formulate a plan for the eradication of guineaworm disease, it is necessary that the disease foci are identified and for each focus the infective water source is also identified, so that necessary measures can be taken to make the water source safe. During hot summer months, that a potential endemic area of the disease suffers from acute scarcity of water. At this time, the people are prone to draw water for domestic use from infective sources, since safe water sources are not easily available in the areas. If this can be prevented the chain of disease transmission will be broken. Once transmission is interrupted in an area for a single season, the disease will be eliminated from there forever. So, for the success of guineaworm eradication programme, the case search operation and identification of infective drinking water sources and rendering them

safe, are the three essential steps. In implementing the programme, priority should be given to places currently having cases, and the areas with the past history of cases should have the next priority.

Factors favouring Eradication :

1. *The transmission is limited to easily definable foci.*

2. *Interruption of transmission in an area for even a single season is enough to stop further transmission of infection.*

3. *The preventive measures like sieving drinking water through muslin cloth.*

4. *Identification of affected persons and contaminated water sources.*

5. *Rural development activities particularly provision of safe water supply contribute to the decline of the intensity and extent of endemicity.*

Eradication strategy : The strategy adopted for the eradication of guineaworm disease has to take into consideration. (1) Provision of alternative safe water supply; (2) Disease surveillance; (3) Personal prophylaxis; (4) Health Education; (5) Making infective water source safe; and (6) treatment of active cases.

Effective role of Engineers : The effective involvement of Engineers, incharge of water supply would have greater impact on the guineaworm eradication programme. The responsibility of the water supply Engineer is (1) to find out the type of water sources existing in the endemic area; (2) the quality of existing water sources; (3) number of water sources existing; (4) effective maintenance of water sources.

It would not be a difficult task to provide safe drinking water to the guineaworm villages. One of the permanent solutions of the problems, would be elimination of the contact between guineaworm patients and water sources and this can be achieved by either carrying out some modification of the source of water or by providing alternative source of safe water supply.

The district Engineer incharge of water supply Programme would identify the list of guineaworm effected villages, accord priority for provision of safe water supply, ensure minimum break down of the installed water sources specially in summer months.

Conclusion : Since the eradication programme is a time bound activity schedule, the target would be achieved with the co-ordination

of both medical and Engineering personnel. Medical and health officers will help by means of health education, treatment of infected sources with chemicals. But the Major role would have been kept on Engineers in eradicating this disease by means of providing safe water to these affected villages on priority basis.

In Andhra Pradesh the Rural water supply department is charged with the greater responsibility in implementation of this eradication programme. Out of 830 guineaworm affected villages 272 villagaes are fully covered and for 117 villages, sanction have been accorded under ARWS and 112 villages are proposed to be covered under ARWS. The remaining 329 villages are partially covered.

Under the dynamic leadership of Sri. Md. Inamul Haq, Chief Engineer, R.W.S. the Rural water supply department has achieved tremendous goals and targets and this is the right time for the department to extend the full cooperation in implementing the guineaworm eradication programme successfully with greaater enthusiasm. It would be hopeful that this will be achieved with in the time bound schedule under Technological Mission.

USE OF MICRO COMPUTER

N. Prabhakar*
R.P. Nanda*

INTRODUCTION

Advent of 20th Century has brought in a technological revolution with the introduction of Micro Computers in India, the tedious calculations hither to made on calculators and slide rules have become easy with the ability of incorporating various data combinations and logic in iteration within the programmes used on Micro Computer.

The Micro-Computers can be used for water supply systems in the following modes:

-- Evaluation of design parameters
- design of distribution net work
- design of structures and
- Data base management systems

The evaluation of design parameters involves determination of capital cost of the scheme with variation in period of design which has a direct bearing on different cost-involving components such as OHSRS, GLSRS, Treatment units etc.

Design of distribution net works becomes easier with the use of Micro-Computer. In general, the manual methods of calculation will take much time for working out a single iteration. However, the computer can give us a most economical solution performing as high as 60 and odd number of iterations (wider different combinations of size and material of pipe, loss of head permissible / K.M.)

TRAINING

We had the opportunity of being trained in the use of software developed for water supply network designs by the World Bank/UNDP under the Project RAS/81/001.

During the course of our training we have been exposed to and had hands-on experience on the use of Micro-Computer and the Software package developed by the World Bank/UNDP.

Though we have been given a software package of 10 programs; the hands on experience was limited to few programme which are useful in our day to day designing of the schemes.

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We limit our present discussion only to BRANCH AND LOOP programs, as these two are very much useful for any of our scheme design.

BRANCH

Branch program uses the Hazen William flow equation for the least cost-design of branched water distribution networks. It handles 50 pipes and 51 nodes and 9 candidate pipe diametres. It calculates pipe diameter, hydraulic information and costs.

LOOP

Loop program uses the Hardy-cross analysis and the Hazen William flow equation to simulate flows in looped water distribution net works. It enables us to quickly search around several alternatives designs and easily find a very good solution. The program can handle 500 pipes and 400 nodes.

Here, the node means, the point where there is a bifurcation of pipeline or there is change in rate of flow, ie.,withdrawal from the mode or both.

Design of structures such as elevated water tanks, Ground level water tanks and underground water tanks can be performed with ease.

These days we are also to provide our administrators and decision makers with different sorts of reports viz. Monthly Progress of Physical and Financial achievements, village inventory details etc. This can be done with ease with the use of Micro Computer based 'data base' program.

With this program a maximum of a billion records per file can be stored and as and when required this data can be manipulated for generating required report s.

CONCLUSION

Using computer it is possible to optimise design period minimise cost of distribution network and generate different data reports.

With regard to minimum cost of distribution networks an economy of a minimum of 10% over a good manual design in Rural net work is possible.

WATER SUPPLY TO SCARCITY VILLAGES IN NELLORE DISTRICT - A STUDY

V.Suryanarayana*
Dr. G.Ram Prasad*
Dr. G.Raja Reddy*

SUMMARY

A succinct account of location, topography, climatic conditions, rainfall, geoglogical and hydrological conditions of Nellore is given. Based on the hydrogeological conditions of Nellore district is divided into three zones namely weathered and fractured crystallines in the western parts, Laterites and other soft rocks in the middle and Alluvial deposits along the rivers and coastal sands in the eastern parts.

The quality of water in relation to crystalline rocks, laterites and Alluvial deposits is discussed. In accordance with the definitioin the water scarcity villages are identified and the measures taken to supply potable water are described. To circumvent the difficulties confronted in certain water scarcity villages, the remedial measures are suggested. The data regarding the quality of water scarcity villages are incorporated in the annexure.

GEOLOGICAL & HYDROLOGICAL CONDITIONS

The geological formation in the district ranges from oldest Archean rocks Cuddapahs and recent alluvium and blown up sands.

(Hydrogeologically Nellore district may be broadly divided into three zones, namely weathered and fracture crystallines in the western parts, Laterites and other soft rocks in the middle and alluvial deposits along the rivers and coastal sands in the eastern parts.

GROUND WATER CONDITIONS

a)Ground water in crystalline rocks

Weathering is recorded down to a maximum depth of 15 to 20 metres. Depth of water level varies from 3 to 12 M in the wells. In majority of the parts dug wells are feasible. The quality of ground water is good with electrical conductivity.

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b)Ground water in Laterities

It is observed that the water level recedes to greater depth during summer period and the fluctuations are about 5 to 10 meters.

In laterite the quality of ground water is potable with EC ranging from 200 to 1000 microsiemens/CM.

c)Ground water in Alluvium

The Pennar river forms major part of the alluvium in Nellore and Kovur taluks and to a little extent in Atmakur Taluk. Swarnamukhi river mainly forms its alluvial deposits to a larger extent in Gudur Taluk and lesser extent in Venkatagiri and Sullurpeta taluks. Kalinga river alluvium is confined to Sullurpet taluk only.

LOCATION AND DESCRIPTION OF WATER SCARCITY VILLAGES

The total revenue villages in the district are 1,110 with 1,221 Hamlets. The villages where there is no source existing within a distance of 1.6 kilometres or where water is available at a depth more than 15 metres (or) where the water sources are having excessive salinity, are identified as problem villages. There are 749 such villages. They comprise 70% of the total villages in the district.

During general study of the identification of problem villages in Nellore district 349 villages are located in crystalline terrains of uplands, 150 villages in lateritic and other soft rock formations and 250 villages in river and coastal alluvial areas. Due to lack of fractures or fissures in the hard rocks some bore wells drilled were unable to yield water during summer period and for this detailed and intensive ground water surveys must be undertaken to locate the feasible sites. Due to local pollution in the villages the quality of ground water becomes unsuitable for drinking purpose.

RECOMMENDATIONS

1. Intgegrated hydrogeological and geophysical surveys must be taken up to locate the fractures and fissures in the hard rock terrains.
2. Proper location of the site must be done by avoiding pegmatitic zones and other related soft mica formations.
3. The bore well site for drinking purpose must be located away from the local polluted area of the village.

4. Care must be taken to construct the bore wells properly and tap the entire thickness of the saturated zone so that the bore wells may not go dry during dry spell.

5. Subsurface drainage must be provided at water-logged areas to facilitate the existence of fresh shallow water zones for drinking purpose.

6. A number of tube wells may be constructed away from the sea coast to supply potable water to the problem villages located in the coastal belt of Gudur, Vakadu and Sullurpeta taluks through pipelines.

7. Desalination plants may be established in most of the problem villages to solve the drinking water problem.

8. Percollation tanks or rubble bunds may be constructed across small nallaha or streams to store water for underground supply to the wells located in the down-stream areas.

9. In coastal areas heavy draft from the wells must be avoided as it may resut salt water intrusion. Identification of such areas must be done by detailed studies and by conducting a number of long duration pumping tests. Pumping hours may also be regularised.

10. The villages must be educated for taking proper care and maintenance of the bore wells so that their life period may be increased.

ACKNOWLEDGEMENTS

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DISASTER PREPAREDNESS AND MANAGEMENT

BY

Sri K.L.S. Murthy, B.E., (Hons.)
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I have attended UNCHS-SERC Workshop on Cyclone Disaster Mitigation organised at the Structural Engineering Research Centre, Madras, during February 21-27, 1986. The Workshop was sponsored by the United Nations Centre for Human settlements (Habitat), Nairobi. The objectives of the Workshop were to identify the existing knowledge and expertise which may be applied directly towards mitigation of the effects of cyclones, particularly in the developing countries and to explore the possibilities of developing plans and programmes to minimise damage to dwellings and other structures built in the cyclone-prone regions.

A series of lectures in the following areas were presented by the experts during the workshop:

- --- Nature of disasters and public reaction.
- --- Architectural, constructional, socio-economic, and planning aspects of human settlements.
- --- Housing environment, community infrastructure, and rural development.
- --- Public information, functions of governmental and Non-Governmental organisations.
- --- Modelling, mitigation, and control of hazards due tc severe cyclones.

In addition to these lectures, a series of case studies from the under-developed countries, namely, Bangladesh, Haiti, Jamaica, Malaysia, Sri Lanka and Vietnam, were also presented in the workshop.

These lectures and case studies indicated that large number of cyclonic storms across the Bay of Bengal coastline and other regions of Indian Ocean, furious hurricanes across the parts of Latin America and Africa, severe typhoons across the Asian Pacific coastline continue to cause havoc destroying thousands of houses, damaging crops, and the most important of all, killing people. More than 11,000 people were reported to have lost their lives during 1985 cyclone in Bangladesh. Similar reports were published on the destruction of dwellings in India, Caribbean islands, Sri Lanka, and Vietnam.

Natural disasters of all kinds can cause great losses in human life: they also cause substantial damage to property and can have serious impacts on economically productive activities. Generally speaking, their effects are greatest in developing countries, and the poorer the developing country the greater the setback it can suffer from a natural disaster, since most developing country economies lack the capacity and resilience to absorb the losses resulting from a natural disaster. Furthermore, within developing countries, the poor are usually the worst hit, because they experience great difficulty in recovering from the physical and economic losses caused by a natural disaster.

Everyone recalls the tragedy caused by the cyclones in the southern coastal districts of India in 1977 when a tidal wave of unprecedented nature almost six metres high hit the taluqs of Divi and Bandar in Andhra Pradesh. Wind velocity attained some 150 Km per hour. Holdings within a range of some 20 Km of coastal area were destroyed. Huge casualities in life and property were sustained by the people living in the Cyclone affected areas. Hundreds of thousands of people were rendered homeless and 60 villages were completely washed away, resulting in the death of nearly 10,000 people.

We all know that cyclones cannot be prevented. They are a natural phenomenon. However, these calamities must be anticipated increasingly in the context of preventive measures as part of wider disaster management schemes involving the understanding, participation and preparedness of people and of all authorities concerned.

The following subjects were discussed by various speakers on pre and post disaster management in the Workshop:

Speaker : A.K. SEN SARMA, IMD, INDIA.
Topic : Meteorological factors relevant to Engineering design in cyclone-affected areas.

Speaker : N. BALASUBRAMANIAN, PWD, MADRAS.
Topic : Salient features of the cyclone shelters constructed by PWD.

Speaker : R.D. JOHN, DEPT., OF SPACE, INDIA
Topic : Post-disaster operations.

Speaker : G. DATTATRI, MMDA, INDIA
Topic : Planning of human settlements in cyclone-prone areas.

Speaker : K. MADHAVA SARMA, DEPT., OF COMMERCIAL TAXES, MADRAS.
Topic : Infrastructure development in Cyclone-affected regions.

Speaker : S.K. SHARMA, HUDCO, NEW DELHI.
Topic : Role of Governmental and Non-Governmental Organisations.

Speaker : V. JAYASANKAR, NITIE, BOMBAY.
Topic : Diasaster management and regulatory and co-ordinating mechanisms.

Speaker : P.R. RAO, CBRI, HYDERABAD.
Topic : Housing colonies and shelters in coastal Andhra Pradesh.

Speaker : Z. GEORGE, SERC, MADRAS.
Topic : Simple and advanced construction methods for buildings and other structures in cyclone-prone areas.

Speaker : A.V. SUBRAMANIAM, PWD, MADRAS.
Topic : New Building materials.

Speaker : P.PURUSHOTHAMAN, ANNA UNIVERSITY, MADRAS.
Topic : Wind effects on buildings in cyclone-prone areas.

Speaker : A. MOHAMMED HARIS, SCHOOL OF ARCHITECTURE, MADRAS.
Topic : Architectural design of residential buildings in cyclone-prone areas.

Speaker : N.P. RAJAMANE, SERC, MADRAS.
Topic : Repair of shelters and other structures in cyclone-prone areas.

Speaker : B. VENKATESWARLU, SERC, MADRAS, INDIA.
Topic : Cyclone-resistant design of pitched roofs.

RECOMMENDATIONS OF THE WORKSHOPS

After elaborate deliberations on the topics the following are the recommendations of the workshop.

1. The workshop strongly recommends the setting up of Disaster Management foundations in countries exposed to large scale natural hazards such as cyclones and floods. These are expected to act as data bank for all information and technical know-how, and act and activate the involved agencies.
2. In Cyclone-prone areas a rigorous drill for cyclone preparedness be undertaken well ahead of the monsoon months to ensure

that all the links in the chain for cyclone disaster management are in working condition.

3. Careful consideration may be given to the systems approach in pre-and post-disaster management which take into account all the relevant factors, (meteorological, statistical, economic) sociological), inputs, agencies etc., in modelling the cyclone disaster.

4. Instead of embarking on building of structures exclusively for cyclone shelters, it is recommended that community facilities, such as schools, and primary health centres may be designed and built at strategic locations so that they can withstand the fury of cyclones and tidal waves. these can be used as cyclone shelters as and when needed.

5. It is suggested that vegetation cover in urban environment may be increased. Also, porous pavements may be provided to reduce the run-off. This incidentally, improves the ground water storage.

6. Wherever feasible, water courses may be diverted so as to avoid flooding of thickly populated urban areas. This philosophy is very similar to by-pass roads being provided for transport vehicles to avoid congestion of traffic in urban localities.

7. More monitoring stations for wind velocity measurements are recommended to be set up in cyclone-prone areas. Installation of gust anemometers that can withstand wind speeds in excess of 50 m/sec. and operating on uninterrupted power supply is recommended.

8. In major industrial complexes, structures may be categorised into two types, namely,

   i) Post-disaster survival structures, and

   ii) normal structures.

   Design recommendations for these structures are to be evolved suitably.

9. Latest available knowledge in wind-structure interaction should be used in engineering designs.

10. Marginal improvements like increased number of J-bolts, use of U-Bolts, and provision of stiffening elements at eaves and ridges which significantly improve the performance of pitched roofs, shall invariably be adopted in structural designs.

11. Wherever feasible, mass-produced precast structural components

may be used in building construction for pre and post-disaster housing. This would result in improved quality control, speed and economy. Use of ferrocement as replacement to timber and in other service structures, such as water tanks, is recommended.

12. Serious attention must be paid in improving the shelters of low income groups to achieve better safety levels.

CONCLUSIONS:

The subjects discussed in the workshop are very interesting and pertinent to our department and it is suggested that we may sponsor our Engineering personnel for attending such workshops as our state is having a long coastal belt and subjected to frequent cyclones. It is also suggested that our Nagarjuna Rural Engineering Training Centre may also organise similar workshops or seminars so that not only the Engineers of Panchayat Raj Department but also Engineers of other departments like Irrigation, R & B, Public Health and other Government departments connected with cyclone disaster mitigation can participate to acquaint themselves with the latest technology and share the experiences of other States and other Nations.

The following are the suggestions as far as concerned to Panchayat Raj Engineering Department.

1. Generally it is observed that cyclones occur during the period from May to November in coastal Andhra and we have to take necessary action for upkeep and improve the P.R. roads leading to villages in coastal belt before April and before September of every year on priority basis as these communications are vital and useful for evacuation of people in the event of cyclone warning and for relief operations after cyclone.

2. Similar action has to be taken in respect of school buildings and other public buildings within coastal belt duly providing adequate water supply and sanitary arrangements so that these buildings can be used as shelters during cyclone.

3. As far as possible only pucca R.C.C. roofed buildings should be taken up for schools and other buildings taken up in the coastal belt to avoid damages in the event of cyclone.

4. In respect of structures being constructed or porposed to be constructed in the coastal belt such as buildings, C.D. works

on roads, R.C.C. overhead service reservoirs, etc., we have to see that adequate cover is provided for R.C.C. structures as per I.S.I. code of practice para nos. 18.2.1 and 18.2.2 to avoid possible damage due to rusting.

5. Adequate care should be taken for the regular maintenance of buildings, water supply schemes, etc., located in the coastal belt by taking up of painting to prevent rusting and damage of steel members. It may be desirable to use alluminium in place of steel to avoid damage due to saline atmosphere.

6. It is desirable to adopt wider base supporting structure for R.C.C. overhead service reservoirs than adopting narrow stemp for architechtural beauty, etc., to have more stability. The present type designs may be adopted duly providing extra cover for R.C.C. members.

7. Wherever A.C. sheet roofing is provided care should be taken to provide adequate number of U-Bolts and J-Bolts and wind ties with M.S. flats at least near eves and ridge points.

8. The cyclone shelters should be provided with adequate fecilities to store fuel (i.e. Kerosine) and food products to encounter cyclone disaster.

DESALINATION TECHNOLOGY

R.P.Nanda*
K.Prabhaker Reddy*

INTRODUCTION

One of the aims of the Technology Mission is to provide quality drinking water. Excess salinity is one of the health hazards. The permissible Total Dissolved Solids (TDS) in drinking water is 1500 PPM. In Andhra Pradesh we have around 1100 villages affected by excess salinity. These villages are predominantly in shore areas, where the situation around us becomes "Water, Water everywhere but not a drop to drink" and only the Desalination Technology comes to our rescue. Broadly, the technological processes available are (i) Distillation Desalination (ii) Electro dialysis and (iii) Reverse osmosis.

The Processes:

Distillation has been regarded as the most developed process and has proved its merit for large scale desalination.

Solar distillation process involves solar stills of suitable dimensions constructed generally in East-West orientation. The output from the stills is largely dependent on solar radiation intensity, ambient temperature and wind velocity. It is observed that the efficiency of solar energy utilisation in solar stills ranges between 20-30% and annual average productivity ranges between 2-3 ltrs./M^2/day. Though the technique is good and useful for supply of drinking water to isolated communities, such isolation increases the cost of construction.

- Multi stage Flash distillation
- Vertical tube evoparation
- Vapour compression, etc.,

Electro dialysis process involves the flow of saline water over the ion-exchange membranes subjected to flow of direct current between the two ends of the stack of membranes. The Na^+ ions and cl^- ions get separated and saline-free water is thus made available.

The reverse osmosis process involves the pumping of saline water at a pressure higher than that of Osmotic Pressure into porous pipes lined with cellulose Acetate (CA) membrane. The C.A.membrane restricts the flow of dissolved solids through the membrane and thus the potable water is made available.

In our Panchayati Raj Department in all we have four desalination plants; one each of Solar distillation, Electrodialysis and two Reverse Osmosis plants.

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As cost of product by desalination is much more than in any conventional systems, the per capita supply is limited to 10 litres per day to serve for drinking and culinary needs only. The cost of production of desalinated water under ideal O&M procedures can be as low as one paisa per litre.

Broad Details of Estimate

Cost of setting up of a desalination plant has broadly two components (i.e.) infrastructure and actual plant itself.

A. Estimate for Infrastructure

1. Development of source, including drilling and installing a pumpset.	..	Rs. 40,000.00
2. Construction of Building.	..	Rs.1,00,000.00
3. Treated water tank - 20,000 Ltrs.capacity.		Rs. 40,000.00
4. Filter raw-water tank 30,000 ltrs.capacity.		Rs. 60,000.00
5. Electrical, plumbing, PS charges,unforseen items etc.,		Rs. 24,640.00
	Total.	Rs.2,64,640.00
B.Cost of Desalination Plant with all accessories including fabrication, errection and commissioning.		Rs.8,25,360.00
	Grand Total:	Rs.10,90,000.00

This plant will supply desalinated water to a village with about 1600 population at a 10 lpcd, where the raw water quality is about 10,000 ppm.

Cost of scheme per capita is Rs.165.40; as the Technology Mission has stated that the percapitda cost of these schemes shall be calculated excluding the cost of plant.

Cost of production of desalinated water should be about Rs.0.01 per litre. However, the department so far has only achieved the average of Rs.0.027 per litre in the R.O.plants.

Annual O&M costs of the plants is about Rs.18/- per capita per annum as against Rs.8/- to Rs.14/- per capita per annum of a conventional water supply scheme.

In view of the encouraging results and funding being provided by Government of India, the Panchayati Raj Engineering Department has now proposed a project for 18 shore area villages in 9 coastal districts.

The Project costing Rs.1.44 crores has since been sanctioned by the Government of India (communicated through Lr.No.Q/14016/1/86-RWS, dt.13.3.1987 from Deputy Secretary to Government of India, Department of Rural Development). The cost of the project has to be reduced by exploring the possibility of low-cost techniques for developing infrastructure and fabrication and errection of the plants.

"EXPERIENCES OF BILATERAL PROJECT IMPLEMENTATION"

K. THIRUPATHAIAH*

INTRODUCTION

1. It is aimed to project certain experiences in implementing the bilateral project in Andhra Pradesh aided by Royal Netherlands Government.

1.1 History : There are many pockets having excessive fluoride content in ground water in the State of Andhra Pradesh. Particularly in Prakasam, Guntur, Krishna, Nalgonda, Rangareddy and Karimnagar districts, we find larger areas. The initial survey conducted by Panchayat Raj Engineering Department envisages 171 villages in 6 districts where the fluoride content in drinking water is more than 2 ppm. Subsequent surveys revealed that there are many number of villages in 17 districts of the State which require attention. The Government of Andhra Pradesh is taking very effective steps to provide safe drinking water to all fluoride effected villages.

1.2 Fluorosis - Effect of excess Fluoride water : The main cause for fluorosis is in take of water having excess fluoride content. It's effect is much more aggressive when the status of the people is too low to have nutritious food. It will adversely effect kidnies, stiffen the joints and finally leads to permanent disability. There is no exception even for cattle.

1.3 Dutch Assistance : The Royal Netherlands Government have come forward to provide safe drinking water facilities to 171 earlier identified villages in the State of Andhra Pradesh. They have agreed generously to extend assistance partly in the shape of grant and partly in the shape of loan under bilateral assistance programme. This project is first of its kind taken up in Andhra Pradesh in the fluoride effected areas. The objective of the project is to provide safe drinking water with less fluoride content.

2. SCOPE OF THE PROJECT

171 fluoride effected villages in the districts of Prakasam, Guntur, Krishna, Nalgonda, Karimnagar and Kurnool have been taken up in this project. It consists four comprehensive schemes, and 52 individual schemes with a total outlay of Rs.115.5 million. Grant part of the assistance is Rs.55.79 million and the loan part is Rs.59.71 million. The scheme contemplates to provide

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safe drinking water to an ultimate population of 6.95 lakhs. The project is at final stage of completion with a revised cost of Rs.153.35 million.

Coverage of villages

i)	Prakasam District	a)	CPWS Scheme to Darsi and 80 other villages	81
		b)	CPWS Scheme to Chandravaram and 25 other villages	26
		c)	CPWS Scheme to Kurichedu and 5 other villages	6
		d)	Individual schemes to 12 villages	12
ii)	Guntur District	a)	Individual schemes to 21 villages	21
iii)	Krishna District	a)	CPWS Scheme to Adiviravula-padu and 5 other villages.	6
iv)	Nalgonda District	a)	Individual Schemes to 14 villages	14
v)	Karimnagar	a)	Individual Schemes to 3 villages	3
vi)	Kurnool	a)	Individual schemes to 2 villages	2
				171

3. *IMPLEMENTING AGENCY*

The task of implementation of the project was entrusted to the Panchayati Raj Engineering Department in the State of Andhra Pradesh as it is responsible in implementation of development activities in rural areas. There is a separate Engineering branch for implementation of Rural Water Supply Schemes headed by the Chief Engineer, Rural Water Supply. The Government of Andhra Pradesh have accorded separate sanction exclusively, one circle and four divisions with necessary supporting field staff to implement the project. Panchayat Raj Engineering Department has already implemented major water supply schemes in Kurnool,

Ananthapur and Krishna Districts. With that background Panchayati Raj Engineering Department has successfully completed the present project.

4. EXPERIENCES

Experiences have broadly classified into 2 categories viz., Technical and Managerial.

4.1 Technical

4.1.1 Water demand for live stock

While formulating the scheme, it was considered to provide safe drinking water to only human population at the rate of 50 litres percapita per day. during the real implementation of the programme, it is felt that there is an equal need to provide safe drinking water for cattle which are being effected by the fluorosis. This was taken into account and the per capita demand was increased to 60 litres per day. Distribution system was redesigned to accommodate the change.

4.1.2 Source :

In view of the magnitude of the water demand, it was established to take surface water from Nagarjuna Sagar Canal which is the economically viable source. For all comprehensive schemes which cover about 119 villages, the source is surface water from N.S. Canal. The raw water is also having fluoride content about 0.8 ppm. For other individual schemes both surface water from N.S. Canal and also safe underground water has taken as sources.

4.1.3 Summerstorage tanks :

As the source mainly is from N.S. Canal, eventually there is a need for summer storage tanks. Particularly in case of Darsi and Chandavaram head works big reservoirs of 2538 million litres and 855 million litres capacities have been constructed by bridging the gap in between the natural hillocks. It was also contemplated to have the advantage of the run off from the free catchment of the tank.

4.1.4 Seepage and its utility :

Inspite of all necessary precautionary measures taken at the time of designing and implementation of earthern bunds, seepage was observed. Seepage water collected in the toe drain is being carried to sump and from there the water is being pumped into

slow sand filters. Thus seepage water is being put to use. However, it is better to have storage capacity of the summer storage tanks for entire canal closure period plus 50% extra towards percolation and evaporation losses.

4.1.5 Filter period - Advantage of gravity flow from S.S. Tanks

The present design of slow sand filters is for 16 hours filteration and declining rate of filteration during night for about 8 hours. The rate of filteration is 0.1 mt/hr. In both the cases of Darsi and Chandavaram schemes, filters are located near by the side of S.S. tanks and the water is being fed into by gravity. This facilities the existing filters to take extra load of 14.2%.

4.1.6 Balancing reservoir - Need to increase the capacity:

In case of comprehensive scheme at Chandavaram, the balancing reservoir has been constructed with a capacity of one hour of daily demand. The basic functioning is to create energy required for distribution of water by gravity. The capacity of the tank is not sufficient to store demand required at the time of power interruptions. There should be minimum storage capacity of 6 hours to store water required to accommodate the needs during frequent failures of power.

4.1.7 Water hammer :

It is observed bursting of gravity main at the foot of the hillock due to water hammer frequently in gravity main from balancing reservoir i.e., in raising mains. Pressure relief valves have been installed and A.C. pressure pipe in the gravity main portion have been replaced with C.I. Pipes.

4.1.8 Lengthy gravity Main :

For both the CPWS Schemes of Darsi and Chandavaram lengthy gravity mains to a length of about 392 Kms. have laid with all needed pipeline's appurtenance. The real difficulty what we experienced was, as the line was passing through dry fields, the shepherds used to drill holes to the gravity main to get water for their sheeps. Intensive patrolling arrangements were made to control the vulnerable reaches.

4.1.9 Covering intermediate villages in CPWS Scheme:

While identifying 119 villages of CPWS Schemes many of the fluoride effected intermediate villagaes were not considered

and local people have made requests and also felt essential to provide water to them. 30 such villages which can be accommodated in CPWS Scheme in Darsi in particular and a seperate scheme was formulated with an estimated cost of Rs.29.2 million. Dutch Government have also agreed to finance the scheme.

4.1.10 Distribution - Water for weaker sections

The gravity mains are designed with peak load factor of 1.5 and internal distribution was designed with peak load factor of 3. It was contemplated to provide internal distribution for the villages where the ultimate population is more than 2000 through RCC OHSR and to provide distribution through Cisterns for villages of less than 2000 population. It is proposed to extend the distribution to weaker sections particularly Scheduled Castes localities.

4.1.11 Capacity of Overhead Service Reservoir:

The present OHSR's capacity is 1/4 of the daily demand. It is also proposed to supply water 4 hours in the morning and 4 hours in the evening every day. The storage capacity of 6 hours of OHSR is theoritically sufficient for a continuous supply of 16 hours and the drawal period of 8 hours. To accommodate the fluctuations in drawal periods there is a need to increase the capacity of OHSR to 1/3 daily demand.

4.1.12 Power interruption :

Power interruptions were recorded and it is observed from the frequency of interruptions, there is need to install generator. In all the major schemes provision to purchase generator has to be made while formulating the schemes.

4.2 Managerial

4.2.1 Planning and Programming :

Conventional methods of traditional planning have been adopted while implementing the programme by Panchayati Raj Engineering Department. It is a time to take advantage of new management techniques evolved such as PERT and CPM in implementing the future projects.

4.2.2 Inter-departmental Coordination :

Eventhough there is a persuation from Panchayati Raj Engineering

Department, there were many delays in getting either permission or implementation of certain activities by other departments which are associated with the implementation of the project due to lack of sufficient cooperation. For instance delays in construction of intake structure by the irrigation department and permission of R&B department and Railway authorities for corssing the mains, similarly getting power from A.P. State Electricity Board. Thus due to lack of effective interdepartmental coordination the project has suffered. There is an imperative need to have APEX Committee at State level consisting Senior Officers from Departments of Panchayati Raj, Irrigation, Power, R&B, National Highways, Revenue and Indian Railways.

4.2.3 *Monitoring :*

The present monitory systems existing in Panchayati Raj Engineering Department in monitoring the programmes has to be reoriented for effective monitoring. It is not sufficient just to monitor the physical progress of ongoing schemes, but there is a need to even to monitor water quality of existing schemes. Panchayat Raj Engineering Department is in that line to stabilise the existing systems.

5. *ROLE OF EVALUATION MISSIONS*

The Evaluation missions have played an excellent role in not only reviewing the progress but also in evolving noval ideas to improve the present system and also for formulating new schemes. Its scope ranges from soak pit near stand post to processing the base line data with computers. The review was critical and suggestive and helped the Panchayati Raj Engineering Department in effective implementation of the project.

6. *CONCEPT OF INTEGRATED APPROACH*

It is an outcome of innovative thinking of evaluation missions, it is felt essential to have integrated approach to improve over all health conditions in addition to supply of safe drinking water in fluoride effected areas.

Associated Activities

- *To impart health education related to water supply and sanitation.*
- *To introduce sanitation programme in order to eliminate the risk of transmission of water borne diseases.*

- *To involve local people in all associated activities of water supply and sanitation.*
- *To provide income generating schemes to raise their level of socio-economic conditions and to have nutritious food, particularly for weaker sections, Scheduled Castes and Scheduled Tribes.*

7. *CONCLUSIONS*

7.1 *The strategy to be adopted to combat fluorosis shall be two pronged.*

- *To provide safe drinking water*
- *To provide income generating schemes in order to improve the economic conditions of the people to have nutritious food, particularly for weaker sections and Scheduled Castes.*

7.2 *Water supply for cattle shall be provided by increasing percapita demand from 50 litres/day to 60 ltrs/day and providing tubs at appropriate places.*

7.3 *Arrangements for utilisation of seepage water of Summer storage tank.*

7.4 *Increasing the capacity of balancing reservoir to 1/4th daily demand.*

7.5 *Design of slow sand filters with 0.1m/h rate of filteration for 24 hours, wherever it is feasible to feed filter by gravity which will save about 15% of filter area of conventional design in addition to elimination of low lift pumps.*

7.6 *The present system of designing gravity mains with peak load factor of 1.5 and for internal distribution with a peak load factor of 3 are found to be satisfactory.*

7.7 *Over Head Service Reservoirs :*

The capacity of OHSRs have to be increased to 8 hours of daily demand instead of 6 hours of daily demand.

7.8 *Hygienic conditions should be maintained near by the vicinity of the stand posts.*

7.9 *Provision of generators for major schemes to run the pumps at power interruption.*

7.10 *Latest management techniques have to be adopted in planning*

and programming the projects.

7.11 Health education related to water supply and sanitation is essential.

7.12 Formation of APEX Committee to sort out inter-departmental problems and to improve the coordination.

8. ACKNOWLEDGEMENT

Author is indebited to Mr. V. Changson, I.A.S. Managing Director, A.P.S.C.C.F.C. Ltd., who accorded permission to present paper and Sri R. Kondala Rao, Chief Engineer (Tribal Welfare) for his guidance. He is thankful to Sri Md. Inamul Haq, Chief Engineer, Rural Water Supply, who encouraged. He also extends his thanks to Mr. R. Trietsch, D.H.V. Consulting Engineer and Sri K. Naram, Retired Chief Engineer (Public Health) and Consultant, Environmental Engineering who have given their valuable advices as members of the evaluation team during their visit to N.A.P. Scheme.

HUMAN RESOURCES DEVELOPMENT

* M.RAGHAVULU,B.E.,

BACKGROUND

In April 1982 the Steering Committee for Cooperative Action for the International Drinking Water Supply and Sanitation Decade gave full endorsement to a paper entitled Basic Strategy Document on Human Resources Development 1. The purpose of the Basic Strategy Document is to serve as an outline guide to decade human resources strategies and approaches for national and international agencies alike.

The Basic Strategy Document provides an overview of the three dimensional human resources development process, which comprises :

1. PLANNING
2. TRAINING ; and
3. MANAGEMENT.

This handbook, which is designed as a practical guide to implementing Human Resources Development, expands on the three dimensional process.

OBJECTIVES

The purpose of the handbook is threefold :

1. To clarify the Human Resources Development concepts in current use ;
2. To show how these concepts can be applied to organizations operating in water supply and sanitation ; and
3. To guide water supply and sanitation agencies/ ministries toward a more systematic approach to Human Resources Development and away from adhoc actions.

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* S.E. (PR) Nellore.

A brief description of each chapter follows :

CHAPTER 1 : Overview — Senior managers and training managers are provided with four major approaches for strengthning Human Resources Development within their agencies :

1. Human Resources Development (HRD) as a process ;
2. The HRD Appraisal and Planning Guide ;
3. The Dual-Focus Approach ; and
4. The Systematic Approach to Training.

CHAPTER 2 : Planning — The 11-step Human Resources Planning Model for Plan ners and Senior Managers preparing a Manpower Development Plan.

OBJECTIVES (Cont'd)

CHAPTER 3 : Training — How to produce a training and development plan. Its seven key elements. How to design a training and development programme. How to formulate a training programme for community - based workers.

CHAPTER 4 : Managerment — The need for Senior Operational, personnel and Training Managers to integrate the Planning, Training and Management of HRD to help ensure that the total agency plan is achieved. The need to get the right balance, first between an agency's operational/business needs and the needs of its employees and secondly across all the elements of its personnel policy.

HUMAN RESOURCES MANAGEMENT

WORKSHOP FOR SENIOR MANAGERS

OBJECTIVES:

To explore human resources strategy options based on

- Major Weaknesses and constraints of your authority
- New techniques and approaches.

To train senior managers as trainers of their colleagues.

To develop action plans for reorienting and strengthening human resources activities with the aim of helping to improve the performance of the authority.

HUMAN RESOURCES MANAGEMENT

WORKSHOP FOR SENIOR MANAGERS

The Programme comprises:

1. Management Orientation Workshop. For 8-10 Senior Managers, to be trained as trainers. They will be:

   i) provided with a choice of effective management techniques and approaches enabling them to decide on those most appropriate to their needs

   ii) encouraged to identify managerial and organizational constraints to performance and consider possible strategies for improvements, and

   iii) prepared for facilitator's role in implementing an Action Planning Workshop for their coleagues, specifically via:

2. Trainers Trial-Run Workshop

   - To follow the above workshop.
   - A trial-run of the above workshop for the 8-10 participants operating as trainers. (Each taking one session).

3. Management Action Planning Workshop

- for 18-20 senior managers run by the 8-10 new trainers
- intention (i) to identify and assess people and performance problems, (ii) to provide choice of management techniques for dealing with problems, and (iii) on this basis to determine priority Act Plans for next two years.

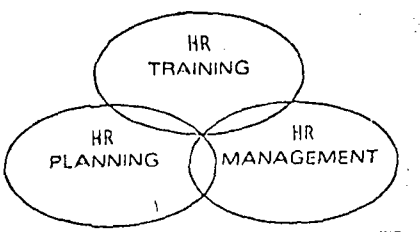
International Drinking Water Supply and Sanitation Decade 1981-1990.

Human Resources Development (HRD)
Need of countries:

- Basic Strategy Document
- Desk Study - 30 Manpower Plans

HRD HANDBOOK AND MANAGEMENT WORKSHOPS:

Human Resources Development is an integrated 3 dimensional process



Frequent Deficiencies:

- insufficient data on people - numbers/experience, etc.
- Lack of standards for performance and staffing
- Inadequate diagnosis to determine reasons for deficiencies
- Reliance on formal education programmes.

Finding

"....a Staff to population served ratio of 1 : 190 -- this ratio is indicative of severe overstaffing".

Recommendation

-None-

Findings

"There have been very high attrition rates in all occupational categorie f staff. Many of the posts were filled as many as four to five times during the last three years".

Recommendations

"Vacant posts should be filled as soon as possible".

"In view of the time needed to train additional professional and technical staff it is imperative that steps be taken to guard against the loss of existing key staff".

(No steps are mentioned)

Findings

"There is a very large number of persons engaged in vehicle maintenance"...'186...excluding trainees and administrative staff.

The usable fleet is around 500 vehicles.

(An appraisal)...suggests a total technical staff of 50 persons...(only is required).

"The level of staffing is so high that...it has a negative effect on the work".

Recommendation

"The only possible approach is to build inventory levels to improve the percentage of vehicles operating".

Conclusions

1. Problems identified - often no real solutions offered.

2. Business and Operations Planning - Little and inefficient, therefore little manpower planning and thus, little HRD Planning.

3. Education and Training

   - often too theoretical and academic
   - technical and not manager-oriented
   - stand alone and rarely addresses underlying problems
   - few expensive fellowships when need is for more to reeceive manager development at home.

4. Management Development - rarely mentioned and

Never - how managers should Communicate, Consult with and Involve Staff in e.g., joint problem sharing/solving and quality circles.

- how to Motivate managers and they their staff
- to get best from resources
- to get commitment to agency's purpose
- to get high performance and productivity
- and rewarding acordingly.

5. Performance Productivity - mentioned rarely - not seen as important.

Never nothing linkages of:-

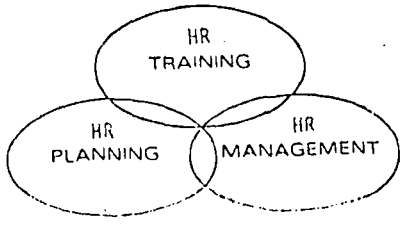
Job descriptions Objectives Measurement Reward/ Sanctions Promotion/Careers

6. Improved Performance requires each of the above activities to be more fully covered and more fully integrated.

JANUARY 1985 HOWARD GIBSON

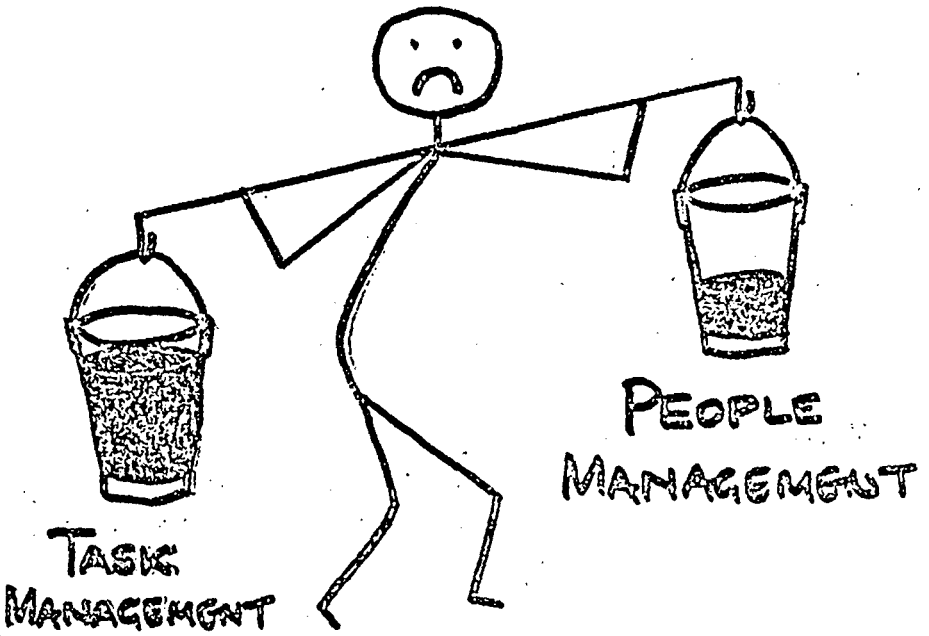
HUMAN RESOURCES DEVELOPMENT

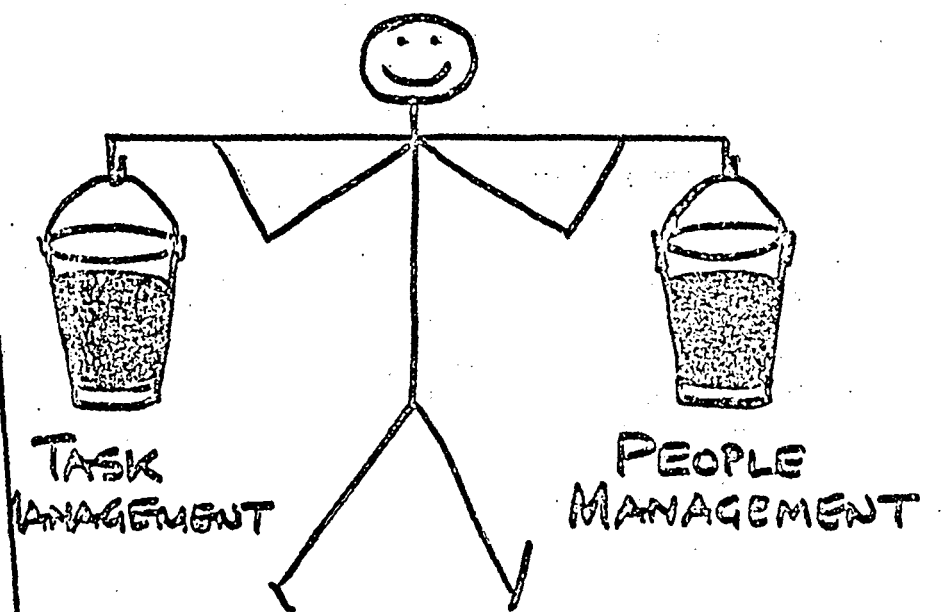
AN INTEGRATED 3 DIMENSIONAL PROCESS



Management - traditional approach

- Planning - Strategy and Objectives
- Organizing - Establishing structure of authority through which work sub-divisions are arranged.
- Staffing - Selection & training & provisioning of staff
- Directing - Making decisions & ensuring they are carried out


PEOPLE
MANAGEMENT
TASK
MANAGEMENT


TASK
MANAGEMENT
PEOPLE
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OS11-2-7

- Coordinating - The various functions/sub-divisions

- Controlling - Budgeting, reporting & controlling expenditure.

CAUSES OF PERFORMANCE PROBLEMS IN THE WATER AND SANITATION SECTOR

Cause of Problem	Estimated percent of problems of this type
Lack of skill or knowledge	----------%
Environment in which the worker must perform	----------%
Motivation, incentive, or attitude	----------%
Other (Please specify)	----------%
TOTAL	100%

Explanatory Notes

Deficiencies in human performance can generally be traced to one or more of the 3 causes noted above. Based on observations of your own water and/or sanitation authority, please fill in your estimate of the percentage of performance deficiencies attributed to each of the 3 causes shown.

Lack of skill or knowledge - The worker does not know how, when or how well to perfor.

Envirofnmental and/or management causes - The work environment, the management procedure the supplies, the tools, the work procedure, the lack of available transportation, etc., prevent or hinder the worker from performing adequately.

Motivation, incentive or attitude -- The worker's motivation or attitude interferes with his/her performance, or the incentives provided are inadequate.

EXCERPTS FROM RECENT WS&S REPORTS

WHICH HIGHLIGHT PERFORMANCE PROBLEMS AND RECOMMEND TRAINING OF INDIVIDUALS AS THE SOLTION

1. "An important factor ... is the necessity toreduce unaccounted-for water, including system leakage wastage, to minimum levels".

   Q.1 - Is training the only solution?

   Q.2 - If nfot what else might help ?

2. "Transportation for carrying out rural water and sanitation activities in regions is affected by poor transport management".

3. "The urban water supply systems have undergone rapid deterioration in recent years due to the lack of repair and routine maintenance..."

4. "Water quality surveillance is not being done on a systematice basis and analytical capacity is substantially below a desirable level".

Lack of Skill or Knowledge

a) Has the worker been trained to carry out mastery performance ?

b) If the training has been conducted, was it adequate ?

c) Is there evidence that the worker does not know what, when, how, or how well to do the task ?

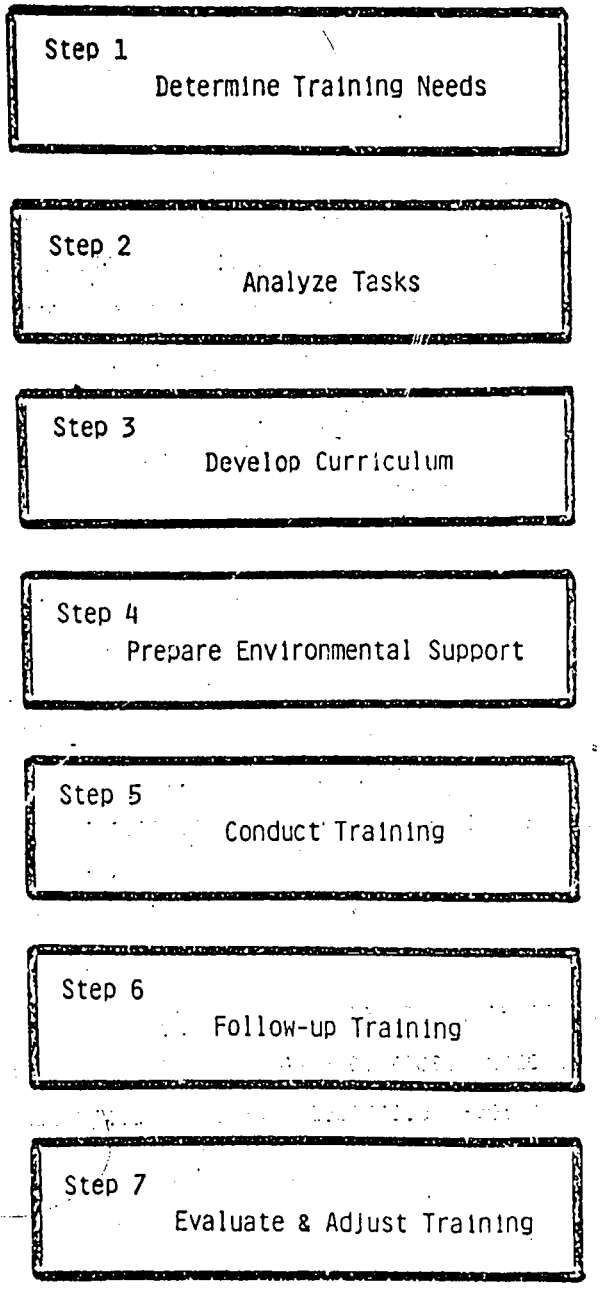
d) Is there evidence that the worker can perform, but has difficult transferring the knowledge or skill to the job?

Environmental and/or Management Causes

a) Are there poor working conditions where the task must be performed?

b) Are tools and equipment adequate?

c) Is there sufficient time to perform this task?


Step 1
Determine Training Needs
Step 2
Analyze Tasks
Step 3
Develop Curriculum
Step 4
Prepare Environmental Support
Step 5
Conduct Training
Step 6
Follow-up Training
Step 7
Evaluate & Adjust Training

d) Is there sufficient manpower assigned to perform this task?

e) Is there disagreement over the method used to perform this task?

f) Is there a lack of access to data or resources?

g) Are the criteria for job performance too high?

h) Is there interference from another task (i.e., scheduling)?

i) Is there adequate supervision?

MOtivational, Incentive or Attitudinal

a) Can the worker perform some of the time, but not always?

b) Is good timely feedback provided on performance?

c) Are there adequate incentive to the worker?

d) Is the task unpleasant in the mind of the worker?

e) Are poor supervision techniques used?

f) Does the worker lack perception of the values of the task?

g) Are there appropriate consequences for adequate and inadequate performance?

h) Is the task repetitive or boring?

i) Is the task of low priority or competing priority?

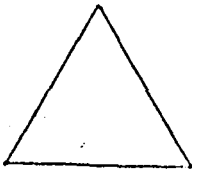
TRADITIONAL APPROACHES TO IMPROVING PERFORMANCE

INDIVIDUAL TRAINING

(Employee Performance)

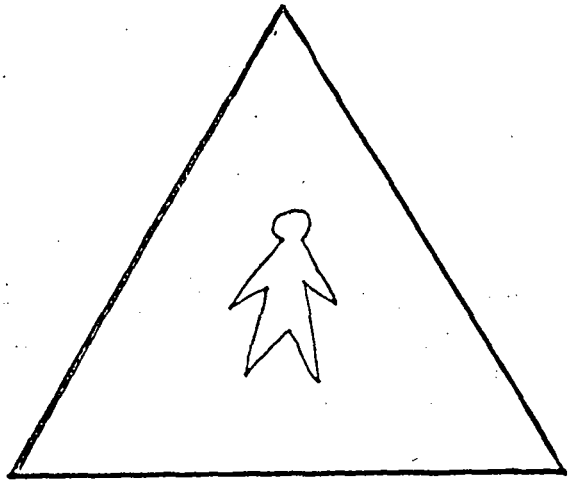
- OR -

SYSTEMS DEVELOPMENT



(Organizational Performance)

THE DUAL FOCUS APPROACH



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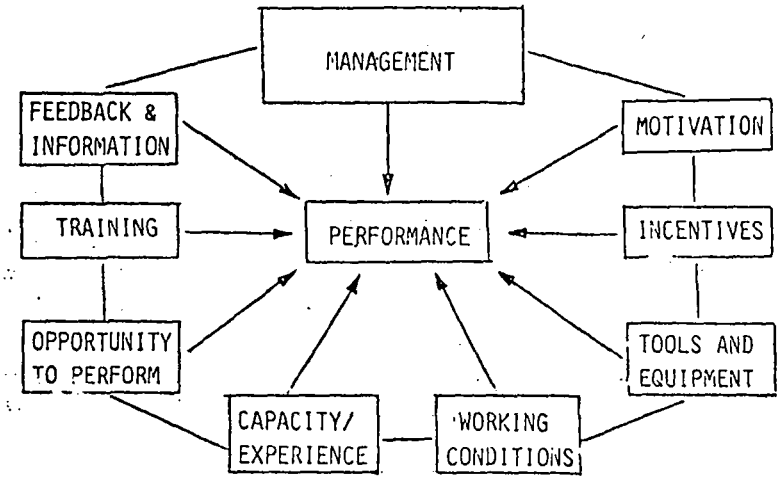
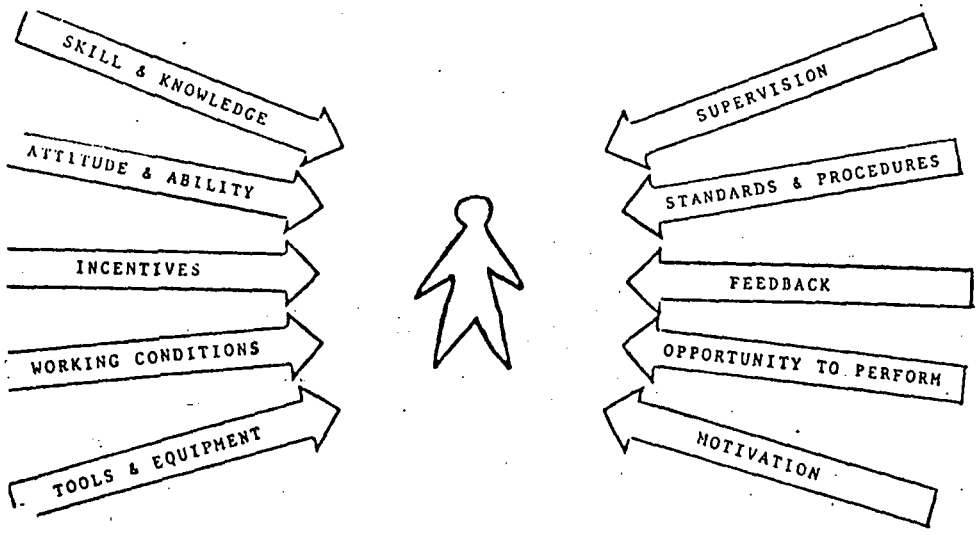
FACTORS AFFECTING PERFORMANCE



FACTORS AFFECTING HUMAN PERFORMANCE



OSII-2-13

Present of paper by Sri N. RAMCHANDRA REDDY, Dy.Executive Engineer, Sub-division Shadnagar, Mahabubnagar district.

THE ROLE OF MANDAL ENGINEERING OFFICERS IN MANDAL PRAJA PARISHAD OFFICERS AND IN ZILLA PRAJA PARISHAD OFFICES

The Role of Mandal Engineering Officer is the vital and significant role, who in fact discharges duties in every field of Engineering as planned by the Government in all the spheres of developmental activities in performing all kinds of duties. Mandal Engineering officer alone prepares the estimates for all kinds of activities in the Mandal Praja Parishad Office, as per the requirement, which is needed. The subjects which are mainly dealt are as follows. Minor Irrigation works, School Buildings contructions, Gram Panchayat Buildings and other buildings in various schemes, Road works, C.I. well works, Borewells, Rural Water Supply and Projected Water Supply schemes and in all activities. He executes all the works and all the bills are usually recorded by him alone for payments. Mandal Engineering Officers are really needed to execute all type of works with quality and control and who have the record the measurements, no sooner the works are got executed and who have to ensure payments in time and also they have to ensure good quality and effective supervision of works so that all the proposes works or activities in all the sectors of Development have got to be completed in a proper way in time. So works are executed, while creating desired sets, in every Mandal Praja Parishad areas and so also in each Zilla Praja Parishad areas, of each district so also in each State accordingly.

The following factors are needed to ensure good quality, effective supervision works to expedite the schemes as per the stipulated period with the specific grant and in specific time as mentioned below.

1. Accomodation.
2. Facilities like Assistants finance & stationery etc.,
3. Transport
4. Technical Powers.
5. Judicial Powers legally while executing works in term of codes.

6. Administrative Powers in proviting all sorts of materials in terms of codes etc.,

7. Power of entrustment of works in the district.

8. Vehicles etc., for repairing borewells with equipment.

9. Administrative powers to tackle subordinates like clerks, gangmen and the work-Inspectors etc.,

10. To maintain dignity on par with like Sub-Inspectors in Police Department to have a qualitative work by the enforment of law.

or

11. Mandal Development Officer should cooperate with the Mandal Engineering Officer while executing works in the department.

12. The prestage of the department actually lies with dignity of the Mandal Engineering Officers in the department.

13. In short, the dignity of the department shall lie ultimately on the performance of the Mandal Engineering Officer in each Praja Parishad Office and so in the district or in the State.

It is a fact that, Mandal Engineering Officer is made to work under the control of Mandal Development Officer, so the image of the Mandal Engineering Officer shall has to beraised on par with others like in the Police Department and like the work of a Sales TAx Inspector or Excise Inspector or like the Forest Range etc., so all in the functions of the State in each department so also in the functions of Panchayati Raj Engineering Department.

14. There is a imperative need and it is felt unavoidable. So it has become absolute necessity to do so, to improve the image of the department in the eyes of the Public for one reason or the other. It is also felt that things can be got done easily by influencing the Mandal Engineering Officers in the Department. So it should be got done.

15. Therefore, it is requested the concerned authorities should examine this issue, once again in this matter, as deemed fit, to improve the image of the department, along with the good performance of the Mandal Engineering Officers in the Department.

16. Consequently, it is requested to consider all the facts as mentioned above in all the aforesaid matters, sympathetically and requested issue this suitable orders or measures which are needed in these days to adopt them wherein the Role of Engineers are subjected to strong criticisms in Public eye on some other occasions. It must be got done by adopting suitable remedial measures to this effect.

17. It is indeed a good occasion like this, it is an auspicions occasions, wherein all Engineers in the Department should do something to adopt a good policy, so that the Role of the Engineers would be effective and dignified, so that the image of department would be multiplied by its performance in the State.

RURAL WATER SUPPLY WORK SHOP

O.N

RURAL WATER SUPPLY - ROLE OF TECHNOLOGY

SHORT TALK ON

" TAPPING OF IRRIGATION CANALS - PRECAUTIONARY MEASURES TO BE OBSERVED "

Sri M. Subba Rao, B.E.,
Executive Engineer,
Panchayat Raj, ONGOLE

All living beings need water and every activity of human-being involes use of wter most importantly for drinking purpose. Water required for other purposes lie bahing and washing etc., counts for more than drinking purpose.

The primary source of all water supply is precipitation mostly due to rainfall. The portion that parcelates into ground and the run-off are the useful compoenents for human usage. In rural areas ground water is general source for drinking plurposes. In cases of presence of flouride, salinity and other unwanted minerals surface water has to be tapped for all purpose.

In regions of deep blackl cotton soils the ground water is brakish and the only alternative would lbe surface water. The common surface water sources in Andhra Pradesh are rivers, reservoirs, canals and drains.

Canals are artificial channels generally trapezoidal in shape constructed on the ground to carry water to the fields either from rivers or a tank or reservoir.

The canal system commonly known consists of the following classification.

1. MAIN CANALS : These are water carriers to feed branch canals.

2. BRANCH CANALS : Usually feeder channels for major and medium distributaries. They carry discharges over 5 Cumecs.

3. MAJOR DISTRIBUTARIES : Channels carrying water from 1/4 to 5 Cumecs.

4. MINOR DISTRIBUTARIES: Usually carries less than 1/4 Cumecs.

5. WATER COUCES These are small direct field channels.

I. For any water supply lscheme the source should be quite dependable. Therefore, tapping water from water-courses and minor distributaries is not advisable. This is one of the fore-most precaution to be observed while tapping water from canals.

II. The second point to be considered is duration of flow in the canals. While implementing water regulation in canals off and on system is being practised. In such cases water required for the entire year should be drawn during the canal flow periods only. Further all the canals are closed during summer; the closure period may vary from 30 to 100 days. This should be kept in mind while designing the water mains and pump-sets. In case of Nagarjuna szgar canals 180 days of drwal is being adopted and in case of Krishna lCanals 260 days is accoun ted for.

III. SELECTION OF TAPPING POINTS :-

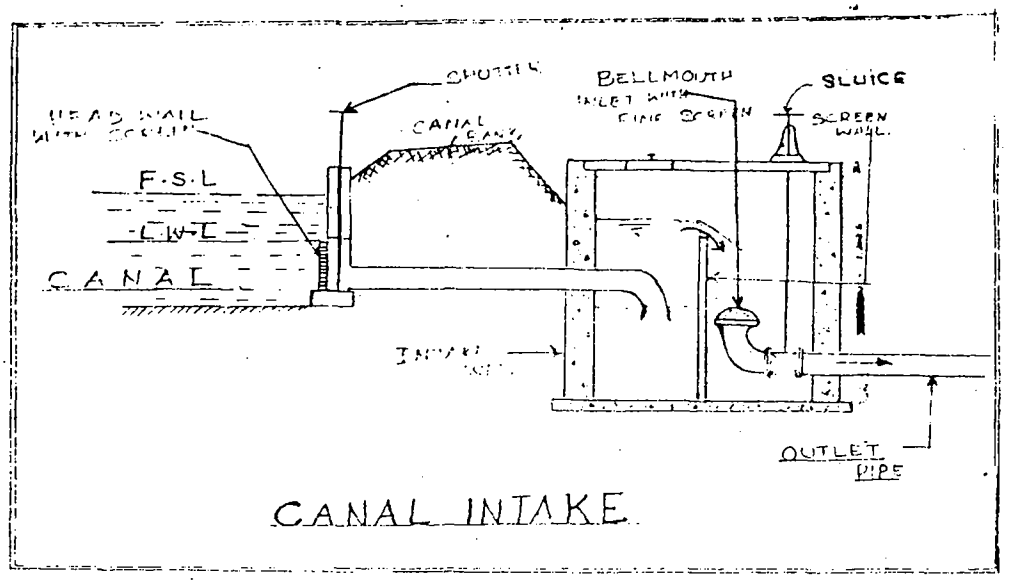
a. Tapping of canals at their curves should be avoided as the regime of canal gets distrubed at the curves causing eresion and sitting on cancve and convex sides, respectively.

b. Upstream side of drops should be preferred to avoid the head and to avoid entering of silt into the main due to turbulence on the down-stream side.

c. Tapping canals at village points must be avoided for, the canal bunds and water in canals near villages are highly polluted. The most of the cases the lcanal bunds would be either of plublic lavatory or burial ground. Bathing by animals and washing lghats are very much common at village points. Further, the village drains as well out-lets of some of the setic tanks are left open into canals. Therefore, to avoid drwal of polluted water a sufficiently head reach must be selected even if extra pipe line cost is involved. Again to avoid further pollution the water drawn from the lcanal to the lstorage tanks must be through conduits.

IV. IN-TAKE STRUCTURES :-

The canal water carries suspended matter viz., excreta of birds, animals, dead leaves, weeds, field produce and sometimes dead bodies of animals land human beings toe. To avoid the above types of suspended material entering into water mains a suitable in-take structure protected by barscreen must be provided. (A typical In-take structure is depicted below:)



CANAL INTAKE

V. DESIGNING OF WATER MAINS :-

Canals running in slopy regions though provided with drops keep flowing with scouring velocities and hence carry silt and even fair size boulders. The floating matter and boulders can be arrested from entering the water mains but not the fine silt and clay which may choke up the water mains. Therefore, while designing the mains, self cleansing velocity of minimum 0.6 Mts/Sec. should lbe ensured.

While pumping in involved 16 hours of puming in a day is being adopte in designs. But in rural areas the aailability of power and operation of pumpsets for 16 contineous lhours is very uncertain. Therefore, it is feel that in case of individual schemes left to Gram Panchayats for lmaiontenance, better this standard is reduced to 8 or 10 hours.

In a nutsheel the followiong precautionary measures are to be observed in tappiong irigation canals.

I. Selection of dependable canal system.

2. Drawal of total wate5r required during the lcanal flow periods only duly accountiong for regulation and closure periods of the

canals.

3. Selection of roper tapping point to ensure gravity flow and to avoid drawal of polluted water.

4. Drawal of lwater through conduits to avoid pollution.

5. A suitable in-take strecture to avoid suspended material entering into the water mains.

6. Ensuring self cleansing velocity in gravityh mains to safeguard against silting. In case of pumping better the hours of pumping be around 8 to 10 lhours a day.

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PROJECT FOR PROPOSED C.P.W.S.SCHEME TO UDDANAM AREA COVERING 268 VILLAGES OF ICHAPURAM MANDASA AND KASIBUGGA PANCHAYAT SAMITHIS OF SRIKAKULAM DISTRICT IN ANDHRA PRADESH.

ESTIMATE COST Rs.690. LAKHS.

* SRI M.V. RAMAKRISHNAIAH

1. INTRODUCTION :

The comprehensive P.W.S. cheme for Uddanam area of Srikakulam District, is a water supply scheme to cover 268 villages and hamlets with sources from Bahuda River, Mahendratanaya River and Bellas (Water springs.)

I. 1. GEOGRAPHICAL FEATURES :-

The area of the project is situated Geographically- Latitude. 18° 20' to 19° 10' of Northern Latitude, Longitude. 83° 05 to 84° 15 of Eastern Longitude. The population as per 1981 census is 1,88,893.

The predominent soils of the area are sandy upto 0.50 metres depth and later mixture of sand and red earth in most of the villages. The global coordination of the scheme are

Latitude. 18° - 20'

Longitude. 83° - 05

I.2. RAINFALL :-

The average rainfall of the area is :

1.	Ichapuram.	1020 mm
2.	Sompeta.	1029 mm
3.	Palasa.	1007 mm

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* Executive Engineer Panchayat Raj Department.

I. 3. WATER SOURCES :-

There are two major rivers by name Bahuda and Mahendratanaya which flow in the Panchayat Samithi of Ichapuram and Mandasa, respectively. For the Kasibugga area the water is to b e pumped from the River Mahendratanaya to cover the area. Further, for some of the groups of Ichapuram and Mandasa Panchayat Samithis the sources are taken as Beelas (Springs) at the recognised points.

I. 4. SOCIO-ECONOMIC CONDITIONS:-

Uddanam area is the most backward area in the Srikakulam District. It lacks all basic amenities like drinking water, communication and electricity. The people of this part are uncivilised and much below poverty line. Most of the people are labourers and as they do not find any work in this area, they generally migrate to neighbouring state to earn their livelyhood. The main crops grown in this area are cashew and coconut. Paddy is also grown in a few hectores, where water spring exists in coastal belt. Such areas are locally called as Beela areas.

As water is not available in the nearest vicinity half of the family members have to be engaged only to secure drinking water, they have to walk about 3 to 4 Miles in sandy track for a pot of water and thus they are unable to earn their daily wages, especially in summer.

2. 1 N E E D :-

Since the area being of sandy soils and that there is no possibility of tapping water between 120 to 150 feet (which is also not guaranteed, not to dry up) a special project to cover the villages is needed for providing safe drinking supply.

2. 2 FINANCING :-

The comprehensive P.W.S. Scheme is proposed under the generous Royal Assistance of Swedish Government.

3. 1 . SCOPE OF THE PROJECT :-

This project aims at providing protected water supply for 268 villages in 3 panchayat Samithis of Ichapuram, Mandasa and Kasibugga in 15 Grouping with a headwork. The water shall be distributed to the village through public stand posts at suitable places according to population.

3. 2 . DESIGN CRITERIA :-

It is proposed for supply water @ 40 Ltd.,per day.

3. 3 DISTRIBUTION NET WORK :-

There are 268 villages to be provided with distribution which require theoritic survey such as compus survey of the villages and survey of levelling with reference to G.T.S.

GROUPING OF THE VILLAGES :

The Uddanam area covering 268 Villages is grouped into fifteen for convience of supply of water from fifteen sources. The sources are 3.66m dia infitration wells at river Bahuda, river Mahendratanaya, Bidimi Jakkava and Beelas as listed below :

Group	I	-	Construction of 3.66m dia infiltration well at River Bahuda.	
Group	II	-	-do-	at River Bahuda
Group	III	-	-do-	at Neelavanka Beela
Group	IV	-	-do-	at Kaviri Beela
Group	V	-	-do-	at Jagathi Beela
Group	VI	-	-do-	at Kusumpuram Beela
Group	VII	-	-do-	at Manikyapuram Beela
Group	VIII	-	-do-	at Zinkibadra Beela
Group	IX	-	-do-	at Mahendratanaya River
Group	X	-	-do-	at Mahendratanaya River
Group	XI	-	-do-	at Bidimi Jakkara
Group	XII	-	-do-	at Bidimi Jakkara
Group	XIII	-	-do-	at Bidimi Jakkara
Group	XIV	-	-do-	at Bidimi Jakkara
Group	XV	-	-do-	at Mahendra Tanaya River

SUMMARY

The present project of C.P.W.S. scheme covers 268 villages and hamlets of "Uddanam area in the Panchayat Samithis of Ichapuram (108 villages) Mandasa (94 villages) and Kasibugga (66 Villages). The Toral population served will be 1,88,893. The project is being taken up under Bilatula Assistance programme (Swedish Government) for a tune of 69 Millions.

The project area covers economically backward people, a majority of whom are fishermen and Aghnikula Kshatrias, who have no other livelihood. The area is of sandy soil, the ground water table ranges from 120 to 150 feet from ground level and it is difficult to get water. Also the experience proves that the borewells and open wells executed in the area are likely to get dry up in a period of 3 years, number of family members has to spend a long time to fetch water from longer distance and thus lose their livelihood for the day.

This project will inprove the socio-Economic conditions of the people in general, particularly in providing protected drinking water facilities and help ameliorate health standards and their livelihood.

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U.K. PROJECTS AND DANISH ASSISTANCE

S.A.Kabeer*

The aim of the Decade Programme is to provide basic aminity i.e. water supply to entire population and sanitation facility to 25% population in the rural areas by 1990-91. This is being tackled on war-footing basis. But due to limited grants released both by the State Government and Government of India under Rural Water Supply, it may not be possible to achieve the goal of Decade Programme and in turn we have to seek financial assistance from friendly countries.

Royal Netherlands Government have already offered this type of assistance to the water supply project of 171 flouride affected villages. In addition to this 4 new water supply projects in the district of Prakasham, Kurnool, Mahboobnagar and Medak will also be implemented with their assistance.

There are other areas in the State where implementation of such type of projects is needed. Recently the Government of United Kingdom have also come forward offering financial assistance for the implementation of suitable projects for rural water supply. The Chief Engineer, R.W.S. had a discussion with the officials of British High Commission on 13th February 1987 at New Delhi. As per the discussion, one district has been selected from each region ie..Krishna district from Costal Region, Ananthapur district from Rayalaseema Region and Nalgonda district from Telangana Region. The preliminary project reports for these three district are under finalisation for posing under united kingdom's aid.

The project for Krishna district will be covering 240 villages consisting of 89 villages affected with fluoride, 151 villages affected with excess salinity. The tentative cost of this project is Rs.1530lakhs. It will serve a population of 4.86 lakhs by individual and C.P.W.S.schemes.

The project for Ananthapur district will be covering 409 villages consisting of 93 villages affected with fluoride and 316 villages having hard core areas. The tentative cost of this project is Rs.1000.00 lakhs. It will serve a population of 7.08 lakhs by individual and C.P.W.S.schemes.

The project for Nalgonda district is a typical one. The main project will be covering 195 villages consisting of 90 problematic villages and the remaining 105 enroute villages. Again, the 90 problematic villages consist of 8 fluoride affected villages and 82 scarcity villages. The ground water potential is very meagre in these villages. As there is no possibility of taking up of individual schemes, C.P.W.S.scheme has been proposed with source as Nagerjunasagar Dam near left canal. The main project comprising 5 zones will be costing Rs.4300 lakhs.

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The present project which is being posed for United Kingdom's aid consists of 3 zones only, which are Zone-I, Zone-II and Zone-III, embracing 23,43 villages and one village, respectively, totalling to 67 villages. The tentative cost of this project is Rs.2500 lakhs. At present, it will serve a population of 0.766 lakh, but the headworks and pumping main are so designed to serve the population of 2.28 lakhs for all the 195 villages.

It is expected that all the above three water supply projects will be okeyd by the Government of United Kingdom and will be implemented in a phased manner. These projects will prove a boon to the rural masses of the three districts.

ROLE OF SCIENCE AND TECHNOLOGY IN SOLVING DRINKING WATER PROBLEMS

BY

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The Seventh Plan of the Government of India envisages providing drinking water facilities to the entire rural population. To help implementation of these facilities through Minimum Needs Programmes (MNP) And Accelerated Rural Water Supply Programme (ARWSP), the Technology Mission hass been set up by the Central Government. The Mission will deal with specific problems like salinity, fluoride content, presence of iron, and bacteriological contamination. It will also deal with ground water management, assessment of water availability etc., The Principal idea is to adopt an integrated and inter-disciplinary approach with a view to ensuring continued availability of safe water in rural areas for drinking purposes. The objectives of the Mission have been clearly defined. The Mission proposes to involve cost effective technology mix to achieve the 3 principal objective viz. covering 2.27 lakh problem-villages by 1990, supplying 40 LPCD potable water in non-desert areas and 70 LPCD in desert areas (40 for human beings and 30 for cattle). The new strategy is to focus on 5 functional Sub-Missions in the entire country (eradication of guinea-worm, control of fluorosis, control of brackishness, removal of excess iron, and source finding, conservation and recharging of the ground water) and on 50 Mini-Missions (Project areas) to evolve new cost effective science and Technology techniques. The other strategies are simultaneous application of these techniques for the rest of the problem villages and development of an integrated approach for water conservation.

The mission approach is to take up pilot projects in the coming 2 years: 11 districts during 1986-1987 and 12 districts during 1987-1988. The first phase covers Andhra Pradesh (Kurnool), Gujarat (Kutch), Haryana (Gurgaon), Karnataka (Gulbarga), Madhya Pradesh (Jhabua), Meghalaya (Khasi Hills) Mizoram (Aizwal), Rajasthan (Barmer), Tamil Nadu (Ramanathapuram), Uttar Pradesh (Mirzapur), and West Bengal (Bankura).

The Rural Department in the Central Ministry of Agriculture is the nodal agency for the Technology Mission. The management is through Empowered Committee at the national level which is assisted by four Technology Advisory Groups. At the State level, Secretary -in-charge of Rural Water Supply is the State Project Co-ordinator

with State Advisory Committee, District Level Project Co-ordination Committee, etc., to assist him. A funding of about Rs. 150 crores during the Seventh Plan is envisaged to be channeled through ASRWSP and RLEPGP.

a. Develop Research and Development to Mission requirements.

b. Co-ordinate activities of all research organisations for adequate and timely science and Technology inputs.

c. Co-ordinate with other agencies.

d. Provide necessary assistance in the identification of the project, preparation of Project Report, Technical appraisal,etc.

e. Help the Project Agency in preparing an Operation and Maintenance (O&M) manual.

f. Reorient normal programmes to meet Mission requirement.

The CSIR Laboratories involved are CSMCRI,ITRC,NEERI, NGRI, RRL-Jorhat and SERC-Roorkee. A few more CSIR Laboratories are expected to be involved for specific tasks.

In Andhra Pradesh, Kurnool district has been identified for the pilot project. The Chief Engineer, Rural Water Supply, PR & RD, is looking after the Mission work from the State Government side. An Executive Director for the Mission has recently been applinted by the State Government. For CSIR inputs, the co-ordinator is NGRI-Hyderabad with participation from NEERI-Nagpur and Hyderabad, CSMCRI-Bhavnagar, NICD-New Delhi, NGRI/CGWB/NRSA and PTC (HYD).

Kurnool district, located in the South-West part of the State, is a predominantly drought-prone area. The State Government and the concerned organisations including CSIR Laboratories/PTC-Hyderabad have taken various steps in the Mission work. The main problems of the district are scarcity, salinity and brackishness, fluoride, and bacteriological (mainly guinea-worm) contamination. Survey and testing work has been carried out in select villages. A draft project report has been prepared by the State Government with the help of Participating organisations.

So far as technological inputs are concerned,NGRI hasthe expertise in matters related to ground water,NEERI has the experitise in deflouridation, guinea-worm/bacterial eradication, and iron removal, and CSMCRI has the expertise in desalination by different methods. After the draft report is finalised the actual implementation will be taken up by the State Government with the assistance from concerned organisations.

A Few Suggestions Towards an Effective Management of Materials in Rural Water Supply Projects

BY

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SUMMARY

The importance of materials management in Rural Water Supply programme is explained. The normal practice of mixing up stores-keeping with the inventory management is not desirable. The latter must be the responsibility of a higher level management. An allocation of the managerial functions is suggested within the frame work of the existing organisation. A network is developed for project schedule, and it enables the determination of time and material estimates. A proper inventory management is the essence of the materials management. The inventory is classified based on the consumption, criticality and a service level is assigned to each group of classification. The latter influences the inventory control measures. Three inventory models are discussed. In view of the importance of the inventory management, it is suggested to constitute an inventory committee to review the inventory levels and the governing policies for its control periodically. The statistical methods of quality control provide effective measures to control the quality. It is desirable to maintain a panel of good suppliers to ensure the desired quality, proper service, and reasonable prices.

1. INTRODUCTION

SCOPE :

Material management emerged as a distinct management function. It embraces such functions

as the study of the need, identification of sources of supply, fixing up the right price, the follow-up to ensure proper delivery, inventory control, transportation, receiving, quality control, surplus disposal and material handling.

The uncertainty both in demand and supply calls for dynamism in the decisioning process. Management science has contributed valuable mathe matical techniques like decision theory, game theory, simulation, linear programming, regression analysis, forecasting methods to aid problem solving in material management. It is a blend of managerial judgement, gained through experience and training, and the appropriate mathematical model that provides an effective management.

The volume of purchases made by department is large, and there ara a few potential suppliers. The supplier, who invests large sums of money keeping the department in mind and whose organization is small compared to the department, frequently resorts to different kinds of stratagies to secure the business he wanted. In suah an environment, the purchase manager tastes real power by having the right to award or withhold business. It is the manner by which he exercises this power that influences the image of the department significantly. Procurement function is thus not a simple buying. It involves problem solving. It occurs most of the times in a social context. It therefore requires both analytical skill and maturity in interpersonal relations.

IMPORTANCE :

In water supply schemes, materials share nearly more than two-thirds of the estimates on an average. The annual inventory carrying charges, which includes rent, taxes, salaries, interest charges, handling costs, physical deterioration cost, may amount to about one-fifth of the cost of the material. It may be still higher as the department, on the whole, lacks inventory consciousness. Thus the material component consumes a large portion of the water supply estimates. An effective procurement system therefore contributes substancial savings. This emphasizes why the material acquisition should be managed in the most effective manner possible.

A poor performance of the materials function gives rise to wrong quantities, improper quality, and late delivery. It makes the life miserable for the ultimate user of the service. Good management of materials avoids trouble. An indicator for it is the absence of the complaints from the users of the service.

A proper management of the material enhances the interual and external lamge of the department. It, by its inherent nature, stimulates the talent.

2. FUNCTIONAL ALLOCATION

Rural water supply wing is a small srvice organization. A separate purchasing wing is considered not necessary at its present level of activity. A judicious allocation of the managerial functions is therefore desirable to achieve a satisfactory level of performance. The allocation of the managerial work is one of the most subtle aspects of the organizing process. To suggest a suitable apportionment of the duties among the departmental officers, we take a look at the various functions that come under material management. They are material estimates, inventory control, purchasing, transportation, Stores, receiving, material handling, disposal of scrap and surplus and quality control.

Project Manager (Executive Engineer) develops the total project execution schedule. It enables one to determine the time and quantity schedules for materials that are required to maintain the execution schedule,

The system of inventory control maintains records of material on hand, on order, and total usage. It introduces measures to preserve an adequate and balanced inventory. It issues requisition to the purchasing wing when need arises.

The purchasing function translutes the requisitions issued by the inventory control into purchase orders, and follow up to ensure delivery at the right time with proper quality and quantity. It is rated as dynamic if the purchase Manager has

the authority and competence to decide on matters concerning the specifications and selection of materials.

The three functions described in the preceding three paragraphs are vital in the management of materials. It is ideal, in one sense, to assign them to the Executive Engineer, Superintending Engineer and Deputy Chief Engineer respectively. However, we need a potentially strong communication channel to make this centralized purchase function sucsessful. It invites higher reserve inventories to compensate for the extra time involved. The geographical disperation of the projects add further problems. On the other hand, the practice of keeping inventory control with the stores depa rtment is not desirable. The latter aspect, which is concerned with the storage and han dling of inventory after it has been received, is looked after by the Executive Engineer. Furthermore the many decisions that must be made in carrying out a sound policy of inventory control should be the responsibility of a higher level management. Effectiveness therefore demands that both the functions inventory control and the purchase are assigned to the Superintending Engineer.

The Deputy Chief Engineer may look after such aspects concerning the purchase, which are dealt effectively at a central level in the organization. They are to evaluate and standardize the speci fication of the materials, to select the best sources of supply and to negotiate the terms of the purcha se in respect of annual rate contracts, to maintain necessary records to provide data on the price trends and supplier performence.to maintain proper contacts between the department and suppliers. and to look constantly of new and more effec tive sources of supply for reducing cost and achieving better service.

The functions of store keeping. which involve an accurate control and maintenance of the records, and materials handling, which is concerned with the movement of the materials within the division, are the responsibility of Executive Engineer.

The Assistant Engineer is responsible for identification and handling of the material on receipt, quantity verification, report making. and routing of material to the place of use or storage.

The functions of quality control. which involve the inspection of materials and suppliers operations, and the disposal of scrap and surplus are better performed if they are alloted to the Deputy Chief Engineer. The research and development cell, under the control of Deputy Chief Engineer. is required to make a careful study and analysis of materials and sources of supply to promote quality and service.

The organizational structure, thus developed, is shown in Annexure I. The body presided by the Chief Engineer and consisting of the Deputy Chief Engineer. Exetutive Engineer (R & D), Executive Engineer (Q.C) determines the policies which aim at a sound management. It aims at presenting a unified policy and practice to all suppliers. This results in sounder, broader, more enlightened procurement policy. The body issues written policy statements, send memos, and calls for staff meetings to maintain an effective communication of the policies,

The Superintending Engineer should report to this body periodically, and specifically if need arises. The main concern of the Chief Engineer is to bring the several managerial functions into one fold. He takes measures to ensure the co-ordination of the proper procurement activities, proper consolidation of quantities, prompt payment of bills, satisfactory regulation and control of inventories, and accurate adaptation of purchases to needs throughout the department. Improper and inadequate control would invariably lead to an uncoordinated and haphazard performance with many persons working at cross purposes. To make his function successful, he should be given adequate assistance and must have the backing of the Government, the top executive management, He should also receive reports from the lower level to develop an effective communication. The reports should contain a condensed version of the significant transactions that take place in the department. They should be specific, brief, and to the point. They should cover such aspects like inventory

levels, delivery performance of suppliers, and others. The statistical data in the report must be reduced to bar charts, pie charts, graphic curves, and tables for easy assimilation.

The organization structure thus introduced should select adequate sources of suppiy, control the inventory and quality of supplies. These aspects are discussed in the three succeeding sections after a brief description of estimation of meterial requirements given in the following section

3. MATERIAL REQIREMENTS

The Executive Engineer develops a plan for the execution of project, referred to as project schedule. It is usually described by a set of statements or bar charts. They are almost replac ed by network techniques in the modern management. The Project schedule provides the relavant information about the needs of the material. This isillustrated in the following.

The net work for typical water supply scheme with a bore well as source is developed and given in Annexure II. The detailed description of each activity and important events are shown in in Annexure III. The material requirements can then easily be derived from the network. They are given in Annexure IV.

The inventory control of the items in Annexure IV is explained in section 5 while their quality control is dealt with in section6.

Incidentally we may note from the net work that the work on the source, subsequent sanction of estimate, procurement of pumps. and O. H. S. R. construction are critical activities. The non-commencement of the O. H. S. R. till the event of completion of pumping main is justified on the reasoning that all most all the schemes are in villages where there is acute scarcity of water even for drinking. In such circumstances we can not expect adequate quantities of water for proper construction of reservoir unless the water is brought to the O. H. S. R. site from the source. Plenty of water assures a sound construction.

While the selection of source, its drilling. testing. and development are critical activities both from the planning and financial point of view, they are often ignored, and effort is spent in many instances in the procurement of the materials like R. C. C. pipes.

The selection of pumps is an important engineering judgment which is to be based on certain basic data that is obtained from the yield test and others. There are instances where pumps are purchased when the source is not drilled (There is no basic data at all in such a case); and even in such cases where the bore well is drilled the purchase of pumps is based on the inadequate data furnished by the so called V - notch test conducted at the time of drilling.

It is the above poor management of the materials that is responsible for any embarrassments and criticisms faced by the Rural Water

4. A BRIEF SKETCH ON THE SOURCES OF SUPPLY

The essence of the acquisition process is the rational selection of dependable and progressive sources of supply. They are identified by a proper evaluation extending over such factors like technical capability. manufacturing strength, financial strength, and management capability.

A good supplier does not hesitate to provide the desired quality, proper service and deliver on time as promised at acceptable price. He reacts to unforeseen needs such as accelerated or decelerated volumes of business, specification alterations, service problems. and any other requests that are legitimate. He suggests better ways of serving the department and looks for the new ways of development. He provides technological and other expertise when requested. He remains competetive on a continuing basis.

It is hard to find suppliers who fit these requirements. The art of good purchasing is to keep them on top in the supplier list when they are found. They should be well rewarded to

secure and maintain their active interest and co-operation. The greatest reward one can offer is the assurance of future business in response to a satisfactory performance.

There is always a certain rationale present in awarding a certain volume of business to a supplier. The art of good purchasing is to make the reasoning behind that decision as sound as possible.

There is an uncertain environment present in almost every supplier choice. Therefore, there is a certain risk inherent in the decision. This is more so with an unknown supplier. In such cases, the Manager may try to minimize it by placing a trial order, seeking additional information, and asking for advice from others on such matters as engineering judgement.

Thus the job of a materials Manager is not simple. Furthermore if he treats the uncertainty, regarding the future business, as a powerful tool to keep the suppliers on their toes, the latter may fix priorities among their customers. When there is a shortage of raw materials, he may face problems in the procurement of vital requirements. On the other hand, the real danger threatens when the materials Manager becomes a puppet in the hands of suppliers. The suppliers evaluate the materials Manager with reference to his square dealing the courtesy he has extended, his honesty and straight for wardness. They appreciate and remember these qualities. It is the materials Manager who enhances or detracts the reputation of the department.

It is in this context that the supplier management assumes an important role. To have an effective supplier management, a source selection committee and a source relationship committee may be constituted chaired by the deputy Chief Engineer. The latter may periodically review the source relationships, consider the measures to improve present relationships, review any deficiencies, and recommended corrective measures. The former may evaluate the suppliers at the time of annual rate contract or whenever the need arises.

Dickson [1] proposed 23 factors which may be used in evaluating the potential suppliers (Annexure V). The most important measures are quality, delivery and the record of performance in the previous transactions. They are tangible and concrete, whereas the other yardsticks measure performance by inference. Though prices play a prominent role, they are usually determined objectively. Based on these meatures, the suppliers may be rated as top rating, good, fair, and satisfactory.

An application of these principles is made to select adequate sources of supply from the local market in respect of C. I. D. joints and valves. The analysis reveals that there is no potential supplier worth mentioning for the supply of valves. With regard to the C.I.D. joints, the list of suppliers gets reduced to a very few.

It is in this type of situation that the material management takes the rasponsibility of the development of a suitable source. Source development is not initiated as an appropriate technique or tool, but it is thrust upon the management as the only alternative than making the component itself.

5. INVENTORY CONTROL

The material component of Rural Water Supply schemes was identified earlier (Section 3, Annuxure IV). A preliminary step towards the development of an inventory system is an analysis of the material based on Annual consumption value and criticality. It gives a classification of the material in a matrix form, which will be referred to as materials matrix for convenience. The items in the first, second and third columns represent 75, 15, and 10 percent of annual consumption respectively. The rows represent a progressive decrease in the criticality.

If the stock-out and overstock cost of each item are known a service level (it may be defined as the rate of number of units supplied and the number of units demanded), can be easily assigned to it. Unfortunately they are difficult to estimate. Such a complicated anaiysis is considered

not necessary for the water supply schemes. However it is not difficult to make a reasonable estimate of the required service levels based on experience. Both the materials matrix and its companion matrix of service levels are given in Annexure VI. The latter forms the basis to identify the inventory control policies: The inventory control measures vary considerably for various items depending on their position in the materials matrix.

For instance, it is proposed to control the purchase of R.C.C. and H.D.P.E. pipes through systems contracting. It is relatively a new technique, and it is simply stockless buying. It is a blanket type contract (quite similar to the annular rate contract of Rural Water Supply wing for R.C.C. and H.D.P.E. pipes) which is developed in great detail regarding the approximate quantities to be used in specified time periods, prices, with a flexibility for adjustment, making deliveries within a specified period, simplified requisitions and billing procedure, and a complete catalogue of all items covered by the contract. Under this system, the powers of acquisition may be delegated to the Assistant Engineers. They issue requisitions to the suppliers right at the time when the material is needed for use in the project without having any necessity to route it through the stores. This procedure achieves a minimal red tape and substantial inventory reductions.

For the other items one of the three models described later in the present section can be employed to achieve a proper inventory control.

Inventories are important for several reasons. They facilitate the smooth execution of project, provide protection against the uncertainties in supply and demand, and enable a reasonable utilization of man-power. Britney (2) classified the inventories into 15 categories based on their functions and forms. Three are relavant in our context. They are cycle, buffer and anticipation inventories.

Cycle inventories are very common. The annual demand is ordered at several points in a year. The order size in each cycle may be fixed by the so-called economic order quantity. Cycle inventories tend to accumulate at various points in the system.

Buffer inventories exist at a point in the system as a result of uncertainty of the demand and supply of the material at that point. The higher the service level, the higher is the level of buffer inventory. The latter may be determined by balancing the stock-out and carrying costs.

Anticipation inventories are accumulated for a well defined future need. They may arise because of expected changes in demand, supply, or price.

Anticipation inventories have become a source of continuous annoyance to the R.W.S. Wing. They are usually built on two grounds; one the future price increase and other the lapse of grants. Material purchase is based on need and economical considerations. By their very meaning anticipation inventories and lapse of grants do not go together, and absolutely there is no rationale behind such a transaction.

Anticipation inventories, built on the foundation of expected price increase, must be dealt with extreame care. Yhis is a case where there is a trade-off between carrying costs and price increases. Aljian (3) gave a detailed break-up of the costs that are involved in the carrying costs. All of them must be carefully analyzed before taking a decision A characteristic feature of the R.W.S. Wing is the inadequate storage space and imporoper facilities for handling. Their effect on some of the tactors listed by Aljian must be seriously thought of. Another aspect that shc uld be well thought off is that tne purchase of large anticipatory stocks (in respect of certain materials whose production is limited) at one point in the system can create stock-outs at other points in the system. In view of all these aspects, an inventory committee presided by the Chief Engineer may be set up.

The committee is made responsible to take decisions on the need for purchase of anticipation

inventories, fix the levels of buffer inventory, and lay down the broad inventory control policies.

The Government, which is the top management, may review the reports of the committee periodically. The inventory level should neither be too high nor too low. An excessive inventory may lead to the freezing of the capital. and consequently to the inability to maintain the required levels of inventory in respect of certain items and also the project schedule. This situation is not so uncommon in the execution of Rural Water Supply schemes. It also makes the carrying charges unduly excessive. The inventory purchased and kept in stock for unduly long periods will always represent some loss even though it is subsequently used. A low inventory level also has its disadvantages like the unexpected shortages may interfere with the project schedule etc.

For any given situation, there is always a correct quantity and a right time to purchase it. To implement this principle, inventory control and purchase wings must work in close co-ordination. The correct quantity is the one at which the cost of acquisition equals the cost of the possession. This is referred to an economical order quantity.

The process of building up, cutting down. and rebuilding up the inventories (with no respect for the economical quantities) during the periods of releases, nonreleases, and further releases of grants respectively contributes little to the enhancement of the sound management.

Inventory control may be defined as the planning. ordening, and scheduling of materials. It aims at minimizing the capital investment subject to the constraint of feasibility,

Broadly speaking most procurement inventory control models are of two types, deterministic and probabilistic. The former, in contrast with the latter, assumes conditions of certainty regarding demand, price, and costs. Though they are not realistic, the deterministic models are useful in many situations. Both the deterministic and probabilistic models may be further divided into fixed quantity and fixed period type.

l and n are procurement times in time units and in terms of pieces, X is an economic order quantity. The set-up and possession costs are denoted by a and b respectively. The price per unit is denoted by c, and the demand by d. X is the only variable.

The total cost z is given by

$$z = cd + \frac{d}{x}\, a + x\, c\, \frac{b}{2} \qquad (1)$$

The function takes minimum when its derivative is zero.

$$\frac{da}{x_2} + \frac{cb}{2} = 0$$

$$x = \sqrt{\frac{2\,ad}{bc}} \qquad (2)$$

The above value represents the economic order quantity. A buffer inventory may be added to this model to give a safety factor. The latter insures against contingencies such as unforeseen increase in the rate of usage, delays in delivery schedules, and receipt of defective materials etc. The level of buffer inventory depends on the service level.

Operationally a fixed period model is simpler. But they require a higher level of buffer inventory

The total cost is again given by

$$z = cd + \frac{d}{x}\, a + xc\, \frac{b}{2} \qquad (3)$$

Further more

$$\frac{d}{x}\, y = l$$

Where y is the period covering the order and it is expressed as fraction of the year. Thus

$$x = yd \quad \ldots \quad \ldots \quad (4)$$

Introducing (4) on (3)

$$z = cd + \frac{a}{y} + \frac{bcd}{2}\, y \qquad (5)$$

For a minimum,

$$-\frac{a}{y^2} + \frac{bcd}{2} = 0$$

Transposition yields

$$y = \sqrt{\frac{2a}{bcd}} \qquad (6)$$

The above value represents the optimal period.

To explain the probabalistic inventory models, add a buffer stock in figure 1. Let 'l' be the lead time. Assume that the daily demands $X_i (i = 1, \ldots l)$ are independent normal random variables with a common mean 'u' and variance 'σ'.

It then follows that the usage

$$X = X_1 + \quad \ldots + X_l \quad \ldots \quad (7)$$

during lead time 'l' is a normal random variable whuse mean and variances are 'l u' and 'l σ^2' respectively [4]. The confidence limits for the latter are governed by the chi—square distribution [5]. Using the relavent tables and the given setvice level, one can determine the confidence limit for the standard devication of (7) as 'L $\sqrt{l}$ σ' (where L is a number obtained from the tables) which represents the level of buffer inventory. So, whenever the inventory level drops to 'lu + L $\sqrt{l}$ σ' a purchase order is issued for the economic order qnantity given by (2)

6. QUALITY CONCEPT AND ITS CONTROL

Quality is a combination of several characterstics. The specific combination depends on the intended function and economics, and it is always a compromise. Quality is the heart of a sound purchasing system. It can not be divorced from technical suitability. However the primary considerations of the quality may vary over such a range as the case and simplicity of operation efficiency, durability and reliability (Reliability is a numerical measure of the quality. It is a mathematical probability of the satisfactory performance of an item for a specified time).

The determination of the right quality for a given purpose is the responsibility of the research and development cell.

A clear and accurate description of the quality determined is essential. It may be achieved through a set of specifications that cover physicl or chemical characterstics, material and methods of manufacture, and performance, and by engineering drawings. The research and development cell may be entrusted with the task of developing specifications and engineering drawings for various material components.

Specifications convey to the supplier a clear idea about the quality of the item. Unless we have some means to see that the specifications are lived up to by the suppliers, the purpose of the development of a set of satisfactory specifications is defeated. Inspection is therefore needed, and it ensures compliance with the standard of quality.

The inspection of the material may be done either at source or at the destination. There are certain benefits in the former, people, that are to be trained to acquire the necessary skills, are few. Uniformity of inspection and acceptance criteria, and elimination of service delays and transportation costs arising from the rejection of nonconforming material are achieved. Since the staff makes periodical inspections of the source, irregularities in proudcts are earlier detected and corrected.

It is a good practice to include the procedure for inspection and testing in specifications. It is the responsibility of the Executive Engineer (Quality Control) to prescribe the sampling procedure, specify the statistical limits, and prepare a statement of the procedure of the statistical method employed.

The rule of thumb methods are inadequate. At the same time the screening is neither practicable nor reliable in most situations. The alternative is to sample- The sampling methods are based on the laws of probability, and their use reduces the inspection time and effort considerably. Sampling procedure varies with each situation. It is always the aim to secure a sample that is representative of the total population being tested. Random sampling is a common technique.

The basic principle in random sampling is to accept a method of selection that gives every member of the population an equal chance of being drawn. If the entire consignment can be throughly mixed together, then a sample, picked up from any part of the mixed population, represents a valid random sample. If it is impossible to mix the members throughly together, then they can be assigned consecutive numbers and the numbers can be picked up at random. Since human minds are poor random number generators, the process may be accomplished through the use of tables of random sampling numbers or a standard computer program. The sample identified by these numbers is subjeeted to detailed inspection.

The sample statistics can be classified into two types, attributes and variables. Their probability density functions are binomial and normal respectiveiy.

The statistical methods of quality control determine a sample of minimum size for a given lot. They determine an acceptable degree of variability. They also ensure an acceptable level of accuracy.

Three types of sampling plans are normally employed, A single sampling procedure is empioyed on small lots where there is a need to maintain a high quality level. By the use of sampling tables, the sample size is determined with reference to the size of the population and the acceptable quality level. The entire lot is rejected if the number of defectives in the sample exceeds the acceptable number.

In double—sampling plans. on the other hand, quality tests are conducted on a small initial sample drawn from the population. If the results are not decisive, a second sample is drawn and tested. The average number of pieces inspected in double-sampling procedure is usually smaller than in single-sampling procedure.

To illustrate the double-sampling plan, con sider a lot of 4,000 pieces. The acceptable quality level is 1%. The two sample sizes 150 and 300 pieces and the permissible defectives are 3 and 7 respectively. The testing procedure is as follows.

1. a) If $d_1 \leq 3$, accept the lot.

   b) If $d_1 > 7$. reject the lot.

   c) If $3 < d_1 \leq 7$ indecisive and go to step 2.

2. If $(d_1 + d_2) \leq 7$. accept.

   If $(d_1 + d_2) > 7$, reject.

d_1 and d_2 denote the number of defectives in the two samples.

The third plan of sampling is the sequent'al sampling. It is employed where lots are comparatively large and homogeneous. It involves lesser inspection. As we proceed with the test of each place, the decision to accept, reject or continue with the inspection is made. Sequential sampling charts greatly facilitate inspection. They are diagra matic representation of the relavent mathematical formula, and on them the two regions of acceptance and rejection are deliniated. A decision to accept or reject is taken depending on the boundry reached as we proceed with the plotting of points with each piece.

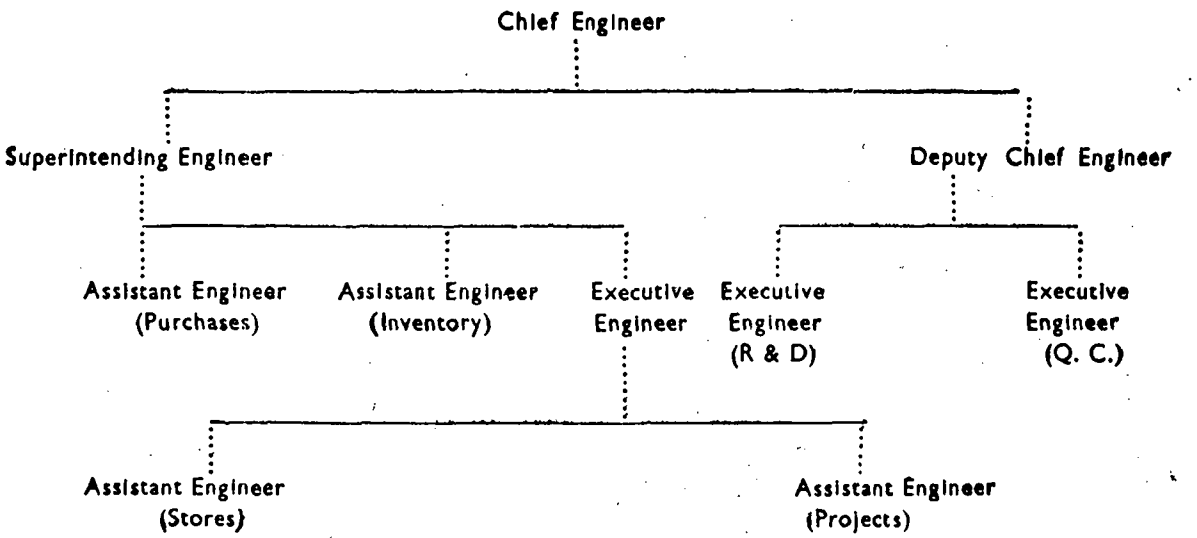
7 DISCUSSION

In this paper, the management of material is viewed in the limited context of the existing frame work. It is felt that there is no need for a major shake up of the existing organisational structure of the R.W.S. Wing at the present level of activity, though there is a need for strengthening. One such area which needs strengthening is the geophysical exploration of ground water. A survey team, headed by an experienced geophysicist, is essential for each circle.

There is a need to write up a purchase manual. It may be necessary to constitute several committees to develop various aspects of the manual concerning the standardization and description of the material specifications, inventory polices, quality control aspects and others.

ANNEXURE-I

ORGANIZATIONAL STRUCTURE



ANNEXUR - III

Description of network activities and important events.

Sl. No.	Activity	Description	Time in weeks	Important events	Description	Earliest time	Latest time	Slack time
1	2	3	4	5	6	7	8	9
1.	1-2	Geophysical Survey	1					
2.	1-3	Requisitution of casing pipe	1					
3.	1-4	Fixing of bore drilling agency	2					
4.	2-5	Bore drilling	1					
5.	5-6	Yield test	1					
6.	5-7	Water analysis	2					
7.	6-8	Interpretation and decision on source	1	8	Source settled	6	6	0
8.	8-9	Lead time for sending of estimates	4					
9.	9-10	Designs approval	1					
10.	10-11	Sanction of estimates	1	11	Estimate sanctioned	12	13	1
11.	10-12	Administrative lead time for procurement of pumps	2					
12.	12-13	Lead time for receipt of tenders	4					
13.	13-14	Analysis and finalisation of tenders	2					
14.	14-15	Suppliers lead time	6					
15.	14-16	Requisition for G.I. pipes, specials and chlorinator from store	1					
16.	14-17	Power connection	4					

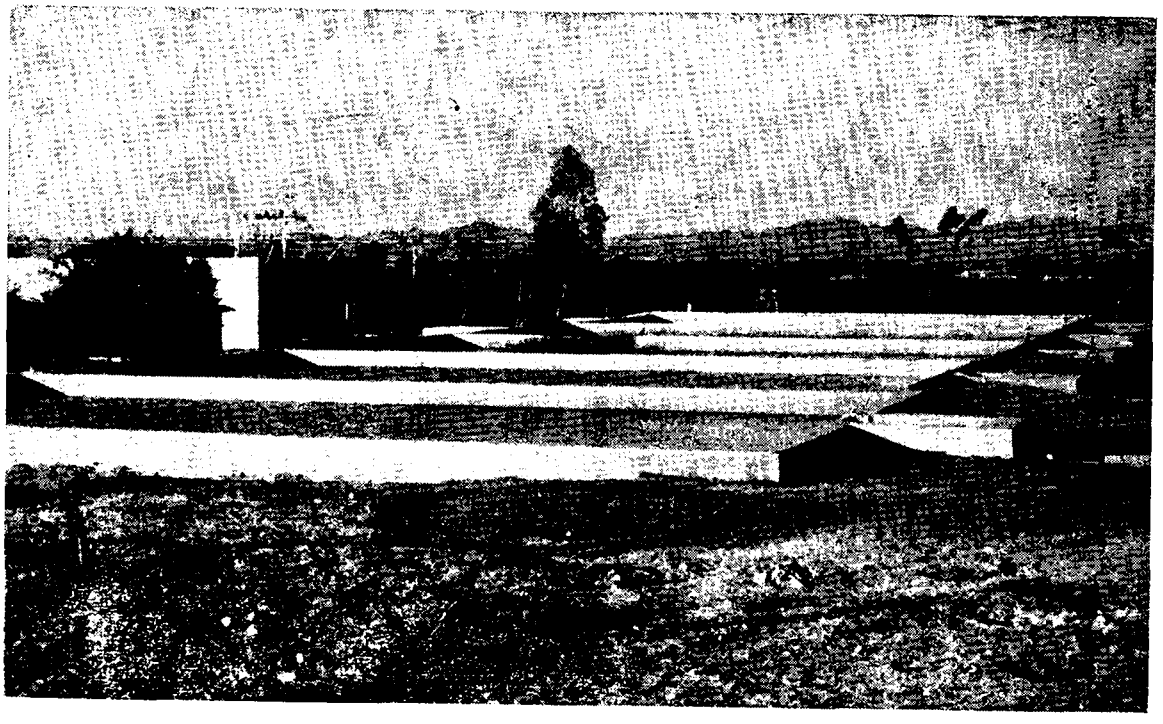
1	2	3	4	5	6	7	8	9
17.	14 18	Procurement of materials for internal electrification	2					
18.	11-19	Administrative lead time for pump room						
19.	19-20	Administrative lead time for entrustment	4					
20.	20-21	Completion of Foundation	1					
21	21-22	Completion of basement	1					
22.	22-23	Completion of super-structure	2					
23	23-24	Completion of Roof slab	1					
24.	24-25	Finishing	3					
25.	24-26	Fixing shutters of doors and windows	2					
26.	11-27	Floating tender notices for laying and jointing of pump-ing main	2					
27.	27-28	Entrustment of pumping main	4					
28.	28-29	Completion of laying and jointing	8					
29.	28-30	Construction of chambers	2					
30.	29-31	Testing of pumping main	2					
31.	31-32	Trench closing and completion of pumping main	1	32	Pumping main completed	30	30	0
32.	11-33	Requisition for A.C. pipes, C.I.D. joints and specials	2					
33.	11-34	Invitation of tender for O.H.S.R.	1					
34.	11-35	Requisition for steel and cement	1					
35.	34-46	Entrustment of OHSR	4	36	OHSR Started	30	30	0

1	2	3	4	5	6	7	8	9
36.	35-37	Procurement of cement and steel	1					
37.	38-39	Foundations and leveling cource for OHSR	2					
39.	39-40	Completion of staging	6					
40.	40-41	Completion of Ring grider and bottom slab	3					
41.	41-42	Side walls	2					
42.	42-43	Roof slab	3					
43.	42-44	Fixing of connections to O.H.S.R.						
44.	43-45	Testing of O.H.S.R.	2	45	OHSR tested	49	49	0
45.	29-46	Invition of tenders for distribution system	1					
46.	46-47	Entrustment of Distribution systems	3	47	Distribution system started	32	32	1
47.	29-48	Indenting distribution system pipes	1					
48.	48-49	Procurement of pipes	4					
49.	47-50	Completion of laying and jointing	8					
50.	47-51	Construction of chambers	6					
51.	47-52	Construction of public taps	7					
52.	50-53	Testing of distribution system	4					
53.	53-54	Completion of distribution	4	54	Scheme commissioned	49	49	0
54.	38-55	Procur ement of vertical pipes etc	2					
55.	15-56	Physical verification of pumps	1					
56.	56-57	Installation and testing of pumps	1	57	Pumps installed	27	27	0

ANNEXUR - IV

Material Requirement

Sl. No.	Name of the material	Event at which material is		Procurement time	
		Requisitioned	Expected	Mimimum	Maximum
1	2	3	4	5	6
1.	Pumps.	10	15	14	14
2.	A. C. Pipes.	11	33	2	6
3.	C. I. Valves.	11	33	2	6
4.	C. I. Pipes.	38	55	2	7
5.	H. D. P. E.	29	49	5	6
6.	R. C. C. Pipes.	29	49	5	6
7.	Steel.	11	35	1	16
8.	Cement.	11	35	1	16
9.	G. I. Pipes.	14	16	1	6
10.	Electrical connections (internal)	14	18	2	6
11.	C. I. Specials for A. C	11	33	2	6
12.	Casing pipe pipes	1	3	1	2
13.	C. I. specials for RCC	29	49	5	6
14.	C. I. specials for C. I. pipes.	29	49	5	6
15.	Manhole covers.	11	33	2	6
16.	Chlorinators.	14	16	1	6
17.	G. I Specials.	14	16	1	6
18.	M. S. Ladder,	38	55	2	7
19.	Lightening arrestor.	38	55	2	7
20.	Water level indicator.	38	55	2	7
21.	Fly proof ventilators.	38	55	2	7



Head-works Alur at P. W. S. Scheme
Kurnool Dist. (A. P.)

P.W.S. Scheme at Poluru Village of
Yeddanapudi in Prakasham Dist. A.P.

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