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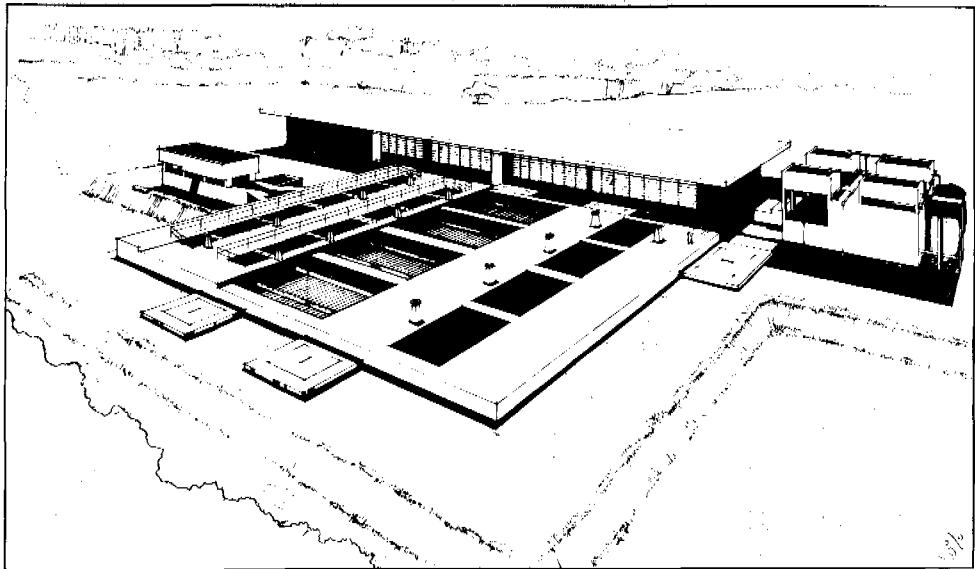
Report of a Regional Seminar on A Modular Approach in Small Water Supply Systems Design

Jakarta, Indonesia, 6-10 October 1981

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small water supply systems design**

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Organised by:
Directorate General Cipta Karya, Indonesia
and
International Reference Centre
for
Community Water Supply and Sanitation

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International Reference Centre
for Community Water Supply

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summary

The Regional Seminar on a Modular Approach in Small Water Supply Systems Design was held to assess the validity of using a modular approach in planning, designing, constructing and operation of small water supply systems; the ultimate goal was to provide a safe and adequate supply of water to as many people as possible within a relatively short time frame and with each country's commitment to the goals and objectives of the International Drinking Water Supply and Sanitation Decade. Participants were briefed on and discussed various small water supply programme aspects; they included planning, administration, finance, standard design criteria, appropriate technology, research and development, criteria and guidelines, manufacture of standard water treatment plants, maintenance, training of plant operators and community involvement.

résumé

Le Séminaire Régional sur une Approche Modulaire de la Conception de Petits Systèmes d'Approvisionnement en Eau était organisé pour évaluer la validité de l'application d'une telle approche de la planification, la conception, la construction et l'opération de petits systèmes d'approvisionnement en eau; l'objectif final était d'assurer un approvisionnement en eau sain et adéquat au plus grand nombre de personnes possible dans une période relativement courte, ainsi que dans les termes de l'engagement de chacun des pays en ce qui concerne les buts et les objectifs de la Décade Internationale pour l'Approvisionnement en Eau Potable et l'Assainissement. Les participants ont été informés sur et ont discuté les différents aspects d'un programme d'approvisionnement en eau; inclus étaient la planification, l'administration, le financement, des critères de conception de normes, la technologie appropriée, la recherche et le développement, la fabrication d'usines de traitement d'eau normalisées, la maintenance, la formation d'opérateurs d'usine et l'implication des communautés.

resumen

El Seminario Regional sobre un enfoque modulado para el diseño de sistemas pequeños de suministro de agua potable se llevó a cabo a fin de evaluar la validez del uso de enfoques modulados para la planeación, el diseño, la construcción y la operación de sistemas pequeños de suministro de agua potable; el objetivo final era la provisión de agua sana y suficiente para tantas gentes como sea posible, todo dentro de un marco temporal relativamente corto y ajustándose al compromiso de cada país para con las metas y objetivos de la Década Internacional de Suministro de Agua Potable y de Saneamiento. Se informó a los participantes quienes discutieron los varios aspectos de un programa para suministros pequeños de agua; éstos incluyen la planificación, la administración, la financiación, los criterios estándar para el diseño, la tecnología apropiada, la investigación y el desarrollo, los criterios y los lineamientos, la producción de plantas estándar de tratamiento de aguas, el mantenimiento y el entrenamiento de los operadores de las mismas y la involucración comunitaria.

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Commitments of governments in relation to the International Drinking Water Supply and Sanitation Decade call for the provision of numerous facilities in a short-time span.

With only limited resources at hand, there is a need for knowledge on pertinent programme planning and implementation methods.

Aspects of such methods have been discussed at the reported seminar; they include essential elements such as recurrent use of standard designs, major involvement of specially trained sub-professionals and participatory action of beneficiaries.

Findings and recommendations of the seminar are reported for dissemination and presented for follow-up and use in national plans.

T. K. Tjiook, IRC

preface

A Regional Seminar on a Modular Approach in Small Water Supply Systems Design was convened from 6 to 10 October 1980 in Jakarta, Indonesia by the Directorate General Cipta Karya, Ministry of Public Works, Republic of Indonesia, in association with the International Reference Centre for Community Water Supply and Sanitation. This is in line with the objective of governments in the region and the International Reference Centre to promote information and technology support programmes in the developing countries and international cooperation in community water supply and sanitation.

The Seminar was organised five weeks before the launching of the International Drinking Water Supply and Sanitation Decade meeting by the United Nations scheduled for the 10th of November 1980. The Seminar was attended by participants from Australia, Bangladesh, Colombia, Federal Republic of Germany, France, Great Britain, Hong Kong, India, Indonesia, Malaysia, Nepal, Netherlands, Singapore, Sri Lanka. In addition to the official participants there were participants from the United Nations Development Programme, World Health Organization, UNICEF, U.S. Agency for International Development, Asian Development Bank and representatives from the Ministries of Public Works, Health, Industry and Home Affairs, Planning Institute, Universities, Indonesian Association of Water Enterprises, Indonesian Science Foundation, foreign and local consulting engineers and manufacturers.

The Regional Seminar acknowledged the support of the WHO, UNICEF, USAID and the Governments of the Netherlands and Indonesia in making this Seminar possible.

1. background and objectives

The Regional Seminar on a Modular Approach in Small Water Supply Systems Design was organized for the benefit of practising engineers, planners and manufacturers involved in water supply programmes in the region. The Seminar was held against the background of the commitment of governments in the region for the provision of safe and adequate water to as many people as possible within a short period of time in keeping with the goals and objectives of the International Drinking Water Supply and Sanitation Decade 1981 - 1990.

General objective

To introduce a modular approach in planning, design and construction of small water supply systems, in order to provide safe and adequate water to as many people as possible within a short time frame.

Strategies

1. To assess the validity of the modular approach in the Seminar.
2. To exchange design and construction experience.
3. To develop recommendations for the rational planning and implementation of small water supply systems.

2. programme

The Seminar was opened with an address of welcome by Ir. Oemarsidik, the chairman of the organizing committee. He thanked the IRC for their support in organizing this Seminar. This was followed by an address by the UNDP Deputy Resident Representative, Mr. Hasegawa, who informed the Seminar of the deep commitment of the UN system to the goals and objectives of the International Drinking Water Supply and Sanitation Decade. However, in reviewing the action plan and strategy of each country to meet the goals of the Decade, he requested them to consider carefully the three major problem areas of technology, economics and social acceptability. In this context, he reminded the seminar participants of the challenging task to be faced in public acceptance of any new technological system.

His Excellency the Ambassador of the Netherlands Van Gorkom lauded the regional approach for exchange of knowledge and experience, the Indonesian Government's policy of improving health of the people in the impressive programme for water supply and sanitation facilities planned. He further reiterated the Netherlands Government's commitment to cooperate with the Indonesian Government in the development of water supply and, in particular, the introduction of standardized components that will facilitate the accelerated construction of water treatment plants at lower costs. He expressed the hope that the findings of the Seminar will contribute directly in fulfilling the Government's objectives of providing the basic human need of water supply in the area.

The Honorable Minister of Public Works of Indonesia, Dr. Poernomasidi Hadjisarosa in welcoming the participants outlined the massive programme of providing water supply to the population and saw that with a modular approach to standardize the system, the targets set could be achieved. He then drew his parallel experience to the highway programme in the country where he pointed out that the Government 10 years ago was facing a programme of upgrading 35,000 km of roads. If they had to provide the normal standard roads, only 30% of the programme could have been achieved. By modifying the standards in some cases the Government was able to achieve 80% of its target. He requested the Seminar to look into the question of modifying the criteria so that a larger population could benefit from the water supply programme. This is to spread development

more equitably throughout the country in keeping with Government policy. This would also achieve the communities' awareness of development reaching their villages and involve them in the development process of the nation.

The programme emphasized a modular approach in small water supply design which could benefit countries in the region embarking on an accelerated water supply programme in keeping with each country's targets set to meet the goals and objectives of the International Drinking Water Supply and Sanitation Decade 1981 - 1990.

The Seminar was divided into:

(a) Plenary sessions, with presentation of working papers on each subject by speakers and opportunity for clarification and preliminary discussion by the participants.

(b) Group Meetings, to provide an opportunity for the participants to become better acquainted and to discuss the presentation, expressing their ideas and problems in a more informal atmosphere; specific topics and background documents served as guidelines for the discussions.

(c) The status of water supply programmes for small urban and rural communities in Indonesia, India, Malaysia, Nepal, Sri Lanka and Thailand was presented at the seminar.

The reports of the group meetings, supplemented by a summary of problems and recommendations or concluding statements, were presented at the plenary sessions.

The Seminar decided to consider the subject 'a Modular Approach in Small Water Supply Systems Design' under the following broad headings:

1. National planning with new approaches
2. Administration of programmes
3. Finance
4. Standard design/procedures/approaches/appropriate technology and research
5. Criteria and guidelines
6. Manufacturing standardized water treatment plants
7. Organizational and financial aspects of maintenance
8. Training and utilization of sub-professionals
9. Community involvement in small water supply programmes.

The adopted recommendations of the Seminar were presented by the chairman of the Seminar Ir. Hidajat Notosugondo at the closing session. In the closing ceremony the Junior Minister for People's Housing Mr. Cosmas Batubara acclaimed the regional cooperation in the Seminar and expressed his appreciation for the input in the Government development strategy to serve as many people as possible, in particular covering the low-income and urban poor.

3. issues discussed

3.1. National programme planning with new approaches

Agencies responsible for planning and implementation of water supply programmes have to develop new approaches in the field of design, construction, operation and maintenance of water supply systems to meet the government's stated goals of providing safe water to all its people within a short period of time taking into consideration the resources of the countries. The conventional approach of project implementation involving master planning, preliminary engineering and detailed designing for individual projects in isolation demands modification, as it impedes the quick implementation of the large number of small projects in the short time frame required to fulfill the objectives of the governments. This calls for a review of the existing policies and strategies laid out for project preparation and implementation. Standardization is one among many options that was considered as a tool to shorten the time frame in project preparation and implementation.

Taking into account each country's resources that can be deployed to the sector of 'water supply' against the competing demands of other sectors, the planning should be standardized with small scale low cost modules for water supply packages consisting of treatment plants, distribution systems and pump houses, etc. It must be developed in a manner so that implementation is accelerated, operation becomes simple and maintenance economical.

Material planning and scheduling of water supply systems components should be developed and advance procurement of materials should be planned. Stocks should be located at central places so that the time consuming process of procuring materials and equipment is shortened.

In order to achieve wider population coverage within a short time frame, a programme approach with a first phase to meet immediate demand with provision for expansion at a later date to meet the future demand is deemed desirable.

Standardization of components will help the design and construction engineers in reducing the time frame for project preparation and implementation. Community involvement at different stages of planning,

construction, operation and maintenance is essential in order to instil in them a sense of belonging.

3.2. Administration of programmes

The policy of governments in the region is to provide safe water to as many people as possible. This policy has been further reinforced by the government's commitment to the goals and objectives of the International Drinking Water Supply and Sanitation Decade. Traditionally an agency of government is charged with this responsibility. There are also other agencies of government involved in this sector.

The responsibility of planning, designing and construction of a large number of small systems must rest with the national and state/provincial governments in order for the stated goals of governments to be achieved. The operation and management of these systems should be carried out by a competent authority until the communities are trained to take over and manage them themselves.

The smaller water systems to be supplied to the rural areas will need governmental support in finance, technology and administration to function efficiently.

Another option is the establishment of regional water authorities which would assist in the pooling of the limited technical and managerial expertise available to maintain and operate the small water systems. The larger and well-managed regional authorities may be able to subsidize smaller systems in the operation and maintenance by having scaled water charges for the large water consumers and higher water charges for industries as is already practised by some countries in the region.

Water supply development has become a problem in that several agencies of government are involved and it calls for a coordinated and well formulated development plan for implementation. Water sources are also becoming scarce in certain areas and there are competing water uses, i.e. for drinking water supply, irrigation, industry, etc. There is need for coordination between the competing water users for the rational use and management of water both at national and provincial level.

3.3. Finance

It has been shown that successful community development programmes

including water supply projects have had strong community leadership and initiative.

Small urban and rural communities generally lack adequate economic strength to meet the burdens of investment and operation costs. Even if construction costs are met, most of the small urban and rural water supplies would require government subsidies at least at the initial stages of operation when these communities are getting used to the benefits of using potable piped water. However with time, it is expected that a community used to a piped potable supply will be prepared to pay higher water rates.

The ultimate objective of water supply development and operations should be financial viability as soon as this is possible.

Standpost supplies are the key component in small water supply operations. The strategies adopted to collect the charges are varied. If not well thought out for each particular application, collection may be hampered and difficulties may arise.

Planning and management of water supply and sanitation development for small communities on a large scale (programme scale) must of necessity be carried out centrally, and so also the financing. National governments usually derive the required finances partially from external sources and many problems have been associated in procurement and utilisation of these external loans. The problem has been the differing procedures and priorities adopted by the many lending/donor agencies, the processing time and reporting cycles, the lack of adequate flexibility in the utilisation of the loan and on occasion the requirement to procure from specific markets.

There has been a trend amongst the external lending agencies towards investment in institutional strengthening, although in general past investment showed a preference for financing hardware and projects.

3.4. Standard designs/procedures/approaches/appropriate technology and research

The goals of the International Drinking Water Supply and Sanitation Decade lay a heavy demand on water supply planning agencies for implementation of a large number of schemes. The conventional approach to project planning and implementation may not be applicable to meet these goals. The technology now exists for achieving the goals set down, however, it is up

to the concerned agencies to find more suitable methods of applying this technology to increase the rate of project implementation.

Countries should begin to develop standard design manuals based on their own and on other countries' experiences. The standard designs and specifications should be as simple as possible, keeping in mind the need for quick installation and ease for operation and maintenance yet meeting the minimum acceptable level of service.

These manuals will help streamline the process of water project implementation by decreasing the time needed for individual design of projects.

Inter-country cooperation may be one method of developing needed experience with which to produce standard design manuals. For example the IRC supported an extensive field testing study on slow sand filters in a number of countries around the world from which a comprehensive report and design manual was produced. Many countries in the region have developed similar manuals through bilateral programmes like the modular treatment plant in Indonesia which could be an item for inter-country field testing. Similar inter-country cooperation may be considered which could facilitate development of design manuals and technology transfer.

Inter-country cooperation on research and development projects to develop other innovative water systems should be considered taking into consideration cultural patterns and constraints in developing countries.

3.5. Criteria and guidelines

The need for criteria and guidelines is obvious, especially in the developing countries where manpower is one of the major constraints and where mass project construction programmes are to be implemented.

The goal of the United Nations' International Drinking Water Supply and Sanitation Decade is to provide safe water and adequate sanitation to all people of the world at the most realistic service standards by 1990, and one of the most effective tools towards achieving this target is that each country should adopt simple design criteria and guidelines to suit its own particular conditions and situation for standard practices.

The criteria and guidelines should be adopted in such a way that the standard of services as well as the standard of quality to be provided be

modified to the extent acceptable in order that they can be used for expediting the planning, design and construction of water supply systems in a shorter time span, within the limited available budget, and to cover the greatest number of people possible.

The criteria and guidelines with regard to planning and development aspects should lay more emphasis on 'the simple source spot' development such as shallow or tube wells installed with handpumps instead of merely focussing on the 'piped water treatment system'.

Criteria and guidelines should be evaluated by competent teams of experts to reflect the country's policy towards achieving its own goals and objectives, and should be formulated in a suitable manner for easy reference.

Criteria and guidelines should also be flexible in order that they can be adapted to suit particular local conditions and situations according to different types of socio-cultural patterns and different ranges of economic levels.

3.6. Manufacturing of standard components for modular (steel) water treatment plants

The rationale of the modular design philosophy is aimed at producing compact easily transportable units in home factories, for quick erection on-site without large or complicated equipment. The effectiveness of this approach may be hampered by the absence of regular transportation to the regions of the selected sites, as well as scarcity of vessels and road equipment with the proper facilities.

There is a necessity to apply high safety factors to ensure continuous functioning of the equipment under wide variations in load. This practice often leads to higher unit costs.

The economy of scale for manufacturing steel water treatment plants demands a large scale operation, in order to procure the necessary materials, manufacturing the several types of plant, transporting and erecting, and establishment of a proper operation level. In order to ensure that the large scale and dispersed nature of the processes of manufacturing, constructing and operating the standard water treatment plants do meet the criteria required, it is necessary for a specialised body to be established for the coordination of all activities and

processes.

Industries prefer a degree of flexibility for types of goods to be delivered in order to be competitive. They prefer not to standardize to the last piece and are in favour of operational standards, specifying only plant performance requirements. Furthermore it is advisable to begin with parts standardization for fast-moving items that are of a wear-and-tear nature, or that could be readily manufactured in the country. The Indonesian experience in modular steel treatment plants can serve as a model in which the standardization requirements to meet local needs is worthy of examining in terms of complying to regulatory, manufacturing and operational standards.

Modern production is occurring in what might be named 'networks' rather than in singular factories. These production networks are most extensively developed in the rich countries of the world, with branches connected to much smaller production 'complexes' in developing countries.

Because of its advanced nature, rich countries' production networks can produce an immense variety of products quickly and efficiently. Hence the prevailing philosophy of design is: manufacture, ship and erect on-site. For small water treatment plants this philosophy has been worked out into a number of compact units available from several manufacturers, factory tested and ready for procurement.

When acquiring such units from abroad, the standards and the manufacturing practices from the supplying country are also imported. Given the need for a variety of types of treatment plants, this would lead to acceptance of many standards, with a series of consequences for the acquiring country, especially for operating and maintaining the plants.

Hence, a receiving country needs a set of regulatory standards in order to be able to profit of the availability of well developed technological structures elsewhere in the world, while at the same time protecting its own interest in efficiently operating the received equipment.

Furthermore, also in order to contribute to the qualitative and quantitative growth of its home industries, a receiving country must give preference to those products of which the manufacture can be transferred to a local enterprise, at least partially. Therefore, as a complement of the regulatory standards, there is a need for standards of manufacture in order to progressively match foreign design to local capabilities.

And, finally, because the articles and systems must fulfill their function in the best possible way with the longest possible lifetime, working under differing load conditions and environmental influences, there is also a need for operating standards which must be met by imported and locally manufactured goods alike.

For modular treatment plants, the Directorate of Sanitary Engineering, in cooperation with the International Reference Centre for Community Water Supply, has developed typical treatment plants in a Netherlands' financed study. These designs incorporate in a material form most of the standards referred to above. Hence they are of a model with a nature to be used as a reference for production and testing.

3.7. Maintenance

Maintenance and operation of systems comprising a water supply programme are essential as the final module towards eventual success or failure of that programme. Because such a topic encompasses more than technical parameters, technicians have refrained from fully becoming involved in this respect. This does not preclude that even in the developing stages of Western countries such a topic did not evolve until it became obvious through final inspection, thereby forcing a restructuring of educational and institutional structures relating to water resources and community development.

The demand upon water and sanitation planning boards in developing countries because of the International Drinking Water Supply and Sanitation Decade is apparent and will be more so on the maintenance and operational component. The maintenance and operation of small water systems itself pose several issues dealing with institutional changes, logistics and community participation.

The goal is to achieve a flexible institutional structure which is flexible enough to encompass a modular approach or package approach towards area development with viable maintenance, quality control and operational components supported through community participation when and where feasible.

In consideration of the above goal, decentralisation of existing institutions serving water resources is required. This may be undertaken after careful study and should relate to the probable distribution of

authority, responsibility, funding and/or personnel with the problems encountered. The community would then have the opportunity to participate in the choice of systems and acceptance of the technology selected enhancing the communication channel between institution and community thereby providing greater support for the system. It is recognised that the level of community participation planned will depend upon the complexity, type and extent of the system; however, involvement of the community by way of labour, local material and in construction and operation/maintenance will act as a constraint on such planning. This would provide the basis of the modular or packaged approach towards smaller and simpler units enhancing area development in respect to sanitation and water resources. In view of the above, community participation in relation to maintenance would be simple and routine maintenance where major repairs being the responsibility of the institution concerned.

Logistically, the standardization of units and equipment in order to reduce the type and number of different pieces of equipment would facilitate a more efficient system of procurement of spare parts, their storage, training of operating staff and ease of repairs.

Consideration should be given to the evaluation of the performance of different pieces of equipment periodically in order to check redundancy of existing equipment and to reduce the need of stocking large reserves of spares.

Since the credibility of a system depends on the acceptance and use by a community, spare parts should be made readily available at convenient points in the logistic system and at subsidised rates if not free so that the system could be repaired as soon as defects occur. This would suggest that all equipment selected should be such that spares are readily available at the supplier's end and procured locally, when possible, in order to compensate for any system of total or partial subsidising of spare parts.

3.8. Training

The use of standardized components in developing small water supply systems in developing countries may reduce the need of highly skilled staff who will otherwise be required in developing such systems by the

conventional methods. However, manpower development will still be essential for the successful implementation of the programme and this could only be achieved through well-planned training programmes.

It is also a part of the planning of training programmes to make a forecast of manpower requirements at each level of the various tasks and disciplines involved in the planning, construction, administration and operation and maintenance of the system. Well-trained personnel should be made available to conduct field surveys of water resources, topographic conditions and other characteristics of the proposed sites, as well as to collect population data to enable planners to define the size of the system and the level of service that should be provided.

Technicians will be needed to supervise construction and for the proper operation and maintenance of the water supply system. Social scientists will play an important role in dealing with the community to secure their involvement and participation at all stages of implementation of the water supply programme.

With regard to the number of personnel, a standard manpower chart needs to be defined, which should be related to the size of the system, the capacity of the plant, the population served, etc.

A very large number of trained personnel will be required for this mass approach which necessitates recruitment of new staff and their training in accordance with the job descriptions defined.

It seems impossible to offer centralized training programmes for that large a number of people, as time will be the main constraint.

However, a central administration and training agency needs to be established in this manpower development programme which will carry out the following tasks:

1. To define the requirements of personnel to be recruited for the various jobs, such as background education, practical experience, intelligence and the appropriateness of the person to the type of job.
2. To develop standard training modules, manuals and aid appropriate to the kind of job and the level of training.
3. To train instructors who will be assigned to regional training centres established subsequently to speed up the training programme.

A mobile training centre could also be developed when such a centre is considered effective. Assignment of trainees to existing plants (i.e.

on-the-job training) should be considered as an essential part of the training programme, as giving practical experience is the most effective method of training.

3.9. Community involvement

Community involvement is an essential component, needed to ensure the success of water supply programmes. Three mutually exclusive factors, or dimensions, seem to be relevant in understanding community involvement processes:

1. Socio-cultural, e.g. behavioural patterns of the communities concerned.
2. Environmental-technological, e.g. theories and methods used by sanitary engineers.
3. Economy and market, e.g. processes and principles involved in replacing one type of goods or services with another.

It must be emphasised that those responsible for improving the hygiene and sanitation of small communities in developing countries should base their work on the software part of environmental technology.

It is desirable that standard modules be developed for approaching and involving communities in order to be able to jointly arrive at solutions which would be both integrated in the community's behaviour and would be more advantageous than existing water use patterns.

It is advisable to establish regular water forums at various levels, between governments and communities, in order to provide the governments with an understanding of the real needs of the people and of limiting factors to finding and implementing solutions for improving community sanitary conditions.

Water supply programmes should incorporate activities to develop community leadership and initiative in the planning, implementation, proper operation and adequate maintenance of water supply systems.

4. summary and conclusions

The Regional Seminar on a Modular Approach in Small Water Supply Systems Design,

taking note of the governments' commitments for providing water supply and sanitation facilities to as many people as possible within a short time frame,

realising the magnitude of the task before them,

taking into consideration the limited finance, technical expertise, trained manpower, materials, capacity for consultancy and contracting,

agreed that the services for the implementation of the programme targets, would require development in accordance with the following conclusions of the Seminar.

4.1. National programme planning with new approaches

The most important need is initially to pool the expertise available locally for planning and developing new approaches in the standardization in the field of design, manufacturing, construction, operation and maintenance.

In order to carry out the work on a mass approach basis, design manuals prepared within a specific time frame are desired. The normal strategy of providing a high level of service to a limited number of communities should be revised, to provide a larger population with a lower but acceptable standard.

The involvement of the community in the implementation of the programme is essential in order for social acceptance of the system by the community for the ultimate maintenance and operation of these systems by them. It is desirable to closely monitor the performance of the systems built in order to apply corrected measures in future designs and constructions, and to involve manufacturers in the production of standardized components.

4.2. Administration of programmes

It is highly desirable for water supply programmes to receive high priority in national development planning, and coordination is necessary between different government agencies involved in water supply.

This calls for an overall programme approach in the planning and implementation of numerous systems instead of a project approach. For the large scale development of small urban and rural water supply facilities it is necessary to have it centrally planned.

Due to the urgency of constructing a large number of water supply systems in a relatively short time-frame, a modular approach for planning and training programmes should be initiated to prepare technical skills to be made available to local bodies for the installation, operation and maintenance of these systems.

Further, the revenue earned from the water supply should be exclusively reserved for the future operation and maintenance of these systems. The need of a cross-subsidy has been identified as one of the options in making small water supply systems operationally feasible. As water sources are becoming scarce and there are competing users, coordination between the various water users is necessary.

4.3. Finance

Financing small water supply systems has been one of the biggest problems faced by developing countries. In order to make these small systems feasible, it is desirable that community involvement programmes be developed with identification of key community leadership to involve communities in the programmes.

Government subsidies would be required during the commencement of the systems when the community is being introduced to the benefit of piped potable water. Subsidies will be needed until the small communities are able to meet investment and operation and maintenance costs.

It is also desirable to explore the possibilities of uniform procedures and approaches amongst lending institutions towards the processing and utilization of external loans.

Lending agencies should be required to allow a reasonable degree of flexibility in the utilization of the loans and to allow recipient countries to formulate procedure guidelines and criteria for adoption that

would be acceptable to the lending agencies.

Public standpost supply constitutes an important aspect of small water supply systems and a policy towards collection of water rates for this supply merits careful consideration.

4.4. Standard design/procedures/approaches/appropriate technology and research

The development of a standard design manual by each country is desirable, keeping in mind the time factor. The standards set in the manuals must give allowance for dynamic changes and improvements as more experience is gained incorporating easy-to- operate and maintain procedures. Type designs collected from other countries may be included in the manual with appropriate modifications for local application and field testing.

The Indonesian approach of mass distribution design and bulk procurement for a number of towns may be further developed in water supply systems. In the field of research and development, options should be developed for the introduction of ferrocement in the construction of water supply components, and hydraulically powered systems, among other items. Further research is necessary in improving raw water quality by natural filtration in river beds, different standpipes designed and tested for community acceptance, minimum maintenance and durability.

4.5. Criteria and guidelines

There is an urgent need for the development of criteria and guidelines for mass project construction programmes, where manpower is one of the main constraints. Criteria and guidelines for standard practice must be reviewed by a committee of technical experts before adoption. Guidelines and criteria should also be flexible for adoption to suit particular situations in respect to socio-cultural differences and different ranges of economic levels, including the minimum acceptable level of service requirement.

It is desirable to present the criteria and guidelines in separate volumes for easy reference, namely: design, construction, maintenance and operation, embodying all aspects related to the local situation.

4.6. Manufacturing standard components for modular (steel)water treatment plants

The modular design philosophy to produce compact, easily transportable plants is desirable for mass production and calls for special attention in maintenance and operation procedures. The large scale and the dispersed nature of the processes of manufacturing, constructing and operating of standard water treatment plants calls for a supervisory body charged with coordination and controlling the various activities and processes.

The need is also identified to evaluate existing designs, by a team of experts, with the Indonesian DSE/IRC *) design which will function as a model. This is a prerequisite in order to formulate regulatory, manufacturing and operational standards to meet the local situation.

4.7. Maintenance

The failure of many small water supply systems is due to poor maintenance. There is a need to develop an institutional structure for operation and maintenance to suit the different types of systems, flexible enough to encompass a modular or package approach towards area development.

Preventive maintenance is strongly emphasized instead of breakdown maintenance. There is a need to select simple systems such that operation and maintenance costs are minimal and within the affordability and management capability of the community.

4.8. Training

The forecasting of manpower requirements is necessary at each level for the various tasks involved in the planning, construction, administration, operation and maintenance of the system.

It may not be possible to offer centralised training programmes to a large number of people due to time constraint. A central administration and training agency needs to be established to define requirements of personnel to be recruited for the various jobs, to develop standard training modules, manuals and aids, and to train instructors to man the regional training centres.

The development of a mobile training centre to train personnel at existing

*) Indonesian Directorate of Sanitary Engineering/International Reference Centre for Community Water Supply and Sanitation

plants should be considered as an effective method of an on-the-job training programme.

4.9. Community involvement

Community involvement has been identified as one of the key issues in the success or failure of the operation and maintenance of small water supply systems. Community acceptance of the technology introduced is very necessary. Appropriate technology should be applied and integrated with the social and economic aspects of the community.

The establishment of regular forums on water supply and sanitation at various levels between the government and communities to provide understanding of the real needs of the people and to educate them on the benefits of utilising safe water adds to the realisation of the requisites of the communities and the goals and objectives of government.

5. recommendations

5.1. National planning

5.1.1. Governments' commitment to the objectives and targets of the International Drinking Water Supply and Sanitation Decade has given high priority to the water supply and sanitation sector. To attain the objectives and targets set, it is necessary that a National Water Supply and Sanitation Plan be formulated and implemented. It is recommended that the National Water Supply and Sanitation Plan follow a programmatic rather than a project-by-project approach.

5.1.2. Many government agencies are involved in the development of water supplies for domestic use. It is of paramount importance that their activities be coordinated at all levels: national, provincial and local. Similarly, other government agencies are involved in water resources planning and development. Close coordination should also be promoted and undertaken to obtain optimum benefits from the water resources especially in areas with water shortage.

5.1.3. Expertise in water supply programme planning should be developed.

5.1.4. The mass approach strategy in water supply programmes should be considered seriously. The mass approach to water supply projects has three essential elements: community involvement, imaginative design considerations such as the use of standard modules, and implementation by multi-disciplinary staff including voluntary workers.

5.1.5. The relatively high level of service presently followed needs to be reviewed, with the objective of attaining wider population coverage through lower but acceptable standards of service.

5.1.6. Close monitoring of the water supply programme implementation is necessary to detect at an early stage deficiencies in design, inadequacies in logistic support and difficulties in manpower recruitment and development.

Monitoring of completed projects should also be closely followed and the

information fed back in the planning, design, construction, operation and maintenance of water supply systems.

5.2. Finance

5.2.1. National governments have increased considerably their financial allocations for water supply and sanitation programmes.

Nevertheless, there is still a need to tap external sources of financing. There are also thousands of communities with potential especially for financially supporting maintenance and operation, that can be tapped through appropriate tariff structures.

5.2.2. Many problems have been associated in the procurement and utilisation of external loans for water supply programmes. Initiative needs to be taken to develop uniform procedures among lending institutions in the processing and greater flexibility in the utilization of external loans, e.g. use of loans for strengthening of institutions, including manpower development.

5.2.3. Small water supply systems generally need financial support and such support should be provided by the Central Government (subsidy) or from more affluent water supply enterprises (cross-subsidy) until they become self-sustaining.

5.2.4. Public standpost supplies and the mode of collection of revenues from these systems constitute key aspects in programmes of this nature. Therefore policies towards tariffs for public standpost supplies and the collection of water charges should receive careful consideration.

5.3. Technology

5.3.1. It is proposed to publish a manual of type designs collected from as many countries as possible and adapted and field tested for a country's use.

5.3.2. Each country should develop a standard design manual preferably through inter-country cooperation to benefit from each others experience. Designs are selected on the basis of simplicity and easy maintenance yet meeting minimum acceptable levels of service.

5.3.3. The Indonesian mass approach to distribution network design and estimates for bulk procurement of piping materials for a great number of towns may be promoted in other countries if applicable.

5.3.4. Each country should adopt criteria and guidelines to suit its conditions and suitable to allow the needs of the greatest number of people possible to be covered. Draft guides containing proposed criteria and guidelines for design and construction should be reviewed by a national committee of experts before adoption.

5.3.5. Modular treatment plants such as designed under a DSE/IRC *) cooperation should function as a model and be used as a basis for production and for reference.

5.3.6. Before embarking on implementation programmes of standard water treatment plants, regulatory, manufacturing and operational standards should be established.

5.4. Operation and maintenance

5.4.1. Proper operation and adequate maintenance of water supply systems have their beginnings in the appropriate design and proper construction of the system. The type of system designed should therefore be carefully selected with a view to easy operation and simple maintenance within the management capability of the local community.

5.4.2. The operation and management of these systems should be carried out by a competent agency until the communities are trained to take over and manage them themselves.

5.4.3. Improvement of operational and management capabilities of local bodies should aim at operation, maintenance and improvement of the water supply systems and the revenues earned from water supply undertakings should be reserved for these purposes.

*) Indonesian Directorate of Sanitary Engineering/International Reference Centre for Community Water Supply and Sanitation

5.4.4. Relying simply on the community for operation and maintenance without a suitable institutional arrangement often precludes the efficient use of these systems. The development of a flexible institutional structure for operation and maintenance to suit the different types of systems such as handpumps, rain water collection, and small piped systems are therefore stressed.

The institutional structure should be flexible enough to encompass a modular or package approach towards operation and maintenance of water supply systems.

5.4.5. A standard set of financial, administrative and technical procedures appropriate to the system should be laid down for efficient management. Preventive maintenance in addition to breakdown/repair maintenance is strongly emphasized.

5.4.6. The absence of logistical control often delays the repairs and recommissioning of the systems. The standardization of units and equipment is strongly emphasized in order to reduce the number of types of equipment thereby facilitating a more efficient system of procurement of spare parts, their storage, and ease of repair by the operating staff.

5.4.7. The evaluation of the performance of different pieces of equipment used should be made from time to time to continuously improve the performance or to drop the use of unefficient equipment and to reduce the need of keeping in stock large numbers and wide variety of spares.

5.4.8. Spare parts should be made readily available at convenient points in the logistics system and at a subsidized rate if not free so that the system can be repaired as soon as defects occur.

5.4.9. Contributions from the community by way of labour, local material, involvement in construction, and operation/ maintenance are emphasized. These are means to generate a sense of ownership of the system in the community which would ultimately lead to the financial viability of the system.

5.4.10. The level of community participation in operation and maintenance planned should depend upon the complexity, type and size of the system.

5.5. Manpower development

5.5.1. A large number of trained manpower will be required in the national water supply and sanitation programmes to meet the national targets in the International Drinking Water Supply and Sanitation Decade. It is considered essential that a manpower development plan to support the programme be formulated and implemented.

5.5.2. The manpower development plan should include a realistic forecast of all categories of manpower required after a careful analysis of the various tasks to be performed.

5.5.3. The manpower development plan should incorporate recruitment and training programmes to develop skills needed for the tasks specified in the job descriptions.

5.5.4. The training programme should incorporate the adequate development of teachers and training facilities. The use of training modules should be considered.

5.5.5. A central administration and training agency needs to be established to define requirements of personnel to be recruited for the various jobs, and to develop standard training modules, manuals and aids, and to train instructors for the training centres.

5.5.6. The development of a mobile training centre to train personnel at existing plants should be considered as an effective method of an on-the-job training programme.

5.6. Community involvement

5.6.1. The Seminar considers community involvement as an essential component to ensure the success of water supply programmes. Those involved in water supply programmes/projects should therefore understand the community involvement processes.

5.6.2. Appropriate modules for approaching and involving communities in water supply programmes/projects should be developed.

5.6.3. Community involvement should be incorporated in all phases of water supply programmes/projects.

5.6.4. Water supply programmes should incorporate activities to develop community leadership and initiative in the planning, implementation, proper operation and adequate maintenance of water supply systems.

5.6.5. The establishment of regular forums on water at various levels between governments and communities to provide understanding of the real needs of the people and to educate the people on the benefits of utilizing safe water adds to the realization of the requisites of communities and the goals and objectives of governments.

5.7. Research and development

5.7.1. An important objective of research and development is the development of technologies appropriate to the community situation with its cultural characteristics, its available resources and its level of development or what is referred to as appropriate technology.

5.7.2. In general, the technology is available for achieving national targets set for the International Drinking Water and Sanitation Decade. However, there is need to develop more suitable methods for accelerating the rate of project implementation. The development of standard design manuals contributes to this effort.

5.7.3. TCDC mechanisms should be considered in the transfer of appropriate water supply technologies. Inter-country projects for field testing (in countries which have not adopted / adapted them) and demonstrations of modular water supply system designs are recommended.

5.7.4. Specific research topics recommended include:

(a) Ferrocement: Construction of water supply components in using ferrocement may be more economical and faster.

- (b) Standposts: Different standpost designs need to be tested for (1) community acceptance, (2) required maintenance, (3) durability and (4) adequacy to meet sanitary requirements.
- (c) Hydraulic powered systems: More research needs to be conducted in simplification of the mechanical operation of treatment plants.
- (d) Iodine Treatment: This type of treatment may be studied as an alternative for disinfection in community water supply.
- (e) Flocculation: More research needs to be conducted to reduce flocculation retention time thus reducing the size and cost of plants.
- (f) Local pipe, pump, etc. manufacture: Development of local manufacture of pipes, pumps, etc. should be considered.
- (g) Plastic well screens: There is a need for further development of plastic well screens.
- (h) Improving the quality of raw water: In attempting to reduce the cost of water treatment, research should be conducted in ways to extract better quality raw water such as using the natural filtration of river beds.
- (i) Research and development projects: The development of other innovative water supply systems taking into consideration cultural patterns and constraints in developing countries should be considered.
- (j) Local Hypochlorite: Simple on-site preparation of disinfectant should be studied to overcome the problem of logistics especially for remote areas.

6. recommendations for international action

The Regional Seminar

1. Proposed that the recommendations of the Seminar and information transfer activities be followed up by agencies involved in international information and technology support programmes such as the International Reference Centre for Community Water Supply and Sanitation with inter-country projects in the spirit of Technical Cooperation among Developing Countries;
2. Adopted the resolution to bring the recommendations of the Seminar to the attention of the UNDP Administrator for advising related agencies and the developing countries of the recommendations to be used in national plans in the context of the International Drinking Water Supply and Sanitation Decade.

annexes

annex 1

programme of the regional seminar on a modular approach in small water supply systems design

Held from 6 to 10 October 1980, in Jakarta, Indonesia

SUNDAY, OCTOBER 5, 1980

17.00 : Registration of Participants

MONDAY, OCTOBER 6, 1980 - Hotel Hyatt Aryaduta
Room: Panti Surya

09.00 - 10.15 : 1. OPENING

- 1.1. Introduction by the Chairman of the Organising Committee
- 1.2. Address by the UNDP Resident Representative
- 1.3. Address by the Ambassador of the Netherlands
- 1.4. Address and Official Opening by the Minister of Public Works

10.15 - 11.00 : C O F F E E

2. PLANNING

General Chairman: Hidajat Notosugondo

11.00 - 12.30: Introductions

- 2.1. Modules in a programmatic approach T.K. Tjiook
- 2.2. Strategies in national community water supply Susanto Mertodiningrat planning
- 2.3. Systems approach in small water supply programme B. van Bronckhorst planning

12.30 - 13.45: L U N C H

13.45 - 14.45: Introductions

- 2.4. Planning, economic and financial aspects L. Engelen
- 2.5. Case Study of Nepal L. Roberston

14.45 - 15.00: T E A

15.00 - 16.00: Introductions

- 2.6. Case study of Thailand D. Nitipavachon
- 2.7. Case study of Sri Lanka P.U. Gunasinghe
- 2.8. Case study of Malaysia A. Sekarajasekaran

TUESDAY, 7 OCTOBER, 1980

08.00 - 10.00: Discussions in 3 working groups

P1. NATIONAL PROGRAMME PLANNING WITH NEW APPROACHES

Room : Panti Surya
Moderator : P. Chatterjee
Rapporteur: Rahardjo

P2. ADMINISTRATION OF PROGRAMMES

Room : Merdeka
Moderator : K.A. Waheed Asghar
Rapporteur: Darmawan Saleh

P3. FINANCE

Room : 541
Moderator : R.Wirasinha
Rapporteur: E. Budirahardjo

10.00 - 10.30: C O F F E E

3. TECHNOLOGY

Chairman: Susanto Mertodiningrat

10.30 - 12.30: Introductions

- | | |
|---|---|
| 3.1. The Role of typical and standard designs in small community water supplies | F.E. McJunkin |
| 3.2. Standard procedures for design of water systems for a great number of small towns | A. Bot |
| 3.3. Inconventional design approach to obtain a 'standard list' of pipe material for procurement purposes | Rahardjo |
| 3.4. Modular approach to assemble fittings | Suratmo |
| 3.5. Need for criteria and guidelines for design and construction | Darmawan Saleh & Dr. Harun
Sukarmadijaya |

12.30 - 13.30: L U N C H

13.30 - 15.00: Introductions

- | | |
|---|---------------------------------|
| 3.6. Typical treatment plants | J. Arboleda V. |
| 3.7. Study of standard water treatment plants in Indonesia | M.J. van Melick/
Pudjastanto |
| 3.8. Manufacturing aspects of steel water treatment plants in Indonesia | Dr. E.J. de Bruijn |
| 3.9. Research and development aspects | Dr. W.L. Reyes |

15.00 - 15.15: T E A
15.15 - 15.45: FILM OF UNICEF

WEDNESDAY, OCTOBER 8, 1980

08.00 - 10.00: Discussions in 3 working groups

T1. STANDARD DESIGN/APPROACHES/APPROPRIATE TECHNOLOGY/RESEARCH

Room : Panti Surya
Moderator : F.E. McJunkin
Rapporteur: L. Robertson

T2. CRITERIA AND GUIDELINES

Room : Merdeka
Moderator : Dr. Soetiman
Rapporteur: D. Nitipavachon

T3. MANUFACTURING STANDARDIZED COMPONENTS OF TREATMENT PLANTS

Room : Aryaduta
Moderator : M. Jansen
Rapporteur: B. van Bronckhorst

10.00 - 10.30: C O F F E E

10.30 - 17.00: Excursion to standard water treatment plant in concrete in Tangerang and visit to Taman Mini Indonesia
Leader: Rahardjo

THURSDAY, OCTOBER 9, 1980

4. MAINTENANCE/TRAINING/COMMUNITY INVOLVEMENT
Chairman: Oemarsidik Hadiasmoro

08.00 - 10.00: Introductions

4.1. International drinking water supply and sanitation decade P. Chatterjee

4.2. Aspects of training of sub-professionals A. Milburn

4.3. Training and utilization of sub-professionals in Malaysia A. Sekarajasekaran

4.4. Community involvement in small water supply programmes E.D. Robertson

10.00 - 10.15: C O F F E E

10.15 - 12.15: Discussions in 3 working groups

S1. MAINTENANCE

Room : Panti Surya
Moderator : M.L. Gupta
Rapporteur: S. Dean

S2. TRAINING

Room : Merdeka
Moderator : L. Robertson
Rapporteur: Haryoko

S3. COMMUNITY INVOLVEMENT

Room : Aryaduta
Moderator : B. van Bronckhorst
Rapporteur: R.H. Harris

12.15 - 13.30: L U N C H

13.30 - 14.30: FILM OF UNICEF

14.30 - 15.00: T E A

19.30 - 21.30: CULTURAL EVENING

FRIDAY, OCTOBER 10, 1980

5. FINAL SESSION

General Chairman: Hidajat Notosugondo

09.00 - 10.15: Report of the Seminar by General Chairman

10.30 - 11.00: Closing of the Seminar by Junior Minister of
Public Housing

11.00 - 11.30: C O F F E E

14.00 - 16.00: POST-SEMINAR EXCURSION
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annex 2

list of participants/steering committee

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Darmawan Saleh (Rapporteur)

M.J. van Melick (Secretariat)

annex 3

synopsis of papers

MODULES IN A PROGRAMMATIC APPROACH OF SMALL WATER SUPPLY PLANNING

by T.K. Tjiook

In outlining the scope of the seminar, the author pointed out that approximately 1500 million people in developing countries are without adequate basic sanitary services (1980), of them two thirds are in South and South East Asia. 80% of those without adequate services live outside the urban areas and hundreds or thousands of small and rural water supply systems have to be built in a short period to meet their needs.

New innovative approaches in each country were necessary, involving appropriate criteria and levels of service, modular standardized designs of components, simple construction techniques encouraging local manufacture. Lessons learned all over the world indicate that technology alone is insufficient and a programme approach involving strong local participation is necessary.

Technical cooperation among developing countries was identified as providing a new dimension for achieving self-reliance in development by sharing of skills and experiences, where expertise, capacity and alternative appropriate technologies have been developed.

STRATEGIES IN NATIONAL COMMUNITY WATER SUPPLY PLANNING

by Susanto Mertodiningrat

The policy of the Indonesian Government to provide potable water to as many people as possible at terms that are favourable but within allocated budget limits cannot be met easily. The preparation and implementation of a large number of small water supply systems within the time allocated calls for a modular approach. The targets set are to be achieved by standardized low-cost water supply packages, promotion of stock piling and a programme approach starting with a first immediate phase of water supply

to be expanded for future demands. The spin-offs from this approach are expected in the development of domestic manufacture and intermediate technologies in water supply.

The shortage of skilled personnel is identified and means to overcome this are necessary. Schemes to meet basic needs will be implemented with the aid of grants. These include assistance for operation and maintenance until such time as the community becomes self-supporting. For cities, the expansion of facilities may be carried out by financing fully or partially by the Central Government or by a mix of loan and equity funds.

The large number of projects being undertaken in a region calls for the promotion of regionalisation for the optimum administration and management of the programme.

SYSTEMS APPROACH IN SMALL WATER SUPPLY PROGRAMME PLANNING

by B. van Bronckhorst

It is an ambitious goal to provide safe water, within reasonable limits of time and cost, to the many millions living in small communities outside the cities and towns of Indonesia. A provisional systems analysis showed that only a large scale, dispersedly executed programme and adaptive operation involving prospective users would yield the desired results. Intensive research and development efforts will be needed in order to arrive at an appropriate set of hardware and software alternatives for the wide range of socio-economic and hydro-geologic conditions of the various types of small countries.

To meet the modest target of 43% of the rural population of West Java, a province to be properly served with safe water in the U.N. International Drinking Water Supply and Sanitation Decade, a minimum of one million people must be provided every year. This means the construction of about 500 water supply systems each year, involving between 500 and 2000 skilled workers of all levels, and requiring an annual investment of up to US\$ 50,000,000.

The present institutions are unable to meet this demand and it seems to be the right time to innovate them in order to increase the rate of service. The programme envisaged must be developed accordingly.

SOME PLANNING, ECONOMIC AND FINANCIAL ASPECTS OF STANDARDIZATION OF URBAN WATER SUPPLY SYSTEMS IN INDONESIA

by Leo H. Engelen

In a concise description of policy, strategy and programme of urban water supply systems, a policy for medium term implementation was adopted using standard treatment plants in order to obtain cost savings in a time constrained programme.

It is argued that normalisation is a pre-requisite for standardization, the latter being only one of many instruments which can be used in increasing speed of implementation. The concept of differential net benefits is proposed as a tool to assess and evaluate standardization. In the application of these benefits differential net benefits are traced both on the project and programme level. As quantification was hardly possible due to lack of data, a focused testing of the hypotheses made on the importance of standardization efforts is necessary.

The author in conclusion draws attention to instruments complementary to standardization and the possibility of centralized procurement accompanied by centralized budgeting of materials.

THE ROLE OF TYPICAL AND STANDARD DESIGNS IN SMALL COMMUNITY WATER SUPPLIES

by F. Eugene McJunkin

The use of type and standard designs expands productivity of skilled engineering designers, reduces construction costs, improves construction quality, promotes better operation and maintenance, and promotes local industry and expertise in the manufacture of equipment at lower cost. The author gives an example how to establish national type and standard designs and observes that these programmes indicate some common approaches; he cautions, however, on the borrowing of type designs from others without considering the supplemental information needed to tailor designs to local conditions.

A case study of the use of type designs by the Peruvian Ministry of Health demonstrates its advantage in accelerating water supply service to rural areas and small communities.

METHODOLOGY TO DEVELOP A PROGRAMME FOR MODULAR PURIFICATION PLANTS

by J. Arboleda Valencia

In developing a programme for modular treatment plants, it is suggested to proceed according to the following scheme:

- gathering of preliminary data;
- design of modular plants;
- testing of the design;
- optimisation and standardization of such designs.

A number of aspects have to be studied before entering the design phase of modular treatment plants and the technology should be carefully selected. A summary is given of alternative processes to treat various raw water qualities.

New designed systems should be tested regarding construction problems, good performance and functioning of processes and equipment. Well organized collection of data is advised. No technology or design should however be considered as completely finished nor without possible modifications. In spite of standardization, the engineer should be open for new ideas, if they have been proven to provide better alternatives.

STANDARD PROCEDURES FOR DESIGN OF LARGE NUMBERS OF SMALL WATER SUPPLY SYSTEMS

by A.P. Bot

Conventional ways of designing water supply systems take too much time, require sophisticated input and put a heavy claim on resources of highly trained personnel.

The project design team for the 15 Cities Water Supply Project in Indonesia is presently designing with simplified methods, using estimates for water demand, simple hydraulic calculations, simple levelling, etc. Standardization in design does not only mean standard drawings of physical components, but most of all a standard method/ recipe to proceed step-by-step. The 15 Cities project established such a standard method and was able to delegate a considerable amount of design work to draughtsmen and intermediate level technicians.

NON-CONVENTIONAL DESIGN APPROACH TO OBTAIN A STANDARD LIST OF PIPE MATERIAL FOR PROCUREMENT PURPOSES

by Rahardjo

The non-conventional approach presented aims at cutting down the lead time in procurement of pipes and materials for the construction of a large number of small water supply systems.

The concept provides a tool that can be applied by engineers to estimate pipe sizes and their lengths before the completion of preliminary engineering designs. Normal procedures applied for the purchase of materials in the preparation of conventional engineering projects can be curtailed and 80% of the materials necessary for the project can be ordered, thus cutting the time required in implementing projects, which are usually delayed due to shortage of materials.

MODULAR APPROACH ON ASSEMBLY OF FITTINGS FOR MASS DISTRIBUTION NETWORK DESIGN

by Soeratmo Notodipoero

The design of a large number of water systems needs a modular approach in the assembly of fittings if they are to be built in a short period of time with limited trained technical manpower. The paper identifies the design of distribution systems by use of standard accessories and standard

assembly of fittings: sub-professionals are involved to a great extent in carrying out the detailed work after the preliminary work has been done by experienced engineers.

The work in the preparation of tender documents and bill of quantities is simplified by introducing standard assemblies of fittings.

The mass method for rural water supply programmes has been tested with success in Latin America. Similar aspects are being implemented in Indonesia for the 50 cities programme using package treatment plants and in distribution systems. This approach is expected to solve some of the problems so that the number of projects which should be implemented with the enlarged national programme can be increased.

NEED FOR CRITERIA AND GUIDELINES FOR DESIGN AND CONSTRUCTION

by Darmawan Saleh

In the Third Five Year Development Plan (1979 - 1984) the government of Indonesia is committed to build a great number of water supply facilities for towns and rural centres. Sanitation and drainage schemes are also to be implemented for a number of towns to improve the living environment of the lower income groups.

To meet the enlarged work-load new approaches must be developed for project implementation as well as for operation and maintenance. Criteria and guidelines are urgently needed in the preparation of designs, as reference for design engineers and other groups in acceptance of designs or plants made by manufacturers. Criteria and guidelines for design and construction are very necessary to provide guidance in the completion of design and construction. They would also be used as Codes of Practice by government agencies and as a catalyst for the advancement of technology.

PRELIMINARY DRAFT GUIDELINES FOR DESIGN AND CONSTRUCTION OF PUBLIC WATER SUPPLY SYSTEMS

by Harun Sukarmadijaya

The draft document presented is intended to be developed into a guide for the preparation of plans, the design of works and the drafting of specifications for public water supply systems.

The guidelines prepared are based on the national practice and experience and on reference material supplied by IRC, they cover design criteria for water treatment, piping systems and sources of supply. Besides design criteria other factors were elaborated, e.g. quality standards, basic data, unit operations and criteria specifications, technical aspects, conditions for tendering, bidding and contract documents.

STUDY ON STANDARD WATER TREATMENT PLANTS IN INDONESIA

by M.J. van Melick / Pudjastanto

In 1979 the Indonesian Government expressed the intention to prepare designs for standard surface water treatment plants, which can be prefabricated or partly built-on-site. It was envisaged that standard steel treatment plants, fabricated in series, will save time in planning, design and manufacture.

The report contains general and detailed criteria; the design study for steel treatment plant modules in the capacity range of 20 l/sec to 80 l/sec has been carried out accordingly. The paper describes the results of the design study as well as improvements to existing designs of standard concrete plants in Indonesia as proposed by the study team.

The paper finally mentions the restrictions in the application of the standardized treatment process for differnt types of surface waters.

MANUFACTURING ASPECTS OF STEEL PACKAGE PLANTS IN INDONESIA

by Dr. E.J. de Bruijn

A survey of the availability of materials and the production capacity of engineering workshops has been made and actual standards and specifications for materials currently in use in Indonesia are considered. General comments on the feasibility of the set-up of a modular scheme for steel package plants and recommendations for the organization of production and maintenance given.

Advantages and disadvantages of this type of plants are discussed. Attention is paid to the specific and typical items concerning the Indonesian situation and the consequences for design, construction and transport.

General observations are made with respect to manufacturing problems, especially to proper welding procedures, production planning, dimensional standards, quality of the workmanship and inspection and testing procedures.

Main conclusions are:

- Several factories have suitable capacity and most required materials are available.
- Set-up of a training programme for operators is necessary.
- Set-up of a system for maintenance of plants is required.
- Set-up of an inspection scheme for production control should be made.

RESEARCH AND DEVELOPMENT OF APPROPRIATE WATER SUPPLY SYSTEMS

by Dr. W.L. Reyes

The concept of appropriate technology focusses on the need to take into consideration the social, political, cultural, economic and environmental characteristics of the community in which a technology is introduced. Technologies appropriate to a national setting will most probably be a 'mix' of the various subsets of technology, which planners and decision makers of the country have to balance carefully in order to attain optimal socio-economic development.

Criteria for defining appropriateness of technology in environmental health can be described under the headings of hygienically, technologically and scientifically sound, socially and culturally acceptable, environmentally sound and economically feasible.

Research and development of modules in the water supply sector should be considered as an approach in the development of appropriate technology. In this connection, it may be helpful to recognise that appropriate technology could be considered to have two components: hardware and software.

Appropriate technology hardware may be considered to refer to the tools, equipment, structures to house specific treatment and other processes and systems (combinations of tools, equipment, etc.).

Appropriate technology software may refer to the management procedures, evaluation methodologies, educational and training modules, etc. It has been pointed out in a number of documents that the weaker links in the water supply sector are more on the appropriate technology software, although much still remains to be done in the appropriate technology hardware as shown by the discussions in the regional seminar. The concept of developing modules in the hardware and software components of appropriate technology is highly recommended, e.g. water filtration module, training module, mass communication module, etc. This Regional Seminar hopefully has catalysed interest in the modular approach including essential research and development on this subject.

TRAINING PROGRAMME ASSOCIATED WITH MALAYSIA'S RURAL ENVIRONMENTAL SANITATION PROGRAMME

by A. Sekarajasekaran

Training of personnel has been an essential part of Malaysia's Rural Environmental Sanitation Programme. Basically the training programme consists of two phases. Phase I deals with all aspects of the programme as it is believed that they can more effectively deal with the day-to-day problems if the personnel has a general knowledge of the related subjects.

Phase II builds up on the broad base and develops specialist skills in accordance with the programme requirements.

The philosophy is that training must be continuous and progressive. This is the only way for staff skill to keep pace with the technological changes which are taking place. A continuous training programme is also carried out in the villages. Practical instruction in construction and maintenance techniques is required for the communities to actively participate in the programme.

ASPECTS OF THE TRAINING OF SUB-PROFESSIONALS IN A MASS APPROACH TO SMALL SCALE WATER SUPPLY PROGRAMMES

by A. Milburn

Key factors in a mass approach of small scale water supply programmes are involvement of the community in construction and operation, the use of simple standard designs and the use of well-trained sub-professional personnel. Several other factors having a bearing on manpower development are discussed. Technicians for which tasks are described are: sanitarian, to provide liaison with the community; water sources, survey, design and construction technicians. High quality manuals must be prepared to guide design and construction technicians. Technician training should be: pre-service off-the-job training dealing with basics and use of manuals and on-the-job training, to gain experience.

COMMUNITY INVOLVEMENT IN SMALL WATER SUPPLY PROGRAMMES

by Edwin D. Robertson

The author attempts to define and analyse the critical factors involved in achieving user and community participation in small water supply programmes by reviewing the following areas of information and experience.

1. Direct working experience in Organization, Training and Development in the West Java Rural Water Supply Project over a period of approximately two years.

2. Review of Case studies from West and Central Java.
3. Notes and Recommendations from Project Seminars and Training Courses conducted during 1979 - 1980.

The failure of many small rural water supply programmes clearly rests on a lack of recognition of the important factors which motivated rural communities to accept new schemes of water supply with the changes in understanding and behaviour involved. The paper attempts to identify some of these factors, including the role and function of Government Agencies and their inter-related organisation, the socio-logical aspects, the educational and technical training and the manpower requirements for effective action based on a proper analytical review of each rural situation to produce the appropriate strategy.

DECADE PLANS FOR INDIA

by P. Chatterjee

India's budget for water supply development increased from US\$ 25 million in the first Five Year Plan (starting 1951) to US\$ 4,000 million in the current plan ending in 1985, to cover 3119 towns (total population 110 million people) and 57,600 villages (total population 490 million people). India's target of the International Drinking Water Supply and Sanitation Decade is to bring coverage to urban water supply to 100%, rural water supply to 100%, urban sanitation to 80%, and rural sanitation to 25%. Due to limited budget allocations appropriate levels of coverage will be applied in the programme such as house connections, public stand-posts and handpumps. To achieve the goal a committee at national level is being set up which will look into the overall programmes including manpower and material requirements - also a National Document is being prepared containing information on the water supply and sanitation situation in every community throughout the country.

In addition to construction, other activities intended to accelerate the implementation of the programme include training and monitoring programmes, standardization manuals and guidelines for water supply

(completed in 1976) and sanitation (1980). The manual sets levels of service such as per capita supply of 40 - 70 litres per day for rural areas, terminal pressures in the distribution, one public tap for 250 persons, standardized handpumps, etc.

Types of sources of water are identified such as springs, canals, hard rock drilled bore-holes, shallow wells, etc.

For the operation and maintenance of handpumps in rural areas, a three level maintenance system has been introduced. The first level is a villager who is trained to do the maintenance. In the event of his failure to repair, he reports to the second one, a mechanic. In the third level there is a qualified engineer with a mobile van.

SOME OBSERVATIONS TO A MASS PROJECT CONSTRUCTION PROGRAMME - THAILAND

by D. Nitipavachon

Since its inception in 1976, the National Potable Community Water Supply Programme in Thailand has constructed and put into operation some 700 community piped water supply systems for rural communities throughout Thailand. The mass project construction programme has been mainly carried out using standardized design drawings of various types and capacities of water systems applicable for different ranges of population.

Three evaluation programmes carried out in 1972, 1978 and 1979 reveal that in nearly all cases of the systems that have not continued to function, the problem appears to be managerial rather than technical.

The recent evaluation in 1979 conducted by the USAID indicates that the greatest impact of these projects have been the economic benefits.

CASE STUDY - SRI LANKA

by P.U. Gunasinghe

In 1971 the population of Sri Lanka was 12.7 million of which 2.8 million (22%) was urban, 8.7 million (68.5%) rural and 1.2 million (9.5%) in the

estate sector. In the rural sector about 20% of the households had a piped water supply and the rest derived water from dug wells.

The target is to provide 100% of the rural population in Sri Lanka with safe water by the year 2000. To this end three programmes are currently being implemented to improve the water supply situation in the rural areas namely piped water supply systems, community wells and deep wells adopting hand pumps. These programmes are being implemented with assistance from UNICEF, the World Bank and bilateral aid.

In the design of rural water supply schemes, standardized units such as intakes, treatment units, storage tanks, etc. are being adopted successfully.

In general, appropriate technology and external support in the form of consultancy services, equipment etc. are of great benefit to improve coverage of rural water supplies in Sri Lanka.

CASE STUDY - MALAYSIA

by A. Sekarajasekaran

Malaysia has a well developed supply system with a population coverage of 90% in the urban areas in 1975. This is projected to cover 95% and 97% by 1980 and 1985 respectively. The rural coverage by water supply facilities was approximately 38% in 1970 (including 27% through house connections) and projected to 66% in 1980 (including 40% through house connections). The government's commitment to the programme of providing these basic sanitary needs will further be enhanced during the Fourth Socio-Economic Development Plan 1981 - 1985. The success of the rural water supply and environmental sanitation programme has been largely due to community participation. The water supply systems in the remote rural areas where water is not provided by public water undertakings are implemented by the Ministry of Health's personnel with community participation. They comprise of simple systems which are operated and maintained by the community on completion. The Ministry of Health also ensures that the systems are functioning, monitors them and provides technical assistance and guidance whenever necessary.

CASE STUDY - INDONESIA

By Darmawan Saleh

Indonesia after its independence inherited a number of water supply systems in various cities and towns which were built in the pre-World War II period. Since 1952 some water treatment plants and distribution systems were constructed by big cities to expand the existing ones to meet the increasing water demands. The construction of some schemes was initiated in a programme oriented way since the First Five-Year Development Plan (1969 -1974). In this programme the projects were in the form of rehabilitation of existing systems and in the Second Five-Year Development Plan it increased the capacities of water production and new main distribution pipes were constructed, bringing the nation's water supply capacity to 20,000 litres per second. Although the coverage reached 40% of the urban population only the middle and high income groups benefitted from the projects.

In the Third Five-Year Plan starting 1979 a new approach for water supply development is adopted by the government. Coverage of the new schemes will reach small towns and rural communities with emphasis to serve water to as many people as possible and especially the lower income population. The new strategy among others includes construction of water systems with modules, immediate utilisation of water production available, shortening project preparation and implementation, lowering investment costs, standardization of equipment and materials.

In the aspect of financing water supply projects the government budgets are supplemented with foreign aids in the form of loans or grants from international lending agencies and donor countries. Through this arrangement the implementation of plans is accelerated whilst bringing benefits to a larger population.

CASE STUDY - NEPAL

by L. Robertson

Depending on the topography Nepal can be broadly divided in hills, midlands and tarai (lowlands). About 91% of the total population (12 million) lives in the villages and 9% in urban areas. At present, about 81% of the urban population is served by piped water supply systems. However, none of the systems can be said to be adequate and they all provide intermittent supply. In rural areas only about 70,000 people living in 210 villages have piped water supply.

Three agencies responsible for providing drinking water are:

1. Local Development Ministry (LDM). Serving rural compact communities with populations under 1500, and shallow tube wells in tarai. Community involvement plays a vital role in its programme.
2. Department of Water Supply and Sewerage (DWSS). Responsible for rural compact communities with populations of 1500 and over in the hills and midlands and in zonal and district headquarters.
3. Water Supply and Sewerage Board (WSSB). Responsible for providing adequate water supply to all urban centres.

His Majesty's Government of Nepal has a long term plan for the water decade period of 1981 - 1990 to increase the population coverage from 10.5% in 1981 to 68% in 1990. The plan envisages the provision of at least one piped water supply system in each of the Panchayats in hills and midlands by 1990. The tarai rural population will be covered during the same period through the construction of adequate tube wells with handpumps.

Constraints are the necessity of import of major construction materials and equipment, difficult transport conditions and shortage of trained technical manpower. Annual investment is very low, and large investment will be required to meet the need for water supply and sanitation both in urban and rural areas.

annex 4

some background documents

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