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R E P O R T

OPERATION AND MAINTENANCE

small

SUPPORT TO WATER TREATMENT PLANTS IN

INDONESIA

PROJECT GTA-46

by

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R822-5769

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1.

INTRODUCTION

The Indonesian Government in the context of the National 3rd Five year plan (1979-1984), plans to introduce the use of Standard Water Purifications Plants for Surface Water. Indonesian Government plans to stimulate domestic manufacture of Standard Water Purification Plants with optimum utilisation of local materials and labour.

On request from the Directorate of Sanitary Engineering to the Netherlands Government to provide technical assistance, the International Reference Centre has undertaken a study for the production and use of Standard Water Purification Plants. This specific report is a part of this study and is related to the operation and maintenance services of small Community Water Supplies.

2.

TERMS OF REFERENCE

The Terms of Reference as were included are given here under: -

- a. To study current operation and maintenance organisation and practice of small public water supply systems in Indonesia from reports, verbal information and plant visits;
- b. To draft proposals including institutional, technical, logistical support required for strengthening operation and maintenance services of small community water supplies;
- c. To propose schemes for operation and (preventive) maintenance including monitoring and inspection required for good functioning of the Standard Water Purification Plants planned for the small towns;
- d. To outline a staffing scheme and courses, and manuals required for instructing and upgrading the proposed personnel;

The consultancy period for the above Terms of Reference was for a period of two weeks.

3. DISCUSSIONS WERE HELD WITH IR. OEMAR SIDIK HADIASMORO

In-charge of Sub Directorate Development and Staff under him, Mr. Suwandi, Mr. Erhas S, Mr. Haryono Adali, and Sri Yanto, *Surveillance?* Sri Suyati and Widyawati of the Directorate of Health Facility.

Directorate-laboratory was visited and also the class rooms and dormitory of the conference centre at Jakarta.

Reports of earlier consultants as then ready, were available. The report now prepared is based on the above discussions, visits and reports.

4. TO STUDY CURRENT OPERATION AND MAINTENANCE ORGANISATION AND PRACTICE OF SMALL PIPED WATER SUPPLY SYSTEMS IN INDONESIA FROM REPORTS, VERBAL INFORMATION AND PLANT VISITS

- 4.1. The present organisation dealing with water supply and sanitation in Indonesia is the Directorate of Sanitary Engineering. The Director works under the Directorate General of Housing, Building, Planning and Urban Development under the Ministry of Public Works ~~and Electric Power.~~

The Directorate of Sanitary Engineering has four sub directorates for planning, construction, development and logistics. Organisational charts are given in Appendix. The sub directorate dealing with the subject of operation, management and training is the sub-directorate for development.

- 4.2. The sub-directorate for development has four sections dealing with Management Development, Technical Development, Training and Laboratory. Under the present system the water supply schemes are constructed and then handed over to the local authorities for operation and maintenance

There is no direct control of the Directorate such as monitoring, reporting and inspections over the completed schemes. The staff required for operation was stated to be recruited locally by the project staff during construction, who obtain practical training during construction and then operate these schemes. Generally, this staff is not to the desired level of training and/or experience.

- 4.3. The sub-directorate has been siezed with the problem of serious shortcomings in operation and maintenance. It was stated that while the water works were being operated somehow, there was hardly any maintenance resulting in deterioration of plants and other works.

In order to oversee the operation and maintenance the Central BPAM is supposed to undertake this responsibility. Since 1977, when three water works were included for control, till today, 35 out of 200 towns provided with water supply could be brought under this scheme. It was stated that it was aimed to bring 45 water works under control before the end of the year. There was one manager at each of these 35 places. Budgetary information was primarily available. Revenue collection is done by BPAM. Water charges were levied for house connections but standpipe supply was more or less free. The revenue collected was just adequate to meet the operational expenditure.

4.4. It was stated that for the 35 places information such as number of staff employed, supply made, number of connections existing, expenditure incurred were received quarterly by the Central BPAM. New forms are being devised by BPAM. Information as at present was incomplete in many cases and no data about water quality or any other technical information about operation was available. It was not obligatory to take samples and get them analysed. The control on water quality as at present was under the Health Ministry and though requested by DSE, reports of water analyses were not endorsed to the Directorate. It was understood that no regular visits or inspections could be carried out by the DSE's staff. The Central BPAM had seven staff members. The Management Development Section and the Technical Development Section were supposed to work in co-ordination for proper monitoring. The DSE felt that technical development wing was weak.

4.5. The sub-directorate has also a training section. There are three officials on the staff. The sub-directorate has plans for a full fledged training centre at Jakarta with seven other centres at Bandung, Surabaya, Denpasar, Ujung Pandang, Medan, Palembang and Banjarmasin.

These proposals will be examined under the Manpower Development Plan of operation (GTA-18).

A list of seminars, conferences, courses held during 1973 to 1977 was available. A total of 37 such courses / seminars were held. Of these five were international seminars/course, one on air pollution control, one on solid waste disposal and one on laboratory course for waste effluents. There was no course for water works operators in this list. However, during further discussions it was revealed that these courses are held, on as and when required basis. The Directorate has at present a centre for training at Jakarta, Class room facilities, some sectional models, office equipment and a dormitory for 30 trainees is available.

Courses under management, finance and technical training are held here. There is no full time training staff attached to the centre but those working in the field and some of the technical institutions are invited for imparting training.

It was stated that seven people were being recruited in order to strengthen the training section.

- 4.6. The Directorate has a laboratory with a staff of 15 persons. It has facilities for physical, chemical and bacteriological examination of water. It has also facilities for testing waste water. There is however no regular schedule for testing of water and analyses are done as and when referred to. This is also not considered as its programme. The present facilities were indicated as adequate for analysis of about 20 samples per day.

Some experimental work on sedimentation, filtration has been carried out in the Laboratory. Some experimental plants such as slow sand filter, oxidation ditch are in the compound of the Laboratory. Class room facility is available for training. A review for upgrading the Laboratory has been recently carried out by the W.H.O.

5. TO DRAFT PROPOSALS INCLUDING INSTITUTIONAL, TECHNICAL AND LOGISTICAL SUPPORT REQUIRED FOR STRENGTHENING OPERATION AND MAINTENANCE SERVICES OF SMALL COMMUNITY WATER SUPPLY SYSTEMS

- 5.1. The present operation and maintenance arrangements have been indicated earlier. The Directorate of Sanitary Engineering which is the technical organisation-connected with water supply has no effective control over the completed water supply systems. There is however realisation about the adverse effects of non-existence of organised operation and maintenance practice and attempts are being made to take over the operation and maintenance through the central B.P.A.M. The Indonesian Government has in the meantime ordered fifty package steel water treatment plants early 1980 and with the project for manufacture and installation of standard water treatment plants now being designed under GTA-46 study, there will be a large number of package steel water treatment plants in operation in Indonesia. The Directorate of Sanitary Engineering has not adequate previous experience in operation and maintenance of such plants. By the very nature of these plants, they will need a very careful maintenance programme in the absence of which they may deteriorate rapidly.
- 5.2. The Directorate of Sanitary Engineering has therefore to devise organisational arrangements for operation and maintenance, prepare the staff by appropriate training and have a proper schedule to achieve a satisfactory operation and maintenance arrangements in a time bound programme.
- 5.3. It is therefore essential to undertake a support programme in operation and maintenance. In view of the immediate likelihood of these plants being put into operation, this support programme may begin from mid 1980 to a period of about twelve months. The recommendations given in this report indicate various aspects of operation and maintenance which can be examined under this programme.

These have also been commented upon under the scheme for operation and maintenance under the related terms of reference. A chart attached in annex gives the outline of such a support programme.

- 5.4. The organisations vitally concerned with this support programme are the central BPAM, the training section and the Laboratory section under the sub directorate for development and the concerned wing of the Directorate of Health Facilities. It will be possible with such a support programme, to organise a satisfactory operation and maintenance system for the package water treatment plants.

6. TO PROPOSE SCHEMES FOR OPERATION AND (PREVENTIVE), MAINTENANCE INCLUDING MONITORING AND INSPECTION REQUIRED FOR GOOD FUNCTIONING OF THE WATER PURIFICATION PLANTS PLANNED FOR SMALL TOWNS

6.1. In devising scheme for operation and maintenance it is necessary to understand the operational policies and organisational arrangements for dealing with operation and maintenance. As at present, though the majority of water supply systems are managed by the local authorities, there is realisation that the small water supply systems need to be brought under the control of central BPAM. There is an urgent need to examine how this can be achieved in a time bound programme and with special reference to the package steel plants as these will need greater attention from the maintenance point of view.

6.2. It is possible to define detailed itemwise schedules of operation and maintenance for each step in process and the frequency and timing for action. It is also necessary to indicate in details the tasks which will deal with preventive maintenance with regard to:-

- a. Structures - steel or concrete as the case may be
- b. Machinery - Electrical
- Mechanical
- c. Instruments and indicators.

6.3. In this connection it is suggested that apart from training of operators who will be in charge of these plants, it has to be examined if a scheme can be brought into operation wherein an expert/manufacturer/travelling service team undertakes periodical inspections of these package plants for adhering to the maintenance schedule. Such an arrangement will specially help in the initial stages to ensure satisfactory maintenance and will also help the operators to gain confidence who will thereafter take over the responsibility of maintenance.

6.4. Monitoring:- It is essential to have an effective monitoring system formed to keep an efficient control over the performance of these standard water purification plants. As at present there is no existing system. Some data are available about the 35 water works under the control of BPAM. New forms and procedures are also being involved. These will need a detailed review.

Monitoring will have to be of two types :-

- a. Monitoring on water quality
- b. Monitoring on performance of treatment plants

6.5. Monitoring on water quality : - Monitoring of drinking water quality is very essential as it is the continuous and vigilant public health assessment of the safety and acceptability of public water supply systems. It includes choice and collection of water samples, laboratory tests, analysis and interpretation of quality data. The quality monitoring therefore needs an efficient laboratory service. While surveillance may be essentially a health measure, the water supply authorities and their supervisory authorities have a vital interest in results and interpretations and it is essential that they are involved in the process of evaluation and corrective action. Hence both water producing and surveillance authority must undertake essential surveillance activities. As at present there is a control system of Drinking Water Quality under the Directorate of Health Facilities. The control scheme is being tried in 21 of the 27 provinces during the last two years. There is however no regular schedule of sampling and testing. Difficulties of long distances from central laboratory located in each province were mentioned. Payments are not made by the local authorities but provisions are made in the State Budget. There is evidently an urgent need for devising a mechanism of coordination so that while making use of the facilities and systems available under the Directorate of Health Facilities, the Directorate of

Sanitary Engineering is fully involved. It will also be necessary to carry out certain tests such as, turbidity, colour, pH, flocculation characteristics (jar test), chlorine demand and residual chlorine levels, daily at site. Records will have to be kept at site and suitable forms, records and reporting systems can be devised. It is possible to train operators at Provincial laboratories in sampling and testing of water samples and best advantage of these facilities be taken.

- 6.6. Monitoring on performance of plants:- The other aspect which needs monitoring is the performance of the water treatment plant. It is necessary to devise forms which give information on details of performance of each unit of treatment plant. The water treatment plant operator will have to maintain records at the water works, which will include readings and observations on the basis of which reporting will have to be done. As stated earlier some forms are being devised by the central BPAM. These will have to be reviewed very carefully. It will not be desirable to have too many forms with too detailed information as it is not likely to be filled in and sent regularly.
- 6.7. It will be desirable to prepare annually a summary of the operational results both from the point of view of quality and plant performance. It will be desirable to have a small technical review group formed under the Directorate which can from time to time review the forms and information received and propose suitable modifications as may be necessary.
- 6.8. Inspections:- It is essential to have the water treatment plants inspected by the supervisory agency at regular intervals to ensure efficient operation of these plants. As at present, there is no regular schedule of inspections which needs to be specified. Suggested contents for the form of inspection are given in annex

Any information sent or inspections carried out and reported upon will not be effective unless action is taken by those concerned to rectify defects or set in order any deficiencies in the plant and extend the necessary assistance. A close follow up is therefore necessary.

7. TO OUTLINE A STAFFING SCHEME AND COURSES AND MANUALS REQUIRED FOR INSTRUCTING AND UPGRADING THE PROPOSED PERSONNEL:-

7.1. Staffing scheme:- The treatment plants are proposed to be located in various provinces and islands and are dispersed. Staffing proposals for standard water treatment plants for various capacities need to be framed urgently. It is necessary to prepare job description, giving details of duties/tasks to be performed by each person and minimum desired qualifications. It will be necessary to have an immediate plan for identifying and recruitment of operators timed half way through the construction so that they have an opportunity to understand the fabrication details. It was stated that it is difficult to get the desired level of trained or qualified personnel. An orientation training programme will have therefore to be quickly organised.

7.2. Courses and manuals:- It is necessary to have a scheme of courses of instructions and also to have a set of manuals prepared for instructions to the operator. As at present there are no courses for operators conducted regularly under D.S.E. as has been indicated earlier. The following courses will have therefore to be initiated immediately:

- a. Operation and preventive maintenance of water treatment plants:
 - i. steel
 - ii. concrete
- b. Procedures for collection and testing of water samples.

The steel plants which have already been ordered out are of three different types and hence while devising course-curriculae for training of operators, this fact will have to be taken into consideration. While details of various courses will perhaps be worked out under plan of operation GTA-18, it is necessary to work out details of such courses which will

have to be immediately started and for this purpose it is necessary to undertake a follow-up programme in operation and maintenance. The courses can be conducted by the sub-directorate for development under D.S.E. through its training section. This section will need strengthening. It will be necessary to give details regarding duration of each course and frequency. Under the training section, the sub-directorate can have an annual schedule of various courses and the operators courses should find place in it. As a follow-up of the orientation training programme, short refresher courses have to be planned so that the operator has an opportunity to undergo further training after a certain period when he has had an opportunity to operate the plant for some time.

7.3. Manuals:- Whatever may be the formal or orientation training of the operator, an operators' manual is indispensable and can be of great help for efficient operation and maintenance of the plant. The manuals which are urgently required to be prepared are for:

- a. Package steel plants: Three different types of plants will be received and one standard design has been prepared which means there will be four types of package steel plants.
- b. Concrete built in situ plants
- c. Collection and testing procedures for water samples.

The manual should in general deal with the following topics:-

- i) General detailed information about the plant, process and functions of each step in the treatment
- ii) Operational procedures - Details of operations of various steps described for starting and closing, of operation in the plant, such as flocculation, settlement, filter operation, disinfection. Details of steps after long and short stoppage of plant. Operational limits.
- iii) Likely defects, variations which are likely to arise in the plant.

- iv) Operation and maintenance schedule
This will contain the check list with the frequency for each unit
- v) Simple arithmetic calculations about dosages of chemicals and how to administrate them.
- vi) Tests and interpretation
- vii) Requirement of chemicals, their storage and precautions required to be taken
- viii) Spares for various machineries, equipment and indicators and likely period when replacement/repairs would be necessary itemwise.
- ix) Trouble shooting guide, which will indicate anticipated trouble under each item/step, the possible causes for such troubles and the remedial measures that need to be taken to set right the operation.
- x) Safety and emergencies;- Emergency procedures with appropriate instructions to ensure that the operator knows his responsibility and duty for proper action whenever there is such an emergency.
- xi) Tables and graphs indicating required dosages and quantities of chemicals.
- xii) Simplified schematic diagrams with enlarged details of any complicated system
- xiii) Ready Recknar (tables).
- xiv) Identification of jobs and check list.

Note: The manual should have sufficient diagrams to indicate mode of operation of each step for easy understanding of the operators.

7.4. Apart from the manual, it is always desirable to have instructions displayed at the workspot which can be easily read or referred to by the operator.

8. RECOMMENDATIONS

8.1. The Indonesian Government has ordered out 50 package steel water treatment plants early 1980. These are from three different manufacturers who have three different types of plants though the process is the same viz. flocculation, sedimentation and filtration. The standard package steel treatment plant being designed under GTA-46 study, will also be ready for adaption in the field. The Directorate will have therefore four types of steel water treatment plants followed by more number of the standard treatment plants in the following years of the Repelita. The Directorate had earlier only conventional in-situ concrete plants with the exception of one or two steel package plants. It was understood that in one case the chemical feed pumps in the package plant were out of order right from the day of installation. The Directorate has therefore almost no previous experience in operation and maintenance of such package plants.

8.2. Regular and efficient operation and maintenance programme is very essential, otherwise, the plants will deteriorate rapidly reducing the effective life. Even as at present the Directorate feels that there is no proper maintenance of existing treatment plants. It is therefore recommended that a support programme in operation and maintenance of package steel plants be undertaken immediately for a duration of 12 months. This study may include the various aspects of operation and maintenance indicated hereafter:

1. To examine the present operational policies and the organisational arrangements for dealing with operation and maintenance of small water supply systems. To identify the deficiencies, shortcomings and the problems existing in the present arrangement. To examine the operation and maintenance organisation under BPAM.

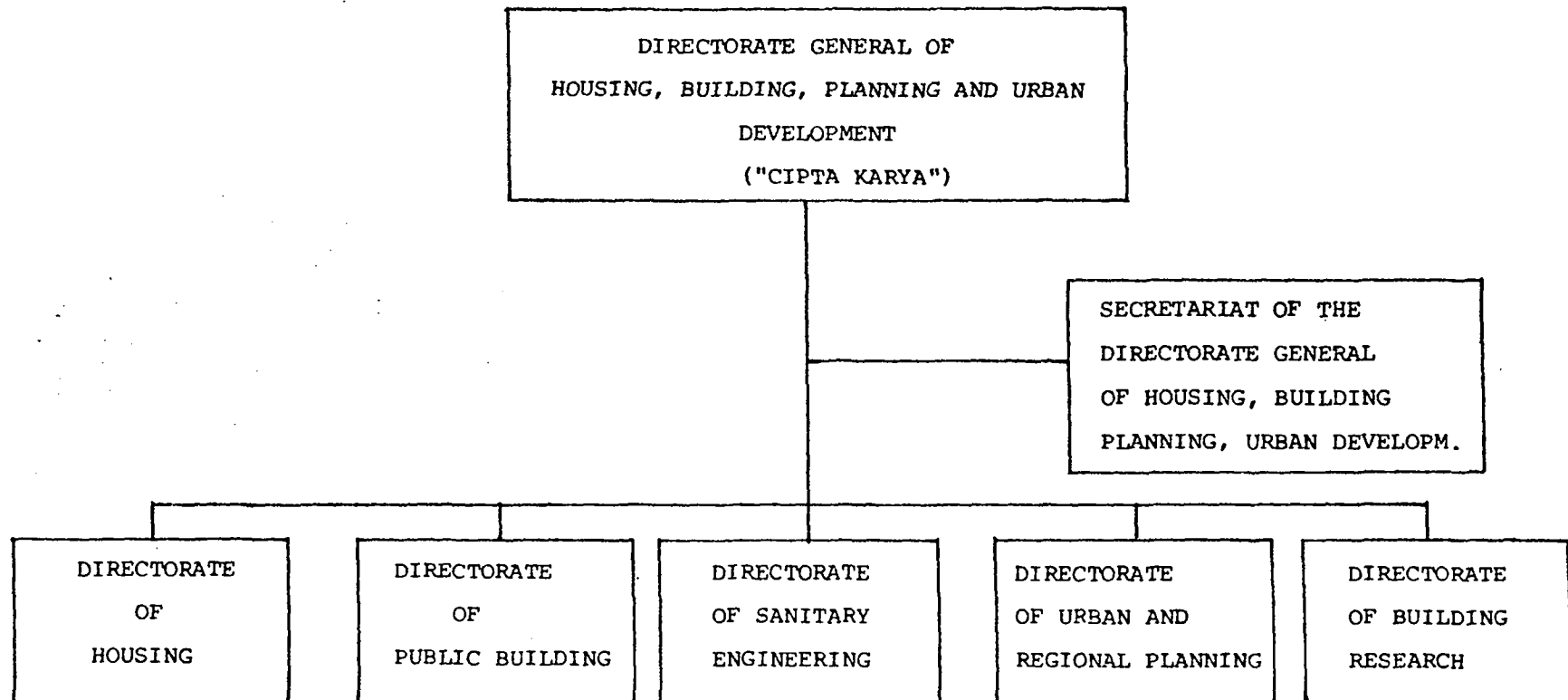
2. To examine if BPAM pattern be adopted for operation and maintenance of all small public water supply systems with special reference to package steel plants. To suggest a chart of organisational set up - under the organisation for operation and maintenance. To identify institutions/ organisations to back up the operation and maintenance programme with proposals for strengthening if necessary. To indicate a time schedule for adoption.
3. To recommend staffing pattern for the treatment plants for various types and capacities. To indicate job description, duties and tasks and minimum educational standard for the personnel for operation and maintenance. To indicate level for recruitment and orientation training for the operators.
4. To propose a plan for operation and maintenance of the package treatment plants to be adapted if so required on a short term and long term basis. To prepare a schedule for operation and maintenance. To evolve a system for monitoring and inspections. To examine need for an expert/manufacturer/travelling service team for regular inspections for keeping to the maintenance schedule as required. To examine the reporting system being designed by the BPAM and suggest changes/additional proforma for operation, maintenance and quality control including frequency and level of submission. To propose a system by which there could be control over operation and maintenance and proper coordination mechanism for quality control under the Directorate. To examine financial requirements for efficient operation and maintenance of standard water treatment plants.
5. To propose training programmes - orientation and refresher courses. To prepare details of syllabi for the same. To identify institutions/laboratories for undertaking such training and examine need for strengthening whenever required. To propose a schedule for such training programmes.

6. To prepare manuals for operation and maintenance and quality control for water treatment plant operators for different types of plants. The manuals may include topics suggested in this report.
7. To examine the designs of various types of package treatment plants and the likely recurring operation and maintenance problems presented by the different types. To identify the likely spares required for the sensitive steps in the treatment process, the feasibility of storage, availability and ease with which these could be procured and installed. To suggest changes if necessary for facilitating efficient and easy operation and maintenance with the staff as would normally be available and with the current level of training.

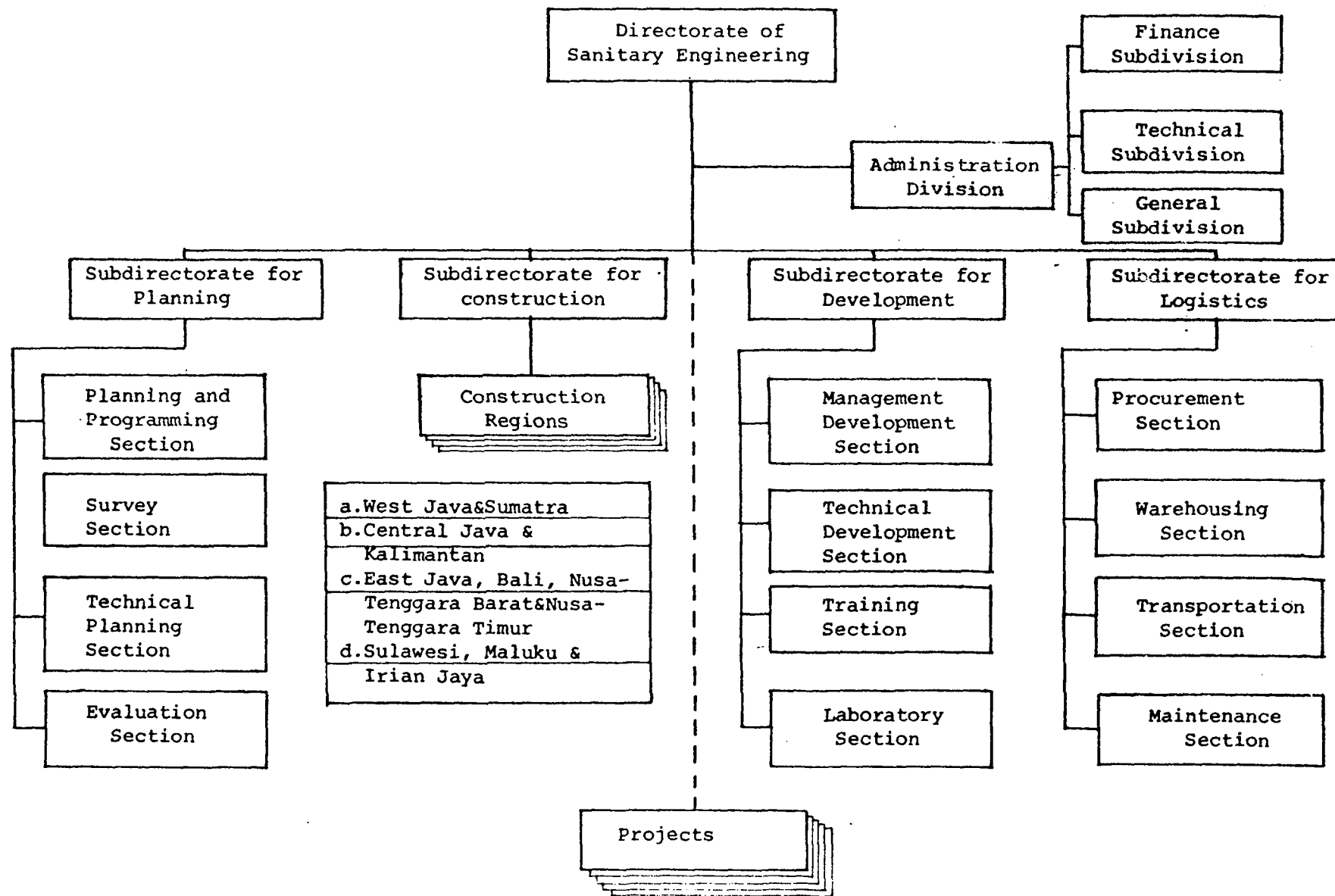
8.3. The programme will need expatriate consultants in the respective fields. The counterpart organisation/institutions will be the BPAM organisation, the training section under the Directorate, the Laboratory under the Directorate and the Laboratories under the Directorate of Health Facilities.

8.4. The importance and urgency for undertaking such a programme needs no over emphasis and needs to be organised on priority.

ORGANIZATIONAL CHART
DIRECTORATE GENERAL OF "CIPTA KARYA"



ORGANIZATION STRUCTURE
 OF THE
 DIRECTORATE OF SANITARY ENGINEERING



INSPECTIONSI. Suggested contents for an inspection form

(Related to water treatment plant)

1. Name of scheme
2. Designed capacity of plant
3. Water supply - Average/day, Maximum/day, Maximum/month
4. Laboratory control :
 - a. samples taken - frequency for physical, chemical, bacteriological analysis
 - b. quality of water maintained/not maintained
 - c. are samples representative
 - d. are there any difficulties in obtaining samples, testing, getting results ?
 - e. is any interpretation made of the results ?
5. Are records kept properly and in the required forms ?
6. What is the condition of the treatment plant ?
 - a. corrosion - is painting or special treatment required
 - b. operation - each step in the plant, as regards quality, quantity
 - c. mechanical operation - moving parts
 - d. structural conditions
7. What proportion of installation is functioning as intended and delivering sufficient water of acceptable potability ?
8. Personnel - operators
 - i. level of initial training
 - ii. level of formal training in water treatment and duration of training
 - iii. total experience in a) water treatment plant, b) in the present plant
9. Is staff adequate ?
10. What are the most frequent complaints ?
 - water works authority
 - operators
 - consumers
11. Is any equipment out of order and for what duration ?

12. Water borne diseases in Community ?

13. Suggested corrections of deficiencies, or improvements.

II. 1. Inspection report reviewed by:-

2. Action taken:-

Note:

Detailed form can be designed after discussions with all concerned.

Quality control - sampling, analysis and reporting

<u>Present system</u>	<u>Suggested system</u>
1. <u>Sampling:</u> By officials of Kotamadya/Kabupaten (health services) together with officials of related service	By water works operators and by officials of K.H.S. when required
2. <u>Frequency of</u> <u>sampling:</u> Not regularly	Needs to be defined for each type of tests - physical, chemical, bacteriological
3. <u>Testing of</u> <u>samples:</u> Provincial laboratory	Provincial laboratory and laboratory at the water works
4. <u>Reporting</u> <u>of results:</u> a. Komadya/K.H.S. b. Ministry of Health/ Director General of Medical Care c. Provincial Health Service d. Manager Enviromental Health Facilities	a. Kotamadya/K.H.S. b. Provincial official of BPAM
5. <u>Action:</u> Manager Environmental Health Facilities	Provincial BPAM official
6. <u>Evaluation</u> <u>and recommendations:</u> a. Monthly by head of Kabupaten/K.H.S. b. Sending to the Mayor	Provincial BPAM official and sending to a. Mayor b. Sub-Directorate of Development

NOTE: 1. BPAM to notify official for each province
2. In case there is no such officer, officer in the nearest
province be notified

Designing information system for monitoring

1. Design forms and records to be kept at site and other levels.
2. Determine levels of reporting and frequency
3. Determine levels for final analysis of information received.
4. Prepare a check list for each level and for each frequency.
5. Determine level for preparing annual summaries.

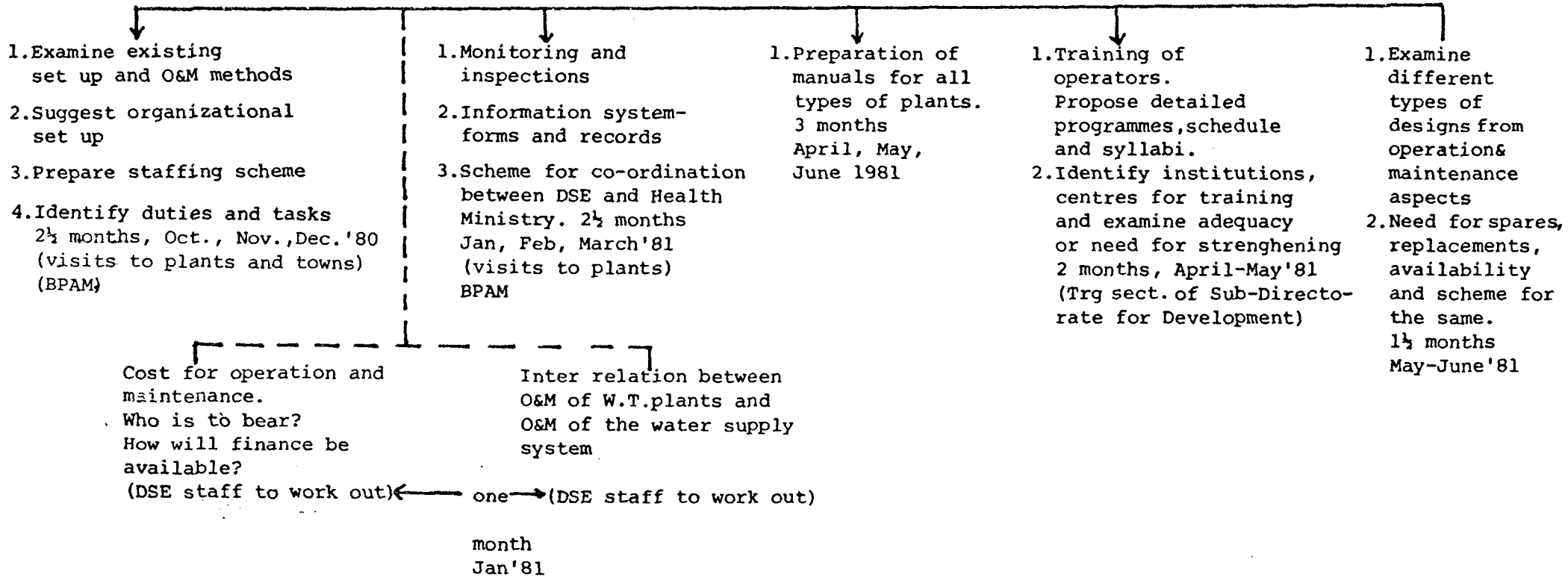
Note :

1. Information which is not to be acted upon need not be called.
2. Same type of information should not be repeated or called for in different forms.
3. Static information be identified and level of recording the same for easy reference be determined.
4. Information/forms be classified according to type of activity.

SUPPORT PROGRAMME IN OPERATION AND MAINTENANCE

(standard water treatment plants)

(Plan for operation)



SUPPORT PROGRAMME IN OPERATION AND MAINTENANCE

The following information may be kept ready by the counterpart staff for the support programme in operation and maintenance earlier to the arrival of expatriate consultants. This will enable the consultants to make proposals/recommendations in a short period.

I. ORGANISATION AND STAFFING

1. Detailed and complete chart of organisation under D.S.E. with a plan of Indonesia indicating location of offices if any.
 2. Present staffing structure of a typical water supply system giving different designations and duties allocated, also, typical cost estimate on establishment at such a treatment plant.
 3. Promotion ladder for these employees if any.
 4. Any available manual on employees.
 5. Inventory of 35 schemes under BPAM with data about capacity of plant and no. of employees catagorywise/ shiftwise. Staff chart under BPAM and plan indicating location of these 35 places.
Indicate also proposals of D.S.E. for expansion of BPAM if any.
 6. Indicate provision of funds made in a year for BPAM by Govt. workwise if available (as a subsidy).
 7. Any Govt. regulations/orders about control of water works by BPAM.
 8. Local laws/Acts investing authority for control of water works with the local authority.
 9. Suggest typical places/plants for inspection by the Consultant.
- Study to keep a close liaison with Manpower Development Programme.

II.

MONITORING AND INSPECTIONS

1. Keep sets of existing forms on information system.
2. Indicate levels of reporting and frequency.
3. Keep set of data/observations kept at site.
4. Keep set of inspection forms in Vogue and indicate frequency if any.
5. Information about control system on Drinking Water quality under the Directorate of Health Facilities.
Set of forms adopted by this Directorate and frequency.
6. Set of rules/orders of Government regarding control over water quality.
7. Suggest typical plants two or three for inspections at site.
8. Map of Indonesia indicating places where plants are likely to be located during the year and next 2 or 3 years.
9. Information on BPAM as under I.

III. MANUALS

1. Keep designs and drawings of all types of plants for which manuals are proposed to be prepared.
2. Any information/instructions given by manufacturers.
3. Any manuals/guidelines issued by D.S.E. or BPAM.

Note:

Assistance of drawing office will be required for preparing, diagrammes, sketches, monogrammes, etc.

IV. TRAINING OF OPERATORS

1. Details of annual programmes of training courses, orientation courses, refresher courses.
2. Syllabi in existence for such courses and if sets of lectures notes are printed the same may be made available.
3. Information about available training facilities/ institutions/staff and their locations.
4. Details of proposals of strengthening of training section if any. - Close liaison with Manpower development programme.

V.

EXAMINE DESIGNS OF DIFFERENT TYPES

1. Sets of different designs adopted with drawings.
2. Notes on operational experience on these different types.
3. Arrange visits to typical plants.