THE REPUBLIC OF INDIA
CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING ORGANIZATION (CPHEEO),
MINISTRY OF URBAN DEVELOPMENT (MOUD)

THE STUDY FOR FORMULATION AND REVISION OF MANUALS ON SEWERAGE AND SEWAGE TREATMENT

PHASE-2

IN

THE REPUBLIC OF INDIA

FINAL REPORT

VOLUME I: MAIN REPORT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

TEC INTERNATIONAL CO., LTD.

IN ASSOCIATION WITH

WATER AGENCY INC.

FINAL REPORT

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ABBREVIATIONS

BOOT	Build, Own, Operate, and Transfer
BOT	Build, Operate, and Transfer
CMWSS	Chennai Metropolitan Water Supply and Sewerage
CPHEEO	Central Public Health and Environmental Engineering Organization
DF/R	Draft Final Report
EC	Expert Committee
EIA	Environmental Impact Assessment
F/R	Final Report
GCUS	Japan Global Centre for Urban Sanitation
GOI	Government of India
GOJ	Government of Japan
HUDCO	Housing and Urban Development Corporation Limited
IIM	Indian Institute of Management
IIT	Indian Institute of Technology
ILFS	Infrastructure Leasing and Financial Services Ltd.
IT/R	Interim Report
JICA	Japan International Cooperation Agency
JIWET	Japan Institute of Wastewater Engineering Technology
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JS	Japan Sewage Works Agency
JSCSMA	Japan Sewer Collection System Maintenance Association
JST	JICA Study Team
MIS	Management Information System
MNIT	Malaviya National Institute of Technology
MOEF	Ministry of Environment and Forests
MOUD	Ministry of Urban Development
NEERI	National Environmental Engineering Research Institute
NLCP	National Lake Conservation Plan
NRCD	National River Conservation Directorate

NRCP	National River Conservation Plan
O&M	Operation and Maintenance
PHE	Public Health Engineering
PHED	Public Health Engineering Department
PHEE	Public Health and Environmental Engineering
PPP	Public Private Partnership
P/R	Progress Report
TOC	Table of Contents
TWAD	Tamil Nadu Water Supply and Drainage Board
UIDSSMT	Urban Infrastructure Development Schemes for Small and Medium Towns
ULB	Urban Local Body
WG	Working Group

CHAPTER 1 INTRODUCTION

1.1 General

This Study has been carried out as Phase 2 of "The Study for Formulation and Revision of Manuals on Sewerage and Sewage Treatment in the Republic of India".

Based upon the request of the Government of the Republic of India (GOI), the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan (GOJ), was assigned to undertake the Study in close cooperation with the authorities of GOI. Through the discussions on the Scope of Works (S/W) between the Ministry of Urban Development (MOUD) and JICA in September, 2008 and May, 2009, it was decided that the Study would be carried out in two phases, Phase 1 including the preparatory steps for manual preparation, and Phase 2 in which actual manual shall be described, discussed and prepared.

Phase 1 of the Study was carried out from July 2010 to March 2011, and Phase 2 Study has been undertaken during May 2011 to March 2013.

1.2 Background of the Study

In India, increasing urbanization and economic development has necessitated provision, augmentation and maintenance of infrastructure in urban areas. The untreated sewage from urban areas situated on the banks of rivers/lakes is polluting the receiving water bodies (river, lakes, etc.) and has severely deteriorated the water quality. Foreseeing the problem of pollution because of sewage, the Government of India initiated the National River Conservation Plan (NRCP) and the National Lake Conservation Plan (NLCP) which are being implemented through the National River Conservation Directorate (NRCD), Ministry of Environment and Forests (MOEF) since 1985 onwards to preserve the main rivers and lakes by setting up sewage treatment plants (STPs) and treating the sewage before discharging it into the water body.

A large number of sewage treatment plants along with sewage collection systems have been constructed under the MOUD and MOEF sponsored programmes including those by the State Governments under their own plan funds. The number will increase significantly with the launch of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), and increased allocation of funds under NRCD/NRCP. In light of demand, the first Manual on Sewerage and Sewage Treatment was published by MOUD on the basis of recommendations of the expert committee in 1977 for guidance of public health engineers and those associated to the field across the country. The said manual was revised in 1993.

However, over a period of time there has been advancement in technology options (in the field of treatment and collection of sewage), emerging issues like low cost technology options, decentralized sewage treatment systems and the possibility of involving private entrepreneurs in creating infrastructure for sewerage and sewage treatment based on BOOT, BOT, etc. In view of the above, the up-gradation and revision of the existing manual, last published in 1993, has been keenly felt from quite some time.

Further, there is no separate Manual on Operation and Maintenance (O&M) of Sewerage and Sewage Treatment for the benefit of field engineers, though a separate chapter describing O&M has been included in the existing sewerage manual. However, the content is inadequate compared to the needs of the present changed scenario. Hence, it is absolutely necessary to prepare a separate manual for O&M of sewer network and sewage treatment plant. The need for such a manual has been felt especially since many sewage treatment plants in the country are

not functioning properly due to lack of proper O&M, lack of trained manpower and requisite fund allocation, etc., resulting in the discharge of untreated or partly treated effluent to the water bodies, land and sea resulting in the pollution of water bodies and environmental degradation.

Although the implementation of "Study for Formulation and Revision of Manuals on Sewerage and Sewage Treatment" was determined under such background, it was understood that prepared manual was required to fully reflect the existing condition of the sewerage systems in India, and therefore it was required to check the contents which should be included in the manuals considering the present conditions of sewerage systems in India. For this reason, the Study was divided into two phases and accordingly Manual preparation plan was prepared. In Phase 1 of the Study, preparation of the draft Table of Contents was carried out, and the contents which should be included in the Manuals were discussed through the field visits and discussion with Expert Committees, organised by MOUD and representing opinions of Indian side.

In Phase 2 Study, the drafts of 3 parts of the Manual has been prepared taking into consideration the draft table of contents decided during Phase 1 Study, and in collaboration with the working groups and expert committees organised by the Indian side.

1.3 Objectives and Scope of the Study

The main objectives of Phase 2 of the Study include:

i) Preparation of the draft of Manuals including 3 parts: Engineering, Operation and Maintenance, and Management

ii) Technical transfer for the members of the expert committee related to the sewerage systems operation and management practiced in Japan

Although the drafts have been prepared by the JICA Study Team, these manuals will be finally published by MOUD. Therefore, the draft manuals prepared under the Phase 2 Study will serve as materials of the manuals which MOUD will publish, and the Study does not have responsibility of deciding the final contents of the manuals.

In addition, under Phase 2 of the study, the technical transfer has been carried out for the members of the expert committees related to the design of various sewerage systems, and the operation, maintenance, and management systems practiced in Japan.

1.4 Study Area

The study area covers the entire country of India since the manuals aim at contributing to the planning & design, operation & maintenance and management of the sewerage system nationwide.

1.5 Brief Summary of Phase 1

Phase 1 of this Study was carried out during July 2010 to March 2011. The objective of the Study undertaken during Phase 1 was to establish directions for the revision and formulation of manuals on sewerage and sewage treatment through the analysis of actual conditions of sewerage facilities and their operations and discussions with Expert Committees. For this purpose, visits were made to several towns and cities in order to understand existing condition and practices of sewerage system. Also, discussions were made with relevant engineers in order to understand existing practices, issues, and solutions concerning sewerage system and future policies and strategies for providing improved sewerage services.

During Phase 1, three Expert Committee meetings were held, the participants included JICA Study Team and the Expert Committee members. These meetings were held on 26-27 August 2010, 27-28 October 2010, and 19-20 January 2011, respectively.

The Study started with the objectives to revise the existing manuals for sewerage and sewage treatment and to formulate a new manual for operation and maintenance, that is, preparing two volumes of manuals. However, in the 1st Expert Committee meeting held on 26 and 27 August 2010, it was agreed to include 3 parts in the manual: Engineering, Operation and Maintenance, and Management. Inclusion of Management part in the manual was proposed because of the importance of management in sewerage business. Also, during these meetings, tentative Chapters for each part were decided. The Expert Committee members also agreed to include a Chapter on Onsite Methods, both in Engineering and Operation and Maintenance parts of Manual, considering that still a major part of urban India is practicing onsite methods of sewerage management.

The second Expert Committee meeting was held over two days on 27 and 28 October 2010. During this meeting, draft Table of Contents (TOC) including Chapters and Section level, prepared by the JICA Study Team, for 3 parts were discussed and modified wherever needed.

The third Expert Committee was held on 19 and 20 January 2011. In these meetings, the draft TOCs prepared by the JICA Study Team, including Chapters, Sections, and Subsections for Part A Engineering, Part B Operation and Maintenance and Part C Management, were discussed in detail. Accepting the comments and suggestions of the Expert Committee members, TOCs were finally modified and presented in the Final Report of Phase 1.

In the third Expert Committee meetings, the composition of Working Groups for three parts of the manual: Engineering, Operation and Maintenance, and Management, were also discussed and the Chapters to be covered by each Working Group in case of 3 parts were decided as presented in Table 1.1, Table 1.2 and Table 1.3.

Table 1.1 Chapters covered by each Working Group (Engineering)

WG	Chapters covered
A-1	1. Introduction 2. Planning
A-2	3. Design and Construction of Sewers 4. Design and Construction of Sewage Pumping Stations
A-3	5. Design and Construction of Sewage Treatment Facilities 6. Design and Construction of Sludge Treatment Facilities
A-4	7. Recycling and Reuse 8. Onsite Methods 9. Emerging Trends

Table 1.2 Chapters covered by each Working Group (Operation and Maintenance)

WG	Chapters Covered
B-1	1. General 9. Safety and Health Management 11. Budget Estimates for Operation and Maintenance
B-2	2. Sewer Systems 3. Pumping Stations 6. Electrical and Instrumentation Facilities
B-3	4. Sewage Treatment Facilities 5. Sludge Treatment Facilities

WG	Chapters Covered
	7. Quality Analysis
B-4	8. Environmental Conservation 10. Onsite Systems

Table 1.3 Chapters covered by each Working Group (Management)

WG	Chapters covered
C-1	1. General 2. Institutional Framework 4. Community Participation 5. Public Private Partnership
C-2	3. Financial Management 6. Asset Management 7. Management Information System

1.6 Contents of Draft Final Report

This report has been prepared including description of activities carried out during June 2011 to March 2013 and outcomes achieved during the same period. A brief explanation on contents of each Chapter is described below. Final Drafts of the three Parts of the Manual, i.e., Engineering, Operation and Maintenance, and Management, are also included as separate Volumes.

Chapter 1 of this Report is an introductory part that describes the background and objectives of this Study. A brief summary of Phase 1 study including main activities and outcomes is also included in this Chapter.

In Chapter 2, a brief description is made about basic policy of the study and study schedule.

Chapter 3 includes description on organization structure adopted for this Study. It also describes the staffing pattern for carrying out this Study.

Chapter 4 includes an overview of activities undertaken during Phase 2 of this Study. This chapter covers general description on Working Group and Expert Committee meetings, and the Workshops held during June 2011 and March 2013. A brief description is also made regarding Training organized in Japan for the participating members of the Expert Committees.

Chapter 5 outlines the outcomes of Phase 2 of Study.

Appendix 1 presents the Minutes of the Expert Committee meetings related to Engineering, Operation and Maintenance and Management.

Appendix 2 shows the agenda of Workshops on Part A Engineering, Part B Operation and Maintenance and Part C Management.

Appendix 3 includes presentations made during Workshops on Part A Engineering, Part B Operation and Maintenance and Part C Management.

CHAPTER 2 OUTLINE OF THE STUDY

2.1 Basic Policy of the Study

The basic policies adopted for preparation of Manuals are as follows:

i) Based on the agreement of Expert Committees during meetings held in Phase 1 Study, the revision and preparation of Manuals has been carried out comprising 3 Parts: Engineering, Operation and Maintenance, and Management.

   a) Engineering Part of the Manual has been prepared as a revision of the existing Manual on Sewerage and Sewage Treatment with necessary additions and updates of information.

   b) Operation and Maintenance Part of Manual has been prepared as new manual. However, contents relevant to operation and maintenance of sewerage system in existing Manual on Sewerage and Sewage Treatment have been included in the new manual also with necessary updates.

   c) Management Part of the Manual has been prepared new and relevant contents in the existing Manual on Sewerage and Sewage Treatment has been included in the new manual also with necessary updates.

   d) Description in Manuals reflects existing conditions of sewerage systems in India.

   e) In cases where quantitative data/information related to the Indian actual practices are not available, description has been made referring manuals/guidelines of other countries, text books, and reference books.

ii) The Manuals has been prepared considering compatibility with existing Manuals. The Central Public Health and Environmental Engineering Organization (CPHEEO) has published Manual on Sewerage and Sewage Treatment (1993 edition), Manual on Water Supply and Treatment (1999 edition), and Manual on Operation and Maintenance of Water Supply System in India (2005 edition). The review and analysis of these Manuals has been carried out to understand about the user, composition, content, level of description, example calculation, etc., to ensure the compatibility of new Manual prepared under this Study.

iii) It is expected that prepared Manuals will be used countrywide in India. Therefore, contents of the Manuals have been prepared considering conditions prevailing in different parts of India.

   a) During Phase 1 study, visits were made to different parts of India in order to understand existing local conditions (such as weather, climate, culture, power supply situation, finances, etc.). The variation in these factors shall be considered while preparing Manuals to ensure suitability of use of Manuals in various conditions.

   b) In Phase 2 Study, a series of discussion were made with the Working Groups and Expert Committees (including members who have in depth knowledge of sewerage systems and local conditions) in order to exchange the opinions and decide the contents of Manuals that is applicable to different parts of India. Also, before finalizing the Draft Manuals, Workshops were organized officially (for about 150 participants, including staff-members of State Governments, Urban Local Bodies, Academic expert, etc.) to provide opportunity for exchange of opinions on prepared Draft Manuals, and to reflect the opinions in Manuals, as much as possible, based on

discussion with the Expert Committees.

iv) Information on the new technology in the sewerage field has been included in Manuals. Existing Manual was prepared 15 years ago and lacks information on the new technology that can be applied for better performance in many cases. Therefore, in the new Manuals information on new technologies, being applied in several developed parts of the World including Japan, has been included considering the needs and situation in India.

a) In Phase 1 Study, not much were discussed about new technologies to be included in Manuals, and in Phase 2 Study considerations and exchange of opinions has been carried out with the Expert Committee and Working Group members in this respect.

v) Technical cooperation project has been carried out with Japanese Assistance and incorporation of useful information from the result of technical cooperation project has been beneficial while preparing draft on 3 Parts of the Manual.

a) A technical cooperation project namely "Project for Capacity Building in Operation and Maintenance of Sewerage Systems in India (2007-2011)" was implemented and report of the Project is already published. From the results of the Project, some important data relevant to sewerage systems in India (such as information on treatment facilities on national level, existing condition of operation and maintenance, etc.) have been grasped and information on personnel training plan related to operation and maintenance of sewerage systems has also been utilized. Moreover, information and opinions have been exchanged with the JICA specialist assigned as technical adviser to CPHEEO.

vi) In preparing Manual, the sewerage policy in India has been considered. Presently, in India, several States are planning urban development and sewerage development is also an important component. To improve the efficiency of urban local bodies in providing basic services in cities, the MOUD has adopted benchmarks including 28 parameters in four key sectors (water supply, sewerage and sanitation, solid waste management, and storm water drainage). These factors have been taken into consideration while preparing drafts of the Manual.

a) In Japan, in order to aim at improvement in sewerage service level, the business objective is quantitatively evaluated by "the guideline operating index for the improvement in sewerage maintenance management service". The index will be introduced in operation and maintenance manual considering abovementioned document.

2.2 Study Schedule

1) Original work schedule

Original work Schedule at start of the Phase 2 of the Study is presented in Table 2.1 below.

In this schedule, it was planned to distribute chapters of three parts of Manual, namely Part A Engineering, Part B Operation and Maintenance and Part C Management, into 3 and to write draft consecutively in the following manners.

i) The first draft of Manual would be prepared by JICA Study Team.

ii) The first draft of Manual would be discussed in the first Working Group meetings and the second draft of Manual would be prepared by JICA Study Team based on the results of discussions in the first Working Group meetings.

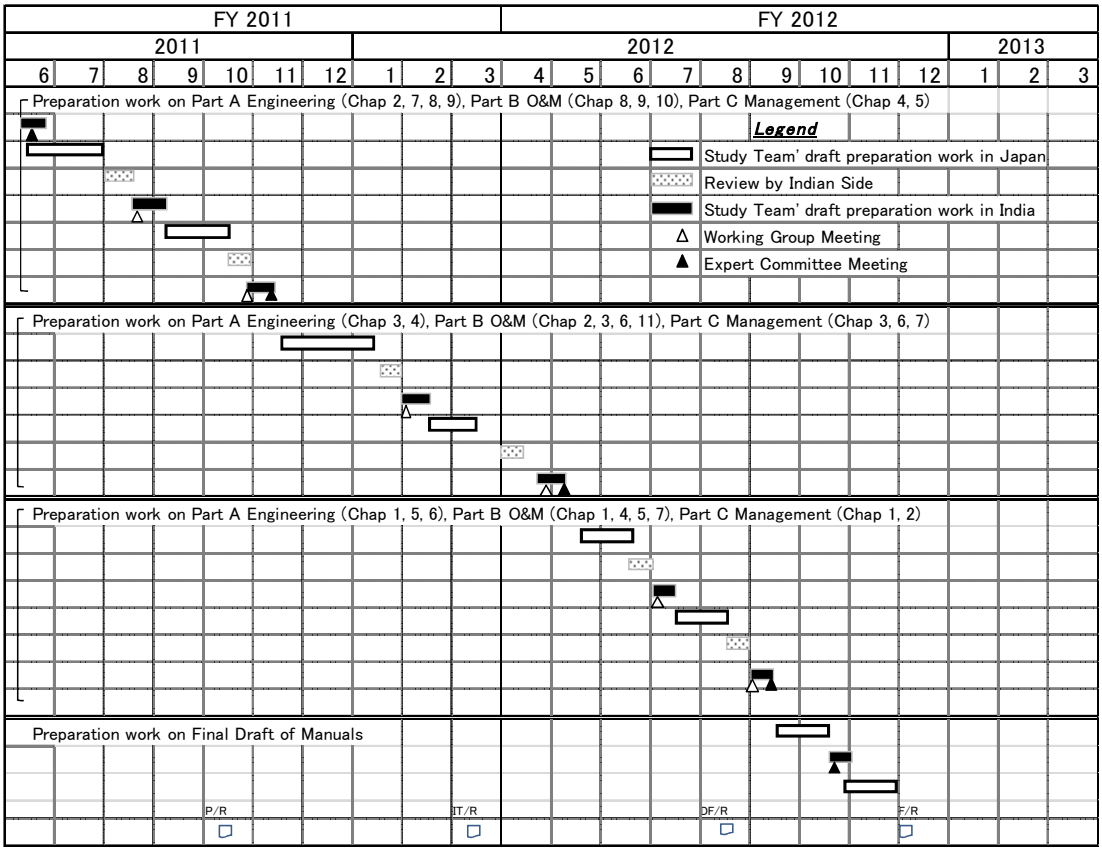
iii) The second draft of Manual would be discussed in the second Working Group

meetings and JICA Study Team would modify the drafts considering comments and prepare the third draft of Manual.

iv) After approval by Expert Committee, final draft would be completed.

Hence, according to the Initial work schedule the JICA Study Team would start draft preparation work in June 2011, prepare draft of three parts of Manual simultaneously and complete it by December 2012 in two preparation works in Japan and two preparation works in India during this period.

Table 2.1 Original work schedule at start of Phase 2 of the Study



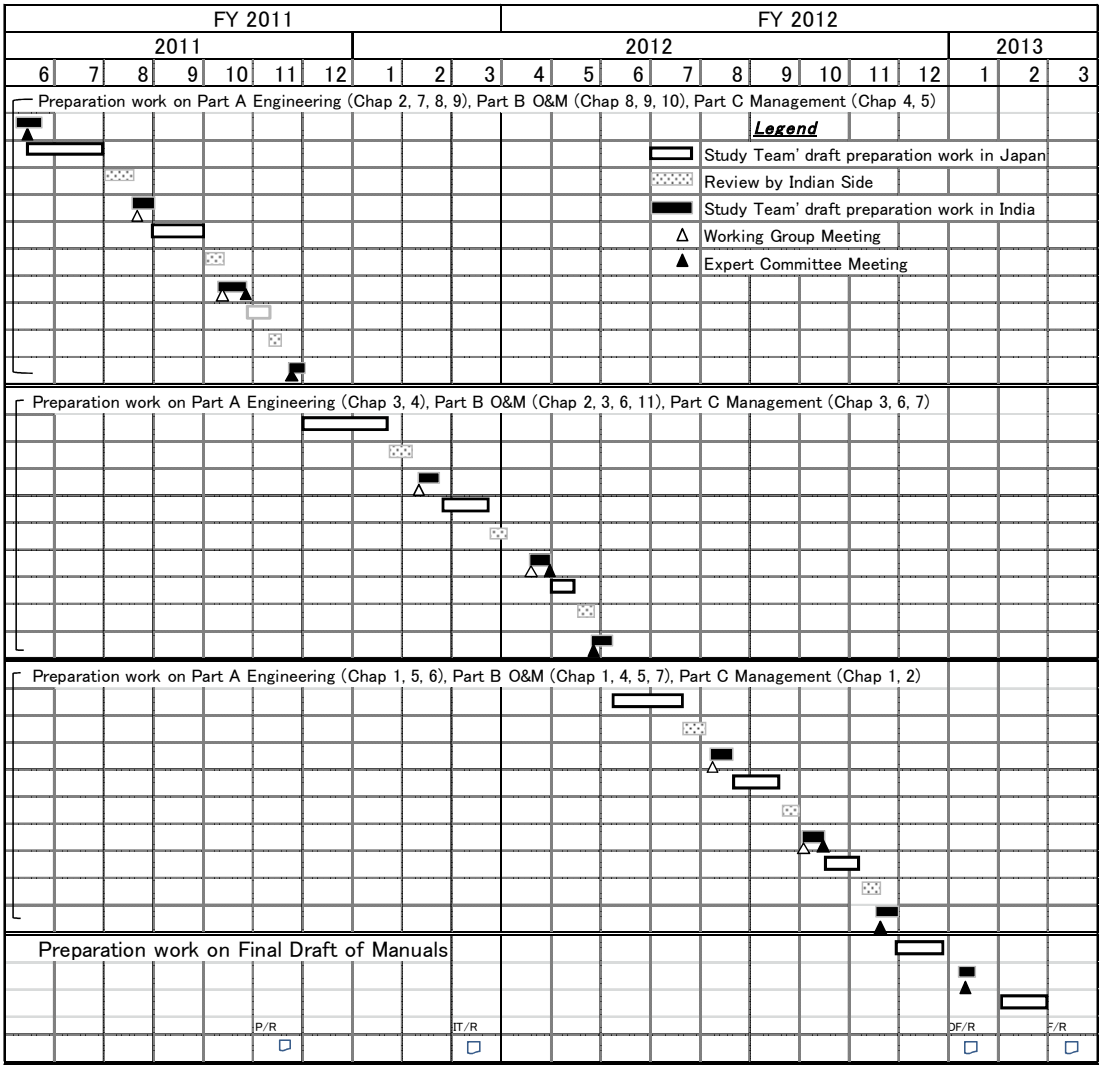
2) Change of work schedule

i) First revised work schedule in June 2011

The Fourth Expert Committee meeting, which was the first one in Phase 2 of the Study, was held in June 2011 in which inception report was explained by JICA Study team.

Consequently, the abovementioned manner of draft preparation work was agreed basically. However, in the fourth Expert Committee meeting, it was pointed out that amendment of drafts (approved from Working Group level) based on directions and discussion of Expert Committee members would also be needed. As a result, it was decided that one more Expert Committee meeting respectively would be added and draft of three parts of manuals would be completed through three preparation works in Japan and three preparation works in India. The first revised work schedule is shown in Table 2.2.

Table 2.2 First revised work schedule in June 2011



ii) Second revised work schedule in October 2011

In the first Working Group meetings held in August 2011, it was pointed out that Indian conditions is not reflected in the primary manuscripts prepared by JICA Study Team and requested JICA Study Team to include more inputs in writing the draft of the Manuals, through the day to day interaction by JICA Study Team with Indian expert(s). Furthermore, in September the MOUD/CPHEEO requested the JICA Study Team that they needed Part A Engineering of the Manual within three months.

Hence, JICA Study Team visited India in the beginning of October 2011 and had preparation of Indian experts who would assist writing the draft of the Manuals and discussed with MOUD/CPHEEO about changes of scope simultaneously.

Consequently, the following points were agreed between the MOUD/CPHEEO and the JICA Study Team. The second revised work schedule, which reflected these points, was also agreed upon.

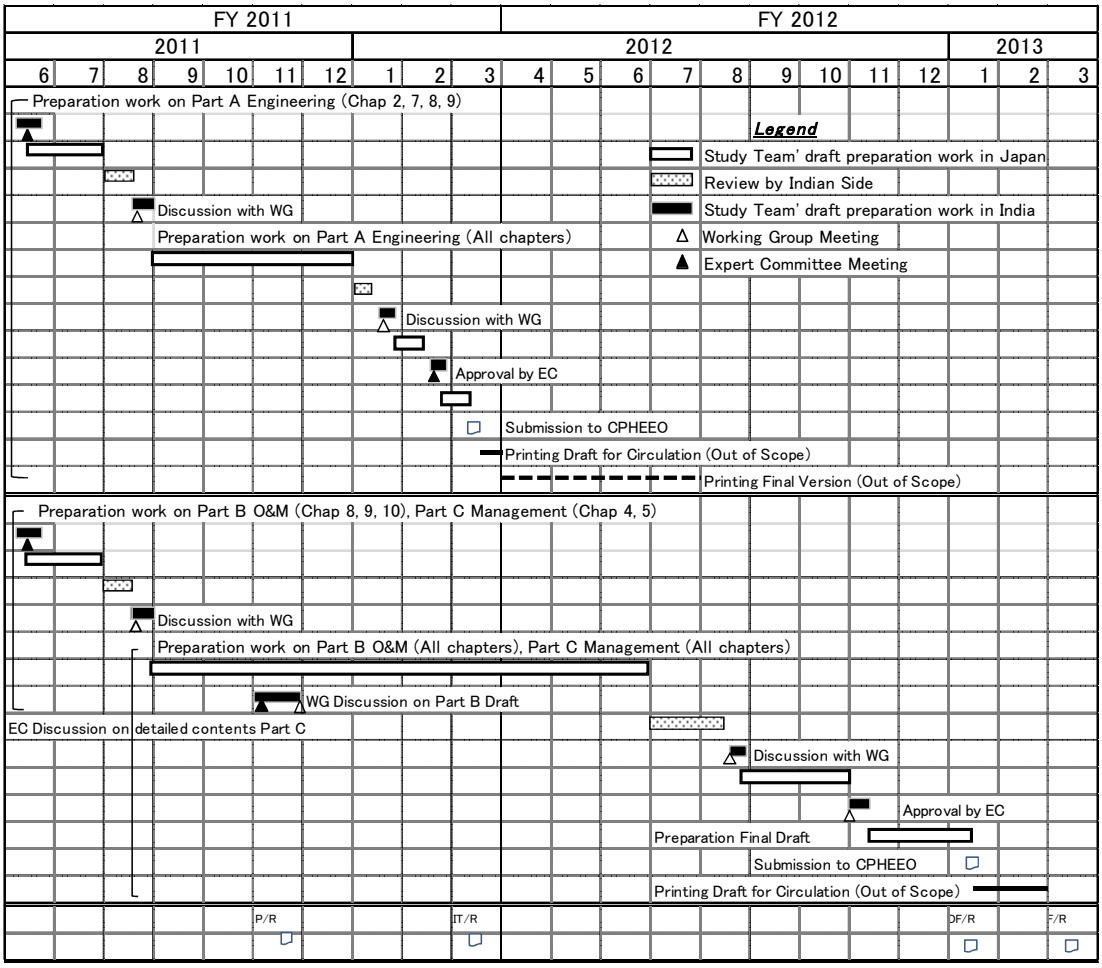
a) Although it would be impossible to complete draft of Part A Engineering of the Manual within three months, it shall be completed by end of March 2012, before

announcement of MOUD's New policy.

b) To achieve this target, JICA Study team will concentrate mainly on the preparation of draft on Part A Engineering of the Manual by March 2012 and completion of the drafts on Part B Operation and Maintenance and Part C Management will be postponed to the end of March 2013.

c) To complete Part A Engineering of the Manual in short period, the entire manuscripts will be prepared and discussed without dividing it into parts.

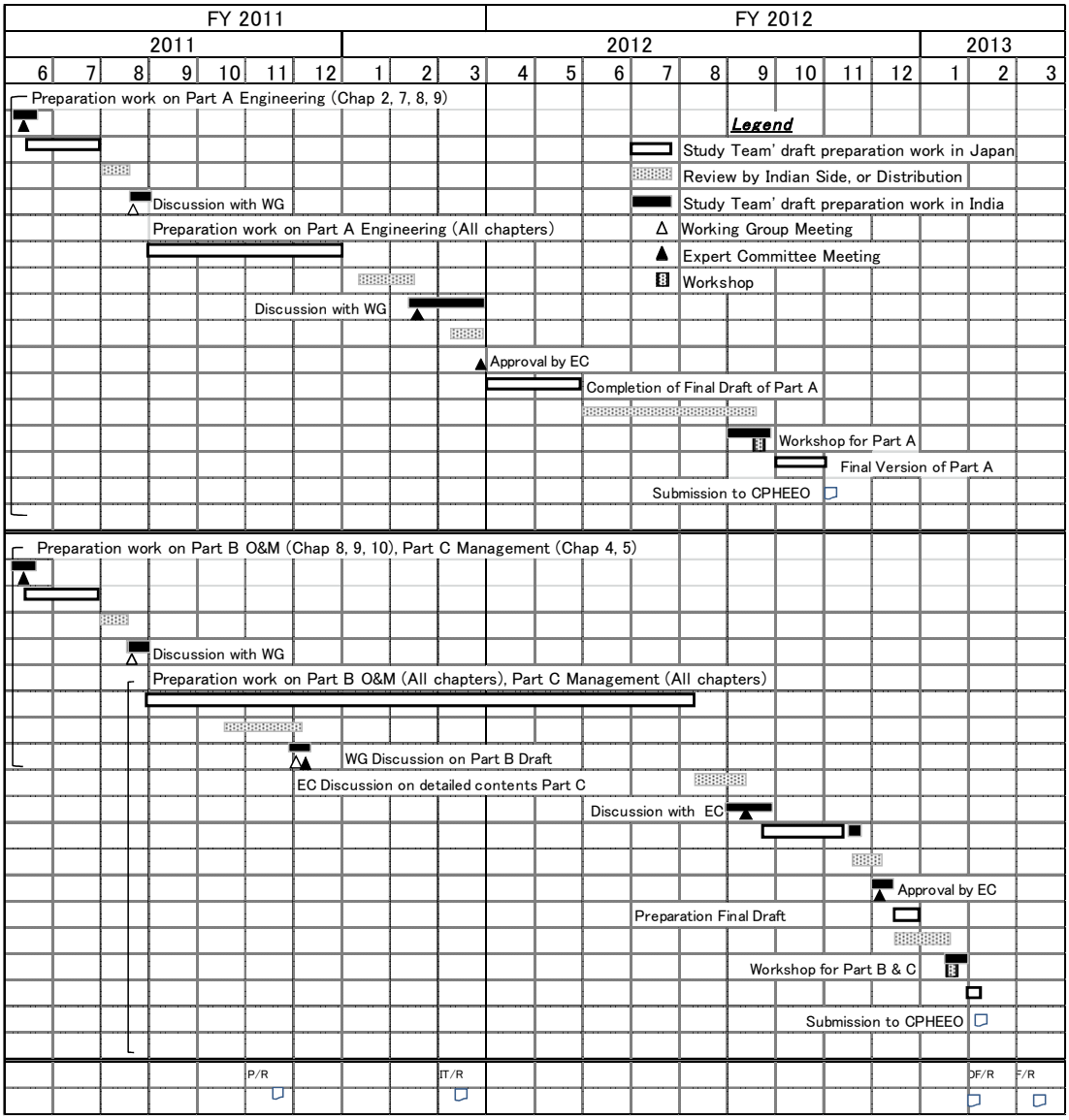
Table 2.3 Second revised work schedule in October 2011



3) Final implementation schedule

This work has been finally implemented with the schedule presented in Table 2.4.

Table 2.4 Final schedule of implementation of this work



CHAPTER 3 ORGANIZATION STRUCTURE

3.1 Organization Structure

The Study has been conducted in coordination with the organizational structure presented in Figure 3.1. Three Expert Committees were formed by Central Public Health and Environmental Engineering Organization (CPHEEO), MOUD, to have meetings in this Phase of Study, in order to review the works carried out by the JICA Study Team. In addition, working groups were formed by CPHEEO to have meetings in this phase in order to discuss on the manuscripts of draft manuals prepared by the JICA study team.

The Steering Committee was to be organized by representatives of MOUD, CPHEEO and JICA in order to monitor the progress of the study and to discuss administrative issues for smooth implementation of the study.

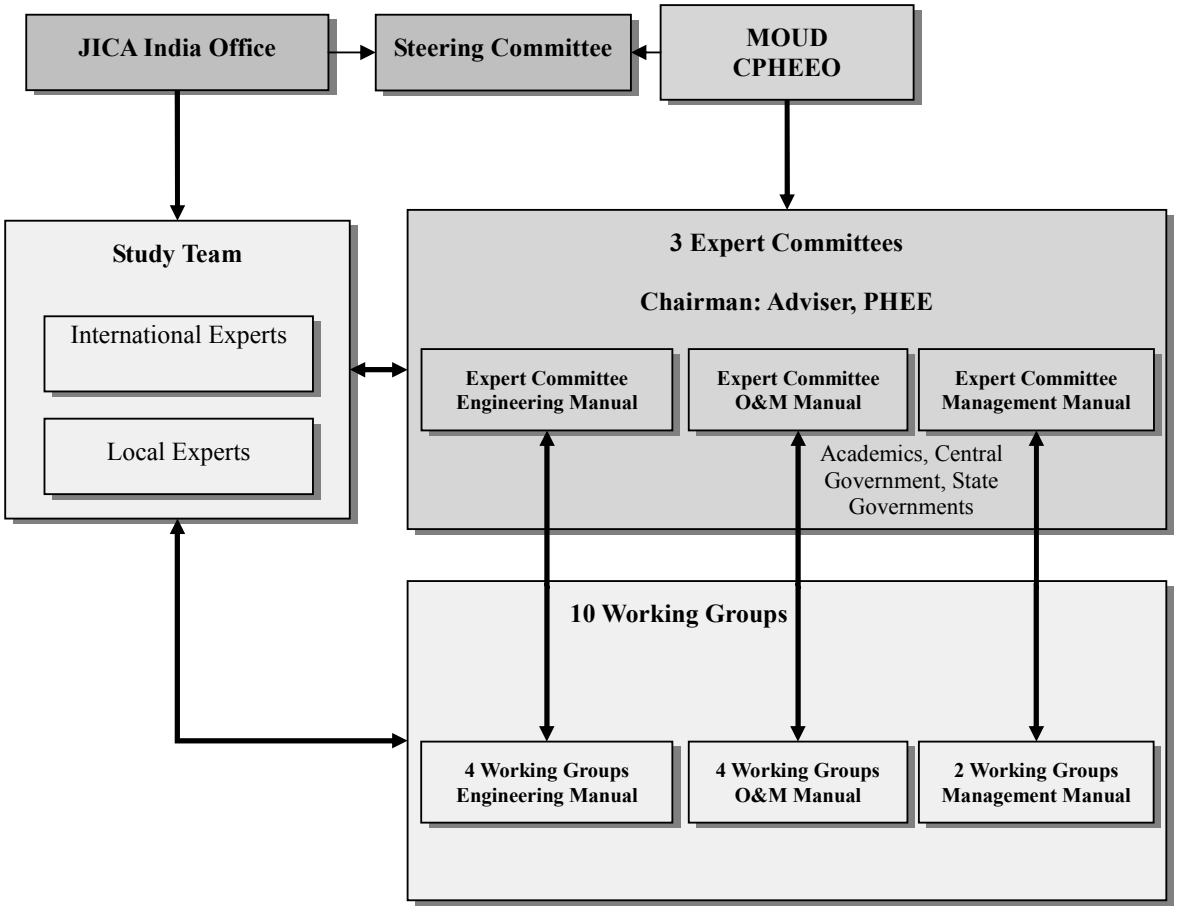


Figure 3.1 Organization structure for this Study

3.2 Expert Committees

Three Expert Committees were formed by CPHEEO namely "Expert Committee for Revision of Manual on Sewerage and Sewage Treatment", "Expert Committee for Preparation of Manual on Operation and Maintenance of Sewerage System" and "Expert Committee for Preparation of Manual on Management of Sewerage system", which include members from central and state government organizations and academic institutes. These Committees were responsible for

reviewing and finalising the Draft on three Parts of the Manual. The list of members of the Expert Committees nominated by CPHEEO and who participated in the Expert Committee meetings is given in Table 3.1, Table 3.2 and Table 3.3 below.

Table 3.1 Members of Expert Committee for Revision of Manual on Sewerage and Sewage Treatment Part A: Engineering

S. No.	Name
1	Dr. S.R. Shukla, Co-Chairman Former Adviser (PHEE), CPHEEO
2	Dr. Arvind K. Nema, Associate Professor, Indian Institute of Technology (IIT), Delhi
3	Mr. Anil K. Dhussa, Director (UWE), Ministry of New & Renewable Energy
4	Mr. B.B. Uppal, Former Deputy Adviser (PHE), CPHEEO
5	Mr. D.P. Singh, Former Chief Engineer (Ganga), Uttar Pradesh (UP) Jal Nigam
6	Dr. Hemant C. Landge, Chief Engineer, Maharashtra Jeevan Pradhikaran
7	Dr. Absar Ahmed Kazmi, Associate Professor, IIT, Roorkee
8	Mr. C. Lallunghnema, Joint Secretary, Public Health Engineering Department (PHED), Mizoram
9	Mr. R. Sethuraman, Former Joint Adviser (PHEE), CPHEEO
10	Mr. M. Dhanabalan, Former Chief Engineer, TWAD Board, Chennai
11	Dr. Vinod Tare, Professor, IIT, Kanpur
12	Dr. R. K. Singh, Deputy General Manager (Projects), Housing and Urban Development Corporation Ltd. (HUDCO)
13	Dr. Girish R. Pophali, Scientist, National Environmental Engineering Research Institute (NEERI), Nagpur
14	Mr. Nazimuddin, Senior Environmental Engineer, Central Pollution Control Board, Delhi
15	Mr. D.K. Agarwal, Scientist F, Bureau of Indian Standards (BIS), Delhi
16	Mr. V.K. Chaurasia, Joint Adviser (PHE), CPHEEO
17	Dr. Ramakant, Assistant Adviser (PHE), CPHEEO, MOUD
18	Mr. S.T. Gopalram, Joint Chief Engineer, TWAD Board, Chennai
19	Dr. Dinesh Chand, Joint Adviser (PHEE), CPHEEO
20	Dr. M. Dhinadhayalan, Member Secretary Joint Adviser (PHE), CPHEEO

Note:

i) Members of the Expert Committees nominated by CPHEEO and participated in the Expert Committee meetings

ii) PHEE (Public Health and Environmental Engineering) and PHE (Public Health Engineering) are used by different levels of officials of the same department of the CPHEEO.

Table 3.2 Members of Expert Committee for Preparation of Manual on Sewerage and Sewage Treatment Part B: Operation and Maintenance

S. No.	Name
1	Dr. S.R. Shukla, Co-Chairman Former Adviser (PHEE), CPHEEO
2	Mr. S.V. Ahuja, Former Project Director, Gujarat Water Supply and Sewerage Board
3	Mr. G. Elangovan, Former Engineering Director, Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), Chennai
4	Dr. Absar Ahmed Kazmi, Associate Professor, IIT, Roorkee
5	Mr. R. Sethuraman, Former Joint Adviser (PHEE), CPHEEO
6	Prof. Arunabha Mazumdar, Former Director, All India Institute of Hygiene and Public Health (AIIH&PH), Kolkata
7	Mr. S.M. Jejurikar, Former Chief Engineer (M&E) Municipal Corporation of Greater Mumbai
8	Mr. B. I. Dalal, Additional City Engineer Surat Municipal Corporation
9	Mr. R. N. Gupta, Former Engineer in Chief, PHED, Chhattisgarh
10	Mr. J.S. Bahra, Executive Engineer, Punjab Water Supply and Sewerage Board
11	Mr. M. Satyanarayanan, Director (Projects), Hyderabad Metropolitan Water Supply & Sewerage Board
12	Mr. M. Sankaranarayanan , Former Joint Adviser (PHEE), CPHEEO
13	Mr. J.B. Ravinder, Deputy Adviser (PHE), CPHEEO
14	Dr. Ramakant, Assistant Adviser (PHE), CPHEEO
15	Mr. J.P. Mani, Project Manager, UP Jal Nigam
16	Mr. Dilip Padhi, Chief Engineer & Member Secretary, Odisha Water Supply & Sewerage Board
17	Mr. S.P. Rudramurthy, Former Additional Chief Engineer, Bangalore Water Supply and Sewerage Board
18	Dr. Dinesh Chand, Joint Adviser (PHEE), CPHEEO
19	Dr. R. K. Singh, Deputy General Manager (Projects), HUDCO
20	Mr. S.P. Garnaik, Energy Economist, Bureau of Energy Efficiency, Ministry of Power
21	Dr. M. Dhinadhayalan, Member Secretary Joint Adviser (PHE), CPHEEO

Note:

i) Members of the Expert Committees nominated by CPHEEO and participated in the Expert Committee meetings

ii) PHEE (Public Health and Environmental Engineering) and PHE (Public Health Engineering) are used by different levels of officials of the same department of the CPHEEO.

Table 3.3 Members of Expert Committee for Preparation of Manual on Sewerage and Sewage Treatment Part C: Management

S. No.	Name
1	Dr. S.R. Shukla, Co-Chairman Former Adviser (PHEE), CPHEEO
2	Dr. K. Balooni, Professor, Indian Institute of Management (IIM), Kozhikode
3	Mr. S. Srinivasan, Senior Vice President, IL&FS Water Ltd.
4	Dr. Ms. Urmila Brighu, Associate Professor, Malaviya National Institute of Technology (MNIT), Jaipur
5	Mr. R.N. Gupta, Former Engineer in Chief, PHED, Chhattisgarh.
6	Dr. R.K. Singh, Deputy General Manager (Projects), HUDCO
7	Dr. Ramakant, Assistant Adviser (PHE), CPHEEO
8	Dr. Zillur Rahman, Associate Professor, Department of Management Studies, IIT, Roorkee
9	Mr. J.B. Ravinder, Deputy Adviser (PHE), CPHEEO
10	Dr. M. Dhinadhayalan, Member Secretary Joint Adviser (PHEE), CPHEEO

Note:

i) Members of the Expert Committees nominated by CPHEEO and participated in the Expert Committee meetings

ii) PHEE (Public Health and Environmental Engineering) and PHE (Public Health Engineering) are used by different levels of officials of the same department of the CPHEEO.

3.3 Study Team

The JICA Study Team is composed of the members shown in Table 3.4. There are altogether eleven international experts supported by two local engineers to carry out activities in this Study.

Table 3.4 JICA study team

No.	Name	Job Title	Affiliation
1	Akira TAKECHI	Team Leader	TECI
2	Katsuzo MOTEGI	Sewerage Management	TEC
3	Kiyoshi MIZUFUNE	Planning & Design (Civil)	TEC
4	Alok KUMAR	Planning & Design (Sewer)	TECI
5	Guillermo MADARIAGA*	Planning & Design (Mechanical& Electrical)	TECI
6	Masatoshi YAMADA**	General Editor	TECI
7	Yoshitaka ITO	O&M (Facility, Sewer)	WA
8	Teruo SUGA	O&M (Mechanical)	WA
9	Mikio SUZUKI	O&M (Electrical)	WA
10	Akira MORITA	Onsite Planning & Design/O&M	WA
11	Gururaj RAO	Coordinator/O&M	TECI

TECI: TEC International Co., Ltd.; TEC: Tokyo Engineering Consultants Co., Ltd.; WA: Water Agency Inc.
*: During FY 2011; **: During FY 2012

Initially, based on the 4th Expert Committee meetings, it was agreed to submit the final draft of the Manuals (including 3 parts of Engineering, Operation and Maintenance, and Management) by October 2012. However, during the discussion with MOUD/CPHEEO in the beginning of October 2011, the MOUD/CPHEEO informed the JICA Study Team that they needed Part A Engineering of the Manual as early as possible rather than the time frame agreed, October 2012 and JICA Study Team agreed to submit the final draft of Part A Engineering of the Manual by the end of March 2012, accepting the MOUD/CPHEEO's requirement. To achieve this target, it was realized by the JICA Study Team that there is a need to modify schedule and reorganize the Study methodology in order to optimize the short time available to the JICA Study Team.

To prepare a Manual that is suitable and specific to Indian situations, it was considered to include more inputs of Indian experts in writing the draft of the Manual, through the day to day interaction by JICA Study Team with Indian expert.

CHAPTER 4 ACTIVITIES IN PHASE 2

4.1 General

On completion of Phase 1, in June 2012, Phase 2 of the Study was started. In the beginning, Inception Report was explained to the participants of the 4th Expert Committee meetings related to Engineering and Operation and Maintenance parts, describing the approach towards draft preparation and schedules. In August 2011, Working Group meetings were organized for all the three parts of the Manual including Engineering, Operation and Maintenance, and Management in order to discuss prepared drafts on 4 Chapters of Engineering, 3 Chapters of Operation and Maintenance, and 2 Chapters of Management.

After the abovementioned Working Group meetings, Central Public Health and Environmental Engineering Organization (CPHEEO), MOUD requested to submit Engineering Part of the Manual by March 2012, much earlier than planned initially. Accordingly, approach and methodology of writing the Manual was changed to achieve earlier completion of Engineering part. For this purpose, upon discussion with the CPHEEO, provision of including Indian writers was considered.

In the meantime, based on the comments and suggestions received during the Working Group meetings held in August 2011, relevant drafts of all three parts of Manual were modified and improved. Modified drafts of these Chapters of Operation and Maintenance, and Management were discussed again in Working Group meetings held in November 2011.

Draft of all 10 chapters in Part A: Engineering of the Manual was prepared and submitted to the Working Group members in the mid of January 2012 for their consideration and review. During 13-17 February 2012, Working Group meetings were held on all chapters of Part A. Based on the comments received during these meetings, the draft of Part A was modified and submitted for discussion in the Expert Committee (EC) meeting held during 26-28 March 2012. After completion of the EC meeting, the comments received during these meetings were incorporated, as appropriate, and modified draft of Part A was submitted to the CPHEEO on 1 June 2012 for distribution and discussion in the Workshop on Part A held on 20 and 21 September 2012. Considering the feedback in the Workshop, Part A draft was modified and finally submitted to CPHEEO on 3 November 2012.

Similarly, drafts on all chapters of Part B Operation and Maintenance and Part C Management were prepared and submitted to CPHEEO on 6 and 9 August 2012, respectively for consideration and review of the EC members of Parts B and C. To discuss these drafts, EC meetings were held during 10-13 September 2012. These drafts were modified again considering comments and suggestions in the EC meetings and modified drafts were submitted to the CPHEEO on 17 November 2012 for consideration and review of EC members and subsequently EC meetings were held on 5 and 6 December 2012. Drafts were revised considering comments in EC meetings and drafts were submitted to the CPHEEO on 14 December 2012 for distribution and discussion in the Workshop on Part B and C held on 21 and 22 January 2013. Taking into consideration comments and discussions before and during Workshop, these drafts are revised and the final draft is submitted along with this report.

Two trainings were organized for the members of Expert Committees in Japan during 14 to 18 November 2011 and 28 May to 1 June 2012 in which the participants were able to understand existing practices of sewerage systems operation and maintenance, and management in Japan.

Brief description of these activities is given below.

4.2 Working Group and Expert Committee Meetings

4.2.1 4th Expert Committee Meetings

Based on the data collected during Phase 1 Study and through review of other references, the inception report was prepared to discuss with the Indian counterparts about schedule and methodology adopted in Phase 2 Study.

For this purpose, on 7 and 8 June 2011, 4th EC meetings were organized. EC meeting related to Engineering was held on 7 June 2011, and on 8 June 2011 the EC meeting related to Operation and Maintenance part was organized. In these meetings, the JICA Study Team briefly explained about Phase 2 Study including objective, team-members, schedule and methodology. The members also discussed about formation of the Working Groups needed for intensive discussion on draft of Manuals prepared by the JICA Study Team henceforth. Consequently, it was decided that the CPHEEO will form the members of the Working Group and inform JICA Study Team about it later on. The minutes of these meetings are presented in Appendix 1.

Figure 4.1 Photographs of 4th Expert Committee meetings

In Phase 1 of this Study, Table of Contents for the three parts of the Manual (Engineering, Operation and Maintenance, and Management) were prepared through several discussions with the members of the Expert Committee. Initially, Part A Engineering included 10 chapters, Part B Operation and Maintenance included 11 chapters, and Part C Management included 10 chapters. Therefore, it was decided to distribute chapters of these parts of the Manual into roughly 3 groups and to write draft consecutively. Accordingly, the first draft was prepared including 4 Chapters of Part A Engineering, 3 Chapters of Part B Operation and Maintenance, and 2 Chapters of Part C Management listed in Table 4.1.

Table 4.1 List of chapters included in the first draft

Chapter No.	Title of Chapter
Part A: Engineering	
2	Planning
7	Recycling and Reuse of Sewage
8	Onsite Methods
9	Emerging Trends
Part B: Operation and Maintenance	
8	Environmental Conservation
9	Occupational Hazards, Safety Measures and Health Aspects
10	Onsite Systems

Chapter No.	Title of Chapter
Part C: Management	
5	Public Private Partnership
6	Community Participation

4.2.2 Working Groups Meetings in August 2011

The first draft of Manual including abovementioned Chapters after preparation was distributed to the members of the relevant Working Group members for their review. In order to discuss these drafts, the first Working Group meetings were held during 18 to 26 August 2011 with schedule as indicated in Table 4.2.

Table 4.2 Schedule of the first working group meetings

Date	Working Group	Chapter
18th August 2011	A1	2 (Engineering)
19th August 2011	B1	9 (Operation and Maintenance)
23rd August 2011	A4	7 (Engineering)
24th August 2011	A4	8 and 9 (Engineering)
25th August 2011	B4	8 and 10 (Operation and Maintenance)
26th August 2011	C1	5 and 6 (Management)

Very intensive and detailed discussions were held on the draft. Comprehensive comments were received from several members of the Working Group. Discussions were also made on some of the comments.

Figure 4.2 Photographs of working group meetings held in August 2011

In many cases, the names of the Sections were modified and sequence of the Sections was rearranged. In case of Engineering part, the members suggested to write Chapters more concisely and considering rearranged subsections. For Operation and Maintenance part also, the contents of the draft was suggested to be rearranged. In case of Management part, the Table of Contents was also discussed for Chapters 1-6 and the contents of other Chapters was decided to be discussed in the next Expert Committee meeting of Management to be held in December 2011.

4.2.3 Working Groups (Part B O&M) and Expert Committee (Part C Management) Meetings in December 2011

On 2 December 2011, meeting of the Working Group members was organized in order to present and discuss the contents of Chapter 8 Environmental Conservation, Chapter 9 Occupation Hazards, Safety Measures and Health Aspects, and Chapter 10 Onsite Systems of the Operation and Maintenance part of the Manual. Comments and suggestions were made by the Working Group members on modified draft. It was suggested to concise the contents of these Chapters. JICA Study Team agreed to look through the comments and suggestion and incorporate changes wherever required.

Expert Committee meeting related to Management part was held on 5 December 2011. In this meeting, initially, the Table of Contents of all Chapters were discussed again and modified based on the discussion. Also, draft written by JICA Study Team on Chapter 5 Public Private Partnership and Chapter 6 Community Participation were presented and discussed. Suggestion and comments were made by the Expert Committee members and JICA Study Team agreed to incorporate relevant modifications. Detailed comments and suggestions are presented in Appendix 1.

4.2.4 Working Group Meetings (Part A Engineering) in February 2012

Upon the request of CPHEEO and subsequent discussions, it was decided to prepare the draft of all the Chapters of Engineering part of the Manual. Consequently, all the Chapters in Engineering part were written and submitted to the CPHEEO to be distributed to the members of Working Group for their review and comments. After the review, meetings were held during 13 to 17 February 2012 to discuss the contents of all 10 Chapters of Engineering part. Detail of comments and suggestions are presented in records of meeting included in Appendix 1.

Table 4.3 Schedule of the working group meetings held in February 2012 on Part A Engineering

Date	Working Group	Chapter
13 February 2012	A2	3. Design and Construction of Sewers 4. Design and Construction of Sewage Pumping Stations
14 February 2012	A3	5. Design and Construction of Sewage Treatment Plants 6. Design and Construction of Sludge Treatment Facilities
15 and 16 February 2012	A4	7. Recycling and Reuse of Sewage 8. Onsite Sanitation 9. Emerging Trends
17 February 2012	A1	1. Introduction 2. Planning 10. City Sanitation Plan

Figure 4.3 Photographs of working group meetings held in February 2012

4.2.5 Expert Committee Meetings on Part A Engineering in March 2012

Based on the comments and discussions in the previous meetings held in February 2012, the draft of all the chapters of Part A Engineering was modified and revised draft was submitted to the CPHEEO for consideration and review of the EC members. During 26 to 28 March 2012, EC meeting on the submitted draft was held with the schedule presented in Table 4.4.

Table 4.4 Schedule of expert committee meetings held in March 2012 on Part A Engineering

Date	Chapters
26 March 2012	2. Planning 3. Design and Construction of Sewers 10. Preparation of City Sanitation Plan
26 March 2012	4. Design and Construction of Sewage Pumping Stations and Sewage Pumping Mains 5. Design and Construction of Sewage Treatment Facilities 6. Design and Construction of Sludge Treatment Facilities 11. Decentralized Sewerage
26 March 2012	7. Recycling and Reuse of Sewage 8. Onsite Sanitation 1. Introduction

Several comments were made and it was suggested to modify the draft and submit for consideration and review by the members in the Workshop on Part A. Detail on comments made during this meeting are included in the Minutes of Meeting presented as Appendix 1.

4.2.6 Expert Committee Meetings on Part B Operation and Maintenance and Part C Management in September 2012

Draft of all the Chapters included in Part C Management and Part B Operation and Maintenance of the Manual were prepared and submitted to the CPHEEO on 6 and 9 August 2012, respectively. These drafts were distributed to relevant EC member for their review. EC meetings were held during 10-13 September 2012 to discuss all the chapters of Part B and C with the schedule listed in Table 4.5. Deliberation and discussions were held on all the chapters of Part B and C and a number of suggestions were made, details on these meetings are provided in the Minutes of Meeting as Appendix 1.

Table 4.5 Schedule of EC meetings on Part B Operation and Maintenance and Part C Management held in September 2012

Date	Part	Chapter
10 September 2012	C	1. Introduction 2. Legal Framework 3. Institutional Framework and Capacity Building 4. Financing and Financial Management
11 September 2012	C	5. Public Private Partnership (PPP) 6. Community Participation 7. Asset Management 8. Management Information System (MIS) 9. Environmental Impact Assessment (EIA) 10. Disaster Management
12 September 2012	B	1. General 2. Sewer System 3. Pumping Stations 4. Sewage Treatment Facilities 5. Sludge Treatment Facilities
13 September 2012	B	6. Electrical and Instrumentation Facilities 7. Quality Analysis 8. Environmental Conservation 9. Occupational Hazards, Safety Measures and Health Aspects 10. On-site Systems 11. Budget Estimates for Operation and Maintenance

Figure 4.4 Photographs of EC meetings on Parts B and C held in September 2012

4.2.7 Expert Committee Meetings on Part B Operation and Maintenance and Part C Management in December 2012

The draft of all chapters of Part B and Part C were modified considering comments and suggestions made in the EC meeting held in September 2012. Revised drafts on Parts B and C were submitted to CPHEEO on 17 November 2012 to be reviewed and discussed in the EC meeting. Considering submitted draft, EC meetings were organized on 5 and 6 December 2012 for Part B and C, respectively. On 5 December 2012, all the chapters of Part B were discussed and some improvements were suggested. On 6 December 2012, chapters of Part C were

discussed and comments and suggestions were made to improve the draft. Details on these meetings are given in the minutes provided in Appendix 1.

Figure 4.5 Photographs of EC meetings on Parts B and C held in December 2012

4.3 Organization of Workshop

4.3.1 Workshop on Part A Engineering

Incorporating the comments and suggestions during EC meetings held in February and March 2012, the draft of all chapters of Part A was modified. Revised draft of Part A was submitted to the CPHEEO on 1 June 2012 for consideration and discussion by the Workshop participants. A two-day Workshop was organized on 20 and 21 September 2012 for finalization of Revised and updated Manual on Sewerage and Sewage Treatment (Part A: Engineering). Altogether about 107 people participated in the Workshop. The participants included representatives of various Central and State departments, organizations having public health/environmental engineering background particularly in sewerage and sanitation sector, ULBs, funding agencies, technology providers, etc. Deliberation and discussions were made during the workshop and a large number of comments were received.

Figure 4.6 Workshop for finalization of Part A Engineering of the Manual held on 20-21 September 2012

Presentation and discussions on chapters included in Part A were made according to the schedule listed in Table 4.6 and Appendix 2.

Table 4.6 Chapters discussed in Workshop on Part A Engineering

Date	Chapters
20 September 2012	1. Introduction 2. Planning 3. Design and Construction of Sewers 4. Design and Construction of Sewage Pumping Stations and Sewage Pumping Mains 5. Design and Construction of Sewage Treatment Facilities 10. Preparation of City Sanitation Plan
21 September 2012	6. Design and Construction of Sludge Treatment Facilities 7. Recycling and Reuse of Sewage 8. Decentralized Sewerage System 9. On-site Sanitation

4.3.2 Workshop on Part B Operation and Maintenance and Part C Management

Drafts of all the chapters of Part B and Part C were modified considering comments and suggestions made during EC meetings on these Parts held during September 2012 and December 2012. Revised drafts were submitted to CPHEEO on 14 December 2012 for consideration and distribution to all relevant agencies/officials for their review and comments. Accordingly, Workshop on Part B and C were held on 21 and 22 January 2013 to present and discuss all the chapters with schedule presented in Table 4.7 and Appendix 2. The workshop was attended by about 91 persons. The participants included representatives of various Central and State departments, organizations having public health/environmental engineering background particularly in sewerage and sanitation sector, ULBs, funding agencies, etc. Deliberation and discussions were made during the workshop and a number of comments were received.

Figure 4.7 Workshop for finalization of Part B Operation and Maintenance and Part C Management of the Manual held on 21-22 January 2013

Table 4.7 Chapters discussed in Workshop on Part B Operation and Maintenance and Part C Management

Date	Chapters
21 January 2013	Part B: Operation and Maintenance 1. Introduction 2. Sewer Systems 3. Pumping Station 4. Sewage Treatment Facilities 5. Sludge Treatment Facilities 6. Electrical and Instrumentation Facilities 7. Monitoring of Water Quality 8. Environmental Conservation
22 January 2013	Part B: Operation and Maintenance 9. Occupational Health Hazards and Safety Measures 10. On-site systems Part C: Management 1. Introduction 2. Legal Framework and Policies 3. Institutional Aspects and Capacity Building 4. Financing and Financial Management 5. Budget Estimates for Operation and Maintenance 6. Public Private Partnership (PPP) 7. Community Awareness and Participation 8. Asset Management 9. Management Information System 10. Potential Disasters in Sewerage and Management

4.4 Organization of Training in Japan

4.4.1 First Training

Under this Study, first training of counterpart (for the member of Expert Committee related to Engineering and Operation and Maintenance) was organized in Japan during 14 and 18 November 2011. The training included interaction of participants with several agencies that organized explanation and visits to sewerage facilities. The schedule of first training program is presented in Table 4.8 below. Through this training, the participants were able to understand existing practices of sewerage system planning, operation and maintenance, and management in Japan.

4.4.2 Second Training

Second training was organized for the members of the Expert Committee during 28 May and 1 June 2012. The training was held in Japan in which visits were made to various sewerage and sanitation facilities. During this programme, participants interacted with the Experts of various Agencies through lecture and explanation, visit to facilities and discussions after site visit. The schedule of this second training programme is presented in Table 4.9.

Table 4.8 Schedule of first training in Japan

COUNTERPART TRAINING PROGRAMME
FOR
THE STUDY FOR FORMULATION AND REVISION OF MANUALS ON SEWERAGE AND SEWAGE TREATMENT PHASE-2 (1st fiscal year)
IN THE REPUBLIC OF INDIA

Date		Place	Time	Lecturer (person in charge)	Affiliation organization	Content of Training and others	
14-Nov-11	Mon.	TIC, Orientation Room	9:00-12:30	Mr. YAMAGUCHI Tadami, et al.	JICA	Briefing	Explanation, such as staying place and life in Japan
			12:30-14:00			(Lunch including Travel)	
		GCUS, Convention bureau, 5th floor	14:00-14:30	Mr. MIZUFUNE Kiyoshi	JICA Study Team (Tokyo Engineering Consultants, Co. Ltd. (TEC))	Orientation of training	Explanation of Training program
			14:30-15:30	Mr. MATSUMIYA Yousuke	Japan Global Center for Urban Sanitation (GCUS)	Lecture (1)	The present condition and trend of sewerage works in Japan
			15:30-16:30			(Break)	Technical introduction by GCUS participation company etc.
			16:30-17:30	Mr. MINAMI Masayoshi	Japan Institute of Wastewater Engineering Technology (JIWET)	Lecture (2)	Trend of new technology related to reuse of treated water, and sludge recycling in Japan
			17:30-19:00			Reception party	GCUS, Conference room, 5th floor
15-Nov-11	Tues.	JS Training Center	10:00-11:30	Mr. ISHII Hirokazu Mr. KITAGAWA Mitsuo	Japan Sewage Works Agency (JS)	Lecture (3)	About training activities of Japan Sewage Works Agency (JS)
			11:30-13:30			(Lunch including Travel)	
		JSCSMA Training Center	13:30-15:30	Mr. UEMATSU Shigeo	Japan Sewer Collection System Maintenance Association (JSCSMA)	Lecture (4) & Field Visit (1)	Demonstration of sewer operation and maintenance technology
16-Nov-11	Wed.	Kiyose Water Reclamation Center	10:00-12:00	Site in charge	Kiyose Water Reclamation Center, Bureau of Sewerage, Tokyo Metropolitan Government	Field Visit (2)	Kiyose Water Reclamation Center
			12:00-14:00			(Lunch including Travel)	(Lunch including Travel)
		Ariake Water Reclamation Center	14:00-16:00	Site in charge	Ariake Water Reclamation Center, Bureau of Sewerage, Tokyo Metropolitan Government	Field Visit (3)	Ariake water Reclamation Center
			16:00-16:30	Mr. ENDOU Kei, et al.	JICA	Press Interview	Press interview to participant for public relations
17-Nov-11	Thurs.	Tatsunosato clean center	10:00-12:00	Mr. KOSUGI Takao Mr. AOYAMA, et al.	Ryugasaki Regional Sanitary Association	Field Visit (4)	Tatsunosato clean center
18-Nov-11	Fri.	TIC Seminar Room #15	10:00-12:00	Dr. Alok Kumar, et al.	JICA Study Team	Preparation for Debrief session	Preparation for Presentation and discussion by training members
			12:00-13:00			(Lunch)	
			13:00-14:00	Mr. MOTEGI Katsuzo, et al.	JICA Study Team	Debrief session	Presentation and discussion by training members
			14:00-14:30	Ms. KUBOTA Kazumi	JICA	Debrief session	Handing over of certificate, etc.

TIC : JICA Tokyo International Center

Table 4.9 Schedule of second training in Japan

COUNTERPART TRAINING PROGRAMME
FOR
THE STUDY FOR FORMULATION AND REVISION OF MANUALS ON SEWERAGE AND SEWAGE TREATMENT PHASE-2 (2nd fiscal year) IN THE REPUBLIC OF INDIA

Date	Place	Time	Lecturer (person in charge)	Affiliation organization	Content of Training and others	
28 May 2012 Monday	TIC Orientation Room	9:00-12:30		JICA	Briefing	Explanation, such as staying place and life in Japan
		12:30-14:00			(Lunch)	
	TIC Seminar Room #4 (3F)	13:30-14:00	Mr. MIZUFUNE Kiyoshi	JICA Study Team (Tokyo Engineering Consultants, Co. Ltd.(TEC))	Orientation of training	Explanation of Training program
		14:00-15:00	Mr. TANIGUCHI Naohiro	Tokyo Engineering Consultants, Co. Ltd.(TEC)	Lecture (1)	The present condition and trend of sewerage works in Japan
		15:00-15:20			(Break)	
		15:20-16:20	Mr. FUJITA Shouichi	Tokyo Engineering Consultants, Co. Ltd.(TEC)	Lecture (2)	The present condition of Operation and Maintenance technology of sewerage works in Japan
		16:20-17:20	Mr. KARIYA Kaoru	Tokyo Engineering Consultants, Co. Ltd.(TEC)	Lecture (3)	The present condition of Onsite sewage treatment in Japan
	Akasaka SUBIR	19:00-21:00			Reception Party	
29 May 2012 Tuesday	Ochiai Water Reclamation Centre	10:00-12:00	Site in charge	Ochiai Water Reclamation Centre, Bureau of Sewerage, Tokyo Metropolitan Government	Field Visit(1)	Ochiai water Reclamation Centre
		12:00-13:30			(Lunch including	
	Tokyo Metropolitan Buildings	13:30-14:00	Mr. MOTEGI Katsuzo	JICA Study Team (Tokyo Engineering Consultants, Co. Ltd.(TEC))	Field Visit (2)	The present condition of utilization of treated wastewater in Tokyo Metropolitan Government Buildings
	Bureau of Sewerage, Tokyo Metropolitan Government	14:30-16:40	Mr. KAWANA Yukio Mr. NAKANO Takayuki	Facility Management Division, Bureau of Sewerage, Tokyo Metropolitan Government	Lecture (4)	The current topics on Operation and Maintenance of sewerage works in Tokyo Metropolitan Government
30 May 2012 Wednesday	Ichinokawa Water Recycling Centre, Namekawa Town, Saitama Prefecture	10:00-12:00	Site in charge	Arakawa-sagan North Sewerage Office, Saitama Prefecture	Field Visit (3)	The present condition of Maintenance and Operation of Oxidation ditch plant
		12:00-14:00			(Lunch including	(Lunch including Travel)
	Kazo City, Saitama Prefecture	14:00-16:00	Site in charge	Sewerage Division, Kazo City, Saitama Prefecture	Field Visit (4)	Farm village drainage work facilities, Kazo City
31 may 2012 Thursday	Saitama City Sewage Treatment Centre, Saitama Prefecture	10:00-12:00	Site in charge	Sewerage Division, Construction Bureau, Saitama City	Field Visit (5)	Saitama City Sewage Treatment Centre
		12:00-13:30			(Lunch including	
	Omiya South Clean Centre, Saitama City	13:30-15:30	Site in charge	Facility Division, Environment Bureau, Saitama City	Field Visit (6)	Omiya South Clean Centre
	Saitama City	16:00-16:30	Site in charge		Field Visit (7)	Johkaso for domestic use
1 June 2012 Friday	TIC Seminar Room #11 (4F)	10:00-12:00	Dr. Alok Kumar, et al.	JICA Study Team	Preparation for Debrief session	Preparation for Presentation and discussion by training members
		12:00-13:00			(Lunch)	
		13:00-14:00	Mr. MOTEGI Katsuzo, et al.	JICA Study Team	Debrief session	Presentation and discussion by training members
		14:00-14:30		JICA	Debrief session	Handing over of certificate, etc.

TIC : JICA Tokyo International Centre

CHAPTER 5 OUTCOMES OF THIS STUDY

The outcomes of Phase 2 of the Study carried out during May 2011 to March 2013 are summarised below. The components of final report included in this study are shown in Table 5.1.

5.1 Final Draft of 3 Parts of Manual on Sewerage and Sewage Treatment

5.1.1 Part A: Engineering

Draft of Part A Engineering has been finalized based on the comments and suggestions during workshop and after the workshop also.

Part A on 'Engineering' addresses the core technologies and updated approaches towards the incremental sanitation from onsite to decentralized to conventional collection, conveyance, treatment and reuse of the potential resource of sewage and is simplified to the level of the practicing engineer for day to day guidance in the field in understanding the situation and coming out with choice of approaches to remedy the situation. In addition it also includes recent advances in sewage treatment, sludge and septage management to achieve betterment of receiving environment. By no means, this is a text book nor it should be. It is a simple to understand guideline for the field engineer. Final draft prepared by the JICA Study Team is presented as Volume II.

5.1.2 Part B: Operation and Maintenance

Considering the comments and suggestions made during Workshop on Part B, the draft of all the chapters have been modified and revised draft is presented as Volume III.

Part B on 'Operation and Maintenance' addresses the issues of standardizing the human resources and financial resources that are needed to sustain a system created at huge costs without it slipping into an edifice for want of codified requirements of these so that it becomes possible to address these in the estimate stage itself and seek a comprehensive approval of fund allocations and human resources besides ushering in the era of public private partnership to make the projects self-sustaining. It is a simple to understand guidance for the resource seeker and resource allocating authorities.

5.1.3 Part C: Management

Chapters in Part C have been revised considering the comments and suggestions made during workshop and is presented as Volume IV.

Part C on 'Management' addresses the modern methods of project delivery and project validation and gives a continual model for the administration to foresee the deficits in allocations and usher in newer mechanisms. It is a tool for justifying the chosen project delivery mechanism and optimizing the investments on need based allocations instead of allocations in budget that remain unutilized and get surrendered in end of fiscal year with no use to anyone. It is a straightforward approach to a mundane approach over the decades.

5.2 Training in Japan

Under this Study, two trainings of counterpart (for the member of Expert Committee related to Engineering and Operation and Maintenance) were organized in Japan; the first training was held during 14-18 November 2011 and the second training was held during 28 May-1 June 2012.

With this training, the participants from expert committee members contributed to main

objectives of the Study, namely formulation and revision of manuals on sewerage and sewage treatment through grasping the present situation of operation, maintenance of the sewerage facilities in Japan including application of state-of-the-art technology. The implementation reports related to Counterpart Training under the Study for Formulation and Revision of Manuals on Sewerage and Sewage Treatment Phase 2 (1st and 2nd fiscal years) in the Republic of India have been submitted to JICA.

Table 5.1 Component of final report in this study

S. No.	Component
1.	Volume I: Main report
2.	Volume II: Final draft of manual on sewerage and sewage treatment, Part A: Engineering
3.	Volume III: Final draft of manual on sewerage and sewage treatment, Part B: Operation and Maintenance
4.	Volume IV: Final draft of manual on sewerage and sewage treatment, Part C: Management

APPENDICES

APPENDIX 1 MINUTES OF EXPERT COMMITTEE MEETINGS

Minutes of the 4rd Meeting of the Expert Committee and JICA Study Team on the Updation and Revision of the Manual on Sewerage and Sewage Treatment – (Part A: Engineering) held at Nirman Bhawan on 7th June, 2011 at 10:30AM.

The fourth meeting of the Expert Committee members, the JICA Study Team and the representatives of CH2M HILL (India) Pvt. Limited for the Updation and Revision of the Manual on Sewerage and Sewage Treatment – (Part A: Engineering) was held under the Chairmanship of Dr. Dinesh Chand, Joint Adviser (PHEE), CPHEEO, MOUD on 7th June 2011 at 10.30 AM in CPWD conference room no. 103, A-Wing, Nirman Bhawan, New Delhi. The list of participants is attached at ***Annexure - I.***

At the outset, the Chairman welcomed the members of the Expert Committee, experts from JICA Study Team, representatives of JICA, and representatives of CH2M HILL (India) Pvt. Limited, Gurgaon and proposed the agenda of the committee for discussion.

The Chairman requested the JICA Study Team to make a power point presentation on the outcomes of the Phase – I study and further course of action for Phase – II study for updation and revision of the Manual on Sewerage and Sewage Treatment. The Chairman suggested all the Expert Committee Members to discuss and finalise the plan for drafting of the Manual including the formation of Working Groups.

Mr. Akira Takechi, Team Leader JICA Study Team, made a power point presentation on the outcome of Phase – I study and requested Dr. Alok Kumar, JICA Study Team to continue with work plan for study of Phase-II.

Dr. Alok Kumar made a power point presentation on the work plan and study schedule for the Phase – II study. Dr. Alok Kumar informed about the function of the working groups with the JICA Study team and the requirement of the working groups & Expert Committee meetings.

The Expert Committee and JICA Study team unanimously decided the following:

1) Dr. S.R. Shukla suggested that constitution of Working Groups may not be feasible as there would be delay in finalizing the chapters within the time frame set by JICA study team. Prof. Vinod Tare suggested that each and every chapter will be thoroughly examined by experts only when the Working Groups are constituted and in the absence of which the quality of chapters/manual will not be ensured. The Chairman was of the view that the decision regarding the

finalization of Working Group has already been taken in the third meeting and JICA study team prepared their action plan accordingly. Therefore, it would be appropriate to carry forward the process of preparing the chapters with working groups as per the decision taken earlier.

2) The Expert Committee was of the opinion that all the 10 Working Groups of the three manuals should be working in parallel for drafting the various chapters with a view to finalise all the chapters simultaneously.

3) JICA Study team will forward the draft chapters / manuscripts in the form of soft copies to CH2M HILL and the same in the form of soft and hard copies will be forwarded to all the members as well as members of the working group for their views and suggestions as per the time frame set in the work plan. The draft chapters have to be examined and comments sent to CH2M Hill by the members of working group as well as the members (optional) within 15 days from the date of receipt of the chapters so as to consider the same in the next meeting of the Working Group and subsequently Expert Committee.

4) It was also decided by the expert committee members that the first draft report shall be submitted by JICA Study team on double spacing. After the comments made by the Working Group(s) the modified chapters shall be submitted by JICA study team on 1.5 spacing for further review by the working group(s)/ expert committee and final manuscript spacing shall be decided during the next Expert Committee meeting.

5) It was decided by the Expert Committee that each chapter will be discussed and finalized in at least two meetings of the Working Group and the draft chapter finalized by the Working Group will be sent to the Expert Committee for consideration. The draft chapter will be discussed and finalized by the Expert Committee in at least in two sittings. Thus each chapter will see at least two meeting of Working Group and Expert Committee each.

6) CH2M Hill shall be responsible for conducting various Working Group meetings and preparing minutes of meetings and forwarding the minutes to all the Working

Group members and a copy endorsed to the Member Secretary and Member Coordinator of the Expert Committee. However, JICA study team agreed to prepare minutes of meeting for various Work Group meetings. CH2M Hill shall organize the meetings in consultation with CPHEEO as indicated in Work Plan.

7) Dr. S.R. Shukla, Co-Chairman of the Expert Committee requested JICA Study Team to provide the work plan, time frame and deliverables of each Working Group and action plan to complete the final draft of the manual in the stipulated time frame. He indicated that while preparing the work plan, JICA study team shall keep in mind that all the three manuals shall be finalized within the time period of 15 months from June 2011 as agreed by JICA study team.

8) The critical parameters such as population projections, design period, per capita water supply, peak factor, minimum diameter of sewer and life of material were discussed in the meeting. In regard to the design period, it was decided that the design period of 30 years may be reconsidered keeping in view the huge population growth in the urban areas of the country. Prof. Vinod Tare was of the view that the design period of the STP shall be reduced from 15 years to 5 to 10 years to avoid the under utilization of treatment capacity. In regard to sewerage network, it was decided to reduce the design period from 30 years to 20-25 years after analyzing the population growth pattern and density of population during the last 30-40 years based on census data. The Expert Committee members felt that such analysis shall be carried out by JICA study team and the same may be discussed in the Working Groups and Expert Committee meetings.

9) Dr. S.R. Shukla and Mr. M. Dhinadhayalan suggested to include sections/chapters on 'zero discharge' and sewerage system in cold and hilly terrain respectively in the proposed Manuals. The JICA Study Team agreed for the same.

10) JICA study team proposed to finalise the draft manuals in September 2012 and to hold the workshop in the month of October 2012 for stakeholders' consultations. Shri M Dhinadhayalan, Member Secretary, requested JICA study team to complete the task of finalization of all the three draft manuals one month prior to holding of

the workshop for circulation of the manuals to the major ULBs and other concerned Departments / Agencies for their comments. JICA study team agreed to the same.

11) JICA study team has agreed to prepare the detailed action plan in a tabular form indicating the details of various chapters to be prepared and discussed by the Working Groups, date of meetings of the Working Group and Expert Committee of all the three manuals, dates for finalizing the draft manuals and holding the workshop etc., within 10-15 days from the date of 4th meeting and forward the same to all the members of the Working Groups / Expert Committee. However the draft working schedule presented by JICA study team to the expert committee is attached at ***Annexure II.***

Dr. Alok Kumar has informed that training for the Expert Committee at Japan shall be organized in two spell of time during 2011-12. Mr. M. Dhinadhayalan suggested the JICA Study Team to change the terminology of training with study tour for Expert Committee members. Mr. Toru Kobayakawa was also in the same opinion.

The working group members and the coordinator for each of the working groups have been finalized by the Expert Committee and the same is attached at ***Annexure III.***

It was informed by the JICA Study Team that **the 1st Working Group Meeting shall be held in third week of August 2011 and the 5th Expert Committee Meeting shall be held during November 2011.**

The meeting was ended with vote of thank to the chair.

ANNEXURE : I

Meeting Date	7th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the Updation and Revision of the Manual on Sewerage & Sewage Treatment – Part A : Engineering**

Members Present:

S. No.	Name	Designation	Department	E mail address	Contact No./ Mobile No.
1	Dr. Hemant Landge	Chief Engineer	Maharashtra Jeevan Pradhikaran	[redacted]	
2	Dr. Girish R. Pophali	Scientist NEERI	Wastewater Tech Division, Neeri	[redacted]	
3	Dr Vinod Tare	Professor	IIT Kanpur	[redacted]	
4	Er. C. Lallunghnema	Jt. Secy (T)	PHED, Mizoram	[redacted]	
5	Anil Dhussa	Director	Min. of New and Renewable Energy	[redacted]	
6	V. K. CHAURASIA	Dy Adv (PHEE) CPHEEO MoUD	MoUD CPHEEO	[redacted]	
7	D. P. SINGH	Ex. Chief Engineer U.P. Jal Nigam, Lucknow	U.P. Jal Nigam	[redacted]	
8	A. A. Kazmi	Assoc Prof	IIT Roorkee	[redacted]	
9	Dr. S. R. SHUKLA	Member & Co-option	—	[redacted]	
10	Dr. Ramakant	Asstt. Adviser (PHE)	CPHEEO, MoUD	[redacted]	

Meeting Date	7th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the Updation and Revision of the Manual on Sewerage & Sewage Treatment – Part A : Engineering**

S. No.	Name	Designation	Department	E mail address	Contact No.
11	M. Dhinadhayalan	Dy. Advisor	CPHEEO	[redacted]	
12	Dr. Dinesh Chand	Jt Advisor	— do —		
13	Masatashi YAMADA	JICA Expert	ditto		
14	Nima SATO	JICA INDIA Office Representative			
15	TORU KOBAYAKAWA	JICA INDIA			
16	Mihir Sorti	JICA India			
17	Teruo Suga	JICA Study team			
18	Katsuzo Motegi	JICA Study Team			
19	Kiyoshi Mizutune	JICA Study Team			
20	Yoshitaka Ito	JICA Study team			
21	Akira Takechi	JICA Study Team			
22	Alok kumar	JICA Study Team			

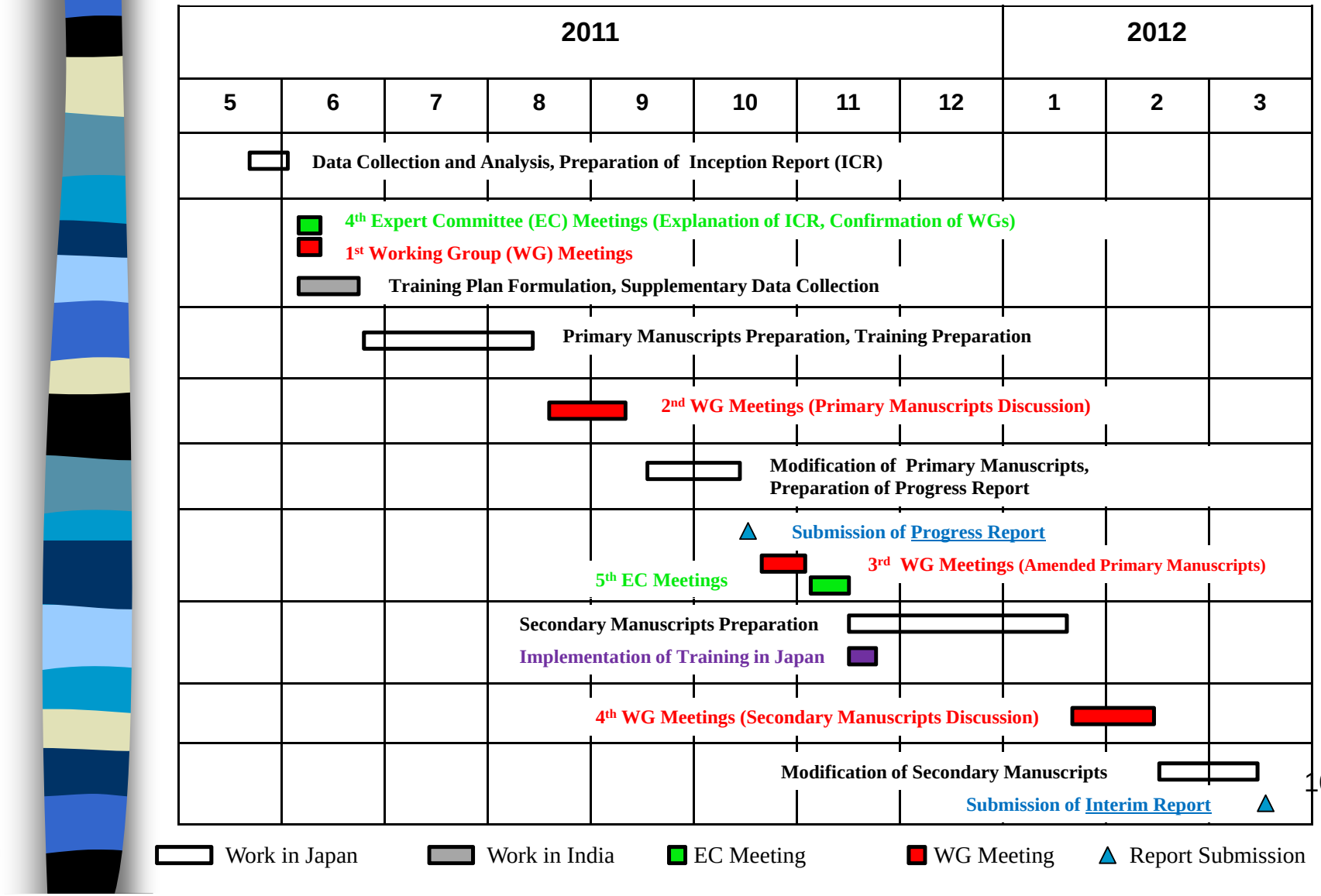
A1-7

Meeting Date	7th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the Updation and Revision of the Manual on Sewerage & Sewage Treatment – Part A : Engineering**

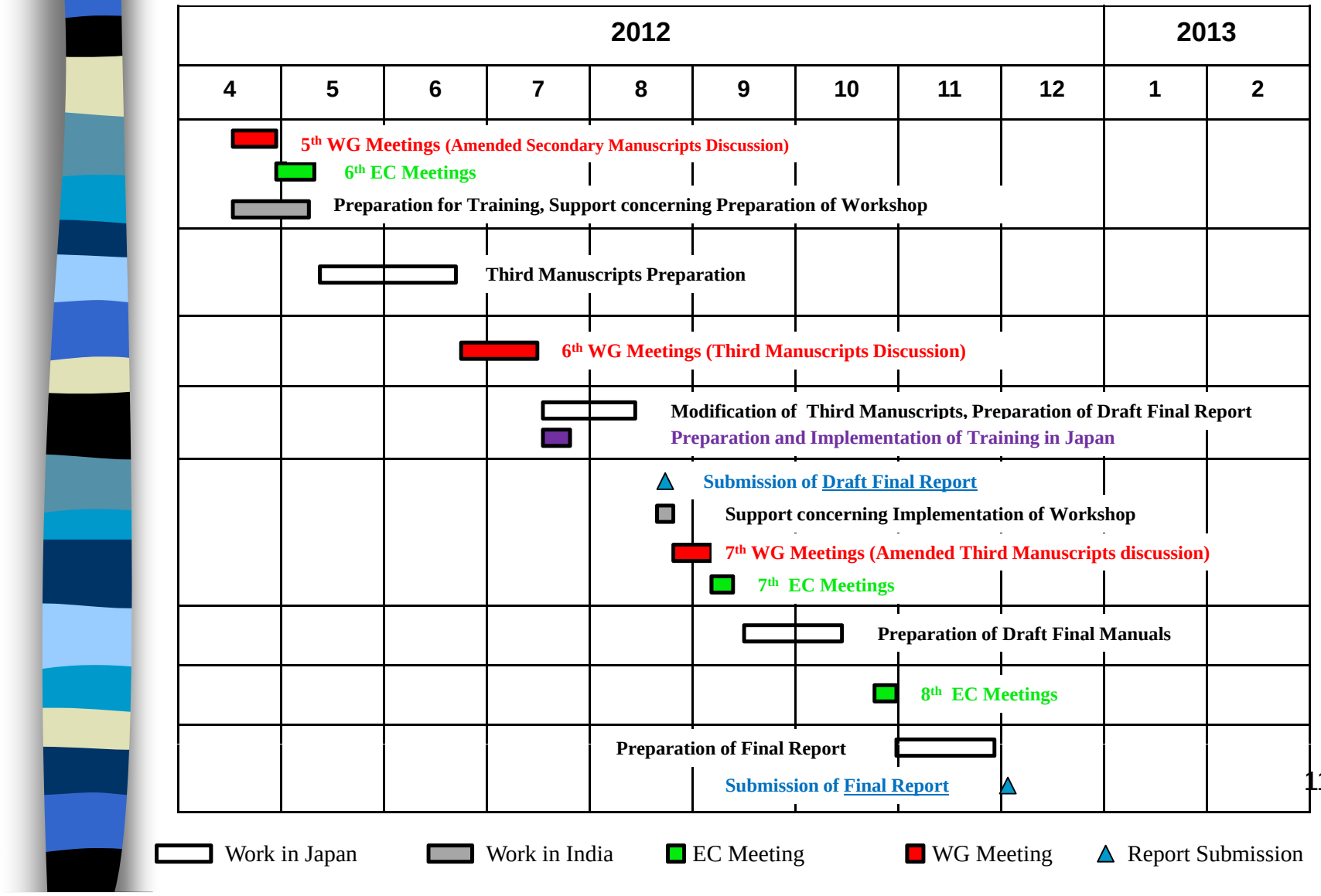
S. No.	Name	Designation	Department	E mail address	Contact No.
23	Gururaj Rao	JICA Study Team		[redacted]	
24	mikio SUZUKI	JICA study Team			
25	Akira HORITA	JICA Study Team			
26	Guillermo MADARIAGA	JICA Study Team			
27	Nazim uddin	Sr. Env. Engineer	CPCB		
28	Dr. R.K. Singh	Asstt. Chief (Projects)	HUDCO		
29	B. B. UPPAL	Ex Dy Adviser (PHE) EPHEEO, Consultant	Ex By Adviser (PHE) Min of UD		
30	Deepak Sharma	Consultant.	CH2M Hill		
31	Amit Patni	consultant	CH2m Hill		
32	Naveen	Consultant	ch2mhill		
33	R. Sethuraman	Ex Jt Adviser	CPHEEO		
34	Sbandaramoorthy	Rd, Engg Director	CMWSSB		

ANNEXURE : II

Study Schedule – FY2011



Study Schedule – FY2012



ANNEXURE : III

Working Group Details for Updation and Revision of the Manual on Sewerage and Sewage Treatment – (Part A: Engineering)

Working Group (WG)	**Chapter no**	**Chapter description**	**Members, Affiliation** (JICA Study Team)	**Members, Affiliation** (Expert Committee members)
A-1	1	Introduction	Akira TAKECHI Katsuzo MOTEGI Kiyoshi MIZUFUNE Alok Kumar Guillermo Madariaga	Dr. S.R. Shukla@ Dr. Kazmi Abssar Ahmed Mr. M. Dhinadhayalan Dr. Ramakant
	2	Planning		
A-2	3	Design and Construction of Sewers	Akira TAKECHI Katsuzo MOTEGI Kiyoshi MIZUFUNE Alok Kumar Guillermo Madariaga	Shri. R.Sethuraman@ Dr. Hemant Landge Shri. D.P. Singh Dr. Kazmi Abssar Ahmed Mr. Nazimuddin Shri B.B. Uppal Shri. S.T. Gopalram Shri Dhanapalan*
	4	Design and Construction of Sewage Pumping Stations		
A-3	5	Design and Construction of Sewage Treatment Facilities	Akira TAKECHI Katsuzo MOTEGI Kiyoshi MIZUFUNE Alok Kumar Guillermo Madariaga	Dr. Vinod Tare @ Dr. A.K. Dhussa Shri. D.P. Singh Dr. Kazmi Abssar Ahmed Shri. C. Lallunghnema Mr. Nazimuddin Dr. Girish R. Pophali Dr. Arvind K. Nema Shri B.B. Uppal Dr. R. K. Singh
	6	Design and Construction of Sludge Treatment Facilities		

Working Group (WG)	Chapter no	Chapter description	Members, Affiliation (JICA Study Team)	Members, Affiliation (Expert Committee members)
A-4	7	Recycling and Reuse	Akira TAKECHI Katsuzo MOTEGI Kiyoshi MIZUFUNE Alok Kumar Guillermo Madariaga Akira MORITA	Dr. S. Sundaramoorthy@ Dr. Kazmi Abssar Ahmed Shri. C. Lallunghnema Dr. Vinod Tare Mr. Nazimuddin Dr. Arvind K. Nema Shri V.K. Chaurasia Dr. R. K. Singh Mr. M. Dhinadhayalan Dr. Ramakant Shri. R.Sethuramn
	8	Onsite Methods		
	9	Emerging Trends		

Note: * New Member
@ Coordinator of the working group

The fourth meeting of the Expert Committee members, the JICA Study Team and the representatives of CH2M HILL (India) Pvt. Limited for the Preparation of the Manual on Sewerage and Sewerage Treatment - (Part B: Operation and Maintenance and Part C: Management) was held under the Chairmanship of Dr. Dinesh Chand, Joint Adviser (PHEE), CPHEEO, MOUD on 8th June 2011 at 10.30 AM in CPWD conference room no. 103, A-Wing, Nirman Bhawan, New Delhi. The list of participants is attached at ***Annexure - I.***

At the outset, the Chairman welcomed the members of the Expert Committee, experts from JICA Study Team, representatives of JICA, and representatives of CH2M HILL (India) Pvt. Limited, Gurgaon and proposed the agenda of the committee for discussion. The Chairman has informed all the members that Mr. M. Dhinadhayalan, Member Secretary of the Expert Committee was not able to attend due to his official duty outside Delhi.

The Chairman requested the JICA Study Team to make a power point presentation on the outcomes of the Phase – I study and further course of action for Phase – II study for the Manual on Sewerage and Sewage Treatment - (Part B: Operation and Maintenance) and (Part C: Management). The Chairman suggested all the Expert Committee Members to discuss and finalise the planning for drafting of the Manual including the formation of Working Groups.

Mr. Akira Takechi, Team Leader JICA Study Team, made a power point presentation on the outcomes of Phase – I study and requested Dr. Alok Kumar, JICA Study Team to continue with work plan for study of Phase-II in respect of Part B & C.

Dr. Alok Kumar made a power point presentation on the work plan and study schedule for the Phase – II study. He has informed about the function of the working groups with the JICA Study team and the requirement of the working groups & Expert Committee meetings.

The Expert Committee and JICA Study team unanimously decided the following:

(1) The Expert Committee was of the opinion that all the 10 Working Groups of the three manuals should be working in parallel for drafting the various chapters with a view to finalise all the chapters simultaneously.

(2) It was decided that JICA Study team will forward the draft chapters / manuscripts in the form of soft copies to CH2M HILL and the same in the form of soft and hard copies in double space will be forwarded to all the members of the working group as well as other members for their views and suggestions as per the time frame set by the JICA study team in the work plan. The draft chapters have to be examined and comments sent to CH2M Hill by the working group as well as other members (optional) within 15 days from the date of receipt of the chapters so as to consider the same in the next meeting of the Working Group / Expert Committee.

(3) CH2M Hill shall be responsible for conducting various Working Group meetings and preparing minutes of meetings and forwarding the minutes to all the Working Group members and a copy endorsed to the Member Secretary and Member Coordinator of the Expert Committee. However, JICA study team agreed to prepare minutes of meeting for various Work Group meetings. CH2M Hill shall organize the meetings in consultation with CPHEEO as scheduled in work plan..

(4) It was decided by the Expert Committee that each chapter will be discussed and finalized in at least two meetings of the Working Group and the draft chapter finalized by the Working Group will be sent to the Expert Committee for consideration. The draft chapter will be discussed and finalized by the Expert Committee in at least in two sittings. Thus each chapter will see at least two meeting of Working Group and Expert Committee each.

(5) Dr. S.R. Shukla , Co-Chairman of the Expert Committee requested JICA Study Team to provide the work plan, time frame and deliverables of each Working Group and action plan to complete the final draft of the manual in the stipulated time frame as decided in meeting on 7th June, 2011.

(6) Mr. Sankaranarayan suggested to include Septage Management chapter in the manual and a provision of septage management policy (collection of multiple housing units). JICA Study team agreed to include the same in the Manual (Part B: Operation and Maintenance).

(7) A brief discussion held within the committee meeting for the Manual on Part C: Management and chairman told that JICA Study team will continue to work for Manual on Part C: Management and in July 2011, MOUD will inform the details on working group members and their coordinators.

(8) Dr. S.R. Shukla suggested to include Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) in the Part C of the manual explaining the need of EIA, parameters, and how to execute EIA for STPs. JICA Study team and Expert committee members agreed to include the same in Part C of the Manual.

(9) Mr. Sethuraman advised to include air and noise prevention control act in the O&M Manual (Part: B) and National Urban Sanitation Policy in the manual and expert committee members agreed to include the same in the Manual.

(10) Expert Committee suggested to include the Service Level Benchmarking for sewerage system brought out by the Ministry in the Management Manual (Part: C)

(11) JICA study team has agreed to prepare the detailed action plan in a tabular form indicating the details of various chapters to be prepared and discussed by the Working Groups, date of meetings of the Working Group and Expert Committee of all the three manuals, dates for finalizing the draft manuals and holding the workshop etc., within 10-15 days from the date of 4th meeting so as to forward the same to all the members of the Working Groups / Expert Committee. However the draft working schedule presented by JICA study team to the expert committee is attached at ***Annexure II.***

(12) JICA study team proposed to finalise the draft manuals in September 2012 and to hold the workshop in the month of October 2012 for stakeholders' consultations.

(13) It was decided by the expert committee members that the first draft report shall be submitted by JICA Study team on double spacing. After the comments made by the Working Group(s) the modified chapters shall be submitted by JICA study team on 1.5 spacing for further review by the working group(s)/ expert committee and final manuscript spacing shall be decided during the next Expert Committee meeting.

(14) It was also decided that the full meeting of the third expert committee for the management manual (Part: C) shall be conveyed at the earliest after issue of formal order for its constitution..

Dr. Alok Kumar has informed that study tour for the Expert Committee at Japan shall be organized in two spell of time during 2011-12.

The working group members and the coordinator for each of the working groups have been finalized by the Expert Committee and the same is attached at ***Annexure III***.

It was informed by the JICA Study Team that **the 1st Working Group Meeting shall be held in third week of August 2011 and the 5th Expert Committee Meeting shall be held during November 2011.**

The meeting was ended with vote of thank to the chair.

ANNEXURE : I

Meeting Date	8th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the preparation of the Manuals on Sewerage & Sewage Treatment – Part B : Operation and Maintenance**

Members Present:

S. No.	Name	Designation	Department	E mail address	Contact No.
1	G. ELANGOVAN.	Engineering Director (Rtd.)	Chennai metropolitan water supply & sewerage Board.	[redacted]	
2	M. SANKARANARAYAN	Rtd JOINT ADVISER (PHEE) CPHEEO	MIN. OF U.D GOI		
3	DR. S. SUNDARA-MOORTHY	Retd. ENGG DIR CMWSSB Bd.	CMWSSB Chennai		
4	R. SETHURAMAN	Ex. Advisor (PHEE) I/c CPHEEC	CPHEEO M/O UD.		
5	J.P Mani	Project Manager	UP Jal Nigam		
6	A. A. Kazmi	Assoc. Professor	Civil Engineering IIT Roorkee		
7	DILIP PATNI	Chief Engineer (PH) & Member Secretary OWSSB	H&UD Deptt Govt. of Orissa		
8	S.P. RUDRA MURTHY	BANGALORE (Retd) WATER SUPPLY AND → Addl. Chief Engineer			
9	DR S.R SHUKLA	SEWERAGE BOARD → Former Adv (PHEE) CPHEEO	Member & Convenor		
10	Dr. Dinesh chand	Jt Adviser (PHEE)	CPHEEO MOUD		

Meeting Date	8th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the preparation of the Manuals on Sewerage & Sewage Treatment – Part B : Operation and Maintenance**

S. No.	Name	Designation	Department	E mail address	Contact No.
11	Masatashi YAMADA	JICA Expert	JICA CPHEEO	[redacted]	
12	Mino SATO	JICA INDIA office representative			
13	TORU KOBAYAKAWA	JICA Andhra			
14	Yoshicaka Ito	JICA TEAM			
15	KATSUZO MOTEGI	JICA STUDY TEAM			
16	Kiyoshi Mizutune	JICA Study Team			
17	mikio Suzuki	JICA study Team			
18	Akira Takechi	JICA STUDY TEAM			
19	ALOK KUMAR	JICA STUDY Team			
20	SUGA TERUO	ditto			
21	GURURAJ RAO	JICA Study Team			
22	Akira MORITA	JICA STUDY TEAM			

Meeting Date	8th June 2011
Time	10.30 AM
Venue	Ministry of Urban Development
Project	**Fourth Meeting of Expert committee and JICA study team for the preparation of the Manuals on Sewerage & Sewage Treatment – Part B : Operation and Maintenance**

S. No.	Name	Designation	Department	E mail address	Contact No.
23	Guillermo Madariaga	Jica Study Team		[redacted]	
24	Amit Patni	Consultant	CH2M Hill		
25	Nareen Prakash	consultant	ch2m hill		
26	Deepak Sharma	Consultant	CH2M hill		
27					
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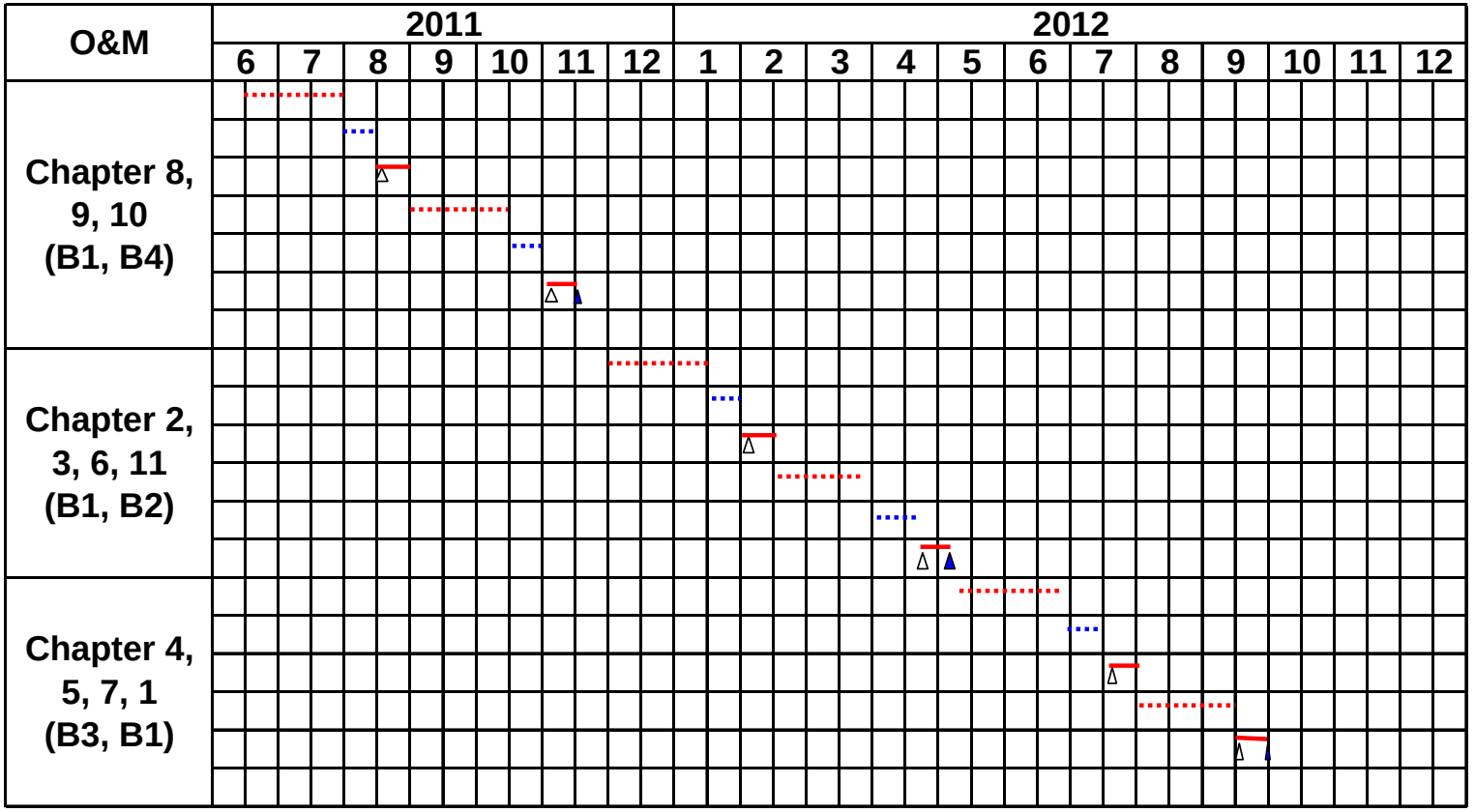
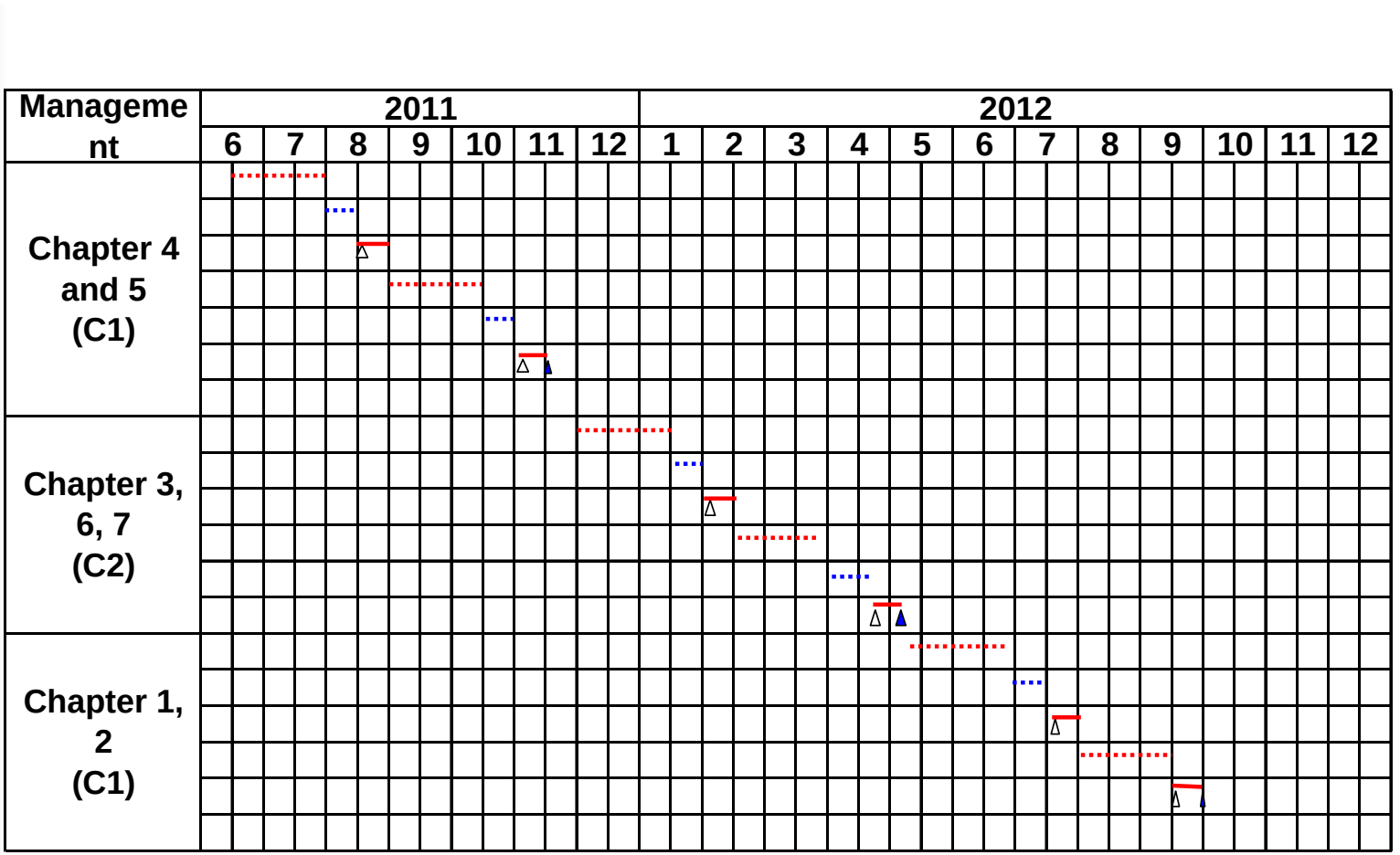
ANNEXURE : II



:Study Team's draft preparation in Japan
:Review by Indian Side
:Working Group Meeting(s)
:Expert Committee


Management
2011
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2012
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12
Chapter 4 and 5 (C1)
Chapter 3, 6, 7 (C2)
Chapter 1, 2 (C1)
:Study Team's draft preparation in Japan
:Review by Indian Side
:Working Group Meeting(s)
:Expert Committee

ANNEXURE : III

Working Group Details for the Preparation of the Manual on Sewerage and Sewerage Treatment - (Part B: Operation and Maintenance and Part C: Management)

Working Group (WG)	Chapter no	Chapter description	Members, Affiliation (JICA Study Team)	Members, Affiliation (Expert Committee members)
B-1	1.	General	Akira TAKECHI Yoshitaka ITO Teruo SUGA Gururaj RAO	Dr. S.R. Shukla @ Dr. Kazmi Absar Ahmed Shri. M. Sankaranaryanan Dr. Ramakant Shri K.L. Swara
	9.	Safety and Health Management		
	11.	Budget Estimates for Operation and Maintenance		
B-2	2	Sewer Systems	Akira TAKECHI Teruo SUGA Mikio SUZUKI Gururaj RAO	Shri G. Elangovan @ Shri. S.V. Ahuja: Shri. S.M. Jejurikar Dr. Kazmi Absar Ahmed Shri. J.B Ravinder Shri. Sumit Dutta Shri M. Satyanarayanan Representative of BEE Representative of Surat MC.
	3	Pumping Stations		
	6	Electrical and Instrumentation Facilities		
B-3	4	Sewage Treatment Facilities	Akira TAKECHI Yoshitaka ITO Mikio SUZUKI Gururaj RAO	Shri. R.Sethuraman @ Shri. S.P. Rudramurthy Shri. S.V. Ahuja Shri. S.M. Jejurikar Shri Dilip Padhi Dr. Kazmi Absar Ahmed Prof. Mazumdar* Representative of Surat MC.
	5	Sludge Treatment Facilities		
	7	Quality Analysis		
B-4	8	Environmental Conservation	Akira TAKECHI Teruo SUGA Gururaj RAO Akira MORITA	Dr. S. Sundaramoorthy @ Dr. Kazmi Absar Ahmed Mr. M. Dhinadhayalan Dr. Ramakant
	10	Onsite Systems		
	12	Septage Management		

Note: * New Member
@ Coordinator of the working group

Minutes of the 2nd Meeting of the Working Group on Operation & Maintenance of Sewerage and Sewage Treatment Plant (Part –B) held in India International Center, Lodi Estate, at 10.00 A. M. on 2nd December 2011.

The second meeting of the Expert Committee Members, JICA Study Team and representatives of CH2M HILL (India) Pvt. Limited of Working Group on Operation & Maintenance of Sewerage and Sewage Treatment Plant (Part – B) held under the Chairmanship of Dr. S. R. Shukla, Former Adviser (PHEE), Ministry of Urban Development in India International Center, Lodi Estate, New Delhi at 10.00 A.M. on 2nd December 2011. The list of participants is appended.

At the outset, Dr M. Dhinadhayalan welcomed all the participants to the meeting and requested Dr. Shukla to Chair the meeting. Dr. Shukla thanked to all the members present in the meeting. He mentioned about following three chapters those were to be discussed during the meeting;

1. Chapter – 8: Environmental Conservation
2. Chapter – 9: Occupational Hazards, Safety Measures and Health Aspects
3. Chapter – 10: On – Site Systems

The summary of discussions held during the meeting is as follows;

While appreciating efforts put in by the JICA Study Team in drafting above chapters, Dr. Shukla opined that text of these chapters were in text book type whereas contents of chapters should have been a sort of ready reckoner reference which could serve as a guiding tools by field engineers / personnel. He further suggested that instead of explaining various aspects in details it would better to mention them in bullet-form giving only the important and essential aspects of the text. This would not only shorten the length of the text but also easier to follow and understand. The suggestion was accepted by the JICA Study Team. **(Action: JST)**

The Expert Member of the working group were of the opinion that the text of the chapter-9 which was of 106 pages (double spacing) needed to be brought down to 25 to 30 pages (double spacing) by curtailing the write-up as suggested by the members while respective chapters were discussed. The Team Leader Mr. Tekachi welcomed the suggestion. **(Action: JST)**

Before initiating discussions on the chapters Dr. Alok Kumar requested Mr. Suga, member of JICA Study Team to give power-point presentation for all the three chapters before starting the discussions. Mr. Suga gave a brief presentations on the chapters to be discussed highlighting comments offered by expert members during the first meeting of the Working Group and modified versions incorporating all comments in the revised draft chapters to be discussed in the meeting. Thereafter, each chapter was taken up in seriatim for discussions as under;

1. Discussion on Chapter – 8, 'Environmental Conservation'

Drawing attention to the Section 8.2 on 'Air Pollution', Dr. Dhinadhayalan suggested to modify the heading with respect to odor problem and control. He further mentioned that gases generated and emitted from sewerage systems and sewage treatment plants as indicated in Table 8.1 and 8.2 should relate only to those major gases

generated and emitted as hydrogen sulfide, methane etc be mentioned with proper effluent limits as per Indian standards, W.H.O., or E.P.A. standards/norms. The suggestion was accepted by the participants. Mr. Tekachi assured that proper modifications will be incorporated in the next modified draft chapter. **(Action: JST)**

Dr. Ramakant was of the view that this manual was to be used in India, therefore those photographs depicting Japanese using equipment and instruments should be deleted and only photographs showing only equipment and instruments to be used for various activities be included in the manual. The suggestion made by Dr. Ramakant was accepted by the JICA Study Team. **(Action: JST)**

Mr. Bahra drawing attention to section 8.2.4.5 on 'control measures' for septic tanks suggested that for 'ventilating pipes' the IS: 2470 (Part I) – 1968 code of practice be followed. It was further suggested by him that while describing the effects of aerosols proper care be taken in the text to describe its definition, source of origin and size, and how these aerosols were harmful to human health. The JICA Study Team acceded to the suggestions. **(Action: JST)**

Dr. Dhinadhayalan drawing attention to section 8.4 on 'Noise Pollution and Vibration' suggested that various types of pollutants emitting from the sewerage system and sewage treatment plants be categorical mentioned with their ill effect on human health. He also mentioned about the text relating to the section 8.6 on 'Water Pollution' and suggested that proper Indian Code of practices be referred to and text of this section be modified accordingly. The written comments offered and made available by other members would be suitably incorporated in the chapter by JST. **(Action: JST)**

2. Discussion on Chapter – 9 'Occupational Hazards, Safety Measures & Health Aspects'

Dr. Dhinadhayalan suggested that in section 9.1 'Objective should precede 'Introduction' and the text of the chapter should be summarized in affirmative language. **(Action: JST)**

Dr. Singh was of the opinion that Table 9.1 to Table 9.6 be deleted as the contents of these tables had not much of relevance to the title of the chapter. He further suggested that the sources from where the information had been culled out be indicated at the bottom of the tables. **(Action: JST)**

Dr. Dhinadhayalan mentioned that Table 9.12 be deleted and instead its contents are briefly described in the text of the chapter in relevant section. He further suggested that Table 9.13 might be retained with a statement that manual entering in manhole be prevented as far as possible and under inevitable conditions proper precautions be taken to avoid any eventualities. Table 9.15 might be summarized. Mechanical cleaning of sewers and septic tanks under Manual Scavenging Act of Government of India be included in the text of this chapter. Dr. Dinadhayalan agreed to forward a brief write-up on this aspect to JST for incorporating in the text. **(Action: Dr. M. Dhinadhayalan & JST)**

Following suggestions were made to improve the quality of the text under local conditions;

Mr. Bahra – section 9.3.1.3 needed to be rewritten in brief.
Dr. Ramakant – Ponds mentioned in the write-up needed clarification and the text should always be written in third person.

Mr. Sethuraman suggested that details of staffing pattern given in the Table 9.18 should be included in the Management (Part – C) of the manual by specifically mentioning staff strength at various levels depending upon the size (population) of the city. The written comments offered and made available by other members would be suitably incorporated in the chapter by JST. **(Action: JST)**

Dr. Dhinadhayalan, while concluding discussions on Chapter – 9, agreed to forward briefs of the following information to JST for incorporating the same suitably in the chapter since these were important in the light of the National Urban Sanitation Policy of Government of India.

1. Welfare measures for sanitation workers,

2. Mechanical equipment for cleaning of sewers and septic tanks,

3. Occupational hazards in sanitation systems.

(Action: Dr. Dhinadhayalan & JST)

3. Discussions on Chapter – 10 'On-Site Systems'

Prior to the discussion on Chapter – 10, Mr. Takechi with the permission of the Chairman briefly explained the future plan of time - schedule for the preparation of Manuals on Engineering (Part –A) , on Operation & Maintenance (Part – B), and on Management (Part – C). He mentioned the schedule as indicated below;

Tentative time - schedule for the preparation of draft and final version of manuals

Sl. No.	Name of the Manual	Original schedule	Revised Schedule for draft final
1.	Engineering (Part – A)	December 2011	June 2012
2.	Operation & Maintenance (Part – B)	December 2012	March 2013
3.	Management (Part – C)	December 2012	March 2013

(Action: Dr. Dhinadhayalan, JICA and JST)

Mr. Takechi mentioned that the JICA Study Team would make every effort to stick to the above time – schedule in completing the assignment of preparation of all the

three manuals as per the schedule indicated subject to the approval of Ministry of Urban Development, Government of India and JICA, Government of Japan.

Initiating discussion on chapter – 10, Dr. Dhinadhayalan was of the opinion that operation and maintenance aspects of on-site sanitation system and its impact be clearly and briefly defined under the section 'Introduction' including all different systems that are being recommended in the Part A Manual and how best these could be operated and maintained. **(Action: JST)**

Mr. Sethuraman suggested that title of the chapter should be 'On-site Sanitation Systems'. All the members endorsed the suggestion. Mr. Sethuraman further mentioned that there were many septic tanks in the country did not have soakage pit facilities due to space constraints and the effluent such septic tanks is directly discharged in to open drains or on open space creating environmental problems. To encounter such problems suitable solutions be addressed in the chapter. The use of mini package treatment plants also needed to be clearly addressed under local conditions and included in the chapter. The write-up on activated sludge process be deleted from the chapter as this not in conformity to on-site sanitation systems in the country. Moreover, ASP system form the part of Engineering (Part – A) manual. **(Action: JST)**

Mr. Bahra suggested that under section 10.2.1 the volume of water used for flushing should be 2 to 3 liters; of course, this might require specific design of toilet seat. **(Action: JST)**

Dr. Ramakant was of the view portion of the text dealing with off-site treatment plants with conventional technologies be deleted and proper linkage with Engineering (Part – A) and Operation & Maintenance (Part – B) be defined in the chapter. **(Action: JST)**

Dr. Dhinadhayalan suggested that the frequency of septic cleaning shall be included in the chapter. The guidelines on O&M of onsite system given in the existing manual shall be referred to and the same may be updated and incorporated in the chapter. He also suggested that that a brief write-up on Septage Management Program highlighting on-site sanitation inventory, the role of various stakeholders (Households and Municipality) for regular cleaning of septic tanks shall be included in the chapter. JST was also requested to include details on various mechanical equipments required for sewer and septic tank cleaning. He agreed to provide the required information on various equipment for cleaning of sewers and septic tanks to JST. The written comments offered and made available by other members would be suitably incorporated in the chapter by JST. **(Action: Dr. Dhinadhayalan and JST)**

The third meeting of the Working Group on Operation & Maintenance of Sewerage and Sewage Treatment Plant (Part –B) as decided to be held in April / May 2012 tentatively subject to the convenience of working group members and JST. Suitable date for the meeting would be confirmed and intimated to all the concerned accordingly.

The meeting ended with vote of thanks to the Chair.

Appendix

Second meeting of the Working Group on Operation & Maintenance of Sewerage and Sewage Treatment Plant (Part – B) held in India International Center, Lodi Estate, New Delhi, 110 003 on 2nd December, 2011.

List of Participants

Sl. No	Name	Designation/Department	E-mail address	Contact No.
1.	Dr. Alok Kumar	Expert/ JICA Study Team		
2.	Akira Takeuchi	Team Leader/JICA Study Team		
3	Terro Suga	Expert/ JICA Study Team		
4.	Mikio Suzuki	Expert/ JICA Study Team		
5.	Yoshitaka Ito	Expert/ JICA Study Team		
6.	Akira Morita	Expert/ JICA Study Team		
7.	Katsuzo Motegi	Expert/ JICA Study Team		
8.	General Rao	Expert/ JICA Study Team		
9.	Kiyoshi Mizuhata	Expert/ JICA Study Team		
10.	Takashi Sakakibara	Expert/ JICA		
11.	R. Sethumadhavan	Former Joint Adviser (PHEE), CPHEEO, MoUD		
12.	J.S. Bakshi	Executive Engineer, PWSSB		
13.	Dr. R. K. Singh	Asst. General Manager (Projects), HUDCO		
14.	Dr. S. R. Shukla	Former Adviser (PHEE), CPHEEO, MoUD		
15.	Dr. M. Dinesh Kumar	Deputy Adviser (PHE), CPHEEO, MoUD		
16.	Dr. Ramakant	Asst. Adviser (PHE), CPHEEO, MoUD		
17.	Shital Chinchwade	Team Leader, CH2M HILL, Gurgaon, (HR)		
18.	Ms. Padma Kale	Support Staff, CH2M HILL		
19.	Ms. Miho Sato	JICA India office, New Delhi		

No.Q-16011/1/2007-CPHEEO
Government of India
Ministry of Urban Development
(CPHEEO)

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Nirman Bhawan, New Delhi
Dated: 3rd January, 2012

Sub: Minutes of First Expert Committee Meeting for Preparation of Manual on Sewerage and Sewage Treatment - Part C: Management – Regarding

Please find enclosed a copy of the Minutes of First Expert Committee Meeting for Preparation of "Manual on Sewerage and Sewage Treatment - Part C: Management", held in Conference Room No.103, Nirman Bhawan, New Delhi on 5th December, 2011, for information and necessary compliance.

It is requested that all the suggested action points as brought out in the Minutes may kindly be complied with.

Encl: As above

3/1/2012

(Dr. M. Dhinadhayalan)
Deputy Adviser (PHE) & Member Secretary
Tel. No.011-23062418
Fax No.011-23062482
Email : mdheen@gmail.com

To

As per list enclosed

Copy submitted for information to:

(i) PS to Joint Secretary (UD), Ministry of Urban Development, Nirman Bhawan.
(ii) PS to Director (LSG), Ministry of Urban Development, Nirman Bhawan.

(Dr. M. Dhinadhayalan)
Deputy Adviser (PHE) & Member Secretary
Tel. No.011-23062418

Minutes of the First Expert Committee Meeting for Preparation of the Manual on Sewerage and Sewage Treatment, Management (Part – C) held in Conference Room No. 103, Nirman Bhawan, New Delhi on 5th December 2011 at 10.30 A.M.

The first meeting of the expert members, JICA Study Team and representatives from CH2M HILL (India) Pvt. Ltd. for Preparation of the Manual on Sewerage and Sewage Treatment, Management (Part – C) was held in Conference Room No. 103, Nirman Bhawan, New Delhi on 5th December 2011 at 10.30 A.M.

The list of participants is appended.

The Chairperson Ms. E. P. Nivedita, Director (LSG), Ministry of Urban Development was unable to attend the meeting due to her pre-occupation in Parliamentary work and therefore Dr. S. R. Shukla, Member of the Expert Committee was requested by Dr. Dhinadhayalan, Member-Secretary of the Expert Committee to preside over the meeting which was agreed to by Dr. Shukla.

At the outset, Dr. Dhinadhayalan welcomed all the members present in the meeting and requested them to introduce themselves; being the first meeting of the Expert Committee for preparation of the Manual on Sewerage and Sewage Treatment, Management (Part – C). Thereafter, he proposed the meeting agenda and requested members to initiate discussions and deliberate on the agenda.

Two draft chapters prepared by the JICA Study Team (JST), as mentioned below, were discussed during the meeting. A handout incorporating all the observations / comments offered by Expert Members during the preparatory meeting on the subject held on 26th August 2011 was also circulated by Mr. Mizufune of JST for its use during deliberations.

1. Draft Chapter 5 on 'Public Private Partnership' and

2. Draft Chapter 6 on 'Community Participation'

Prior to the discussion Mr. Takechi with the permission of the Chairman briefly explained the future plan of time - schedule for the preparation of Manuals on Engineering (Part –A), on Operation & Maintenance (Part – B), and on Management (Part – C). He mentioned the schedule as indicated below;

Tentative time - schedule for the preparation of draft and final version of manuals

Sl. No.	Name of the Manual	Draft of the manual	Draft final version of the manual
1.	Engineering (Part – A)	December 2011	June 2012
2.	Operation & Maintenance (Part – B)	December 2012	March 2013
3.	Management (Part – C)	December 2012	March 2013

(Action: Dr. Dhinadhayalan, JICA and JST)

Mr. Takechi mentioned that the JICA Study Team would make every effort to stick to the above time – schedule in completing the assignment of preparation of all the three manuals as per the schedule indicated; subject to the approval of Ministry of Urban Development, Government of India and JICA, Government of Japan. He emphasized the need for the preparation of Manual on Engineering (Part – A) on priority basis as per the directives of the Ministry of Urban development, Government of India. (Action: JST)

At the beginning of the deliberations, Dr. Alok Kumar gave a power-point presentation on the Table of Contents regarding Part – C of the manual which was prepared during the preparatory meeting held on 26th August 2011 and requested members to offer their views so as to finalize the same before drafting chapters on Management (Part – C). Views offered by members on Table of Contents were in seriatim as follows;

Dr. Dhinadhayalan suggested that under section 1.1 Vision and Mission in chapter – 1 on 'Introduction', National Urban Sanitation Policy (NUSP) of Government of India be included. He mentioned that a booklet on NUSP was given to all the expert members during the first meeting of the Expert Committee held in August 2010. Required information on the policy issues could be culled out from the same for inclusion in the chapter. (Action: JST)

Mr. Srinivasan suggested that in so far as section 1.2 on Stakeholders was concerned, it could be further brought down in the chapter highlighting roles and responsibilities of various stakeholders viz. Central Government, Stat Governments, Urban Local Bodies, Regulatory Authorities, N.G.Os and Communities etc. (Action: JST)

Prof. Rehman was of the view that the title of chapter 2 should be 'Legal Framework' which was more appropriate with the contents of the chapter, instead of 'Institutional Framework'. He further suggested that other relevant Bye-laws and Acts relating to sewage management, if available, could be included. Dr. Balooni suggested that a brief write-up on 74th CAA wherein devolution of powers to ULBs has been recommended to raise revenues for efficient and effective management be included with a proper title of the sub-section under the chapter. (Action: JST)

Mr. Srinivasan and Dr. Balooni were of the opinion that section 2.2 'Organizational Setup' be a part of Chapter – 3 as section 3.1 which was more appropriate when the title of Chapter – 3 was modified as 'Institutional Framework and Capacity Building'. They also suggested revamping of the existing institutional set up in the concerned State Government Departments and Urban Local Bodies for efficient management of the Sewerage and Sewage Treatment Plant Systems. It was decided that Chapter – 3 with its sub-sections be referred to Mr. Srinivaschary, ASCI, Hyderabad for necessary modifications and inputs on the same. Dr. Dhinadhayalan agreed to initiate action on the same at the earliest possible. He further suggested that organizational set-up for different classes of cities and towns be proposed for efficient functioning of the systems. (Action: Dr. Dhinadhayalan, Mr. Srinivaschary, JST)

Mr. Srinivasan suggested that in Chapter – 4, self-sustainability, regular operation and maintenance, asset management along with water supply management systems, revenue generation etc. with proper financial planning be incorporated suitably in the chapter. The heading of section 4.4 should be Revenue & Expenditure. (Action: JST)

While discussing contents of chapter – 5 "Public Private Partnership", it was suggested by Mr. Srinivasan that a write-up on 'Constraints and Issues' under section 5.4 and Risk Assessment and Mitigation' under section 5.10 be included. (Action: JST)

With respect to chapter – 6, " Community Participation" Mr. Ravindran suggested that a brief write-up on 'Community Participation Law' (CPL) under reforms be included in the chapter suitably, for which he suggested that the copy of this reform as brought out in the NUSP be circulated along the minutes of the meeting so that the view of the members could be incorporated suitably in the chapter. (Action: CH2M HILL & JST)

Following suggestions made by the members on chapter – 7, "Asset Management' for suitably incorporating in the chapter.

Mr. Srinivasan and Dr. Balooni – Ranking and rating performance parameters and qualities of assets with periodic assessment needed to be included in the chapter. For asset documentation JICA would provide the templates for using as a model by the utility agencies.

Mr. Ravindan: The real-time assessment of assets on the ground and its linkage with G.I.S. be mentioned. In section 7.4 other mechanical equipment should also be included. Under operation and management of the systems energy efficiency be included.

(Action: JST)

Dr. Dhinadhayalan was of the opinion that the importance of M.I.S. being the most important aspect of management of the system be highlighted at the beginning of the chapter. Periodic updating of various activities under M.I.S. would be essential by the utilities agencies for efficient system management. (Action: JST)

While discussing contents of chapter – 9, Mr. Srinivasan mentioned that for setting up of sewerage and sewage treatment plant E.I.A. is not statutory at present. However, for setting up of sewage treatment plant State Pollution Control Boards' consent was required. Dr. Dhinadhayalan was of the opinion that this manual under preparation would be used for the next 15 to 20 years and it might be possible during this period E.I.A. would made mandatory and hence this manual would serve as an important guide to user agencies. Dr. Rehman mentioned that E.I.A. should include Environmental Management Plan (EMP) and Risk Assessment and Mitigation as well. (Action: JST)

It was decided that the title of chapter – 10 should be 'Disaster Management Plan'. The heading of the section 10.2 should be 'Emergency Situations'. (Action: JST)

After tentatively finalizing the Table of Contents of the Chapter on Management (Part-C) two draft chapters as mentioned below were taken up for discussion during post lunch session;

1. Chapter-5 'Public Private Partnership (PPP), and

2. Chapter-6 'Community Participation'

Discussions on Chapter – 5 'Public – Private – Partnership'

Some of the important points, as mentioned below, suggested by Mr. Srinivasan for inclusion in the chapter with a brief write-up;

1. Risk involvement in PPP,

2. Construction efficiency,

3. Collection efficiency,

4. Outsourcing the services,

5. Sharing of risks between public and private sector,

6. Sewerage and SWM model through PPP,

7. Tax concession at least for 20 years,

8. Community awareness (continuous program with targets),

9. Model concession agreement (copy was to be provided by Mr. Srinivasan),

10. Carbon credit approach, etc.

Dr. Balooni mentioned that sub-contracting of provision of infrastructure services was a big issue and this needed to be addressed with some suggestions as accountability, disincentives for inefficient and inferior quality works etc. He also mentioned about Enabling Environment and Need for Reforms be addressed.

Dr. Dhinadhayalan mentioned that the suggestions made under section "Enabling Environment for PPP" have not been properly addressed to and suggested that in order to create enabling environment, the role of the Govt. of India, State Govts. and ULBs and the action required at all level to attract PPP shall be incorporated under the aforesaid section. He also suggested that while advocating for PPP, annuity model for sewer and septic tank cleaning equipment be highlighted. He further suggested that on-site sanitation system was also important under present scenario in the country; this should also be brought under the purview of PPP.

Dr, Shukla mentioned that water supply and sanitation program was under social sector program of Government of India; and since water supply and sanitation was a non-remunerative program it had no incentives for attracting PPP.

Dr. Dhinadhayalan suggested that one time grant being provided by the Govt. of India under various programs be released on installment basis over a period of about 5-10 years to ULBs in order to attract PPP in implementation and operation and maintenance of sewerage infrastructure and also with a view cover the financial risks anticipated by PPP and improve the service delivery ; and during this intervening period of about 5-10 years ULBs should make efforts to make the system self-sustainable with the help of the community and other user agencies in order to sustain PP[P in the sector.

Having discussed the chapter – 5 on PPP in detail, Mr. Srinivasan was kind enough to come forward to help JST in drafting the chapter and requested JST to forward a soft copy of the draft chapter – 5 in Word File version him at the earliest so that it could be modified keeping in view the above observations made by the members and prevailing conditions in the country. (Action: Mr. Srinivasan and JST)

Discussions on Chapter – 6 'Community Participation

Initiating discussion on 'Community Participation', Dr. Dhinadhayalan suggested that a brief write-up on community awareness for on-site and off-site sanitation systems be included in the chapter at appropriate place. He further mentioned that brief write-up on Septage Management Program regulations and guidelines also be included at appropriate place in the chapter. (Action: JST)

Dr. Balooni suggested that under the sub-section 6.3.5, references could be made on the following;

a. Achieving community participation,

b. Decision making process,

c. Different forums for discussions community participation.

Dr. Balooni was of the view that school children should also be allowed for field visits to water supply and sewage treatment plants so as to make them aware of the impacts of such facilities on the health of the human beings and also for creating better environment. A brief write-up in this context be added in the chapter. (Action: JST)

Dr. Dhinadhayalan suggested that awareness amongst the sanitation workers who are responsible for sewers and septic tanks cleaning be also mentioned along with community participation. The messages for creating awareness shall also include the elimination of manual scavenging of sewers and septic tanks. (Action: JST)

The next meeting of the Expert Committee for Preparation of the Manual on Sewerage and Sewage Treatment, Management (Part – C) proposed to be held during April/May, 2012 subject to the convenience of all the expert members and JICA Study Team.

The meeting ended with vote of thanks to the Chair.

Appendix

First meeting of the Expert Committee for Preparation of Manual on Sewerage and Sewage Treatment Plant – Management (Part – C) held in Conference Room no. 103, Nirman Bhawan , New Delhi, 110 011 on 5th December, 2011.

List of Participants

Sl. No	Name	Designation/Department	E-mail address	Contact No
1.	Dr. Alok Kumar	Expert / JICA Study Team	[redacted]	
2.	Akira Takeuchi	Team Leader / JICA Study Team		
3	Teruo Suga	Expert / JICA Study Team		
4.	Miki Suzuki	Expert / JICA Study Team		
5.	Yoshitaka Ito	Expert / JICA Study Team		
6.	Akira Morita	Expert / JICA Study Team		
7.	Katsuzo Motegi	Expert / JICA Study Team		
8.	G. Hanumanta Rao	Expert / JICA Study Team		
9.	Kiyoshi Mizumoto	Expert / JICA Study Team		
10.	Takashi Sakakibara	Expert / JICA		
11.	Dr. R.K. Singh	Asst. General Manager (Projects), HUDCO		
12.	Dr. M. Dinakaraiyatan	Deputy Adviser (PHE), CPHEEO, MoUD		
13.	Dr. S. R. Shukla	Former Adviser (PHEE) CPHEEO, MoUD		
14.	Dr. Krishnan Balkoni	Associate Professor, IIM, Kozhikode		
15.	J. B. Ravindran	Deputy Adviser (PHE), CPHEEO, MoUD		
16.	S. Srinivasan	Senior Vice President, ILFS, Water		
17.	Dr. Zillur Rahman	Associate Professor, IIT, Roorkee		
18	Ms. Mino Sato	JICA India office, New Delhi		
19.	Sunil Chinchwade	Team Leader, CH2M HILL, Gurgaon, (HR)		
20.	Ms. Padma Kara	Support Staff, CH2M HILL		

Minutes of Second Working Group meeting (of the 1st Sub-Working Group) on Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)

The second meeting of Working Group (of the 1st Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 17th February 2012 at 10.30 A.M.

List of participants attended the meeting is appended.

Summary record of discussions held during the meeting is as follows:

At the outset, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed all the members including members of JICA Study Team, members of the working group and representatives from CH2M Hill.

Dr. Dhinadhayalan requested Dr. Shukla, Coordinator of the 1st Sub-Working Group to preside over the meeting as Chairman and initiate discussions on chapter-1 on 'Introduction', chapter-2 on 'Planning', and chapter-10 on 'Preparation of City Sanitation Plan'. Dr. Shukla thanked all the members and accepted to Chair the meeting. The Chairman started discussions on chapter in seriatim and requested Dr. Alok to give power-point presentation of chapter-1.

1. Discussions held on chapter-1 on 'Introduction' were as follows;

i) Preamble at section 1.1 should be in line with the preamble mentioned in the 'Manual on Municipal Solid Waste Management' published by the Ministry of Urban Development.

ii) In line 127 on page 1-3 "community toilets" should be added after 'public toilets.

iii) In line 231 on page 1-5 instead of Ministry of Welfare, the Ministry of Social Justice and Empowerment' be added.

iv) Sub-section 1.6.1 heading should be as 'Recent Trend – Centralized vis-à-vis Decentralized Wastewater Management Systems'.

v) Sub-section 1.6.2 title should be as 'Recent Wastewater Treatment Technologies' as approved and adopted.

vi) Para 5, 6, 7, and 8 (line no. 361 to 364) should be deleted.

vii) Under section 1.8 'RELATIONSHIP WITH OTHER SECTIONS (PART-A AND PART-B) OF PROPOSED MANUAL, following priorities be followed (from line 430 t0 432);

a. Part-A on Management,

b. Part-B on Engineering, and

c. Part-C on Operation & Management

Thereafter, from line 433, a brief about each Part needed to be emphasized with proper justifications. It should also briefly mention the objective to be achieved that was to discharge better quality of treated effluent in the receiving environment.

vii) There was a need for mentioning very important aspects of 'Septage Management' in the chapter-1 on 'Introduction'. A brief write-up on the subject, as given below, be included in the chapter at an appropriate place.

Septage Management in India

"Septage management is a new concept in India. Access to improved sanitation in urban India has risen but the management of onsite sanitation systems such as septic tanks remains a neglected component of urban sanitation and waste water management. Septage, which is a fluid mixture of untreated and partially treated solids, liquid and sludge of human or domestic origin, flows out of septic tanks and enters waterways or is generally disposed into nearest water body or low lying areas. This leads to serious health and environmental implications. This necessitates a well-defined regulation, guidelines, and management strategy for septage in the country. This septage management approach, discussed in this manual, **(proper chapter no. with sub-section may be given**), is an effort for assuming that septage is managed in a responsible, safe, and consistent manner across cities throughout the country"

viii) Section 1.10 on page 1-11 needed to be redrafted.

ix) Table 1.1 on page 1-11 needed to be revised and updated in the context of discussions held during working groups meetings.

2. Discussions on Chapter-2 on 'Planning' held were as follows;

i) A sub-section 2.1 on 'Vision' should be included as an introductory Para. The text for the matter be reproduced from section 1.5 on page 1-6 to 1-7. In line 76, the word 'sewerage systems' to be replaced with 'collection systems'.

ii) Section 2.2 'NEED FOR PLANNING' needed redrafting on the basis of suggestions made by the members during the discussions.

iii) Under section 2.3 'BASIC DESIGN CONSIDERATIONS', a sub-section 2.3.1 'City master plan' be added.

iv) In line 98 in place of 'Cost aspects' – 'Financial aspects' be substituted.

v) A new sub-section 2.3.10 on 'Geographical information system' be included.

vi) Section 2.3.5 on page 2-2 the title should be Financial Aspects.

vii) The title of sub-section 2.3.2 at d) should be 'Public-Private-Partnership'.

vii) In section 2.3.5 a new sub-para g) on 'Financial sustainability' be added.

viii) Table 2.1 should be in conformation to table as in chapter-3.

ix) Section 2.3 needed redrafting on the basis of observations listed above and suggestions made by the members wherever needed, during the meeting.

x) Section 2.4 needed redrafting keeping in view the text on the topic from the old manual incorporating G.I.S.

xi) The text of the section 2.4.8 from line 279 to 285 needed rechecking and redrafting.

xii) Section 2.5.5 'Design Effluent Quality' be shifted to chapter-7 in appropriate section.

xiii) Figure 2.1 on page 2-8 be shifted to chapter-7 in appropriate section.

xiv) Section 2.5.6 'Planning of Sewer System' needed elaboration.

xv) Section 2.10 on 'Engineering Reports and Facility Plans' was not required and be deleted.

xvi) It was decided to include the planning design period for onsite, decentralized and centralized system as 5 years, 5-15 years and 30 years respectively.

xvii) It was also decided to change the table for the design period of various components as follows. The design period of STP shall be reduced to 10 years (from base year) from the existing norm of 15 years and accordingly the pumping station and related components shall be restricted to 10 years.

xviii) The implications in adopting different planning periods preparing City Master Plan and City Development Plan (20 years) and Master plans for water supply and sewerage (30 years) were discussed. It was decided that a planning period 30 years may be adopted for the preparation of Master Plan for water supply and sewerage. However, TCPO may be requested to increase the planning period from 20 years to 30 years for the preparation of City Master Plan and CDP by CPHEEO.

xvii) As per the directives of Government of India every school in the country should have adequate and proper sanitation facilities. Bringing out this important directive a brief write-up should be drafted and added in the text of chapter-2.

3. Discussions on Chapter-10 on 'Preparation of City Sanitation Plan' held were as follows;

i) The contents of section 10.4 'Basic Planning Model' should be replaced with Annexure-II of 'National Urban Sanitation Policy' of government of India including proper figures and photographs of the Annexure-II. **(Action: Dr. Shukla)**

ii) Under section 10.5 a brief write-up be included on 'City Master Plan' indicating its importance in development of a city. **(Action: Dr. Shukla)**

iii) Table 10.1 'Sample Format for Preparing City Sanitation Plan' as referred under section 10.6 'CITY SANITATION PLAN OUTLINE' may be retained. Because;

a. Approach under section 10.4 would be as functional, whereas

b. Methodology as mentioned under Table 10.1 would help engineers to prepare DPRs on 'City Sanitation Plan'.

iv) Algorithm on 'Decision Tree: Selecting Appropriate Technical Option (On-site, Decentralized, and Conventional) as modified and finalized during the working group meeting held on 17.2.12, a reference may be made in the text of chapter-10 at suitable place and be added as an Annexure. In regard to this, a brief write up may be included.

v) Observations/comments as furnished by the representatives of GIZ and WSP in writing needed to be examined and suitably incorporated in the chapter (s).

vi) JICA Study team was also requested to incorporate the written comments forwarded earlier by the different members of the working groups in the respective chapters.

While concluding the meeting, Member-Secretary requested to all the members to forward their observations & comments, if any, to C.P.H.E.E.O. and CH2M Hill within the next 10 days positively so as to finalize the draft for putting up to the Expert Committee meeting for its approval during the second fort-night of March 2012.

The meeting ended with a vote of thanks to the Chair.

Annexure

The second meeting of Working Group (of the 4th Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 17th February 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No.
1.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
2.	Shri B. B. Uppal	Ex. Dy. Adviser (PHE) CPHEEO, MoUD		
3.	Shri S.T. Gopalram	Joint Chief Engineer, TWADB, Chennai		
4.	Shri R. Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
5.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
6.	Dr. A.A. Kazmi	Associate Professor, I.I.T., Roorkee		
7.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
8.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
9.	Dr. Alok Kumar	JICA Study Team		
10.	Mr Kiyoshi Mizutune	JICA Study Team		
11	Mr Akira Takechi	JICA Study Team		
12.	Dr.S.Saktheeswaran	JICA Study Team		
13.	Dr.S.Sundaramoorthy	JICA Study Team		

1st WG (Chap 1,2,10) - S

S. No.	Name	Designation & Address	E-mail address	Contact No.
14.	Mr Katsuzo Motegi	JICA Study Team	[redacted]	
15.	Mr Guillermo Madariaga	JICA Study Team		
16.	Mr Teruo Suga	JICA Study Team		
17.	Mr Takashi Sakakipara	JICA Expert, JICA		
18.	Ms. Emi Doyle	Program Specialist, JICA		
19.	Mr Shital Chinchwade	Team Leader (Planning)		
20.	Ms. Padma Kara	CH2M Hill		
21.	Mr Vivek Raman	WSP		
22.	Ms. Vaishali Nandan	GIZ		
23.	Ms. Sweta	GIZ		

Minutes of Second Working Group meeting (of the 2nd Sub-Working Group) on Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)

The second meeting of Working Group (of the 2nd Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at Conference Hall, Foyer, YMCA Tourist Hostel, Jai Singh Road, New Delhi 110-001 on 13th February 2012 at 10.30 A.M.

List of participants attended the meeting is appended.

Summary record of discussions held during the meeting is as follows.

At the outset, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed all the members including members of JICA Study Team, members of the working group and representatives from CH2M Hill. He mentioned that during the Expert Committee meeting held during August 2011, it was decided that since the manual under preparation was to be used under Indian conditions, it should have the flavor of local scenario prevailing in the country with applications of recent advancement in Sewerage and Sewage Treatment technologies based on design standards and norms prescribed by the government to preserve the environment.

In order to follow this objective it was decided in consultation with JICA and the Ministry of Urban Development to appoint an Indian Expert Team to assist JICA Study Team in drafting the manual. The assignment has been given to Dr. S. Sundaramoorthy, Member of the Expert Committee keeping in view of his vast experience and expertise in the field of Environmental Engineering, and his competency to fulfill the challenging assignment within prescribed time-frame.

Dr. M. Dhinadhayalan requested Mr. R Sethuraman, Coordinator of the 2nd Sub-Working Group to preside over the meeting as Chairman and initiate discussions on Chapter-3 on Design & Construction of Sewers and Chapter-4 on Design & Construction of Sewage Pumping Stations. Mr. R Sethuraman thanked all the members and accepted to Chair the meeting.

Mr. Akira Takechi, Leader of JICA Study Team, acknowledged efforts of the C.P.H.E.E.O., Ministry of Urban Development and JICA in approving the proposal for drafting of the manual by Indian Team headed by Dr. Sundaramoorthy. He also expressed his satisfaction about the progress made by Dr. Sundaramoorthy and his team for accomplishing such a gigantic task in bringing first draft of the manual within the limited time and conditions.

While initiating discussions, the Chairman requested Dr. S. Sundaramoorthy & his team and other members to initiate discussions on the subject. At the outset, , Dr. Sundaramoorthy introduced his team members, Dr. Saktheeswaran, Environmental Engineering Expert and Mr. Vasudevan, (Retired Chief Engineer), Bangalore Water Supply & Sewerage Board, (Karnataka), as Electrical Engineering Expert for their contribution in preparing the draft of the manual. He also mentioned about the association of a few students of I.I.T., Chennai in drafting the manual. Thereafter, he requested Dr. Alok of the JICA Study Team to proceed with a power-point presentation of the draft Chapter-3 on Design & Construction of Sewers.

During power-point presentation of the Chapter-3, members of the 2nd Working Group offered their views and observations, which were accepted and clarified by Dr. S. Sundaramoorthy. Discussions held during the meeting were summarized as follows;

1. At the beginning, Dr. S. Sundaramoorthy mentioned that basic structure of the old manual (1993) was followed in drafting the chapters and wherever updating and revisions were necessary keeping in view recent advancement in technologies and approaches practiced in other countries which are considered to be suitable under local conditions have been adopted in drafting the chapters of the manual.

2. The table of contents on Pumping Mains in chapter-3 may be shifted to chapter-4.

3. Table 3.3 may be deleted as it had no significance in present context.

4. While discussing Para 3.30 'Measurement of Flow in Existing Drains/Sewers, it was decided that more practical conditions prevailing in the country might be adopted for measurement of flow in drains and buried sewers. Most of the existing sewers were outdated in the country and therefore a practical approach considering various formulae and methods needed to be adopted.

5. While discussing Para 3.12 'Materials, Shapes and Sizes of Sewers', members were of the view that certain portions of the sub-sections needed redrafting keeping in view of materials used and standards/specifications followed and also to avoid any legal complications at a later date.

6. Dr. S. Sundaramoorthy was of the view that modern method such as ultrasonic method be adopted for measurement of flow in sewers which was more reliable and easy in its application.

7. Since rehabilitation of existing sewers is a very important aspect in view of projects approved under JNNURM it is considered necessary to adopt techno-economic feasible approach in this regard and therefore suitable technology be described for the purpose.

8. Testing of sewer lines needed to be elaborated using various methods which are more suitable under different conditions.

9. Applications of vacuum and pressurized sewers needed proper justification for their uses under Indian conditions as they appear to be more complex.

10. Application of trench-less technology for laying sewers under different conditions with its techno-economic feasibility compared to open trench methods be elaborated adequately with supporting diagrams in the text.

11. Design period for laying of sewers and construction of pumping stations is an important issues and hence it needs to be addressed considering various geographical and local conditions.

12. Some members suggested that the minimum dia of 200 mm shall be recommended instead of 150 mm dia which has been recommended in the existing manual. However, the Chairman as well as other members mentioned that increasing the minimum size of

sewers from 150 to 200 mm will further reduce the velocity in the initial reaches, as even in the 150 mm size the self cleansing velocity is not able to be achieved, because of which flushing of sewers in the initial reaches has been suggested. In this regard, it was decided that Mr. D.P.Sing will carry out one case study for a project area and come out with techno-economic feasibility in adopting the minimum dia and the same would be discussed in the Expert Committee meeting which would decide the minimum dia to be recommended in the manual. **(Action: Mr. D.P. Singh)**

13. As mentioned in section 3.15.2 regarding inadequate velocity in sewers results in generation of excess hydrogen sulphide gas (H2S) and its generation is depended on the temperature inside the sewer. Members of the working group were of the opinion since this is a very important criteria needed to be included in design of sewers with minimum velocity, a short write-up be included in the text of the chapter.

(Action: Mr. D. P. Singh)

14. There was a suggestion that peak-factor should be based on the classification of towns i.e. depending upon the present population and designed population of towns under consideration.

15. It was suggested by members that proper percentage of infiltration and exfiltration be shown in a tabular form for different areas under consideration for design of sewers.

16. Proper coating materials which are resistant to corrosion under various adverse conditions be mentioned, preferably in a tabular form.

17. There was a need to prioritize sewerage system and sewage treatment viz. wastewater collection system, transportation of collected wastewater, its treatment at desired level and standard and finally safe disposal of ~~the~~ treated effluent. All these aspects have to be incorporated in the DPR for implementation of the project in a more effective and efficient manner.

18. It was decided that information on duration vs. intensity of rainfall would be furnished and forwarded to JICA Study Team. **(Action: Dr. Ramakant)**

19. An illustrative sketch of a deep man-hole and photograph of leaping weir be included in the draft chapter at appropriate place. **(Action: JICA Study Team)**

20. It was mentioned that a soft copy for the design of wastewater lift stations would be furnished by the member. **(Action: Mr. B. B. Uppal)**

21. It was unanimously decided to include guidelines prescribed by the NRCD (MoEF) and TCPO (MoUD) for public and community toilets. **(Action: C.P.H.E.E.O.)**

22. Norms for public toilets also be obtained from B.I.S. **(Action: B.I.S.)**

23. Working group members were of the view that priority and phasing of construction of various components of sewerage and sewage treatment plant were necessary during planning and construction period and therefore a brief write-up be included in the text for the guidance of planners and implementers.

(Action: Mr. S T Gopalram)

Discussions on Chapter-4

1. It was decided that a typical drawing of a wet-well with all proper specifications be included in the chapter. **(Action: JICA Study Team)**

2. A separate drawing depicting submersible pump-set used in sewerage system be furnished and included in the chapter. **(Action: JICA Steady Team)**

3. The Chairman mentioned that detailed observations and comments were already forwarded to CH2M Hill for consideration and the same be got examined by the JICA Study Team for inclusion in the respective chapters.
(Action: CH2M Hill & JICA Study Team)

Summing-up;

While summing up the discussions held during the meeting, the Chairman desired that;

1. His observations and comments as mentioned above sent to CH2M Hill be duly considered while drafting chapters 3 and 4. **(Action: JICA Study Team)**

2. Dr. S. Sundaramoorthy was requested to redraft sections and sub-sections of chapters 3 & 4 as per the suggestions made by members incorporating all modifications in the text.
(Action: JICA Study Team)

3. Wherever necessary and as suggested by the members latest BIS standards and specifications be referred to in the text. **(Action: JICA Study Team)**

4. Necessary design and drawing and sketches of various components, including graphs, charts etc. as discussed in the meeting may also be included in the draft chapters. **(Action: JICA Study Team)**

Concluding the meeting, the Member-Secretary requested ~~to~~ all the members to forward their observations & comments, if any, to C.P.H.E.E.O. and CH2M Hill within the next 10 days positively so as to finalize the draft for placing before the Expert Committee meeting for its approval during the second fort-night of March 2012.

The meeting ended with a vote of thanks to the Chair.

Appendix

Meeting of Working Group (of the 2nd Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', held at Conference Hall, Foyar, YMCA Tourist Hostel, Jai Singh Road, New Delhi 110-001 on 13th February 2012 at 10.30 A.M.

List of Participants

S. No.	Name	Designation & Address	E-mail address	Contact No.
1.	Shri R. Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
2.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
3.	Shri D. K. Agrawal	Scientist 'F', B.I.S.		
4.	Shri Nazimuddin	Sr. Env. Engineer Scientist 'D'		
5.	Shri B. B. Uppal	Ex. Dy. Adv. (PHE) C.P.H.E.E.O., MoUD		
6.	Shri H. C. Landge	Chief Engineer, MJP Mumbai		
7.	Shri S.T. Gopalrawm	Joint Chief Engineer, TWADB, Chennai		
8.	Shri D. P. Singh	Ex. Chief Engineer, U.P. Jal Nigam		
9.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
10.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
11.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
12.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
13.	Dr. R. Girish Pophali	NEERI, Nagpur		

S. No.	Name	Designation & Address	E-mail address	Contact No
14.	Dr. Alok Kumar	JICA Study Team	[redacted]	
15.	Mr Kiyoshi Mizutune	JICA Study Team		
16.	Mr Akira Takechi	JICA Study Team		
17.	Dr.S.Saktheeswaran	JICA Study Team		
18.	Dr.S.Sundaramoorthy	JICA Study Team		
19.	Mr Katsuzo Motegi	JICA Study Team		
20.	Mr Guillermo Madariaga	JICA Study Team		
21.	Mr Takashi Sakakipara	JICA Expert, JICA		
22.	Mr Teruo Suga	JICA Study Team		
23.	Mr R. Vasudevan	Retd. Chief Engineer, BWSS Board, Bangalore		
24.	Mr Shital Chinchwade	Team Leader (Planning)		
25.	Mr Padma Kara	CH2M Hill		
26.	Mr L. Thiyagarajan	Deputy Chief Engineer, TWAD Board, Chennai		

Minutes of Second Working Group meeting on Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)

The second meeting of Working Group (3rd Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at Conference Hall, Foyer, YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 14th February 2012 at 10.30 A.M.

List of participants attended the meeting is appended.

Summary record of discussions held during the meeting is as follows:

At the outset, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed all the members including members of JICA Study Team, members of the working group and representatives from CH2M Hill. He mentioned that during the Expert Committee meeting held during August 2011, it was decided that since the manual under preparation was to be used under Indian conditions, it should have the flavor of local scenario prevailing in the country with applications of recent advancement in Sewerage and Sewage Treatment technologies based on design standards and norms prescribed by the government to preserve the environment.

In order to follow this objective it was decided in consultation with JICA and the Ministry of Urban Development to appoint an Indian Expert Team to assist JICA Study Team in drafting the manual. The assignment has been given to Dr.S. Sundaramoorthy, Member of the Expert Committee keeping in view of his vast experience and expertise in the field of Environmental Engineering, and his competency to fulfill the challenging assignment within prescribed time-frame.

Dr. M. Dhinadhayalan requested Dr. Vinod Tare, Coordinator of the 3rd Sub-Working Group to preside over the meeting as Chairman and initiate discussions on Chapter-5 on Design & Construction of Sewage Treatment Plants and Chapter-6 on Design & Construction of Sludge Treatment Facilities. Dr. Tare thanked all the members and accepted to Chair the meeting.

Mr. Takechi, Leader of JICA Study Team, acknowledged efforts of the C.P.H.E.E.O., Ministry of Urban Development and JICA approving the proposal for drafting of the manual by Indian Team headed by Dr. Sundaramoorthy. He also expressed his satisfaction about the progress made by Dr. Sundaramoorthy and his team for accomplishing such a gigantic task in bringing draft manual under such limited conditions as mentioned above.

While initiating discussions, the Chairman requested Dr. S. Sundaramoorthy & his team and other members to start discussions on the subject. At the beginning, Dr. Sundaramoorthy introduced his team members, Dr. Saktheeswaran, Environmental Engineering Expert and Mr. Vasudevan, (Retired Chief Engineer), Bangalore Water Supply & Sewerage Board, (Karnataka), as Electrical Engineering Expert for their contribution in preparing the draft of the manual. He also mentioned about association of few I.I.T. Chennai students who were closely associated in drafting the manual. Thereafter, he requested Dr. Alok of the JICA Study Team to proceed with a power-point presentation of the draft chapter-5 on Design & Construction of Sewage Treatment Plants.

During power-point presentation of the chapter-5, members of the 3rd Working Group offered their views and observations, which were accepted and clarified by the Author. Discussions held during the meeting were summarized as follows;

1. At the beginning, Dr. S. Sundaramoorthy mentioned that basic structure of the old manual (1993) was followed in drafting the chapters and wherever updating and revisions were necessary keeping in view recent technologies and approaches practiced in other advanced countries which were suitable under Indian conditions.

2. Members were of the opinion that;

i) Table 5.2 'General discharge standards' on page 5-3 may be deleted.
ii) Figure: 5.8 'Fixed film synthetic media filters should be more clear in synthetic filter media zone.
iii) Table: 5.4 'General treatment efficiencies of conventional treatment processes' may be modified as decided during the meeting.
iv) Table: 5.5 'Loading of land costs at stated percentage of capitalized costs of STPs' be deleted.
v) Sections: 5.4, 5.5, 5.6, 5.6.1 up to 5.6.6, may be deleted.
vi) Section 5.6.7 may be shifted to multistoried arrangements.
vii) Table: 5.7 'Settling velocities and surface overflow rates for ideal grit chamber at 10 deg. C' may be modified as decided.
viii) Section 5.13.3 'Flow Equalization' may be deleted.
ix) Under Para 5.14.3 'Types of Settling', a para may be added on design of settling tank.
x) Table: 5.9 'Design parameters for clarifiers' needed review and modifications.
xi) Section: 5.14.6.9.2 'The Equipment Free Clarifier' was a technology developed by NEERI, Nagpur on a bench scale model for which NEERI got it patented. Since this was not yet proven technology that could be applied at large scale, members were of the view it could not be included in the manual.
xii) Section: 5.15.1.6.4.5. 'Surface Aerators' needed redrafting.
xiii) Section: 5.15.1.6.4.6 'Mixing Requirements' needed redrafting keeping in view EPA guidelines.
xiv) Section: Operations' may be shifted to O & M Manual.
xv) Table: 5.12 'Characteristics and design parameters of activated sludge systems for sewage' may be shifted to design section.
xvi) Figure: 'Illustrative depiction of a biologically chocked media in an immobilized carrier' may be deleted.
xvii) Section: 5.15.4.6 'Operation and Maintenance' be shifted to O & M Manual.
xviii) Members were of the opinion that while designing sewage treatment plants, following steps with a brief write-up be mentioned in the chapter;
- Functional design
- Hydraulic design, and
- Structural design

xix) Standard of treated effluent discharged into natural receiving bodies be stringent as per guidelines fixed by the local authorities.
xx) While designing sewage treatment plants, design period should be calculated based on base year and gestation period.

xxi) Due to scarcity of land availability in cities and towns, possibilities of commissioning multistoried systems be explored.

xxii) UASB technology for domestic wastewater treatment was not feasible due to various technological and economical reasons and therefore should not be recommended.

xxiii) Standards notified by NRCD (MoEF) regarding total and feacal coli-form in the treated effluent quality be mentioned in the chapter.

xxiv) Members of the opinion that few solved examples on the topic be given in the Box in the chapter write-up instead of in annexure.

3. Dr. Tare made a power-point presentation on effluent standards regarding coliform removal adopting tertiary treatment as presented in MoEF regarding water quality in Ganga River.

4 The members were very much concerned about the biological contamination (faecal coliform) of surface water bodies which are being used as source of drinking water. The existing manual recommended various sewage treatment technologies suiting to the effluent standards notified by the statutory authorities in the country. However, no discharge standards have been notified for meeting requirement for total and faecal coliforms by these authorities. As the secondary treated sewage (effluent from secondary treatment plant) containing high level of faecal coliform, which results into biological contamination of water bodies, it was decided by the working group that the technological options for treating the secondary treated wastewater up to tertiary level be recommended in the manual as the faecal coliform level in the tertiary treated effluent will be very low as compared to secondary effluent and the same can be treated by disinfection (chlorination). It was decided that this option can be recommended only for the effluent which is disposed in into water bodies which are source of drinking in the downstream. The cost aspects were also discussed. The capital cost for setting up of tertiary plant and O&M cost for chlorinating the tertiary treated effluent would further increase by additional 15 to 20%. It was also decided that wherever, the sewage treated up to tertiary level, this can be reused for various consumptive uses.

5. Member were also concerned about the disposal of effluent from the tertiary treatment plant at the same location were untreated sewage is discharged. Thus, the vary purpose of treating sewage up to tertiary level was defeated. And therefore, it was suggested that manual should recommend construction of interceptor sewers for transportation of sewage up to the sewage treatment plant.

6. With the permission of the Chairman, the Author requested Mr. Vasudevan, Retired Chief Engineer, Bangalore Water Supply & Sewerage Board, who was an electrical engineering expert to give a power-point presentation on Electrical and Instrumentation. Mr. Vasudevan in his power-point presentation gave an example of a typical 11 KV/415V indoor KIOSK installed in one of the sewage treatment plants in Bangalore. He broadly explained the system layout as depicted in Figure: 5.47 'Typical electrical single line diagram for 11KV/415V transformer station with indoor KIOSK on 11 KV side showing connection to D.G. panel, symbol descriptions and notes'. The power-point presentation made by Mr. Vasudevan was appreciated by the members. It was requested to Mr. Vasudevan to provide detailed information about various capacities of sewage treatment plants and electrical machinery and instrumentation required in a tabular form. Mr. Vasudevan agreed to furnish desired information. **(Action: Mr. Vasudevan)**

7. Mr. Thyiagarajan, Deputy Chief Engineer, TWAD Board, Chennai with the permission of the Chairman gave a power-point presentation on design of sewer networks including location of pumping stations using field data as per design given in the old manual. The soft-ware was prepared using Excel program with application of branch approach. It was decided that possibility of using this soft-ware in the proposed manual be explored and be accommodated in the text where ever feasible. Mr. Thyiagarajan agreed to provide the software developed by TWAD Board for its application by field engineers.

Action: Mr. Thyiagarajan)

JICA Study team was also requested to incorporate the written comments forwarded earlier by the different member of the working group in the aforesaid chapter.

While concluding the meeting, Member-Secretary requested to all the members to forward their observations & comments, if any, to C.P.H.E.E.O. and CH2M Hill within the next 10 days positively so as to finalize the draft for putting up to the Expert Committee meeting for its approval during the second fort-night of March 2012.

The meeting ended with a vote of thanks to chair.

Appendix

Meeting of Working Group (of the 8th Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at Conference Hall, Foyer, YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 14th February 2012 at 10.30 A.M.

List of Participants

S. No.	Name	Designation & Address	E-mail address	Contact No
1.	Dr. Vinod Tare	Professor, I.I.T., Kanpur		
2.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
3.	Shri D.K.Agrawal	Scientist 'F', B.I.S.		
4.	Shri Nazimuddin	Sr. Env. Engineer Scientist 'D'		
5.	Shri B. B. Uppal	Ex. Dy. Adv. (PHE) C.P.H.E.E.O., MoUD		
6.	Dr. R.K.Singh	D.G.M.(Projects) HUDCO		
7.	Shri S.T. Gopalrao	Joint Chief Engineer, TWADB, Chennai		
8.	Shri R.Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
9.	Shri D. P. Singh	Ex. Chief Engineer, U.P. Jal Nigam		
10.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
11.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
12.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
13.	Dr. A.A. Kazmi	Associate Professor, I.I.T., Roorkee		
14.	Dr. R. Girish Pophali	NEERI, Nagpur		

S. No.	Name	Designation & Address	E-mail address	Contact No.
15.	Dr. A. K. Nema	Associate Prof. I.I.T., Delhi		
16.	Shri C. Lallunghnema	Jt. Secy. (Tech.) P.H.E.D. Mizoram		
17.	Dr A. K. Dhussa	Director, MNRE, New Delhi		
18.	Dr. Alok Kumar	JICA Study Team		
19.	Mr Kiyoshi Mizufune	JICA Study Team		
20.	Mr Akira Takechi	JICA Study Team		
21.	Dr.S.Saktheeswaran	JICA Study Team		
22.	Dr.S.Sundaramoorthy	JICA Study Team		
23.	Mr Katsuzo Motegi	JICA Study Team		
24.	Mr Guillermo Madariaga	JICA Study Team		
25	Mr Takashi Sakakipara	JICA Expert, JICA		
26.	Mr Teruo Suga	JICA Study Team		
27.	R. Vasudevan	JICA Study Team		
28.	Mr L. Thiyagarajan	Deputy Chief Engineer, TWAD Board, Chennai		
29.	Mr Shital Chinchwade	Team Leader (Planning)		
30.	Ms Padma Kara	CH2M Hill		

Minutes of Second Working Group meeting (of the 3rd Sub-Working Group) on Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)

The second meeting of Working Group (of the 3rd Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at Conference Hall, Foyer, YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 15th February 2012 at 10.30 A.M.

List of participants attended the meeting is appended.

Summary record of discussions held during the meeting is as follows:

At the outset, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed all the members including members of JICA Study Team, members of the working group and representatives from CH2M Hill. He mentioned that though the draft chapter-6 on Design & Construction of Sludge Treatment Facilities was slated for 14th February 2012 was to be discussed under the chairmanship of Prof. Tare but due to time constraints it could not be discussed on the same day. And, therefore, it was taken up along with other chapters were to be discussed on 15th February 2012.

Dr. Dhinadhayalan requested Prof. Kazmi, Coordinator of the 4th Sub-Working Group to preside over the meeting as Chairman and initiate discussions on Chapter-6 on Design & Construction of Sludge Treatment Facilities along with other chapters – chapter-7 on Recycle and Reuse of Sewage, chapter-8 on Onsite Sanitation and chapter-9 on Emerging Trends which were scheduled for two days i.e. on 15th & 16th February 2012. Prof. Kazmi thanked all the members and accepted to Chair the meeting. He was also glad to shoulder additional responsibility of discussing chapter-6.

1. Discussions held on chapter-6 on Design & Construction of Sludge Treatment Facilities and observations made by the members were as under;

i) Disposal of sludge in metro and other big cities is posing a big problem in India. Composting can be a feasible option but due to its less demand, alternative technologies can be suggested. If stringent regulations could be adopted, like in Japan, it could be incinerated and incinerated sludge in the form of ash could be used for construction materials such as bricks for partition, tiles for pavement of roads, etc. Another option would be solar or heat drying. Dried sludge not only reduce the handling and transportation cost but also can be used either as a fertilizer or used for burning in brick kilns as a low calorific value fuel. **Dr. Kazmi has provided literature on solar drying.**

ii) It was also suggested that dewatered sludge could be mixed with grinded organic municipal solid waste and could be used as a good soil conditioner (compost). However, this process needed proper policy guidelines, stringent regulations and standards and above all community awareness.

iii) It was also suggested that guidelines for disposal of sewage sludge as followed and practiced in advanced country like U.K. it might be suitably modified for its application in India.

2. Some of the important observations made by members were as follows;

i) Table 6.1 'Design guidelines for sludge quantities in biological STPs' be corrected and modified as discussed during the meeting.

ii) In Table: 6.3 'Typical application of sludge pumps', Hazen's value 'c' for wastewater and different types of sludge be included.

iii) Section 6.1.3.7 'Requirement of Standby Units' needs elaboration with 100% standby units.

iv) In section 6.3.1.8.9 'Measuring Devices' add flow and sludge density meter for plants more than 1 MLD.

v) Lines from 387 to 391 be shifted before line 420.

vi) Before Table 6.7 explain about functional loading and hydraulic loading.

vii) Table 6.7 & Table 6.8 be merged together.

viii) Table 6.9 'Mass balance of solids in sludge – primary and excess activated sludge, before and after high rate digestion (per capita per day basis). This table needed modifications as discussed during the meeting. **Dr. Kazmi shall provide the relevant information.**

viii) Under Para 6.5.6.2 'Digester Shape and Size' a photograph of Egg Shaped digester be included.

ix) In section 6.5.11 'Gas Collection and Storage' some photographs be included.

x) In Section 6.5.11.2 'Storage (Gas Holder) a brief write-up with photograph of HDPE gas holders be given.

xi) After section 6.7.3.6 add a small write-up on construction of sludge drying bed in high rainfall areas in the country.

xii) Sections 6.8.3.1 'Filtration', 6.8.3.2 'Dewatering by Compression', and 6.8.3.3 'Centrifugal Separation' be shifted to O & M manual.

xiii) Section 6.8.7 'Belt Press' a mention be made about "enclosed with U.V. cover.

xiv) In Section 'SLUDGE DISPOSAL' following points be highlighted;

a. sludge water removal,
b. every batch of sludge treatment,
c. sludge storage yard and detention period.

xv) Title of section 6.10.2.2 should be 'Sludge Storage Yard (covered)'. This could be multilayer or multistoried with solar drying green house system. Drawing of the arrangements be included.

xvi) Storage yard capacity might be 5 to 7 days.

xvii) Table 6.13 'Piping materials' be modified as per suggestion made and specify standard color coding of pipes with direction in the table.

xviii) The title of the section 6.12 should be 'Reconstruction/Rehabilitation of Sludge Treatment Facilities'. A design with factual data of the entire plant with its drawing be given.

xix) Under section 6.13.3 'Utilization of Dried Sludge' a reference from U.S.E.P.A. be made.

xx) The Working Group members of the view that patented system which are not in the public domain should not be given or referred in the manual. Examples of only those systems which were in the knowledge in public domain be incorporated in the manual.

xxi) Design of SBR system with all specifications along with drawing should also be included in the manual. **(Already provided by Dr. A. A. Kazmi)**

xxii) It was also desired that land area and power requirement for various units for treating per MLD of sewage be included in a tabular form.

3. It was decided by the members that it would be more appropriate to include Section 9.3 of the draft chapter at the end of section 6.13 and section 6.14 with the title 'Advances in Sludge Treatment'

4. As it had already mentioned earlier Para 1 (ii), that mixing of treated sludge with grinded municipal solid wastes and converted into compost and methane gas may be environmentally and economically viable solution. For the purpose Dr. Nema had agreed to furnish a write up for its inclusion in the chapter. (**Action: Dr. A. K. Nema)**

5. Dr. Tare made a power-point presentation on effluent standards regarding coliform removal adopting tertiary treatment as presented in MoEF regarding water quality in Ganga River.

6. The members were very much concerned about the biological contamination (faecal coliform) of surface water bodies which are being used as source of drinking water. The existing manual recommended various sewage treatment technologies conform to the effluent standards notified by the statutory authorities in the country. However, no discharge standards have been notified for meeting requirement for total and faecal coliforms by these authorities. As the secondary treated sewage (effluent from secondary treatment plant) containing high level of faecal coliform, which results into biological contamination of water bodies, it was decided by the working group that the technological options for treating the secondary treated wastewater up to tertiary level be recommended in the manual as the faecal coliform level in the tertiary treated effluent will be very low as compared to secondary effluent and the same can be treated by disinfection (chlorination). It was decided that this option can be recommended only for the effluent which is disposed in into water bodies which are source of drinking in the downstream. The cost aspects were also discussed. The capital cost for setting up of tertiary plant and O&M cost for chlorinating the tertiary treated effluent would further

increase by additional 15 to 20%. It was also decided that wherever, the sewage treated up to tertiary level, this could be reused for various consumptive uses.

7. JICA Study team was also requested to incorporate the written comments forwarded earlier by the different members of the working groups in the respective chapters.

While concluding the meeting, Member-Secretary requested to all the members to forward their observations & comments, if any, to C.P.H.E.E.O. and CH2M Hill within the next 10 days positively so as to finalize the draft for putting up to the Expert Committee meeting for its approval during the second fort-night of March 2012.

The meeting ended with a vote of thanks to the Chair.

Annexure

The second meeting of Working Group (of the 4th Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at Conference Hall, Foyer, YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110 001 on 15th February 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No.
1.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
2.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
3.	Shri Nazimuddin	Sr. Env. Engineer Scientist 'D'		
4.	Dr. R.K.Singh	D.G.M.(Projects) HUDCO		
5.	Shri S.T. Gopalrao	Joint Chief Engineer, TWADB, Chennai		
6.	Shri R. Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
7.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
8.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
10.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
11.	Dr. Vinod Tare	Professor, I.I.T., Kanpur		
12.	Dr. A. K. Nema	Associate Prof. I.I.T., Delhi		
13.	C. Lallunghnema	Jt. Secy. (Tech.) P.H.E.D. Mizoram		
14.	Dr. Alok Kumar	JICA Study Team		
15.	Kiyoshi Mizufune	JICA Study Team		

3rd WG (Chap 6) - 5

S. No.	Name	Designation & Address	E-mail address	Contact No.
16.	Akira Takechi	JICA Study Team	[redacted]	
17.	Dr.S.Saktheeswaran	JICA Study Team		
18.	Dr.S.Sundaramoorthy	JICA Study Team		
19.	Katsuzo Motegi	JICA Study Team		
20.	Guillermo Madariaga	JICA Study Team		
21.	Takashi Sakakipara	JICA Expert, JICA		
22.	Teruo Suga	JICA Study Team		
23.	Shital Chinchwade	Team Leader (Planning)		
24.	Padma Kara	CH2M Hill		

Minutes of Second Working Group meeting (of the 4th Sub-Working Group) on Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)

The second meeting of Working Group (of the 4th Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 16th February 2012 at 10.30 A.M.

List of participants attended the meeting is appended.

Summary record of discussions held during the meeting is as follows:

At the outset, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed all the members including members of JICA Study Team, members of the working group and representatives from CH2M Hill.

Dr .M. Dhinadhayalan requested Prof. Kazmi, Coordinator of the 4th Sub-Working Group to preside over the meeting as Chairman and initiate discussions on chapter-7 on Recycle and Reuse of Sewage, chapter-8 on Onsite Sanitation and chapter-9 on Emerging Trends which were scheduled for two days i.e. on 15th & 16th February 2012. Prof. Kazmi thanked all the members and accepted to Chair the meeting. The Chairman started discussions on chapter in seriatim and requested Dr. Alok to give power-point presentation of chapter-7.

1. Discussions held on chapter-7 on 'Recycle and Reuse of Sewage' as follows;

i) In India recycle and reuse was considered under non-organized sector and therefore a brief write-up on following aspects be included in section-1 'Introduction'

a. Overview of current practices adopted in the country and else where, and
b. Guiding principles for recycle and reuse of sewage in the country.

ii) A table regarding waste water reuse suitable under Indian conditions be prepared on the basis of U.S.E.P.A. table on the subject with proper modifications.
(Already provided by Dr. Kazmi)

iii) In section 7.9 'Other users' industrial-cooling be specified.

iv) Indian experiences in 'Recycling and Reuse' such as CPCL in Chennai and GMR in Delhi could be suitably added with flow diagrams.

v) It was decided Dr. Tare in association with Dr. Kazmi would furnish a brief write-up on 'Recycle and Reuse' highlighting Indian experiences. **(Draft write up is already provided by Dr. Kazmi, pl. include suggestions of Prof. Tare, Prof. C.N. Haas and Prof. takashi Asano)**

vi) It was decided that the successful case studies either be incorporated at the end of the chapter or be added at Annexure.

vii) The working group decided that design of 'Leaping Weir' could be taken from the old manual (1993).

viii) Members were of the opinion that 'Bioremediation of Open Drains' carrying sewage does not fall under the scope of sewerage technologies. By adopting this process, meant virtually converting open natural drains which were supposed to carry only storm water, into open sewers. And, therefore, this technology was not recommended.

(ix) The working group members were of the opinion that guidelines for discharge of treated sewage should be included in the manual preferably in a tabular form giving chemical and biological standards for use of treated sewage for agriculture purposes and discharging into open surface water bodies which were normally the sources of bathing and drinking water. **(Already provided on draft write-up of recycling and reuse)**

2. Discussions held on draft Chapter-8 'On-Site Methods' and views expressed by the members were as follows:

i) The title of the chapter should be 'On-Site Sanitation' instead of 'On-Site Methods' as indicated.

ii) Figure 8.1 'Domestic wastewater treatment system' should be limited to the 1 MLD capacities and should be transferred to a new chapter on 'Decentralized wastewater treatment System' proposed to be included in the manual.

iii) On-site sanitation systems were interim measures till a decentralized or a full sewerage system was recommended and adopted.

iv) Heading of section 8.2 should be 'Interim Measures' and under this section various methods in vogue should be described with a proper caution to protect ground water and surface water pollution due to indiscriminate disposal of waste water from these on-site units. Stringent effluent standards be adopted and applied for the discharge waste water from such units.

v) For providing adequate space for laying of sewer lines, construction of pumping stations and land for construction of treatment plants are required for decentralized and centralized wastewater treatment systems, the Town Planning Department of the respective should make necessary provisions for such systems and be consulted by the executing agencies.

vi) Section 8.2.4 be deleted. Instead a brief about Abolition of Manual Scavenging Act, 1993 be added.

vii) Under section 8.3.1 'Conventional Septic Tank'. It was suggested that effluent from septic tanks should be discharged into a lined channel constructed along with storm water drain as an interim measure .till a proper sewerage system was laid. Outfall from such drains should be connected to a decentralized or centralized wastewater treatment system. A brief write-up on the subject be included in the chapter. **In addition, advanced septic tanks such as anaerobic baffled reactor or settling+ anaerobic**

filter type systems should be encouraged. Dr. Kazmi will provide write-up on package septic tank – Anaerobic filter type system.

viii) Under section 8.4.5.2 'Sludge Treatment Facility' it was suggested that a sub-section 8.4.5.2.1 on 'Treatment of sludge at Independent Sewage Treatment Plant' be included.

ix) Dr. Tare gave a very nice and informative power-point presentation on 'On-Site Sanitation with Zero Discharged Toilets'. The system developed was very useful from the following view points;

a. Water required only for abolition purpose to be treated.
b. The units of toilet can be used ranging from a single user to number of users and could be designed and constructed accordingly.

c. Unit (s) was a mobile type and could be easily transported from one place to other.

d. Effluent coming out from the unit could be used for horticulture purposes.

e. Solids from the unit which was digested could be used as organic manure.

It was decided by the working group this technology could be included in the manual because of its advantages as mentioned above. Dr. Tare was advised to give a brief write-up along with design and diagram for its inclusion in the manual. Dr. Tare accepted request made by the members. **(Action: Dr. Tare already provided information)**

3. Discussions on draft chapter-9 'Emerging Trend' and observations made by the members were as follows:

i) The heading of section 9.2 should be 'Recent Technologies in Sewage Treatment' instead of 'Sewage Treatment Technologies as mentioned. This section from page no. 9-1 to 9-54 up to subsection 9.2.16.6 be shifted to Chapter-6 on 'Sewage Treatment' with following observations which was more appropriate for the text to be included in its proper place;

a. Under table 9.1 at page 9.3 word 'Advanced/ should be substituted with 'Recent Technologies'.

b. Section 9.2.3.4 needed redrafting in context of removal of colloidal particles.

c. Tables 9.4, 9.7, 9.8, 9.9, and 9.10 needed modifications on the basis of views expressed by members.

d. Table 9.9 (on page 9-4) should maintain sequences as mentioned in Table 9.1.

e. Figure 9.12 on page 9-17 should be deleted.

f. Section 9.2.4 should be rewritten as 'Anaerobic-anoxic-oxic (A2O) Process (combined biological and phosphorous removal).

g. Figure 9.15 should include membrane out side.

h. It was decided to include a brief write-up on SBR (3 Types) in the manual. Dr. Kazmi was willing to forward the desired text on the subject.**(Action: Dr. Kazmi already provided).**

i. It was decided to delete lines 903, and a portion of line 931 and 932 wherein company's name had been mentioned.

j. Figure 9.21 should have the correct reference.

k. Sections from 9.2.14 to 9.2.14.6 be deleted.

l. Section 9.2.15 'Ozone Disinfection' should be included at the end of Chapter-6 and a comparative statement with other disinfections, in a tabular form should be included in the text.

m. Lines nos. 1592 and 1592 should be deleted

n. Section 9.2.18 (page 9-57) to section 9.2.18.6 (page 9-60) should be deleted.

o. Tabular design information and sample calculations of advanced treatment systems shall be provided by Dr. Kazmi

4. In view of discussions on draft chapter-9, it was observed that the sequences of various sections and sub-sections needed updating.

5. It was suggested by few of the members during the meeting that a chapter on 'Decentralized Wastewater Management System (DWMS)' should be added as a new additional chapter in the manual. The suggestion was accepted unanimously for adding a new chapter on DWMS after the chapter-5 on 'Design and Construction of Sewage Treatment Plants' (or at an appropriate place in the manual) thus make a total of 11 chapters in the manual. **Dr. Kazmi shall provide the information on advanced on-site systems and package plants**

6. JICA Study team was also requested to incorporate the written comments forwarded earlier by the different members of the working groups in the respective chapters.

While concluding the meeting, Member-Secretary requested to all the members to forward their observations & comments, if any, to C.P.H.E.E.O. and CH2M Hill within the next 10 days positively so as to finalize the draft for putting up to the Expert Committee meeting for its approval during the second fort-night of March 2012.

The meeting ended with a vote of thanks to the Chair.

Annexure

The second meeting of Working Group (of the 4th Sub-Working Group) on 'Preparation of the Manual on Sewerage and Sewage Treatment – Engineering (Part – A)', was held at YMCA Tourist Hostel, Jai Singh Road, Near Jantar Mantar, New Delhi 110-001 on 16th February 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No.
1.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
2.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
3.	Shri Nazimuddin	Sr. Env. Engineer Scientist 'D'		
4.	Dr. R.K.Singh	D.G.M.(Projects) HUDCO		
5.	Shri S.T. Gopalrao	Joint Chief Engineer, TWADB, Chennai		
6.	Shri R.Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
7.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
8.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
9.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
10.	Dr. Vinod Tare	Professor, I.I.T., Kanpur		
11.	Dr. A. K. Nema	Associate Prof. I.I.T., Delhi		
12.	C. Lallunghnema	Jt. Secy. (Tech.) P.H.E.D. Mizoram		
13.	Dr. Alok Kumar	JICA Study Team		
14.	Mr Kiyoshi Mizufune	JICA Study Team		

S. No.	Name	Designation & Address	E-mail address	Contact No.
15.	Mr Akira Takechi	JICA Study Team	[redacted]	
16.	Dr.S.Saktheeswaran	JICA Study Team		
17.	Dr.S.Sundaramoorthy	JICA Study Team		
18.	Mr Katsuzo Motegi	JICA Study Team		
19.	Mr Guillermo Madariaga	JICA Study Team		
20.	Mr Teruo Suga	JICA Study Team		
21.	Shital Chinchwade	Team Leader (Planning)		
22.	Padma Kara	CH2M Hill		

No.Q-16011/1/2007-CPHEEO
Government of India
Ministry of Urban Development
(CPHEEO)

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Nirman Bhawan, New Delhi
Dated: 17th April, 2012

Sub: **Minutes of the final meeting of the Expert Committee for finalization of pre-final draft of updating and revision of the Manual on Sewerage & Sewage Treatment: Part A (Engineering).**

Please find enclosed a copy of the minutes of the final meeting of the Expert Committee for finalization of pre-final draft of Updating and Revision of the manual on Sewerage and Sewerage Treatment: Part - A (Engineering) held under the Chairmanship of Dr. S. R. Shukla, Former Adviser (PHEE), CPHEEO, Ministry of Urban Development during **26th to 28th March 2012** in Hotel 'The Royal Plaza', Ashoka Road, New Delhi, 110 001 for information and necessary compliance.

It is requested that all the suggested action points as brought out in the minutes may kindly be complied with and views/comments/suggestions forwarded to the Ministry latest by **25th April 2012** for necessary follow up.

Encl: As above

(Dr. M. Dhinadhayalan)
Deputy Adviser (PHE) & Member Secretary
Tel. No.011-23061571
Fax No.011-23062482
Email : mdheen@gmail.com

To

As per list enclosed

Copy submitted for information to:

(i) PS to Joint Secretary (UD), Ministry of Urban Development, Nirman Bhawan.
(ii) PS to Director (LSG), Ministry of Urban Development, Nirman Bhawan.

(Dr. M. Dhinadhayalan)
Deputy Adviser (PHE) & Member Secretary
Tel. No.011-23061571

Copy to:

(i) Ms. Emi Doyle, JICA Representative, JICA India Office, New Delhi
(ii) Team Leader, JICA Study Team

Dr. M. Dhinadhayalan)
Deputy Adviser (PHE) & Member Secretary
Tel. No.011-23061571

MINUTES OF THE FINAL MEETING OF THE EXPERT COMMITTEE FOR FINALIZATION OF PRE-FINAL DRAFT OF UPDATING AND REVISION OF THE MANUAL ON SEWERAGE AND SEWAGE TREATMENT: PART-A (ENGINEERING)

Final meeting of the Expert Committee for finalization of pre-final draft of Updating and Revision of the manual on Sewerage and Sewerage Treatment: Part - A (Engineering) was held under the Chairmanship of Dr. S. R. Shukla, Former Adviser (PHEE), CPHEEO, Ministry of Urban Development on **26th to 28th March 2012** at 10.30 A.M. in hotel 'The Royal Plaza', Ashoka Road, New Delhi, 110 001.

The list of participants attended the meetings on 26th, 27th and 28th March 2012 is enclosed as annexures to the minutes of the meetings for three days.

At the outset the Chairman welcomed all the members of Expert Committee and briefly highlighted about initiatives taken by the C.P.H.E.E.O. Ministry of Urban Development, Government of India in association with JICA, JICA Study Team, and CH2M HILL (India) Pvt. Ltd. in preparation of the pre-final draft within a period for the last one and half year. He appreciated untiring efforts put in by Expert Committee members along with the JICA Study Team and Dr. Sundaramoorthy and his team and who extended their continued support in preparation of pre-final draft of the manual which was a challenge to accomplish such a gigantic task within prescribed short time frame.

The Chairman pointed out that there are 10 chapters in this pre-final draft document and keeping in view the task of finalizing draft of these chapters within a period of three days time, he requested expert members to be brief in discussions and offer their views, comments, observations in a more precise and constructive manner so as to finalize draft at the end of third day.

In order to initiate discussions on the pre-final draft the Chairman suggested tentative agenda agreed by expert members as follows;

<u>On 26th March 2012:</u>

1. Chapter-2 - 'Planning'
2. Chapter-3 – 'Design and Construction of Sewers', and
3. Chapter-10 – 'Preparation of City Sanitation Plan'

<u>0n 27th March 2012:</u>

4. Chapter – 4: 'Design and Construction of Sewage Pumping Stations'
5. Chapter – 5: 'Design and Construction of Sewage Treatment Facilities'
6. Chapter – 6: 'Design and Construction of Sludge Treatment Facilities' and
7. Chapter – 9: 'Decentralized Sewerage System"

<u>On 28th March 2012:</u>

8. Chapter – 7: 'Recycling and Reuse of Sewage'
9. Chapter – 8: 'On-site Methods' and
10. Chapter – 1: 'Introduction'

Discussions were held on the chapters as per the agenda on each day and action taken on observations and suggestion made by each of the expert members were incorporated in the pre-final draft so as to finalize the draft keeping in view the policy and practices of Government of India and how best this manual could be made user friendly for the service engineers giving due regard to techno-economic feasibility of various technologies to be adopted under local urban Indian conditions. The most important aspect was given a very serious and important consideration was the 'Health of the Community in Urban Areas in the Country'.

Keeping the above objectives in view, following procedures were adopted and adhered to in finalizing the pre-final draft and action to be taken by the respective expert member;

i) Wherever grammatical mistakes, typographical errors, minor corrections in formulae were observed in text of the chapters; same have been corrected and incorporated as far as possible during discussions by Dr. Alok Kumar of JICA Study Team (hereafter including Dr. Sundaramoorthy and his team will be referred as JICA Study Team).

ii) There were some additions, alterations, deletions, modifications in the text of the chapters; same have been duly incorporated wherever necessary by the JICA Study Team.

iii) There were instances where shifting of some lines or sub-section from a chapter(s) to a more appropriate place in the same chapter or to some other chapter were observed necessary; the same have been incorporated to the extent possible by the JICA Study Team.

iv) It was also observed and deliberated in details during the meeting that in order to have a more elaborate and meaning full approach to be adopted during the finalization of the draft to make the manual more useful; it was decided that appropriate additions by way of a small writ-up be prepared by respective expert(s) and same may be incorporated at suitable portion(s) of the text of the chapter(s). The expert(s) who agreed to furnish the write-up as required has been mentioned in the minutes.

Keeping in view the above approaches, the minutes of the meetings have been drafted as under per the agenda mentioned above.

26th March 2012: DAY – 1.

List of participants is enclosed at Annexure-I

1. Chapter – 2 - 'Planning'

i) As mentioned above, actions were taken to incorporate necessary modifications in the text of the chapter as required. **(Action: JICA Study Team)**

ii) Since Figure 2.1 is appearing at a more appropriate place in the chapter on 'Decentralized Sewerage System', same may be deleted. **(Action: JICA Study Team)**

iii) Section 2.3 needs redrafting and sub-section 2.4.3 (d) 'Odor and Mosquito Nuisance' be shifted to chapter-5. **(Action: JICA Study Team)**

iv) Table 2.1 'Design period of sewerage components' required modifications based on the discussions on the subject held at length during the meeting. Some of the expert members of the view that design period of various components of sewerage system has a direct implications on the cost of the project and therefore in order to have an economical approach the design period of each component of the sewerage system needed careful consideration. It was decided during the meeting that members may forward their comments in writing to C.P.H.E.E.O. for taking decision on a more appropriate design period of the components so as to arrive at a logical figures keeping in view various compelling circumstances.

(Action: Members of EC, CPHEEO. And JICA Study Team)

v) Section 2.8 'Laying of Sewer System' be inserted under section 2.10 as first Para and a reference of chapter-7 may be mentioned under section 2.9.

(Action: JICA Study Team)

vi) Under section 2.13.1.7 a proper sentence regarding utilization of incinerated sludge be added at e). **(Action: JICA Study Team)**

vii) The table on Service level benchmarks for sewerage and Sewage Treatment brought out by the Ministry shall be included under the sub-heading 2.14.2 Feasibility Report stating that every DPR formulated by the State Govt./ULB shall include existing benchmarks and proposed benchmarks after implementation of the scheme.

2. Chapter – 3 'Design and Construction of Sewers'

i) Procedure for modification of chapter – 2 as mentioned under Para 1.i), the same action plan was adopted for Chapter – 3 as well.

ii) Table 3.1 was deleted and in its place a reference of 2.5 could be made, after proper modification, was suggested. **(Action: JICA Study Team)**

iii) Tables 3.2, 3.3, and 3.5 need small modifications and same could be incorporated, as suggested by the members. **(Action: JICA Study Team)**

iv) Section 3.8 heading should be 'Industrial Effluent', and the text of the Para under 3.8 needs modification specifying industrial effluent discharge standards for discharging in to sewers, water bodies and on land. It was agreed by a member to forward a brief write-up on the subject for its inclusion in section 3.8.

(Action: Mr. Nizamuddin, CPCB & JICA Study Team)

v) Table 3.6 needed little modifications to be incorporated. **(Action: JICA Study Team)**

vi) Para 3.11.3 and 3.11.4 along with the figures and details of non-conventional sewer system may be given as a cross reference in chapter-9 on 'Decentralized Sewerage Systems'. **(Action: JICA Study Team)**

vii) Text of the Para under section 3.12.4 'Stoneware or Vitrified Clay' needs to be re-drafted in a more positive manner as given in the old manual (1993).

(Action: JICA Study Team)

viii) Para 3.12.8.1 needs to be redrafted as per the old manual (1993). An additional section as 3.12.8.3 on 'Structured Wall Pipes' may be added with the latest ISI code of practice. ISI code of practices may also be given for other pipes such as HDPE, GRP, and FRP. **(Mr. Agrawal, BIS and JICA Study Team)**

ix) The heading of the Table 3.10 should be 'Design velocities to be ensured in gravity sewers'. After the text under Para 3.15.2 the reference may be given. Under section 3.15.3 a small write-up may be added regarding controlled measures to be adopted to dissipate energy in drop man holes**.** **(Action: JICA Study Team)**

x) Table 3.12 to be modified as per the manual on Water Supply and Treatment (2nd edition) published by the Ministry of Urban Development. **(Action: JICA Study Team)**

xi) Table 3.13 should be brought below Figure 3.12. **(Action: JICA Study Team)**

xii) Table 3.14 in column Maximum Slope (%) instead Slope in ration be given. Table 3.15 needs verification and modifications according to the values of n and c given in the manual on water supply and treatment, as referred above, as suggested by the members and reference be given under the table. **(Action: JICA Study Team)**

xiii) Line nos. from 1168 to 1170 on page 3-34 of the pre-final draft are repetition as these statement already appeared on page 3-27 and therefore statement on page 3-34 be deleted and Para above line nos. deleted be suitably redrafted and modified.

(Action: JICA Study Team)

xiv) Various scales adopted for various plans and drawing needs to be suitably modified and table need to be prepared accordingly. **(Action: JICA Study Team)**

xv) Dr. Nema, Professor, I. I. T., Delhi member of the Expert Committee mentioned that I. I. T., Delhi had already developed 'Window Based Software for the Design of Sewer Network' for the Ministry of Urban Development and it needs further updating / modification to enable the field engineers for its easy adoption. This software would serve as an important user friendly tool to field engineers for economical design of sewer network. He further mentioned that some more expenditure will be involved for finalization of the software. Ms. Emi Doyle, JICA, New Delhi representative requested

that the proposal of financial requirement for the finalization of software may be prepared by IIT, Delhi and forwarded to JICA, New Delhi through CPHEEO, Ministry of Urban Development for further necessary action. **(Action: Dr. Nema, C.P.H.E.E.O., JICA)**

xvi) Under section 3.57.1 'Laying of Pipe Sewers' pipe materials from the old manual (1993) be reproduced in addition to structured walled pipes, AC pipes, HDPE and PVC along with the text already in the section 3.57.1. **(Action: JICA Study Team)**

xvii) It was suggested that under section 3.62 and 3.63 following may be added;

a. A conceptual diagram with reference, and

b. Laying, jointing and testing of all types be included under the section preferably in a tabular form. **(Action: JICA Study Team)**

xviii) Statements under Para 3.67.21 'Sewer Rehabilitation' may be deleted. **(Action: JICA Study Team)**

xiv) It was informed by Mr. Agrawal, expert member from BIS that all relevant BIS references needed to be updated in all the chapter of the manual wherever applicable. JICA Study Team agreed that they will sit with him and update all the BIS references as mentioned in the chapters of the manual. **(Mr. Agrawal and JICA Study Team)**

3. <u>Chapter-10: 'Preparation of City Sanitation Plan'</u>

i) In line 54 on page 10-2 instead of Management of sewerage, Management of sewage be written. **(Action: JICA Study Team)**

ii) Under section 10.4.2.7 'Technical Options' in line 413 on page 10-11 a reference be made to chapter on 'On-Site Sanitation' for such technologies. **(Action: JICA Study Team)**

iii) In line 425 and 426 the sentence starting from –see for instance be deleted. **(JICA Study Team)**

iv) In Figure 10.2 'Decision Tree: Selecting the Technical Option (Onsite, Decentralized or Conventional Systems)' technologies such as Zero Discharge Toilet System (ZDTS) and JACKSHOU be mentioned in appropriate boxes. **(Action: JICA Study Team)**

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27TH MARCH 2012: DAY – 2

List of participants is enclosed at Annexure-II

During the second day of the meeting i.e. on 27th March 2012 following four chapters were discussed as per the agenda;

1. Chapter – 4: 'Design and Construction of Sewage Pumping Stations'

2. Chapter – 5: 'Design and Construction of Sewage Treatment Facilities'

3. Chapter – 6: 'Design and Construction of Sludge Treatment Facilities' and

4. Chapter – 9: 'Decentralized Sewerage System"

Methodology for finalization of the pre-draft of the above chapters adopted as similar to the procedures as described in Para i) to iv) on page 2. However, wherever some specific issues relating to additions, deletions, alterations, and modifications are required suitable action plans have been suggested as a follow up action in order to finalize the draft of the manual: Part-A (Engineering) to the extent possible.

Chapters discussed in seriatim are as under;

1. Chapter – 4: 'Design and Construction of Sewage Pumping Stations'

i) Various action points as described in section 4.1.3 'Measures for Safety and Environmental Protection' should be given in bullet form. **(Action: JICA Study Team)**

ii) Figure 4.12 under section 4.18 'Lift Stations' needs to be redrawn to make the figure more clear and legible to read dimensions more clearly. **(Action: JICA Study Team)**

iii) Table 4.3 to be modified as discussed. Figures (a) and (b) under section 4.21 'Anti Vortex' to be mentioned in a large scale to make them clearer.
Action: JICA Study Team)

2. Chapter – 5: 'Design and Construction of Sewage Treatment Facilities'

i) Table 5.1 'Per capita contribution of human waste per day' the unit of human waste generated should be given as gm / day, and the table needs explanations referring to the book authored by Prof. Arceiwala. Foot notes below the table may be deleted. However under the foot notes, the design value of per capita BOD generation and SS along with proper justification shall be mentioned. **(Action: JICA Study Team)**

ii) The text of section 5.1.2 'Raw Sewage Characteristics' be suitably modified and placed as a foot note under table 5.1. **(Action: JICA Study Team)**

iii) Figure 5.4 title should be 'Process flow sheet of conventional aerobic sewage treatment' and may substituted from the old manual (1993). **(Action: JICA Study Team)**

iv) A new sub-section 5.2.1 ‘Anaerobic treatment processes’ before sub-section 5.2.2 be included. Figure 5.7 ‘Fixed film synthetic media filters’ on page 5-6, the media used as shown should be specified as virgin media (not be recycled media) as HDPE and PVC.
(Action: JICA Study Team)

v) Before section 5.2.4 ‘Stabilization Ponds’ a new sub-section with the heading ‘Various Anaerobic Treatment Processes’ be included. Figure 5.11 be deleted. A new sub-section 5.2.6 ‘Facultative treatment processes be added. **(Action: JICA Study Team)**

vi) Figure 5.13 on page 5-10 be shifted to the chapter on ‘Sludge Treatment’, and text of the section 5.3 be shifted at the end of chapter 5. The title of section 5.3 should be ‘Secondary Biological Treatment Process’. **(Action: JICA Study Team)**

vii) Table 5.3 is modified as discussed during the meeting. Various secondary treatment processes shall be brought under this heading as discussed. Dr. Dhinadhayalan informed that the Ministry of Urban Development has brought out an Advisory note on ‘Recent Trends in Technologies in Sewerage System”. Since the approach for the new technologies have been brought out in the note the text from line No. 459 on page 5-12 upto line No.513 at page 5-13 describing the approach may be deleted. However, the technologies recommended in the note shall be taken note of in the Manual. The heading of the sub-section 5.3.1 should be ‘Optimization of Land Area Requirement for Sewage Treatment Plants’. Text under sub-sections 5.3.7 and 5.3.8 be modified considering bypass after PST under extreme emergency and should be recorded under intimation to regulatory authority.
(Action: JICA Study Team)

viii) Text under section 5.6 refers to nutrient removal need to be modified suitably under this section. Under sub-section 5.6.2 ‘Grit Removal’ 100 per cent stand-by grit removal chamber with mechanical or manual systems be included in the text.
(Action: JICA Study Team)

ix) Basic or typical design criteria for Hydraulic regimen of vortex grit separators as specified by vendors be mentioned and included under sub-section 5.6.2.5 ‘Vortex Type Units’. Prof. Kazmi agreed to supply material for inclusion. **(Action: Prof. Kazmi)**

x) Sub-section 5.7.4.2.4 ‘Depth and Detention Time’ in the text should also mention about design parameters such as BOD and SS for PST. The table 5.6 should be modified keeping in view suggestion made during the meeting.
(Action: JICA Study Team)

xi) Figure 5.31 on page 5-49 may be deleted as it is a repetition. Equations (5.28) on page 5-53 and (5.29) on page 5-55 be corrected and modified as discussed. Under sub-section 5.8.1.7.5.4 ‘Diffused Aeration’ system to reduce air temperature from blower to aeration tank along with case studies and actual results and duration of monitoring in respect of temperature profile in aeration tank along with blower capacity and dimensions of aeration tank have been agreed to furnish by Dr. Girish Pophali.
(Dr. Girish Pophali and JICA Study Team)

xii) Sub-section 5.8.1.7.5.10 ‘Excess Sludge Wasting’ needs more elaboration and modification in the text. **(Prof. Kazmi and Prof. Tare)**

xiii) Under sub-section 5.9.5 'Relative Aspects of Disinfection Processes' a table 5.16 on page 5-92 needs expansion incorporating techno-economic and other details in the table. A write-up including table of disinfection efficiencies and update of graphs of river Ganges in figures 5.44 and 5.45 be furnished by Prof. Tare for their inclusion in the text.
(Action: Prof. Tare and JICA Study Team)

xiv) The heading of sub-section 5.10.1 to be written as Desirable Guidelines for Discharge of Treated Sewage into Water Source used for Supply of Drinking Water. The standards notified by CPCB/MOEF shall be included in the table for general discharge. Justification for stringent nitrogen, phosphorus and faecal coliforms for new STPs appears necessary where treated sewage discharge leads to water bodies for use as drinking water sources present and prospective. Availability of various treatment processes shall be mentioned. Examples like the STPs of BWSSB built under JICA Phase-I for stringent nitrogen and phosphorous in the treated sewage shall also be cited.
(Action: JICA Study Team)

xv) The title of sub-section 5.11.4 should be 'Back-up Power Supply' in the line 3738 in place of diesel generators back-up power supply mentioned. **(JICA Study Team)**

xvi) Under section 5.15 'Recent Technologies in Sewage Treatment' a small write-up needs to be prepared and included. **(Prof Kazmi, Prof Tare and JICA Study Team)**

xvii) Figure 5.63 on page 5-138 may be deleted. **(Action: JICA Study Team)**

3: Chapter – 6: 'Design and Construction of Sludge Treatment Facilities'

i) Table 6.1 and 6.2 needed to be redone based on actual findings in the fields. Prof. Kazmi and Prof. Tare agreed to modify tables accordingly. **(Prof. Kazmi and Prof. Tare)**

ii) Under the text of sub-section 6.3.1.7 'Requirement of Standby Units' whether thickening of sludge by mechanical dewatering is proposed, should be highlighted in the text. Under sub-section 6.3.1.8 'Pump Appurtenances' Prof. Kazmi agreed to furnish a table for different types of pumps for taking decisions by the design engineers.
(Prof. Kazmi and JICA Study Team)

iii) On page 6-10 at appropriate place a schematic diagram of anaerobic gas holders be furnished with a conceptual sketch of anaerobic gas digester.
(Action: JICA Study Team)

iv) Figures 6.8 on page 6-46 and 6.9 on page 6.47 be deleted. A write-up incorporating the use of polyelectrolyte system with proper doses for thickening of sludge along with 15 to 25 per cent extra space required for sludge drying bed be included in the text at a proper place in sub-section 6.8.9 on page 6-51. **(Action: JICA Study Team)**

v) Title of section 6.13 be rewritten as 'Upgrading and Retrofitting of Sludge Treatment Facilities'. **(Action: JICA Study Team)**

4: Chapter – 9: 'Decentralized Sewerage System"

i) The title of chapter-11 (of pre-final draft) should be 'Decentralized Sewerage System', and section 11.1 be shifted to chapter-1 on 'Introduction'. The definition of decentralized system under a typical situation in which decentralized sewerage system is recommended shall be included. **(Action: JICA Study Team)**

ii) In table 11.2 norms for public toilets are required to be mentioned in the table as per T.C.P.O. norms of Government of India. **(Action: Dr. Dhinadhayalan)**

iii) The text from lines 395 to 403 on page 11-13 needs to be modified as discussed in the meeting considering such facilities to be provided for different genders, age group, and for disabled persons. **(Action: JICA Study Team)**

iv) Section 11.9 'Dealing with Septage' and section 11.10 'Logistics of Septage Collection' be shifted to chapter on 'Onsite Method'. **(Action: JICA Study Team)**

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28TH MARCH 2012: DAY – 3

List of participants is enclosed at Annexure-III

During the third & final day of the meeting held on 28th March 2012 wherein following three chapters were discussed as per the agenda;

1. **Chapter – 7: 'Recycling and Reuse of Sewage'**
2. **Chapter – 8: 'Onsite Methods'' and**
3. **Chapter – 1: 'Introduction'**

Methodology for finalization of the pre-draft of the above chapters adopted as similar to the procedures as described in Para i) to iv) on page 2. However, wherever some specific issues relating to additions, deletions, alterations, and modifications are required suitable action plans have been suggested as a follow up action in order to finalize the draft of the manual: Part-B (Engineering) to the extent possible.

Chapters discussed in seriatim are as under;

1. Chapter – 7: 'Recycling and Reuse of Sewage'

i) Under sub-section 'Overview of Current Practices Adopted in India' in sub-Para g) metropolitan cities like Mumbai, Bangalore, and Delhi be mentioned.
(Action: JICA Study Team)

ii) I.C.A.R., Government of India standards for the reuse of sewage giving full information in tabular form be prepared and added at a proper place in the text of the chapter.
(Action: B.B.Uppal and JICA Study Team)

iii) A brief write-up on various usages of treated sewage for urban, agricultural and industrial specifying details of standards for such uses be added in the text of the chapter at proper place. **(Action: Prof. Kazmi and JICA Study Team)**

iv) Table 7.4 on page 7-27 and table 7.11 on page 7-38 values indicated therein be corrected and modified. **(Action: JICA Study Team)**

2. Chapter – 8: 'Onsite Methods'

i) Text of section 8.1 and sub-section 8.1.1 needed to be modified and redrafted as per the discussions during the meeting. Under sub-section 8.1.2.3 including up-flow anaerobic filters and back flow filter with a modified write-up may be added in the text.
(Action: Prof. Kazmi and JICA Study Team)

ii) Text of the section 8.2 'Abolition of Manual Scavenging Act, 1993, needed modifications incorporating recent amendments in the Act. It was proposed to modify the text with a brief to be furnished **(Action: Dr. Dhinadhayalan and JICA Study Team)**
iii) A brief write-up on advanced septic tanks prepared by Prof. Kazmi be included under sub-section 8.3.4.7 'Up-flow Anaerobic Filter'.
(Action: Prof. Kazmi and JICA Study Team)

3. <u>Chapter – 1: 'Introduction'</u>

i) The text of the section 1.1 'Preamble' should be inline with the preamble as of the Manual on Municipal Solid Waste Management published by the Ministry of Urban Development, Government of India. **(Action: Dr. Shukla and JICA Study Team)**

ii) Wherever the word 'wastewater' in the text of chapter-1 appears should be substituted with 'sewage'. **(Action: JICA Study Team)**

iii) Under sub-section 1.2.2 'Present scenario of urban sanitation in India' a brief write-up on 'Status of existing sewerage facilities in India' be included.
(Dr. Dhinadhayalan and Dr. Shukla)

iv) Existing first Para of sub-section 1.2.2 be shifted under sub-section 1.2.3 'Impact of Poor Sanitation' and a brief write-up on loss to the nation may also be included.
(Action: Dr. Shukla and JICA Study Team)

v) Recently modified Liberation of Manual Scavenging Act (1993) be included in sub-section 1.4.2. **(Dr. R.K.Singh and Dr. Dhinadhayalan)**

vi) The text under sub-section 1.4.3 may be deleted. **(Action: JICA Study Team)**

vii) Under section 1.8 lines 403 to 405 should be modified as below;

(i) Part – A on Engineering
(ii) Part – B on Operation & Management, and
(iii) Part – C on Management.

viii) Section 1.9 along with the table should be deleted. **(Action: JICA Study Team)**

ix) It was decided in the meeting that the Chapter – 1 on 'Introduction' should be re-written incorporating the followings important points:

(i) Preamble from manual on MSW,

(ii) Objective of the Millennium Development Goal,

(iii) Need of the present manual,

(iv) A brief on Service Level Bench Marks for Sewage Management as mentioned in the Handbook on Service Level Benchmarking published by the Ministry of Urban Development, Government of India, 2008 and the table indicating benchmarks shall be reflected under heading 2.14.4 of Chapter-2.
(Action: Dr. Dhinadhayalan, Dr. R. K. Singh, and Dr. Shukla)

On the last final day of the meeting CPHEEO has mentioned that 'Editorial Committee' will be constituted to edit the entire text of the draft manual so as to maintain uniformity and continuity and a proposal will be put up for the constitution of the editorial committee to the Ministry for its approval. **(Action: CPHEEO)**

While concluding the meeting on its third and final day, the Chairman expressed his sincere thanks to all the Expert Members of the Committee in accomplishing the gigantic task within such a short period. He particularly expressed his gratitude to the JICA Study Team who extended their fullest support in achieving the objective.

The Chairman expressed his thanks to CPHEEO, Ministry of Urban Development for nominating him as a member-cum-cochairman of the Expert Committee for updating and revision of the Manual on Sewerage and Sewage Treatment. He expressed his gratitude to the JICA for extending financial support in this endeavor and managing one study tour to Tokyo, Japan during November 2011 for a group of expert members of the committee to get a first hand information regarding how the sewerage and sewage treatment systems being implemented in Japan and how best it could be replicated in India under local conditions.

The Chairman was thankful to representatives of JICA (India) and CH2M HILL (India) Pvt. Ltd. for providing all the logistic support in the preparation of the final draft of the manual and also extending their full cooperation for making the visit of expert members to Japan a success. He thanked the management of the hotel The Royal Plaza for providing such an excellent venue for conducting the meeting for three days.

The meeting ended with a vote of thanks to the Chair.

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Annexure-I

The Final Meeting of the Expert Committee for finalization of the Pre-final draft of Updating and Revision of the Manual on Sewerage and Sewage Treatment: Part- B (Engineering) held at the hotel The Royal Plaza, Ashoka Road, New Delhi on 26th March 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No
1.	Shri M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
2.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
3.	Shri B. B. Uppal	Ex. Dy. Adviser (PHE), CPHEEO, MoUD		
4.	Dr. A. K. Nema	Associate Professor, I.I.T. Delhi		
5.	Shri R.Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
6.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
7.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
8.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
9.	Dr. Alok Kumar	JICA Study Team		
10.	Shri Kiyoshi Mizufune	JICA Study Team		
11	Akira Takechi	JICA Study Team		
12.	Dr.S.Saktheeswaran	JICA Study Team		
13.	Dr.S.Sundaramoorthy	JICA Study Team		
14.	D. K. Agrawal	Scientist 'F', B.I.S., New Delhi		
15.	D. P. Singh	Chief Engineer(Rtd.), U.P.Jal Nigam		

16.	Dr. R. K. Singh	Dy. G.M. Project, HUDCO	[redacted]
17.	Takashi Sakakipara	JICA Expert, JICA	
18.	Ms. Emi Doyle	Program Specialist, JICA	
19.	Dr. Hemant C. Landge	Chief Engineer, M.J.P., Mumbai	
20.	C. Lallunghaema	Jt. Secretary, P.H.E.D., Mizoram	
21.	Shri Nizamuddin	Sr. Env. Engineer, CPCB	
22.	Dr. Girish R. Pophali	Senior Scientist, NEERI, Nagpur	
23.	Ms. Padma Kara	CH2M Hill	
24.	Shri Shital Chinchwade	Team Leader (Planning)	

Annexure-II

The Final Meeting of the Expert Committee for finalization of the Pre-final draft of Updating and Revision of the Manual on Sewerage and Sewage Treatment: Part- B (Engineering) held at the hotel The Royal Plaza, Ashoka Road, New Delhi on 27th March 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No
1.	M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
2.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
3.	A. K. Dhussa	Director, MNRI, Govt. of India		
4.	Dr. A. K. Nema	Associate Professor, I.I.T. Delhi		
5.	R.Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
6.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
7.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
8.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
9.	Dr. Alok Kumar	JICA Study Team		
10.	Kiyoshi Mizutune	JICA Study Team		
11.	Akira Takechi	JICA Study Team		
12.	Dr.S.Saktheeswaran	JICA Study Team		
13.	Dr.S.Sundaramoorthy	JICA Study Team		
14.	Dr. Vinod Tare	Professor, I.I.T., Kanpur		
15.	D. P. Singh	Chief Engineer(Rtd.), U.P Jal Nigam		
16.	Dr. R. K. Singh	Dy. G.M. Project,		

S. No.	Name	Designation & Address	E-mail address	Contact No.
		HUDCO	[redacted]	
17.	Takashi Sakakipara	JICA Expert, JICA		
18.	R. Vasudevan	Retired Chief Engr. B.W.S.S.B.		
19.	C. Lallunghaema	Jt. Secretary P.H.E.D., Mizoram		
20.	Nizamuddin	Sr. Env. Engineer, CPCB		
21.	Dr. Girish R. Pophali	Senior Scientist, NEERI, Nagpur		
22.	Padma Kara	CH2M Hill		
23.	Shital Chinchwade	Team Leader (Planning)		

Annexure-III

The Final Meeting of the Expert Committee for finalization of the Pre-final draft of Updating and Revision of the Manual on Sewerage and Sewage Treatment: Part- B (Engineering) held at the hotel The Royal Plaza, Ashoka Road, New Delhi on 28th March 2012 at 10.30 A.M.

List of participants

S. No.	Name	Designation & Address	E-mail address	Contact No
1.	M. Dhanabalan	C.E. (Retd.), TWAD Board, Chennai		
2.	Dr. Ramakant	Asstt. Adviser (PHE), C.P.H.E.E.O., MoUD		
3.	Dr. Vinod Tare	Professor, I.I.T., Kanpur		
4.	Dr. A. K. Nema	Associate Professor, I.I.T. Delhi		
5.	R.Sethuraman	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
6.	Dr.M.Dhinadhayalan	Deputy Adviser(PHE) C.P.H.E.E.O., MoUD		
7.	Dr. S.R.Shukla	Ex. Adviser (PHEE) C.P.H.E.E.O., MoUD		
8.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
9.	Dr. Alok Kumar	JICA Study Team		
10.	Kiyoshi Mizutune	JICA Study Team		
11.	Akira Takechi	JICA Study Team		
12.	Dr.S.Saktheeswaran	JICA Study Team		
13.	Dr.S.Sundaramoorthy	JICA Study Team		
14.	D. K. Agrawal	Scientist 'F', B.I.S., New Delhi		
15.	D. P. Singh	Chief Engineer(Rtd.), U.P.Jal Nigam		

S. No.	Name	Designation & Address	E-mail address	Contact No.
16.	Dr. R. K. Singh	Dy. G.M. Project, HUDCO	[redacted]	
17.	Takashi Sakakipara	JICA Expert, JICA		
18.	Ms. Emi Doyle	Program Specialist, JICA		
19.	V. K. Chaurasia	Dy. Adviser (PHE), CPHEEO		
20.	C. Lallungha erna	Jt. Secretary, P.H.E.D., Mizoram		
21.	Nizamuddin	Sr. Env. Engineer, CPCB		
22.	Dr. Girish R. Pophali	Senior Scientist, NEERI, Nagpur		
23.	Padma Kara	CH2M Hill		
24.	Shital Chinchwade	Team Leader (Planning)		

Minutes of the Meeting for finalization of Draft of the Manual on Sewerage and Sewage Treatment (PART-C on Management)

The Third Meeting of the Expert Committee for finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-C on Management) was held under the chairmanship of Dr. S.R.Shukla, Co-chairman of the Expert Committee in the Hotel Royal Plaza, Ashok Road, New Delhi on **10th and 11th September 2012** at 10 AM.

The list of participants is appended.

Following are the brief of discussions held during the meetings.

The meeting was to be chaired by Ms. Veena, Director (LSG), Ministry of Urban Development, Government of India, she was unable to chair the meetings due to her pre-occupation in urgent Government commitments. Under the circumstances, Dr. Dhinadhayalan, Deputy Adviser (PHE) & Member Secretary suggested Dr. S. R. Shukla, Former Adviser (PHEE), Member & Co-chairman of the Expert Committee to preside over the meeting. Dr. Shukla accepted the suggestion with the consent of other Expert Members and agreed to chair the meetings.

The meeting started with the brief introduction of each Expert Member present in the meeting. Initiating the discussions, chairman briefly highlighted importance of management in sewerage sector. He mentioned that waster supply and sanitation sector in India considered as a welfare sector which is a non-remunerative sector and therefore in order to judge the effectiveness and efficiency of the sector on the basis of cost-benefit ratio one should consider the cost-effectiveness instead. The management of the sector on cost-effectiveness is a very important and sensitive subject and therefore all the concerned agencies must be very careful in implementation of the sanitation program as a whole considering all the aspects of management on a long term sustainable basis.

Thereafter, the chairman suggested that since this meeting was for two days so out of 10 chapters contained in the draft manual, the Expert Committee might consider at least 5 chapters on first day depending upon availability of the time. Keeping in view the time factor during the discussions, following chapters were discussed in seriatim during two days of the meeting;

Day-1, 10th September 2012

1. Chaper-1 on Introduction
2. Chapter-2 on Legal Framework
3. Chapter-3 on Institutional Framework and Capacity Building, and
4. Chapte-4 on Financing and Financial Management

Day-2, 11th September 2012

5. Chapter-5 on 'Public – Private – Partnership (P-P-P)'
6. Chapter-6 on 'Community Participation'
7. Chapter-7 on 'Asset Management'
8. Chapter-8 on 'Management Information System (MIS)'
9. Chapter-9 on 'Environmental Impact Assessment (EIA)', and
10. Chapter-10 on 'Disaster Management'

At the outset, the chairman requested Dr. Alok Kumar of the JICA Study Team (JST) to make a brief presentation of above chapters so as to initiate discussions on the subjects contained in the text of each of the chapters.

1. It is pertinent to mention that suggestions and views offered by expert members for each chapter during the discussions regarding title of the chapter, sections and sub-sections of chapters, small modifications in the text of the chapters etc have been incorporated by the JST during presentation of chapters. The JST was also suggested wherever the text of section or sub-section is lengthy and descriptive the same should be written in the bullet form so as to make it more effective and easily understandable. However, some of the important additional observations made on chapter are mentioned in the minutes as under. **(Action – JST)**

2. Expert members were of the views that each chapter needed redrafting particularly emphasizing importance of the aspect spelt out in the chapter in the context of Indian situations with reference to Total Sanitation Program Policy of Government of India. **(Action – JST)**

3. Chapter-1 on 'Introduction' needed to be redrafted highlighting the need for management of the sector briefly describing the significance of each chapter for an effective and efficient management for sustainability of the system created or proposed to be created. The Vision and Mission of the Ministry on sanitation envisaged under NUSP 2008 may be included. **(Action – JST)**

4. Regarding the 74th CAA, it was suggested that all the activities covered under the Act be mentioned emphasizing the devolution of powers to all the Urban Local Bodies (ULBs) including Total Sanitation components. **(Action – JST)**

5. In chapter-2 on 'Legal Aspects' all the Acts referred therein should be described year-wise. Table 2.1 'Used based classifications of surface water in India' and Table 2.2 'General standards for discharge of environmental pollutants' be shifted to the appropriate chapter in Part-A (Engineering) **(Action – JST)**

6. In section 2.8 'BIS Discharged Standard' be included and a cross reference of the recommended effluent discharge guidelines in Part – A (Engineering) be made in the cahpter. **(Action – JST)**

7. Para 3.1 and 3.1.1 to 3.1.3 needed more elaborations in line with manual on MSWM published by the Ministry of Urban Development. Regarding qualifications etc the summary of excel sheet from Part – B on O & M be referred to. **(Action – JST)**

9. It was suggested that some more relevant training courses be included in the Table 3.9 'List of refresher courses sponsored by MoUD' by the CPHEEO in order to fulfill the objective of Total Sanitation Program of Government of India.

(Action – Dr. Dhinadhayalan and JST)

10. Para 4.1 'Introduction' needed elaborations in the context of Millennium Decade Goal (MDG) with reference to urban sanitation. This Para needed redrafting. **(Action – JST)**

11. In Para 4.3 'Sources of Funding' a sub Para on guidelines for 'Corporate Social Responsibility' (CSR), program of the Ministry of Company Affairs, Government of India needed to be included in the Para at suitable place.

(Action-JST)

12. Sub-section 4.4.3.12 'Why PPP is not taking off in Sewerage' be shifted to chapter on PPP and sub-section 4.4.3.14 needed redrafting as discussed. **(Action – JST)**

13. Figure 4.5 'Portrayal of unsustainable nature of PPP in urban sector infrastructure' and Figure 4.6 'Portrayal of sustainable nature of PPP in urban sector infrastructure' be sifted to chapter on PPP. **(Action – JST)**

14. Para 5.1 'Introduction' and Para 5.2 'Need for PPP' needed redrafting in a more elaborate manner covering all the aspects of Total Sanitation including centralized, decentralized and on-site sanitation systems. . **(Action – Mr. Gupta and JST)**

15. It was decided that a report of the World Bank on 'PPP for Sewerage Schemes' be briefly described and included in this chapter. **(Action – Dr. Dhinadhayalan and JST)**

16. It was further decided by the Expert Committee that a modal PPP contract be included in the chapter as an Annexure. Mr. Gupta has agreed to provide a model PPP contract document. A reference may be made to the Contract Labour Act, 1970 by referring the provision made in the MSW Manual **(Action – Mr. R N Gupta and JST)**

17. A brief write-up on billing and collection of sewerage and sanitation systems be included for which approach adopted in the Operation and Maintenance of Water Supply Systems published by the Ministry of Urban Development be referred. **(Action – JST)**

18. The Expert Committee was of the view that sub-section 6.1 'Introduction' of the chapter 6 on 'Community Participation' needed more elaboration highlighting need for community awareness and participation in sanitation sector. Community definition required more detailing viz. cast, creed, religion, gender, age group, profession etc. It was suggested to change the title as "Community participation and Awareness"

(Action – JST)

19. In sub-section 6.3.2 'Identifying Existing Local Community' Contacts' a point on 'Health impact due to lack of sanitation' be included, and under sub-section 6.3.3 ' Listing out

Messages to be communicated' an item on 'Need for community participation in achieving Total Sanitation be added. **(Action – JST)**

20. A brief write-up on Modal bye-law of Community Participation Law' as mentioned under the central program of government of India (JNNRUM) be included. **(Action- JST)**

22. Expert Committee was of the opinion that the title of Section 6.8 should be 'Need for Enforcement' and the section needed redrafting. **(Action – JST)**

23. A new sub-section 6.10.3 on 'Summary' be drafted and added. **(Action – JST)**

24. The Expert Committee felt that the entire Chapter 7 on 'Asset Management' needed redrafting in the light of the Management aspect of Sewerage and Sewage Treatment. The committee was of the opinion that Dr. Urmila, member of the expert committee would be in a better position to draft the chapter as the subject contained therein of her interest and specialization and therefore she was requested to accept the suggestion which Dr. Urmila agreed. Mr. Gupta also agreed to help Dr. Urmila by giving a brief write-up on Asset Management. **(Action – Dr. Urmila, Mr. Gupta and JST)**

25. The Expert Committee was of the opinion that Section 8.9 on 'Various Main / Sub-systems for MIS in Sewerage System' be shifted under Section 8.1 on 'Introduction' with some more elaborations emphasizing the need for MIS at Central, State and ULBs programs. **(Action – JST)**

26. It was suggested by the committee that a Para on 'Complaint, Redressal, and Monitoring be added in this Chapter. **(Action – JST)**

27. Dr. Dhinadhayalan mentioned that the software for Service Level Benchmarking (SLB) on Sewerage and Sanitation services is available on the Ministry of Urban Development website www. urbanindia. nic.in. The same may be referred to in the manual. **(Action – JST)**

28. Expert Committee also discussed in detail on the views expressed during the meeting and also conveyed in writing by Mr. Takashi Sakakibara and Dr. Balooni on very important aspects in each of the Chapters which were duly endorsed by the committee for incorporating appropriately in various chapters as suggested. **(Action – JST)**

While concluding the meeting, the Chairman expressed his satisfaction on behalf of the Expert Committee for fruitful discussions held during meeting for two days. He further requested to all concerned to forward their suggestions, comments in the form of a brief write-up or a chapter to Dr. M. Dhinadhayalan, Member Secretary and to Mr. Shital of CH2 MHILL by e-mail latest by 30th September 2012 so as to prepare the draft of the Manual Part-C on Management within the prescribed time-frame. All the members agreed to fulfill the task assigned to them within the dead line of 30th September 2012.

The meeting ended with a vote of thanks to the Chair.

(N.B. - Enclosure to this may also be seen for necessary actions by respective Expert Members)

Enclosure

List of Inputs needed from the Expert Committee members Part C

(To be submitted the latest by 30th September 2012)

Expert Committee Member	Chapter	Item
Dr. Dhinadhayalan	1	Vision and Mission statements
Dr. Balooni	1	Write up on brief mention about Chapter 2 Legal Framework and Chapter 3 Organization Setup contents
Mr. Gupta	2	Write up related to Article 21 and Article 225 of the Constitution
Dr. Dhinadhayalan	2	Recent developments in 74th Constitutional Amendment; 18 functions
Dr. Dhinadhayalan	2	Section 2.8 BIS Discharge Standards Malaysian guidelines information on effluent standards for Septic Tanks
Dr. Dhinadhayalan	2	Will give latest developments on Manual Scavenging Act to JST. These are to be included in Section 2.9.
Dr. Dhinadhayalan	2	Time frame for achieving Service Level Benchmarks (SLB)
Dr. Balooni	3	A paragraph giving introduction of the chapter
Dr. Dhinadhayalan/Dr. Urmila Brighu	3	Will provide a note on regulatory mechanism (with regard to service delivery, fixing tariff, and so on). Also some write-up on monitoring of PPP.
Dr. Dhinadhayalan	4	Updated list of refresher courses by CPHEEO
Dr. Dhinadhayalan/Mr. Sheetal	4	Information on example of support provided by MPs through local area development funds (MPLAD), Ministry of Statistics and Programme Management
Dr. Dhinadhayalan	5	Report on PPP by World Bank
Mr. RN Gupta	5	One paragraph of Introduction
Mr. RN Gupta	5	Model contract for Amravati for water supply.
Dr. Dhinadhayalan	5	One paragraph on Advantages of PPP in context of sewerage
Dr. Dhinadhayalan	5	Policies by Government of India and State Govts. in the context of PPP
Dr. Dhinadhayalan	5	Suggestive reforms for energy environment – World Bank Report
Dr. Dhinadhayalan	6	Information on Model Community Participation Law (Guidelines)

Expert Committee Member	Chapter	Item
Dr. Urmila Brighu	7	Introductory part of Asset Management – at least two paragraphs Go through and finalize Chapter 7
Dr. Dhinadhayalan	8	Report on National mission on sustainable habitat – Indicators on Sewerage and Sanitation Services.
Dr. Shukla	10	One paragraph on other disasters such as manmade, employees going on strike, etc. in Section 10.1.

Appendix

Third Meeting of Expert Committee for finalization of Draft of the Manual on Sewerage and Sewage Treatment (Part – C on Management) held in the Hotel Royal Plaza, Ashok Road, New Delhi on 10th & 11th September 2012.

List of Participants

Sl. No	Name	Designation/Department	E-mail address	Contact No
1.	Dr. Alok Kumar	Expert/JICA Study Team		
2.	Kiyoshi Mizumoto	Expert/JICA Study Team		
3.	Dr. S.Sundaramoorthy	Expert/JICA Study Team		
4.	Akira Takeuchi	Team Leader, JST		
5.	Katsuzo Motegi	Expert/JICA Study Team		
6.	Masatoshi Yamada	Expert/JICA Study Team		
7.	Dr. Girirali Rao	Expert/JICA Study Team		
8.	Yoshitaka Ito	Expert/JICA Study Team		
9.	Teruo Sugo	Expert/JICA Study Team		
10.	Mikio Suzuki	Expert/JICA Study Team		
11.	Akira Morita	Expert/JICA Study Team		
12.	Ms. Emi Doyle	JICA, India		
13.	Dr. S. R. Shukla	Former Adviser (PHEE)		
14.	Dr. M.Dakshinamurthy	Deputy Adviser (PHE) CPHEEO		
15.	Dr. Rama Kant	Asstt. Adviser (PHE)		
16.	Dr. R. K. Singh	DGM (Projects), HUDCO		
17.	R. N. Gupta	Former E-in-C, PHED, Govt. Of Chhattisgarh		
18.	Dr. Urmila Bilgaiyan	Associate Professor, MNIT, Jaipur		
19.	Dr. K. Balkoski	Professor, IIM, Kozikode		
20.	Dr. Zillur Rahman	Associate Professor, I.I.T., Roorkee		
21.	Takashi Sakakibara	JICA Expert, CPHEEO		
22.	Sital Chinchwade	Team Leader, CH2 MHILL		
23.	Padma Kara	Project Assistant, CH2 MHILL		

Minutes of the Meeting for finalization of Draft of the Manual on Sewerage and Sewage Treatment (PART-B on Operation & Maintenance)

The Fifth Meeting of the Expert Committee for finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-B on Operation & Maintenance) was held under the chairmanship of Dr. S.R.Shukla, Co-Chairman of the Expert committee in the Hotel Royal Plaza, Ashok Road, New Delhi on 12th and 13th September 2012 at 10 AM.

The list of participants is appended.

Following are the brief of discussions held during the meetings.

The meeting was to be chaired by Ms. Veena, Director (LSG), Ministry of Urban Development, Government of India; she was unable to chair the meetings due to her pre-occupation in urgent Government commitments. Under the circumstances, Dr. M. Dhinadhayalan, Deputy Adviser (PHE) & Member Secretary suggested Dr. S. R. Shukla, Former Adviser (PHEE), Member & Co-chairman of the Expert Committee to preside over the meeting. Dr. Shukla accepted the suggestion with the consent of other Expert Members and agreed to chair the meetings.

The meeting started with the brief introduction of each Expert Member present in the meeting. Initiating the discussions, the Chairman briefly highlighted importance of operation and maintenance in sewerage sector. He mentioned that water supply and sanitation sector in India considered as a welfare sector which is a non-remunerative sector and therefore in order to judge the effectiveness and efficiency of the sector on the basis of long term sustainable basis operation and maintenance of sewerage and sewage treatment system is a very critical and essential activity which requires continuous attention of agencies responsible for operation and maintenance.

Thereafter, the chairman suggested that since this meeting was for two days so out of 11 chapters with appendices in the draft manual for discussions, the Expert Committee might consider at least 5 chapters on first day depending upon availability of the time. Keeping in view the time factor during the discussions, following chapters were discussed in seriatim during two days of the meeting;

Day-1, 12th September 2012

1. Chaper-1 on ‘General’
2. Chapter-2 on ‘Sewer System’
3. Chapter-3 on ‘Pumping Stations’
4. Chapte-4 on ‘Sewage Treatment Facilities’
5. Chapter-5 on ‘Sludge Treatment Facilities’

Day-2, 13th September 2012

6. Chapter-6 on 'Electrical and Instrumentation Facilities'

7. Chapter-7 on 'Quality Analysis'

8. Chapter-8 on 'Environmental Conservation'

9. Chapter-9 on 'Occupational Hazards, Safety Measures and Health Aspects'

10. Chapter-10 on 'On-Site Systems', and

11. Chapter-11 on 'Budget Estimates for Operation and Maintenance'

At the outset, the Chairman requested Dr. Alok Kumar of the JICA Study Team (JST) to make a brief presentation of above chapters so as to initiate discussions on the subjects contained in the text of each of the chapters.

1. It is pertinent to mention that suggestions and views offered by expert members for each chapter during the discussions regarding title of the chapter, sections and sub-sections of chapters, small modifications in the text of the chapters etc have been incorporated by the JST during presentation of chapters. In addition, observations/comments offered on the content of the manual forwarded by Mr. Ahuja and Mr. Bahra, expert members have also been discussed and incorporated in the manual appropriately. The JST was also suggested wherever the text of section or sub-section is lengthy and descriptive the same should be written in the bullet form so as to make it more effective and easily understandable. However, some of the important additional observations made on chapters are mentioned in the minutes as under.

(Action – JST)

2. The title of Chapter – 1 should be 'INTRODUCTION' and under sub-section 1.1 'Need of Operation & Maintenance' giving a brief of operation and maintenance of sanitation systems. In this context the Manual on Operation and Maintenance of Water Supply & Treatment published by CPHEEO, Ministry of Urban Development may be referred. A relevant cross-references of other parts of the manuals be made.

(Action – JST)

3. Title of sub-section 1.6 be 'Potential Risks in Sewerage and Sanitation', and 1.7 be 'Sanitation Ledger'. A brief about NUSP & SLB also needed to be included in sub-section 1.7. **(Action – JST)**

3. The Table 2.1 needed changes in the Indian context. It was agreed that a modified brief write-up along with the table will be furnished by Mr. J B Ravinder.

(**Mr. J B Ravinder and JST)**

4. Tables 2.2 and 2.3 needed changes as suggested during the meeting and a cross reference be given in Table 2.3. **(Action – JST)**

5. While discussing sub-section on 'Sewer Inspection and Maintenance', It was suggested that directions issued by the Honble' Supreme Court and other Courts on the subject be briefly mentioned. It was also suggested to include a brief write up on cross

contamination of water supply and prescribe horizontal and vertical distances between sewer and water supply lines in the chapter as has been recommended in the water supply manual. This relevant point shall be included in Part –A and Part B manuals. **(Action – JST)**

6. Figure 2.22 needed some corrections and similarly a figure mentioning Indian conditions may also be included. **(Action – JST)**

7. Dr. M Dhinadhayalan was of the view that occurrences of diseases are very much prevalent due to poor sanitation therefore there is a need for proper coordination amongst the line departments. He further desired that a brief write-up on the operation and maintenance of decentralized sewerage system may also be included. **(Dr. M Dhinadhayalan and JST)**

8. Sub-section 3.4.2.2 needed redrafting for Figure 3.9 cross reference to Part-A of the manual be given. Sub-section 3.4.5 and 3.4.6 to be shifted to chapter on 'Introduction'. **(Action – JST)**

9/ Sub-section 3.6.3 needed illustrations, whereas 3.6.4.2 needed redrafting. Line number 607 to 622 be shifted to Part-A of the manual. **(Action – JST)**

10. In sub-section 3.7.3 equations for flow of sewage and calculations for rectangular and circular sewers be provided. **(Action – JST)**

11. In section 3.8 a brief writ-up on training need be added and also a brief about the contractual obligations which could be renewed when expired be mentioned. The expert committee was of the view that Mr. S M Jejurikar of ex-MCGM may also extend his expertise and help in drafting the chapter-3. **(Action – Mr. S M Jejurikar and JST)**

12. The committee was of the opinion that brief write-ups on importance of nutrient control, oxygen capacity at various temperatures and biological uptake rate be added under sub-section 4.7.2.3.3. **(Action – JST)**

13. Sub-section 4.7.4 be deleted. A brief write-up was to be provided by Prof. A A Kazmi regarding sub-section 4.7.7.5 on 'Jar Testing'. **(Action – Prof. A A Kazmi and JST)**

14. Sub-section 4.9.1 needed to be modified and redrafting. Under sub-section 4.9.1.1 sketches of Bio-towers with flow diagram be added. **(Action – JST)**

15. Sub-section 4.13.4 0n 'Aerobic Ponds' needed redrafting including brief about aerobic, facultative and anaerobic forms of the ponds be added. **(Action – JST)**

16. Sub-section 4.17.1 on 'Pressure Sand Filtration' needed redrafting in bullet form. **(Action – JST)**

17. Section 5.3 on 'Aerobic Digestion' be removed. Under sub-section 5.4.1 more illustrations with figures with detailed information be furnished. **(Action – JST)**

18. Sub-section 5.5.3.4 on 'Screw Press' needed redrafting including operation and maintenance of screw press. **(Action – JST)**

19. Sub-section on 'Rotary Press' be summarized in a small Para with figure and section 5.6 on 'Sludge Drying Bed' needed redrafting with reference to JICA Manual.
(Action – JST)

20. The title of the Chapter 6 should be 'Electrical and Instrumentation System'. It was decided by the committee a brief write-up on power potential and energy audit be furnished by the expert Mr. Garmaik from the Bureau of Energy which was agreed by Mr. S P Garnaik, who has also volunteered to review the entire chapter and modify based on the latest development and forward to the JST.
(Action – Mr. S P Garnaik and JST)

21. Title of the Chapter 7 suggested as 'Sampling and Analysis'. It was also suggested that a brief on the need of sampling and analysis be added in the sub-section on Introduction. **(Action – JST)**

22. Under sub-section 7.2.3 a table showing parameters and frequency of collection of samples be added. Also a backup arrangement with Wriklers' method for measurement of D. O. may also be included. A table be included on the basis of mandatory parameters required whether daily or weekly basis. **(Action – JST)**

23. Section 7.10 on 'Planning of Laboratories Facilities' be shifted to Part-A of the Manual in appropriate chapter and a cross reference of the same be made here in Part-B. **(Action – JST)**

24. The norms for laboratory facilities for different classes of towns may be included in Chapter-7 on the basis of norms given in the O&M manual on water Supply systems **(Action :JST)**

25. Sub-section on 'General Method of Prevention of Odor' needed more elaboration with illustrations. **(Action – JST)**

26. A brief write-up needed to be added under section 8.3 on 'Epidemiological Pollution' and needed to be cross referred to chapter on 'Occupational Health Hazards' in Part-C of the manual. **(Action – JST)**

27. Section 8.5 on 'Water Pollution' needed redrafting and be shifted to chapter on 'On-site Sanitation' **(Action – JST)**.

27. Section 10.1 on 'Introduction' needed redrafting emphasizing the situations warrant for 'On-site Sanitation'. Latest IS Code of Practices (with amendments if any) be mentioned in the text. **(Action – JST)**

28. A reference needed to be regarding 'Advisory Note on Septage Management' prepared by the Ministry of Urban Development. The word sludge may be substitute with septage and guidelines on septage management may be included **(Action – Dr. Dhinadhayalan & JST)**

29. An Excel Spread Sheet for machinery and equipment for septic tank cleaning needed to be prepared and included in the chapter. **(Action – JST)**

30. Chapter-11 on 'Budget Estimates for Operation and Maintenance' be shifted to Part-C of the Manual as a separate chapter and an Excel Spread Sheet on 'Septage Management' be included in the chapter. The O&M expenditure for septage and sewer cleaning may also be included in the estimate for O&M. It was suggested to include a brief on revenue generation to ensure self sustainability of the project and a cross reference may be made from the Chapter on "Financial Management" of part C of the manual. **(Action – JST)**

While concluding the meeting, the Chairman expressed his satisfaction on behalf of the Expert Committee for fruitful discussions held during meeting for two days. He further requested to all concerned to forward their suggestions, comments in the form of a brief write-up or a chapter to Dr. M. Dhinadhayalan, Member Secretary and to Mr. Shital of CH2 MHILL by e-mail latest by 30th September 2012 so as to prepare the draft of the Manual Part-B on Operation & Maintenance within the prescribed time-frame. All the members agreed to fulfill the task assigned to them within the dead line of 30th September 2012.

The meeting ended with a vote of thanks to the Chair.

(N.B. - Enclosure to this may also be seen for necessary actions by respective Expert Members)

Enclosure

List of Inputs needed from the Expert Committee members Part B

(To be submitted the latest by 30th September 2012)

Expert Committee Member	Chapter	Item
Mr. RN Gupta	1	Write-up on Workmanship and Quality of Equipment
Mr. JB Ravinder	2	Table 2.1 - Will give a write-up on this period of inspections for India and the defect liability period.
Prof Majumdar	2	Safety measures should be taken before any manhole entry. Directions of honourable Supreme Court and High Courts shall be taken care of in this respect.
Dr. Dhinadhayalan	2	Paragraph on Cross Contamination of Water Supply including information on decentralized sewerage also
Dr. Shukla/Dr. Dhinadhayalan	2	Accident data on India (during sewerage maintenance work)
Mr. Jejurikar	3	Final file sent by JST to be reviewed
Prof. A Majumdar, Dr. Kazmi, and Mr. Rudramurthy	4	Write up on Start-up of different types of STPs.
Prof. A Majumdar, Dr. Kazmi, and Mr. Rudramurthy	4	Building up MLSS in ASP
Dr. Kazmi	4	Elaborated information on Jar Testing
Mr. SP Garnaik	6	To review the content of this Chapter along with relevant Chapter of Part A and add essential information. JST to send the relevant files.
Dr. Dhinadhayalan	8	Minimum distance between WS pipes and sewers
Dr. Dhinadhayalan	9	Information on bill on sanitation workers and regulation of employment. Also, one more bill on Rehabilitation of Manual Scavengers will be passed where workers are being recognized as hazardous sanitation workers. One paragraph each on both bills. Contract Labour (Regulation and Abolition Act 1970)
Prof. A Majumdar	9	Photographs of items in First Aid Box
Prof. A Majumdar	8 and 9	Photographs of STPs – beautification and landscaping and other items specific to that treatment plant
Dr. Dhinadhayalan	10	Preventive routine maintenance from Malaysia

Appendix

Fifth Meeting of Expert Committee for finalization of Draft of the Manual on Sewerage and Sewage Treatment (Part – B on Operation & Management) held in the Hotel Royal Plaza, Ashok Road, New Delhi on 12th & 13th September 2012.

List of Participants

Sl. No	Name	Designation/Department	E-mail address	Contact No
1.	Dr. Alok Kumar	Expert/JICA Study Team		
2.	Kiyoshi Mizofune	Expert/JICA Study Team		
3.	Dr. S.Soundaramoorthy	Expert/JICA Study Team		
4.	Akira Takeuti	Team Leader, JST		
5.	Katsuzo Motegi	Expert/JICA Study Team		
6.	Masatoshi Yamada	Expert/JICA Study Team		
7.	Dr. G.Hanumantha Rao	Expert/JICA Study Team		
8.	Yoshitaka Ito	Expert/JICA Study Team		
9.	Teruo Sugo	Expert/JICA Study Team		
10.	Mikio Suzuki	Expert/JICA Study Team		
11.	Akira Morita	Expert/JICA Study Team		
12.	Ms. Emi Doyle	JICA, India		
13.	Dr. S. R. Shukla	Former Adviser (PHEE)		
14.	Dr. M.Dhinadhayalan	Deputy Adviser (PHE) CPHEEO		
15.	Dr. Rama Kant	Asstt. Adviser (PHE)		
16.	Dr. A. A. Kazmi	Associate Professor, I.I.T., Roorkee		
17.	R. N. Gupta	President, NWWA		
18.	S. P. Garnaik	Energy Economist, BEE, Ministry of Power		
19.	Prof. Mazumdar	Ex Director & Professor, AIIPH, Kolkata		
20.	B. I. Dalal	Addl.City Engineer (Drainage), Surat M.C.		
21.	Takashi Sakakibara	JICA Expert, CPHEEO		
22.	J. B. Rauldeo	Deputy Adviser (PHE) CPHEEO, MoUD		
23.	S. M. Jejurkar	Ex. C. E. MCGM		
24.	J. S. Bakra	EXN, PWIS & SB, Chandigarh (Punjab)		
25.	M. Satyanarayana	Director, HMWSSB, Hyderabad		
26.	M. Sankaranarayana	Ex Jt. Adviser(PHE), CPHEEO, MoUD		
27.	S. V. Akila	Ex Project Director (WS), Gujarat		
28.	S. P. Brahmanthy	Addl.C. E., BWSSB, Bangalore		
29.	Sital Chinchwade	Team Leader, CH2 MHILL		
30.	Padma Kara	Project Assistant, CH2 MHILL		

Minutes of the Sixth & final Meeting of the Expert Committee for Finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-B) on Operation & Maintenance

The Sixth and the final Meeting of the Expert Committee Members for Finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-B on Operation & Maintenance) was held under the Chairmanship of Dr. S. R. Shukla, Co-Chairman of the Expert Committee in the Hotel Royal Plaza, Ashoka Road, New Delhi on 5th December 2012 at 10 AM.

Before the meeting started Mr. Mizufune, Expert Member, JICA Study Team informed that due to some inevitable circumstances Mr. Takechi, Team Leader, JST could not come from Tokyo and therefore in his absence he will be representing JST.

At the start of the meeting, Dr. Shukla welcomed all the Expert Members and briefly mentioned about the work-plan for discussions to be held during the day for finalization of the final draft of the Manual on Sewerage and Sewage Treatment (Part-B on Operation & Maintenance), he mentioned that there are 10 chapters in the Manual to be discussed and finalized and keeping in view the time available, he suggested that Expert Members should be brief and concise in putting up their views so as to accomplish the finalization of the draft within the prescribed period. All the Expert Members agreed to the suggestion and showed their willingness to start the meeting.

The list of participants is appended.

Dr. Shukla requested Dr. Alok, Expert Member JST to start power-point presentation of the chapters of Part-B of the Manual in order to initiate discussions on the chapters in seriatim. Before starting presentation, Dr. Alok made a reference to the two sets of comments distributed to all the members and explained that following procedures had been adopted by the JST in reply to the comments and observations on chapters of Part-(B) of the manual received from members of the Expert Committee.

1. Comments and Observations offered by the members and duly accommodated and complied with in each chapter.

2. Comments and observations offered by the members and incorporated with detailed explanations required subject to the approval and concurrence of the Expert Committee during the meeting for inclusion in the text of the chapters.

3. Comments and observations offered by the members needed further discussions for incorporating in the respective chapters.

Following are the brief of discussions held during the meeting.

I. Chapter-1

1. Expert Members of the view that Chapter-1 on 'Introduction' should include a brief write-up on sanitation as whole and such facilities to be provided as per the guidelines stipulated in the

'National Urban Sanitation Policy' of Government of India and 'Service Level Benchmarking (SLB) and a cross reference may be made to Part – (A) of the Manual. **(Action – JST)**

2. Proper modalities to be worked out preparing guidelines jointly by a committee of the State Pollution Control Board and Urban Local Body for discharging industrial effluent in domestic sewers. The guidelines prepared by the joint committee must be strictly adhered. **(Action - JST)**

II. Chapter – 2

1. It was suggested by the Expert Committee Members that a brief write-up may be added at the end of sub-section 2.2.5.4 regarding fatal accidents related to general Indian conditions. A brief on the subject without giving authentic statistics may be added. **(Action – JST)**

2. Dr. M. Dhinadhayalan suggested that under Para-2.2.6.2 a brief write-up on joint periodical meeting of all the line departments be held at least twice in a year and a meeting once in every six month regarding judgment of inspection and examination results of sewers. **(Action – JST)**

3. Para – 2.2.6.2 on judgement based on the results of inspection and examination needed redrafting. **(Action – JST)**

4. It was decided by the Expert Committee that regarding operation of pumps the practice as mentioned in the old manual under revision would be followed as mentioned in the design chapter of Part-A (Engineering) of the Manual. **(Action – JST)**

5. Dr. Kazmi suggested that few illustrations (photographs) be added to the text to make it more impressive and effective. Mr. Rudramurthy of B.W.S.S.B. agreed to provide illustrations regarding Bangalore Waste Supply & Sewerage Board. **(Action – Mr. Rudramurthy and JST)**

6. Dr. Dhinadhayalan suggested that a write up on "Information control technology" for effective monitoring of operation and maintenance of sewerage system shall be included. It was also suggested that a write up on creation of data base in all the urban local bodies for effective O&M of sewerage system be included in Chapter I. These points may be further elaborated in details in the relevant chapters**.** **(Action –JST)**

IV. Chapter - 4

1. Dr. Kazmi suggested that a cross reference of Duncan Mara be made under sub-section 4.13 regarding maintenance of oxidation ponds. Prof. Mazumdar also suggested control of obnoxious odor emanating from oxidation ponds due to low pH for which adequate measures required to be taken to raise the pH for which concerned agency to take proper action. For the purpose a brief write-up mentioning laboratory testing for odor control be added in the text. **(Action – JST)**

2. It was suggested that a brief write-up on operation & maintenance of DEWATS and package treatment plants should also be included in this chapter. So far in India disinfection by UV has not in practice except chlorination as disinfectant at a large scale. However, privately operated STPs might be using UV as a disinfectant. **(Action – JST)**

V. Chapter – 7

1. Text of Para 7.2 on 'Need for Sampling and Analysis' may be changed to passive sentences. Para – 7.2.3 may be modified as discussed. **(Action – JST)**

2. The Expert Committee suggested that qualification and experience of plant operators be mentioned based on the capacity of STPs in the Appendix 7.1. **(Action – JST)**

VI. Chapter – 8

1. Reference to IS Code 2470 be mentioned where necessary on page 8.4. **(Action – JST)**

2. Last Para of sub-section 8.5 on 'Water Pollution' be deleted and on page 8-4 'by authorized laboratory be added suitably in the text. **(Action – JST)**

VII. Chapter – 10

1. Dr. Dhinadhayalan suggested that under sub-section 10.3.1 a reference needed to be added regarding Septage Management Plan on the basis of the 'Advisory Note on Septage Management' prepared by the Ministry of Urban Development may be suitably included in the text. **(Action – Dr. Dhinadhayalan and JST)**

2. Dr. Dhinadhayalan also suggested that a write-up on details regarding machinery and equipment for septic tank cleaning prepared by the Ministry of Urban Development be included in the chapter.

(Action – Dr. Dhinadhayalan and JST)

It was suggested by the Expert Committee that experiences of the Expert Members of JST regarding operation & maintenance of about 40 STPs visited during later part of 2010 in India be included at appropriate section of the Part-B of the manual. The write-up should clearly highlighted the deficiencies encountered by the concerned agencies responsible for O & M and how best the problems being faced could be solved. Such analysis would certainly pave the way for efficient and effective O & M of sewerage systems. **(Action – JST)**

In order to make Part-B (O & M) more interesting and effective, Prof. Kazmi suggested that cartoon clips or caricatures depicting do's and don't by the communities and plant operators may be added in appropriated sections or sub-sections in the chapters of Part-B of the Manual.

(Action – JST)

While concluding the Expert Committee meeting, the chairman thanked all Expert Members for their elaborate and constructive deliberations. He requested all the Expert Members those were willing to offer their comment or suggestion may please forward same through e-mail to Dr. Dhinadhayalan, Deputy Adviser (PHE) & Member Secretary with a copy to Mr. Shital, CH2M HILL latest by 10th December 2012 so as to finalize the draft by mid December 2012 by JST.

The meeting ended with a vote of thanks to the chair.

Appendix

Sixth & final Meeting of the Expert Committee for Finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-B) on Operation & Maintenance held on 5th December 2012

List of Participants

Sl. No	Name	Designation/Department	E-mail address	Contact No.
1.	Dr. Alok Kumar	Expert / JICA Study Team		
2.	Dr. S. Sakthivelkumar	Expert JST		
3.	Dr. S. Sundaramoorthy	Expert JST		
4.	Terio Shiga	Expert / JICA Study Team		
5.	Mikio Suzuki	Expert / JICA Study Team		
6.	Yoshitaka Ito	Expert / JICA Study Team		
7.	Akira Morita	Expert / JICA Study Team		
8.	Katsuzo Motegi	Expert / JICA Study Team		
9.	Dr. Gunnaji Rao	Expert / JICA Study Team		
10.	Masatoshi Yamada	Expert JST		
11.	Kiyoshi Mizuhara	Expert / JICA Study Team		
12.	Takashi Sakakibara	Expert / JICA		
13.	R. Sethuraman	Former Joint Adviser (PHEE), CPHEEO, MoUD		
14.	J.S. Bakshi	Executive Engineer, PWSS II		
15.	Prof. Amiyabala Mazumdar	Ex. Director, A.I.I.P.H. Kolkata		

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16.	Dr. S. R. Shukla	Former Adviser (PHEE), CPHEEO, MoUD	
17.	Dr. M. Dhinadhayalan	Deputy Adviser (PHE), CPHEEO, MoUD	
18.	Dr. Ramakant	Asst. Adviser (PHE), CPHEEO, MoUD	
19.	B. I. Dalal	Additional City Engineer Surat Municipal Corporation	
20.	S. M. Joglekar	Ex. Chief Engineer MCGM	
21.	R. N. Gupta	Ex. Engineer in Chief P.H.E.D., Chhattisgarh	
22.	S. P. Rudramurthy	Additional Chief Engineer BWSSB,	
23.	S. V. Ahuja	Ex. Project Director Gujarat Water Supply	
24.	G. Elangovan	Ex. Engg. Director CMWSS Board	
25.	Prof. A. A. Kazmi	Associate Professor I.I.T. Roorkee	
26.	Shital Chinchwade	Team Leader, CH2M HILL, Gurgaon, (HR)	
27.	Ms. Padma Kale	Support Staff, CH2M HILL	

Minutes of the Fourth & final Meeting of the Expert Committee for Finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-C) on Management

The Fourth and the final Meeting of the Expert Committee Members for Finalization of the Draft of the Manual on Sewerage and Sewage Treatment (Part-C) on Management was held under the Chairmanship of Dr. S. R. Shukla, Co-Chairman of the Expert Committee in the Hotel Royal Plaza, Ashoka Road, New Delhi on 6th December 2012 at 10 AM.

The list of participants is appended.

The meeting was to be chaired by Ms. Veena, Director (LSG), Ministry of Urban Development, Government of India but she was unable to chair the meeting as she was on leave. Under the circumstances, Expert Members of the committee suggested that Dr. S. R. Shukla, Former Adviser (PHEE), Member & Co-chairman of the Expert Committee to preside over the meeting. Dr. Shukla accepted the suggestion of the Members and agreed to chair the meeting.

Before the meeting started Mr. Yamada, Expert Member, JICA Study Team informed that due to some inevitable circumstances Mr. Tekachi, Team Leader, JST could not come from Tokyo and therefore in his absence he will be representing JST.

At the start of the meeting, Dr. Shukla welcomed all the Expert Members and briefly mentioned about the work-plan for discussions to be held during the day for finalization of the final draft of the Manual on Sewerage and Sewage Treatment (Part-C) on Management, he mentioned that there are 10 chapters in the Manual to be discussed and finalized and keeping in view the time available, he suggested that Expert Members should be brief and concise in putting up their views so as to accomplish the finalization of the draft within the prescribed period. All the Expert Members agreed to the suggestion and showed their willingness to start the meeting.

Dr. Shukla requested Dr. Alok, Expert Member JST to start power-point presentation of the chapters of Part-C of the Manual in order to initiate discussions on the chapters in seriatim. Before starting presentation, Dr. Alok made a reference to the one set of comments distributed to all the members and explained that following procedures had been adopted by the JST in reply to the comments and observations on chapters of Part-(C) of the manual received from members of the Expert Committee. Dr. Sundramoorthy assisted Dr. Alok in explaining all the sections and sub-sections of the chapters of Part-(C) of the Manual.

1. Comments and Observations offered by the members and duly accommodated and complied with in each chapter.

2. Comments and observations offered by the members and incorporated with detailed explanations required subject to the approval and concurrence of the Expert Committee during the meeting for inclusion in the text of the chapters.

3. Comments and observations offered by the members needed further discussions for incorporating in the respective chapters.

Following are the brief of discussions held during the meeting.

1. Prof. Balooni suggested that write-up under sub-section 3.2.1 on Decentralization of Administration could be included as a part of organizational set-up. **(Action – JST)**

2. The Expert Committee was of the view that the contents of Millennium Decade Goal (MDG) with reference to urban sanitation should be the part of Chapter-1 on 'Introduction'**.(Action-JST)**

3. Mr. Gupta, who is present President of the Indian Water Works Association (IWWA), mentioned that IWWA recognized by Government of India organizes various short term training programs for in-service personnel engaged in water supply and sanitation sector at IWWA local State centers in the country. He suggested that the C.P.H.E.E.O., Ministry of Urban Development should also sponsor such training program by way of extending financial support for such an important program in the sector and after the necessary approval of the Ministry same may also be included in the Part-C of the manual. Dr. Dhinadhayalan, Deputy Adviser (PHE) & Member-Secretary of the Expert Committee welcomed the suggestion and requested Mr. Gupta to forward the proposal in the form of an action plan on the subject for consideration of the Ministry. **(Action – Mr. Gupta, Dr. Dhinadhayalan & JST)**

4. Dr. Dhinadhayalan was of the opinion that applied R & D should also be included in the Part – C of the manual in appropriate chapter. The R & D activities should be need based with particular reference to urban sanitation sector. A write-up on the subject be included in the manual under finalization wherein adequate funding for carrying R & D activities in urban sanitation projects recommended. He suggested that R & D on Information Control Technology with the basic objective of affordable O & M in urban sanitation is the need of the day and if required the Ministry of Environment & Forests may be requested to share the guidelines prepared by them for such R & D projects. **(Action – Dr. Dhinadhayalan & JST)**

5. Dr. Dhinadhayalan further suggested that a brief regarding 'National Mission on Climate Change', the important program of the Government of India should also be highlighted at a proper place in the Part-C of the manual. **(Action – Dr. Dhinadhayalan & JST)**

6. Regarding sub-section 4.4.3.12 on 'Why P-P-P is not taking off in Sewerage', some of the expert Committee members were critical about the success of P-P-P model being applied in urban sanitation in the country. Dr. Sundaramoorthy mentioned that P-P-P model applied in Alundur town sewerage scheme in Tami Nadu is not a model that could be replicated else where. The reason is that community participated in financing the capital works but when the question f financing of O & M of the sewerage system arose, community was not willing to contribute for the same and the entire responsibility is with the public and private sectors.

7. Dr. Dhinadhayalan suggested that 4Ps (People – Public Sector – Private Sector – Participation) be used in the text in place of 3Ps (Public Sector – Private Sector – Participation) keeping in view the role of people participation play in the long-term sustainability of the sanitation systems. Roles and responsibilities of the community (people) should be clearly spelt out in the text of the manual. **(Action – JST)**

8. Mr. Srinivasan mentioned that the P-P-P model contract document for sewerage project for the city of Kolhapur in the state of Maharashtra included in the manual as reference is project specific. This model contract could not be used as a reference specific to any project and the city. There are number of variables to be considered and taken into account for drafting a model contract document for P-P-P. He showed his willingness to forward a sample contract document including key clauses for inclusion in the manual which could be used for any type of project and city with certain modifications by concerned agencies. **(Action – Mr. Srinivasan & JST)**

9. Dr. Dhinadhayalan was of the opinion that the manual should clearly spelt out the 'Polluters' Pay Principle' by considering various options such as directly charged from the community, should be as a cess or sewage tax, sewage tariff or a certain percentage of annual ratable value of the property. He suggested that O & M cost should be related to cost recovery which should contain components of establishments, repairs & renewals, energy cost etc. and if feasible it should be component of financial arrangement for capital investment. Finances collected from such procedures when strictly adhere-to and implemented would of great advantage for the sustainability of O & M of the sanitation systems. Various models for different types of systems and approaches be included in the manual. **(Action – JST)**

10. Dr. Dhinadhayalan was of the opinion that the manual should focus on achieving total sanitation as many households which depend on insanitary latrines and defecate in the open need to be either converted to sanitary latrines or to be provided with individual sanitary toilets. He requested that the way forward including subsidy components for conversion/construction of sanitary toilets and the guidelines of the scheme being implemented Govt. of Tamil Nadu for extending subsidy for conversion/construction of sanitary toilets may also be included in the manual.

(Action-JST)

11. Dr. Urmila agreed to furnish a revised write-up of chapter – 7 on 'Asset Management'. Expert committee members of the view that references be made on capital management including new and aged assets and how to account for O & M on long-term self sustainability of the projects and also 'G.I.S.' which is one of the important tools in Asset Management in the manual. **(Action – Dr. Urmila & JST)**

12. Expert committee members of the view that Central Government or Sate Governments, as the case may be, should provide subsidy to community for converting insanitary latrines into sanitary toilets. An appropriate write-up should be included in the manual. This recommendation in the manual would serve to a great extent to the 'National Urban Sanitation Policy' of Government of India. **(Action – JST)**

13. Dr. Soondaramoorthy explained the contents of the Chapter-10 on 'Budget Estimates for Operation & Maintenance' in brief about logical basis justifying O & M cost for different capacities of sewage treatment plants considering various scenarios of activities involved.

The Expert Committee was of the opinion that relevant and appropriate place of this chapter should be just after Chapter-4 on 'Financing and Financial Management'. The chapter-10 should be brought after chapter-4 with proper renumbering of the chapters in the manual. **(Action – JST)**

14. Dr. Balooni suggested that chapter on 'Introduction' in each of the part of the manual e.g. Part-A (Engineering), Part – B (Operation & Maintenance), and Part – C (Management) should have a brief description of 'Vision and Mission' of the sanitation program of Government of India. He also suggested that every Part of the manual should contain a small write-up drawing up the conclusion from the text of each of the manuals. Expert members of the committee welcomed the suggestion. **(Action – JST)**

While concluding the meeting, chairman appreciated constructive discussions and deliberations during the meeting to further improve the contents of the chapters of Part-C (Management) of the manual and requested all the Expert Members with particular reference to Dr. Urmila, Mr. Srinivasan, and Mr. Gupta to forward their comments, suggestion through e-mail to Dr. Dhinadhayalan with a copy to Mr. Shital, CH2M HILL latest by 11th December 2012 so as to finalize the draft by 15th instant.

The meeting ended with a vote of thanks to the chair.

Annexure

Fourth and Final Meeting of the Expert Committee for Finalization of the draft of Manual on Sewerage and Sewage Treatment (Part – Management) held on 8th December 2012

List of Participants

Sl. No.	Name	Designation/Department	Email address	Contact No.
1.	Dr. Alok Kumar	Expert, JICA Study Team		
2.	Kiyoshi Mitsuhara	Expert, JICA Study Team		
3.	Dr.S.Sundaramoorthy	Expert, JICA Study Team		
4.	Dr.S. Sakthieswaran	Expert, JICA Study Team		
5.	Katsuo Motegi	Expert, JICA Study Team		
6.	Masakoshi Yamada	Expert, JICA Study Team		
7.	Dr. Gururaj Rao	Expert, JICA Study Team		
8.	Teruo Sugo	Expert, JICA Study Team		
9.	Ms. Emi Doyle	JICA, India		
10.	Takashi Sakakibara	Expert, JICA, CPHEEO		
11.	Dr.M. Dhinesh ayalan	Dy. Adviser(PHE),CPHEEO		
12.	Dr. S. R. Shukla	Former Adviser (PHEE)		
13.	Dr. K. Baloorl	Professor, IIM, Kozikode		
14.	S.Srinivasan	Senior V.P., IL&FS Water Ltd.		
15.	Dr. Ms. Urmila Brighu	Asso. Prof., MNIT, Jaipur		
16.	R. N. Gupta	Former Exe.C., PHED, Chh.		
17.	Dr. R. K. Singh	DGM (Proj.CD, HUDCO		
18.	Dr. Ramakant	A. A. (PHE), CPHEEO		
19.	Shital Chinchwade	Team Leader, CH2M HILL		
20.	Padma Kaul	Project Assistant, CH2M HILL		

APPENDIX 2 AGENDA FOR WORKSHOP

सत्यमेव जयते

A Two-day National Workshop for Finalisation of Revised Manual on Sewerage and Sewage Treatment

20 – 21 September, 2012

Venue : Hall No 4, Vigyan Bhavan, Maulana Azad Road, New Delhi, 110011

Agenda

Day 1: 20th September, 2012 (09.00 a.m. – 05.30 p.m.)

Schedule	Subject	Speaker
0900-1000	Registration	
1000-1045	***Opening Session***	
1000-1005	Welcome Address	Ms. Veena Kumari Meena Director (LSG), MoUD , Govt. of India
1005-1015	Address on City Development Plan in the context of Sewerage and Sanitation	Shri J.B. Kshirsagar, Chief Town Planner TCPO, MoUD, Govt. of India
1015-1025	Address on JICA Assistance to Water and Sanitation Sector in India	Shri Shinya Ejima, Chief Representative of JICA, JICA India Office
1025-1040	Keynote Address	Dr. Sudhir Krishna Secretary, MoUD, Govt. of India
1040-1045	Vote of Thanks	Dr. M. Dhinadhayalan Deputy Adviser (PHE), CPHEEO, MoUD
1045-1100	**Tea Break**	
1100-1300	***Technical Session 1, Chair – Dr. S.R. Shukla, Former Adviser (PHEE), CPHEEO*** ***Co-chair – Dr. M. Dhinadhayalan, Deputy Adviser (PHE), CPHEEO*** ***Rapporteur – Shri Takashi Sakakibara, JICA Expert, CPHEEO***	
1100-1110	Introductory Remarks	Dr. M. Dhinadhayalan, Dy. Adviser (PHE), CPHEEO, MoUD
1110-1130	Summary of policy on revision of the Manual	Shri Akira Takechi, Team Leader, JICA Study Team (JST)
1130-1245	Chapter 1 - Introduction Chapter 2 – Planning Chapter-10 – Preparation of City Sanitation Plan	Dr. Alok Kumar, JICA Study Team
1245-1300	Interactions	
1300-1400	**Lunch**	
1400-1600	***Technical Session 2, Chair – Dr. S. Sundaramoorthy, Former Engg. Director, CWSSB*** ***Co-chair – Shri V. K. Chaurasia, Deputy Adviser (PHE), CPHEEO*** ***Rapporteur – Shri Amit K. Saha, Assistant Adviser (PHE), CPHEEO***	
1400-1530	Chapter 3 – Design and Construction of Sewers Chapter 4 – Design and Construction of Sewage Pumping Stations	Shri Masatoshi Yamada & Shri Kiyoshi Mizufune, JICA Study Team
1530 -1545	Interactions	
1545-1600	**Tea Break**	
1600-1730	***Technical Session 3, Chair – Prof. Vinod Tare, IIT, Kanpur.*** ***Co-chair –Representative from Central Pollution Control Board, New Delhi*** ***Rapporteur – Dr. Ramakant, Assistant Adviser (PHE), CPHEEO***	
1600 -1710	Chapter 5 – Design and Construction of Sewage Treatment Facilities	Shri Katsuzo Motegi, JICA Study Team
1710-1725	Interactions	
1725-1730	Wrap-up Remarks	Dr S R Shukla, Co-Chairman of the Expert Committee

सत्यमेव जयते

A Two-day National Workshop for Finalisation of
Revised Manual on Sewerage and Sewage Treatment
20 – 21 September, 2012
Venue : Hall No 4, Vigyan Bhavan, Maulana Azad Road, New Delhi, 110011

Agenda

Day 2: 21st September, 2012 (08.00 a.m. – 01.00 p.m.)

Schedule	Subject	Speaker
0800-0805	Introduction of Days Schedule	Dr. S. R. Shukla, Co-Chairman of the Expert Committee
0805-0935	***Technical Session 4, Chair – Prof. A. A. Kazmi, I.I.T. Roorkee.*** ***Co-chair – Representative from Delhi Jal Board, Delhi*** **Rapporteur – *Dr. Ramakant, Assistant Adviser (PHE), CPHEEO***	
0805-0920	Chapter 6 – Design and Construction of Sludge Treatment Facilities Chapter 7 – Recycling and Reuse of Sewage	Shri Masatoshi Yamada, JICA Study Team
0920-0935	Interactions	
0935-1100	***Technical Session 5, Chair – Prof. A.K. Nema, I.I.T. Delhi.*** ***Co-chair – Shri J.B. Ravinder, Deputy Adviser (PHE), CPHEEO*** ***Rapporteur – Shri Takashi Sakakibara, JICA Expert, CPHEEO***	
0935-1045	Chapter 8 – Decentralized Sewerage System Chapter 9 – Onsite Sanitation	Dr. Alok Kumar & Shri Kiyoshi Mizufune, JICA Study Team
1045-1100	Interactions	
1100-1115	**Tea Break**	
1115-1300	***Technical Session 6, Chair & Presenter - Dr. S. Sundaramoorthy, Former E.D. CMWSSB*** ***Co-chair – Shri D. P. Singh, Former Chief Engineer, UP Jal Nigam*** ***Rapporteur - Shri A. K. Saha, Assistant Adviser (PHE), CPHEEO***	
1115-1200	Appendix - Design of Sewers and Pumping Stations – Example calculation	Dr. S. Sundaramoorthy , JICA Study Team
1200-1245	Appendix - Design of Sewage Treatment and Sludge Treatment Facility – Example calculation	Dr. S. Saktheeswaran, JICA Study Team
1245-1255	Concluding Remarks	Dr S R Shukla, Co-Chairman of the Expert Committee
1255-1300	Vote of Thanks	Dr M Dhinadhayalan Deputy Adviser (PHE), CPHEEO
1300-1400	**Lunch**	

सत्यमेव जयते

Two day National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment (Part B: Operation & Maintenance) and (Part C: Management) on 21-22 January, 2013 at New Delhi

Agenda

Day 1: 21st January, 2013 (0900 Hrs -1800 Hrs)
Venue: Gulmohar Hall, First Floor, India Habitat Centre, Lodhi Road, New Delhi.

Schedule	Subject	Speaker
0915-1015	Registration	
1015-1125	***Opening Session***	
1015-1020	Welcome Address	Shri Ashutosh Joshi, Director (UD), MoUD
1020-1030	Address on Initiatives on Urban Sanitation	Dr. Ashok Singhvi, Joint Secretary (UD), MoUD
1030-1040	Address on JICA Assistance to Water & Sanitation Sector in India	Shri Taisuke Watanabe, Senior Representative, JICA India Office
1040-1100	Summary of policy on formulation of the Manual on Sewerage and Sewage Treatment (Part A, Part B & Part C)	Shri Akira Takechi Team Leader, JICA Study Team (JST)
1100-1115	Keynote Address	Dr. Sudhir Krishna, Secretary (UD), MoUD
1115-1120	Release of Documents of MOUD (i) Advisory Note on Septage Management in Urban India (ii) Guidelines for Decentralised Wastewater Management	Dr. Sudhir Krishna, Secretary (UD), MoUD
1120-1125	Vote of Thanks	Dr. M Dhinadhayalan, Deputy Adviser(PHE), CPHEEO
1125-1140	**Tea Break**	
Manual on Sewerage and Sewage Treatment Part B: Operation & Maintenance		
1140-1305	***Technical Session 1, Chair –Dr S R Shukla, Former Adviser (PHEE), CPHEEO Co-chair – Dr M Dhinadhayalan,Deputy Adviser (PHE), CPHEEO Rapporteur – Shri Takashi Sakakibara, JICA Expert,CPHEEO***	
1140-1200	Chapter 1 - Introduction	Dr. S. Sundaramoorthy, JICA Study Team
1200-1225	Chapter 2 – Sewer Systems	Mr. Teruo Suga, JICA Study Team
1225-1245	Chapter 3 – Pumping Station	Mr. Gururaj Rao, JICA Study Team
1245-1305	Question & Answer	
1305-1405	**Lunch**	
1405-1555	***Technical Session 2, Chair – Dr. S. Sundaramoorthy, Former Engg. Director, CMWSSB Co-chair – Shri M Shankarnaryanan, Former Joint Adviser (PHEE),CPHEEO Rapporteur – Dr. Ramakant, Assistant Adviser (PHE), CPHEEO***	
1405-1450	Chapter 4 – Sewage Treatment Facilities	Mr. Yoshitaka Ito and Mr. Gururaj Rao JICA Study Team
1450-1535	Chapter 5 – Sludge Treatment Facilities	Mr. Teruo Suga, JICA Study Team
1535-1555	Question & Answer	
1555-1610	**Tea Break**	
1610-1745	***Technical Session 3, Chair – Prof A Mazumdar, Former Director, AIIH&PH Co-chair – Shri S P Garnaik, Energy Economist, BEE Rapporteur – Shri A K Saha, Assistant Adviser (PHE), CPHEEO***	
1610 -1635	Chapter 6 – Electrical and Instrumentation Facilities	Mr. Mikio Suzuki, Mr. Gururaj Rao and Mr. R. Vasudevan, JICA Study Team
1635-1700	Chapter 7 – Monitoring Water Quality	Dr. S. Sundaramoorthy, JICA Study Team
1700-1725	Chapter 8 – Environmental Conservation	Mr. Yoshitaka Ito and Mr Gururaj Rao, JICA Study Team
1725-1745	Question & Answer	
1745-1800	**Concluding Remarks**	**Dr S R Shukla, Former Adviser (PHEE)**

सत्यमेव जयते

Two day National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment (Part B: Operation & Maintenance) and (Part C: Management) on 21-22 January, 2013 at New Delhi

Agenda

Day 2: 22nd January, 2013 (0900 Hrs- 1815 Hrs)
Venue: Silver Oak, Ground Floor, India Habitat Centre, Lodhi Road, New Delhi.

Schedule	Subject	Speaker
1000-1045	***Technical Session 4, Chair –Professor A A Kazmi, IIT Roorkee Co-chair – Shri J B Ravinder, Deputy Adviser (PHE), CPHEEO Rapporteur – Dr. Ramakant, Assistant Adviser (PHE), CPHEEO***	
1000-1010	Chapter 9 – Occupational Health Hazards and Safety Measures	Mr. Mikio Suzuki and Mr. Gururaj Rao JICA Study Team
1010-1020	Chapter 10 – Onsite Systems	Mr. Akira Morita JICA Study Team
1020-1035	Advisory note on Septage Management in Urban India	Shri Takashi Sakakibara, JICA Expert
1035-1045	Question & Answer	
1045-1100	**Tea Break**	
Manual on Sewerage and Sewage Treatment Part C: Management		
1100-1240	***Technical Session 5, Chair –Professor K Balooni, Indian Institute of Management Kozhikode Co-chair – Shri V K Chaurasia, Deputy Adviser (PHE), CPHEEO Rapporteur – Shri Takashi Sakakibara, JICA Expert,CPHEEO***	
1100-1115	Chapter 1 – Introduction	Dr. Alok Kumar, JICA Study Team
1115-1140	Chapter 2 – Legal Framework and Policies	Mr. Kiyoshi Mizufune, JICA Study Team
1140-1155	Chapter 3 – Institutional Aspects and Capacity Building	Dr. Alok Kumar, JICA Study Team
1155-1220	Chapter 4 – Financing and Financial Management	Dr. S Sundaramoorthy, JICA Study Team
1220-1240	Question & Answer	
1240-1345	**Lunch**	
1345-1605	***Technical Session 6, Chair –Shri R N Gupta, Former Engineer-in-chief, PHED Chattisgarh Co-chair – Shri S Srinivasan, Sr Vice President, IL&FS Water, Chennai Rapporteur – Mr A K Saha, Assistant Adviser (PHE), CPHEEO***	
1345-1435	Chapter 5 – Budget Estimates for O&M	Dr. S Saktheeswaran, JICA Study Team
1435-1525	Chapter 6 – Public Private Partnership	Mr. Katsuzo Motegi, JICA Study Team
1525-1545	Chapter 7 – Community Awareness and Participation	Mr. Katsuzo Motegi, JICA Study Team
1545-1605	Question & Answer	
1605-1620	**Tea Break**	
1620-1805	***Technical Session 7, Chair – Dr. S. Sundaramoorthy, Former Engg. Director, CMWSSB Co-chair – Prof Urmila Brighu, MNIT Jaipur Rapporteur – Dr. Ramakant, Assistant Adviser (PHE), CPHEEO***	
1620-1645	Chapter 8 – Asset Management	Mr. Masatoshi Yamada, JICA Study Team
1645-1720	Chapter 9 – Management Information System	Mr. Kiyoshi Mizufune, JICA Study Team
1720-1745	Chapter 10 – Potential Disasters in Sewerage and Management	Mr. Masatoshi Yamada, JICA Study Team
1745-1805	Question & Answer	
1805-1810	**Concluding Remarks**	**Dr S R Shukla, Former Adviser (PHEE)**
1810-1815	**Vote of Thanks**	**Dr M Dhinadhayalan, Dy Adviser (PHE)**

APPENDIX 3 PRESENTATIONS MADE DURING WORKSHOP

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Summary of Policy on Revision of Manual

CPHEEO, MOUD

JICA Study Team

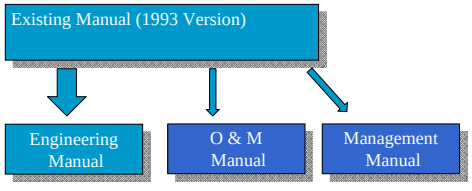
20th September 2012

1

Background of Revision and Updating of the Existing Manual

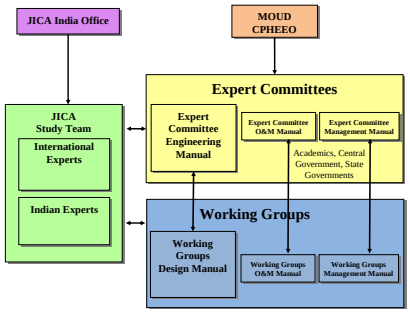
- Advance in technology since 1993
- Increased environmental awareness
- More stringent conditions of environmental compliance and regulatory requirements
- New concepts: Decentralized system, septage management, reuse of treated sewage, city sanitation plan, PPP, asset management,,,,,
- Importance of O&M and Management

Existing Manual and New Manuals



3

Organizational Structure



4

Work Flow of Manual Preparation

5

Overall Policy

- Compatibility with existing Manual
- Compatibility with existing conditions in India
- Compatibility with sanitation policy in India
- Compatibility with relevant regulations
- Compatibility with National Urban Sanitation Policy 2008

6

Policy of Revision and Updating

- Rearrangement of the contents from process oriented to facility oriented
  (separation of sewage treatment and sludge treatment, process description along the treatment flow)
- Updating design criteria based on proven performances of processes under Indian conditions
  (design period, Roughness coefficient, depth of clarifier)
- Introduction of new technologies which became practical after the Existing Manual
  (Mainly sewage treatment and sludge treatment)

7

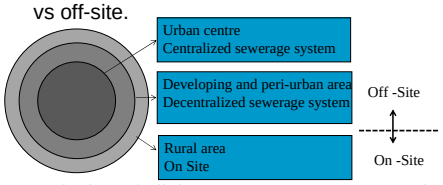
Policy of Revision and Updating

- Introduction of new concepts in relation with sanitation
  (New Chapters for Decentralized sewerage, reuse, city sanitation plan)
- Developing MS excel based software for widely used design procedures to make it easy for doing the design and also for others to check the same.
  (saving time and avoiding calculation errors)

8

Compatibility with NUSP 2008

- Systematic arranging of sanitation concepts, such as centralized vs decentralized, on-site vs off-site.



- Inclusion of all the measures, systems and facilities in Manual

Evolving incremental sewerage systems for widest geographical coverage in the investment finance

9

Towards the future revision/update

Suggestions

- Nation-wide information/data accumulation and its integrated management.
- Introduction of study, experiments and pilot plant test for manual updating
- Periodical addendum to be released, say once in two years on validated design procedures of newer treatment technologies as studied for Indian conditions

10

Thank you for your attention

11

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 1: INTRODUCTION ~

CPHEEO, MOUD

JICA Study Team

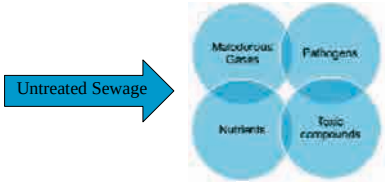
20th September 2012

Contents

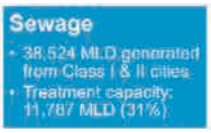
Revised Sections indicated in RED.

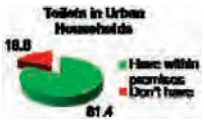
Need of Safe Sanitation

- Urban population percentage (of total) increased from 27.8% (2001) to 31.8% (2011)
- Number of towns increased from 5,161 to 7,935
- Deficient in infrastructures



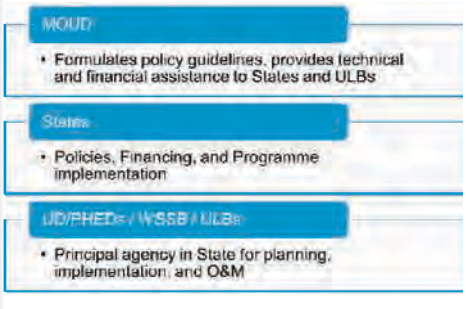
Present Scenario of Urban Sanitation





- Inadequate sewage collection networks & Insufficient sewage treatment capacity
- Lack of Finance & Capacity of ULBs

Sector Roles and Responsibilities



National Urban Sanitation Policy

- MOUD published NUSP in 2008
- Goal: Transform urban India into community-driven, totally sanitized, healthy, and livable cities/towns
- Salient features
  - Cities open defecation free
  - Eliminate manual scavenging
  - Municipal sewage and storm water management
  - Recycle and reuse of treated sewage for non-potable use
  - Solid waste management
  - Services to poor
  - Improved public health and environment

Need for Revision and Updating of the Existing Manual (1993 version)

- Latest technologies in sewerage
- Increased environmental awareness
- More stringent conditions of environmental compliance and regulatory requirements
- New contents such as: Decentralized system, septage management, recent technologies, reuse of treated sewage, preparation of city sanitation plan, etc.

Part A, B and C of Manual

- Part A: Engineering
  - Guideline for practicing engineers for designing sewerage and sewage treatment facilities
  - Includes incremental sanitation from onsite methods to decentralized to conventional
  - Recent advances in sewage treatment, sludge and septage management, Guidelines on reuse of treated sewage
- Part B: Operation and Maintenance
  - Guidance on sustainable O&M practices for centralized and onsite sanitation systems in India
- Part C: Management
  - For administration and management level staff for efficient Project planning and implementation and optimizing the investment for improved sanitation and living environment
  - Guidelines on PPP, Financial planning and management, Revenue and O&M, Community participation, etc.

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 2: PLANNING ~

CPHEEO, MOUD

JICA Study Team

20th September 2012

Contents (1)

Revised Sections indicated in RED.

Contents (2)

2.1 Vision

NUSP

All Indian cities/towns become totally sanitized, healthy and liveable, and ensure and sustain good public health and environment for all citizens with special focus on hygienic and affordable sanitation facilities for urban poor and women.

2.2 Objectives

Proper collection and transportation of generated sewage, and treatment to required degree in short, medium, and long term, and disposal/reuse without causing health or environmental problems

Short term

- Immediate provision of onsite system (only sanitary latrines)
- Interim provision till implementation of medium and long term solution
- Targeting 5 years from base year

Medium term

- Provision of decentralized system where conventional system not yet feasible
- Targeting 15 years from base year

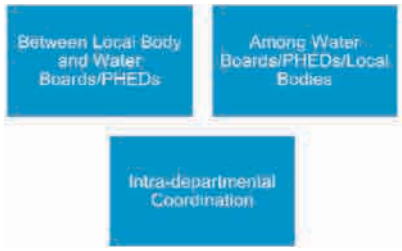
Long term

- Conventional sewerage system
- Targeting 30 years from base year

2.4.2 Institutional Aspects

- Capacity of existing local authority
- Revenue collection and reliability
- Capacity building needs
- Public private partnership

Inter- and Intra-departmental Coordination



City Master Plan and City Sanitation Plan

City Master Plan

- City master plan to be the basis of project
- Master plan to be prepared with target of 30 years
- Mandatory provision of adequate and proper sanitation facilities in schools

City Sanitation Plan

- City sanitation plan should be a part of city development plan and be prepared in accordance with NUSP
- Planning period for onsite, decentralized and centralized systems shall be 5, 15 and 30 years respectively

Method of Population Projection

- Demographic method
- Arithmetic increase method
  - Large and old cities, well settled & established communities
- Incremental increase method
- Geometrical increase method
  - Growing towns and cities with expansion potential
- Decreasing rate of growth
- Graphical method
  - Based on single city
  - Based on cities with similar growth pattern
- Logistic method
- Method of density

Layout and Arrangement of Sewerage

Decentralized

- Simplified
- Settled
- Twin drains

Conventional sewers

- When the habitation is populated to a level where revenue can sustain O&M

Twin drain: An integrated master drain which has two parallel drains inside. Laid on both sides of the road. The house-side drain is for effluent from septic tank & grey water. The road-side drain is for stormwater runoff.

Legislation and Regulations (1)

Water (Prevention and Control) Act 1974

- Consent to establish from PCB before STP construction
- EIA not needed for STP as per 2006 Notification by MOEF
- Consent to operate before starting operation

Environmental (Protection) Act, 1986

- Discharge standards for treated sewage, noise, air emission standards are prescribed
- PCB empowered to tighten these standards when needed

Municipal Byelaws

- Owner of property to dispose of sewage in proper manner
- If municipal sewers exist within specified distance, sewage of property must be discharged into it

Legislation and Regulations (2)

Indian Standards

- Quality levels of bought out items and construction quality

Town and Country Planning Act

- Stormwater drains to be built on both sides of road, where it is possible.

2.11 Guidelines on House Sewer Connections

- Need to amend byelaws to make it compulsory for the occupant to avail house sewer connection wherever public sewerage exists
- Include house service connection as part of sewerage project itself
- Float EMI schemes for repayment of house service sewer cost

Service Level Benchmarks for Sewage Management

S. No.	Proposed Indicator	Benchmark (%)
1	Coverage of toilets	100
2	Coverage of sewage network services	100
3	Collection efficiency of the sewage network	100
4	Adequacy of sewage treatment capacity	100
5	Quality of sewage treatment	100
6	Extent of reuse and recycling of sewage	20
7	Efficiency in redressal of customer complaints	80
8	Extent of cost recovery in sewage management	100
9	Efficiency in collection of sewage charges	90

Source: Handbook on Service Level Benchmarking, MOUD

2.14 Planning of Sewerage System

- **Objective**:
  - Should not remain UNUSED for long
  - Should not become INADEQUATE very soon
- **Approaches**
  - Sewer system: Incremental Sewerage
  - Pumping station: twin wet well for degritting
  - STP: consider emerging trends

2.15 Planning of Sludge Treatment and Utilization

- Sludge reuse:
  - Biomethanation to get energy
  - digested sludge as soil filler in agriculture or farm forestry
  - Pellets to marketable soil fillers or composted organic fertilizer
- Common treatment facilities for sludge from several STPs: transportation is difficult.
- Transportation: only in form of dewatered sludge cake

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 3: DESIGN AND CONSTRUCTION OF SEWERS ~

CPHEEO, MOUD

JICA Study Team

20th September 2012

Constitution

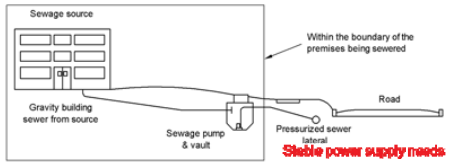
- Chapter 3 Design of Sewers
- Chapter 4 Sewer Appurtenance
- Chapter 5 Material for Sewer Construction
- Chapter 6 Structural Design of Buried Sewers
- Chapter 7 Construction of Sewers
- Chapter 8 Maintenance of Sewerage Systems
- Chapter 22 Corrosion Prevention and Control

Chapter 3 Design and Construction of sewer

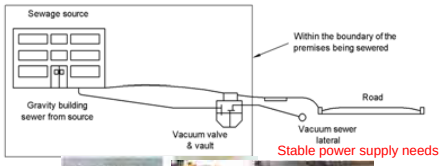
Additions in New Manual

- a) Type of collection system
  - Pressurized sewer
  - Vacuum sewer system
- b) Measurement of Flow in Existing Drain/Sewer
  - The Palmer-Bowlus Flume
- c) Materials, shape, and size of sewer
- d) Slope of sewer (3.17, 3.20,Table 3.113.11)
- e) HDPE Manholes
- f) Pile Supports in loose soils(3.30)
- g) Pipe Spacing
- h) Manhole Rehabilitation(3.37)
- j) Water jetting issue(3.60)
- k) Air test (3.61.2)
- l) sewer renovation(3.65.2)
- m) corrosion (3.69)

3.11.3 Pressurized Sewers



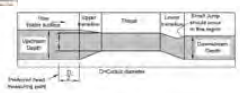
3.11.4 Vacuum Sewer System

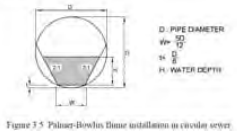


Stable power supply needs

Measurement of Flows in Existing Drain/Sewer

The Palmer-Bowlus Flume





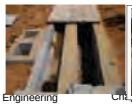
(i) less energy loss;
(ii) minimal restriction to flow &
(iii) Easy installation in existing conduits.

Flow Measurement: Based on Water Level

- Install a Palmer-Bolus (PB) flume at the manhole invert, and the water level sensor at its upstream
- Measure flow with the low flow rate stabilized at high accuracy
- Not suitable for locations susceptible to rainfall
- Water depth for measurement: Up to around 30% of sewer diameter

3.13 Shape and Size of Sewers

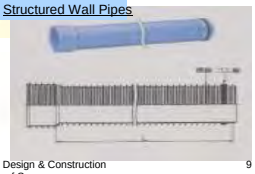
- Circular section (most commonly used)
- Egg shaped section (hydraulic advantage)
- Box conduits (free shape size)
- Twin drain Shallow sewer



Non- Metalic Non-concrete Synthetic Material Pipe

Double *Wall Corrugated Polyethylene* Pipes

Structured Wall Pipes



Solid Wall UPVC Pipes

Manning's Coefficient of Roughness

New manual

Type of material	Condition	n
Salt glazed stone ware pipe	Good	0.012
Salt glazed stone ware pipe	Fair	0.015
Cement concrete pipes and masonry with cement mortar plaster	Good	0.013
Cement concrete pipes and masonry with cement mortar plaster	Fair	0.015
FRP		0.01
HDPE / UPVC		0.01
CI with cement mortar lining		0.01
DI with cement mortar lining		0.01

Old Mnual

Type of Material		Condition	n
Salt glazed stone ware pipe		(a)Good	0.012
		(a)Fair	0.015
Cement Concrete Pipes.		(a)Good	0.013
with collar joints)		(a)Fair	0.015
Spun concrete pipes (RCC & PSC)with Socket Spigot Joints (Design Value)			0.011
Masonary	(a)Neat cement plaster		0.018
	(a)Sand and cement plaster		0.015
	(a)Concrete, steel troweled		0.014
	(a)Concrete, wood troweled		0.015
Stone-work	(a)Smooth, dressed ashlar		0.015
	(a)Rubble set in cement		0.017
	(a)Fine, well packed gravel		0.02
Earth	(a)Regular surface in good condition		0.02
Steel	(a)Welded		0.013
	(a)Slightly tuberculated		0.02
	(a)With spun cement mortar lining		0.011
Cast Iron	(a)Unlined		0.013
	(a)With spun cement mortar lining		0.011
Asbestos cement			0.011
Plastic (smooth)			0.011

Table 3.13 Minimum Slope of Sanitary Sewer

Table 3.13 Minimum slopes of sanitary sewers

Sewer Size (mm)	Minimum Slope (%)	1 in
150	0.6	170
200	0.40	250
250	0.28	360
300	0.22	450
375	0.15	670
450	0.12	830
525	0.10	1000

Present peak flow in lps	Slope per 1,000
2	6.0
3	4.0
5	3.1
10	2.0
15	1.3
20	1.2
30	1.0

3.16.2 Hazen-Williams Formula (Circular Pipe)

- The hydraulic analysis of pumping mains

Sl. No.	Conduit Material	Recommended values for	
		New Pipes	Design
1	RCC with socket & spigot joints	140←present manual (150) ←old manual	140 (120)
3	HDPE, UPVC, GRP, FRP	150 (150)	140 (120)
4	Steel. CI & DI all with cement mortar lining	140 (140)	140 (100)

Note: Even though the C value can be taken as 145 for Water supply, but for sewage 140 shall be taken for design purpose. Reference: CPHEEO, Manual on Water Supply & Treatment, 1999.

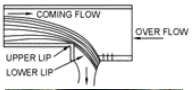
3.18.1 Side Flow Leaping Weirs

Incoming flows in excess of the desired dry weather flow will go
past in the channel and flows in excess will "leap" over the weirs
on the sides to be diverted to storm sewers.

$L = 7.6 \times 10\text{-}4 \times V \times D \times \text{Log}(h1/h2)$

L : Required length in m
V : Velocity of approach in m/s
D : Dia of the sewer in mm
h1, h2 : Heads in m above the crest of the weir upstream and downstream

3.18.2 Floor Level Leaping Weir



Source: Daniel Sztruhar, et.al. "Combined sewer overflow assessment in Slovakia",

A floor level leaping weir is formed by a gap in the invert of a sewer through which the dry weather flow falls and over which a portion of the entire storm leaps.

3.23 RCC AND COMBINATION MANHOLES

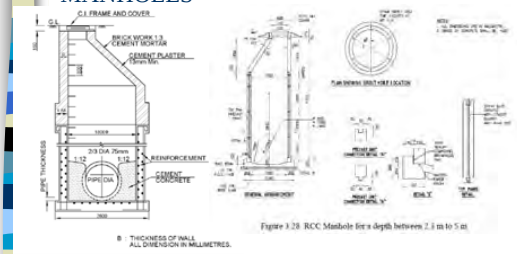


Figure 3.28 RCC Manhole for a depth between 2.1 m to 5 m

COMBINATION MANHOLES Type

RCC Type

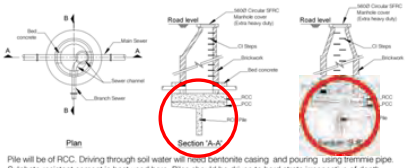
3.24 HDPE MANHOLES

safeguarded against the uplift pressure due to high ground water table and also crushing under high traffic load etc. by suitably anchoring

HDPE manholes with EN 13598-2: 2009 and ISO (ISO 9001: 2008) specifications are recent entrants.
But the Indian standards are yet to be brought out by BIS

3.36 PILE SUPPORTS IN LOOSE SOILS

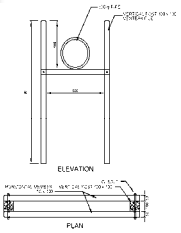
Where the soil is weak, RCC piles shall be driven to hard stratum.



Pile will be of RCC. Driving through soil water will need bentonite casing and pouring using tremmie pipe.
Sulphate resistant cement is best used here. Piles should be driven to hard strata irrespective of depth.
RCC and PCC to be poured integrally and concreted of sulphate resistant cement.

3.50 Supporting Strength of Rigid Conduit

3.50.3.2 Bedding in Quicksand Soil Conditions



it is necessary to anchor the sewer to the ground and hold it at the
grade as laid in the face of soil sinkage.

Figure 3.44 Example of Venteak supported sewer pipe

Figure 3.45 Typical arrangements for laying sewers in high subsoil locations using dewatering pump sets, tube wells and Venteak piles with cross brace and nylon rope wrapping around the sewers securing it to the venteak piles and brace

3.59 PRECAUTIONS AGAINST UPLIFT

Other than the metallic and concrete pipe sewers

high groundwater conditions :

- above the pipe level in high ground water locations,
- water logged locations and
- coastal areas.

The concrete surrounds or venteak piles

3.60 THEWATER JETTING ISSUES (1)

Manual sewer cleaning is restricted by court.

the mechanical sewer cleaning has gained momentum

Jet rodding cum vacuum suction sewer cleaning machine is shown above. The reverse jet at the nozzle releases a "jack hammer" action.

3.60 THEWATER JETTING ISSUES (2)

- The permissible pressure rating has to be evolved for various pipe materials and sizes in India
- The pressures hereunder are the maximum pressures.in UK

Table 3.27 Maximum jetting pressure in case of different types of pipes

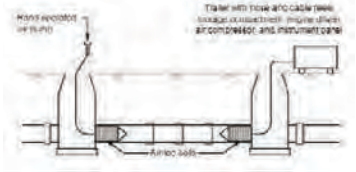
No	Maximum Jetting Pressure	concrete	clay	plastic	Bricks fibre
1	Meter of Water	3450	3450	1800	1030
2	BAR	345	345	180	103

Source: Water Jetting Code of Practice, Water Research Centre, UK, 2005

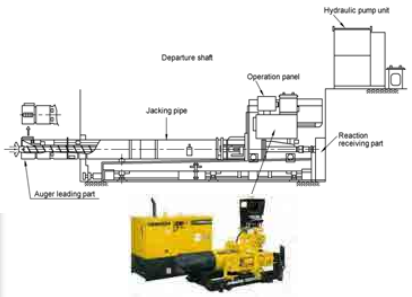
Generally 40-250 Bar is used in Japan

7. Section 3.61.2 Air Testing

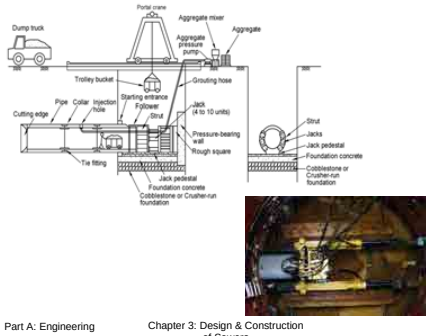
Diameter, mm	minutes	Diameter, mm	minutes	Diameter, mm	minutes
100	0.3	400	2.1	750	4.8
150	0.7	450	2.4	800	5.4
200	1.2	500	3.0	900	6.0
250	1.5	600	3.6	950	6.6
300	1.8	700	4.2	1,070	7.3



g) Guided Auger Boring



h) Pipe Jacking

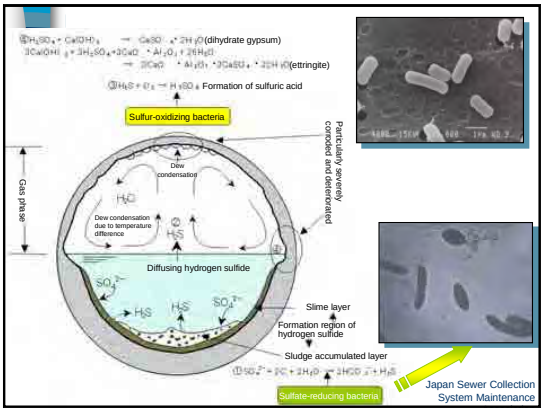


i) Tunnel Boring / Utility tunnelling / Trenchless Technology

http://wired.jp/wv/gallery/2009/10/22/

.

Diameter: more than 1500mm



Japan Sewer Collection System Maintenance

3.69.7 Sewer Protection

3.69.7.1 Liners

A plastic polyvinyl chloride sheet

3.69.7.2 Protective Coatings

Any protective coating used should possess the following qualities;

(i) it should be resistant to acid attack,

(ii) it should bond securely to the concrete,

(iii) it should be economical and durable,

(iv) it should be resistant to abrasive action by flow of sewage

(v) it should be thin enough to fill all pores and irregularities in the surface.

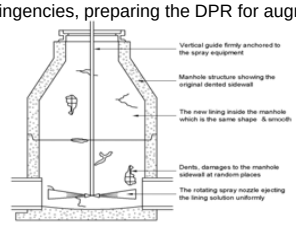
The coating should be continuous with no pin holes or other breaks.

Sewer Damage & Rehabilitation

Source:JSWA

3.37 MANHOLE REHABILITATION

Old manholes are needed to look into the rehabilitation contingencies, preparing the DPR for augment of sewerage.



Recent technologies provide for spray lining of the manholes without man entry.

Local Design of Manhole Cover

Part A: Engineering Chapter 6: Design & Construction of Sludge Treatment Facilities 31

Thank you very much

Part A: Engineering Chapter 3: Design & Construction of Sewers 32

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 4: DESIGN AND CONSTRUCTION OF SEWAGE PUMPING STATIONS AND SEWAGE PUMPING MAINS ~

CPHEEO, MOUD

JICA Study Team

20th September 2012

Contents

- **Sewage Pumping Stations And Sewage Pumping Mains**
  - Main revised items
  - Later key points of some revised items.

Main Revised Items (1)

Revised sections indicated in red.

4.1 General Considerations

Design Flow, Location and Configuration, Measures for Safety and Environment Protection, Design of Suction Water Level, Design Discharge Level, Selection of Power Source

4.2 Screen and Grit Chamber

Gate, Screens, Configuration/Number of Grit Chambers and Method of Degritting,Treatment and Disposal of Screenings and Grit,etc.

4.3 Machinery Room

4.4 **Measures against Odour**

4.5 Pumps

Types of Pumps, Types of Pump Stations, Screw Pump Stations, Number of Pumps, Selection of Pump

Main Revised Items (2)

Revised sections indicated in red.

4.6 Wet Well

Structure, Interior Linings and Waterproofing for Old Wells, Floor Slopes, Lighting, Ventilation, Wet Well Design Criteria, Structural Design Criteria

4.7 Pump Basics

Centrifugal Pumps, Computation of the Total Head of Pumping, System Head, Operating Point of a Centrifugal Pump, Parallel Operation, Stable Characteristic, Cavitation in Pumps

4.9 Prime Movers

4.10 Surging of Pump and Water Hammer

4.11 Piping and Valves

Main Revised Items (3)

Revised sections indicated in red.

4.12 Appurtenances

Air-Release and Air/Vacuum Release Valves, Drain Valves, Additional Appurtenances, Dry Well, Automatic Operation of Pumps and Equipment, Protective Equipment

4.13 Auxiliary Power Devices

4.14 Alarm Systems

4.15 Flow Measurement

Magnetic Flow Meters, Ultrasonic Flow Meters

4.16 Corrosion Prevention and Control in Pump Sets

Main Revised Items (4)

Revised sections indicated in red.

4.17 Rehabilitation/Reconstruction of Pumping Station

4.18 Lift Stations

4.19 Installation of Pumps

4.20 Pumping Mains and Design Approach

Design Formula, Computation of Pump Kilowatt, Velocity Considerations in Design of Pumping Mains, Injection and Relay Pumping Mains

4.21 Anti Vortex

Key Points of Some Revised Items

4.2 Screen and Grit Chamber
4.2.2 Screens

- **Use travelling mechanized endless screen**
- **Use rectangular profile of flow to the screen**
- **Use two successive screens, one coarse and the other fine in large pumping stations for backup**
- **Use hand operated screen in small pumping stations**

4.2.2 Screens

Typical hand operated screen facility at shallow sewers in pumping stations

4.2.4.Grit Chamber

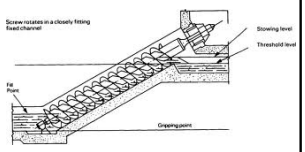
- Pump grit directly to STP if HDPE and PVC pipelines used
- Grit well - an independent well upstream of the wet well
- A simple submersible pump set for reliable grit removal
- Wet well high sewage level to be below the level of incoming and outgoing sewers
- Design grit chamber to house submersible pump sets
- Pass sewage grit mixture through vortex separators
- Handle grit at the bottom with screw classifiers like in detritors
- Use an enclosed and compact system eliminating human contact

Grit Chamber

4.5.1 Types of Pumps

immersible pump

4.5.3 Screw Pump Stations



4.17 Rehabilitation/Reconstruction of Pumping Station

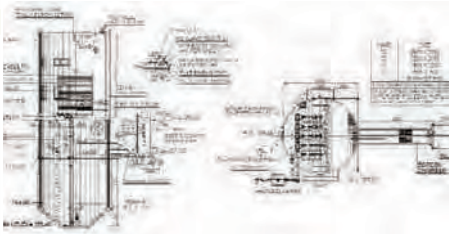
- Required in contingency situations
- Use variable frequency drive to increase pump speed
- Install diesel pump sets in open area and connect pumped sewage to existing delivery main header for a 10% extra flow
- Construct standby control panel room to use if civil works start crumbling
- Apply unite on wet well outer surface of walls to arrest leakages
- Sink another wet well and shift pump sets to repair old well

4.17 Rehabilitation/Reconstruction of Pumping Station

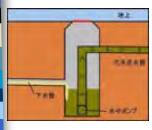
4.18 Lift Stations (1)

- Use intermediate lift stations:
  - at locations with high water table
  - In rocky terrain,
  - when depths of excavation exceeds about 3 m
- Submersible pump stations interposed in gravity sewer network
- The procedure:
  - Sink a wet well
  - Divert incoming deeper sewer to it
  - Use the submersible pump to lift the sewage
  - Discharge it to the next on line shallow sewer.
- Any number of lifts can be inserted
- Connect to dedicated electricity feeders

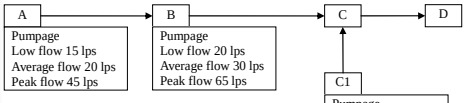
4.18 Lift Stations (2)



4.18 Lift Stations (3)



4.20.4 Injection and Relay Pumping Mains (1)



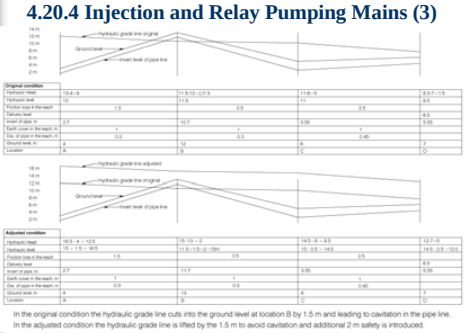
Reach	Design Flow conditions, in lps		
	Low flow	Average flow	Peak flow
A-B	15	20	45
B-C	35	50	110
C1-C	30	50	120
C-D	65	100	230

Illustration of pumping main hydraulics on serial pumping mains

40.20.4 Injection and Relay Pumping Mains (2)

- First step:
  - ✓ Calculate the friction loss and fittings loss in the "spine" pipe line
  - ✓ Add all losses and establish the preferred diameter from velocity considerations.
- Next step:
  - ✓ Plot the hydraulic head line, the ground level and invert level line
- Final step:
  - ✓ *Mark the delivery level and connect backwards by losses
  - ✓ Verify that hydraulic grade line is above GL by at least 2 m
  - ✓ If not, raise it by 2 m above GL at the crown point
  - ✓ . The delivery levels for pumps at different points are obtained.

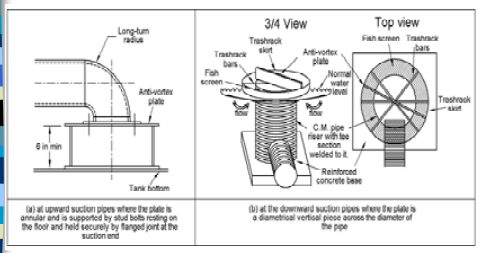
4.20.4 Injection and Relay Pumping Mains (3)



In the original condition the hydraulic grade line cuts into the ground level at location B by 1.5 m and leading to cavitation in the pipe line. In the adjusted condition the hydraulic grade line is lifted by the 1.5 m to avoid cavitation and additional 2 m safety is introduced.

4.21 Anti Vortex

- Anti vortex attachments normally used at the suction end to break up vortex formation



(a) at upward suction pipes where the plate is annular and is supported by stud bolts resting on the floor and held securely by flanged joint at the suction end

(b) at the downward suction pipes where the plate is a diametrical vertical piece across the diameter of the pipe

Thank you for your attention.

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 5: DESIGN AND CONSTRUCTION OF SEWAGE TREATMENT FACILITIES ~

CPHEEO, MOUD

JICA Study Team

20th September 2012

New Manual

Chapter 5 Design and Construction of Sewage Treatment Facilities

Old Manual

Chapter 10 Design Basic Consideration
Chapter 11 Pretreatment–Screening and Grit Removal
Chapter 12 Sedimentation
Chapter 13 Aerobic suspended Growth System
Chapter 14 Aerobic attached Growth System
Chapter 15 Stabilization Ponds
Chapter 16 Anaerobic Treatment of Wastewater
Chapter 19 Tertiary Treatment of Sewage for Reuse
19.3 Tertiary Treatment Methods

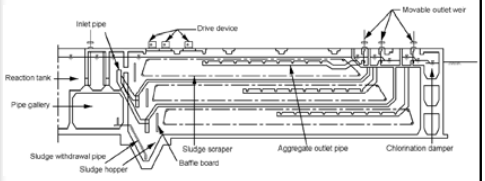
Modification and Revision of Chapter 5 are following

- Screening, Grit Removal and Flow Equalization
- Settling
- Sewage Treatment
- Disinfection Facilities
- Desirable Treated Sewage Quality and Processes
- Electrical and Instrumentation
- Rehabilitation of Sewage Treatment Facilities
- Recent Technologies in Sewage Treatment

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (1)

Example of Secondary Clarifier in 3 layers

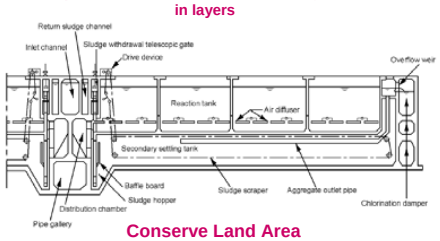


Conserve Land Area

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (2)

Example of Reaction Tank and Secondary Clarifier in layers



Conserve Land Area

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (3)

Example of Underground STP, Ariake, Japan

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (4)

Control Building of STP

Sewerage Exhibition Hall "Rainbow" in STP

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (5)

Gymnasium in STP

Swimming pool in STP

5.3 Secondary Biological Treatment Process

5.3.5 STP Land Area (6)

Example of Effective Use of Upper Part of STP Mikawashima, Japan

5.3 Secondary Biological Treatment Process

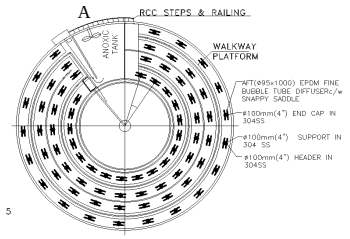
5.3.5 STP Land Area (7)

Park on STP

Baseball Park on STP

Secondary Biological Treatment Process

Arrangement of Anoxic, aeration & settling in a composite layout at New Delhi Airport STP



Sewage, Return sludge and Return mixed liquor enters anoxic tank at A. From here it passes into spiral aeration channels in plug flow and finally to settling tank at center.

Secondary Biological Treatment Process

Arrangement of Anoxic, aeration & settling in a composite layout at New Delhi Airport STP

During Construction

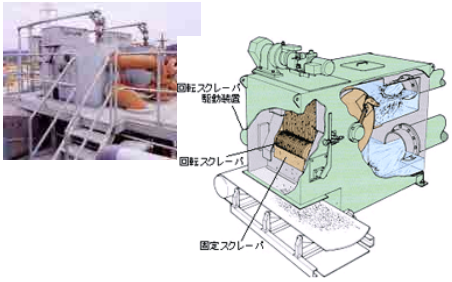
After Commissioning

5.3 Secondary Biological Treatment Process
5.3.18 Grading and Landscaping

Grading and Landscaping
Vrishabhavathi Valley STP, Bangalore

5.6.1 Screening

- **Example of Rotary Drum Screen**



5.6.2 Grit Removal

■ **Example of Grit Chamber (1)**

- **Rectangular Type**

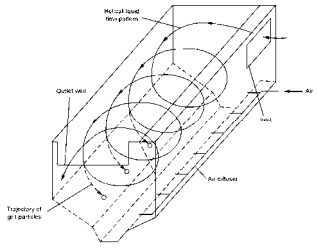
Example of Grit collector - Scraper type -

Example of Grit collector - Jet nozzle type using treated sewage -

5.6.2 Grit Removal

■ **Example of Grit Chamber (2)**

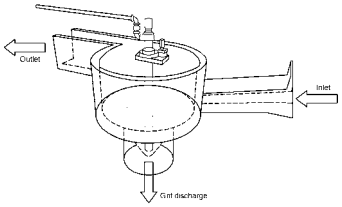
- **Aerated grit chamber**



5.6.2 Grit Removal

■ **Example of Grit Chamber (3)**

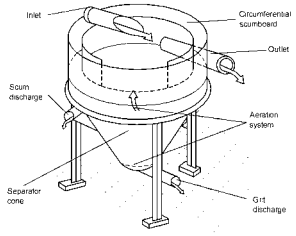
- **Vortex Grit Separator**



5.6.2 Grit Removal

■ **Example of Grit Chamber (4)**

- **Vortex and Scum Grit Separator**



5.7 Settling

5.7.4 Design Considerations

Design Prameter for Clarifiers (Table 5.6)

Type of Settling	Overflow rate, $m^3/m^2/day$		Solid loading, $kg/day/m^2$		Side Water Depth, m	Weir loading, $m^3/m/day$
	Average	Peak	Average	Peak	Average	Average
Primary Clarifiers						
1) Primary Settling only	25 - 30	50 - 60	-	-	≥ 2.5 - 3.5	125
2) followed by secondary treatment	35 - 50	80 - 120	-	-	≥2.5 - 3.5	125
3) with activated sludge return	25 - 35	50 - 60	-	-	≥3.5 - 4.5	125
Secondary Clarifiers						
4) Secondary settling for activated sludge	15 - 35	40 - 50	70 - 140	210	≥3.0 - 3.5 : New 3.5 - 4.5 : Old	185
5) Secondary settling for extended aeration	8 - 15	25 - 35	25 - 120	170	≥3.0 - 4.0 : New 3.5 - 4.5 : Old	185

5.7 Settling

5.7.4 Design Considerations

- Primary Clarifiers

Surface of Rectangular Primary Clarifier

Inside of Rectangular Primary Clarifier - Sludge Scraper -

5.7 Settling

5.7.4 Design Considerations

Primary Clarifiers

Primary Clarifiers

Secondary Clarifiers

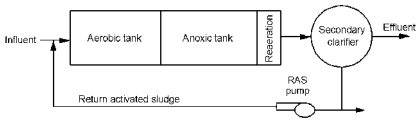
The free fall permits additional entrainment aeration of the secondary treated sewage.

5.8 Sewage Treatment

5.8.1 Activated Sludge Process

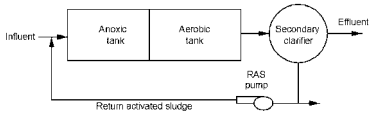
- Nitrogen Removal (1)

- Wuhrmann Process

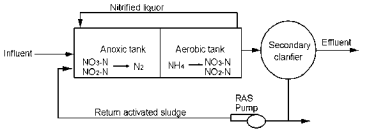


- Nitrogen Removal (2)

- Ludzack Ettinger Process (Wuhrmann Modified)

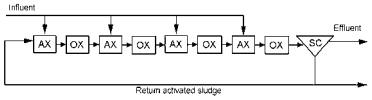


- Recycled Biological Nitrification/Denitrification Process - Modified Ludzck Ettinger (MLE) Process-

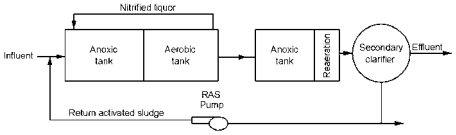


- Nitrogen Removal (3)

- Step-feed Multistage Biological Nitrogen Removal Process

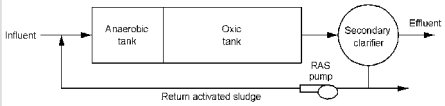


- Bardenpho Process (4 Stage)



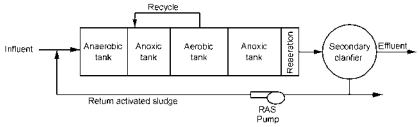
5.8.1 Activated Sludge Process (4)

- **Phosphorus Removal**
  - **Anaerobic-Oxic Activated Sludge Process (AO Process)**

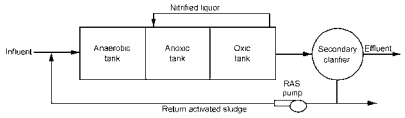


5.8.1 Activated Sludge Process (4)

- **Nitrogen and Phosphorus Removal**
  - **Bardenpho Process (5 Stage)**

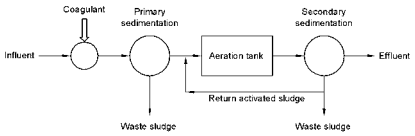


  - **Anaerobic-Anoxic-Oxic (A_2O) Process**



5.8.6 Supplemental Treatment Processes

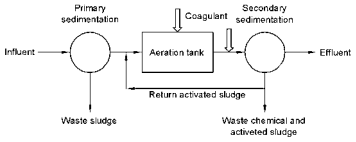
- **Phosphorus Removal**
  - **Chemical Precipitation**



Phosphorus solubility with pH variation in water

5.8.6 Supplemental Treatment Processes

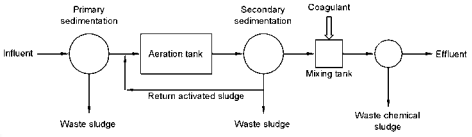
- **Phosphorus Removal**
  - **Chemical Precipitation**



Phosphorus solubility with pH variation in water

5.8.6 Supplemental Treatment Processes

- **Phosphorus Removal**
  - **Chemical Precipitation**



Phosphorus solubility with pH variation in water

5.9 Disinfection Facilities

- **Chlorination**

Chlorine Dosing Facility
(Using sodium hypochlorite solution)

Chlorine Contact Basin

5.9 Disinfection Facilities

➢Ultraviolet Radiation

Closed Reactor Type

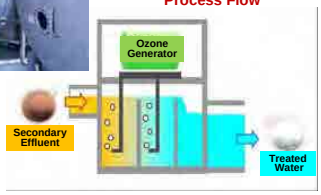
Open Channel Type

5.9 Disinfection Facilities

➢Ozone System

Ozone Generator
- Kyoto City, Japan -

Process Flow



5.9 Disinfection Facilities

Technical factors and feasibility considerations in disinfectant choice

No.	Considerations	Chlorine	Chlorine Dioxide	Ozone	UV
1	Flexibility	2	2	2	2
2	Reliability	1	2	3	2
3	Complexity	2	3	3	2
4	Effectiveness	2	1	1	2
5	Need for Piloting	1	4	3	3
Rating based on scale of 1 to 5 with 1 indicating best degree of confidence					

Source: US-EPA-Design Manual-Municipal Wastewater Disinfection-EPA/625/1-86/021

5.9 Disinfection Facilities

■ The best methods of achieving 100% faecal microbes removal recommended by CPCB

" Performance of Sewage Treatment Plants - Coliform Reduction - CUPS/ 69 /2008 – CPCB "

➢ coagulation- flocculation followed by chlorination after secondary treatment

5.11 Desirable Treated Sewage Quality

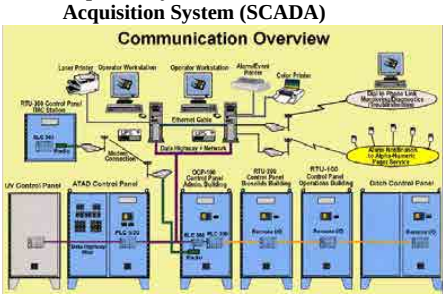
Recommended discharge guidelines for treated sewage discharge into surface water which after some travel may join a drinking water source which is to be used as source of supply for drinking .

Parameter	MOEF Standards*	Recommended Values (not to exceed)
BOD, mg/l	30	10
SS, mg/l	100	10
TKN, mg/l	100	10
Dissolved P, mg/l	5	2
Faecal Coliforms, MPN / 100 ml	Not specified	230

*Note: General Standards, Environmental Protection Rule, 1986

5.12 Electrical and Instrumentation

5.12.12 Supervisory Control and Data Acquisition System (SCADA)



5.12 Electrical and Instrumentation

Control Center of STP
- Tokyo, Japan -

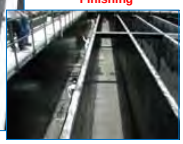
5.14 Rehabilitation of Sewage Treatment Facilities

Example of Rehabilitation of STP
- Chlorine Contact Basin -

The concrete surfaces have to be rehabilitated

Epoxy resin paste used to fill, patch and rebuild concrete

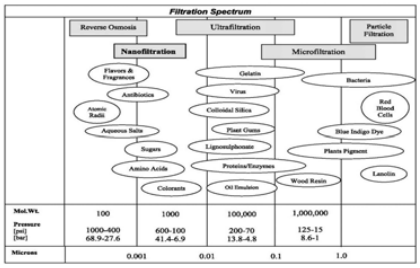
Finishing



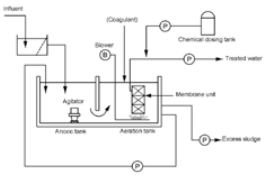
South District Wastewater Treatment Plant, Florida, USA

5.16 Recent Technologies in Sewage Treatment

5.16.9 Membrane Filtration (MF, UF, NF, RO)

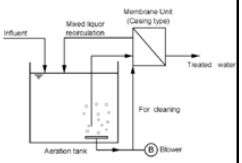


5.16.10 Membrane Bioreactor Process



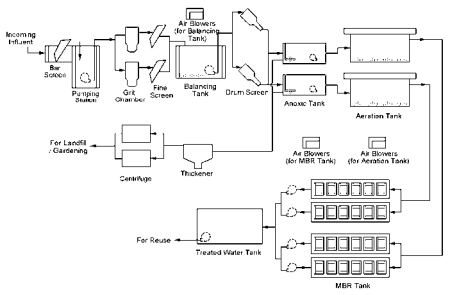
➢ Immersed Membrane

➢ External Membrane



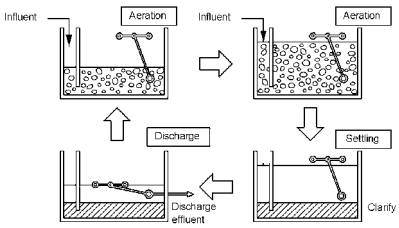
5.16.10 Membrane Bioreactor Process

➢ Schematic Flow Diagram of 4.54 MLD STP in Delhi



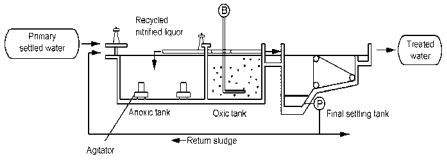
5.16.11 Sequencing Batch Reactor (SBR)

➢ Typical operating cycles of Intermittent SBR process



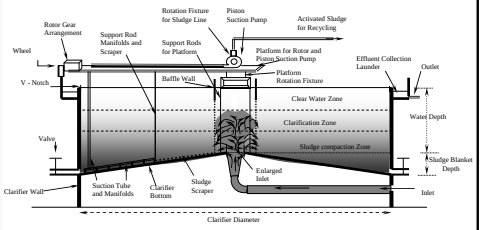
5.16.12 Moving Bed Biofilm Reactor (MBBR)

➢ **Example of Process Flow**



5.16.19 Improved Circular Secondary Clarifier (HYDROPLUME®) CSIR-NEERI

➢ **HYDROPLUME® Clarifier**



From concluding para of Chapter-5

There are various technology options available for treating sewage. The technology option as well as the project cost would be outlined in the detailed project report prepared for implementing the project. Irrespective of the technology chosen, STP projects could be developed on a long term commitment from the private sector partner either on PPP/build own operate transfer (BOOT) basis or on engineering procurement construction (EPC) plus O&M for 15 years where a part of the EPC cost is payable over a long-term O&M period. However, it is suggested that no new technologies will be considered under EPC contract.

Children are playing in a water park that contains treated sewage after secondary treatment, sand filtration, chemical coagulation, and RO.

Thank you

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 6: DESIGN AND CONSTRUCTION OF SLUDGE TREATMENT FACILITIES ~

CPHEEO, MOUD

JICA Study Team

21st September 2012

Contents

Sludge Volume Reduction

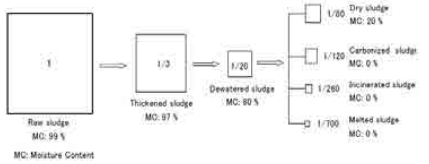
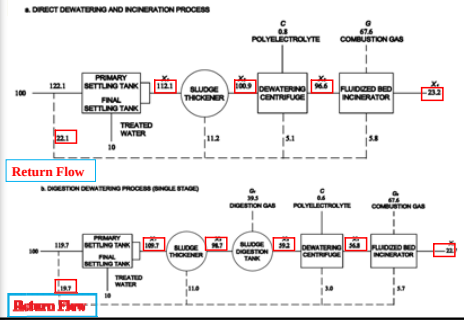


Figure 6.21 Sludge volume reduction of each step of sludge treatment process

6.2 SLUDGE QUANTITIES（1）



6.2 SLUDGE QUANTITIES（2）

Table 6.3 Example of solids recovery rate in each treatment stage

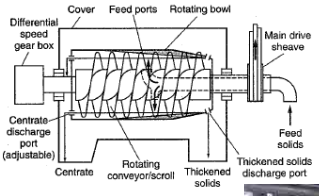
Process	Solids recovery rate	
Sludge thickening	Gravity thickening	80 to 90%
	Centrifugal thickening	85 to 95%
	Air floatation thickening (dispersed air)	More than 95%
	Gravity belt thickening	More than 95%
Sludge digestion	Sludge reduction ratio due to formation of gas, etc.	30 to 40%
Sludge dewatering	Pressure-type screw press dewatering	More than 95%
	Rotary pressure dewatering	More than 95%
	Belt press dewatering	90 to 95%
	Centrifugal dewatering	More than 95%
Sludge incineration	Sludge reduction ratio due to formation of gas, etc.	40 to 80%
	Recovery rate	80 to 90%

6.3.1 Sludge Pumps

Table 6.4 Typical applications of sludge pumps

Type of pump	Max suction lift (m)	Max % solids handled	Typical application
Centrifugal pumps a)Non-clog b)Vortex flow	 4.5 4.5	 2 6	Primary settled sludge, chemical sludge,
Air lift	0	6	Return sludge
Archimedean Screw	0	6	Return sludge
Positive displacement, plunger or diaphragm pump	6.5	10	All sludges
Centrifugal screw	6.5	10	All sludges

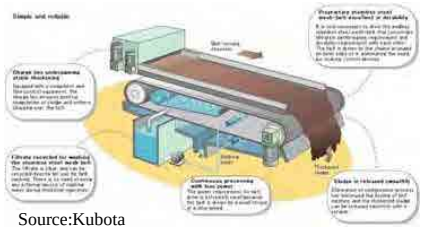
6.4.2 Centrifugal Thickening(2)



Toyohashi city

6.4.3.2 Dispersed-air Floatation Thickening

6.4.4 Belt Type Thickener



Source:Kubota

6.5.6 Structure

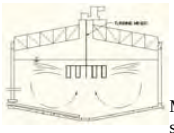
Computational fluid dynamic can help decision of the dimension.

Low Height Cylindrical
Source: Perungudi STP Chennai Metropolitan Water Supply & Sewerage Board

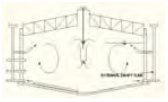
Egg Shaped
Kmazawa STP Yokohama City, Japan. Source: Kajima Corporation

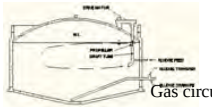
Tall form Cylindrical
Source: Article on Biomethanation by A K Dhussa and V K Jain, Newsletter, National Bioenergy Board, MNRE, March 2002.

6.5.7 Mixing System(1)

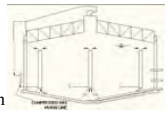


Mechanical system



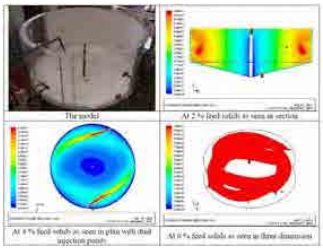


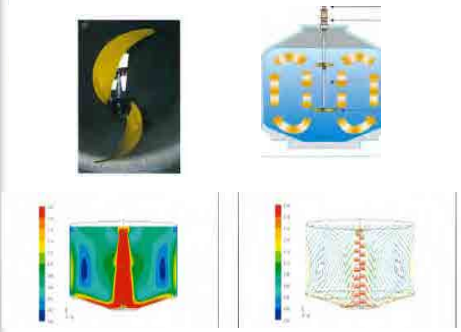
Gas circulation system



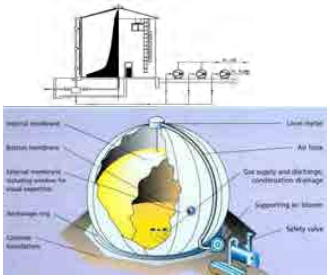
6.5.7 Mixing System (2)

- Many types of sludge mixing arrangements in tandem with the shape of digesters
- Computational Fluid Dynamics (CFD) modelling





6.5.12.2 Storage



Gas Holder

Figure 6.12 Some views of gas holders.

6.5.15.3 Stripping of Hydrogen Sulphide in Digester Gas

- Digester gas: Methane (CH_4), Hydrogen Sulphide (H_2S) and Carbon Dioxide(CO_2).
- Hydrogen Sulphide →Sulphuric acid
- Damage: the burner
  the gas in engines

6.5.15.3.1 Biochemical Process

- $H_2S + OH = HS + H2O$
- $HS + (O_2)/2 = S + OH$

Bio-chemical scrubber in the foreground and dewatering beds at far end for Sulphur

6.5.15.3.2 Biological Process

- $2HS + O_2 = 2S + 2\ OH$
- $2HS + 4O_2 = 2SO_4 + 2\ H$

Biological scrubber and sulphide gas disposed off as dissolved sulphate to inlet of the STP.

6.5.15.3.3 Chemical Process

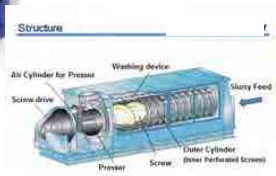
- through a venturi scrubber sprayed with caustic solution

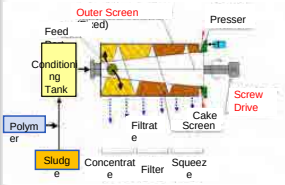
Chemical scrubber with first stage venturi and second stage packed bed. Caustic is used for naturalization and implies bleeding when saturation limit is met with

6.8 SLUDGE DEWATERING

- Dewater
  - 6.8.3 Filter
    - 6.8.4.2 Polyelectrolytes
    - 6.8.5 Screw Press
    - 6.8.6 Rotary Press
    - 6.8.7 Belt Press
  - 6.8.3 Centrifugal
    - 6.8.4.2 Polyelectrolytes
    - 6.8.9 Centrifugal Dewatering Machine
  - 6.8.4.2Ferric chloride, lime etc.
    - 6.8.8 Filter Press
    - 6.8.10 Vacuum Filter

6.8.5 Screw Press





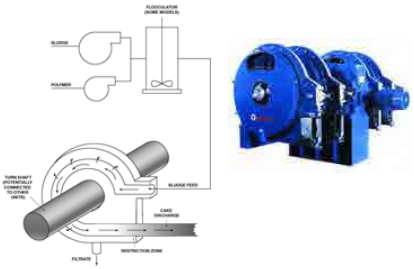
1. Filter chamber of Screw press is the space formed by outer cylindrical metal screen and inner conical screw shaft.

2. The slurry is dewatered by decreasing the chamber capacity and driving power of screw blade.

Metal Screen details

3. At the final stage, the cake is compressed and dewatered by back pressure due to presser and driving power of screw blade.

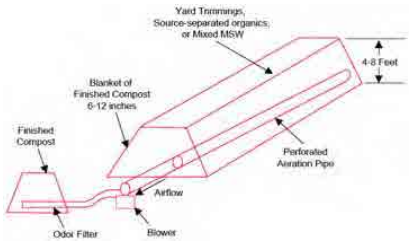
6.8.6 Rotary Press



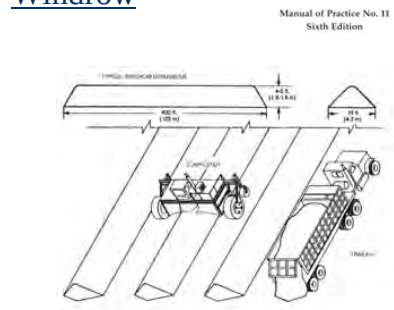
6.10.2 Types of Composting Methodsリンク

a. Aerated static pile
b. Windrow
c. In-Vessel
d. Actual Case

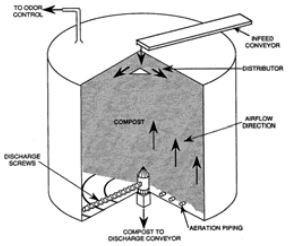
Configuration of an aerated static pile composting method



Windrow



An example of In-Vessel composting reactor



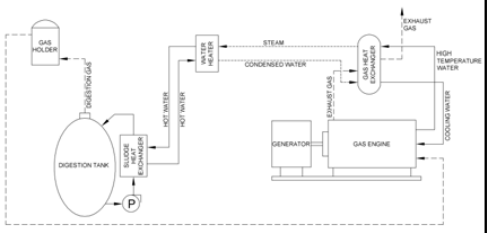
Composting facility

(Hiroo town)

6.10.6 Mixed Composting of Sewage Sludge and Municipal Solid Waste

6.14.2 Digester Gas Utilization

- Fuel： boilers, incinerating sludge, gas engines
- Siloxane→Harmful to gas engine



of Sludge Treatment Facilities

Utilization of Digestion gas

Anaerobic Condition with Methane Power Generation by Gas Engine

Digestion Tank

Generation using Metahne Gas as fuel

Siloxane

5000hr Operation

6100Hr Operation with Siloxane removal

Bio-gas for bus fuel

(Source: JSWA)

Digester in Kobe city

CH_4 Gas Purificator (97% or more)

6.15 ADVANCES IN SLUDGE TREATMENT

- Soil sludge immobilization
  - Utilisation as material for immobilized blocks
- Sludge Drying
  - Utilisation as Soil filler
  - Utilisation as Fuel

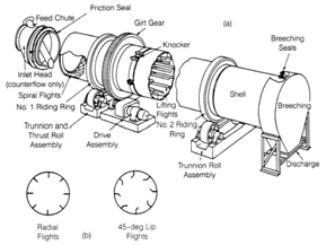
6.15 ADVANCES IN SLUDGE TREATMENT

Ingredient for concrete materials

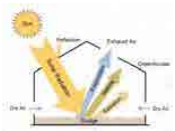
Ingredient for Paver materials

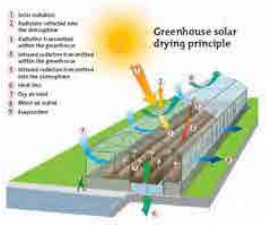
Yokohama City

6.15.3 Heat Drying



6.15.4 Solar Drying





~National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 7: RECYCLING AND REUSE OF SEWAGE

CPHEEO, MOUD

JICA Study Team

21st September 2012

Contents

7.1 INTRODUCTION

- "Handbook on Service Level Benchmarking" by MoUD
- Reuse and recycling of sewage

↓

- At least 20%

7.1.1 Overview of Current Practices

(a) Farm Forestry,

(b) Horticulture,

(c) Toilet flushing,

(d) Industrial use as in non-human contact cooling towers,

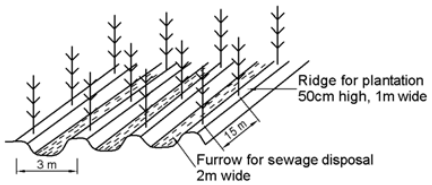
(e) Fish culture

(f) Indirect & incidental uses.

Sewage Farm Forestry

Karnal, India

Indian agricultural Research Institute, Karnal



Sewage Farm Forestry

KARNAL TECHNOLOGY

(Sewage fed Agro-forestry)

- **Application of sewage should be controlled in order to ensure that water is either evaporated or consumed within 12 – 18 hours and there is no water stagnation. This will lower production of foul smell, eliminate mosquito breeding and ensure that wastewater does not percolate down to contaminate groundwater**
- **Species of trees used are Eaucalyptus, Poplar and Leucaena**
- **Trees are fully grown within 7-8 yrs and are used as fuel-wood, timber or pulp, leading to revenue generation**
- **Land requirement is very high (1.5 – 2.0 ha./mld)**

Toilet flushing,

7.2.9 Tokyo Metropolitan, Japan (Toilet flushing water, dual-pipe system, rapid sand filter system)

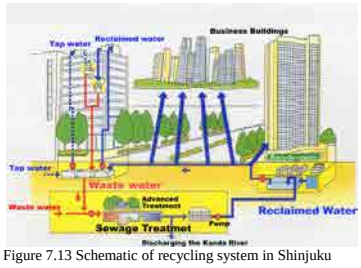
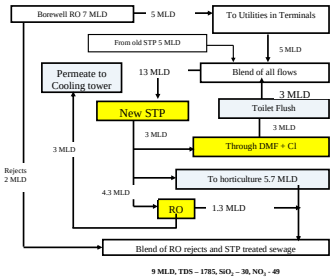


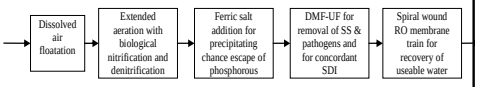
Figure 7.13 Schematic of recycling system in Shinjuku

Toilet flushing & Cooling water

7.2.2 Reuse Plant at Indira Gandhi International Airport, Delhi, India (1)

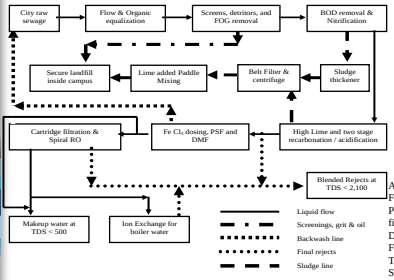


7.2.2 Reuse Plant at Indira Gandhi International Airport, Delhi, India (2)



Industrial use

7.2.1 Raw Sewage Treatment and Reuse as Cooling Water at M/S GMR Vasavi Thermal Power Plant, Chennai, India

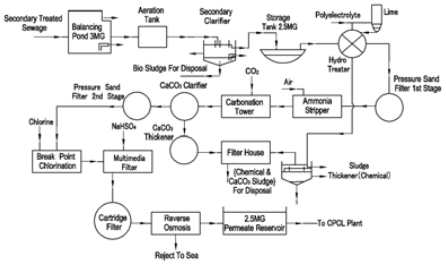


Abbreviation
FOG: Fat Oil Grease
PSF: pressure sand filter
DMF: Dual Media Filter
TDS: Total Desolved Solid

Industrial use as in non-human contact cooling towers

7.2.3 Reuse Plants at Chennai Petroleum Corporation Ltd. (CPCL) and Madras Fertilizers Ltd. (MFL)

(Cooling water: bio-nitrification process + Lime + RO)



Fish culture

7.2.7 Mudiali (Kolkata), India

Indirect & incidental uses

7.2.10 Restoration of Meguro River, Japan

Table 7.4 Average influent and effluent water quality for the Ochiai Water Reclamation Facility

Parameters	Intake water		Discharge Water	Regional water quality standards
	Low stage	High stage	High stage	
BOD_5 (mg/l)	220	190	1	25 or below
COD (mg/l)	92	92	7	-
Total nitrogen (mg/l)	31.7	27.9	11.5	30 or below
Total phosphorus (mg/l)	5.7	3.9	1.5	3.0 or below

Indirect & incidental uses

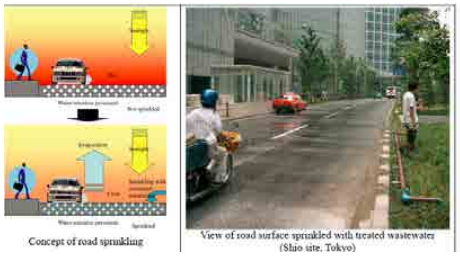
Figure 7.16 Water from Jungnang sewage treatment plant reused for road cleaning

Indirect & incidental uses

Figure 7.17 Highly treated sewage used at subway coach depot for cleaning

Indirect & incidental uses

7.2.12 Ground Cooling



Concept of road sprinkling

View of road surface sprinkled with treated wastewater (Shio site, Tokyo)

Figure 7.18 Road sprinkling with treated wastewater

Indirect & incidental uses

7.2.13 Singapore NEWater

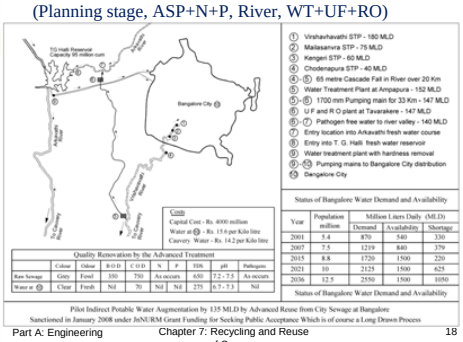
Water scarcity in SP.

Processes: multi-barriers filtration and ultraviolet (UV) disinfection

- Industrial usage,
- Potable water (Blend surface resovouir water and treated water)

Indirect & incidental uses

7.2.5 Bengaluru, India (Planning stage, ASP+N+P, River, WT+UF+RO)



Indirect & incidental uses

7.2.8 Orange County California, USA

- Recharge : Groundwater Replenishment System(GWRS)
- Multi-barrier process(MF&RO), UV & hydrogen peroxide

7.3.1 Guiding Principles for India Agriculture

7.3.1.1 Key Principles

a) Never be used for edible crops or plants (millets, etc)

b) Inter basin transfer of such reuse are not to be encouraged.

c) Local sewage is best treated with stabilization ponds followed by maturation ponds.

d) Rotational crop pattern shall be investigated for an all the year round utilization and designed such that the runoff of treated sewage in summer is minimized.

e) Manual direct handling shall be avoided and field channels are better suited as compared to sophisticated drip irrigation etc.

f) Discharge standards for disposal on land by the MoEF

g) Specific limitations on individual parameters.

7.3.2 Guiding Principles for India

Farm Forestry

- Non-water needs in rainy season should be in mind
- Better to carry out all treatment, not sprit STP and Farm

Horticulture

- TDS limit shall not exceed the TDS limit of the groundwater at any time.
- Alkalinity is removed to prevent for scaling of leaves

Toilet Flushing

- Reuse shall be only after activated carbon and ultra filtration membranes

7.3.5 Guiding Principles – Industrial and Commercial

- Once through cooling water
- Recirculating evaporative cooling water
- Boiler feed water
- Non-human contact process water
- Irrigation of landscape around industrial plants

Fish Culture

- Fish grown in sewage as a acceptable food is not recommended whether it is in private or public sector

7.3.10 Standard of Treated Sewage and its Uses

Table 7.16 Recommended treated sewage quality

S. No.	Parameter	Recommended Value (Not to Exceed)
1	SS	100
2	TDS	2100
3	pH	5.5 to 9.0
4	Temperature ° C	(A)
5	Oil & Grease	10
6	Minimum Residual Chlorine	1
7	Ammonia. Nitrogen as N	50
8	Total Kjeldahl Nitrogen as N	100
9	Free Ammonia	5
10	BOD	30
11	COD	250
12	Dissolved Phosphorous as P	5
13	Nitrate Nitrogen as N	10
14	Faecal Coliform	Non-detectable / 100 ml
15	Colour	Colourless
16	Odour	Odourless
17	Turbidity	≤ 2 NTU

Standard of Treated Sewage and its Uses

Discharge standards are for "Land for Irrigation"

Table 7.17 Recommended treated sewage quality for restricted crops not to be eaten raw

No.	Parameter	Recommended Value (Not to Exceed)
1.	pH	6.5 to 8.3
2.	BOD5	10 mg/L
3.	TSS	10 mg/L
6.	Maximum Faecal Coli forms	230 MPN/100 ml
7	Helminths egg	≤ 1 egg / L

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering
~ Chapter 8: DECENTRALIZED SEWERAGE SYSTEM ~

CPHEEO, MOUD

JICA Study Team

21st September 2012

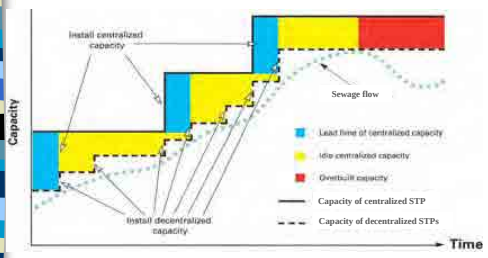
Contents

Revised Sections indicated in RED.

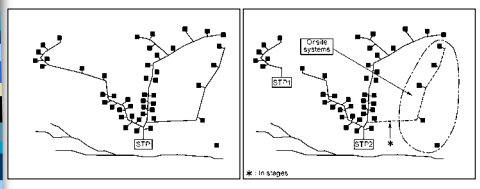
8.2 Challenges in Sustaining Centralized Sewerage

- Huge capital cost
- Designed for ultimate population of target year
- If population growth and development does not occur as expected
- Repeated road cuts due to slow development
- Monitoring of illegal connection difficult due to large area
- Revenue is meagre to cover cost

Centralized vs. Decentralized Sewerage Planning

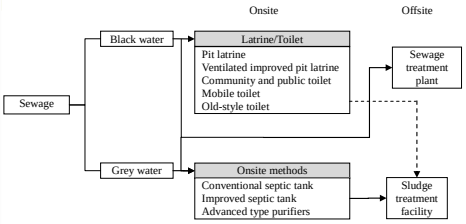


Centralized vs. Decentralized Sewerage

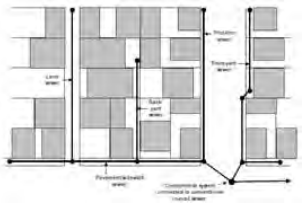


Centralized Sewerage Decentralized Sewerage

Domestic Sewage Treatment (<1 MLD)

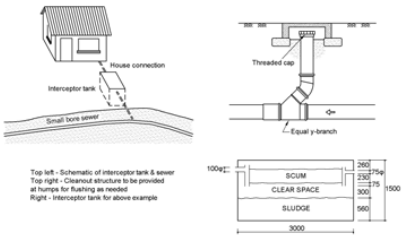


8.5.1 Simplified Sewerage



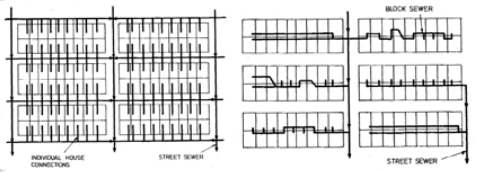
- Laid in private land, either front or back yard
- Shallow depth with cover 400mm or less
- Minimum allowable sewer diameter is 100mm
- Allows small access chambers instead of large manholes
- **Design**: http://www.efm.leeds.ac.uk/CIVE/Sewerage/manual/pdf /simplified_sewerage_manual_full.pdf

8.5.2 Small Bore Sewer System (1)



- To collect and transport only liquid part of domestic sewage for off-site treatment and disposal; solids separated in aqua privies
- Components: House connection, Interceptor tanks, sewers, cleanouts and manholes, vents

Layout of Conventional vs. Shallow Sewers



Conventional sewer

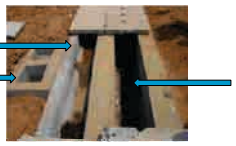
Shallow sewer

8.5.4 Twin Drain System

- Twin drain on both sides of roads
  - Drain on house side receives septic tank effluent and greywater.
  - Drain on road side receives stormwater
- Even in case of low flow (28 lpcd), sediments can be scrapped forward by each owner after removing cover slabs

Sewage drain

Terminal chamber for storm water of house emptying into road side drain by pipe below house side drain



Stormwater drain

8.5.4 Twin Drain System – Performance of Functioning System at Kolachel Tamilnadu (Mean Values)

	Location	BOD_5	COD	SS	TKN	Total P
1	Septic Tank entry	1,294	2,565	4,142	170	30
2	Up flow filter entry	702	1,509	1,450	111	24
3	Up flow filter outlet	399	1,003	628	88	14
4	Grey water	362	615	359	28	16
5	Stabilization pond inlet	51	212	57	14	11
6	Stabilization pond outlet	31	144	42	10	8
7	Maturation pond 1 outlet	32	144	42	10	8
8	Maturation pond 2 outlet	23	124	38	7	6

Norms for Toilets for Public Rooms as per Model Building Byelaws

Sl. No.	Sanitary Unit	For Male	For Female*
1.	Water Closet	One per 100 persons up to 400 persons; for over 400 add at the rate of one per 250 persons or part thereof.	Two for 10 persons up to 200 persons; over 200 add at the rate of one per 100 persons or part thereof.
2.	Ablution Taps	One in each W.C.	One in each W.C.
3.	Urinals	One for 50 persons or part thereof.	Nil
4.	Wash Basins	One per W.C. and urinal provided	One per W.C. provided

i) It may be assumed that the two-thirds of the number are males and one- third females
ii) One water tap with drainage arrangements shall be provided for every 50 persons or part thereof in the vicinity of water closet and urinals.
* At least 50% of female WCs may be Indian pan and 50% EWC

- Off-site treatment: connect to existing collection system - centralized or decentralized

One-way See through Public Toilets

- Pay and use see through mirror toilets: facilitates security for lone users

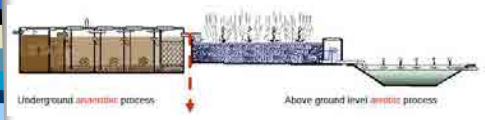
Toilet Facilities for Infrequent Events

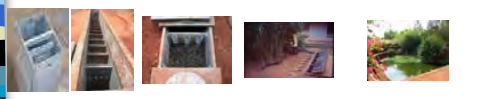
For fairs, festivals, and public meetings in maidans where large no. of people congregate

Patrons	Male						Female			
	Toilets		Urinals		Sinks		Toilets		Sinks	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
<500	1	3	2	8	2	2	6	13	2	2
<1000	2	5	4	10	4	4	9	16	4	4
<2000	4	9	8	15	6	7	12	18	6	7
<3000	6	10	15	20	10	14	18	22	10	18
<5000	8	12	25	30	17	20	30	40	17	20

(a)- Where alcohol is not available; (b)-Where alcohol is available
Source: US Federal Emergency Management Agency. "Special Events Contingency Planning, Job Aid Manual"

8.9 DEWATS





Pretreatment Settler | Anaerobic Baffled Tank Reactor | Anaerobic Filter | Planted Gravel Filter | Polishing Pond

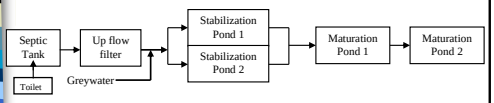
- Non-mechanized, self-operating system for isolated habitation
- Requires large area, Vector propagation control in planted gravel filter and polishing pond.

8.10 Recommendations

- As Incremental Sewerage: in newly developing peri-urban and rural settings.
- As combination of decentralized collection system and incremented capacity of STP
- Public Acceptance: Public consultation needed

Incremental Sewerage

Total Self-Contained System (Example of Kolachel, Tamilnadu)



Septic tank upflow filter

Twin drain

Stabilization and Maturation Pond

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 9: ON-SITE SANITATION ~

CPHEEO, MOUD

JICA Study Team

21st September 2012

Contents

- What is “Septage” ?
- Main Revised Items on On-Site Sanitation
- Key Points of Some Revised Items

What is “Septage” ?

- Fecal sludge removed from:
  - Septic Tanks
  - Pit Latrines
  - Similar on-site toilets.

Main Revised Items on On-Site Sanitation

Main Revised Items on On-Site Sanitation

Revised sections indicated in red.

9.1 Overview of on-site

9.2 Abolition of manual scavenging

9.3 Interim measures

Pour flush water seal latrine, night soil digesters, conventional septic tank, public/community toilets, mobile toilet, ZD toilet, improved septic tank, package septic tank, advanced on-site treatment system

9.4 Decision making for on-site treatment technology

9.5 Dealing with septage

9.6 Logistics of septage collection

9.7 Septage treatment facilities

9.8 Treatment of septage in existing STP

9.9 Treatment of septage at indipendent septage treatment plant

9.10 Advantages snd disadvantages of the systems

9.11 Composting of dewatered septage or sludge

9.12 Dewaterd sepatege sludge reuse

Key Points of Some Revised Items

On-site Classification

- Latrine/Toilet
  - Pour Flush Water Seal Latrine
  - Community/Public Toilet
  - Mobile toile
  - Zero Discharge Toilet System
- Simple Treatment Method
  - Septic Tank System
- Advanced Treatment System
  - Improved Septic Tank
  - Package Septic Tank
  - Advanced On-site Treatment System (Johkasou)

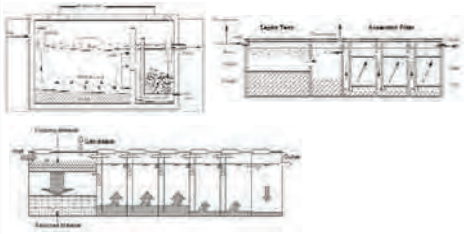
Toilets

- **Pour Flush Water Seal Latrine**
- **Public and Community Toilets**
- **Mobile Toilet**
- **Zero Discharge Toilet System**



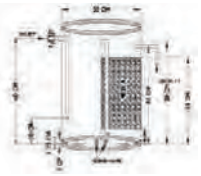
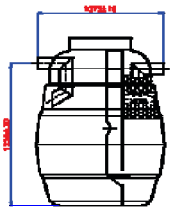

On-site treatment systems (1)

- Improved Septic Tank - Up-Flow Anaerobic Filter



On-site treatment systems (2)

- Package Septic Tank

Anaerobic Filter Type System

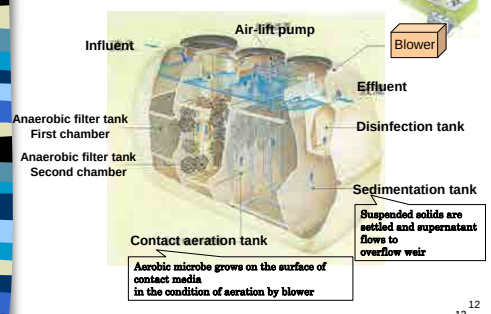
Contact Aeration Type System

On-site treatment systems (3)

- Advanced Anaerobic - Aerobic Type On-site Treatment System (Johkasou)

Package-type			On-site construction-type
Small-scale	Medium-scale	Large-scale	Medium/Large-scale
(About 5 to 50 people)	(About 51 to 500 people)	(Approx. 500 to 5,000 people)	(More than 500 people)
			

What is Johkasou?



12

9.4 Decision making for on-site treatment technology (2)

Planning an on-site system and making it successful require the following decision-making processes.

- Stage 1: Outline survey of settlements and services
- Stage 2: Needs assessment and consultation
- Stage 3: Identifying appropriate technologies
- Stage 4: Developing costed options
- Stage 5: Reaching consensus on preferred options

9.4 Decision making for on-site treatment technology (1)

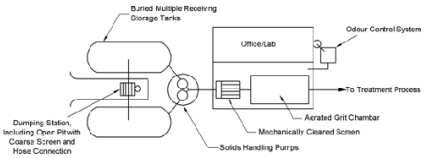
- Sludge generated in on-site treatment shall be treated and disposed of considering its impact on the surrounding environment.
  - ✓ Sludge shall not pollute the environment
  - ✓ Sludge shall not produce any diseases or pests
  - ✓ Sludge shall not be disposed of illegally
  - ✓ Sludge shall be reused as effectively as possible.
- In any case, it is recommended to effectively change the septage and sludge to compost for agricultural use or to soil conditioners in its final disposition. However, if there is no other option, they shall be buried at the final disposal site.

9.7 Septage treatment facilities

- Sludge generated in an on-site treatment facility is regularly extracted and hygienically treated.
- The sludge treatment method includes:
  - ✓ delivery to a existing sewage treatment facility and treatment with sludge generated in the sewage treatment process,
  - ✓ treatment in a independent sludge treatment facility,
  - ✓ solar drying on a floor, and
  - ✓ treatment by a mobile dehydrating truck.

9.8 Treatment of septage in existing STP(1)

Pre-Treatment of Septage



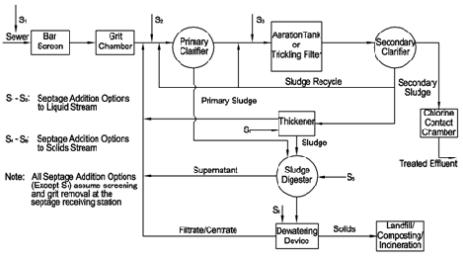
Typical septage receiving facility

9.8 Treatment of septage in existing STP (2)

- Co-treatment in Existing STPs-Liquid Stream
- Co-treatment in Existing STPs-Sludge Stream
- Points of Addition of the Liquid and Sludge Streams

9.8 Treatment of septage in existing STP (2)

Points of Addition of the Liquid and Sludge Streams



Points of likely addition of liquid and solids from septage on to existing STPs

9.9 Treatment of septage at indipendent septage treatment plant (1)

- When the distance or the capacity of the plant becomes a limiting factor, it is not feasible transport the septage to the sewage treatment facilities and treat it.
- In this case treatment plants specially meant for septage treatment becomes an attractive option.
- Independent septage treatment plants are designed specifically for septage treatment and usually have separate unit processes to handle both the liquid and solid portions of septage.

9.9 Treatment of septage at independent septage treatment plant (2)

- Selecting an appropriate septage management method depends on both technical aspects and regulatory requirements.
- The selected management option should conform to local, State, and Central regulations.
- Some factors that determine the process of selection are: land availability and site conditions, buffer zone requirements, hauling distance, fuel costs, labour costs, costs of disposal and other legal and regulatory requirements.

9.9 Treatment of septage at indipendent septage treatment plant (3)

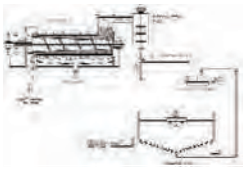
- **Case 1: Land Area is not limited but Funds are Limited**
- **Case 2: Land Area is Limited and Funds are also Limited.**
- **Case 3: Land Area is Limited and Funds are not limited**

9.9 Treatment of septage at indipendent septage treatment plant (4)

- **Case 1: Land Area is not limited but Funds are Limited**
- **Option - 1**
- Pretreatment ----- Anaerobic Digesters - Dewatered & Dried Sludge ---- Composting ----- Reuse as Organic Fertilizer; Filtrate of Sludge Drying Bed and Digester supernatant ------ Pumping ------ Reed beds (or) Constructed wetlands ------- Electricity generation from digester gas.
- Totally nature based system with mechanical equipment as needed.

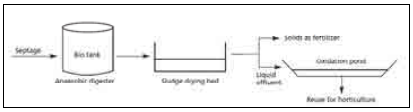
Pre-Treatment of Septage and Septage Dewatering

Pre-Treatment of Septage



Septage Dewatering

9.9 Treatment of septage at indipendent septage treatment plant (4)



Nonthaburi in Thailand

9.10 Advantages and disadvantages of the systems (1)

Septage treatment at existing sewage treatment plant

Description	Advantages	Disadvantages
Septage is added to the pumping station, upstream manhole or sludge treatment process for co-treatment with sewage sludge. Septage volumes that can be accommodated depend on plant capacity and types of unit processes employed.	Most STPs in India are underutilized and are capable to handle some septage. As skilled personnel and laboratory facilities are available in STPs, easy to operate and maintain.	Potential for STP upset if plants are running at full capacity. Increased sludge treatment cost.

9.10 Advantages and disadvantages of the systems (2)

Independent septage treatment facility

Description	Advantages	Disadvantages
A facility is constructed solely for the treatment of septage. Treatment generates residuals, i.e., dewatered sludge and filtrate which must be dried, composted (dewatered sludge) and properly treated (filtrate) prior to being disposed of.	Provides regional solutions to the septage management.	High capital and operation and maintenance cost. Requires high skills of operation in case of mechanical dewatering.

National Workshop for Finalisation of Revised and Updated Manual on Sewerage and Sewage Treatment

Part A: Engineering

~ Chapter 10: PREPARATION OF CITY SANITATION PLAN ~

CPHEEO, MOUD

JICA Study Team

20th September 2012

Background

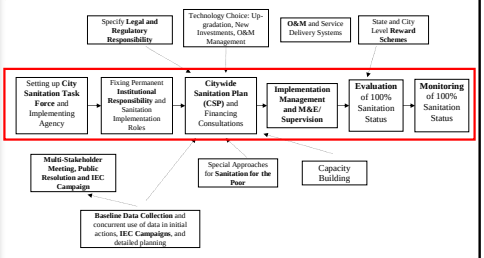
- Until now emphasis on conventional sewerage system
- Policy towards Total Sanitation
- Solid and Liquid waste management
- In this Manual: Sewage management
- Onsite + Decentralized + Conventional
- Decision Tree

Contents

Revised Sections indicated in RED.

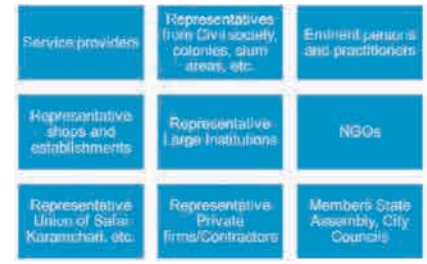
Planning Process

Generic Elements of Planning, Implementation, and M&E of Citywide Sanitation



Core Principles to be addressed for Achieving 100% Sanitation

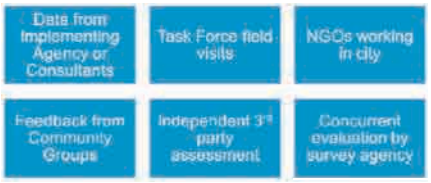
City Sanitation Task Force



Task force headed by the Mayor, and Executive head (e.g. Municipal commissioner) as the convener

Monitoring and Evaluation

- Mechanisms used in Monitoring implementation



National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Summary of Policy on Formulation of Manual

CPHEEO, MOUD

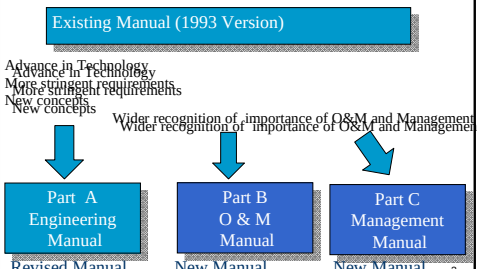
JICA Study Team

Mr. Akira Takechi, Team Leader

21st and 22nd January 2013

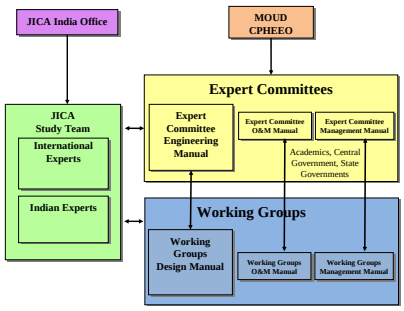
1

Existing Manual and New Manuals



2

Organizational Structure



3

Work Flow of Manual Preparation

4

Overall Policy

- Compatibility with existing Manual
- Compatibility with existing conditions in India
- Compatibility with sanitation policy in India
- Compatibility with relevant regulations
- Compatibility with National Urban Sanitation Policy 2008

5

Policy for Part B: O&M

- Aiming to offer guidelines to worker/operator of sewerage system
- Covering operation methods to obtain proper performance of the sewerage system, procedures to maintain the system dependable level and measures to secure safety of the system

6

Policy for Part C: Management

- Aiming to offer tools for sewerage service administration
- Covering legal framework, institutional aspects, financing, budgeting, public private partnership, asset management, community participation, information management and disaster management

7

Towards the future revision/update

Suggestions

- Nation-wide information/data accumulation and its integrated management.
- Introduction of study and experience for manual updating
- Periodical addendum to be released, say once in two years on validated O&M and Management procedures of newer sewerage and sanitation technologies as studied for Indian conditions

8

Thank you for your attention

9

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment

Part B : Operation & Maintenance
~ Chapter 1: Introduction

CPHEEO, MOUD
JICA Study Team
Dr S Sundaramoorthy
21st January 2013

Need for O & M 1/2

There are O & M manuals in other countries for
- Sewage Collection System
- House service connections
- Sewage Pumping Stations & Pumping mains
- Sewage Treatment Processes
- Utilization of biological sludge
- Containment of chemical sludge

In our country, there are no such manuals
There is no standardizing of Practices
There is no common basis for budgeting
Hence almost everything is ad hoc & historical

Need for O & M 2/2

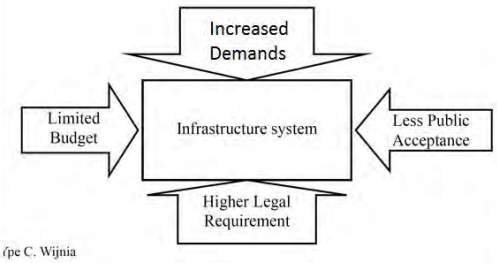
Some of the key issues contributing to poor O & M are

1. Lack of finance, inadequate data on O & M
2. Multiplicity of agencies, overlapping responsibilities
3. Inadequate training of personnel
4. Lesser attraction of maintenance jobs in career
5. Lack of performance evaluation and monitoring
6. Inadequate emphasis on preventive maintenance
7. Lack of operation manuals
8. Lack of appreciation of facilities by the community
9. Lack of real time field information etc.

Reasons for the Stalemate

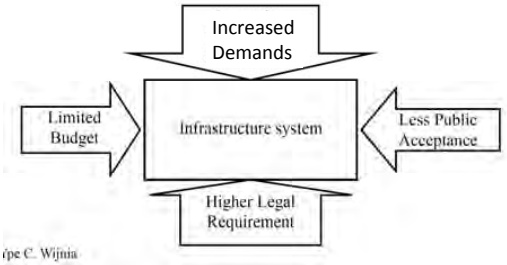
1. **No Direct Laws or regulations for sewerage**
2. **Discharge Standards are only "paper tigers"**
3. **No norms for realistic budgets**
4. **Even if norms are made, funding crunch**
5. **Preventive maintenance is very rare**
6. **Quality of equipments in samples Vs deliveries**
7. **Field operators have no career prospects**
8. **Public Expectations Vs Fund limitation of ULBs**

Sewerage Infrastructure-Pressure from all sides



ſpe C. Wijnia

1. Budget is fixed
2. Pleasing one crushes the other
3. End result is total static-nothing improves
4. Thus system can only go from bad to worse

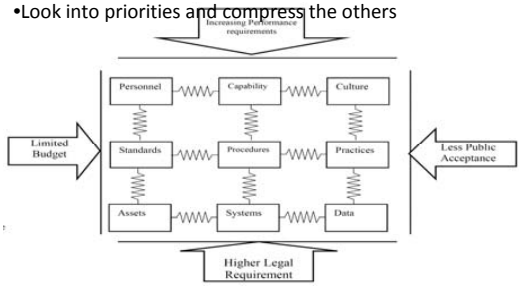


ſpe C. Wijnia

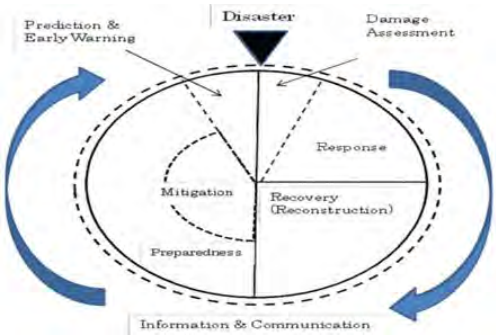
Infrastructure is a matrix of personnel, capability, culture, practices, procedures, standards, assets, systems and data

•A rigid corner boundary has to be opened out

•Look into priorities and compress the others



Preparedness for Disaster Response in Sewer Systems 1/2



Preparedness for Disaster Response in Sewer Systems 2/2

1. Disaster prevention systems should be established
2. No data on the condition of sewers and manholes
3. Ledger of "as constructed" almost absent
4. Once a disaster happens it is an emergency
5. Materials and specialized techniques to with stand EQ prone area
6. Periodical updating of condition of sewers and manholes are reqd
7. On top of all these, not to forget disasters of the past

Hence this O&M Manual Containing chapters on

1. **Need for O&M**
2. **Basic Considerations of O&M**
3. **Outlines of O&M**
4. **Organization of O&M**
5. **Community Awareness and Participation**
6. **Potential Risk with respect to Sewerage System**
7. **Sewerage Ledger**
8. **Budget Estimation for O&M**
9. **Summary**

The Ultimate Goal is to liberate Manual Scavenging

Elsewhere

In India, we need to reach this goal and towards that goal, locally appropriate technologies in sewerage are predisposing factors & covered in part A manual. This part-B shows how to plan a sustainable O&M

Only when we reach this goal,
we can realize the full objective of the
"Employment of Manual Scavengers and Construction of Dry Latrines – (Prohibition) Act 1993

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation & Maintenance

~ Chapter 2 : SEWER SYSTEMS ~

CPHEEO, MOUD

JICA Study Team

Mr. Teruo Suga

21st January 2013

Chapter Contents

2.1 Introduction

- Objective of Maintenance

The objective is to keep the system in good condition, so that it can accomplish efficiently its intended purpose of collection and transportation of sewage to the treatment plant.

- Type of Maintenance

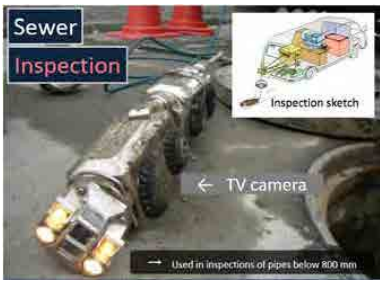
There are three types of maintenance of a sewerage collection system

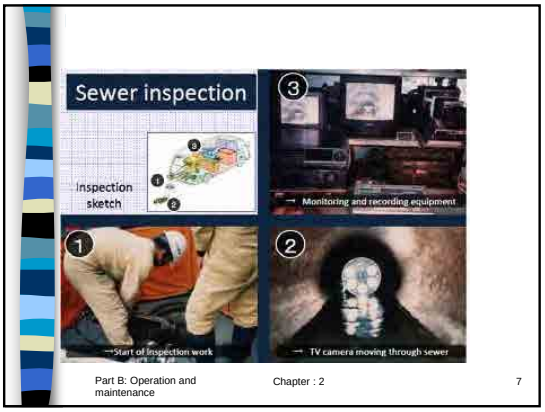
1) preventive,
2) routine
3) emergency.

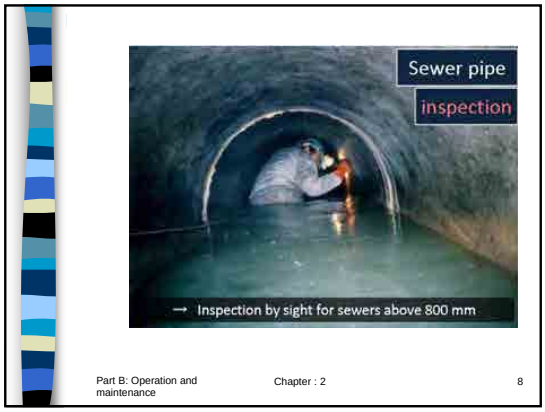
2.2 Inspection and Examination

- Important role of sewer maintenance engineer
- Carry out periodical inspection for sewerage collection system
- Get enough information about theirs conditions.

Inspection and Examination for Sewer







2.3 Sewer Cleaning

- Manual cleaning
  With suction hose and suction truck
- Mechanical cleaning
  With water jet (High-Pressure sewer cleaner)

Please ensure safety for workers!

Sewer Cleaning

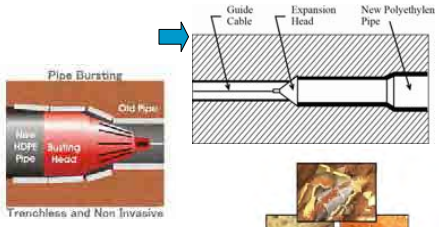
2.4 Sewer Rehabilitation

- Replace new sewers with trench excavation (Dig out and relay sewer)
- Trenchless methods

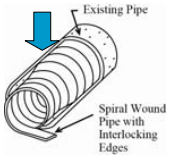
1. Pipe bursting process
2. Spiral wound slip lining process
3. Cure-in-place pipe installation procedure
4. Cross-section lining

Trenchless methods

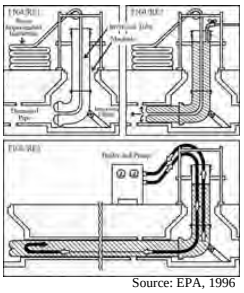
Pipe bursting process



Spiral wound slip lining process



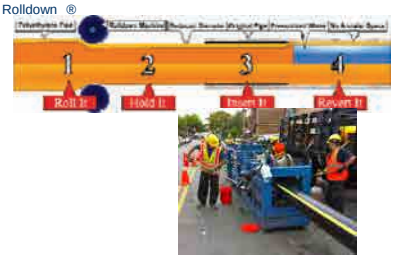
Cure-in-place pipe installation procedure



Source: EPA, 1996

Cross-section Lining

Rolldown ®



2.6 Protection against Infiltration and Exfiltration

- Infiltration of sewer

  Due to infiltration, overload of sewer collection system and over load of pump station and STP occurs.
- Exfiltration of sewer

  Due to exfiltration, contamination of groundwater or soil occurs.

2.7 Manholes and Appurtenances

Following essential items are included:

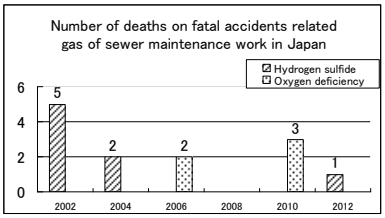
1. Inspection and examination
2. Checking method of inside conditions
3. Record format

2.11 Safety Practices

In sewer maintenance, following two are important for safety:

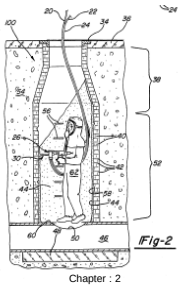
1. Traffic control for inspection and cleaning works
2. Keep “confined space entry procedure “ for manhole inspection or cleaning . (appendix 9.3)

Fatal accidents related to gas in sewer maintenance work



Sorce: Japan Sewer Collection System Maintenance Association 2012 Safety measures for sewer maintenance works

Example of manhole entry



Thanks for your attention

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 3: PUMPING STATION ~

CPHEEO, MOUD
JICA Study Team
Mr.Mikio SUZUKI
Mr.Masatoshi YAMADA

21st January 2013

Chapter Contents

1. Pumping Station

- Transfer sewage to STPs
- Daily O&M is essential

Figure1.1 Pumping station in Japan

http://www.city.okazaki.aichi.jp/menu4078.html

2. Screen

2-1. Type of screen

- Remove debris

Figure 2-1
Mechanically-cleaned bar screen
Source: WEF, 2010

Figure 2-2 UNIDO type arc screen
Source: Tamil Nadu Water Supply and Sewerage Board, 2012
For small and medium depths and elevated channels (animation in next slide)

Figure2-3 An example of risky platform

2. Screen

2-2. UNIDO type arc screen

Figure 2-3 UNIDO type arc screen (Source: Ramnad STP TWAD Board)

2. Screen

2-3. Important points of O&M

- Check water level difference before & after screen
- Collect and remove screenings as often as necessary
- Check proper operation of rake
- Do not resume operation after emergency shutdown by safety device unless the problem is solved

3.Grit removal

3-1. Grit removal equipment

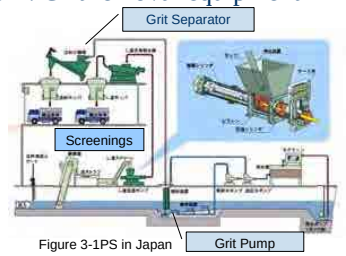


Figure 3-1PS in Japan

Source:2008-2013 Japan Sewage Treatment Plant Constructors Association

3.Grit Removal

3-2. Important points of O&M

- Check pump for undue noise or vibration
- Check grease condition
- Do not resume operation after emergency shutdown by safety device unless the problem is solved
- Measure insulation resistance of prime mover regularly
- Rinse grit

4.Pump

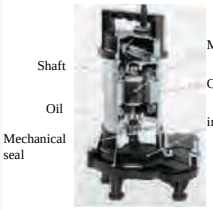


Figure 4-1 Submersible pump

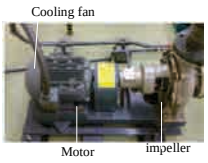


Figure 4-2 Centrifugal pump

4.Pump

4-1.Important points of O&M

- Check bearing temperature
- Check for undue noise or vibration
- Check for abnormal reading of pressure, voltage and current
- Check packing for leakage
- Check grease condition

4.Pump

4-2. Leaks from gland packing

Figure 4-3 Good condition

Figure 4-4 Undesirable condition

5.Non-Return Valve

Figure 5-1 Check-valve
(PS in Indian)

5.Check-valve
5-1. How it works

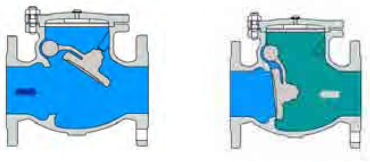


Figure 5-2 Opening and closing of the check valve (Left:Open Right:Closed)

5.Check-valve
5-2. Important points of O&M

- Inspect clapper facing
- Check shaft for wear

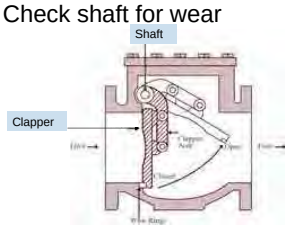
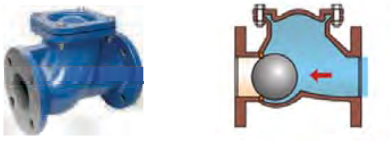


Figure 5-3 Check valve

5.Check Valve, Ball Type
5-2. Ball-valve

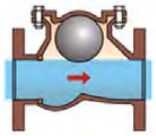
- a. How it works



Ball - valve

5.Check Valve, Ball Type
5-2. Ball-valve
b. Remarkable point of O&M

- Maintenance free valve



Ball- valve

6. Flow measuring devices
6-1. Type of flow-meter

Figure 6-1
Electromagnetic flow meter
In Japan

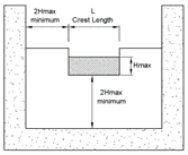


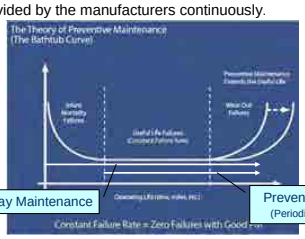
Figure 6-2
Weir Flow-Meter

6. Flow measuring devices
6-2. Important points of O&M

- Full pipe for correct measurement
- Keep pipe inside free from bubbles
- Repaired only by the manufacturer

7. Preventive Maintenance

- Manufacturers can provide such skilled staff and special tools.
- Maintenance based on their long experience and abundant information on their products.
- Provided by the manufacturers continuously.



Day-to-Day Maintenance

Preventive Maintenance
(Periodically Maintenance)

8. Record Keeping

To Identify and duplicate optimum operating conditions

- A record of equipment performance and repairs
- Inspection report
- Recommended maintenance

(Tables for record keeping detailed in manual)

9. Duties of Site Engineer in Charge and Higher Ups

- Check the entries of the operator in the previous three shifts
- Take corrective action
- Alert the supervisor by e-mail
- Make an entry in the site register
- Send an e-mail message to the plant in charge (if not improved)

10. If the SPS is under O&M by the Contractor

- Do same as above mentioned
- Supervisor should review the site registered once a fortnight

11. Troubleshooting

11-1. Pump won't start or run

Trouble	Likely cause	Remedy
Pump won't start or run	Impeller is jammed with debris	Remove any obstructions.

Extracted from Appendix 3.2 "Possible Causes and Corrective Actions to Check for Pumps"

Fig8.1 Impeller jammed with debris

11. Troubleshooting

11-2. Motor hums but little or no fluid is pumped from pit

Trouble	Likely cause	Remedy
Motor hums but little or no fluid is pumped from pit	Check valve is stuck or closed, or installed incorrectly	Remove any obstructions

Extracted from Appendix 3.2 "Possible Causes and Corrective Actions to Check for Pumps"

Fig8.2 Closed check valve

11. Troubleshooting

11-3. Pump Starts and Stops too Often

Trouble	Likely cause	Remedy
Pump Starts and Stops Too Often	Sewage is coming back into pit from discharge pipe	Replace the check valve

Extracted from Appendix 3.2 "Possible Causes and Corrective Actions to Check for Pumps"

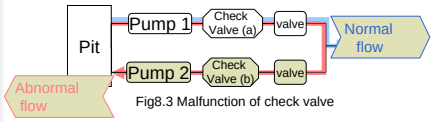


Fig8.3 Malfunction of check valve

Source: Kasaokacity Japan

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 4: SEWAGE TREATMENT FACILITIES~

CPHEEO, MOUD

JICA Study Team

Mr. Yoshitaka Ito and Mr. Gururaji Rao

21st January 2013

Chapter Contents (1)

Contents of manual (2)

4.4 Oil and Grease Removal Units

All these units are mostly patented and there are no fixed O&M guidelines. Each unit has to follow the guidelines of the respective manufacturer.

4.5 Equalization Basin

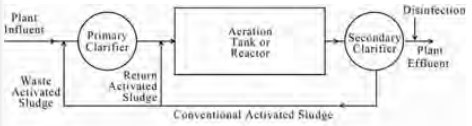
Monitored items are:

- Basin dissolved oxygen level;
- Influent pH;
- Mixers and/or aeration blower status;
- Influent/effluent status pumps; and
- Influent/effluent flow.

4.6 Primary Treatment

The most important operation is the daily cleaning of the overflow weirs and the weekly scraping of the floor and walls of trough. Also periodical checking of the walkway for corrosion is important. In actual day to day working, the operator should not lean or put his weight on the handrails.

4.7 Activated Sludge Process (ASP)



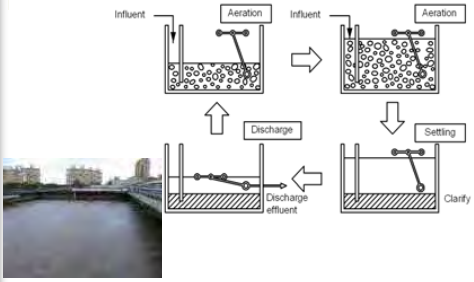
4.7.1 Description of Activated Sludge Process (ASP)

Operational parameters:

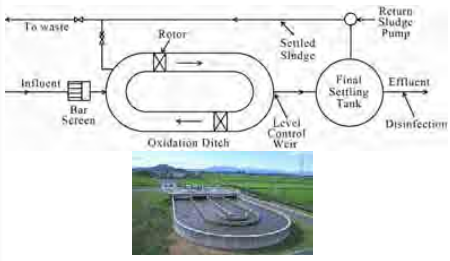
- MLSS
- SRT
- F/M ratio
- Excess Sludge Wasting
- Return Sludge Flow

4.7.3 Extended Aeration Process

4.7.4 Sequencing Batch Reactor (SBR)

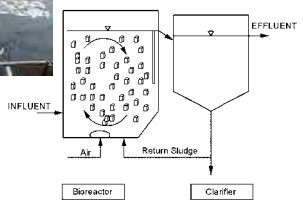


4.7.5 Oxidation Ditch

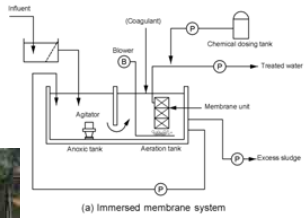


4.8 Aerated Lagoon

4.10 Moving Bed Bio Reactor (MBBR)

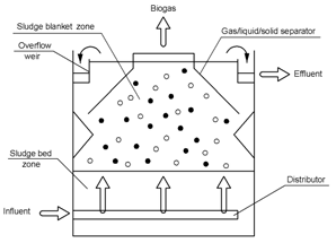


4.11 Membrane Bio Reactor (MBR)



(a) Immersed membrane system

4.12 Up Flow Anaerobic Sludge Blanket Reactor (UASB)



4.13 Waste Stabilization Pond (WSP)

White towel test

4.14 Farm Forestry

Please hand over the O&M work to the local forestry department who are competent in this.

4.15 Fish Pond

These ponds shall not be used henceforth except in the case of the Mudiali farm.

4.16 Secondary Sedimentation Tank

Secondary clarifiers in the activated sludge process are the most critical and require the most attention from the operator

- Levels of sludge blanket in the clarifier
- Concentration of suspended solids in the clarifier effluent
- Control and pacing of return sludge flows

Bulking -General-

Undesirable state :
Low settleability with bulked activated sludge

<Filamentous bulking>

<Desirable activated sludge>

<Slime bulking>

Affects settlement & consolidation

Affects flocculation

Effect of Bulking on Treated Water Quality

Poor solid-liquid separation in final sedimentation tank

Overflowed sludge causes treated water quality to deteriorate

<Normal>

Only supernatant overflows

Good

Well settled and consolidated sludge
(Excellent withdrawal efficiency)

<Bulking>

Activated sludge overflows

Poor

Low density Large volume
(Poor withdrawal efficiency)

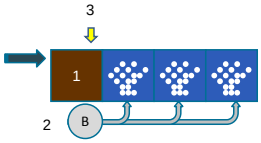
Bulking -Influence-

Overflow of activated sludge in final sedimentation tank
(In Japan)

Bulking -Measures-

Bulking may be prevented by the following measures:

1. Anaerobic-aerobic operation
2. Low load, high DO
3. Chemicals against filamentous bacteria



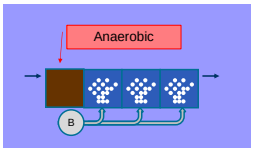
Bulking -Measures 1 –

1. Anaerobic-Aerobic operation

Make the first part of the reaction tank anaerobic.

Facultative bacteria eat up the organic matter.

Bulking bacteria cannot grow due to insufficient food.



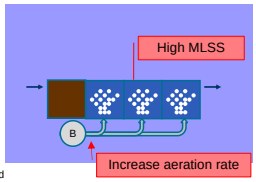
Bulking -Measures 2-

2. Low load and High DO

Bulking bacteria prefer high load and low DO condition.

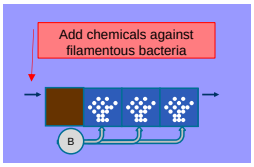
Low load by high Mixed Liquor Suspended Solids (MLSS)
High DO by increasing aeration rate

Bulking bacteria cannot grow



Bulking -Measures 3-

3. Chemicals against filamentous bacteria



Sludge putrefaction-General-

- Sludge putrefaction occurs at high concentrations of organics in sludge.
- Problems due to putrefaction:
  - ✓Decreased efficiency in thickening and dewatering
  - ✓Deteriorated treated water quality
  - ✓Decreased efficiency in treatment
  - ✓Equipment corrosion and odour problem

Sludge putrefaction-General-

Floating scum in final sedimentation tank in Japan

Sludge putrefaction-Measures-

- Grit chamber / Pump well: Scum is generated
  ⇒Flush and remove sludge regularly
- Primary Settling Tank: Accumulation & putrefaction
  ⇒Withdraw at scheduled intervals
- Final Settling Tank: Floatation and overflow of accumulated sludge
  ⇒Withdraw at scheduled intervals and control sludge-liquid interface
- Thickening tank: High load in return flow due to floating and overflow sludge
  ⇒Control sludge-liquid interface
- Sludge storage tank: Putrefaction
  ⇒Keep sludge level low

4.18 Disinfection Facility

4.20 Preventive Maintenance

- Preventive Maintenance addresses the civil, mechanical, electrical, instrumentation and automation aspects.
- In respect of mechanical equipment, it is better to enter into a contract with the contractor who has built the STP to do this as per the directions of the equipment suppliers and retain the equipment supplier to check and certify the work.

4.21 Troubleshooting

Please refer to Appendix 4.1 (A-22 to A-49)

Example: Table A4.1-1 Manual bar screens

Trouble	Likely cause	Remedy
Operator not able to carry the raking bar with him while climbing up	There is no arrangement to keep the raking bar near the platform	Make arrangement for hanging the rod on the outer air side of the sidewall at waist height while standing on the platform.

4.22 Record Keeping

- Operation:

  The purpose of recording data is to track operational information that will identify and duplicate optimum operating conditions.

- Maintenance:

  A record of instrument performance and repairs allows operations or maintenance personnel to properly evaluate an instrument's effectiveness and determine if the instrument meets the objectives used to justify its purchase and installation.

4.22 Record keeping for operations

At site

In monitoring room

In water analysis lab.

4.22 Record keeping for maintenance

Basic maintenance information :

- Plant equipment identification number,
- Model number and serial number,
- Type,
- Dates placed into and removed from service,
- Reasons for removal, location where installed,

4.22 Record keeping for maintenance

Maintenance basic information :

- Calibration data and procedures, Hours required to perform maintenance,
- Cost of replacement parts,
- Operations and maintenance manual references and their locations, and
- Apparatus failure history

4.22 Record keeping for maintenance

Inspection and recordkeeping at site (in Japan)

Register the collected data on PC (In Japan)

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 5: SLUDGE TREATMENT FACILITIES ~

CPHEEO, MOUD

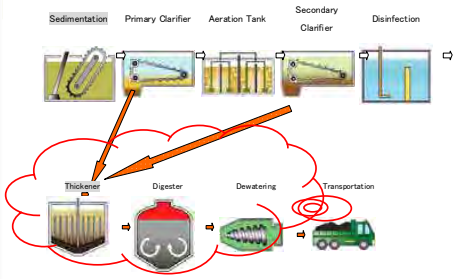
JICA Study Team

Teruo Suga

21st January 2013

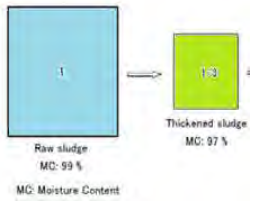
Chapter Contents

Sludge Treatment Facilities



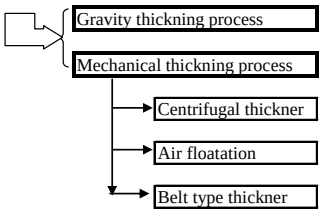
Sludge Thickening

Purpose of thickening (Volume reduction)



5.1 Sludge Thickener

Sludge Thickning Process



Resource: 2009 JSWA statistic Data

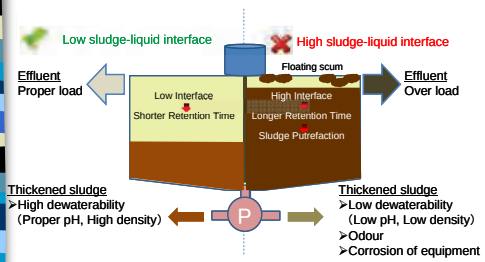
Sludge Thickening by Gravity

- Important points for Gravity thickener's O&M are as follows:

1. Periodical check of sludge blanket depth (Daily)
   Check sludge condition and supernatant conditions
2. Adequate discharge of sludge from the thickener. (Constant discharge)

Keep fresh sludge in the thickener!

【Operation of Thickening Tank】



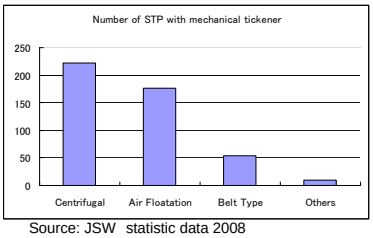
Operation with sludge blanket depth check and withdraw sludge, following troubles may be avoided or reduced

- Odour from thickener
- Too thin Sludge content,
- Drive motor trip,
- Chocking of sludge pump

Troubleshooting of gravity thickener

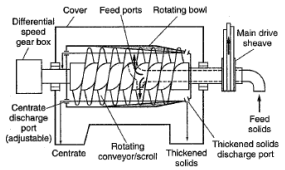
Trouble	Likely causes	First stage remedies
Thickened sludge is not what is designed for	Typically a minimum detention time is needed for sludge solids to break free of bound water and thicken at the bottom. If this is not occurring, the thickened sludge will be very weak	Check volumes of sludge and dilution water entering the tank from their flow meters. Reduce the flows so they do not exceed design values. Check flocculator also

Number of STP with mechanical thickener in Japan



Source: JSW statistic data 2008

(1) Centrifugal Thickener



Toyohashi city

Maintenance points for Centrifugal Thickener

1. Check tension and condition of V-belt,
2. Polymer feeding facilities including storage tank.

Troubleshooting for Centrifugal Thickener

Trouble	Likely causes	remedies
Low content of sludge	Poor quality of feeding sludge.	Increase G effect.

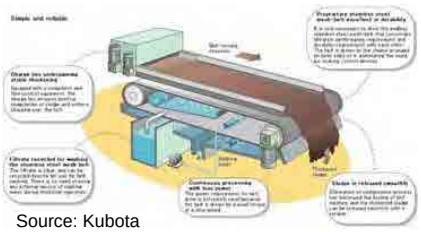
(2) Air floatation Thickener

Source: www.sanyokako.co.jp

Operation Parameters for Air Floatation Thickener

1. SVI of feeding sludge
2. Quality of supernatant
3. Condition of thickened sludge
4. Air /Solid ratio
5. Thickness of froth

(3) Belt Type Thickener



Source: Kubota

Trouble Shooting for Belt Type Thickener

Trouble	Likely causes	remedies
Too low pressure of washing water	Sediment of sludge in washing pump	Cleaning the washing pump with disassembly
Vibration or abnormal noise	Lack of lubricant oil for bearing	lubrication.

5.3 Anaerobic sludge digesters

Points of operation

- Uniformity and consistency are key points for digester operation.
- Constant solids volume and concentration is essential. (continuous feeding is better)
- Solids withdrawal should be adequate rate and periodical

Maintenance Points for sludge digesters

1. Periodical Check of solid and scum in tanks
2. Air tightness test for gas piping and storage facilities, including air release valve and safety devices

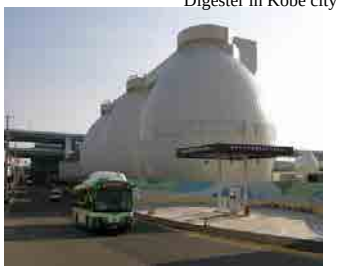
Troubleshooting of Digester

Trouble	Likely causes	First stage remedies	Second stage remedies
Smell of hydrogen sulphide when walking around the base of the fixed dome on the digester	Apply soap solution to all piping joints to verify any leaky joints or cracked pipes.	Erect a sign board in local language and all familiar languages that gas is leaking and persons shall not go to the top of digesters	Do not try to fix the problem by yourself. Call the equipment supplier to attend to it

Bio-gas for bus fuel

(Source: JSWA)

Digester in Kobe city

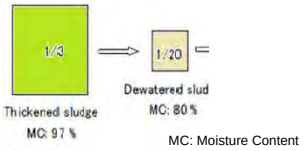


5.4 Sludge Dewatering

Raw Sludge is 1

Thickened sludge is 1/3

Dewatered sludge 1/20



MC: Moisture Content

5.5 Sludge Drying Bed

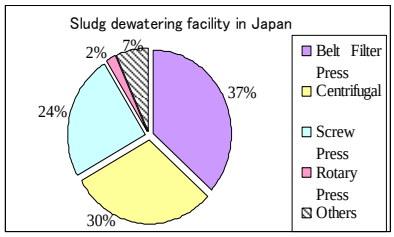
Source: Chennai Metropolitan Water Supply & Sewerage Board

Sludge drying beds

Other dewatering systems should be adopted due to the following reasons:

1. It requires a large land for proper operation.
2. It is difficult to treat increasing sludge timely. (In rainy season)
3. It is difficult to control odour.
4. It is difficult to control methane gas from sludge.

5.4 Sludge dewatering

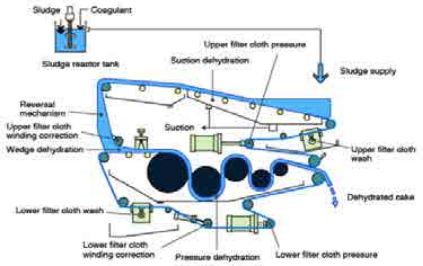


Source: JSWA 2008 statistics data

Operational Key points for Mechanical Dewatering

1. Sludge treatment with polymer dosing before dewatering.
2. Cationic polymer for sludge treatment.
3. Maintenance of polymer dosing facilities is point of O&M.

(1) Belt Filter Press



Trouble Shooting for Belt filter press

Trouble	Likely causes	remedies
Dewatered Sludge amount decrease	Stacking of Piping and Pump	Cleaning of piping and pump
Vibration or abnormal noise	1) Air lock in pump 2) In balance of Aliment	1) Air purge. 2) Adjustment alignment of machine

Source:www.emapumps.com.au

(2) Centrifugal Dewatering

MC：about 80%

Source: Wakayama Ito STP

Troubleshooting of dewatering

Trouble	Likely causes	Remedies
Metallic noise in moving parts	May be due to worn out bearings or absence of lubrication	Lubricate moving parts

Centrifugal Dewatering in India

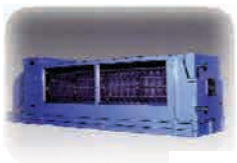
Source: Chennai Metropolitan Water Supply & Sewerage Board

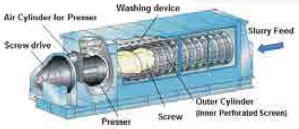
Tanajiwadi STP in Pune

Centrifuge for dewatering

Dewatered sludge

(3) Screw Press

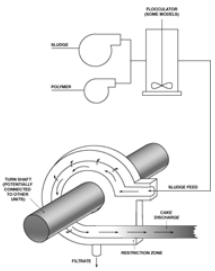




Troubleshooting for Screw Press

Trouble	Likely causes	Remedies
Vibration or abnormal noise	1) Lack of lubricant oil for bearing 2) Miss contact with mechanical parts	1) Inspection and supply. 2) Repair of facilities
Over heating of bearing	1) Lack of lubricant oil 2) Deterioration of oil	1) Inspection and supply. 2) Exchange

(4) Rotary Press



Troubleshooting for Rotary Press

Trouble	Likely causes	Remedies
Over current of motor	Clogging sludge cake below spacer	Remove of sludge cake
Sudden decrease of sludge cake	Air lock in piping	Air purge

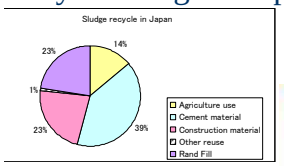
5.6 Preventive Maintenance

All preventive maintenance of equipment is to be done as per the equipment manufacture only.

5.7 Trouble shooting

- Trouble shooting are shown in each facilities.

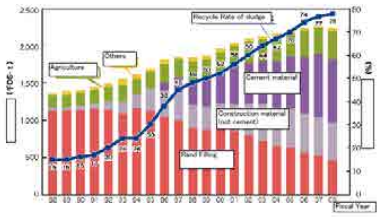
Recycle sludge in Japan



Resource: HP of MLIT in Japan, 2008 data

Agriculture reuse

Sludge recycle in Japan



Resource: HP of MLIT in Japan, 2008 data

5.8 Record Keeping

- For operation and maintenance, record keeping is important same as Chapter 4.

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 6: ELECTRICAL AND INSTRUMENTATION FACILITIES ~

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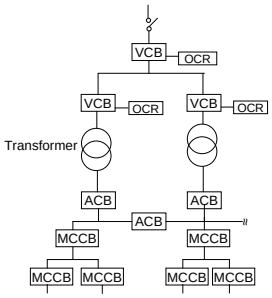
21st January 2013

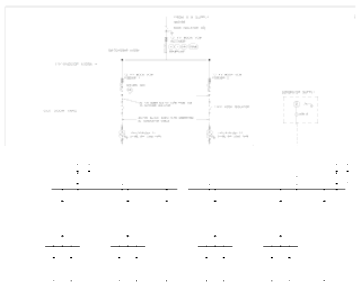
CONTENTS

Single line Diagram

- DEPICTS THE SCHEMATIC OF ENTIRE POWER FLOW IN THE PLANT WITH ELECTRICAL EQUIPMENTS AND INSTRUMENTATION
- VERY IMPORTANT REFERENCE FOR MAINTENANCE STAFF
- SHOULD BE DISPLAYED AT THE SUBSTATION, ALL SWITCHBOARD AND CONTROL ROOMS

6.1 A Typical Single Line Diagram





6.2 Power Supply system
Power Receiving and Transforming Equipments

- Description of various equipments in sub station like
  - Disconnecting Switch
  - Circuit Breaker
  - Fuses
  - Instrument Transformers
  - Power Transformers
  - Relays
  - Lt Switchboard, Bus Bars, MCCB, Contactors.
  - Power Factor Correction Equipment

High Tension (HT) Panel

- Circuit Breaker
  - Air Break Circuit Breakers (ACB)
  - Vacuum Circuit Breaker (VCB)
  - Inert Gas Circuit Breaker (SF6)
- Important points of O&M
  - Check abnormal noise and smell
  - Do not work on HT panel by yourself

Protective relays

- Type of protective relays
  a. Over current relay (OCR)
  b. Under voltage relay (UVR) and Over voltage relay (OVR)
  c. Earth fault relay
- Important points of O&M

Check connections for looseness and check cables for discolouration.

Transformer

- Step down voltage from 11kV to 440v , 3 phase

Transformer in an STP

- Important Check Points of O&M
  - ✓ Check connections of cables for looseness and overheating
  - ✓ Check the transformer for abnormal vibration and noise.
  - ✓ Check oil and winding temperature regularly
  - ✓ Check for moisture ingress by observing the colour of the silica gel
  - ✓ Check for level of oil in the conservator

Low Tension (LT) Panel

- Distribute voltage to control panels
- Consists of MCCB, PCS, etc.

Important points of O&M

- ✓Check for overheating, abnormal noise, and colour
- ✓Check indicators
- ✓Check names of panels
- ✓Check for proper earthing

LT panel in an STP in Japan

6.3 Standby Power Supply System

Standby Power Supply System should be provided that supplies full power continuously to all aerators, pumps and clarifiers

- GAS ENGINES
- DUAL FUEL ENGINES
- O&M ISSUES

SUPPLY INTERRUPTIONS

GUIDELINES FOR OPERATOR DURING SCHEDULED AND UNSCHEDULED POWER INTERRUPTION WHEN PLANT STOPS; PRECAUTIONS BEFORE AND DURING RESTARTING

6.4 Prime Movers

- Induction Motor
- Starter
- Characteristics of Induction Motor
- Performance Assessment of Motors
- Condition Monitoring Techniques
- Speed Control Equipment
- Motor Protection Equipment

6.5 PROCESS INSTRUMENTATION

- FLOW MEASUREMENT
- LEVEL MEASUREMENT
- PRESSURE MEASUREMENT
- Ph, OXIDATION-REDUCTION POTENTIAL
- DISSOLVED OXYGEN
- TEMPERATURE
- MLSS NEPHLO-PHOTOMETER

Process Instrumentation
Flow measurement

- Open channel flow- Level and velocity
  - – Parshall flume
  - – Ultrasonic flowmeter
- Pipeflow- Velocity or differential pressure
  - – Ultrasonic flowmeter
  - – Magnetic Flowmeter
  - – Differential pressure transducer

6.5 Process Instrumentation

Level Measuring Equipment (Ultrasonic)

- Measures water level by generating a pulse of ultrasonic waves
- Important points of O&M
  - ✓ Requires little daily maintenance
  - ✓ Keep liquid surface without scum, foam and wave
  - ✓ Repair whenever the meter breaks down

Process Instrumentation

Pressure

- Pressure gauge- diaphargm or bourden
- Load cell sensing
- Capacitance bridge sensing
- Ultrasonic sensing

Process Instrumentation

Dissolved oxygen (DO) meter

- Measures DO in sewage
- Important points of O&M
  - ✓Regular cleaning of diaphragms
  - ✓Zero calibration and span calibration
  - ✓Regular replacement of internal electrode solution
  - ✓Regular cleaning of an electrode and replacement if broken

6.6 Monitoring And Control Through S C A D A

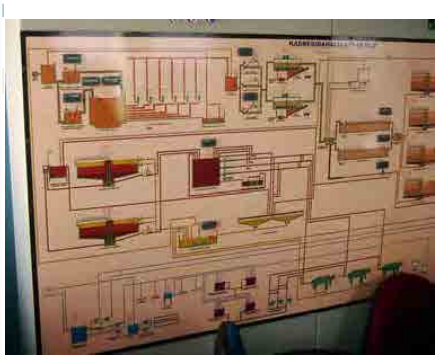
- Overview
  - Transmitter, Receiver & Transmitting Medium
- Signals
  - Analog Input And Output Signals
  - Digital Input And Output Signals
- Human Machine Interface (HMI) –To Communicate And Set Points Of Action To The Machine, Like A Keyboard Or Mouse For Human To Machine And Monitor Display For Machine To Human.
- Programmable Logic Controller- Senses Input Signal And Changes Output Actions Based On Set Rules In The Memory.

Automatic Control

- Feed Back- Compare Process Variables With Set Points, Repeat Corrective Actions Till Desired Variables Achieved.
- Feedforward – Predict Influences , Combine With Feedback Control, To Reduce Abnormalities.
- Sequence Control- Control Proceeds According To Pre-programmed Sequences.

SCADA- Graphic Display

No.	Contents
1	Grit chamber facilities
2	Water treatment facilities
3	Disinfection facilities
4	Sludge thickening facilities
5	Sludge digestion facilities
6	Sludge dewatering facilities
7	Power supply system
8	Trend graph
9	List of messages
10	List of alarms



6.8 Energy Audit

- One Unit of Energy conserved is two units generated
- The study of pattern of energy consumption , identify areas where performance is not energy efficient, and Measures to reduce/conserve energy in an STP.
- Use of SCADA in Energy Audit: The efficiency of major energy intensive equipment -heavy-duty pumps are monitored, and efficiency calculated. When the efficiency of the pump drops below a specific level, the SCADA warns that the equipment is operating below its efficient level.
- In Japan, such an arrangement is provided in SCADA in relation to a set of pumps.

Stages of Energy Audit

- Preliminary Energy Audit –Assess level, depth and complexity of issue.
- Detailed Measurements, Analysis and recommendations
- Review of energy Audit with reference to results after implementation for future planning
- Every organisation selects an Energy Auditor to plan conduct tests and collate results .

Energy Audit

- Energy conservation Act 2001 has been enacted by government of India to develop guidelines on Energy conservation ratings and certification.
- The Bureau of Energy Efficiency assists the Government in developing policies and strategies with thrust on self-regulation and market principles.

Energy Audit- Major Factors affecting energy wastage

- Idle running of equipment
- Higher rating of equipment
- Overloading , overheating of equipment
- Mechanical defects – Bearing, base & foundation, Vibration, Noise, Mis-alignment, valves throttled
- Poor thermal insulation
- Leakage of water, oil, heat etc
- Ageing -normal wear and tear

6.10 Inspection Tools
Multimeter

- Measures the voltage and current of the circuit

6.10. Inspection Tools
Clamp-on Meter

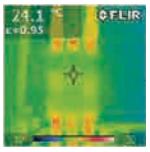
- Measures the current during operation

6.10 Inspection Tools
Megger

- Measures the insulation resistance of the equipment

6.10 Inspection Tools
Thermograph

- Measures and displays temperature of equipment



6.10 Inspection Tools
Infrared thermometer

- Measures pinpoint temperature


Infrared thermometer

6.11 Troubleshooting

- Transformer
- Starters, breakers, and control circuits
- Motor

6.11 Troubleshooting
Transformer

- Abnormal noise

Troubles	Causes	Remedy
Abnormal noise	Noise originating from the inside of the transformer	Contact the manufacturer or transformer repairer.

6.11 Troubleshooting
Starters, breakers, and control circuit

- Overheating

Troubles	Causes	Remedy
Overheating	Loose power connection.	Tighten the connection.
	Poor ventilation at location of starter / breaker.	Improve ventilation.

6.11 Troubleshooting
Starters, breakers, and control

- Starters,/breakers not holding on at the ON-position

Troubles	Causes	Remedy
Starter / breaker not holding on ON-Position	Relay contacts are not contacting properly	Check and clean the contacts
	Latch or cam worn out	Readjust latch and cam

6.11 Troubleshooting
Starters, breakers, and control

- Fusing of contacts

Troubles	Causes	Remedy
Fusing of contacts	Short circuit	Remove short circuit fault and ensure that fuse or circuit breaker rating is correct.
	Low voltage	Check and correct voltage.

6.11 Troubleshooting
Motor

- Hot bearing

Troubles	Causes	Remedy
Hot bearings	Badly worn bearings	Replace bearings.
	Insufficient grease	Maintain proper quantity of grease in bearing.
	Excessive lubricant	Reduce quantity of grease.

6.11 Troubleshooting
Motor

- Motor does not start

Troubles	Causes	Remedy
Motor does not start	No supply voltage	Check voltage in each phase
	Motor may be overloaded	Start on no load by decoupling
	Starter or switch/breaker contacts improper	Examine starter and switch/ breaker for poor contact or open circuit

Inspection

- For safety, inspection of electrical equipment should be done only by persons with thorough knowledge of electricity and licenced to test and repair electrical equipments
- Training on use of Safety gear like gloves , rubber mats, Discharge rods , fire-fighting, first aid, insulated tools should be imparted to all operating staff.

Thank you for your attention.

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment

Part B : Operation & Maintenance
~ Chapter 7: Monitoring Water Quality

CPHEEO, MOUD
JICA Study Team
Dr S Sundaramoorthy
21st January 2013

Contents

Sampling – Grab & composite

Grab samples - should state time of collection

When the samples are taken, they should be refrigerated immediately to preserve them from continued bacterial decomposition. When all the samples have been collected for a 24-hour period, the sample from specific location should be combined or composited together according to flow fora single 24-hour composite sample.

Mixing of samples of MLSS is important

Storage & Transit

1 to 2 liters of sample is enough
Fractional samples at 1, 2 to 3 hours

All samples should be immediately transported to laboratory. In case there is delay in transportation, the preservation time to be as short as possible and not exceeding 24 hours and the ice shall not be found melted receipt of the sample.

Tests and Frequency

Table 7.2 is daily tests for secondary treatment

Table 7.3 is weekly tests for secondary treatment

Table 7.4 is monthly to bi-annual tests

Table 7.5 is monthly basis for Ponds

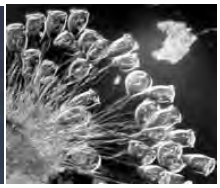
Field Tests

1. BOD test is useless for daily plant control
2. COD to BOD is same for a given STP
3. Hence do COD test and interpret BOD
4. Measuring D O in aeration tank is tough
5. D O meter probes get choked very often
6. On line D O measurement – same story
7. Continuous cleaning type of probe is needed
8. Best is qualitative test, Illustrated in next slide
9. Use pocket microscope for rotifers & protozoa

Field Check for DO
Can also be done in test tube by dropper bottles

Instant Check for BOD in Secondary Sewage
Courtesy-Severn Trent, UK

If we can see these healthy and active in MLSS, we need not worry too much on a day to day basis

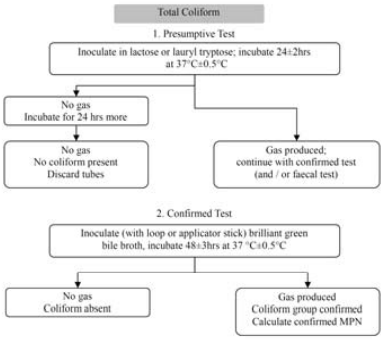


Coliform Test

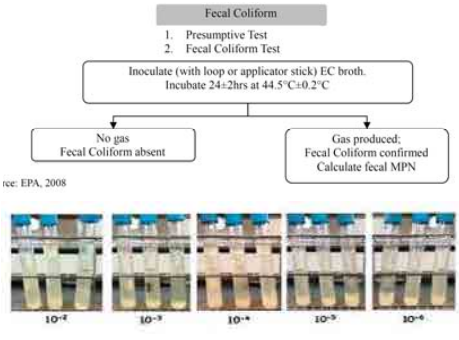
Gastroenteritis	Salmonella	Faeces-Human / animal
Typhoid	Salmonella	Faeces-Human
Dysentery	Shigella	Faeces-Human
Cholera	Vibrio Cholera	Faeces-Human
Hepatitis	Virus	Faeces-Human/shellfish
Amoebiasis	Amoeba	Faeces-Human
Giardiasis	Giardia Lambia	Faeces-Human/animal

- It is not easy to test these organisms in drinking water
- Faeces also contains coliform organisms
- If coliforms are present, probably one or more of above may be present
- In which case, confirmatory test for faecal coliform organisms is needed

Coliform - Faecal coliform testing



Coliform - Faecal coliform testing-MPN



Coliform-Faecal coliform testing-Plate count

Though more accurate than the MPN tubes, this is also time consuming and requires care

Coliform-Faecal coliform Colilert test Rapid 7 hour faecal coliform test

A rapid 7-hour faecal coliform (FC) test for the detection of FC in water – Accepted by US-EPA.

This 7-hour FC test was found to be suitable for the examination of surface waters and unchlorinated sewage and could serve as an emergency test for detection of sewage or faecal contamination of potable water.

Instead of 72 hours of olden tests, it is recommended that this shall be the guideline test to verify the faecal coliforms in treated sewage before chlorination itself.

Frequency Management

Laboratory results must stop at an intermediate stage and should not go all the way to the CEO every day. This will only set in motion a parallel organization in detecting reporting matters and replying to higher ups and the staff will lose interest. On the other hand, a fortnightly concise physical reporting illustrating any specific changes in raw sewage or treated sewage and suggesting ways & means and asking for specific funds / assistance alone should be sent to the CEO.

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 8: ENVIRONMENTAL CONSERVATION~

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Mr. Yoshitaka Ito and Mr. Gururaj Rao

21st January 2013

Chapter Contents

8.1 Introduction

- Operational measures
- Plant beautification and landscaping

8.2 Odour

- Odour from the Sewerage System
- Odour Control Methods and Technologies

8.3 Epidemiological Pollution

- Effects on Health
- Locations of Sources
- Measurement
- Preventive Measures

8.4 Soil Contamination

8.5 Water Pollution

8.6 Sewage Treatment Plant Beautification and Landscaping

8.7 Regulation of Greenhouse Gas

- Greenhouse Gas
- Control
- Effective Use of Biogas

8.8 Carbon Credit Record

8.9 Summary

- Explanation on Carbon Credit Record
- Environmental considerations during sewage treatment in STP

8.2 Odour

- General Methods of Prevention of Odour
- Deodorising Methods

General Methods of Prevention of Odour

- Remove scum routinely
- Remove sludge before it bubbles or floats
- Wash weirs

General Methods of Prevention of Odour

Remove scum routinely

Thickening Tank in STP in India

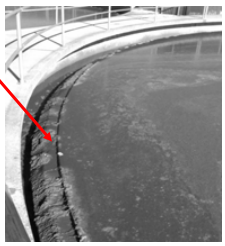
General Methods of Prevention of Odour

Remove sludge

Accumulated sludge (in India)

General Methods of Prevention of Odour

Wash weirs

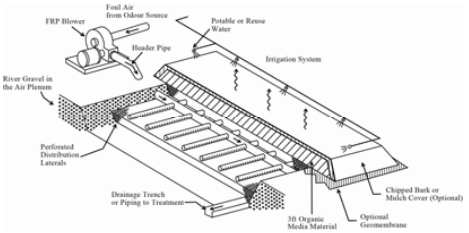


Weir to be washed (Source: WEF)

Deodorisation Methods

A. Soil (Bio) Deodorisation
B. ASP (Activated Sludge Process) - Deodorisation
C. Activated-carbon deodorization Soil (Bio) Deodorisation

A. Soil (Bio) Deodorisation



A. Soil (Bio) Deodorisation (Under construction 1)

(in Japan)

A. Soil (Bio) Deodorisation (Under construction 2)

(in Japan)

A. Soil (Bio) Deodorisation (Under construction 3)

(in Japan)

A. Maintenance of soil deodorisation system （in Japan）

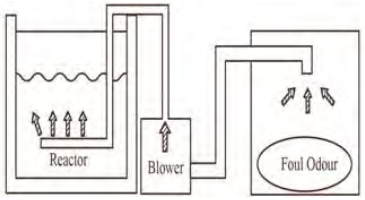
Equipment	Inspection / Work items	Daily	Weekly	Monthly	Biannual
Soil bed	Check gas flow rate and temperature	✓			
	Check soil bed surface	✓			
	Irrigate soil bed	In a timely manner depending on condition			
	Check draining status				
	Plow soil bed				✓
Sprinkling system	Clean nozzle	In a timely manner depending on condition			

A. Soil (Bio) Deodorisation

Key Point:

Air for ventilation may concentrate in a certain part of the soil. In such cases, hole may have formed on the surface. Dig the soil so that air is vented uniformly.

B. ASP (Activated Sludge Process) Deodorisation



B. Maintenance of ASP deodorisation unit (in Japan)

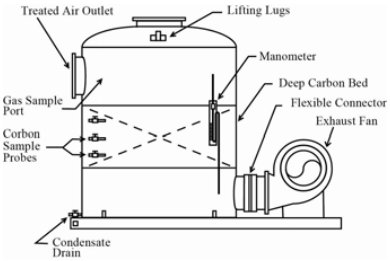
Equipment	Inspection / Work items	Daily	Weekly	Monthly	Biannual
Blower	Check vibration and leakage	✓			
	Check corrosion			✓	
	Check tension of V belt				✓
	Replace bearing grease				✓
Aeration tank	Clean nozzle	In a timely manner depending on condition			

B. ASP (Activated Sludge Process) Deodorisation

Key Point:

Pipes used underwater are likely to clog easily; so periodically clean such pipes and remove the clogged material.

C. Activated-carbon deodorization system



C. Activated-carbon deodorization

（Replacement of the activated carbon-1）

(in Japan)

C. Activated-carbon deodorization

（Replacement of the activated carbon-2）

C. Maintenance of activated carbon adsorption system (in Japan)

Equipment	Inspection / Work items	Daily	Weekly	Monthly	Biannual
Adsorption tower	Check differential pressure	✓			
	Drain condensate			✓	
	Inspect and clean inside				✓
	Check and analyse deodorisation performance				✓
	Replace activated carbon	When life expired			

C. Activated-carbon deodorisation

Key point 1:

A differential pressure gauge is installed between the inlet and outlet of gas in this equipment. If the value indicated by this differential pressure gauge is large, clogging has probably occurred. This is a sign that the activated carbon is to be replaced or the pipe is to be cleaned.

C. Activated-carbon deodorisation

Key Point 2:

Measure the concentration periodically near the outlet. When the value shows a sudden increase, it is time for replacement.
(However, breakdown of the equipment may have occurred; confirm the equipment carefully and then perform work.)

Thank you for your attention!

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation and Maintenance

~ Chapter 9: OCCUPATIONAL HEALTH HAZARDS AND SAFETY MEASURES ~

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22nd January 2013

Chapter contents

9.1 Introduction

Sanitation workers in O&M are exposed to occupational hazards such as:

- Diseases
- Chemical injuries
- Other accidents

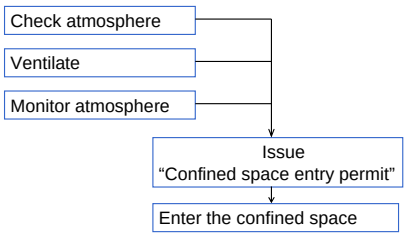
9.1 Introduction

Accidents

- Anoxia, H_2S poisoning & combustible gas
- Chlorine gas poisoning
- Fall
- Slip
- Electric shock
- Fire

9.2 Safety Aspects and Measures

Confined space entry procedure



OSHA confined space entry standards

Substance	Concentration
O_2	19.5% and more
H_2S	Less than 10 ppm
Combustible gas	Less than 10 % LEL

LEL: Low Explosive Level

Preparation for gas measurement in CS*

* Confined Space

- Calibrate in fresh atmosphere

Portable toxic gas detector

Gas measurement in CS*

* Confined Space

- Measure at Top, Middle, and Bottom
- Do not thrust your head into the space

Top Middle Bottom

Measuring points (In Japan)

After gas measurement in CS*

* Confined Space

- Keep ventilating
- Keep monitoring & record measured data
- Obtain permission for entry
- Prepare evacuation equipment
- Station safety guards

Ventilation and record making

Protective devices for hands and legs

- Use whenever in contact with sewage

Gloves and long boots

Respiratory equipment

Self-contained breathing apparatus

Air-line respirator Blower for respirator

Respiratory Equipment

Safety belt

- Use during work at high places

Safety Belt

Portable blower

- Use for providing fresh air


Portable blower and spiral duct

9.3 Health Aspects and Measures

- Health Check

Health check once a year
- Check height, weight
- Chest X-ray examination

- Welfare Measures

a. Provide immediate assistance to a beneficiary in case of an accident
b. Sanction of loan and advances
c. Medical expenses for treatment of major ailments
d. Financial education for education of children
e. Payment of maternity benefit
f. Make provision and improvement of such other welfare measures and facilities as may be prescribed.

9.5 Awareness and training

- Manager
- Technical Staff
- Skilled Staff
- Unskilled Staff

Mock disaster drills

To ensure safety, it is essential that mock drills for fire, earthquake and other disasters be carried out at regular intervals such as once in three months in STPs. Such a mock drill helps to assess the preparedness of various agencies in responding to an emergency situation during a disaster like an earthquake. These drills will also help to evaluate the coordination between various concerned agencies such as medical staff, fire brigade, and the STP staff.

Thank you for your attention.

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part B: Operation & Maintenance

~ Chapter 10: ONSITE SYSTEMS

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JICA Study Team

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22nd January 2013

Chapter Contents

Sections of Chapter 1/3

10.1 Introduction

- Type of on-site systems

10.2 On-site Facility Maintenance Systems

- Administrator (House owner), Vendor

10.3 Maintaining On-site Facilities

- O&M, Desludging, Inspection

10.4 Latrine/ Toilet

- Pour flush water seal latrine, Public toilet, Mobile toilet

Sections of Chapter 1/2

10.5 On-site Methods

- O&M of each method

10.6 Septage Treatment Unit

- "Advisory note on Septage Management Guidelines" (MOUD, 2012)

10.7 Summary

- Role of stakeholders (Administrator, Vendor, State, Municipal government)

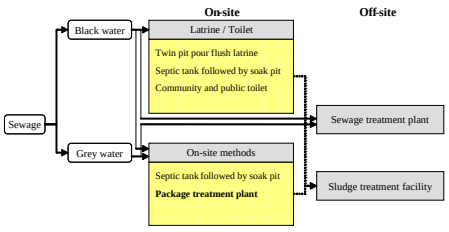
1. Sanitation Situation in India

Population percent

Year	Improved			No sanitation		
	Urban	Rural	Total	Urban	Rural	Total
1990	51	7	18	28	91	75
1995	53	10	21	25	86	70
2000	55	14	25	22	79	63
2005	56	19	30	18	73	57
2010	58	23	34	14	67	51

Source: WHO/UNICEF(2012b)

2. Outline of Onsite Treatment Systems



3. On-site Treatment Facilities


Pour flush latrine


Twin pits pour flush latrine


Public toilet


Septic tank


Package treatment plant (Sintex)

4. Septage Management

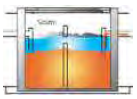
- State and municipal governments need to draw up a septage management plan.

"Advisory note on Septage Management Guidelines" (MOUD, 2012)

5. Septage Management of Septic tank

- When the amount of sludge has reaches half of the depth of tank, desludging period has reached.
- Desludging frequency is once in every 2-3 years.

○



×

6. Features of Johkasou in Japan 1/3

- Performance: BOD 20 mg/L
- Scale: 5-50 persons, 51-200 persons, >201 persons
- Material: Plastic/Concrete
- O&M: Johkasou law
- Penetration: 9% (population rate)
- Installation costs: 514,000 rupees
- Operation and Maintenance costs: 40,000 rupees

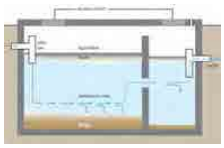
7. Features of Johkasou 2/3

Johkasou

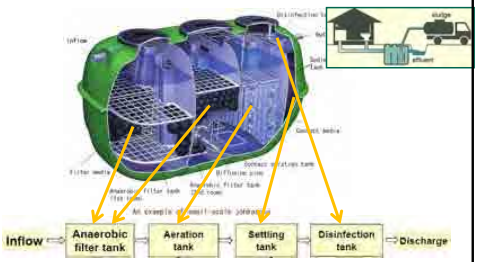
Size : 2.2㎥(5 persons)
～3.8 ㎥(10 persons)
Effluent quality : BOD 20mg/l

Septic Tank

Size : septic tank 3.8～7.6㎥ +
soil absorption system
70～340㎡ per bedroom
(US EPA standard)
Effluent quality : BOD 120～140 mg/l
(EAWAG Compendium)



8. Features Johkasou 3/3

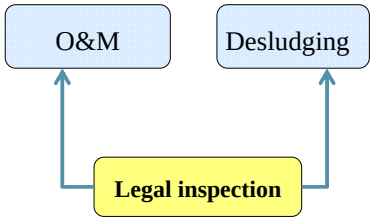


9. O&M, Desludging, Inspection of Johkasou

① Legal Inspection (After start of usage) ② O&M ③ Desludging ④ Legal Inspection (Regular inspection)

Once every four months | Once a year | Once a year

10. Legal Framework



11. O & M of Johkasou

- Items of O&M work

Sludge accumulation check, water quality inspection, inspection of status of mechanical equipment.

12. Desludging of Johkasou

- Items of desludging work

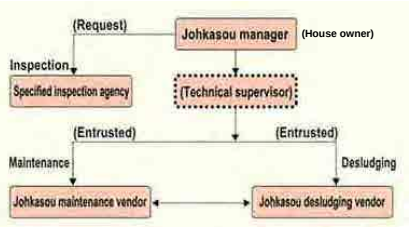
Withdrawing sludge, cleaning the johkasou, checking for faults or defects inside the johkasou.

13. Legal Inspection of Johkasou

- Items of legal inspection work

Visual inspection, Water quality inspection, Document inspection

14. Framework of Johkasou Management



15. Troubleshooting of Johkasou

- Odour: Sludge accumulation, overload, oil contamination, etc.
- Foaming: Use of excessive amount of detergent
- Noise: Blower damage, air filter clogging, air leak in piping

Thank you

Advisory Note on Septage Management in Urban India

January 22nd , 2013

Takashi Sakakibara
JICA Expert, CPHEEO, Ministry of Urban Development
Government of India

Contents

Background

1. Septage is a mixture of solids and water settled at the bottom of septic tank. It has an offensive odour, appearance and is high in organics and pathogenic microorganisms.
2. Census of India 2011 indicates that 38.2% of urban households are connected with septic tanks and about 7% into pit latrines.
3. Although the number of septic tanks will grow steeply in the next few years, there is no separate policy or regulation for septage management in India at present.
4. Most of the septage is discharged as untreated condition and exposing considerable health and environmental risks. Hence, it is crucial that septage management is accorded urgent attention in Indian cities.
5. **Advisory note on septage management in urban India is providing the strategies and guidelines for the septage management at national level.**

Present Status & Current Practices

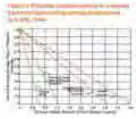
1. The Manual on Sewerage and Sewage Treatment provides guidelines on construction of septic tanks and brief guidelines on septage management.
2. Most on-site sanitation systems are emptied manually in absence of proper mechanical systems. Private operators often transport and dispose of septage in drains, waterways, open land and agricultural fields.
3. Desludging of septic tanks is perceived as a burden by many home-owners and hence they postpone cleaning until the tanks start overflowing.
4. The municipalities/local government bodies are usually empowered for ensuring the safe handling and disposal of septage generated from on-site sanitary installations.

Elements of septage management

1. **Desludging**
   >Desludging of septic tanks and cleaning of sewers need to be carried out using mechanical devices that obviates the need for manual scavenging.
   >Desludging frequencies vary, it is generally recommended to desludge tanks once every two to three years, or when the tank becomes one third full.
2. **Transportation**
   >Vehicles are available in different capacities from 2,000 up to 12,000 litres. Total number of machines depends on the frequency of cleaning of septic tanks and also the distance from the location of septic tanks to the septage treatment facility.
   >The number of septic tank cleaning machines will have to be decided based on local conditions and in consultations with the community and traffic police regarding movement of vehicle.
3. **Treatment and Disposal**
   Treatment of septage at sewage treatment plants
   Treatment at independent septage treatment plants

Treatment of septage at sewage treatment plant

1 Rate of septage is shown in right figure



2 Injection point- i) at the nearest sewer manhole, ii) at the STP, iii) to sludge digesters/sludge drying beds

3 Advantages/Disadvantages are as under

Table 4: Advantages and disadvantages of septage treatment at sewage treatment plant

Method	Description	Advantages	Disadvantages
Treatment at STPs	Septage is added to the pumping station, upstream manhole or sludge treatment location for co-treatment with sewage sludge. Septage volumes that can be accomodated depends on plant capacity and types of unit processes employed.	Most STPs in India are underutilized and will have the capacity to to handle additional septage. As skilled personnel and laboratory facilities are available in STPs, it is easy to operate and maintain.	STP performance may be hampered by addition of septage if the STP is runing at full capacity. Need to be especially concerned with the increased BOD and NH4-N load. Increased grid and sludge treatment cost (on account of increased volume of septage).

Treatment at independent septage treatment plants

Space constraint and unit process

Table 5: Design details and indicative costs for a few treatment options

Unit operations	Treatment options	Design details
Space not a constraint		
Conditioning and stabilization	Lime treatment	2.4 – 3.0 kg/m³ of septage
Dewatering	Sludge drying beds	0.09 – 0.23 m²/capita
Wastewater treatment (Filtrate/liquid from dewatering units)	Any one of the options below could be adopted	
	Anaerobic baffled reactor	2- 3 m³/m³ of septage
	Aerobic/stabilization ponds	Storage volume 2 – 3 years
	Constructed wetland	5 – 10 m²/m³ of septage
Space is a constraint – dewatering with mechanical dewatering system and liquid waste from dewatering units in an anaerobic baffled reactor. The other unit operations are the same.		

Treatment at independent septage treatment plants

1 Pretreatment
2 Lime Sedimentation
3 Mechanical Dewatering

Figure 2: Pretreatment of septage

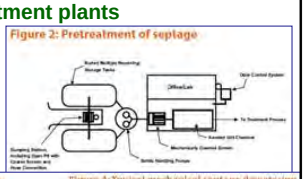


Figure 3: Lime stabilization of septage

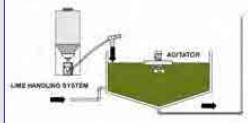
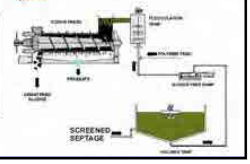


Figure 4: Typical mechanical septage dewatering system



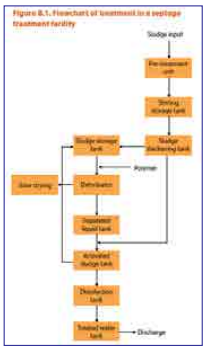
Treatment at independent septage treatment plants

Advantages/Disadvantages

Table 6: Advantages and Disadvantages of independent septage treatment facility

Method	Description	Advantages	Disadvantages
Treatment at independent septage treatment plants	A facility is constructed solely for the treatment of septage. Treatment generates residuals, i.e., dewatered sludge which must be dried and composted (dewatered sludge) and filtrate which must be properly treated (filtrate) prior to being disposed of	Provides regional solutions to sepatge management. Also makes available organic fertilizer	High capital and operation and maintenance cost (compared to co-treatment at a sewage treatment plant) Requires high skilled manpower for the operation of mechanical dewatering machines

Design of independent mechanical septage treatment facility



Model format for calculating number of trucks required for servicing 100,000 population

Table B2 : Model format for calculating number of trucks required for servicing 100,000 population

S. No.	Parameters	Calculation	Remarks
1	Nos. of people per household	5	(A)
2	Nos. of houses	20,000	(B=100,000/A)
3	Frequency of desludging, once every	2 years	(C)
4	Nos. of houses to be desludged per annum	10,000	(D=B/C)
5	Coverage with septic tank	100%	(E)
6	Average sludge volume per house, cu.m.	2.00	(F)
7	Volume to be desludged per annum, cu.m.	20,000	(G=D*E*F)
8	Nos. of working day per annum	300	(H)
9	Volume to be desludged, cu.m./day	66.67	(I=G/H)
10	Size of each desludging truck, cu.m.	2	(J)
11	Nos. of houses per trip	1	(K=J/F)
12	Nos. of trip per day (depends on the distance)	3	(L)
13	Volume desludged per truck per day, cu.m.	6	(M=J*L)
14	Nos. of truck required	11.11 say 11	(N=I/M)
15	Standby (Range 10%-25%)	1.25	(O)
16	Total no. of trucks required	13.75 say 14	(P=NxO)

Regulation and monitoring by ULB/city Utilities

1. ULBs should formulate their own bye-laws and rules for management of septage in the city
2. The Rules should address:
   >Design of Septic tanks, pits etc. (adapted to local conditions) and methods of approval of building plans, or retro-fitting existing installations to comply with rules
   >Special provisions for new real estate developments
   >Periodicity of de-sludging, and O&M of installations
   >Operating procedures for de-sludging including safety procedures
   >Licensing and reporting
   >Methods and locations of transport, treatment and disposal
   >Tariffs or cess/tax etc. for septage management in the city especially disposal
   >Penalty clauses for untreated discharge: for households as well as de-sludging agents
3. Inspection of onsite system and pumping of septic tanks should be carried out by the ULB/Utility.

Financial Management

Key issues

1.Policy and legal framework for financing and involvement of private sector
2.Target setting for revenue generation
3.Tariff structure design
4.Role of government and other stakeholders
5.Contractual arrangements for PPP projects
6.Monitoring, evaluation and accountability for services provision and environmental and economic regulation

Operation and Maintenance

1.General Aspects
Inspection of onsite systems and pumping of septic tanks
Coordinate with existing service providers appropriate Record-keeping systems and reporting procedures
2.Personnel, training and capacity building
Strengthening of PHE training will greatly help capacity building. State Govt/ULBs are requested to depute the concerned officials to participate in the training programme.
3.Communication and Community Participation
4.Primary and Secondary Audiences
5.Consultation workshops
6.Suggested communication approaches and tools
7.Examples of septage communication initiatives ; see Appendix C

Planning and Implementation of septage management schemes

1. Collect data on the households and other properties with on-site arrangements in the city.
2. List out the municipal, private and other septic tank/pit cleaning services active in the city.
3. Identify catchment-wise land for septage treatment facility: use existing STP where available; or acquire land if not available for construction of septage treatment facility.
4. Formulate draft regulations for septage management
5. Choose technology for septage treatment: prepare design of Septage Treatment and Disposal Facility (STDF) along with operation and maintenance costs
6. Conduct Techno-economic feasibility of the STDF
7. Implement construction of septage management and Disposal facility
8. Purchase vehicles and vacuum trucks etc.
9. Launch awareness campaign
10. Initiate Training and capacity building
11. Provide cleaning services incrementally in areas completing surveys of tanks and pits

Thank You

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 1: INTRODUCTION ~

CPHEEO, MOUD
JICA Study Team
Alok Kumar
22nd January 2013

Contents

Management

- To accomplish Goals and Objectives efficiently using available resources (people, money, energy, equipment, materials, time, work procedures, etc.)

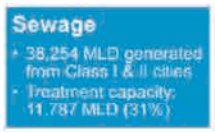
Millennium Development Goals - India

- 8 Goals to be achieved by 2015

Goal 7: Ensure Environmental Sustainability

- MDG target for access to safe drinking water achieved in 2007 (Household without access to safe drinking water sources reduced from 34% in 1990 to 17%, including rural and urban areas)
- May achieve to reduce the proportion of households without any sanitation to about 43% by 2015 missing the target (Target: from 76% in 1990 to 38% in 2015).

Present Scenario of Urban Sanitation



- 32.7% connected to sewerage system; 38.2% using septic tank; 10.5% various toilets
- Inadequate sewage collection networks & Insufficient sewage treatment capacity
- Lack of Finance & Capacity of ULBs

National Urban Sanitation Policy (1)

- Published in 2008 by MOUD
- Goal: Transform urban India into community-driven, totally sanitized, healthy, and livable cities/towns
- Salient features
  - Cities open-defecation free
  - Eliminate manual scavenging
  - Municipal sewage and storm water management
  - Recycle and reuse of treated sewage for non-potable use
  - Solid waste management
  - Services to poor
  - Improved public health and environment

National Urban Sanitation Policy (2)

- Key Issues to be addressed to achieve Goals
  - Lack of awareness
  - Social and occupational aspects
  - Fragmented institutional roles and responsibilities
  - Integrated city-wide approach
  - Focus on limited technology choices
  - Reaching un-served poor
  - Lack of demand responsiveness

Service Level Benchmarking on Sewage Management

S. No.	Proposed Indicator	Benchmark (%)
1	Coverage of toilets	100
2	Coverage of sewage network services	100
3	Collection efficiency of sewage network	100
4	Adequacy of sewage treatment capacity	100
5	Quality of sewage treatment	100
6	Extent of reuse and recycling of sewage	20
7	Efficiency of redressal of customer complaints	80
8	Extent of cost recovery in sewage treatment	100
9	Efficiency in collection of sewage charges	90

To achieve these benchmarks, Governments should attach high priority for implementing Total Sanitation by providing adequate funds within specified time frameworks

Management Needs

- Key Issues
  - Local bodies not financially resourceful to self-generate capital funds.
  - Institutional arrangement and capacity building are inadequate.
- NUSP emphasizes need for sanitation awareness through integrated citywide approach, assigning institutional responsibilities and due regard for demand and supply considerations with special focus on the Urban poor.

Stakeholders (1)

Government of India
- Formulates policy guidelines, provides technical and financial assistance to States and ULBs

State Government
- Assists ULBs in Planning and implementation of schemes; Monitors progress; Financing

ULBs/PHEDs / WSSB
- Principal agency in State for planning, implementation, and O&M

Stakeholders (2)

NGOs
- Conduct programmes on capacity building among the people to take up micro level management functions

Regulatory Bodies
- Independent monitoring of works of NGOs, ULBs, etc., to check if complying with regulations, rules, etc.

Communities/Citizen
- As beneficiary: To bear cost of services and charges for O&M

Structure of Part C of Manual

- Ch 2: Legal framework and policies
- Ch 3: Institutional aspects and capacity building
- Ch 4: Financing and financial management
- Ch 5: Budget estimates for O & M
- Ch 6: Public private partnership (PPP)
- Ch 7: Community awareness and participation
- Ch 8: Asset management
- Ch 9: Management information system
- Ch 10: Potential disasters in sewerage and management

Important Point

In this Manual, Trade names and technology nomenclatures, etc., are cited only for familiarity of explanations and not a standalone endorsement of these products/technologies.

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 2: LEGAL FRAMEWORK AND POLICIES ~

CPHEEO, MOUD

JICA Study Team

Mr. Kiyoshi MIZUFUNE

22nd January 2013

Contents

Related Acts, Rules

1. The Easements Act, 1882
2. 74th Constitutional Amendment, 1993
3. BIS Discharge Standards, 1973
4. Water (Prevention and Control of Pollution) Act, 1974, and its Amendments
5. Designated-Best-Use by Central Pollution Control Board, 1981
6. Environment (Protection) Act, 1986
7. General Standards for Discharge of Environmental Pollutants under the Environmental Protection Rules, 1989
8. Hazardous Waste (Management and Handling) Rules, 1989
9. The Public Liability Insurance Act, 1991
10. Manual Scavenging Act 1993
11. National Environmental Tribunals Act of 1995
12. Water (Prevention and Control of Pollution) Cess Act, 2003
13. Coastal Regulation Zone Notification, 2011
14. An exclusive act for sewerage sector is required.

Policies of Central Government

The overall goals of NUSP to transform urban India into community-driven, totally sanitized, healthy, and liveable cities and towns. GOI shall support the following components:

a. Awareness generation
b. Institutional roles
c. Reaching the un-served and poor households
d. Knowledge development
e. Capacity building
f. Financing
g. National monitoring and evaluation
h. Coordination at the national level
i. Service level benchmarking on sewage management

Policies of State Government

State strategies are recommended to detail out the following generic headings or areas requiring attention similar to the national policy:

a. Clear assignment of institutional responsibility, resources and capacities
b. Setting standards at the State level (within the overall frame of national standards)
c. Planning and financing at the State level
d. Reaching the un-served populations and the urban poor at the State level
e. Service delivery in cities
f. Regulation of cities and regulation within cities
g. Monitoring & evaluation at the state and city levels
h. Capacity building & training

Policies of Urban Local Bodies

The ULBs on their part may frame their policies as under:

a. Cost recovery
b. Levy of sanitation tax
c. Public private partnership
d. Private sector participation
e. Provision of sewerage and sanitation services in slums
f. Allotment of adequate funds for capital and revenue expenditure
g. Human resources development
h. Public grievance redressal mechanism
i. Enforcement
j. Obligations of Municipal Bodies to Provide Drains

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment
Part C: Management
~ Chapter 3: INSTITUTIONAL ASPECTS AND CAPACITY BUILDING ~

CPHEEO, MOUD

JICA Study Team

Alok Kumar

22nd January 2013

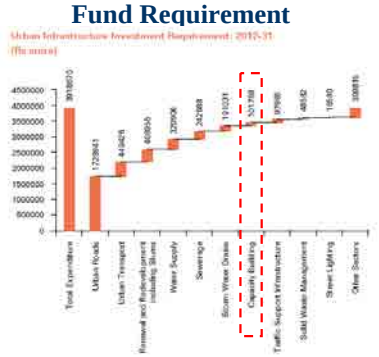
Contents (1)

Contents (2)

Need for Capacity Building

- Advances and improvements in related technologies and introduction of new concepts
- Lack of efficient and effective delivery of services
- Lack of adequate Environmental / PH engineers and other staff members
- Inadequate fund allocation for capacity building
- Institutional capacity building
- Human resources capacity building

Fund Requirement



Plan of Action of Training Program

Career Advancement

- Lack of avenues for Sewage works operators to obtain higher qualifications
- Lack of time
- A set of grades be introduced for Operators
- Staffing for various sized plants should be compulsorily manned by these categories of operators with higher pay scales for higher categories
- Provision of incentives/awards to recognize and encourage employees with remarkable performance

Recommended Categories of Grading for Sewerage Works Operators

Category	Basis of Offering the Grade
A	After 10 years of service in B
B	After 10 years of service in C
C	After 5 years of service in D
D	Entry level

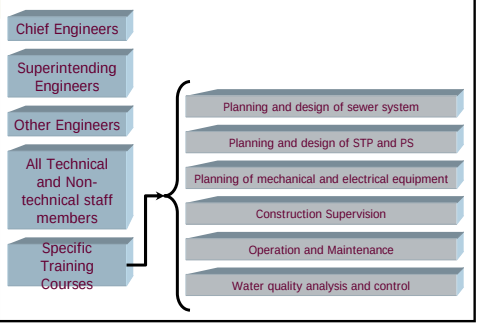
Recommended Staffing for Sewerage

	Range and Volume of public water supply in MLD	Category			
		A	B	C	D
1	Up to 1				All shifts plus one
2	Between 1 and 5		General shift	All shifts plus one	All shifts plus one
3	Between 5 and 10	General shift	All shifts plus one	All shifts plus one	All shifts plus one
4	Above 10	All shifts plus one	All shifts plus one	All shifts plus one	All shifts plus one

Needs for Training Budget

- Professional/Registration fee
- Trainer/Faculty: Honorarium and travel expenses, Accommodation, Ground transportation
- Travel and living expenses for trainees
- Training rooms
- Library facilities
- Equipment costs: Audio-visual, computer
- Material and supplies: Stationery
- Snacks and tea
- Incentives and awards for improved efficiency

Subjects/Areas Identified for Training Inputs



Need for Applied R&D in Specific Aspect

- Data not available for specific problems
- Specific focus in terms of applied R&D is required
- Aims and Objectives in case of Applied R&D are specific to given situation and local practices for upgrading management skills.
- Example fields that require applied R&D:
  - Time and motion study of sewer cleaning
  - Disinfection of secondary treated sewage when discharged to water bodies
  - Fate of ground seeded microbial pollution in hilly regions and hard rock areas

Summary

- Emphasis on capacity development to update on improved and effective methods, recent advances
- Planning of training programmes regularly based on need assessment and allocating funds at planning stage
- Evaluation of training impact on performance of participants and management; Modifications in training methods if needed
- Efforts towards retaining trained staff
- Staffing should be as per Chapter 5
- Staffing and Training courses should be going on repeatedly

Thank you for your attention!

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment

Part C : Management

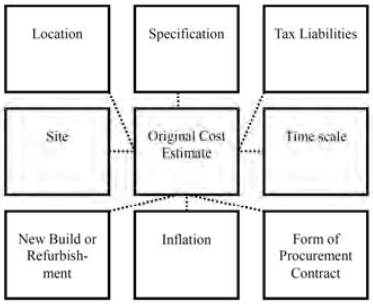
~ Chapter 4: Financial Management

CPHEEO, MOUD
JICA Study Team
Dr S Sundaramoorthy
22nd January 2013

Issues

1. **Capital & Revenue - Is Swiss Challenge the answer**
2. **Government Funding - Nothing but recycled taxes**
3. **Community Funding - Only in private premises**
4. **Tariff Fixation for Sustainability – Levy or pay ?**
5. **Why PPP is not taking off in sewerage – never ?**
6. **Transparency in Bidding & Procuring – Should DPR be brought under public hearing ?**
7. **PCB insisting EIA after award of STP contract - ??**
8. **Incremental Sanitation as the only realistic tool- why sweeping sewerage all out in layouts ?**

Factors and Uncertainties Influencing Costs

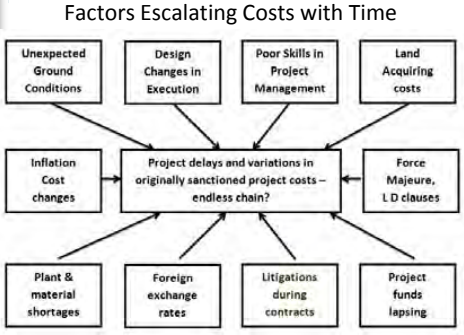


We can at least have some control over these and record them

Factors Escalating Costs with Time

We cannot even guess some factors leave alone the impacts

Factors Escalating Costs with Time



In reality these are the "hidden" factors !!

How to Get at Real time costing 1/2

Technical People alone cannot be responsible for "project delivery as conceived" because of impact of

- Getting land for the project & acquisition costs
- Straight-jacketed procedures impacting costs
- Physical deviations not under control
- Pre-conceived levies subsequently evaporating
- Absence of country based PQs in tender calls
- Political boundaries holding up completion
- "Not in my backyard" resistance by public
- The stakeholders should first endorse the DPR

How to Get at Real time costing 2/2

- In Alandur sewerage PPP, the public agreed for an O&M tariff structure while accepting the project, but backed out after inheriting the project and Govt is subsidizing O&M. This compulsion of time makes it not a good example. Swiss Challenge also fails.
- Make the AG & public as much responsible for sponsoring the DPR through public hearing by enacting an act of Sewerage & Sewage Treatment on the same lines as the Public Hearing under the Water (Prevention & Control of Pollution) Act. After all public may be willing to pay if level of service is not only assured but also enjoyed. This in turn needs appropriate costing & financing initially itself.[7]

Thank you very much

National Workshop for Finalisation of
Manual on Sewerage and Sewage Treatment

Part C : Management

~ Chapter 5: Budget Estimates

CPHEEO, MOUD
JICA Study Team
Dr S Saktheeswaran
22 nd January 2013

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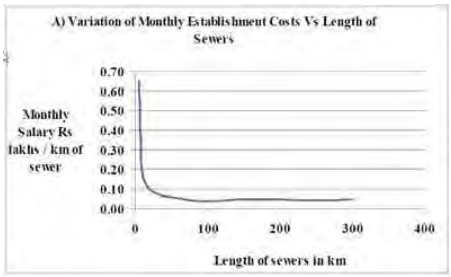

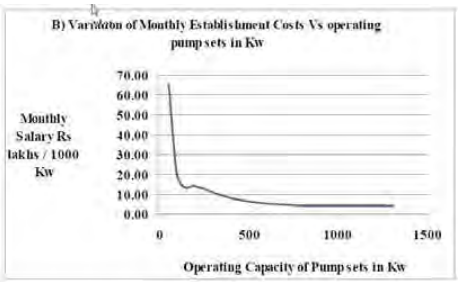

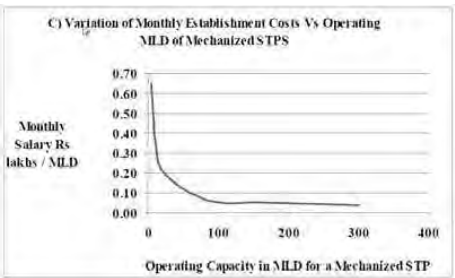

Bundling the Establishment costs of SPS and STP

If these smaller facilities can be bunched together for purpose of establishment, the initial steep portion of the curves can be virtually eliminated and the costs can be practically made into a straight line parallel to the x axis.

In actual practice, the allocated establishment in these SPSs and STPs are not having a continuous work in the O&M except for random checking of the status of machineries.

This can be easily done by keeping the establishment moving between a grouped numbers of SPSs and STPs. In fact this will also help in keeping the establishment getting involved with the work and avoid the staleness of being forced to be idling for most time when handling a small SPS or STP where there is nothing much to do daily.

Repairs and Renewals

The prevailing practice is to take repairs and renewals at about 2% of the STP or SPS cost.

This is where most of the problems of inadequate funding of O&M starts.

The civil works in a sewage contract cannot go on for 30 years as is the case of normal civil structures as per PWD norms.

It is necessary to consider a period of only 25 years for civil tanks of aerobic reactors and 20 years for anaerobic tanks. It is not that the tanks are to be demolished after this period. It only means that there is a need to look into the state of the civil works and carry out rectifications of masonry or concrete or roof protection items.

Repairs and Renewals contd

Provide a head of account of 10 % of civil works cost under the head “unforeseen items” of future works and deposit the money in a security where it will be needed only after 20 years.

For equipment, it is suggested to consider that mechanical equipment will need replacement in 10 years and electrical equipment will need renewal in 15 years.

The better approach will be to assume a compounding rate for the coming years and arrive at the cost of these portions at the renewal year. Thereafter the equivalent cost can be calculated and added together for the total renewal cost to be provided for in the DPR stage.

Depreciation Cost

If we assume that the equipment will have only a scrap value at the end of its service life, the annual depreciation is calculated as:

Annual depreciation = (Cost at zero year – Cost of the scrap value) / life years

The difficulty in using this method in sewerage infrastructure is the fixing of the scrap value after the life years.

The other method of calculating the depreciation is by the formula:
D = [r] / ((1+r) power L)) – 1

Where D is the depreciation, L is the life years, and r is the interest rate as a numeral

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 6: PUBLIC PRIVATE PARTNERSHIP (PPP) ~

CPHEEO, MOUD

JICA Study Team

Mr. Katsuzo MOTEGI

22nd January 2013

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6.1 Definition of Public Private Partnership (PPP)

PPP

- A partnership between a public sector entity (sponsoring authority) and a private sector for the creation and/or management of infrastructure

PPPP

- Recently, another P i.e. People, has been added to the PPP framework, and is now described as Public, Private People Partnership, PPPP, P4 or P[4], being applied.
- In the PPPP concept, people are involved actively in investments and infrastructure.

6.2 Objectives of PPP

Increase the availability of infrastructure services

With greater efficiency (lower cost than the traditional public sector approach)

PPPs make this possible because:

- Access to the substantial financial resources of the private sector
- Benefit from private sector technical expertise, experience and efficiency
- Transfer project-related risks to the private sector

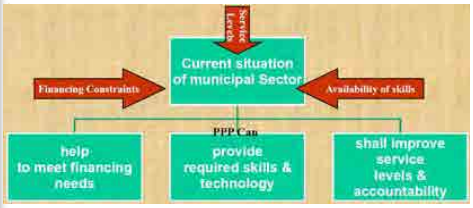
6.3 Typical Characteristics of PPP

1. The private sector is responsible for carrying out or operating the project and takes on the associated project risks.
2. The public sector's role is to monitor the performance of the private partner and enforce the terms of the contract.
3. The private sector's costs may be recovered from user charges and payments from the public sector.
4. Public sector payments are based on performance standards.
5. The private sector will contribute the majority of the project's capital costs.

6.4 Need for PPP in Sewerage and Sanitation Services

1. Need huge capital investment, high cost for O&M, and considerable human resources.
2. The efficiency of the labour force employed in the urban local bodies is far from satisfactory.
3. High wage structure and inefficiency of the work force results in steep rise in the cost of service and yet the people at large are not satisfied with the level of service.
4. It is, therefore, necessary that the local bodies seriously consider private sector participation in sewerage and sanitation services.

6.5 Advantages of PPP (1)



Source: V. Srinivas Chary

6.5 Advantages of PPP (2)

1. Quick and prompt investments, early completion of construction or improvements.
2. The private firm will ensure adequate sewerage facilities and better services.
3. The private firm can enhance the efficiency of services.
4. Users are kept informed by the publication of performance data.
5. Private firms are more flexible in their approach to solve related problems.
6. The private firm does not have the constraint of working within yearly budgetary and can borrow money as required.
7. There could be a gradual change in work culture of the employees.

6.6 Challenges and Issues (1)

➢ Challenges

1. A natural aversion to changes from the people.
2. Fears that the utility and the consumers/users will have no control over the pricing of the services.
3. Some members of the less privileged society may object to PPP.
4. The employees may have fears in respect of pension rights, retrenchment, salary cuts, the loss of identity.
5. Requires a well-defined contract in order to safeguard all parties.

6.6 Challenges and Issues (2)

➢ Issues

1. Sewerage and sanitation services has shifted from government to utility.
2. The utility should give sufficient thought providing sewerage and sanitation services.
3. The utility should weigh the advantages and drawbacks of entrusting these services to a private firm.
4. The utility and government should dispel the fears of the employees.
5. Risk transfer is one of the key arguments favouring PPP projects.

6.7 Potential PPP models(1)

Service contract

- Entrusts specific and restrictive works to the private sector.

Management contract

- Entrusts management of a complete facility which the administration owns to a private sector.

Lease contract

- Leases an institution to a private sector for a fixed period to perform O&M of a public facility.

Concession contract

- Entrusts management of public works to a private sector that has acquired a business license.

BOOT

- A private sector builds, owns, and operates the facility. Upon completion of the contract, the facilities and equipment are transferred to the administration.

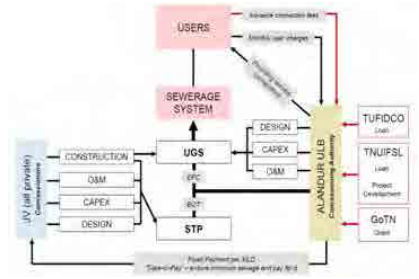
6.7 Potential PPP models(2)

Burden sharing between the administration and private sector

Business Schemes of PPP	Owner of Assets	Operation & Maintenance	Investor	Business Risk	Contract Term
Service contract	Public	Private/Public	Public	Public	1-2 years
Management contract	Public	Private	Public	Public	3-5 years
Lease contract	Public	Private	Public	Share	8-15 years
Concession contract	Public	Private	Private	Private	25-30 years
BOT/BOO contract	Private/Public	Private	Private	Private	20-30 years

6.8 Example of PPP Project (1)

- Alandur sewerage project -1



6.8 Example of PPP Project(2)

- Alandur sewerage project -2

Sector	PPP Project structure	State and Year PPP Contract Signed	Government / Public Sector Entity / Entities	Private Sector Promoter / Sponsor / Consortium Members	Project Cost	Concession Period
Sewerage	Construction Contract (Underground Sewerage System) O&M Contract (Underground Sewerage System) Build-Operate-Transfer (BOT) Annuity (Sewage Treatment Plant)	Tamil Nadu 2000	Alandur Municipality and the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL)	IVRCL Infrastructures and Projects Ltd. and Va Tech Wabag Technologies Ltd.	Rs. 34.6 crores (Sewerage Network) Rs. 6.68 crores (Sewage Treatment Plant)	O&M Contract – 5 years BOT Annuity – 14 years

6.8 Example of PPP Project (3)

- Salt Lake Water Supply and Sewage Disposal System

Sector	PPP Project structure	State and Year PPP Contract Signed	Government / Public Sector Entity / Entities	Private Sector Promoter / Sponsor / Consortium Members	Project Cost	Concession Period
Water & Sewage	BOT (includes Design and Finance)	West Bengal 2007	Kolkata Metropolitan Development Authority (KMDA) and Nabadiganta Industrial Township Authority (NDITA)	Jamshedpur Utilities and Services Company Limited and Voltas Limited	Rs.70.09 crores	30 years

6.9 Key Learnings from PPP Projects (1)

a. Improve quality of supply and reduce cost

The objective of the SWM projects is to improve quality of supply and reduce costs, therefore there are penal clauses for non-conformance to Standards of Quality (SOQ) and the tipping fee is the bid parameter.

b. Achieving operating efficiency and improving service standards

The objective of PPP can also be achieving operating efficiency and improving service standards.

c. Leveraging funds

The increasing urbanization and consequent stress on existing urban infrastructure needs huge investment by local authorities. PPP can be useful for leveraging the funds available with them.

6.9 Key Learnings from PPP Projects (2)

d. Regulatory mechanism

The regulatory mechanism for the project might also have been prescribed by the concession or license agreements.

e. Commercial viability

Viability analysis requires technical studies to determine the physical requirements of the project. To make projects more PPP amenable, certain water volume or capacity utilization is being guaranteed by the Government.

f. Tariff determination

Tariff determination could either be a bid parameter as it is in the water sector, determined ex ante to the bid as it is in the transportation case studies or determined by the Regulator. The tariffs could alternately be market determined and then neither the Regulator nor the Concession Agreement specifies the tariff; it is at the discretion of the Concessionaire.

6.9 Key Learnings from PPP Projects (3)

g. Viability Gap Funding (VGF)

In case of nonviable projects, the Government might need to pay operating or capital grant. This grant could be a capital grant under the VGF scheme or the JNNURM schemes.

h. Institutional mechanism (SPC)

The institutional mechanism for development of projects will be a special purpose company (SPC), either joint venture or non-for-profit organization. The SPC can be jointly formed by government, users and private developers.

i. Capacity building

Development of PPP projects requires capacity building of staff of local bodies.

6.10 Sustainability of PPP (1)

Factors to make PPP successful and sustainable

a. The public sector environment is suited to supporting PPPs

- Strong project ownership and expertise of the project initiating authority
- Stable regime and PPP policies of the public sector
- Capacity and resources within the public sector
- Public sector funding assistance for PPPs

b. ULB should have Financial ability.

- Level of Affluence among the end users
- Financial status of the ULB

c. The project must be commercially viable

- The project must be commercially viable for the private sector and offer value for money (VFM) for the public sector.

6.10 Sustainability of PPP (2)

Factors to make PPP successful and sustainable

d. Risks, roles and responsibilities should be divided appropriately between the public and private

- Appropriate project structuring regarding division of risks, roles and responsibilities between the public and private

e. Willingness and ability of the public to pay for services

- Communication channel with all stakeholders
- Community awareness and participation

Thank you

~National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 7: COMMUNITY AWARENESS AND PARTICIPATION

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22nd January 2013

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7.1 Need for Community Awareness and Participation

The key to success for achieving 100% sanitation and to ensure personal hygiene in the community

The local bodies are the institutions of grass root democracy which can easily interact with the people

The local bodies should therefore, seriously consider involving the community in all programmes

Develop an understanding of the benefits of sewage collection, treatment and disposal, improved sanitary conditions

7.2 Listing out Messages to be Communicated (Excerpt)

a) Health impacts due to lack of sanitation

b) Status and needs of onsite sanitation and sewerage works

c) Avail of sewer connection and avoid open air defecation

d) Accept pay and use principle

e) Change in policy and launching of new schemes

f) Adoption of Citizen's Charter

g) Functioning of information and facilitation counters, grievances handling and redressal system, etc

h) Billing and collection procedures/queries, etc

i) Appropriate septage dealing

7.3 Selection of Communication Methods (1) (Excerpt)

a) Print Media: Newspaper, Handbills, etc.

b) TV/Cable TV/Radio/Web Site

c) Cinema Halls: Slides in cinema theatres

d) Street Plays, Puppet Shows, etc.

e) Hoardings at strategic locations in the city

f) Use of Public Transport System

g) Communication through School Children and College Students

h) Primary School Curriculum to cover the Subject

i) Door to Door Contact

j) Provide Information over Hot-line

7.3 Selection of Communication Methods (2)

Example of Hoardings

Electric Bulletin Board in Tokyo - 1

7.3 Selection of Communication Methods (3)

Example of Hoardings

Electric Bulletin Board in Tokyo - 2

7.3 Selection of Communication Methods (4)

Example of Hoardings

Electric Bulletin Board in Tokyo - 3

7.3 Selection of Communication Methods (5)

Example of Hoardings

Electric Bulletin Board in Tokyo - 4

7.3 Selection of Communication Methods (6)

Communication through School Children and College Students

Primary School Curriculum

Source: MOEF

7.4 Formation of Public Relations Unit and Public Redressal System

a) Registration and redressal of public complaints
b) Guidance for new sewer connections
c) Guidance for assessment of new sewer charges, sewer cess, name changes, etc.
d) Guidance for meeting the concerned officer
e) Pamphlet on procedure related to complaint registration and redressal
f) Obtaining feedback from residents
g) Supply of Citizen's Charter to residents
h) Creation of single window system
i) A separate telephone line to record complaints
j) Define service failure and service recovery measures

7.5 Summary

To achieve 100% sanitation in the community is one such activity where community awareness and participation is the key to success.

The local body can never be successful in urban sanitation without active community awareness and participation, whatever may be the investments made through municipal or Government funds.

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 8: ASSET MANAGEMENT ~

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22th January 2013

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Definition

- "Asset management is a combination of management, financial, economic, engineering and other practices applied to (physical) assets with the objective of maximising the value derived from an asset stock over the whole lifecycle, within the context of delivering appropriate levels of service to customers, communities and the environment and at an acceptable level of risk."

Benefit of AM

- Prolonging asset life
- Meeting consumer demands
- Setting rates based on sound operational and financial planning
- Budgeting focused on activities critical to sustain
- Meeting service expectations and regulatory requirements
- Improving responses to emergencies
- Improving the security and safety of assets
- Reducing excess costs
- Maintaining desired level of services

NEED FOR ASSETMANAGEMENT

Inadequate attention and/or improper O&M

↓

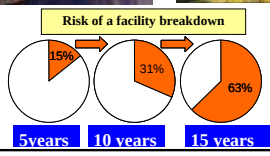
Rapid infrastructure deterioration

Picture 1 Road cave-in caused by sewer pipe (SWMD)

Need of repairment / re-structure

Inadequate attention and/or improper O&M

➡ More frequent extended breakdowns

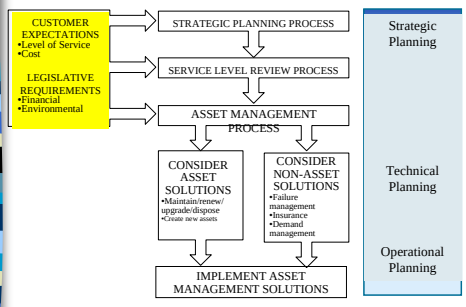


Implement AM

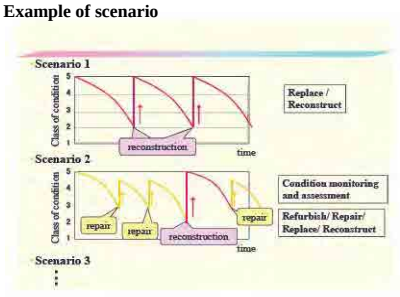
- What are the current conditions of my infrastructure?
  - Inventory of the existing physical assets
  - Assessing their condition
  - Their current value
- What level of performance can I expect from my infrastructure?
  - Performance objectives of each stakeholder
  - Legal and contractual requirements
  - Current levels of performance.

- In my current system, what are the most critical components that will safeguard my required performance in a sustainable manner?
  - Under what circumstances failures occur
  - How they occur
  - With what probability
- What are the minimum costs over the lifecycle that I will have to allow for?
  - To identify the main direct and indirect costs to budget
  - O&M cost is not constant
  - Probability of some forms of failure increases with the age of the asset
- What is the best long-term investment strategy to adopt?
  - Investment planning and identifying how to finance it

Schematic diagram of asset management



Example of scenario



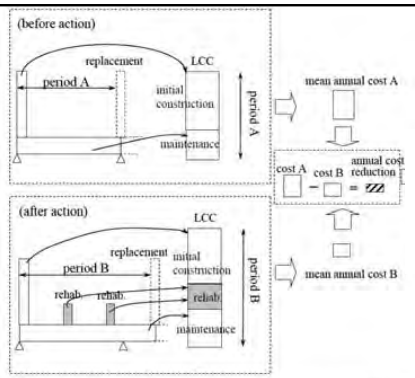


Figure 5 Method for calculating life cycle cost reductions (SWMD, 20

Picture 2 Example of Rehabilitation (SWMD)

AM for STPs (above-ground)-Japan (Effect)

- Cost: 10-20% of asset cost saving (from 9 STPs)
- Maintenance time: Numerical index (class of condition) shows suitable time of replacing or improving aging facilities at STP
- Accountability: Explaining clearly to budget section and citizen (Tax payers).

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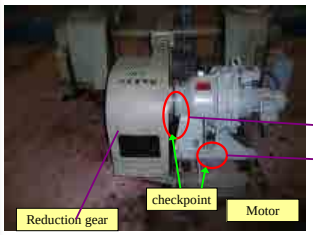
Survey for condition assessment



For example:
・oil leakage
・noise
・vibration etc.

1(poor) — Class of condition — 5(excellent)

Example of Evaluation sheet

(example : sludge collector)

Check device	Check parts	Check item	Aging phenomenon	Aging Area	Value of each item
Driving gear	Reduction gear	wear	Not found/ Found	Not found/ A little found / Found	3.5
		rust	Not found/ Rust as dust/ Rust on surface	Not found/ A little found / Found	2.9
		flaw	23 years	—	3.1
	Motor	rust	···	···	
Main shaft	···				
···					

Condition assessment

Check device	Check parts	Check item	Value of each item	Class of parts condition	weighting ratio	Class of condition
Driving gear	Reduction gear	wear	3.5	2.9	10%	2.9
		rust	2.9			
		time	3.1			
	Motor	rust	4.5	3.2	10%	
		temperature	3.5			
		time	3.2			
Main shaft	Shaft	···	···	2.8	40%	
	Bearing	···	···	4.0	10%	
	···	···	···	···	···	
···	···	···	···	···	···	

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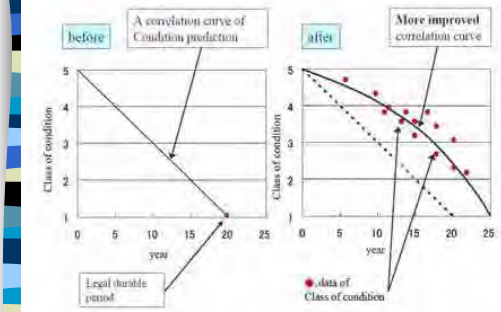

Figure 9 Prediction of the future condition of individual facilities

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5. AM for Sewer

The underground sewer network

⇒Long term budget planning for financial sustainability

- How many kilometers of failed sewers that need rehabilitation exist now?
- How fast do those sewers increase in future?
- How many kilometers of sewers need survey every year?

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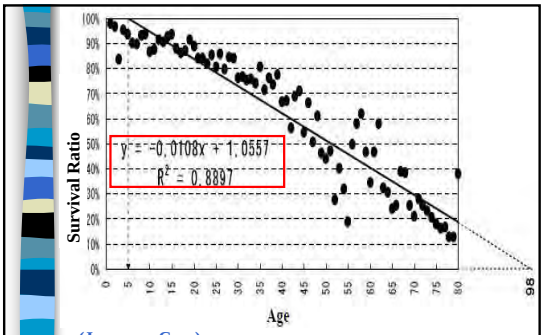

(Japanese Case)

Sewers start dying at 5 years with the speed of 1.08% every year and all sewers are dead by 98 years.

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Figure16 Risk assessment of sewer failures

Risk=Probability of failure*Impact of failure

Probability = f (age, number of lateral, underground condition, vegetation, sewage to be considered)

Impact = f(recovery cost, damage to main road traffic, railway transportation, emergency conveyance route and sewerage service)

Prioritization with the result of risk estimation-
Left: area base, Right: sewer span base

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6. Accident in US

when	place	cause	problem
Sep-2002	Taxon, Arizona	Break of Sewer Main (D=107cm)	• Inflow of Soil to STP (2 months to remove soil) • 78 days road closure. • Residents evacuated to hotels for 78 days

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when	place	cause	problem
Aug 2004	Detroit Michigan	Break of Interceptor (D:335cm, 12m-deep, 1960-installed) leading to sinkhole 9.1m deep, 18.3m wide, 48.8m long. Sandy soil condition blamed	Emergency evacuation order to 600 houses, 350 houses telephone unserviceable, bypass sewer line needed for recovery work to bypass 113～226 thousand m^3, 1 year expected for full recovery

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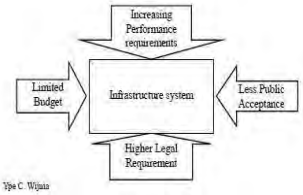
FINANCIAL ASPECT



Source: Ype C. Wijnia

- Optimization of finances like stocks, bonds and derivatives in the face of threats
- If people are satisfied, the tariff can be increased and they will pay willingly.

2013/2/27

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Model to Start with Indian Sewerage AM

- Step-by-step approach
- Data Base is essential
- Procedure Diagram is suggested in manual

a. Asset documentation
b. Condition of Asset
c. O&M cost of the asset
d. Organizing the asset inventory
e. GIS

2013/2/27

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National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 9: MANAGEMENT INFORMATION SYSTEM ~

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22nd January 2013

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Introduction

What is Management Information System (MIS) ?

- Formal system of making available to the management accurate, timely, sufficient, and relevant information to facilitate the decision making process and to enable the organisation to carry out the specific functions effectively and efficiently in tune with organisation's objectives.

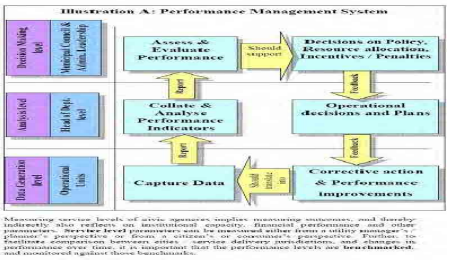
Need for MIS

- The Central and State governments need to function efficiently through proper communications and should have quick access to accurate.
- Urban local bodies require a comprehensive information system for planning, management and de-centralised governance.

MIS in sewerage system

- Financial Management Information System
- Project Management Information System
- Human Resources Management Information System
- Material Management Information System
- Operation and Maintenance Management Information System
- Marketing Management Information System
- Renewal and Repair Alerts System
- Violations of Discharge Quality of Sewage onto Public Water Bodies and Land
- Financial Health Status of the Local Body
- Other MIS

Management Indicators



- MOUD: Handbook on Service Level Benchmark
- Example of Context Information (CI) and Performance Indicators (PI) are shown in Appendix.

Application of MIS in India

- **Bangalore**

Total GIS solution developed for Bangalore includes seven applications: Asset management, Water Supply Management, Sewerage Management, Water Quality Management, Consumer Management, Billing System, and Employee Management.

- **Chennai**

Online Billing and Collection System

- **Kerala Water Authority**

Advanced Billing and Collection Utility System

- **Karnataka**

Online Application Software, TULANA

- **Rajkot**

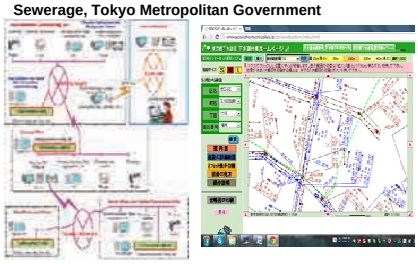
Mobile Phone Technology based MIS

Application of information technology in sewerage – the Japanese experience

- The present sewerage work in Japan is faced with problem across which it goes highly and variably such as,
  - Severe financial situation
  - Preparation to earthquake, tsunami, guerrilla heavy rain, etc.
  - Energy problem
- Sewerage facilities are appropriately managed in sewerage work, and required to provide sustaining and efficient sewerage service.
- ICT (information and communication technology) field is policy developed and business developed as one of the important fields to growth.
- The latest ICT Infrastructure in the world is built.
- Nowadays, many innovative and high-value-added products and services which utilized ICT are produced in field across which it goes variably.

Application of information technology in sewerage – the Japanese experience (2)

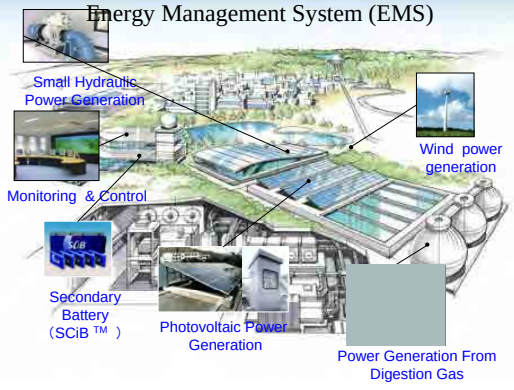
- **Sewerage Mapping and Information System in Bureau of Sewerage, Tokyo Metropolitan Government**



Application of information technology in sewerage – the Japanese experience (3)

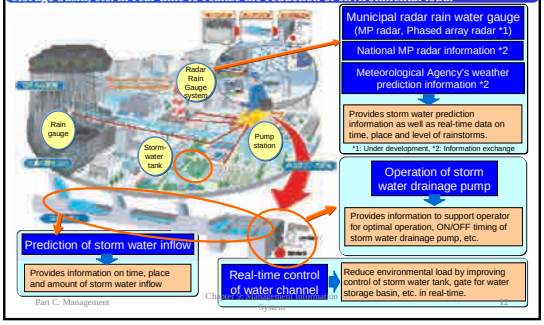
- **An Advanced Information System Using Optical Fibre in Sewers**

Energy Management System (EMS)

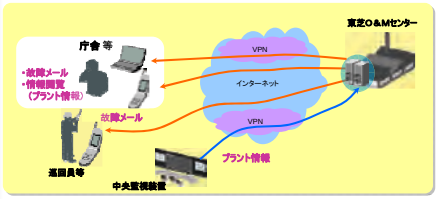


Application for Storm Water Drainage

Predict storm water inflow by using rain gauge, radar system, weather information from others, or else, and control storm water tank, and gate for water storage basin, etc. in real-time to realize the reduction of environmental load.



O&M Remote Service



PHYSICAL USE OF MIS FOR SYSTEM EFFICIENCY ENHANCEMENT

- *Milwaukee metropolitan*

Satellite municipality System Evaluation and Capacity Assurance Plans (SECAP)

- SECAP project intends to: (1) Identify satellite municipality system capacity deficiencies (2) Estimate satellite municipality system bypass volumes and flow rates for selected wet weather events and (3) Summarize peak flows delivered to the MMSD-MIS system for a selection of wet weather events.

Thank you for your attention

National Workshop for Finalisation of Manual on Sewerage and Sewage Treatment

Part C: Management

~ Chapter 10: POTENTIAL DISASTERS IN SEWERAGE AND MANAGEMENT~

CPHEEO, MOUD

JICA Study Team

Mr. Masatoshi Yamada

22th January 2013

Contents

Definition of Disaster

"A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence

which results in substantial loss of life or human suffering or damage to,

and destruction of, property, or damage to, or degradation of, environment,

and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area."

HAZARDS & DISASTER

1)Hydrological & Climatological Disasters
- Floods
- Cyclones

2) Geological Disasters
- Earthquakes
- Tsunami

3) Epidemics
- Gastroenteritis

4) Accident Related Disasters
- Oil Spills

5) Chemical & Industrial Disasters

6) Anthropogenic (manmade) disaster
- Strike
- Vandalism

- **Assess Potential Risk in Each Region**
- **Find vulnerability and Measures**

Untreated Sewage may cause epidemic diseases

Disaster → Sewerage System Malfunction → Untreated Sewage to Environment

Epidemic diseases
Cholera
Typhoid
Gastroenteritis, Etc.
Environmental Impact

Hosur Town 2004, Chennai 1993, and Orissa Flood 1990, show the influence on potable water

Earthquake hazard map of India

Damaged structure due to earthquake- Gujarat 2001

Source: MOEA

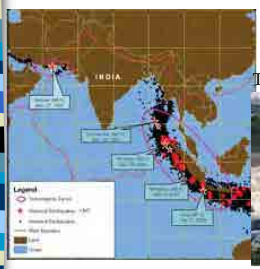
Earthquake

Ojiya city
16 July2007 Cyuetsu earthquake




Source: Niigata Pre Hp

Tsunami



Tsunami in Indian Ocean

Source: MOHA

Tsunami-Japan



Source: MOHA

STP damaged by tsunami

11 March 2011, East Japan Disaaster

Minami gamou SPS

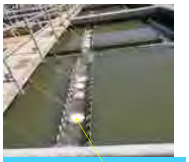
Source: NEERI

Kennan STP

Response to Disaster

Temporary sedimentation

Kennan STP



Calcium hypochlorite

Minami Gamou STP

Submergible Pump

Sennen STP

Water Discharge Vehicle

Response to Disaster



Temporary Toilets

Mobile Toilet

Temporary Toilet on the manhole

Tsunami Reconstruction

Tamil Nadu in Tsunami affected rehabilitation centres

The twin drain under construction and after commissioning at the Tsunami rehabilitated fisher folk settlement.

Disaster Cycle

Source: Meguro, K. and O. Maruo, 2008

Guide to Formulating a Disaster Management Plan

Phase-1: Prevention (Identify and minimize the risks posed by the system)

- Carry out a systematic inspection including building inspection and change factors
- Establish routine housekeeping and maintenance measures to withstand disaster
- Install automatic fire detection and extinguishing systems, and water-sensing alarms.
- Take special precautions during unusual periods of increased risk
- Make security copies of vital records such as collection inventories, and store these off-site.
- Protect computers and data through provision of uninterrupted power supply
- Have comprehensive insurance.

Phase-2 Preparedness (Getting ready to cope)

- Develop a written preparedness, response and recovery plan.
- Keep the plan up-to-date, and test it.
- Keep together supplies and equipment required in a disaster and maintain them.
- Establish and train an in-house disaster response team, imparting training
- Prepare and keep an up-to-date set of documentation
- Distribute the plan and documentation to appropriate locations on-site and off-site
- Institute procedures to notify appropriate people of the disaster and to assemble them quickly.

Phase-3: Response (When Disaster strikes)

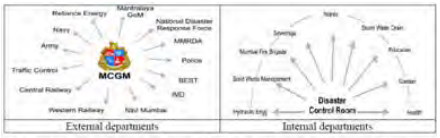
- Follow established emergency procedures for raising the alarm, evacuating personnel and making the disaster site safe.
- Contact the leader of the disaster response team to direct and brief the trained salvage personnel.
- make a preliminary assessment of the extent of the damage, and equipment, supplies and services required
- Stabilize the environment
- Photograph the damaged materials for insurance claim purposes
- Set up an area for recording and packing material
- Transport water-damaged items to the nearest available freezing facility

Phase-4: Recovery (Getting back to normal)

- Establish a program to restore both the disaster site and damaged materials
- Determine priorities for restoration work and seek the advice of an expert
- Develop a phased conservation program
- Discard items not worth retaining, and replace
- Contact the insurer
- Clean and rehabilitate disaster site
- Replace treated material in the refurbished site
- Analyse the disaster and improve the plan in the light of experience.

Ex. DISASTER MITIGATION PLAN (Munbai)

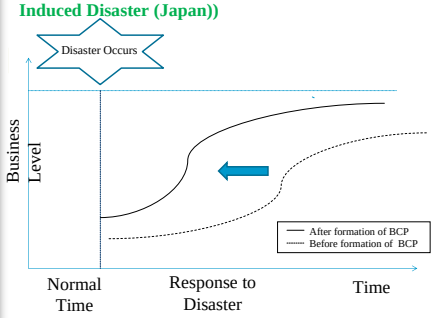
- Mumbai Corporation of Greater Mumbai (MCGM) has establish a Disaster Management Cell.



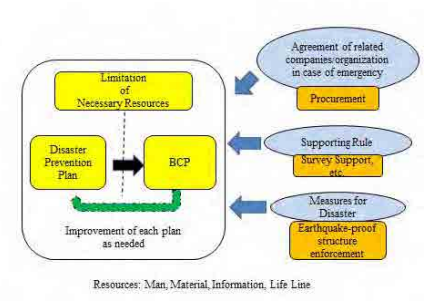
Source: http://msdr-apps.net/confluence/download/attachments/9994339/Mumbai_Presentation_Sasakawa_Award.pdf?version=1

- Sewerage System Operations for Preparedness against Flooding
  - Preparation for Men, Materials, Money, Information

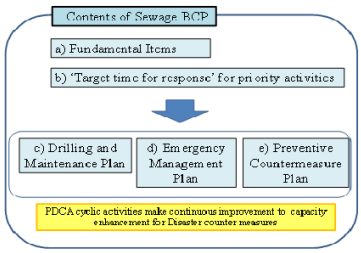
Ex. Business Continuity Plan(BCP) (Earthquake/Tsunami Induced Disaster (Japan))



Ex. BCP(Earthquake/Tsunami Induced Disaster (Japan)



Conceptual chart of the contents of Sewage BCP.



Thank you very much for your attention!

電信柱撤去作業を行うインド隊員たち
http://www.mofa.go.jp/mofaj/press/pr/wakaru/topics/vol73/img/73_photo08.jpg

The National Disaster Response Force (NDRF) in India came to Japan.