

WORLD HEALTH ORGANIZATION



ORGANISATION MONDIALE DE LA SANTE

Western Pacific Regional Centre
for the Promotion of Environmental
Planning and Applied Studies (PEPAS)

Centre régional du Pacifique occidental
pour la promotion de la planification et
des études appliquées en matière
d'environnement (PEPAS)

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REPORT

WHO REGIONAL WORKSHOP

ON

EXCRETA AND REFUSE DISPOSAL

PEPAS, Kuala Lumpur, Malaysia

7 - 11 October 1985

Kuala Lumpur, Malaysia

November 1985

72 PEPAS 85
2668

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Universiti Pertanian Campus, Serdang, Selangor, Malaysia

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ENGLISH ONLY

REPORT

REGIONAL WORKSHOP ON EXCRETA AND REFUSE DISPOSAL

Convened by the

WESTERN PACIFIC REGIONAL CENTRE
FOR THE PROMOTION OF ENVIRONMENTAL PLANNING
AND APPLIED STUDIES (PEPAS)

PEPAS, Kuala Lumpur, Malaysia

7-11 October 1985

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NOTE

The views expressed in this report are those of the participants in the workshop and do not necessarily reflect the policies of the World Health Organization.

This report has been prepared by the Western Pacific Regional Centre for the Promotion of Environmental Planning and Applied Studies (PEPAS) for Governments of Member States in the Region and for the participants in the Regional Workshop on Excreta and Refuse Disposal which was held in Kuala Lumpur, Malaysia, from 7 to 11 October 1985.

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1. INTRODUCTION

A Regional Workshop on Excreta and Refuse Disposal was held at the WHO Western Pacific Regional Centre for the Promotion of Environmental Planning and Applied Studies (PEPAS) on the campus of the University of Agriculture, Malaysia (Universiti Pertanian Malaysia - UPM), Serdang, Selangor, Malaysia, from 7 to 11 October 1985. The workshop was attended by 16 participants and 3 observers from 15 countries or areas in the WHO Western Pacific Region. Observers were from the Asian Development Bank, UNICEF and UPM. A list of the participants, observers, consultants and secretariat members is presented in Annex 1.

2. OPENING CEREMONY

Following an introductory speech by Dr M. Nakamura, Mr Somnuek Unakul, Director, PEPAS welcomed the participants and observers on behalf of Dr H. Nakajima, Regional Director of the WHO Western Pacific Region. The full text of his address is given in Annex 2.

The welcome address was given by Dr Badri Muhammad, Dean, Faculty of Science and Environmental Studies, UPM.

3. OBJECTIVES

The broad objectives of the workshop were:

- (a) to review the present status of excreta and refuse disposal in rural and depressed urban areas and to assess the principles and approaches adopted by the Member States for the integration of sanitation components into International Drinking Water Supply and Sanitation Decade programmes;
- (b) to discuss effective methods and approaches for achieving an adequate level of sanitation in rural and depressed urban areas, including both technical and managerial aspects, appropriate technology, community participation and health education; and
- (c) to review the prevailing methods of information collection, compilation and dissemination on the subject, to discuss the strategies for promoting effective information transfer and utilization, and to elaborate specific subject areas requiring further consideration.

With the above broad objectives, the workshop aimed at the participants having acquired knowledge in the following specific subject areas:

- available technologies on excreta and refuse disposal;
- health aspects of excreta and refuse disposal;
- appropriate technology concepts and applications;

- low-cost on-site excreta disposal systems;
- resource recycling - biogas, aquaculture, and land treatment of waste water; and
- appropriate technologies for composting and landfilling of municipal solid wastes.

4. WORKSHOP SESSIONS

The workshop sessions were chaired by Dr M. Nakamura. Copies of the individual working papers presented during the workshop are available in the PEPAS library and can be obtained on request. The full workshop agenda is given in Annex 3.

Monday, 7 October 1985

Following the opening address, Dr Nakamura, Operational Officer of the workshop gave an introduction to workshop sessions, and introduced the country participants, observers and WHO consultants.

Mr Unakul, Director, PEPAS, presented the role of WHO in low-cost excreta disposal, which discussed the Decade approach to water supply and sanitation, water supply and sanitation as a component of primary health care activities as recommended by the UNICEF/WHO Joint Committee on Health Policies (JCHP), and strategy for WHO's participation in the International Drinking Water Supply and Sanitation Decade. He concluded the presentation with the WHO constitution.

The whole afternoon session was devoted to the presentation of country reports and slides. During the presentation, Mr Dick C. Van Ginhoven, Sanitation Officer, UNICEF/Viet Nam, outlined the UNICEF-assisted integrated sanitation programme in Viet Nam.

Tuesday, 8 October 1985

The discussion of country reports and slide presentations was continued. It was noted that traditionally unpopular and therefore under-funded areas of excreta and refuse disposal and management are gaining new acceptance by public health officials and government leaders.

Mr S. Pillay and Mr Zainuddin Arshad introduced a paper on Malaysian programmes for excreta and refuse disposal. After the presentation, the participants discussed the choice of the most appropriate management techniques for the improvement of sanitation in the city's squatter areas.

Dr Nakamura introduced methodologies for identification and evaluation of planning issues for programme development. He outlined the extent of the excreta and refuse disposal problems in squatter settlements in the Petaling District, Selangor, Malaysia, and explained how a field study was designed and conducted by officials of the Ministry of Housing and Local Government, a student and a lecturer from the University of Agriculture, Malaysia and himself.

The methodologies applied for identification and evaluation of planning issues for programme development, namely, cause-effect diagram, goal-objective tree and K-J method, were described in detail using the study of a squatter settlement in the Petaling District as an example.

Dr Nath was the last speaker for the afternoon session and he covered the subject of overview of technology options for excreta disposal in hot climates. He dealt with the state of art of sanitation in developing countries, the selection of appropriate technology for sanitation, and the refuse potential of excreta disposal options.

Following the discussion the participants visited Kampong Muhibbah where general sanitation in squatter areas was observed.

Wednesday, 9 October 1985

Mr K.H. Kim introduced the alternative technology for excreta disposal in temperate and cold climates. He described the selection treatment process for nightsoil in which most of the efforts should be concentrated on selection and improvement of existing processes rather than on development of new process which could save energy and achieve easy operation.

Following the discussion, Dr Nath gave an overview of technology options for refuse disposal. He dealt with quantum and characteristics of solid wastes, the present status of storage, collection and transportation and disposal of solid wastes in developing countries and technical aspects of waste management.

Mr Kim introduced the overview of technology options for solid waste disposal. He outlined the recyclable materials separation, mound-type landfill and Korean experiences in the field.

The afternoon session was opened by Dr P. Guo who discussed biogas technology for developing countries. In the discussion, the principle of biogas production, the construction of various biogas reactors and necessary equipment were described.

A video tape "When refuse is not refused" was shown at the library, UPM.

Dr Nath covered health implications of excreta and refuse disposal in depressed areas. He outlined excreta-related diseases, mechanisms of transmission for water- and excreta-borne diseases and health and environmental aspects of urban solid waste management.

Thursday, 10 October 1985

The morning sessions was opened by Mr Pillay, Mr Tan, Mr Riduan, Mr Wahid, Mr Mohd. Ramlan, Dr Nakamura, Dr Nath and Mr Kim who discussed priority issues for the development of a national programme on excreta and refuse disposal. The details of the planning process for the development of a national programme for excreta and refuse disposal in a squatter settlement were described using a K-J diagram developed in connexion with a case study presented by the Malaysian team. Several presentations were made by the team members including the national policy perspective in squatter settlements, technology options, the survey results, and socio-cultural considerations.

Mr B. Fisher described the appropriate technology for sanitation in rural areas. He dealt with design options, choice of technology, algorithms for selection of sanitation technology, and design details.

Following this, Dr P. Guo outlined the appropriate technology for wastewater treatment options. This covered the important infectious disease agents with potential for being spread by land application of human night-soil and health benefits of following design criteria for stabilization ponds.

The afternoon session was devoted to discussion and elaboration on the development of a national programme. Various inputs were provided by the participants with respect to the Malaysian presentation in the morning and in-depth discussion and elaboration took place with respect to various planning issues and the Malaysian programme development efforts.

Friday, 11 October 1985

The session began with discussions and elaboration on the previous day all properly framed in the K-J diagram used to present the Malaysian case study. Specific ideas and recommendations were provided by the participants for the development of a short-term plan, a medium-term plan and a long-term plan for the Ministry of Housing and Local Government, Malaysia.

Mr Kim then presented a short paper on the institutional aspects of excreta and refuse disposal, which discussed the importance of community participation. In his presentation, he concluded that in the Republic of Korea, without the Saemaul Undong (new village movement) the rural water supply and sanitation improvement project would not have been possible.

Dr Nath presented a paper entitled, "the project planning and financial aspects of excreta and refuse disposal". He dealt with the objectives of a national sanitation programme, feasibility studies on various technical, institutional and financial arrangements, and resource mobilization through government subsidy/loan.

Dr Nakamura discussed the formulation of a follow-up regional information exchange programme.

5. EVALUATION OF WORKSHOP

Overall, most of the participants were satisfied with the organization, process and outcome of the workshop. Most of them felt that the workshop objectives were met and there was a meaningful exchange of opinions and experience and approaches for solutions. Most of them were satisfied with the working papers presented in the workshop. A few, however, felt that there should have been more time allotted for in-depth discussion on specific problems. Some participants suggested that the duration of the workshop should be longer. Most of them felt that such workshops should be held regularly, and if possible, in different countries of the Region. The exercise on the Malaysian case study, and the methodologies for the same was highly appreciated by the participants.

6. CONCLUSION AND RECOMMENDATIONS

The five-day workshop on excreta and refuse disposal was highly successful in highlighting various issues and problems in the countries or areas of this Region and was effective in disseminating information on various technology options as well as management and socio-economic aspects among the participants from the various countries. At the end of the workshop, there was a general agreement among the participants, observers, consultants and workshop faculty members on the following:

- (a) WHO should continue to organize such workshops on various issues concerning the Decade-related problems from time to time;
- (b) PEPAS should take a more active role in organizing applied research in the field of appropriate sanitation technology and related socio-economic and health aspects and in disseminating information to the Member States in the Region;
- (c) participants also felt that PEPAS could also play an effective role in collecting audio-visual aids on technical, social and health aspects (video tapes, slides, etc.), depicting the experience of different countries (e.g., videotape on Calcutta pilot project shown during the workshop) and then distributing the same to various Member States of the Region;
- (d) it was also suggested that all Member States should send various documents and publications, etc., on water and sanitation aspects to PEPAS for display and dissemination;
- (e) workshop participants also recommended that national governments of the various Member States should review the situation in their country about the progress of Decade programmes, particularly in respect of urban under-served and rural areas and take both short-term and long-term measures for improvement of excreta and refuse disposal facilities in them.

6. ACKNOWLEDGEMENTS

The generous assistance of UPM in providing video facilities is greatly appreciated.

LIST OF PARTICIPANTS

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3. Mr B. Fisher Decade Engineer
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OPENING ADDRESSES

Message from the Regional Director

Dean of the Faculty of Science and Environmental Studies,
Ladies and Gentlemen:

On behalf of Dr H. Nakajima, WHO Regional Director for the Western Pacific Region, I have pleasure in welcoming you to PEPAS to attend this regional workshop on excreta and refuse disposal.

As you are very much aware, the ten year period between 1981 and 1990 has been officially recognized by the United Nations and its Member States as the International Drinking Water Supply and Sanitation Decade. We have almost reached the mid-point of the Decade. Despite what may seem to be insurmountable odds against achieving its goal of providing safe water supplies for more than a billion people and sanitation facilities for some 600 million by 1990, the Decade efforts are being made in many countries with increasing rigor, determination and commitment, leading to some significant progress.

Many of the countries which had virtually no national programme on water supply and sanitation before the Decade have one now. Many of the countries which were facing a problem in attracting donors to fund their water supply and sanitation projects before the Decade are negotiating for and receiving funds now. Many of the countries which felt that their programme was making satisfactory progress without the benefit of the Decade are now giving it a second thought. They now ask questions such as: "Without an adequate sanitation programme, how can our water supply programme provide safe water all the time?", "Are our systems properly maintained and operated after construction?", "Is our programme financially sound and properly managed?"

The more we get ourselves involved in the Decade, the more subtle the questions we are able to ask. For example, we now seem to understand well the kind of constraints we face in promoting the Decade. At a consultation held in Geneva in 1984, the following were identified as major constraints:

1. Low government priority for the sector.
2. Imbalance between coverage in urban and rural areas.
3. The need to integrate sector institutions.
4. Operation and maintenance inadequacies and the need for rehabilitation.
5. Shortage of properly trained staff.
6. Inadequate health impact of Decade programmes.
7. Poor community participation and choice of technology.

8. Failure to attract more external support.
9. Water resource management.

On the other hand, a reappraisal of the cost of attaining the Decade objective revealed that the cost, which was originally reported to be around US\$300 billion for some 70 countries, may have been a two to threefold over-estimation - an encouraging miscalculation indeed.

While we have been able to accomplish a great deal so far, we have a long way to go before we shall be able to state that the Decade was in fact a success.

One area in which we have lagged behind is sanitation, particularly sanitation in the rural and urban underserved areas. Governments give this low priority and the costs of implementing projects are often not affordable. And yet we all know that inadequate sanitation is the reason for a great number of public health problems, even where a good water supply exists.

The subject you will deal with in this workshop, excreta and refuse disposal, is perhaps the most basic issue in sanitation. We know where the problems are, we have the technology, we know how much it costs to provide the necessary facilities, and we may even have the necessary financial resources to achieve the minimum necessary level of services.

The question, however, is not so simple because excreta and refuse disposal is a social issue, it is a cultural issue and above all it is an issue involving basic requirements of human settlements.

I understand that you will discuss technological aspects such as low-cost and innovative technologies, but I understand also that you will be concentrating your efforts on understanding many other aspects of refuse and excreta disposal as a programme of the government and of the people. You will share experiences and you will discuss how to continue sharing your experiences.

If this workshop does not provide us with the magic formulae for excreta and refuse disposal, we should not become discouraged. But we will be discouraged if we can not reconfirm our commitment and determination to make the Decade successful by contributing toward that goal.

I am confident, however, that you will spend the next five days together to learn from each other as much as possible about excreta and refuse disposal in the underserved areas of developing countries and in rural areas and that the workshop will bring about a common understanding of excreta and refuse disposal issues and it will be instrumental in moving us towards the achievement of the Decade goal in the Western Pacific Region of WHO.

May I take this opportunity to wish you all a successful workshop.

Welcome address by the Dean, Faculty of Science and Environmental Studies,
UPM

Mr Somnuek Unakul, Director, PEPAS,
Honoured Guests and Participants,
Ladies and Gentlemen:

I am honoured and happy to have all of you here in our Campus this morning. If this is your first visit to Serdang, may I say "Selamat Datang" (Welcome) and may I express my hope that you will find your stay here enjoyable and pleasant; and if you have been here before, let me say "Welcome back to Serdang". I hope you will find that the facilities and environment are much improved since your last visit.

Ladies and Gentlemen, like many other developing countries in the Western Pacific Region, within this last 25 years Malaysia has undergone rapid development particularly in industrialization and urbanization. We cannot deny that development has made our lives better but it has also produced some negative impact on the environment. For this particular occasion, I should refer to the direct relationship between rapidly increasing urban populations and the issue of sewage and garbage disposal. A casual glance through our newspapers will often show reports of littered streets, clogged drains and waterways, and pollution of surface waters by sewage. Upon close scrutiny, it can be seen that the problem is more acute especially in squatter settlements on the fringes of the cities and townships and to some extent also in the rural areas. For a variety of reasons these sanitary amenities have been sadly neglected in the areas mentioned.

Ladies and Gentlemen, no matter where, the issue of the provision of proper disposal of excreta and garbage has direct implications on human health and well-being. These are respectable subjects, and no government should find it awkward to be associated with them. Simply, we can no longer afford to skirt around the harsh reality. There has been inadequate commitment, especially in developing countries, to resolve these issues satisfactorily. There must be a strong political commitment to want to see the problems erased; and since the resources available for environmental health programmes are nearly always limited, effective strategies must be formulated and brought into action. Although environmental health strategies have been enacted in the past, they were less effective due to autonomous action and lack of inter-agency cooperation. Therefore, I hope that in this meeting, you will seriously examine the structural dimensions of the issues at hand. Time and again it has been noted that short-term development efforts tend to be over-emphasized in order to cope with the most urgent needs, while structural needs tend to be overlooked. Structural problems need structural solutions. The problem of malnutrition needs to be tackled by food strategies, not just by food aid; the problem of health care needs to be tackled by the establishment of primary health care facilities, not just by the supply of medicines; and the problem of excreta and refuse disposal needs to be tackled by comprehensive strategies, not just by constructing latrines and refuse dumps. Correspondingly, we will require more baseline data for the formulation of the right strategies. In times of great stress, as we are experiencing now, the fight for structural policies is more painful but it is the right way. Perhaps the implementation can be phased accordingly in order to reduce stress.

Ladies and Gentlemen, like many other countries, Malaysia needs to train more experts with planning capabilities for its environmental health care programmes. Workshops like this one play a very important role in achieving this goal. I hope that this workshop will generate greater interest in environmental health care planning and hasten the development of more appropriate and effective environmental health programmes. I hope that your various agencies will continue meaningful dialogues, exchange of ideas and pooling experiences on this aspect of environmental management to overcome any problems and shortcomings.

Finally, once again may I welcome you all to the UPM Campus as our guests and wish you a very pleasant stay and many hours of interesting and profitable discussions.

PROGRAMME

MONDAY, 7 October 1985

- 0810 Overseas participants assemble in Holiday Inn lobby
- 0815 Departure of mini bus to PEPAS
- 0900 - 0930 Opening address
Mr Somnuek Unakul, Director, PEPAS
- Welcome address
Dr Badri Muhammad
Dean, Faculty of Science and Environmental Studies,
University of Agriculture, Malaysia
(Universiti Pertanian Malaysia)
- 0930 - 1000 Introduction of consultants and participants
(Dr M. Nakamura)
- Group photograph
- 1000 - 1030 Refreshments in third floor staff lounge
- 1030 - 1040 Administrative briefing
- 1040 - 1100 Introduction to workshop sessions
(Dr Nakamura)
- 1100 - 1200 The role of WHO in low-cost excreta disposal
(Mr Unakul)
- 1200 - 1300 Lunch
- 1300 - 1430 Country reports and slide presentations
(2 countries)
- 1430 - 1445 Coffee break
- 1445 - 1700 Country reports and slide presentations (Cont'd)
(4 countries)

TUESDAY, 8 October 1985

- 0900 - 1015 Country reports and slide presentations (Cont'd)
(2 countries)
- 1015 - 1030 Coffee break
- 1030 - 1200 Country reports and slide presentations (Cont'd)
(2 countries)
- 1200 - 1300 Lunch

- 1300 - 1330 Country reports and slide presentations (cont'd)
(1 country)
- 1330 - 1400 Malaysian programme on excreta and refuse disposal
(Mr S. Pillay and Mr Zainuddin Arshad)
- 1430 - 1445 Coffee break
- 1445 - 1630 Overview of technology options for excreta disposal
in hot climates
(Dr K.J. Nath)
- Discussion

WEDNESDAY, 9 October 1985

- 0900 - 1015 Overview of technology options for excreta disposal
in temperate and cold climates
(Mr K.H. Kim)
- Discussion
- 1015 - 1030 Coffee break
- 1030 - 1120 Overview of technology options for refuse disposal
(Dr Nath)
- 1030 - 1200 Overview of technology options for solid waste
disposal
(Mr Kim)
- 1200 - 1300 Lunch
- 1300 - 1330 Overview of technology options for solid waste
disposal (Cont'd)
(Mr Kim)
- 1330 - 1410 Biogas technology for developing countries
(Dr P. Guo)
- 1410 - 1500 Video presentation in UPM Library, "When refuse is
not refused"
(Dr Nath)
- 1500 - 1515 Discussion
- 1515 - 1530 Coffee break
- 1530 - 1645 Health implications of excreta and refuse disposal
in depressed areas
(Dr Nath)

THURSDAY, 10 October 1985

- 0900 - 1015 Priorities issues for the development of a national programme on excreta and refuse disposal
(Mr Pillay, Mr Tan, Mr Riduan, Mr Wahid, Mr Ramlan and Dr Nakamura, Dr Nath and Mr Kim)
- 1015 - 1030 Coffee break
- 1030 - 1200 Country papers (2 countries)
- 1200 - 1300 Lunch
- 1300 - 1345 Appropriate technology for sanitation in rural areas: technology options, selection algorithm - example design details
(Mr Fisher)
- 1345 - 1430 Appropriate technology for wastewater treatment options
(Dr Guo)
- 1430 - 1700 Discussion on priority issues in excreta and refuse disposal
(Dr Nakamura, All participants)

FRIDAY, 11 October 1985

- 0900 - 1030 Presentation of the discussion and elaboration outputs
- 1030 - 1045 Coffee break
- 1045 - 1130 Short paper on institutional aspects of excreta and refuse disposal
(Mr Kim)
- 1130 - 1215 Short paper on the preparation of project plan and financial statements for excreta and refuse disposal projects
(Dr Nath)
- 1215 - 1245 Proposal on the formulation of follow-up regional information exchange programme
(Dr Nakamura)
- 1245 - 1300 Workshop evaluation
- Concluding remarks
- 1300 - 1400 Lunch

SUMMARY OF COUNTRY REPORTS

CHINA

With a very large population of over one billion living in a vast territory, 80% of which are rural inhabitants, China abounds in natural resources as well as labour force. As a developing country the nation is exerting the utmost in reconstruction for realization of modernization, in industry, agriculture and science and technology, etc. The level of excreta and refuse disposal in rural and urban areas is governed to some extent by economic foundation and traditional farm work in given locality.

Excreta and refuse disposal

The excreta and refuse disposal programmes are carried out by units in two branches of administration in China.

Units handling urban reconstruction are to provide sanitation facilities and carry out cleaning-up, removing and treating the excreta and refuse, whereas the sanitary units monitor and supervise the afore-mentioned.

The policy of public health in China is to lay stress on prevention, and the intensive movement for environmental improvement is effected in an all-round way for better sanitation on a nation wide scale, from the central administration to local authorities at all levels, to which committees and offices for the particular purpose have been attached, the main tasks are propaganda and mobilizing the public to adhere to hygienic practices, and organizing and coordinating the entire society, to carry out activities for better sanitation.

National programmes

In rural areas, the following methods of disposal are generally employed:

1. Composting for high temperature

This method is commonly used, particularly in North China. Nightsoil, animal excreta, refuse, weeds, and stalks are piled up in mixed condition so that the temperature may reach 50-70°C through fermentation, producing satisfactory results. Holes may be made in the piles by sticking in poles; huge heaps may be formed.

2. Biogas production

Methane gas generation is of significance to provide energy resources. According to recent statistics there are about 7 million methane gas generating units in China. According to the Anti-parasitic Diseases Institute of Sichuan Province, the infection rate of hookworm dropped from 63.8% to 5% in rural areas where methane gas production had been popularized.

3. Three-compartment septic tank

This is mostly adopted in South China. The tanks are quite effective and exterminate parasitic ova up to hygienic standards. Tanks of large and medium size can serve towns or collective areas whereas small tanks are used for individual households.

In urban areas, there are two ways of disposal, i.e., via sewerage system or by means of removal.

4. Removal of excreta and refuse

Excreta and refuse from urban areas may be transported to suburban areas for the following treatment:

Fermentation under high temperature (53°C) is adopted in Qingdao for methane gas generation, and composting in Tianjin whereas three compartment septic tanks are employed in cities in South Cities.

As regards the use of fuel, coal is employed predominantly in the cities in China. The refuse comprises a high constituent of inorganic ash, so that, generally speaking, filling and covering may simply be relied upon.

However, organic constituents increase in summer and autumn that the refuse should be heaped up for raised temperature, as is generally practiced.

COOK ISLANDS

Recent census (1984) indicated that the population is 17 600.

Excreta disposal

The Department of Public Health is to ensure the provision of environmental health services by establishing effective programme in the promotion of sanitary toilet facilities.

Refuse disposal

The Ministry of Health and the Ministry of Internal Affairs are working closely for effective sanitary disposal measures, e.g., landfills.

FIJI

Fiji's population in 1980 was 643 151. This compares with a population figure of 588 068 in the 1976 census. The average annual growth rate for the past five years has been 1.8%.

Excreta disposal

Problems of sewage disposal exist in low income human settlements especially in villages and settlements. Pour-flush water sealed latrines are encouraged.

Refuse disposal

All refuse within the cities and towns is collected and disposed of by the city and town councils. The services are confined to their respective proclaimed boundaries. Services outside these areas are catered for by the Rural Local Authorities.

The current method of disposal is by controlled tipping method.

KIRIBATI

Recent census (1985) indicated that the population is approximately 62 000.

Excreta disposal (rural)

Water seal or pour flush latrines are being constructed.

Refuse disposal (urban centre)

Landfill and incineration are practiced.

HONG KONG

The total land area of Hong Kong is 1 063 km² with a total population of 4 986 500 (1981 census). The overall density per square kilometer is 4 760.

Sewerage

Hong Kong has a separate sewerage system. Sewage is collected and disposed of separately from stormwater and it is estimated that about 90% of the total population is served by the public sewerage system. Apart from the floating population, people who are not served by public sewers are mainly either hillsides dwellers or residents in some old premises with no water closet facilities. The sewage from these areas generally finds its way into the storm water drains.

Hong Kong has at present 11 screening plants, 2 primary treatment works and 4 secondary treatment works in operation.

Solid wastes

Government presently disposes of about 6 500 tons per day of domestic, commercial and industrial wastes, about half of which is publicly collected.

Domestic and commercial wastes are collected daily, generally from centralized refuse collection points (RCPs) throughout the territory. The Regional Services Department services approximately 1 300 RCPs, most of which are serving rural communities, while the Urban Services Department services approximately 600 RCPs in Kowloon and Hong Kong island.

Currently, there are eight waste disposal facilities in Hong Kong - three waste incineration plants, a composting plant and four controlled tips.

MALAYSIA

The urban centres in Malaysia are growing very rapidly as evidenced by the increase of the urban population from 2.8 million in 1970 to 4.7 million in 1980. This is expected to be in the region of 5.8 million by 1985. This rapid urbanization has resulted in the generation of large quantities of both waste water and municipal solid waste which have to be adequately collected, treated and disposed of so as not to create public health and environmental problems. It is estimated that about 175 million gallons of domestic sewage and 3 000 tons of municipal solid waste are generated from the urban centres throughout Malaysia each day.

The management of waste water and solid waste in urban areas is the responsibility of the various Local Authorities throughout the country.

Management of domestic sewage

There are various kinds of systems used in Malaysia for the collection, treatment and disposal of sewage from the simple pour flush latrine to comprehensive water-borne sewerage systems.

Bucket latrines, pit latrines and hanging latrines which are very unsatisfactory from environmental health and sanitation view points are still used in most areas of the country.

Population coverage by sanitation facilities in Malaysia

Type of facility	% of total population served	
	1970	1980
1. Flush toilet	19.4	25.8
2. Pour flush latrines	2.6	30.5
3. Bucket latrine	17.1	7.5
4. Pit latrine	27.8	15.3
5. Hanging latrine	33.1	16.4
6. No facility	-	-

Source: 1970 and 1980 population census

In the past, Decade efforts have been made to improve sanitation in the country through a number of approaches. In the rural areas the Ministry of Health has embarked on a rural environmental sanitation programme in which pour flush latrines are constructed through community participation for households without toilets and to replace existing insanitary facilities.

All new developments in the past Decade have also been required to install water-borne sewerage systems following guidelines issued by the Ministry of Health and the Ministry of Housing and Local Government.

Treatment methods that have been used include waste stabilization ponds, Inhoff tanks, aerated lagoons, oxidation ditches, and lately rotating biological contactors and extended aeration systems.

So far 15 sewage Master Plans have been prepared, however, only parts of 5 of these Master Plans have been implemented.

Estimated population coverage by sanitation facilities in 1985 is as follows:

- Flush toilet 35.9%
- Pour flush latrine 39.2%
- Bucket latrine 3.4%
- Pit latrine 8.5%
- Hanging latrine 2.8%
- No facility 10.2% of total population

Management of municipal solid waste

Solid waste collection and disposal has traditionally been the function of Local Authorities. However, in the past public health services has not been given the due priority and very little planning and development took place in this field. As a result the towns and urban centres of Malaysia continue to face problems with regard to collection and proper disposal of solid waste.

In Malaysia, it has been estimated that the per capita waste generation rate is in the region of 0.5 kg/capita/day.

Solid waste characteristics

Components	% kg weight					
	Petaling Jaya*	Kuala Trengganu+	Kuala Lumpur	Malacca	Penang	Klang
Food waste	48.32	66	51	47	41	44
Paper and cardboard	23.56	11	28	28	31	27
Plastic	9.37	3.5	8	11	12	8
Textiles	3.97	1	2	1	4	3
Wood	4.82	6	3	6	5	10
Glass	4.03	1	3	1	3	3
Metal	5.93	11.5	5	6	4	5
Density (kg/m ³)	172	225	286	174	194	204

* 1985 report

+ 1984 report

In Malaysia, many types of collection vehicles are being used, ranging from simple hand carts to compactor vehicles.

At present, all municipal solid wastes are disposed of on land where open dumping and burning are common phenomena. Sanitary landfill is hardly practiced. However, many local authorities are now attempting to at least cover the solid waste with suitable cover materials.

There is no formal resource recovery industry established in Malaysia. However, informally, a lot of waste is recycled.

PAPUA NEW GUINEA

The population in the 1980 census was 3.01 million of whom 87% live in rural areas.

Excreta disposal

In urban areas, a variety of disposal systems is used including sewerage and sewage treatment plants in parts of several major towns, as well as septic tanks.

Most urban houses without sewerage connexion are provided with a nightsoil pan services.

Excreta disposal in rural areas is by means of pit latrines, or in tidal estuaries and coastal areas by overhang latrines.

Refuse disposal

Only Port Moresby and Arawa have a satisfactory method of refuse disposal by the sanitary landfill method. In other towns the refuse is tipped into the sea or if tipped on the land it is not covered.

PHILIPPINES

As at the end of 1984, the population of the Philippines was 53,169,970 with an annual growth rate of 2.4% since 1980. Of this population, 39.36% are in the urban areas while 60.64% are in the rural areas.

In the Five-year Ministry of Health National Plan (1978-1982), the National Environmental Sanitation Program has been emphasized and, during its implementation, it became one of the three top priorities in the public health programme.

Excreta disposal

There are various types of excreta disposal facilities existing in the country, depending on geographical location and its people. The common types are flush toilet, water-sealed toilet, sanitary pit privy, over-hung and drop type. The first three are considered sanitary while the rest are insanitary toilets.

It is the government's policy to encourage and persuade the communities to construct flush toilets with septic tanks in urban areas and water-sealed toilets for rural areas where ground water is kept so as not to endanger the safety of the ground water sources. In areas where water is not available or difficult to obtain, sanitary pit privies are allowed.

In conjunction with the IDWSSD programme, the Ministry of Health has undertaken drastic improvements in the provision of sanitary toilets for every rural household throughout the country through community participation and close coordination of related agencies. The implementation plan was programmed in two stages: the first stage in 1982-85 and the second stage in 1986-90. However, the intensive campaign for toilet construction started in 1983. By the end of 1990, it is envisaged that all households in the country will have a facility for sanitary disposal of waste.

Under the First Rural Water Supply and Sanitation project which comprises the first stage of the International Drinking Water Supply and Sanitation Decade implementation plan, the government, through the Ministry of Health, provides 750 000 units of plastic toilet bowls to the rural population. The construction work is shouldered by the recipient households which include digging toilet pits and provision of superstructures.

Refuse disposal

On the whole, refuse collection and disposal in the country could be classified into three categories, namely, municipal, commercial and individual.

At present, only a small portion of the entire population is served by solid waste collection facilities. Residents of rural areas usually manage to dispose of the waste generated by burning and burying wastes in open pits within their own properties, and, particularly, by recycling organic wastes through animal feeding and composting.

Municipal waste collection systems are generally present in urban areas. However, due to inadequate collection facilities which may be traced to limited budget, services are limited to a fraction of the population.

In a national survey made in July 1981, municipal garbage collection covered 15.5% of total households, communal pits - 4% and various individual methods - 80.5%.

The problem of solid wastes is expected to grow to serious proportions in the near future based on the following general factors:

- (a) rapid population growth;
- (b) urbanization and overcrowding of large cities and municipalities;
- (c) increasing industrialization;
- (d) increasing amounts of throw-away packing and consumer wastes.

The Government, through the National Environmental Protection Council (NEPC), has embarked on a programme designed to enable local governments which have garbage collection along their typical services to improve the management of solid wastes through the solid waste subsidy programme.

The subsidy will be provided to local government units to effect more vigorous and coordinated efforts to resolve problems associated with waste collection, transport, processing and disposal, upon request made through NEPC.

NEPC has identified six major project types:

- (a) resource recovery;
- (b) sanitary landfill;
- (c) biogas systems;
- (d) toilet construction;
- (e) repair/maintenance/acquisition of garbage equipment and facilities;
- (f) solid wastes Master Plan.

REPUBLIC OF KOREA

The population of the Republic of Korea is approximately 40 million in 1985, and about two-thirds of the total population is concentrated in urban areas.

Nightsoil treatment

Excreta disposal programmes in the Republic of Korea are carried out under the auspices of the Waste Disposal Law established in 1961. According to this regulation, overall responsibility for nightsoil disposal programmes comes under the Environment Administration (EA). The main function of EA, in terms of excreta disposal, is to establish regulations and various standards, act as the regulatory agency for enforcing same, develop national programmes and budget for new works as well as overall supervision of operation and maintenance.

Technically, nightsoil disposal programmes are implemented within designated collection areas, with a population density greater than 1 000 persons/km².

About two decades ago, most nightsoil collected from each household in small and large urban areas was transported to maturation ponds with a detention time of about 90 days. After primary treatment in the pond the supernatant was discharged into a local water course while the sludge was disposed of by land application.

Modern nightsoil treatment plants were constructed beginning in 1972. The need for modern treatment facilities in urban areas was due to limited land availability for the establishment of maturation ponds. In addition, maturation ponds were becoming a major water pollution source. At the same time, a developing preference for chemical fertilizers reduced the demand for land application of nightsoil.

As of 1984, EA had constructed 143 nightsoil treatment plants with a total capacity of 8 657 kl/d which could treat about 76% of the total nightsoil collected in the Republic of Korea.

Only two types of latrine are commonly used. One is a conventional water-flush toilet and the other is a vault latrine. It is estimated that water flush toilets and vault latrines constitute 40% and 60% respectively.

The sludge from the septic tanks, and the excreta from vault latrines are removed by vacuum trucks, usually operated by private agencies in conjunction with local municipal authorities. The collected "nightsoil" is transported to existing nightsoil treatment plants.

In the Republic of Korea, water flush toilets with septic tanks are beginning to play a major role in excreta disposal. However, most septic tanks eliminate only 30-40% of the organic fraction, and they have become a potential water pollution source as the number of septic tanks is increasing.

In an effort to overcome the short falls of conventional septic tanks which produce a low-quality effluent, EA established new regulations in 1983. According to these regulations, all new housing complexes and

buildings similar to housing complexes such as commercial units with more than 1 600 m² of total floor space are obliged to establish a community plant.

By the end of 1984, about 1 700 community plants had been constructed. The community plant should produce an effluent that conforms with the associated standard of 60 ml/l in terms of BOD₅.

Due to the interest of the Government of Korea in improving public health and living standards for residents of rural areas, to a level equal to their urban counterparts, EA embarked on an ambitious programme in 1984. This project, known as the Korean Rural Sewage Treatment Project, is proposing to construct 62 nightsoil treatment plants. When completed in 1987, the RSTP projects combined with the existing plants should provide treatment for most of the nightsoil generated and collected in urban and rural areas.

Solid waste disposal

In the Republic of Korea, the per capita production of solid waste is rapidly increasing. The composition and quality is also changing which has resulted in increased costs for treatment and transportation of the wastes.

In an effort to overcome these problems various methods for reducing the volume have been investigated. The Republic of Korea, in an effort to reduce the volume of solid waste, implemented the separation of combustible and uncombustible wastes beginning in 1981.

Plastic recycling

In the Republic of Korea, greenhouses and covers are used extensively for the cultivation of vegetables during cold periods. The volume of vinyl used in rural areas is 200 000 tons per year. This plastic material is disposed of as solid waste.

In order to reduce the volume of solid waste and also to recover used plastics, EA established in 1980 the Korean Plastic Recycling Cooperative to collect used plastics for reuse. Approximately 94% of collected plastics are used to produce septic tanks and low quality containers.

Solid waste landfill

In urban areas most retailers have switched to individual packing of most household products including food stuffs. This, combined with a tremendous population increase, has caused existing landfill sites to be filled to capacity. New sites are difficult to find due to the scarcity of suitable sites and pressure to not use arable land for this purpose.

For reasons of land limitations, one of the cities in Korea is planning to construct a "mound type" of landfill instead of the mere conventional approach which requires more area.

SAMOA

The total area of the islands is 1 062 square miles with 4 islands inhabited. The total population is 158 968 in 1984 census.

Excreta disposal

Four different methods are used: septic tanks, water seal latrine, pit latrine and overhang sea latrine. However, the use of overhang sea latrine is presently discouraged.

Refuse disposal

Refuse from urban centres is collected daily and transported to dump sites, whilst refuse from rural areas is disposed of by incineration, burying and landfill.

SOCIALIST REPUBLIC OF VIET NAM

Viet.Nam is a sub-tropical country where the environment is a factor favourable for the development of germs of intestinal infection and arthropods vectors of diseases.

Besides the environmental factors, the unorganized excretion in gardens, in rice fields and the removal of nightsoil from privy-containers over the country side without adequate hygienic measures and the habit of using fresh waste in agriculture and fish-breeding have brought about the most serious pollution factors to the environment. This constitutes a serious epidemiological danger for the excreta of patients and germ-carriers are a source of propagation of intestinal disease.

Sanitation improvement

To solve the problem of fresh excrement, the Ministry of Public Health of Viet Nam launched an extensive sanitation improvement campaign with a view to preserve the environment and man's health.

In order to prevent the use of fresh nightsoil, the Ministry of Public Health introduced the following sanitary facilities:

Composting toilet

The excreta is anaerobically decomposed and at the same time pathogenic bacteria will be eliminated. The anaerobical action normally takes place for several weeks.

Effectiveness of compost toilet

Length of time	Organic matters g/100g	nitrate g/100g	E. Coli per g of faeces	Ascaris OV (% removal)
Before composting	1,102	0.011	11,100,000	
After 1 week	0.997	-	1,110,000	0
After 4 weeks	0.395	0.210	100	35
After 8 weeks	0.202	0.446	Probably eliminated	50 - 85

Aqua privy

The National Institute of Hygiene and Epidemiology has devised a type of water-septic tank. This type, called the "Improved septic tank" is being studied in the region where vault composting toilet still develops very little in numbers.

Biogas production

The dung from one cow may produce 500 litres of gas per day and the calorific value of gas may be around 4-5 kilo calories per litre. In contrast, human excreta only produces 30 litres of biogas per person daily.

A little information from the field studies on the biogas plant effluent indicates that helminth ova, especially Ascaris ova, may survive in the effluent and sludge.

SOLOMON ISLANDS

Ninety percent of the quarter million inhabitants of Solomon Islands live in some 4 000 localities spread on a land mass of islands totalling 28 450 km² in the South West Pacific Ocean.

Excreta disposal

In urban areas, individual septic tanks are more commonly used in all houses. The effluent is discharged into a constant outflowing sea-current through a defined sewerage system.

In rural areas, methods of excreta disposal more commonly used are:

- (a) pit latrine;
- (b) pour flush; and
- (c) VIP latrines.

Refuse disposal

Controlled tipping is employed in urban centres. Location of sites is mainly in low-lying areas and swampy areas for the purpose of reclaiming the areas for future use.

In rural areas disposal methods in use are:

- (a) pit;
- (b) incineration;
- (c) composting; and
- (d) direct disposal into the sea.

TONGA

Land area

171 islands/36 inhabited
750 km² land
360,000 km² water

Population

100,000
70,000 main island
31,377 - capital (1984)

Excreta disposal

septic tank - 60%
hand flush - 25%
pit latrine - 5%
sludge bed - 10%

Refuse disposal

opening dumping
burning
burying

Collection

in the capital only
50 tons/day

The present system of refuse and excreta disposal in Tonga is appropriate. What is needed is an improvement of the source. Therefore, much is needed through Health Education to change the attitude of the people towards refuse disposal and excreta disposal.

TRUST TERRITORY OF THE PACIFIC ISLANDS (TTPI)

The islands spread over 3 million square miles of ocean with a land area of 2 000 square miles. The total population in 1981 was 130 000, of which 80-90% reside in the rural areas.

Excreta and refuse disposal

Municipal sewer systems are provided in the urban areas and in the under-served section. Pour flush toilets are being constructed to replace overhang and pit latrines. The Department of Public Works is responsible for operation and maintenance of the sanitary facilities which includes refuse disposal and water systems. Refuse disposal systems used in the urban areas are open dump and burning.

Rural areas: no municipal sanitary facilities are provided in rural areas.

Excreta disposal is basically through pour-flush toilets replacing overhang and pit latrines.

Refuse disposal is by burning, burying and disposal in the near shore water.

VANUATU

Port Vila is situated on the south-west of the island of Efate, and is the administrative capital of Vanuatu with a population of approximately 16 000 inhabitants. Seventy percent of this number live in the centre of the town and the rest in the fringe areas.

Excreta disposal

The main method of excreta disposal found in Vila is that of septic tanks. About 70% of the households in Vila use septic tank operations for nightsoil disposal.

Refuse disposal

The method of disposal by the Council at the Tagabe depot is known as sanitary landfill.