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# CARIBBEAN ENVIRONMENTAL HEALTH STRATEGY



**PREPARED AT A CONFERENCE / WORKSHOP  
GRENADA, OCTOBER 9-13, 1978**

**CARIBBEAN COMMUNITY SECRETARIAT  
GEORGETOWN, GUYANA**

# ERRATA

## CARIBBEAN ENVIRONMENTAL HEALTH STRATEGY THE FOLLOWING LINES ON PAGES MENTIONED SHOULD READ:

- |  |  |
|--|--|
| <b>Page 11 line 15</b>                         | — for environmental health and to disseminate the information obtained.                      |
| <b>Page 23</b>                                 | — "NO INFORMATION RECEIVED" should be in line with Montserrat.                               |
| <b>Page 24 Section 2.3.4 line 1</b>            | — Thirdly, trained professional managers were not easily available.<br>In any case           |
| <b>Page 34 Section 3.5.5 line 1</b>            | — The only expenditure reported for waste water collection and disposal systems within       |
| <b>Page 46 Section 7.2.2 line 3</b>            | — planning in the Caribbean is the dependence on foreign expertise and capital. There are    |
| <b>Page 53 Section 7.7.6 line 6</b>            | — provided to cover lower-level technicians (86%)  |
| <b>Page 68 Section 11.7 (iii)</b>              | — Long sea outfalls.   |
| <b>Page 69 Section 11.8 (ix)</b>               | — devise an appropriate management development and training programme.                       |
| <b>Page 75 Section 13.7 line 2</b>             | — should initiate action to protect fish and shellfish from harm that can be traced to toxic |
| <b>Section 13.9 line 3</b>                     | management of the total environment in the wider Caribbean and give active support to        |
| <b>Page 91 General Information</b>             | Population: 224,000 (1977)   |
| <b>Page 98 Solid Waste Management line 13</b>  | Indiscriminate dumping in some   |
| <b>Page 102 Solid Waste Management line 17</b> | Kingstown and other main towns   |

**CARIBBEAN COMMUNITY SECRETARIAT  
PAN AMERICAN HEALTH ORGANISATION/WORLD HEALTH ORGANISATION  
COMMONWEALTH SECRETARIAT**

01/10/78 11:15

PTOJ, 10/10/78

**ENVIRONMENTAL HEALTH STRATEGY**

**(In compliance with Resolution No. 11 of the  
Second Conference of Ministers  
Responsible for Health)**

ENVIRONMENTAL HEALTH STRATEGY  
(In compliance with Resolution No. 11 of the  
Second Conference of Ministers  
Responsible for Health)

**GRENADA  
9 - 13 OCTOBER 1978**

With the co-operation of  
The Commonwealth Foundation  
United Nations Environment Programme  
and the  
United States Agency  
for  
International Development

**CARIBBEAN COMMUNITY SECRETARIAT**

**FIFTH CONFERENCE OF  
MINISTERS RESPONSIBLE  
FOR HEALTH**

**Antigua  
July 10 - 12, 1979**

**CMH 79/5/16**

**d March, 1979**

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Responsible for Health)**

**Prepared at a Caribbean Conference  
jointly sponsored with the  
Pan American Health Organisation/World Health Organisation  
and the Commonwealth Secretariat  
and with the co-operation of  
United Nations Environment Programme  
the United States Agency  
for  
International Development  
and the  
Commonwealth Foundation**

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The Government of Grenada for hosting the final Conference/Workshop at which the Strategy was formulated.

The participants, listed at Appendix I, who attended the Conference/Workshop, and assisted in the development of the Strategy.

The clerical and secretarial staff of the Government of Grenada, and of the CARICOM Secretariat.

The following individuals who gave so willingly, over the past year, much of their time and expertise:-

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**“Sanitation has its history, its archaeology, its literature, and its science. Whoever, indeed, would study the subject with a knowledge worthy of its magnitude must consider it from all angles and with a . . . . wealth of learning”.**

**Cleanliness and Godliness  
by  
Reginald Reynolds**

## **SUMMARY**

**In compliance with a request from the Third Conference of Ministers Responsible for Health, the CARICOM Secretariat, in March 1977, undertook a study of the environmental health conditions in the Member Countries. The purpose of this study was to prepare a Strategy for the solution of the environmental health problems with specific target dates.**

**The Commonwealth Secretariat and the Pan American Health Organisation/World Health Organisation (PAHO/WHO) agreed to co-sponsor with the CARICOM Secretariat, the preparation of the Strategy. The United States Agency for International Development (USAID), the United Nations Environment Programme (UNEP) and the Joint UNEP/ECLA Caribbean Environment Project (CEP) provided valuable assistance.**

**After data collection and analysis by CARICOM and PAHO staff, as well as short-term consultants recruited for the purpose, documents were prepared which provided outlines and preliminary proposals for the Strategy.**

### **Environmental Health Strategy Conference/ Workshop, Grenada. 9-13 October 1978**

**In accordance with a decision taken by the sponsors and other agencies mentioned above, a Conference/Workshop was held in Grenada, during the period 9-13 October, to formulate the Environmental Health Strategy. The participants were drawn from all CARICOM Member States and other Commonwealth Caribbean countries, and consisted of Government officials from the engineering, administrative, planning and health divisions. In attendance too, were representatives of international and regional agencies, USAID, CIDA, the University of Guyana, Caribbean Development Bank (CDB), CARDI, CCEO, and CARICOM and PAHO staff members.**

**The Conference/Workshop considered documents which gave background information on existing environmental health conditions, recommendations for a strategy, together with oral and written presentations on Management and Planning for Environmental Health; Institutional Development; Community Participation and Education; Financing of Environmental Health Projects; Manpower Development, and an Environmental Health Institute for the Commonwealth Caribbean. The participants after meeting in plenary and work-group sessions, agreed on the specific provisions for the Strategy, with defined aims, objectives, and achievement target dates in the environmental health areas of water supply, liquid waste and excreta disposal, solid waste disposal, industrial wastes, beach pollution and the use of pesticides.**

## **The Strategy**

### **Water Supply, Liquid Waste and Excreta Disposal, Solid Waste Disposal, Industrial Wastes, Pesticides, Beach Pollution.**

With regard to the environmental health hazards encountered in the areas mentioned above, the Strategy proposals set goals which may be summarised as follows:-

- (a) Measures should be taken to ensure that each house, especially in rural areas, has a continuous supply of safe water that is easily available, and has approved facilities for sanitary disposal of liquid waste and excreta, and solid wastes.
- (b) Effective, viable Water and Sewerage Authorities should be formed. These should have competent technical and administrative staff headed by an Engineer/Manager, and have sufficient legal powers to carry out defined duties within the umbrella of clear policies set by Governments.

A similar agency should be set up for solid waste management, but whether it should operate as a body separate from the Ministry of Health, will depend upon the size of the country and the magnitude of the problems posed.

- (c) Standards and criteria should be fixed for the design of water and wastewater systems, quality of water produced, and effluents and discharges from industrial plants.
- (d) Separate agencies should be created to monitor and regulate environmental health pollution from any source, and to see that there is compliance with any standards that may be set in order to ensure preservation of a healthy environment.
- (e) Manpower development and training programmes for all environmental health workers should be prepared and implemented without delay. Where it is necessary in the interim to utilise imported expertise, adequate provision should be made for the utilisation of local counterparts and meaningful technology transfer.
- (f) Arrangements should be made to revise existing, and promulgate new legislation in all areas, but especially in those of industrial wastes and the use of pesticides, the full impact of which is not yet being experienced. The duties and functions of the utilities were proposed and a list of the type of expert personnel that will be required from time to time was included.
- (g) Proposals were also made for participation by utilities and/or Ministries of Health in Regional programmes. It was felt that they should have sufficient authority to carry out research and do pilot studies when the need arises.

## **Community Participation and Education**

Proposals were made for:

- (i) The active promotion by Government agencies of environmental health programmes designed to inform the public and gain their acceptance in the field of social affairs, co-operatives, education, health and health education, and community development.

- (ii) The setting up of local committees to co-ordinate all activities in environmental health and gain public acceptance of, and participation in the implementation of programmes.
- (iii) The inclusion of environmental health topics in the curricula of the entire educational system.

### **Regional Programmes**

These were initially limited to consideration of the following:-

- (i) (a) Manpower Development and Training of environmental health personnel;
- (b) establishment of a Commonwealth Caribbean Environmental Health Institute;
- (c) setting up of Public Health Engineering Units to serve a group of countries until each country is able to support its own administrative structure.

A proposal that the CARICOM Secretariat and PAHO/WHO consult with the CDB in an attempt to discover the reasons for the delay in obtaining financial support for environmental health to disseminate the information obtained.

The setting up of a committee to make an inventory of resources, personnel and facilities in the Region that can be utilised in environmental health improvement programmes.

### **Caribbean Environmental Health Institute**

The need was recognised for the establishment of an Environmental Health Institute for the LDCs, if not for all the CARICOM Member States, to control and co-ordinate activities in the assessment of existing environmental conditions; manpower development and training; programme formulation; legislation; provision of expert and technical assistance; transfer of technology; research; preparation of guidelines for Regional action, and any other relevant functions.

In view of the complexity of the proposal and to avoid any possibility of duplication of efforts, the CARICOM Secretariat was requested to carry out a feasibility study with specified terms of reference emphasising the particular needs of the LDCs and the availability of facilities in St. Lucia.

### **Implementation**

In order to achieve successful implementation of the Strategy proposals, three (3) basic conditions are to be fulfilled —

- (a) firm policy commitment by Member States on an environmental health improvement plan;

- (b) provision of funding;**
- (c) community participation and acceptance.**

#### **Plan of Action for CARICOM Member Countries**

Accordingly, the action that Member States were asked to expedite to enable completion of remedial action and attainment of aims and objectives by 1990, are summarised in the following manner:-

- (i) Adopt a firm policy statement to pursue improvement in environmental health especially in the areas of water supply, liquid waste and excreta disposal, solid waste disposal, industrial wastes, and the use of pesticides.**
- (ii) Support a regional manpower development and training programme for all environmental health workers.**
- (iii) Participate in plans to establish a Caribbean Environmental Health Institute.**
- (iv) Establish a Co-ordinated Working Group in Environmental Health to implement the Environmental Health Strategy.**
- (v) Adopt and finance plans designed to remove the major environmental health hazards.**
- (vi) Ensure the inclusion of environmental health topics in the curricula of all educational institutions and initiate community education programmes.**
- (vii) Include environmental health considerations in planning national development programmes.**

PART I  
BACKGROUND INFORMATION

## INTRODUCTION

### ENVIRONMENTAL HEALTH STRATEGY

The Conference of Ministers Responsible for Health has recognised that the greatest causes of sickness and death in the Caribbean Community are poor environmental conditions and the communicable diseases that result from these conditions. But in the present-day Caribbean those who seek to prepare a strategy for dealing with this situation need to take account, not only of sickness and death, but also of the fitness and productivity of the work force as factors indispensable to the process of human development. In this broad sense, environmental health is at once a prerequisite and a product of development.

Environmental Health is a prerequisite to development in the sense that the health of an adult determines the extent to which he can use the knowledge and skills that he has acquired; the health of a child determines his performance at school. Malnutrition in early childhood, which is so often in the Caribbean associated with diarrheal disease, permanently slows later mental and physical development. A safe environment is an essential part of the infrastructure of the tourist industry. The effects on tourism of the outbreaks of yellow fever in 1954 and more recently of dengue (both diseases transmitted by the same mosquito, itself a product of the unwholesome environment) illustrate this principle. A country which is ill-prepared for natural disaster risks grave damage to its economy, and it is the poor who are worst hit. Adequate environmental health services contribute to the social education of the community, to its sense of responsibility for its own development, to its attitude towards work and to its readiness to embrace new ideas and habits. Such services are one of the means of ensuring that the benefits of development reach all segments of society, in other words, of ensuring popular participation in economic growth.

At the same time, environmental health is a product of development in the sense that higher incomes, a rise in the standard of living, and in particular better nutrition, make for improvement in health. Agricultural policy influences food production and therefore has an important bearing on health. Better education improves the ability of people to determine for themselves what the priorities among their community health problems really are and, to adopt the changes in attitudes and in habits that are needed to solve these problems; in other words, general education improves community participation in the health services. Social and economic development increases the availability of managerial skills, which provide dynamism and creativeness in the health services and make possible the more efficient use of scarce resources. In short, broad development policies and decisions have an important effect on environmental health, and the success of projects in the environmental field is as much a result of these policies and decisions as it is of those made within the health sector itself.

The impact of development on environmental health is not all favorable. Certain ill-effects are already apparent in the Caribbean countries. Industrialisation and urbanisation bring overcrowding. The physical planning of living conditions is beginning to need greater attention. There is an increased risk of pollution of water, soil and air. Modern air transport facilitates the spread of cholera and other communicable diseases. Higher priority now has to be given the environmental health services, especially to water supplies, liquid and solid waste disposal and occupational health. Food is in greater danger of contamination. The hazards inherent in the use of pesticides in agriculture and public health are already apparent in Caribbean countries. There is concern, in relation to cancer, about the use of growth-promoting substances — such as antibiotics, hormones and vitamins — to increase meat production. There are other physical and social stresses associated with

industrialisation and urbanisation, for example, noise and traffic and other accidents. There is going to be increasing need for special services that prevent injury to human beings from the dangerous products and by-products of modern technology.

Thus environmental health is an essential component of human development. It cannot be considered in isolation from the development process.

One pervasive theme runs through the policy statements of the Health Ministers Conference: ministers wish to have a basic, adequate service available to everyone, especially the poor and those living in rural areas, in preference to a more expensive, sophisticated service, accessible only to those who can pay or who live in the towns.

When they speak of basic services, Ministers have in mind certain services besides the treatment of the sick: the health education of the community; a food and nutrition policy; special care for mothers and children; a simple system of information about health status and the services themselves; above all, dynamic and creative management. Safe and sufficient drinking water and the sanitary disposal of human waste are certainly included among the basic services.

Indeed, recognising the profound significance of environmental health for human well-being and human development, the Ministerial Conference places this programme area among its four top priorities.

For our practical purposes in the health sector, what is the scope of the environment and what are the diseases for which it is responsible?

The environment has three components: firstly, the general environment, which is largely a government responsibility and mainly comprises the safety of our drinking water, food, and air. (It is convenient, in compliance with Ministerial decisions, to include in this category: housing, pesticide control, the prevention of traffic and other accidents, and disaster preparedness and relief.)

Secondly, the personal environment, which is created by the individual himself, includes his habits with respect to eating, drinking and tobacco smoking, and is probably the most significant in relation to cancer.

Thirdly, the occupational environment, where the issues are the control of work-related disease and safety at the work place, including the agricultural sector, in which the hazards are by no means less serious than those in the factory.

In the Caribbean environment, the most important health hazards arise from pollution of drinking water by the excretions of patients or healthy carriers. Water-borne organisms are one of the chief causes of sickness and death. They are the cause of the diarrheal diseases that account for the great majority of deaths in children under five years of age and for one-fifth to one-third of deaths at all ages. They are the cause of dysentery, typhoid and cholera. The Caribbean countries now run the risk of outbreaks of cholera. The seventh world pandemic, which started in Indonesia 16 years ago, reached the west coast of Africa and south-western Europe, and recently there were serious outbreaks in the Middle East. Through not giving sufficient priority to water supplies in former times, the authorities of our countries now have to be ready at a moment's notice to deal with outbreaks of cholera. We would do well to remember that the factors that now spread gastro-enteritis and typhoid in some countries are the same factors that will spread cholera if the present situation is allowed to continue.

It would not be useful to list all the other environment-related health problems. Suffice it to mention a few of the most significant in the Caribbean context.

Mosquito-borne diseases, e.g. malaria and filariasis, still constitute a major problem. The breeding of *Aedes aegypti* in all the Member Countries is an extremely serious matter,

because the yellow fever virus is to be found in the jungle in nearly all the countries of South America as well as in Trinidad and Tobago and Guyana.

Great quantities of our stored food are consumed by insects and rodents. Leptospirosis or haemorrhagic jaundice is rat-borne and is by no means uncommon as a cause of death in the Caribbean Community.

Cancer is now generally believed to be 60—90% environment-related. Indeed, those engaged in research in this field are inclined to assume that all cancerous growths are environmentally caused until proven otherwise. The scientific evidence is based on epidemiological observation and animal experiments. In the United Kingdom, cancer of the lung due to cigarette smoking now accounts for 40 percent of all cancer deaths in males. We referred earlier to the possible dangers of pesticides and growth-promoting substances as causes of cancer.

Unfortunately, we lack precise information about the magnitude and character of occupational or work-related health problems in the Caribbean Community, and the Ministerial Conference has requested the Secretariat to assemble this information and prepare a regional programme of work. Meanwhile, we would be wise to take account of the conclusions of other countries: for example, that agricultural work is not necessarily safer than work in the factory and carries specific risks such as accidents, chemical poisoning, and respiratory conditions due to such dusts as cotton, wood and tobacco; that occupational stress is five times more important than any other factor as a cause of coronary heart disease; that similar factors cause stomach ulcer; that heat stress contributes to high blood pressure, and that arthritis is commonly work-related and a cause of serious economic loss from absenteeism.

In concluding this introduction, we would refer to a statement made in 1969 by the UNICEF/WHO Joint Committee on Health Policy. Writing about community water supplies and basic sanitation, the Committee reported that no other single measure can do so much for the improvement of health and the standard of living. We ourselves in the Caribbean should now face the fact that, at our present stage of development, we can do as much for our people by improving community water supplies and other environmental health services as by further improvements in the medical care of the individual patient.

To sum up: a Caribbean strategy to solve the health problems of the environment is of far-reaching significance for human well-being and human development in the area, because these problems affect the safety and productivity of a large proportion of the population and the survival of many of the children, because these problems are preventable at reasonable cost, and because the Strategy includes measures that have practical meaning in the everyday life of the poorest of the people and the underserved in the rural areas.

## PART I

### 1. BACKGROUND INFORMATION

#### 1.1 Terms of Reference

1.1.1. At its Second Meeting held in Plymouth, Montserrat during the period 12–16 July 1976, the Conference of Ministers Responsible for Health passed a Resolution, No. 11 of 1976, which reads as follows:

“The Conference,

Convinced that the greatest hazards to human health in the Caribbean are to be found in the environment, and in particular to factors related to the quantity and quality of drinking water and the disposal of wastes;

Wishing to take action for dealing with the situation within the next 10–15 years;

Recognising the need to identify the problems and priorities carefully, and to select objectives and activities that are practicable;

Having studied Document CMH 76/2/6, in which certain activities are outlined;

Knowing that funds are already available for a substantial part of these activities;

APPROVES the programme of work set out in Document CMH 76/2/6, and

REQUESTS the Secretary-General to seek assistance from the Pan American Sanitary Bureau, the Commonwealth Fund for Technical Co-operation, United Nations Environment Programme, Project HOPE and other interested agencies in preparing the strategy, and report on progress at the Third Meeting of the Conference”.

1.1.2 In order to implement this Resolution, discussions were held with the various agencies specified. In the end, positive responses were obtained from the Commonwealth Fund for Technical Co-operation (CFTC) and the Pan American Health Organisation (PAHO), who agreed to provide funds and technical expertise respectively and with the CARICOM Secretariat co-sponsor the strategy.

1.1.3 The Conference of Ministers Responsible for Health, in their Declaration on Health in July 1977, agreed that “priority should be given to the so-called Lesser Developed Countries” (LDCs). This is in conformity with Resolutions 32/185 and 32/186 of the United Nations General Assembly which specifically stress the urgency of rendering technical assistance to the non-independent developing countries of the Caribbean area, namely: Antigua, Dominica, St. Kitts-Nevis-Anguilla, St. Lucia and St. Vincent.

#### 1.2 Inter-Agency Meetings

1.2.1 This cleared the way for recruitment of a Project Manager and the assumption of the policy direction of the work by an Inter-Agency Technical Group. This consisted of representatives of the following agencies:

Joint UNEP/ECLA Caribbean Environment Project (CEP)  
Caribbean Development Bank (CDB)  
Pan American Health Organisation/World Health Organisation (PAHO/WHO)  
United States Agency for International Development (USAID)  
Caribbean Community Secretariat (CARICOM)

1.2.2 At the meetings held in Antigua, Barbados and Trinidad and Tobago, representatives of the Ministries of Health were invited to participate. Seven (7) inter-agency meetings were held, three (3) in Barbados, one (1) each in Antigua and Trinidad and Tobago, and two (2) in Grenada.

### 1.3 Work Plan

1.3.1 The basic work plan for preparation of the strategy arose out of decisions taken at the Inter-Agency Meetings. It can be divided up in the following manner:

- (a) Data Collecting by the Project Manager;
- (b) Assessment of Data Collected;
- (c) Preparation of Reports by PAHO Consultants employed in specified Environment Health areas;
- (d) Preparation of a Background Document for use at the Conference/Workshop from Consultants' Report and other Data that had been gathered;
- (e) Formulation of the Strategy at a Conference/Workshop of Workers in Environmental Health in the Caribbean.

### 1.4 Main Environmental Health Hazards

1.4.1 The environmental health problems in the areas listed below were regarded as posing the greatest threat to the quality of life in the Commonwealth Caribbean. As a result they were selected for attention at this time. By restricting the focus of attention also, it was planned to produce a useful document with realistic objectives within the time allowed for completion.

The areas are as follows:

- Water Supply
- Liquid Waste and Excreta Disposal
- Solid Waste Disposal
- Industrial Wastes and Pesticides
- Beach Pollution

### 1.5 General Assessment

1.5.1 The overall environmental health picture is not always clearly seen mainly because of an acute lack of reliable basic information. This makes it difficult either to arrive at firm conclusions about various conditions, or to predict with confidence certain trends.

1.5.2 From the data that is available, it is fair to state that, except in the case of water supply, there has never been an attempt to apply modern knowledge in the areas selected for study.

1.5.3 It is probably unnecessary to recite the well-known conditions: outbreaks of typhoid occur frequently in Regional Territories, so do gastro-enteritis, dysentery, leptospirosis, and of course, the risk of the spread of cholera remains ever present; solid waste disposal and

vector control problems are not being solved; the beaches are being polluted with liquid wastes and oil. Many of the above problems have been endured from the earliest times, and they are now being augmented by those attendant upon increasing industrialisation and the use of chemicals in the environment.

1.5.4 All this is made worse by the absence of public health education programmes to stimulate community participation which is so necessary if effective solutions are to be found.

1.5.5 In fine, though, the reasons that have delayed the elimination of environmental hazards to health can be attributed to a combination of the following factors:

- (a) the lack of public awareness of the cumulative effect of poor environmental health conditions on the general health status of the community, resulting in acceptance of reduction in environmental health standards;
- (b) the high cost of purchasing basic equipment, plant and materials required for remedial programmes;
- (c) the chronic shortage of local engineering and scientific expertise;
- (d) the economic recession which the countries faced, and which compelled the adoption of tight financial policies, had the effect of restricting expenditure in health to curative rather than preventive programmes.

1.5.6 The Profiles at Appendix II provide some basic information on the individual countries.

## 1.6 Socio-Economic Factors

1.6.1 Many tangible and intangible benefits accrue to communities that succeed in ameliorating their environmental health conditions. For example, the provision of a safe water supply and proper disposal systems for both solid and liquid wastes, not only reduces the incidence of communicable diseases, but also achieves other economic and social improvements. Some of the benefits are listed below at random.

- (i) Avoidance of preventable human suffering caused by disease.
- (ii) Reduction in infant mortality rates.
- (iii) Elimination of the risk of spread of infection or an epidemic, e.g., typhoid, gastro-enteritis, cholera.
- (iv) Lessening in effort and energy usually expended often by mothers and children in fetching water and disposing of excreta and solid waste.
- (v) Improved sanitation and cleanliness resulting from the increased availability of safe potable water in the house.

- (vi) The fall in the incidence of disease spread by water and food, results in a corresponding fall in the numbers of days lost by adult workers through illness from their respective jobs; this should lead to a general increase in productivity.**
  
- (vii) During the construction phase, work is provided and materials are purchased both locally and abroad; the end result is a lowering of the characteristically high unemployment rates and benefits are received from the multiplier effect of the increase in circulation of money.**
  
- (viii) The expanded environmental health service also provides permanent employment opportunities for maintenance and operational personnel.**
  
- (ix) Expanding and effective environmental health activities in public places are likely to have an educational effect on people, thereby encouraging a better approach by them in their home and working environments.**
  
- (x) Improvement in ability to attract tourists.**

## **2. WATER SUPPLY**

### **2.1 History**

**2.1.1** It is worthwhile to look into the history of development of the water supply industry in the Commonwealth Caribbean Countries.

**2.1.2** Traditionally water supply has always been regarded as a social service provided by the State. The consulting engineers were in most cases imported. They came for relatively brief periods, installed systems and departed, not always leaving all engineering drawings for those who came afterwards. Normally, a man who had worked on the construction programme and gained some experience was left to maintain the system. The term "water-works keeper" found in certain countries, perhaps aptly describes his function.

**2.1.3** The Public Works Department usually performed any extension work required, and in some cases the local District Board was given the responsibility for control of the system. The fixing and collecting of rates formed part of the function of the Board, but this was subject to the approval of the central government.

**2.1.4** Eventually, a water authority was set up which had authority to employ a water engineer and other staff. Legislation was also promulgated and this made provisions for preventing waste and pollution of water supplies.

**2.1.5** Finally, from 1960 onwards, PAHO/WHO initiated action towards the creation of a water utility, with legislative authority to function with some independence. At this time too was introduced for the first time the concept of managing water supply systems in a business-like manner, with rates reflecting all costs of production and being paid by the consumers.

**2.1.6** With regard to water distribution, if the figures given for quantity supplied are taken at face value, availability should rank high when compared to countries in Latin America. However, the area suffers from chronic shortages of water, especially during the dry season, poor quality, and operation and maintenance problems.

**2.1.7** For example, reports on the situation from both an MDC and an LDC have assessed leakage as high as 40 per cent. Thus, even though the quantity per capita supplied appears high, the amount of water actually used is certainly less, although difficult to assess at this stage. The following points briefly summarise the true position:

- (a) the urban population has good access to water through house connections;
- (b) the rural population has poor access to water and is available mainly through standpipes;
- (c) both rural and urban areas experience regular daily shortages in supply;
- (d) the rural systems are normally very rudimentary, and produce poor quality water which does not always meet acceptable minimum standards;
- (e) the use of chlorination as a final form of treatment is increasing, but it has not yet been generalised.

**2.1.8** Table I shows the reported population served by water supplies in Commonwealth Caribbean Countries.

**TABLE I  
WATER SUPPLY DISTRIBUTION**

<b>COUNTRY</b>	<b>% POPULATION HOUSE CONNECTION</b>	<b>PUBLIC STAND— PIPE</b>	<b>TOTAL</b>
Antigua	40	56	96
Bahamas - Urban	90	10	100
Rural	35	40	75
Barbados	76	24	100
Belize	30	25	65
Bermuda			
Br. Virgin IIs.			
Cayman IIs.			
Dominica	24	56	80
Grenada	38	50	88
Guyana	70	20	90
Jamaica	53	39	92
Montserrat	70	30	100
St. Kitts/N/A	40	50	90
St. Lucia	34	42	76
St. Vincent	25	65	90
Trinidad & Tobago	50	47	97
Turks & Caicos IIs.			

2.1.9 Perhaps a more useful indicator of the gravity of the water supply problem, is the continuing high incidence of the water-borne diseases, that have already been eliminated in developed countries. Although a general low level of sanitation contributes to the rather frequent outbreaks of typhoid, for example, there is adequate evidence to support the conclusion that water is the principal vehicle of transmission

2.1.10 Table II gives details of cases of Typhoid and gastro-enteritis (under 5 years) that have been reported to CAREC in 1976 and 1977.

**TABLE II**  
**CASES OF TYPHOID AND GASTRO-ENTERITIS**

COUNTRY	No. of Cases			
	TYPHOID		GASTRO-ENTERITIS	
	1976	1977	1976	1977
Antigua	—	2	476	271
Bahamas	11	—	1 837	1 130
Barbados	9	1	105	178
Belize	6	4	634	616
Bermuda	1	—	7	92
Br. Virgin	—	—	30	11
Cayman Islands	—	—	—	15
Dominica	28	48	359	251
Grenada	2	30	1 174	1 422
Guyana	240	184	782	1 468
Jamaica	69	65	—	97
<b>NO INFORMATION RECEIVED</b>				
Montserrat	—	—	—	—
St. Kitts-Nevis-Anguilla	—	—	327	999
St. Lucia	16	57	777	423
St. Vincent	—	—	469	197
Trinidad & Tobago	29	12	6 512	8 652
Turks & Caicos Islands	—	—	200	111

— No Cases  
— Insufficient information

## **2.2 Policy**

**2.2.1** It is true to say that all Governments have endeavoured to provide water in adequate quantities and of good quality to their peoples. The programming, design, choice of equipment, setting of standards have more often than not been left to the engineers whether local or expatriate. However, the policy has been such that the supply of water remains a social service, where business principles are not practised.

**2.2.2** Unfortunately, in common with other developing societies, the Commonwealth Caribbean has been making structural socio-economic changes, while encountering severe financial problems, not always of their own making. Thus the question of selecting programmes from many competing sectors for implementation always arises, and water supply has not always been given the priority it deserves.

**2.2.3** As a result, water supply development has not kept pace with expansion in other sectors like housing, tourism, industrial development. The trend has been to provide supplies to areas subject to the tourist development rather than to rural areas, which have not yet really benefited from expansion programmes. Further, it has been reported that in some territories rural consumers sometimes pay the same water rates for water of lesser quality than that supplied to their urban counterpart.

**2.2.4** In nearly all territories, however, the bulk of the revenue from water rates is collected from urban areas. In addition, there is a reluctance to increase water rates even to meet maintenance and operation costs of utilities.

## **2.3 Management**

**2.3.1** The management of water supply systems is of recent vintage. The introduction of the basic principles, which are the norm in the industrial and commercial sectors has not yet met with general acceptance, and some of the reasons have been identified.

**2.3.2** Firstly, the history of water supply development has not trained the communities to accept water as a commercial product, for which all the attendant costs of production must be paid for in some fashion.

**2.3.3** Secondly, Governments which have recently taken control of their own affairs were perhaps not too anxious to relinquish a section of it even to a semi-autonomous institution of their own creation.

**2.3.4** Thirdly, trained professional managers were not easily available. Differences of opinion exist as to whether the need for one can be justified in a small undertaking where the majority of the planning and implementing problems call for engineering judgement. At least one territory opted for appointment of an Engineer/Manager to head its water utility.

**2.3.5** It is within this context that the planning process becomes blurred and decision-making difficult or almost impossible.

**2.3.6** As a result, except perhaps in the larger territories water resources development, catchment control, good financial management, leak detection and efficient maintenance and operation programmes are not really implemented. In addition, master development plans, where they exist, are not up-dated.

**2.3.7** There is no doubt that management problems exist in most of the territories and a determined effort should be made to develop an appropriate administrative model to deal with water resources development, finance, engineering and operation and maintenance.

**2.3.8** As the move towards complete integration of management of water supply and wastewater systems gains momentum, the need for improvement of present management becomes even more pressing.

**2.3.9** Attention is drawn to the question of revision of legislation in line with present organisational requirements, and administrative changes. However, in addition to legislative provisions, there should be a change in attitude to allow management freedom to manage the systems within the policy guidelines set.

## **2.4 Engineering and Technology**

**2.4.1** Up to 1960 or so, engineering of water supply systems was provided by overseas engineers mainly from the United Kingdom. The water supply systems provided were of small capacities, seldom in excess of 500,000 IGPD. The treatment consisted of sedimentation, coagulation and filtration by means of slow sand filters usually, but there were instances where untreated water was distributed. Within the last 25 years chlorination was also introduced. Then as the water demand increased, treatment plants of larger capacity were required, so rapid gravity filters were utilised.

**2.4.2** In view of the absence of proper records on the subject, it is difficult to state whether the systems were merely poorly designed, or were even then subject to financial constraints. It is certain though that severe inadequacies quickly developed in many systems, especially in storage, filtration and distribution sections.

**2.4.3** With regard to the technology, the problems that now exist in maintenance and operation particularly, are the direct result of absence of training programmes in the past. The equipment was installed, but little thought was given to the training of technicians to keep them operational.

**2.4.4** At present, local engineers are more involved in the planning and development of water supply systems. It is too early to assess the results of their inputs. A major difficulty of course, is the inheritance of a huge backlog of maintenance and operational problems which cannot be easily eliminated, especially as programmes for their solution do not qualify for grants or loans from aid or lending agencies.

**2.4.5** The design of any system must be left to the judgement of the designer. However, in view of the need to reduce foreign exchange costs and known high unemployment rates in territories where crushed coarse and fine aggregate are available, there must be a case for utilising reinforced concrete in the construction of all water retaining structures, dams, sedimentation tanks, slow sand filters and service reservoirs.

**2.4.6** The use of slow sand filters, where capacities are low e.g. less than 500,000 IGPD and suitable land is available, should also be considered, as they do require little technical maintenance. The local construction costs must also be assessed carefully.

## **2.5 Organisation and Administration**

**2.5.1** In general, most countries have accepted with reservations the concept of, and passed legislation creating, autonomous or semi-autonomous agencies with responsibilities for water production and distribution. These agencies fall under the portfolios of various ministries: Health and Local Government, Public Works & Communications and the Prime Ministers' Office. The Montserrat Water Authority, created in 1972 and headed by an Engineer/Manager, is responsible for the design of supply and distribution systems. It is a financially self-supporting utility.

**2.5.2** However, the following variations have been found:

- (a) In Grenada and Dominica, separate offices have been set up to manage the water development programmes, under the direction of a Water Engineer, in effect, cutting off the engineering functions of the utility.
- (b) In Jamaica, a separate agency the Jamaica National Water Authority is responsible for planning, construction and production, leaving distribution functions to local authorities.
- (c) In Guyana, the Guyana Water Authority has jurisdiction in water supplies over the country, but has not yet taken over control of production and maintenance in areas served by the Sugar Industry Labour Welfare Fund Committee, the Guyana Sugar Corporation and the following Town Councils:  
 Georgetown  
 New Amsterdam  
 Linden — (Mackenzie, Christianburg, Wismar)  
 Rockstone
- (d) In Antigua, a Public Utilities Authority is responsible not only for water supplies, but telephones and electricity.
- (e) In Barbados and St. Kitts-Nevis-Anguilla, water supply is still a division of the Ministry of Works.
- (f) In Trinidad & Tobago, a Water & Sewerage Authority has been functioning since 1965.
- (g) In St. Vincent draft legislation to create a Water and Sewerage Authority has been published. The Water Utility is already in existence.

2.5.3 In addition to the above, there have been differences in the background and training of the heads of these organisations. In most territories water engineers have been selected, while in others, technical, administrative and non-technical officials are present.

## 2.6 Finance

2.6.1 Traditionally, capital development programmes for water supplies were financed by grants from the United Kingdom. About twenty years ago, the pattern altered slightly, and a combination of loans and grants was provided. This arrangement is still being followed.

2.6.2 It was possible in 1960 to raise loans for water supplies on the local market in some of the Eastern Caribbean countries.

2.6.3 However, the picture has changed somewhat and now in the Eastern Caribbean countries local costs are financed by loans from the Caribbean Development Bank (CDB). Canada, through its International Development Agency (CIDA), replaced the United Kingdom as the main supplier of off-shore materials which are paid for by grants.

2.6.4 In addition, because of the difficulty in meeting local counterpart funds for loans made by CDB, and in order to get the projects started, the Government of Trinidad & Tobago, and CIDA have contributed to local costs.

2.6.5 The Inter-American Development Bank has made loans to the larger countries: Barbados, Jamaica, Trinidad & Tobago, for water supply improvement programmes.

2.6.6 The United States Agency for International Development, which prior to 1970 provided funds in the area of water supply to Guyana and Jamaica, has not done so for the last five years. However, there is evidence of a revival of their interest in the whole health sector.

2.6.7 UNICEF has given limited assistance to rural water supply improvement programmes in some countries, for example, Dominica and Grenada. However, the contribution on a regional basis has not been great.

2.6.8 With regard to the financing of technical assistance programmes and training, the contribution of the Pan American Health Organisation/World Health Organisation (PAHO/WHO) has been outstanding. From 1960 onwards, PAHO/WHO sponsored the preparation of master water supply development plans in the Eastern Caribbean countries, most of which are still being followed; and encouraged the utilisation of local expert personnel, and the formation of water authorities. This facilitated the process of obtaining financing for water supply projects.

2.6.9 UNDP also financed technical assistance programmes for water supplies in the Eastern Caribbean countries, Guyana, and in Jamaica for water resources development.

2.6.10 Recently, within the past year, the European Economic Community under the provisions of the Lome Convention, has been making grants for water supply programmes.

2.6.11 It seems clear that the relatively small water authorities are not able to introduce rates which will generate sufficient revenue to carry out major capital works programmes, necessary as they undoubtedly are. In the light of the prevailing economic situation in many countries, it does appear that this dependence on external assistance for their financing is likely to continue.

2.6.12 The Government of Trinidad & Tobago is now implementing water development programmes that are expected to cost US\$150M. This is being financed from its own resources.

2.6.13 Table III summarizes the financial contributions made by various agencies in the water supply development programmes of the area during the last five years.

COUNTRY	1969	1970	1971	1972	1973
JAMAICA					
Trinidad & Tobago					
St. Vincent					
St. Lucia					
St. Kitts					
St. Eustace					
St. George					
St. James					
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**TABLE III**  
**INVESTMENT IN WATER SUPPLIES**  
(in million US dollars)

COUNTRY	BDO	CIDA	CDB	IADB	USAID	UNICEF	IBRD	LOCAL	TOTAL
Antigua									
Bahamas									
Barbados			3.24						3.24
Belize									
Bermuda									
Br. Virgin IIs.									
Cayman IIs									
Dominica			0.79						0.79
Grenada		2.20	0.72						3.12
Guyana		0.80			0.19	0.006		0.20	3.12
Jamaica								23.26	24.256
Montserrat		2.90		3.00			4.60	38.20	45.80
St. Kitts/N/A									2.90
St. Lucia	0.15	1.07	0.43					0.90	2.55
St. Vincent									
Trinidad & Tobago				6.10					
								92.41	98.51
<b>TOTAL</b>	<b>0.15</b>	<b>6.97</b>	<b>5.18</b>	<b>9.10</b>	<b>0.19</b>	<b>0.006</b>	<b>4.60</b>	<b>154.97</b>	<b>181.166</b>

2.6.12 Table IV shows the contributions of CIDA to various Environmental Health Projects during the same period 1973-1978.

**TABLE IV**  
**CIDA DISBURSEMENTS — Environmental Health Projects 1973-78**  
(in thousand Canadian Dollars)

COUNTRY	73/74	74/75	75/76	76/77	77/78	TOTAL
Antigua	—	—	—	—	—	—
Barbados	1 007.7	112.9	1 387.2	558.9	762.0	3 828.7
Belize	148.8	161.2	94.1	502.0	1 939.9	2 846.0
Caribbean Regional	0.3	—	135.2	272.6	322.7	730.8
L/W Islands Agricultural Development Fund	—	1.9	69.2	85.0	23.7	179.8
Dominica	407.8	365.9	128.6	39.1	1.6	941.0
Grenada	36.2	19.9	684.1	1 461.1	256.8	2 458.1
Guyana	129.8	120.9	24.5	833.2	74.6	1 183.0
Jamaica	913.8	164.4	74.4	15.5	147.9	1 316.0
Montserrat	448.5	608.0	486.0	38.7	—	1 581.2
St. Kitts	156.2	44.0	84.4	0.2	—	284.8
St. Lucia	84.3	59.9	295.1	507.8	328.4	1 275.5
St. Vincent	10.6	679.0	1 199.8	439.7	98.4	2 427.5
Trinidad & Tobago	—	—	20.0	—	—	20.0
UWI	—	—	—	—	—	—
<b>TOTAL</b>	<b>3 344.0</b>	<b>2 338.0</b>	<b>4 680.6</b>	<b>4 753.8</b>	<b>3 956.0</b>	<b>19 072.4</b>

## 2.7 Manpower Development

2.7.1 This has not been given the priority it requires in the history of water supply. There were organised attempts to provide training for individuals under various Colonial Development and Welfare Programmes after World War II. Indeed, two (2) public health engineering units were established in the Eastern Caribbean Territories, headed by public health engineers who provided on-the-job practical and theoretical training.

2.7.2 Subsequently, this item lost its place in the list of priorities. As a result, there are gaps at the professional level for Managers, Engineers and Surveyors, Accountants, Chemists and Biologists. The neglect is even more marked in the sub-professional, technical,

**supervisory and craftsman grades which include water supervisors, water operators, inspectors and draughtsmen, well drillers, water-quality inspectors, plumbers, pipelayers and other skilled maintenance personnel.**

**2.7.3** Recent estimates indicate that the requirement for manpower training exceeds 4000 and existing institutions in the area are not all oriented to cater for the training needs. Even where the training facilities are available, the number of students that can be trained annually is limited.

**2.7.4** The existing institutions which are designed to meet national and regional requirements are as follows:

- 1. The University of the West Indies**
- 2. The University of Guyana**
- 3. The College of Arts, Science & Technology — Jamaica**
- 4. The Community College — Barbados**
- 5. The John Donaldson Technical and Vocational Institute — Trinidad & Tobago**
- 6. The Government Technical Institute — Guyana**

**2.7.5** In the Eastern Caribbean, tertiary schools have been established. Their curricula vary, but they do cater for trades and other vocational subjects. They can form the basis for upgrading and expansion into full technical colleges to train technicians for that Region.

**2.7.6** In Trinidad and Tobago also, the Water and Sewerage Authority has, with the help of UNDP and PAHO/WHO, established a training centre for its employees. It is being expanded to provide training for the maintenance and operational personnel, over 200 in number, which are required for the water supply systems now under construction.

**2.7.7** In the Eastern Caribbean Territories, the Caribbean Basin Water Management Programme, now in its third year of operation, has made an attempt to deal with the problem. Initially it concentrated on providing formal training up to Certificate or Diploma level at Regional and Canadian Centres for senior level personnel. At present, the emphasis is directed towards training the larger percentage of employees by providing first a pool of trainers with basic technical and instructional skills. Its activities can be summarised as follows:

- (i) Training of trainers**
- (ii) Development of training manuals**
- (iii) Provision of managerial and supervisory training**
- (iv) Establishment of linkages between water utilities and local training institutions.**

### **3. LIQUID WASTE AND EXCRETA DISPOSAL**

#### **3.1 History**

**3.1.1** In the area, the record again shows an unhealthy state which is even more depressing than that of water supplies.

**3.1.2** About 40 years ago, wastewater systems were installed to serve what was then the accepted urban areas. They consisted mainly of sewerage systems taking domestic wastewaters which were emptied through outfalls into the sea.

**3.1.3** The design was done and the construction supervised by engineers from abroad. This is not to say that good engineering was not practised. Indeed, the fact that the systems are still operational today is indicative of the quality of the work.

3.1.4 Usually the central Government turned the system over to the Town Council which fixed and collected rates. This authority also set charges for new connections and alterations. There was then significant community involvement at this level.

3.1.5 In rural areas, about the beginning of the 1950 decade, with the assistance of agencies like the Rockefeller Foundation, Colonial Development and Welfare and UNICEF, programmes for ensuring faecal disposal arrangements for each house were started.

3.1.6 The aim has not been achieved although the programmes are continuing, though in many cases on a restricted basis because of curtailment in financing. However, the number of persons not served by any system is substantial, varying from 5 to 50% in the countries that have supplied completed reports.

3.1.7 Table V gives further details of the population served both by wastewater systems and pit latrine in the countries.

**TABLE V**  
**LIQUID WASTE AND EXCRETA DISPOSAL**

COUNTRY	% Population		
	Wastewater System/Septic Tank	Pit Latrine	No. System
Antigua	17	60	23.6
Bahamas (Urban areas)	97	3	—
Barbados	—	—	—
Belize	3	34	—
Bermuda	—	—	—
Br. Virgin IIs.	—	—	—
Cayman IIs.	—	—	—
Dominica	19	31	50
Grenada	83	50	17.6
Guyana	60	40	—
Jamaica	—	—	5
Montserrat	44	32	24
St. Kitts/N/A	30	61	9
St. Lucia	18	49	33
St. Vincent	20	75	5
Trinidad & Tobago	63	37	—
Turks & Caicos IIs.	—	—	—

3.1.8 It is interesting to note that within the last decade only one country has constructed a wastewater disposal system for its urban communities.

## **3.2 Policy**

**3.2.1** Most of the countries under study have indicated their desire to have wastewater systems installed in all densely populated areas, now housing settlements, and areas set aside for tourist development.

**3.2.2** In the published development plans of Antigua and Dominica, for example, the sewerage of the densely populated areas is mentioned. Antigua has already applied to the Caribbean Development Bank for financial assistance for a wastewater system for its capital city, St. John's. Grenada, with technical assistance from UNDP and PAHO/WHO, has prepared a feasibility study for sewerage extensions in South St. George's which includes the Grand Anse tourist belt and the surrounding villages, and is seeking financial assistance for its implementation.

**3.2.3** Trinidad and Tobago, as was mentioned earlier, had a sewerage system with disposal facilities installed in Port-of-Spain, Arima, and San Fernando in 1962-65.

**3.2.4** Barbados has now started work on a wastewater collection and disposal system for the capital city, Bridgetown.

**3.2.5** Belize obtained assistance for a feasibility study on water supply and sewerage since 1973, but the proposal has not yet been implemented.

**3.2.6** In rural areas, the emphasis has been on ensuring that each house has a septic tank or pit latrine installed according to an approved plan. In some cases, septic tanks are installed, even where topography and soil conditions are not ideal for their proper operation.

**3.2.7** Thus, it does seem reasonable to conclude that there is a genuine desire to see improvements effected in this critical environmental health area. However, thus far, success has not been achieved.

## **3.3 Management**

**3.3.1** Except in the case of the larger countries, for example, Trinidad and Tobago which set up a Water and Sewerage Authority, the management of what systems there are, has been in the hands of various local government bodies which are ill-equipped to perform this duty.

**3.3.2** In countries where these bodies do not function, the responsibility has been transferred to the Ministry of Health and/or Local Government.

**3.3.3** In any case, no attempt has really been made to manage these systems, except in a very minimal way. The responsible authority lacks the expertise to plan extensions, design new systems, gauge infiltration and overloading of sewers, and many other matters vital to the efficient operation and maintenance of wastewater systems.

**3.3.4** In the rural areas particularly, faecal disposal is by means of septic tanks and pit latrines for individual houses and the public health inspectorate supervises the installation. The manufacture of pre-cast units used for latrine installation, is also a duty being performed and the main problem seems to be a lack of central government funding.

## **3.4 Engineering & Technology**

**3.4.1** The pattern follows that of water supply in that, thus far, with possibly a few unreported exceptions, the existing wastewater systems were designed, and their construction supervised by practising engineers from developed countries.

3.4.2 These served the capital mainly and discharged by outfalls, raw sewage into nearby harbours or beaches. Dilution was thus the means of disposal, but as the quantity discharged increased, this became inadequate and pollution problems increased.

3.4.3 There is evidence too, that in some cases, the outfall was shortened because of damage by heavy seas to its submerged portions. When this is left unrepaired either for financial reasons or lack of expertise, discharge of raw sewage closer to land occurs and pollution of the beach is worsened.

3.4.4 The sewers themselves undergo deterioration; vents, manholes and other equipment are damaged, and repairs are not always done. The rates of infiltration into the sewers are high and after heavy rains, sewage backs up and overflows through manholes.

3.4.5 In recent times, and mainly to serve the large hotels catering for the tourist industry, package type sewage treatment plants have been utilised. These are usually installed by the contractors who build the hotel and should, in fact, be maintained by the hotel management.

3.4.6 When nuisances are created either from production of offensive odours, or the discharge of an effluent with a high oxygen demand into a drain leading sometimes to the nearby beach, the local Ministry of Health becomes involved in finding a solution.

3.4.7 It is estimated that over 200 of these plants with varying capacities are in existence in the Caribbean area.

3.4.8 The septic tank has served a useful means of faecal disposal. Most health ministries provide copies of approved standard plans with capacities varying with the number of users. Advice is also given on the location and size of soakaways or tile fields.

3.4.9 Thus, the engineering problems to be faced are as follows:

- (i) The setting up of management and engineering organisations to examine the present wastewater systems and provide solutions for their repair and future efficient maintenance and operation either separately or together with water supply systems.
- (ii) Training of engineers to design wastewater systems and to formulate and develop parameters for the sizing of disposal systems or treatment plants and the establishment of standards for construction.
- (iii) The establishment of criteria for deciding what levels of concentration of population or other consideration, cost, for example, would be used to determine whether either
  - (a) pit latrines;
  - (b) septic tanks, or other
  - (c) water borne systemsis applicable or appropriate for a given community, and
  - (d) what wastewater disposal system should be utilised when (c) has been selected.
- (iv) Training of technicians, and other skilled personnel in the maintenance and operation of plant and equipment chosen in any system.

### **3.5 Organisation and Administration**

**3.5.1** It is not yet clear what type of organisation is gaining acceptance for the management of wastewater systems.

**3.5.2** In the smaller countries, it does appear that the operation of both water supply and wastewater systems are insufficient in scope to justify creation of separate entities. Further, their functions are complementary and to a large extent their problems are similar though not necessarily of the same magnitude.

**3.5.3** On the other hand, it must be stated that the water authorities already created have not yet been able to operate in a manner that would result in an early solution of their problems. Both in the larger and smaller countries, evidence of continuing increase in deficits of expenditure over revenue have been seen. The central government still maintains rather tight control over the management functions, appointments, rate structuring and others.

**3.5.4** On balance though, the low availability both of engineering, administrative and accounting personnel, and the difficulty usually experienced in assembling competent staff to prepare projects and thus justify funding for capital development programmes, would compel a recognition of the benefits to be derived from the efficient utilisation of what expertise is available. This should lead to a merger of the two branches. There is, however, a need to set guidelines which should leave much scope for local adaptation to suit national objectives.

### **3.6 Finance**

**3.6.1** The construction of wastewater collection and disposal systems has proceeded at so slow a pace that it is probably wise not to attribute the reason to any single cause. It is true that originally funds for the financing of what systems were built came from external sources — at least in the case of the Less Developed Countries — who then set the priorities.

**3.6.2** On the whole, these programmes require high capital investment, but the rates of return are low. So they are unattractive financial proposals meriting interest only from donor countries.

**3.6.3** In at least one case where costing was done in some detail, it was found that the cost of installing septic tanks for individual dwellings was as high as that of a central wastewater collection system. However, the latter was not built because of the difficulty involved in obtaining the capital outlay.

**3.6.4** It seems then that a solution to the problem of finance in nearly all countries lies in either raising loans on the local market or obtaining grants or soft loans on concessionary terms. The local contributions would of course depend upon existing socio-economic conditions.

**3.6.5** The only expenditure reported for wastewater collection and disposal systems within the last five (5) years are as follows:

<b>COUNTRY</b>	<b>AMOUNT</b>	<b>COMMITTED</b>
Barbados		\$32,000,000
Jamaica	\$8,400,000	
St. Lucia	\$ 388,000	
St. Vincent	\$2,000,000	

**3.6.6** In addition, the following countries have proposals for extensions and installations of wastewater collection and disposal systems which have not yet been able to attract financial support:

Antigua  
Grenada  
Guyana  
St. Lucia  
St. Vincent

**3.6.7** Indeed, the last named Government started a sewerage construction programme in Kingstown but this was not brought to completion because of unavailability of funds.

### **3.7 Manpower Development**

**3.7.1** Much about what has been said under water supplies applies to this section.

**3.7.2** It is felt that if a decision is taken to combine the activities of these two divisions, i.e., water and liquid wastes, into one organisational unit, then training programmes could be designed to meet the total anticipated needs.

**3.7.3** At this point, attention is drawn to the employment of public health engineers. At present, establishment posts for this discipline exist only in Barbados, Jamaica and Trinidad and Tobago. Even though at the instance of PAHO/WHO, Ministries of Health have sponsored post-graduate training for just under two decades, it has not been possible to establish these posts firmly because of the following drawbacks:-

- (a) lack of executive functions to perform, and under-utilisation of the expertise;
- (b) restricted opportunity for advancement;
- (c) inadequate remuneration;
- (d) the traditional dependence for control and direction of environmental health on a Medical Officer of Health who is not always able to devote his full attention to the service.

**3.7.4** Even in situations where the established posts are filled, there is an almost complete lack of intermediate staff, technical and vocational, such that the performance of the holder is seriously impaired.

**3.7.5** It is therefore suggested that what is now required to give direction and impetus to wastewater and faecal disposal systems is the training and employment of workers at three levels:

- (a) the professional;
- (b) sub-professional or technical,
- (c) vocational.

## **4. SOLID WASTE DISPOSAL**

### **4.1 History**

4.1.1 A search of available information reveals that solid waste (refuse) disposal was up to two decades ago the responsibility of the local government bodies. In some cases, it still remains that way.

4.1.2 The collection was done by open flat-bed trucks in the main towns and by carts in others, from covered oil drums used as refuse bins. Later, fixed concrete bins were substituted in an attempt to reduce maintenance costs.

4.1.3 Subsequently, first the United Kingdom, and then the Canadian Government provided covered vehicles for solid waste collection.

4.1.4 With regard to final disposal, incineration was the usual method of choice. The incinerators were sited near the sea, or other area that was accessible and allowed the easy disposal of incombustibles. However, the increasing cost of machinery and the necessity to fill in swamp lands to reduce mosquito breeding led to the change to landfill practices.

4.1.5 The subsequent increase in the cost of fuel and the prevailing high price set the seal upon the change.

4.1.6 The public Health Inspector was always involved in the exercise. He provided for many years the only expert advice this health area really received on a continuous basis.

4.1.7 The cost of collection and disposal of solid wastes was always met from general rates levied by the local body. However, the entire budgets were subsidised by the central Government when necessary.

### **4.2 Policy**

4.2.1 Solid waste disposal has not ranked high among the priorities of various governments. In fact, in rural areas burning and burial of refuse by individual householders is still common practice. They are also very effective methods.

4.2.2 However, as the communities grew, the volumes increased significantly and as the character of solid waste changed from easily burnt paper and cardboard to metal tins and plastics, disposal presented problems that now command attention.

4.2.3 As a result, solid waste management is only now being looked at very critically. It is mentioned in all published development plans of some of the countries. In Barbados, it is being given some priority attention, and Trinidad and Tobago is considering the award of a consultancy contract for a Solid Waste and Management Plan study.

4.2.4 It does appear that what is now required is the provision of sufficient information in this study to influence the formulation of a policy by governments which now require it, and to inform the public.

### **4.3 Management**

4.3.1 At present, management is being done by the various Ministries of Health in most cases, and is merely one of the many functions being performed. In practice, the responsibility falls upon the senior public health inspector.

4.3.2 As the attendant problems multiply, the need for more specialised engineering management expertise has been demonstrated. Thus far, the collection of solid waste has been done with some thoroughness, but it is in the area of final disposal that the deficiency shows up forcibly.

**4.3.3 The restraints that militate against the delivery of an adequate service can be summarised as follows:**

- (a) poor liaison with other governmental agencies, especially those responsible for new housing, tourist, and industrial developments;**
- (b) inability to purchase, maintain and make provision for replacement of vehicles;**
- (c) insufficient or in some cases lack of financial provisions in the budget;**
- (d) difficulty in selecting suitable disposal sites;**
- (e) absence of public health education programmes to provide information on the real part played by the existing poor conditions in the spread of diseases;**
- (f) absence of a rate structure which could provide needed revenue to defray all costs of operation;**
- (g) public unawareness of the serious implications of the absence of solid waste management.**

#### **4.4 Engineering & Technology**

**4.4.1 From what has already been stated, the engineering inputs into solid waste management have been very minimal. Only in Barbados, Jamaica, and Trinidad and Tobago have the Ministries been able to maintain public health engineers on staff to provide necessary guidance, plan and implement programmes.**

**4.4.2 As a result, while questions of assignment of routes for trucks and coverage gain attention, problems of suitable methods of disposal, disposal site selection, maintenance of vehicles and other equipment, purchase of suitable machinery are not being solved.**

#### **4.5 Organisation & Administration**

**4.5.1 In general the Ministry of Health and/or local Government has administrative responsibility for solid waste, even where a separate agency is created for its operation.**

**4.5.2 In the cases where the Ministry of Health operates the service directly, the work is usually assigned to the public health inspectorate.**

**4.5.3 The inability to perform the function properly can be attributed to major causes such as:-**

- (a) lack of technically trained manpower**
- (b) shortage of heavy equipment e.g. compactors, refuse carriers**
- (c) absence of public awareness and support**
- (d) inadequate financial provision**
- (e) absence of firm policy decisions resulting in ineffective management**

**4.5.4 It is recognised that the public health inspectorate does have training, experience and public image that can be utilised in rural areas to solve solid waste problems. As the problems develop, it seems advisable to assign staff directly, after further training, to form a pool of technical personnel, under a technically qualified divisional head.**

4.5.5 This unit will also have responsibility for all solid waste management and control including selection, maintenance and operation of vehicles and equipment required.

4.5.6 If adequate funds are not available from the country's budget, then there should be legislative provision for imposition of a rate structure.

#### 4.6 Finance

4.6.1 Solid waste activities are generally not provided with sufficient funds to ensure their proper completion. Further, it does not appear that there will be any significant increase in the existing provisions, until general economic conditions improve.

4.6.2 Long range financial planning is not done and it is not possible as long as solid waste management continues to receive such a low priority rating. The usual practice is to consider the subject only when a problem develops.

4.6.3 The shortage of funds has caused many governments to seek external assistance for transport vehicles, and heavy equipment. This type of assistance is being phased out and some of the units are nearing the end of their useful lives without a plan for replacement.

4.6.4 The central Government is the source of funding even where a special agency or separate authority has been set up for administrative purposes. Therefore, even though a separate entity might be held accountable for administrative and operational matters, the agency must still rely on central revenue sources, on apparently the same competitive basis as other Ministries or agencies.

4.6.5 Incidentally, it is even difficult to arrive at the true cost of solid waste collection and disposal as there is not always a separate identifiable provision for the service in the budget.

4.6.6 No fees are generally charged for collection or disposal services, although it does appear that justification exists for the collection of fees for removal and disposal of trade wastes or special wastes such as bulky or potentially hazardous material.

4.6.7 However, before this step could be implemented, it would be necessary to make a careful analysis of the cost of an acceptable operation and to establish a fee schedule based on a unit cost of operation. Fees could also be set in the following manner:

- (a) on a flat-rate basis, where a uniform charge is made to all users
- (b) variable, depending upon type of waste, frequency of collection, etc.

4.6.8 If fees are collected, they should be deposited in a special account, not deposited into the general fund, and utilised solely for defraying solid waste management and operational costs.

4.6.9 Although not all territories have developed their administrative resources to the point where it would be possible to institute fees, it is a means of defraying costs that should be considered at the proper time.

#### 4.7 Manpower Development

4.7.1 It is accepted that solid waste management should now be considered as one meriting rather higher priority than it has thus far attracted.

4.7.2 The policy which now exists is rather uncertain and lacks direction. In this connection also, involvement of the community is essential for the success of any programme for solving disposal of solid waste in a safe way.

4.7.3 It is, therefore, necessary to arrange for the training of all levels of workers to be employed in any organisational structure envisaged. This can take the form of study attachments, short courses abroad, and supervised on-the-job training at the operations level. Provision should also be made for the inclusion in the training programme of public health education personnel.

4.7.4 In the larger territories, separate agencies will continue to operate but with the addition of engineering and accounting expertise on a continuous basis.

4.7.5 A real problem exists in the smaller territories, as the operations cannot justify the creation of separate entities. The training of the workers now employed in solid waste is also very much indicated. With regard to the management and engineering expertise required, the Ministry of Health should continue to provide it by adding to its staff a public health engineer, who will really be responsible for direction of the service and not only in a nominal way.

4.7.6 With regard to the training of other technical personnel, this must be done in conjunction with the proposals made for development of skills of comparable workers in water supply, liquid wastes and faecal disposal.

## 5. INDUSTRIAL WASTES, PESTICIDES

### 5.1 History

5.1.1 Prior to 1960 or thereabouts, the industrial pollution of the environment that occurred in many Caribbean countries came from the sugar industry, and distillery wastes. It took place in all the countries which produced sugar and rum and continues up to the present time almost unabated.

5.1.2 The waste is discharged untreated to the nearest stream, or directly into the sea depending upon which is closer.

5.1.3 There have been numerous complaints about the obnoxious odours produced when deoxygenation of the stream or estuary occurs and the organic substances undergo anaerobic decomposition. No evidence of any attempt to apply treatment has been found. In addition, oil production and refining in Trinidad and bauxite production, which began in Guyana in 1920, have been significant sources of pollution in these countries.

5.1.4 After 1960 onwards, growth in industrialisation was observed mainly in Jamaica, Guyana and Trinidad and Tobago and recently in Barbados, Antigua and St. Lucia. The industries then established which had polluting effects on the environment, included oil refining in Jamaica, Antigua and Barbados, and further expansion in Trinidad and Tobago, bauxite and alumina in Jamaica, cement, food and drink processing, manufacture and cosmetics, pharmaceuticals, fertilisers and batteries.

5.1.5 This resulted in the introduction into the environment of many inorganic and organic chemicals, phosphates and toxic heavy metals such as lead, chromium, zinc, copper and mercury.

5.1.6 As a result, it can now be said that the industrial effluents being found in Caribbean countries fall into the broad classification of:

(a) Chemical effluents from industries using chemicals;

(b) Organic effluents from —

- (i) Food and drink processes
- (ii) Raw materials of animal or vegetable matter
- (c) Effluents from the engineering industries, usually metals and cyanides.

## 5.2 Policy

5.2.1 The industrial development of the Commonwealth Caribbean is only now taking shape, but in some countries, it has not really started.

5.2.2 As a result, a general policy for ensuring that industrial wastes are not discharged without adequate treatment, has not even been formulated. In fact, it is doubtful whether information on the serious risks to which the communities are being exposed has received any wide dissemination.

5.2.3 The evidence is that in the industrialised countries, industry itself participated in regulation of industrial wastes. For example, in the United Kingdom when the Department of Scientific and Industrial Research was created, its aim was to serve "the whole nation, both its industry and its individual citizens". It conducted its own research in building, fuel, food and water, and encouraged industry to do likewise. The findings were publicised and gained general acceptance.

5.2.4 The Caribbean communities have many basic problems to solve. Industrial development and the attraction of foreign capital have been accepted as possible solutions. The countries want to raise living and educational standards, and only the provision of safe potable water is being given high priority among these goals.

5.2.5 There is a serious lack of information in this area, on, for example, the toxicity of some organic compounds such as the pesticides in trade effluents. The introduction of chemical effluents can cause an upsetting of the oxygen balance resulting in fish deaths and eventually the impairment of the use of a river as a source of water supply for domestic, industrial and agricultural processes. A way should therefore be found to influence the formation of a sound policy to deal with the disposal of industrial wastes.

## 5.3 Management

5.3.1 There is no single agency with sole responsibility for environmental control and development.

5.3.2 As would be expected, the Ministry of Health does exercise some authority under the public health laws dealing with river pollution and disposal of trade wastes.

However, no separate organisational structure has been set up.

5.3.3 A notable exception though is Jamaica which has established an Environmental Control Division within the Ministry of Health. The unit consists of a professional staff of twenty officers and its list of functions provided for it to act as a general planning, regulating, monitoring, public health, education and co-ordinating agency for environmental protection. It is also responsible for "assisting in elevating the level of public awareness in the areas of Environmental Health and Pollution Control".

5.3.4 That apart, then it is true to state that as yet serious attempts have not been made to control industrial waste disposal, even in the countries where potentially pollutive industries are being established.

## **5.4 Engineering & Technology**

**5.4.1** In view of the above, assessment in this field is probably unnecessary, except to restate the need to put programmes in motion to obtain expert engineering and scientific personnel, to carry out baseline studies in order to discover the existing status with regard to pollution from industrial wastes, to fix standards and prepare guidelines for future reference and correct existing problems.

p and overflows through manholes.

## **5.5 Organisation and Administration**

**5.5.1** The institutions which have some legal authority to control discharges emanating from industries are —

The Ministry of Health  
The Water or Water and Sewerage Authority  
The Town & Country Planning Board  
The Industrial Development Corporation

**5.5.2** It is difficult to arrive at general conclusions on this matter, as so many occur from country to country. About the only common thread is the lack of trained personnel, both technological and technical in all the institutions.

**5.5.3** It is reported that there is much evidence that the need to attract capital for establishing industries has led to the disregard of expert advice to set up the machinery for ensuring treatment, or control, of discharges that will pose hazards in the environment. The thinking has been that the anticipated economic improvement would generate funds to enable the Governments eventually to finance the corrective measures indicated.

**5.5.4** Given the difficult socio-economic problems that have been more or less inherited, the best option at the moment is to persevere in measures to strengthen institutional development at all levels. That, together with the acceptance if possible of regional criteria, for establishment of industries which all countries will accept, and comply with faithfully, may in the end provide the solutions.

**5.5.5** Barbados does have an active public health engineering division. St. Lucia has opted to introduce legislation to increase the authority of the Ministry of Health to establish emission standards, and Grenada did at one stage include environmental development among the subjects of a ministry. Thus, there are pointers in the right direction.

## **5.6 Finance**

**5.6.1** There are no reports of direct financial provisions for expenditure on improvement schemes in Commonwealth Caribbean countries.

## **5.7 Manpower Development**

**5.7.1** There is at least one regional institution, the Caribbean Agricultural Research and Development Institute, which can at this time initiate studies in the environment towards the collection and typing of relevant baseline scientific data. This avenue should be pursued especially as it can be the means of transferring knowledge to suitably qualified technicians working in the individual countries and thus lay the basis for future work in this area.

5.7.2 However, for formal training, the University of the West Indies should form the focal point where its under-graduates, at least in engineering and the basic science programmes, would be exposed to subjects of environmental importance. Post-graduate programmes in public health and industrial engineering should also be included.

5.7.3 This would entail modifications in the curricula, but it seems to be the only logical means of ensuring that in the immediate future, at least, interest in environmental problems would be stimulated.

5.7.4 At the same time, the institutions already established for training public health inspectors should also modify their programmes to provide in-depth tuition and some specialisation in this area.

## **6. BEACH POLLUTION**

### **6.1 General Assessment**

**6.1.1** The Caribbean Sea, because of its volume and closeness to centres of population, has always been used for the disposal of liquid and solid wastes. With the advent of industrialisation and rise in population, there will be increases in volume and toxicity of some industrial effluents.

**6.1.2** Industrial firms with effluents which present difficulty in treatment and disposal tend to establish themselves on coastal areas. Those that have been mentioned are food processing, heavy and light chemical, iron and steel works, manufacture of antibiotics and other drugs, and cosmetics.

**6.1.3** At present, though, most of the pollution of the beaches originates from —

- (i)** Discharge of untreated or inadequately treated sewage through short outfalls
- (ii)** Discharge of excreta and sludge without adequate treatment
- (iii)** Direct tipping of solid wastes
- (iv)** Industrial wastes
- (v)** Oil

### **6.1.4 Discharge of Liquid Waste, Excreta, Sludge**

**6.1.4.1** There was evidence of fouling of beaches through direct discharge of untreated sewage in harbours or close to the shoreline, for example, from a broken outfall.

**6.1.4.2** The discharge of liquid waste and excreta into the sea does not necessarily harm marine life and often acts as a nutrient for desirable aquatic life. However, where dilution is low, and the water is sheltered, oxygen demand by the waste can have deleterious effects. More importantly, an increase in the faecal coliform count of the water occurs even when there is no visible evidence of gross pollution.

**6.1.4.3** It is fair to state though that the epidemiological evidence does not yet indicate a spread of infection of any significance as a direct result of this condition.

**6.1.4.4** However, when the waters are used for bathing, pathological arguments apart, dirty beaches interfere with the enjoyment by people of the seaside and the pleasure and relaxation obtained either from swimming or sailing.

**6.1.4.5** When sludge is dumped into the sea in large quantities, examination of the receiving water has usually revealed an increase in level of pesticides. It is thought that pesticides are absorbed into the organic matter it contains.

### **6.1.5 Solid Waste**

**6.1.5.1** In many countries, the practice has developed of throwing solid waste over cliffs close to the shoreline, or even directly into the sea. Depending upon the action of wind and tides, the waste is taken back on to the surrounding beaches, sometimes shortly after it was deposited into the sea.

## **6.1.6 Industrial Wastes**

**6.1.6.1** In view of the relatively low level of industrialisation and even in the absence of any studies to monitor existing conditions, it can be said that pollution by industrial wastes is only of importance in a minority of countries.

It can, however, become a more generalised problem in the future and it is worth mentioning that —

- (a) Industrial wastes which contain even low concentrations of heavy metals, phenolic substances, cyanides and synthetic organic chemicals may be toxic to marine life;
- (b) Toxic organochlorine pesticides may also be harmful to marine life;
- (c) Shrimp and lobster fisheries can be adversely affected by waters polluted with industrial waste.

## **6.1.7 Oil Pollution**

**6.1.7.1** The beach can be polluted by oil in the following ways:

- (a) Produced water from off-shore wells containing not only varying amounts of oil, but also toxic chemicals;
- (b) Oil spills during —
  - (i) transfer of crude oil from ship to refinery, or from ship to ship
  - (ii) breaks in crude oil transmission lines
- (c) Cleaning of storage oil containers of ships;
- (d) Damage to large oil tankers resulting in spilling of several thousand gallons of oil.

**6.1.7.2** It is clear that the problems mentioned in (a) and (b) above are of relevance to countries which produce and refine oil. This refers to at most, two countries at the moment. Those listed in (c) and (d) are of regional and even international concern.

**6.1.7.3** The public health significance is not great, but it is of economic relevance to those countries where the beach is a major tourist attraction and tourism contributes greatly to revenue. Already tar balls are being washed up on some island beaches and a major oil spill can cause severe damage to some economies.

**6.1.7.4** However, it does seem that this matter, although of such great importance and relevance to development, is best dealt with regionally, not necessarily within the context of an environmental health strategy.

## **6.1.8 Summation**

**6.1.8.1** In summary then, if action is taken to ensure the sound disposal of liquid wastes, excreta, solid waste, and industrial wastes, the existing major causes of beach pollution, the beach will no longer present an environmental health hazard.

**PART II**  
**THE PROCEEDINGS OF THE CONFERENCE/WORKSHOP**

## PART II

### 7 . PROCEEDINGS OF THE CONFERENCE/WORKSHOP

#### 7.1 Summary of Papers Presented on Selected Topics

7.1.1 The Conference was asked to consider, as a basis for deliberations, the two documents entitled "Summary of Consultants' report and Guidelines for Strategy, PAHO/WHO, May 1978" and "Working Document for Conference/Workshop on Environmental Health Strategy, 2 June 1978".

7.1.2 The content of these two Reports is summarised in the situation analysis reported in PART I.

7.1.3 In addition, various presentations were made on the general theme of the Conference by professionals, of the various Caribbean countries and staff of regional bodies and international organisations with interest in the sector. Such presentations form an integral part of the Conference background and documentation and were intended to give to the participants, a better insight into the problems arising out of planning, financing and implementing of environmental health projects.

7.1.4 In essence, this section reflects these presentations and takes into account the views expressed by other participants through written and verbal comments.

7.1.5 The subjects and authors of the presentations are as follows :-

1. "Management and Planning for Environmental Health" by Carol A. Davis.
2. "Institutional Development" by Domingo Ruiz (Comments by Leo Lawson).
3. "Environmental Health Centre for the Commonwealth Caribbean" by Ronald A. Williams (Presented by Dr. A.M. Gajraj).
4. "Community Participation and Education" by A. Redhead and S. Barnes.
5. "Project Preparation and Financing" by Dr. B. Yankey.
6. "Manpower Development" by Neil Carefoot

#### 7.2 Management and Planning for Environmental Health

7.2.1 Environmental planning has made little headway in the Caribbean as it is an integral part of development planning, and therefore reflects the embryonic stage of the latter. The main reason for the relative under-development of planning in the Caribbean is seen as the historical lack of control of Caribbean economies by the respective Governments which did not change with the advent of independence.

7.2.2 Most territories rely considerably on foreign assistance for development and financing of environmental projects. The dominating factor in the field of environmental planning in the Caribbean is the dependence of foreign expertise and capital. There are typical examples in Member Countries which put into focus the major deficiencies which would need to be corrected.

7.2.3 The statistical and research base for environmental planning is weak, particularly in the field of Health statistics, and this makes it difficult to evaluate the impact of the programme on the health of the population. Long-term objectives may also be sacrificed in favour of short-term benefits.

7.2.4 Effective planning requires a clear statement of acceptable standards as a basis for setting plan targets. WHO standards have been very useful. However, the need is felt for similar standards for other aspects of environmental health, i.e. for various types of sewage disposal, permissible leakage, consumer wastage.

7.2.5 Another major impediment to successful planning is the tendency towards the centralisation of power and the concurrent weakness of local administrations that characterize several Caribbean countries.

7.2.6 The inadequacy of resources generated within the sector is also a major constraint in planning. A case in point exists in a Member Country where the expected revenue for the fiscal year 1977 was 15% of total operating expenses and actual receipt was only 73% of billings.

### 7.3 Institutional Development

7.3.1 PAHO has gained considerable experience in the water and sewerage sub-sector in the formulation and execution of institutional development programmes with the purpose of improving the operation, managerial capacity, and financial position of agencies.

7.3.2 The methodology of the programme consists of a comprehensive approach to the management problems of the agency considering the resources available and the institutional context. External resources serve as a catalyst for a self-development strategy through the action of agency personnel.

7.3.3 Appropriate implementation of the methodology should increase the quality of services and revenue, and attract national and international funds for financing water and sewerage projects. It should also result in better income generation through appropriate rates, and an increase in the life of facilities due to proper operation and maintenance, and the development of human resources.

7.3.4 The steps in the programme include, first, the preparation of a document summarising the main problems and general recommendation sometimes referred to as prediagnosis. The next step is the finalisation of the agreement or terms of reference assigning responsibilities to the parties involved and including a plan of operation and budget.

7.3.5 When the complexity of the undertaking so dictates, it will be necessary to include a diagnostic state in the plan of operation that will prepare a detailed analysis of the problems and of the options for solving them. Detailed guidelines for project formulation and execution would also be developed.

7.3.6 A methodology and guideline with enough flexibility, could be applied to the needs of the individual countries in the Caribbean, taking into account special conditions in the area. For example, with regard to water supply and sewerage, while self-sufficiency may be ideal, the need for some measure of subsidy in the Caribbean area is a fact of life.

7.3.7 The concept of a single national agency responsible for water and sewerage has been generally accepted in the Caribbean area. It is the practice to have a separate agency for implementation and operations and another for regulatory and monitoring.

7.3.8 Any programme for institutional development designed to assist in achieving a breakthrough in improving health standards should take into account the pressing need to really inject a meaningful input by health agencies concerned. The role of the agencies concerned with water supply, sewerage operation and health should be clearly identified in order to avoid any potential areas of conflict.

**7.3.9** Also, any programme of institutional development should promote better use of water resources including the potential for water re-use, the reduction of waste, and a rate structure which reflects Government policy to consumers, particularly those in the lower income bracket where some element of subsidy may be necessary.

**7.3.10** It should ensure the maximum use of local materials and expertise, and ensure maximum co-ordination of efforts of all agencies involved in the sector.

#### **7.4 Preliminary Proposals for a Caribbean Centre for Environmental Health**

**7.4.1** A regional approach in Environmental Health in the Caribbean is appropriate. It will provide the smaller territories with a means of solving common problems they would not otherwise be able to consider on their own. It will also provide all the territories with an opportunity to make a successful effort to develop a unified approach to the solution of environmental health problems encouraging joint effort in the fields of survey, engineering studies, and research.

**7.4.2** In this context, the proposal of an Environmental Health Centre should be given due consideration. Three (3) main objectives were outlined:

- (a) To collect and to make available to CARICOM Governments environmental knowledge and expertise for use in optimizing national environmental health programmes.
- (b) To act as the physical focal point for the provision of technical and financial assistance in environmental health from external sources for the Region and for individual territories.
- (c) To co-operate with existing regional (e.g. CAREC) and national (e.g. Institute of Marine Affairs in Trinidad and Tobago) bodies in environmental health work.

**7.4.3** Proposed activities for the Centre include the areas of training, investigations, emergency assistance, information system, environmental health education, legislation, criteria and standards for environmental health.

**7.4.4** Two alternatives are suggested. Alternative (1) is a centre governed by the CARICOM Health Ministers Conference, while alternative (2) is a sub-centre of the Pan American Centre for Sanitary Engineering (CEPIS), a PAHO regional centre in Lima, Peru. Seven areas of specific consultancy interest have been suggested:

- (1) Water Supply
- (2) Wastewater disposal
- (3) Solid waste management
- (4) Coastal Zone environmental management
- (5) Community sanitation
- (6) Environmental Law
- (7) Technical standards

**7.4.5** A thorough evaluation for the location of the Centre is suggested, based on the following criteria:

- (i) Central locale with good communications with all CARICOM countries;
- (ii) Proximity to other agencies such as CAREC, UWI Engineering faculty;

- (iii) Possession of infrastructure, housing, etc.;
- (iv) Willingness of local government to assist Centre development;
- (v) Existence on the island of environmental health situations for practical training of personnel.

7.4.6 Trinidad and Tobago, and Barbados are suggested as preferred locations. However, special consideration should be given to the availability of the facilities of the Bilharzia Research and Control Department in St. Lucia which will be a decisive factor.

7.4.7 The Centre should be developed in phases. Estimated space requirement for office laboratory and supporting services is 5500 sq. ft

7.4.8 In comparison, the St. Lucia facilities offer a total laboratory space of 3829 sq.ft. and office space of 1220 sq.ft., totalling 5049 sq.ft. The cost of maintenance and operations including upkeep of grounds and building amounted to US\$12,000.00 approximately in 1977.

7.4.9 The operations of the Centre in St. Lucia are presently being sealed down and date of completion of its activity is 1980-81.

7.4.10 The consensus of opinion is that there is a need to better define the role of the proposed Centre with specific regard to the functions that are being carried out by existing institutions in order to determine whether functions outlined for the Centre could not be better fulfilled in other alternative ways.

7.4.11 A detailed feasibility study is proposed in this regard which should be carried out by a team of consultants selected by PAHO and CARICOM.

## 7.5 Community Participation and Education

7.5.1 Governments have not yet entrusted to local communities a major role in making decisions on matters pertaining to their well-being, even though it is realised that their participation is an essential element for change, and success in development projects.

7.5.2 Education is seen as a major element in creating awareness in community leaders of the need to foster community participation, and to inform the communities on the socio-economic determinants of their livelihood. This type of education is lacking in the policies of Governments in the Region.

7.5.3 Environmental education is also essential and should involve the community, making individuals of the communities understand the manifold nature of the environment. In the process, social groups will become aware and sensitized to the problems of the environment.

7.5.4 Planning and implementing strategies for community participation face many obstacles both from within the community and without. The job requires interpersonal skill which fortunately can be acquired.

7.5.5 The China experience is a good example of how community participation can be initiated. However, any model to be appropriate should be based on an assessment of the needs of local people, and their ability to manage their own facilities.

7.5.6 The following criteria were suggested for the selection of environmental health programmes within a community:

- (1) It should be a programme that can be dramatically "sold" to the community;
- (2) It gives more than reasonable expectation of easy and prompt execution;
- (3) It requires minimum expenditure of time and energy for promotion;
- (4) It brings potentially the greatest public health comfort and community returns;
- (5) It affects the greatest number of people;
- (6) It rests to a major extent upon the resources of the people;
- (7) It requires the minimum education of all people;
- (8) It has a strong scientific and technological bias;
- (9) It requires little or no additional research.

7.5.7 Furthermore, the findings of a study of the process of community participation by WHO/UNICEF could be useful in developing a model for the Region.

7.5.8 It has been observed that at the village level, adequacy in coverage, and effective utilisation of health services has been achieved where the population concerned has taken a major responsibility in this effort. The notion of responsibility implies a great deal of reliance in decision-making and the provision of resources to support the programme.

7.5.9 Community participation in health was found to be enhanced by the existence of specific government policies to encourage such participation in both urban and rural development programmes. The decentralization of administration seemed to have given impetus to the process of participation.

7.5.10 Community participation was maximized when local resources were complemented by government resources, and where there was a clear awareness of the benefits to be derived from the programme.

7.5.11 Project activities related to children were used as a starting point to further community participation.

7.5.12 The priorities listed for Community Health Education and Participation were:

(i) Policy supported by legislation for community participation

(ii) Training —

(a) Basic and In-service

(b) Primary — Secondary-Tertiary level schools

(c) Mass publicity with sub-regional link-up between countries

(d) Development of Audio-visual Aids for use in the Caribbean

(e) Closer link-up between Environmental Health experts, the Health Education and the Community Development officers.

## **7.6 Project Preparation and Financing**

### **7.6.1 Guidelines for Caribbean Development Bank (CDB) Financed Projects**

A project is an activity of socio-economic content which has a defined life cycle and which can stand an evaluation test.

7.6.2 The involvement of the CDB starts with project identification. This identification can be initiated by a country through a mission. It can also be phased on an on-going programme which has been developed or part of an overall development plan.

7.6.3 The project preparation is the responsibility of the proposed borrower. However, because of limited technical manpower resources in the Member Countries, and depending on the extent of the work, the following arrangement can be made:

- (i) CDB staff can undertake the preparation. However, there are some reservations to his approach.
- (ii) CDB can give guidance to Member Countries in preparing information, putting it together, and in reviewing and analysing the data.
- (iii) A pre-investment study may be undertaken, and financed by:
  - (a) a Member Country from its own resources;
  - (b) the CDB, as part of the project contribution;
  - (c) a Member Country obtaining assistance from any aid agency for the purpose.

7.6.4 Pre-investment studies are normally done by consultants, with a preference for regional consultants or a mix of regional and external consultants. The mix is common, particularly in agriculture.

7.6.5 All the technical assistance given by bank staff in project preparation is free and not charged to the project.

7.6.6 Project preparation is, therefore, the first step to establishing the technical, commercial, financial and economic feasibilities of the project. If however, a study already exists, this may only require upgrading in the preparation stage.

7.6.7 The preparation stage, apart from saying how feasible the project is, should

look at alternatives in the design of the project;

highlight the issues to be considered, namely: policy issues to be thrashed out in appraisal,

— identify linkages.

7.6.8 Once the management of the Bank is satisfied that the project is eligible for CDB's financing, and funds are not available from other sources to the borrower, then appraisal proceeds.

7.6.9 The Bank is interested in projects which are considered of high economic priority in the economic development strategy of the country, and which are self-liquidating. In other words, the benefits derived in monetary terms cover the operation of the project, including replacements, and servicing debt obligation.

**7.6.10 CDB has no hang-ups on the self-liquidating aspects in the case of a public utility. Several approaches can be developed if the revenue as projected cannot satisfy the estimated costs, operating costs and debt servicing:**

- (i) new rate structures need to be agreed upon;
- (ii) government must allocate a subsidy in the budget to make up the difference.

**7.6.11 Project appraisal is an independent evaluation conducted by the Bank as a lending agency. The following are examined:—**

**7.6.11.1 Technical Aspects**

- (i) project objective, target group defined;
- (ii) project design, including alternatives; these should include: project area; full project description; capital works to be undertaken with specification; technology to be employed; inputs required; manpower resources needed; support services; implementation schedule, and effect on environment.

**7.6.11.2 Organisation and Management Aspects**

Who is going to organise and manage the project?

Is it a new organisation or an existing one?

If an existing one, capacity, performance and scope to add on a new activity must be evaluated.

**7.6.11.3 Commercial Aspects**

Market for product; existing and potential demand.

**7.6.11.4 Financial Aspects**

All costs and revenues

- (a) (i) capital costs: investment items consultancy, contingencies, inflation;
- (ii) operation costs; replacement costs.
- (b) In public utility, examine finance of borrower — revenue generating capacity; current amount.
- (c) Financial plan, deciding where all funds come from since all cannot come from CDB.
- (d) Cash flow projection to show sources and use of funds, and how well the project can carry out itself.

**7.6.11.5 Economic Aspects**

Net economic benefits which can be quantified, and the indirect benefits.

**7.6.11.6 Legal Aspects**

- (i) Is the legal framework sufficient to allow the project to perform?

(ii) Can the entity borrow?

(iii) Who secures or guarantees the loan?

**7.6.12** The terms and conditions of loans are:—

- (i) Interest rate — 4% to 8%
- (ii) Repayment period — 20 years
- (iii) Grace period — 3 to 5 years

**7.7** Manpower Development in Environmental Health

**7.7.1** Manpower is the common element for all aspects of the strategy for environmental health improvement. The experience of the Caribbean Basin Water Management Programme provides a basis for the analysis of manpower problems in the sector and the formulation of a strategy for manpower development. Specific account should be taken of the prevailing attitude both at management and operation level with regard to training, the existing characteristics of the manpower situation, and the notion of balance between management, technical, skilled and unskilled labour.

**7.7.2** One of the factors which has contributed to the misconception about training is the notion that it is intangible. Performance before and after training can be measured, and evaluation should, therefore, be an integral part of all training programmes.

**7.7.3** If training is to be seen in its proper perspective, trained individuals should change their attitudes and share their knowledge with others, thus achieving a multiplier effect.

**7.7.4** The results of a survey carried out in ten (10) Eastern Caribbean countries (1977) is significant in giving insight in the magnitude of the problem of manpower development in Environmental Health. However, the picture is incomplete since it only relates to the water sector.

**7.7.5** The Governments covered by the survey neither had a training policy nor do they normally budget for training of waterworks personnel. All the training provided was sponsored by external sources.

**7.7.6** From 1967, 80% of the funds available for training have been spent on top-and middle-level technicians personnel. This constitutes a serious imbalance considering they only represent 4% of the estimated work force of 2000 employees in the water supply sector for the territories surveyed. The training of middle-level management personnel which accounts for 6% of the work force has been initiated more recently, but no training has been provided to cover power-level technicians (86%).

**7.7.7** The important concept of balance should be taken into account for, on one hand, human resources should keep pace with physical improvements, and on the other, that all employees play an important role in the delivery of services.

**7.7.8** The returning graduates are not required to train others and they do not acquire communication skills to do so. The impression is that many of the prevailing conditions in the water sector are also common to other areas of environmental health. The only positive factors which indicated that a capability has evolved for developing a training delivery system is the presence in each island of a nucleus of technically trained personnel and the presence of local vocational institutes.

**7.7.9** Very little is being done in the Region in the way of developing manpower resources in management, operation and maintenance for liquid, solid, industrial wastes and beach pollution. The need for preparing this type of personnel raises a serious question as to the attainment of the targets of the water and sanitation decade.

**7.7.10** The essential elements of a Training Delivery System are considered to be inventory of manpower and training resources available, the development of adequate training and other related personnel policies, the definition of an organisation structure and training methodology, and the preparation of instructors and performance oriented instructional material. This pattern has been closely followed in the current training programme for waterworks personnel in the Caribbean area.

**7.7.11** The Technical and Scientific Committee of the Ministers of Health has recommended that the existing Caribbean Basin Water Management Programme be used as a model, and expanded to include other areas of environmental health.

**7.7.12** CARICOM and PAHO have already prepared preliminary guidelines for the development of an Environmental Health Training Delivery System.

## **8. SUMMARY OF REPORTS OF WORK GROUPS**

The participants were divided into four work groups, depending on their affiliations and experience. These groups were: (I) Water Supply; (II) Liquid Waste and Excreta Disposal; (III) Solid Waste Disposal; and (IV) Industrial Wastes, Pesticides and Beach Pollution. The groups were requested to consider in their assigned area, the information contained in the Conference Basic Documents, and the presentation made on specific topics in Plenary Sessions, with a view to recommending a strategy for improving environmental health in the Caribbean. The consolidated report of findings of the work groups is now presented. In Part III, the findings of the work groups have been embodied in the proposals of the strategy.

### **8.1 Management and Planning for Environmental Health**

8.1.1 In the past, there has been no evidence of a Planning Methodology peculiar to this Region. Plans were adopted from foreign countries even when they were inapplicable. We need, therefore, to develop our own Planning Methodology. As far as finance is concerned, it was suggested that the principles laid down by the World Bank could be used as a guide to formulate our own.

8.1.2 All the elements necessary for good planning must be included as it permits one to assess the feasibility of the programme in keeping with proper management of the utility. The aim, therefore, is to make an assessment of the total situation as a first step in the development of a methodology for the Region.

8.1.3 It is recommended that Caribbean Territories establish joint Water and Sewerage Authorities to take advantage of similarities in technology and maximum utilisation of manpower and other resources. Special consideration needs to be given to management of liquid waste both at local and national levels.

8.1.4 It is recommended that with regard to distribution of functions of various agencies in the water and sewerage sector, the present arrangement that the water/ sewerage agencies carry out the planning, implementation, and operation of facilities while the health agency undertakes monitoring and regulatory functions should continue.

8.1.5 Further, it is suggested that supervision of smaller sewerage systems, e.g. package plants, septic tanks and pit latrines be delegated to the local health department or statutory local authority according to the conditions obtaining in the particular territory.

8.1.6 In the field of Solid Waste Management, it is recommended that clear national policies be adopted to deal with the formulation and implementation of a Solid Waste Management plan. It is important that in formulating a Solid Waste Management Programme that the fullest support of all related groups and concerned Government agencies including health personnel be obtained.

8.1.7 As an extension of the concept of co-ordination, the close proximity of the Caribbean countries immediately suggests the need for a co-ordinated policy with respect to Solid Waste Disposal.

### **8.2 Institutional Development**

8.2.1 It was suggested that a model be developed for water utility management to meet the requirements of individual utilities which varied in size so widely (in one instance, a utility is

serving a population of 12,000 persons). It was recognised that there were common elements in all models and these could be applied to the smaller territories which were deficient in manpower and financial resources.

8.2.2 It is also recognised that the development of a proper institutional framework could be achieved by the establishment of autonomous bodies, e.g., water supply. However, the end results were not always what were expected, because of political influences. The health services should be represented at the policy decision-making levels and be kept informed of developments at the executive level.

### 8.3 Community Participation and Education

8.3.1 In the development of environmental health programmes, as far as community participation is concerned, there are indispensable and important points to consider:

- (a) What are the needs and what services are required;
- (b) The desire of the community for these services.

8.3.2 This will foster understanding between the community and the agencies. There should also be provision for a direct communication link between the community and the agency, whether a statutory authority or a government department, and provision for a response or feedback from the community in respect of the services desired. The community should be involved at all phases of the programme development, in implementation and operations.

8.3.3 Such an approach to the community will ensure support for whatever needs to be done in the community and will encourage them to share in the responsibility for carrying out improvements.

8.3.4 Communities must be informed of changes in services and why it is necessary to institute changes such as rates and rationing, for example.

8.3.5 Other related sectors should be kept informed at all times of the details of environmental health programmes.

8.3.6 Practical participation of communities should be encouraged, whenever feasible in project implementation in rural and urban areas, especially in such activities as water-mains extension to which they are often willing to contribute labour.

8.3.7 The maximum participation of communities should be promoted also by involvement of health authorities, and by working through any existing agencies which are involved in community development. It was mentioned that Health Committees have a new thrust in Jamaica and these Committees could have a great impact on communities in relation to water supply works.

8.3.8 The education of communities in environmental health matters must be an integral part of the national education policy. Therefore, the Governments are urged to include environmental health education on the school curricula throughout the Region, in order to provide the future generation with an early exposure to information on environmental health conditions that will so closely affect the future lives of its members.

8.3.9 Further, it is recommended that environmental health education be included on the curricula of all teacher-training institutions. Available services of trained personnel, e.g., public health inspectors, nurses and engineers should be used until adequately supplemented. The Governments in the Region must make every effort to have the subject of environmental health included among those to be examined by the Caribbean Council of Examinations (CXC) as soon as possible.

8.3.10 It was noted that the Health Ministers Conference this year called for greater community participation, and in this regard, there was mention of a series of meetings to be held at which Caribbean countries will be asked to identify and submit proposals of their individual needs. It is proposed that following this, an expert committee would be established to develop guidelines for a strategy in Community Participation in the extension of health care.

8.3.11 Governments should encourage community organisations, e.g., Lions, Jaycees, Kiwanis, Adult Education Groups and other private organisations interested in environmental health to promote community education in environmental health. A concerted public relations campaign should be launched employing all available media, e.g., press, radio.

#### 8.4 Financing of Environmental Health Projects

8.4.1 The groups recognised that in the past, and to date, several international agencies have contributed funding in one way or another to the development of water supplies in the Region. This help is appreciated and it appears obvious that it must be continued, increased, and expanded to other aspects of environmental health since the economy of many Governments will not allow them to be self-financing in this matter.

8.4.2 There is need for an analysis of the financial needs of the area, and also to update the inventory of sources of finance which would include the requirements of the various lending institutions.

8.4.3 In particular, certain agencies like the United States Agency for International Development, which previously contributed to the growth of water development in the area, should be encouraged once more to do so.

8.4.4 The role and good work of the CDB were appreciated and supported.

8.4.5 The need for a regional approach on a total Environmental Health Strategy basis, could indicate that funding agencies and donor Governments should channel financial assistance through the CDB.

8.4.6 The groups are aware of statements to the effect that donor Governments and agencies are trying to move away from financing infrastructural-type development projects in preference to employment-creating projects such as irrigation in agriculture, and factory shells for industry. However, they expressed the hope that the approach would not be detrimental to the financial needs of the environmental health sector.

8.4.7 A definite strategy to take active steps to reorient the thinking on this matter, by highlighting the needs and requirements of the Environmental Health Strategy programmes was advocated.

8.4.8 It was felt that with the relative success to date of finding some form of financing for water development, the methodologies employed could be modelled and used for the development of the other aspects of environmental health.

8.4.9 The single most important factor was a documentation of our needs, and in addition, a programme of development for other sectors of environmental health was urged. It should follow the pattern of the preparation of master water supply development plans in the Eastern Caribbean, with the technical assistance of PAHO, as was mentioned in the Working Documents.

**8.4.10 On the problems associated with project preparation:**

- (a) at least one Government felt that a more careful look should be taken at the matter of whether a water supply project should be self-liquidating or not, to attract bank financing.
- (b) the general feeling was that the CDB policy that a public utility should be operated as a self-liquidating basis could be a tremendous catalyst in the efficient operation and management of some utilities and where subsidies are necessary, this should be in clearly identifiable areas of costs.

**8.4.11** It was indicated that the existing differential rates of interest for LDCs and MDCs would be replaced by a common interest rate throughout the Region for environmental health projects.

**8.4.12** They further recommended that:

- (a) environmental health personnel trained in project preparation be placed in the planning authority of each territory and the advice and participation of the relevant environmental health authorities should be sought on a continuous basis;
- (b) each territory should identify the geographical areas of priority for environmental health based on existing conditions and other health criteria.

**8.4.13** It was proposed that Governments in engaging consultancy services should engage local and/or regional expertise in the design and preparation of such projects, since preparation at this stage is critical to the transfer of technology related to the project. Further, they should ensure that trained personnel used during design, preparation, implementation and operation of projects be attached to projects long enough to facilitate the effective transfer of technology.

**8.4.14** Having considered the financial constraints of Caribbean Territories especially the LDCs, it was still emphasised that Governments in the Region should develop master plans for projects dealing with the treatment and disposal of liquid waste and excreta. There is doubt that their implementation is vital and basic to the total development of the countries.

## **8.5 Manpower Development**

**8.5.1** The groups endorsed the notion that training is an integral part of any health strategy.

**8.5.2** They recognized that the need for a regional co-ordinating body on this matter of environmental health manifests itself, and probably most of all, in this aspect of manpower development.

**8.5.3** The following recommendations were made:—

- (i) Regional training programmes in operation, maintenance and management of water supply should be given highest priority;
- (ii) The Caribbean Basin Water Management Programme can and should be expanded to include other environmental health aspects;
- (iii) It is appreciated that some of the larger territories have quite good training programmes, and it is the feeling that more use can be made of these, but probably through the machinery established for the Caribbean Basin Management Programme;

- (iv) In view of the fact that a regional health strategy programme is being planned, it is recommended that all of the participating countries at this Workshop be invited to participate in this regional training aspect. These will include Belize, Bahamas, Bermuda and Turks and Caicos Islands;
- (v) The strategy proposed for an Environmental Health Training Delivery System should be implemented;
- (vi) An in-depth study should be done to fully realise the potential of existing institutions in the Region, especially in this aspect of manpower development.

It was stressed that experience to date indicates that for good response to a regional programme, it appears that the programme should include an appropriate training package;

- (vii) Some of the methods practised by Jamaica, where the stress is on on-the-job training and the provision of incentives for experienced people to fully participate in training others could be adopted;
- (viii) The need for a small number of persons in each territory to be trained or be knowledgeable in the interrelated aspects of the various disciplines and activities. The effects of agriculture and deforestation on water quality, housing development projects and their infrastructural requirements are cases in point;
- (ix) It is to be noted that the Caribbean Water Engineers at their recent Conference in Montserrat gave support to the continuation of the Caribbean Basin Water Management Programme;
- (x) The groups support the suggestion in principle that as a result of this Conference, and to initiate citizens' participation in environmental health matters, a handout along the lines suggested in the "Ten Vital Questions" be done, but that it be suitably modified as a result of the discussions at this Workshop;
- (xi) Minimum standards of education should be established for employees in the health sector;
- (xii) The groups support and endorse the need for an environmental health programme to be taught in schools and accepted the proposed programme as outlined in the presentation on community education

It is further stressed that the strategy should include a provision that the topic be included as a subject to be examined by CXC, at the end of all Secondary Schools Programmes.

Recognition was given to the fact that such a programme would have the added benefit of attracting more students into careers in environmental health with all its allied fields;

- (xiii) The Governments of the Region should make provision in their budgets for the training of personnel in environmental health;
- (xiv) Because of the inefficiency of package plants in the Region, the Governments should take immediate steps to have persons trained in operation, maintenance and monitoring of such plants, especially where substitution of alternative methods of sewage disposal is not feasible.

## **8.6 Environmental Health Institute for the Commonwealth Caribbean**

**8.6.1** The group felt that there is a clear need for a Caribbean focal point to disseminate information on work being performed at several existing institutes in the Region. Additionally, it can provide for the training of management and operations personnel in all aspects of environmental health, and for the adaptation and development of known technology to the Caribbean circumstances.

**8.6.2** However, it was felt that a further in-depth feasibility study should be undertaken to confirm whether this need can be met at a more economical cost by improving existing facilities. Such a study should discuss:

- (1)** Scope and objectives
- (2)** Location
- (3)** Available facilities and the extent of resources available through existing institutions
- (4)** Manpower needs
- (5)** Cost effectiveness of establishing and maintaining the institution in comparison to other alternatives.

**8.6.3** Some participants have clearly indicated that the question of financial support for a new institution is a delicate question. It was noted that other countries with existing facilities might be unwilling to support another institution. Despite the above, the group felt that it would be beneficial if an institute were located in the Caribbean.

**8.6.4** This Centre should provide special accommodation for multi-disciplinary training of personnel, particularly from the smaller territories (LDCs), with emphasis on liquid wastes and excreta treatment and disposal, and water treatment.

**8.6.5** The institution should also function as a specialised agency with continuous responsibility for the identification of manpower and training needs within the Region. It should also have documented information on a regional pool of specialised personnel to serve the Member Countries particularly the LDCs.

**8.6.6** This institution should also be equipped and staffed to carry out research projects, environmental impact assessment studies, and project prefeasibility studies when required. It should also function as the regional information centre on environmental health.

**8.6.7** It was requested of the agencies represented at the Conference to provide information on their relevant services and functions which may be available to the Caribbean utilities.

**PART III**  
**THE STRATEGY**

## **PART III**

### **9. THE STRATEGY**

**9.1** The preparation of the Strategy was motivated by the need to make determined attempts to remedy the environmental health hazards that have threatened the life of the inhabitants of the Commonwealth Caribbean for more than a century.

**9.2** The broad objectives are to:

- (i)** Analyse existing problems in environmental health and suggest practical technically correct solutions which can be implemented within a reasonable period.
- (ii)** Set reasonable guidelines for informing the communities of the risks to which they are now exposed and involving and assisting them in taking corrective measures.
- (iii)** Provide a framework —
  - (a)** for co-ordinating the efforts of countries to effect improvement in environmental health conditions;
  - (b)** for a unified regional approach to financial institutions and international agencies for assistance in improving these conditions.
- (iv)** Generate activities at national levels to utilise fully internal resources, create confidence, and thus attract the right type of assistance to the Member Countries.
- (v)** Make arrangements for evaluation of progress, data collection, and continuous monitoring of developments in environmental health.
- (vi)** Suggest minimum targets for the Region.

**9.3** The provisions of the Strategy which are presented in Sections 10-18 were approved by the participants of the Conference/Workshop.

## 10. WATER SUPPLY

**10.1** Each country should ensure that safe potable water is available twenty-four hours a day, in adequate quantities, as follows:

- (a) in the urban area, to each house;
- (b) in the rural community, within 100 yards of each house;
- (c) for isolated houses and in very small communities, each country will establish its own appropriate targets.

1990

**10.2** Each Government should introduce legislation to ensure that a water and sewerage authority (or a water supply organisation where there are no sewerage systems) is clothed with sufficient legal powers to:

- (i) collect money to meet all costs of operation and maintenance, either by direct charges or by metered rates as within its judgement is appropriate. This should include collecting revenue from some appropriate body for water supplied by standpipes.
- (ii) ensure that though there is a separate body which controls all sources of water catchments, and is responsible for allocation of the water resources to the various end-users, priority will be given to domestic water supply.

1980

**10.3** The water utility should recruit and appoint a competent qualified engineer/manager to manage all its operations and all other staff including technical, administrative, accounting, consumer relations and personnel officers according to guidelines to be established. (Where consultants are employed, counterpart staff should always be provided).

1980

**10.4** Each water authority will --

- (a) Develop and maintain a data collection and management information system which will have readily available all data on its operations including the following:
  - (i) details of revenue and expenditure;
  - (ii) operational and maintenance costs;
  - (iii) job descriptions, minimum standards of education and employee records;
  - (iv) statements of assets and liabilities;
  - (v) quantity of water produced daily;

- (vi) assessments of leaks, wastage, and use, by means of properly conducted leak detection surveys.

1980

- (b) Implement an equitable rate structure.
- (c) Assess training needs and prepare proposals for meeting them, both from its own resources and external sources, with emphasis on inservice training.
- (d) Introduce, develop and maintain proper planning techniques and programming.
- (e) Revise master water supply development programmes to meet projected future demands including assessment of financial needs.
- (f) Prepare detailed plans, both engineering and financial for first phase programmes for submission to, and in accordance with, the guidelines set by donor countries or lending agencies.
- (g) Establish —
  - (i) an appropriate billing and collection system which ensures that all services provided are adequately paid for, including water supplied from public standpipes, the cost of which will be met by some other agency such as local or central Government.
  - (ii) procedures for the purchase, storage and use of materials and equipment needed for capital projects and maintenance and operation, taking into consideration the need for the recognition of the advantages of standardisation and bulk purchasing on a regional basis whenever possible.

1980

10.5 Each water authority should solicit the approval of its national Government to participate in, and contribute funds for its activities on an agreed basis, to a regional or sub-regional organisation which will carry out investigations, prepare guidelines and make recommendations for their uniform adoption on —

- (i) design criteria or standards and model specifications;
- (ii) exchange of information on technical problems and solutions, and in the use of materials and equipment;
- (iii) utilization of various methods of sand filtration, local materials, and selection of appropriate technology;
- (iv) design of water storage structures, and/or systems including those meeting the needs of isolated communities;
- (v) model legislation;
- (vi) introduction of water quality standards and the creation of regional or sub-regional water laboratories;
- (vii) manpower development and training to meet regional needs including an in-depth study to fully realise the potential of existing institutions in the Region;
- (viii) certification and registration of qualified technical personnel: plumbers, pipefitters, draughtsmen, survey technicians and others of this nature;

- (ix) a model utility organisation applicable to various levels of population;
- (x) development of financing and accounting techniques including standard accounting procedures for a utility which will ensure presentation of financial, economic and accounting statements by means of comparative indices;
- (xi) emergency assistance in the event of failure of water systems;
- (xii) training of a small number of persons in each territory in the various interrelated disciplines of environmental health;
- (xiii) a regional approach to funding agencies and governments for financing of water supply projects.

1979

**10.6** Each Government should ensure that all water produced for distribution meets with acceptable water quality standards, that no untreated water is supplied to any inhabitant, and that except where in the judgement of its water engineer, and the Ministry of Health, the omission of a stage or stages is justifiable, surface water supplies should undergo the following treatment:

Coagulation  
Sedimentation  
Filtration  
Chlorination  
Fluoridation

**10.7** All surface and ground water supplies should be disinfected by chlorination.

1988

**10.8** Each Government will support an environmental health training programme to improve the skills of all employees working in water supply, along the lines now being pursued by the Caribbean Basin Water Management Programme, and which has been endorsed by the Ninth Caribbean Water Engineers Conference. Employees working in the areas of liquid waste and faecal disposal and solid waste, can be included in the proposed training programme.

**10.9** All workers, managers, engineers, technicians and other skilled personnel existing or projected should be catered for. As far as possible, local training centres should be used, but consideration should be given to setting up sub-regional centres for the Eastern Caribbean countries. In addition, each water authority will establish its own programme for training in collaboration with other departments involved with environmental health.

1979

**10.10** Each Government will agree to seek jointly with other regional Governments, financial assistance for the setting up of a regional programme which will take steps to improve the quality of water produced. This programme will do the following:

- (i) Set standards for all water produced and appraise existing treatment facilities for producing water to ensure that they will meet them.
- (ii) Recommend guidelines for frequency of collection of samples in both rural and urban areas.

- (iii) **Make recommendations on the establishment of water and/or public health laboratories as required, type of equipment to be used in the laboratory, and by collectors, and testing procedures to be followed.**
- (iv) **Prepare a training programme for laboratory staff, and water sample collectors.**
- (v) **Advise on —**
  - (a) **the purchase of laboratory equipment and supplies, chlorine and fluoride on a regional or sub-regional basis;**
  - (b) **certification and registration of laboratory technicians;**
  - (c) **staffing of laboratories if established before trained local staff is available;**
  - (d) **the necessity or not for enacting of additional legislation to control discharges that are toxic to water consumers into raw water sources or on catchments;**
  - (e) **adequacy of existing water treatment facilities in each country;**
  - (f) **ensure that all water works employees be medically examined as often as is deemed necessary.**

**1980**

**10.11. Each water authority will set up and maintain a public relations programme, the objectives of which are:**

- (i) **to educate the public on the proper use of water;**
- (ii) **to foster good public and customer/utility relations;**
- (iii) **to enlist the aid of the communities in waste prevention and protection of watersheds and installations;**
- (iv) **to encourage aided self-help efforts for extension of water systems and individual connections,**
- (v) **to collaborate with the Ministries of Health and Education in the programme of Health Education at primary, secondary and tertiary levels.**

**1979**

## 11. LIQUID WASTE AND EXCRETA DISPOSAL

11.1 Each country shall take measures to ensure the early establishment of a regional agency for all environmental health matters in which there will be a division to deal with liquid waste and excreta disposal.

December 1979

11.2 Each country shall establish a joint Water and Sewerage Authority in order to take full advantage of similarities in technology and ensure maximum utilisation of manpower and other resources. Where this is not considered feasible, then separate authorities should be formed, but these should have sufficient flexibility to enable maximum co-ordination between the two agencies.

July 1979

11.3 Each country shall create by adequate legislation, a separate and distinct entity or institution for regulating, monitoring, evaluating and setting standards for collection, treatment and disposal of wastewaters. These agencies should be separate and distinct from those responsible for maintenance and construction of systems.

Enactment of Legislation:	Dec. 1979
Creation of Agencies:	Jan. 1981

11.4 As a general rule, wastewater systems should be installed for dense, large-sized populations. However, in arriving at a decision, other environmental conditions, for example, topography, possible water pollution, must be taken into account.

11.5 Each country shall carry out a comprehensive survey of status of liquid waste and excreta disposal, to enable it to determine the type of facilities that are to be provided to improve existing conditions and the management systems that should be employed.

April 1979

11.6 Each country will ensure that each house is provided with an approved means of disposal of liquid wastes and excreta in any of the following ways:

- (a) By a wastewater collection system in all towns, and densely populated centres;
- (b) By individual waterborne systems leading to a septic tank of an approved design;
- (c) By individual pit latrines of approved manufacture and construction;
- (d) By septic or aqua privies.

1990

11.7 Each country will adopt standards for treatment and disposal of wastewater including dilution, and will regulate the treatment facilities that should be utilised. These could take one or more of the following forms:

- (i) (a) Primary:  
Screening and comminution, grit removal, sedimentation;
- (b) Secondary:  
Biological filtration or activated sludge;
- (c) Sludge treatment and disposal.

- (ii) Oxidation ponds.
- (iii) Long sea outfalls.
- (iv) Chlorination.

1990

11.8 Each country shall take a policy decision that in future:

- (a) In the same way that water is given some priority, wastewater collection and treatment facilities should be so considered, and provided in advance of demand. In order to achieve this aim, planning authorities must be required to consult with water/sewerage authorities in the initial stages of development planning, so that proposals for liquid waste treatment and excreta disposal are firmly entrenched in national development plans.
- (b) Financial provisions will be made for the installation of wastewater collection and faecal disposal systems.
- (c) To encourage the establishment of, participate in, and make financial contributions to regional and sub-regional organisations which can provide public engineering expertise and carry out the following functions:
  - (i) the planning and design of wastewater collection and disposal systems;
  - (ii) advise on the production of suitable pit latrine fittings for faecal disposal, concrete pipes for soakaways, materials and equipment required for wastewater collection and disposal systems;
  - (iii) undertake baseline studies and develop criteria for the treatment and disposal of industrial and liquid wastes into the environment;
  - (iv) setting standards for effluent discharges from all treatment plants, including small package aerobic wastewater treatment plants, and toxic industrial effluents;
  - (v) investigate the use of sludges, which has some fertiliser value in agriculture;
  - (vi) advise on siting and the standards of effluents of new industrial premises for the manufacture of drugs, chemicals, or any product which produces toxic effluents;
  - (vii) research into the following:
    - (a) use of oxidation ponds;
    - (b) other methods of faecal disposal, e.g. septic privy, the trough system, the vented pit privy;
    - (c) employment of low cost construction methods;
    - (d) utilisation of indigenous materials;
    - (e) criteria for assessing pollution;

- (f) re-use of sewage effluent;
- (g) transfer, adaptation and development of appropriate technology;
- (viii) evaluate the performance of existing package aerobic wastewater treatment plants;
- (ix) devise on appropriate management development and training programme.

1979

11.9 In the Caribbean context, there is a problem of differentiating rural from urban areas, as these are not properly defined. It will be necessary to carefully evaluate this division, but in the meanwhile, the following objectives should be aimed at:—

- (a) The installation of a wastewater system where feasible.
- (b) The use of septic tanks or other acceptable water-borne methods.
- (c) Continued construction of sanitary pit latrines.

11.10 In countries like Dominica, in addition to the normal criteria of housing, congestion in isolated communities and population density, of special concern is the type of soil structure which inhibits the installation of individual excreta disposal systems. In such cases, there is an obvious need for further in-depth study to determine the most appropriate method of disposal, bearing in mind existing financial and other constraints.

11.11 Each country will examine its rural sanitation programme closely, and provide funding when necessary to its agencies to achieve the following objectives:

- (i) To make available to each house a suitable sanitary method of liquid waste or excreta disposal. In the case of excreta disposal, the design must be self-cleansing, simple to clean, and require little maintenance.
- (ii) To provide facilities which can be purchased by prospective users easily and are acceptable to them, thus reducing the need for communal units.
- (iii) To supply alternative designs of facilities to meet the varying rural conditions that are encountered:
  - (a) varying water table;
  - (b) type of soil;
  - (c) population density, customs and characteristics;
  - (d) availability of water

1980

11.12 Each country shall either enact new environmental health legislation, or amend existing legislation to ensure that the treatment and disposal of liquid waste and excreta is done in such a manner that human health is not in any way affected, and no deterioration of environmental conditions including aesthetic, results.

1980

11.13 Each Government shall adopt the following measures as early as possible:—

- (i) Include in the central planning authorities, environmental health personnel with training in project preparation.

- (ii) Provide training facilities on an on-going basis for environmental health personnel.
- (iii) Identify the areas which require priority attention for installation of wastewater collection and excreta disposal systems.
- (iv) Develop master development plans for the installation of wastewater collection and treatment systems, and excreta disposal methods, preferably on a regional or sub-regional basis, and taking into consideration other social and infrastructural developments.
- (v) Decide when engineering and/or management consultancy services are engaged to provide expertise either locally or regionally in the design and preparation of projects, that locally trained counterparts be assigned to participate meaningfully in all phases of the work involved in order to ensure the effective transfer of technology within the country or Region.
- (vi) In the case of environmental health projects, including liquid waste disposal, adopt an equitable rate structure which will produce adequate revenue at least to meet the expenses of operation and maintenance, and debt servicing charges.

1979

## 12. SOLID WASTE DISPOSAL

12.1 The storage, collection and disposal of solid waste requires significant capital funding and operation, and maintenance expenses.

Each country shall, therefore, adopt clear national policies that will deal with the formulation, implementation and management of a comprehensive solid waste management plan, including but not limited to the following factors:

- (i) Assessment and definition of the scope of the problem
- (ii) The establishment of priority objectives
- (iii) Development of an action plan.
- (iv) National commitment of relevant resources to accomplish the execution of the plan.

1980

12.2 All solid waste management programmes must reflect the total involvement of appropriate health personnel. To achieve this, there should be full co-operation between local and central Government bodies.

Each Government should ensure full co-operation between the local and central Government bodies, and other agencies whose programmes are likely to have environmental health impacts.

1985

12.3 In each country the national Government should give the local Government support in terms of technical, financial and manpower resources to facilitate effective implementation of solid waste programmes.

1980

12.4 Each country should create an agency for management of solid wastes, either as a separate entity, if the size of the country justifies it or as a section of the Ministry of Health. The agency must have authority to engage suitably qualified engineering, technical, administrative and other appropriate staff to carry out its functions and be provided with an adequate budget for its operations.

1980

12.5 Each agency should take steps to ensure that solid waste produced by any source in the country is safely disposed of, without posing an environmental health hazard, by adoption of measures suitable for urban, rural and isolated communities.

1980

In particular, the agency should be able to perform the following functions:

- (i) collect and make inventory from basic information on the source, quantity and characteristics of solid waste including the potential impact upon the environment.

- (ii) **decide on a feasible method of collection, establish routes and frequencies, and ensure that adequate manpower, equipment, vehicles and other sources necessary to produce a satisfactory service are present. Where possible, equipment and vehicles should be standardised in order to avoid the problem of replacement of spares.**
- (iii) **evaluate existing methods of solid waste disposal and effect necessary changes where indicated.**
- (iv) **carry out research and detailed studies into alternative methods of solid waste disposal including visits and familiarisation with similar projects rather than relying solely on published information.**  
1980
- (v) **engage in the following:**
  - (a) **a study in co-operation with interested Governments, of alternative methods of solid waste disposal which may be suitable in certain instances.**  
March 1980
  - (b) **the construction of one or more pilot plants as indicated feasible by the study.**  
Sept. 1980
  - (c) **the monitoring of pilot plants**  
1982
  - (d) **the drafting of guidelines for design, construction, operation and maintenance.**  
March 1982
- (vi) **in collaboration with the Ministries responsible for Education and other relevant agencies, to initiate public health education programmes to inform the inhabitants of the risks and health hazards posed by the employment of careless solid waste collection and disposal practices.**  
1980
- (vii) **use its influence to ensure that health education programmes are designed to provide suitable information for all communities whether urban, rural or isolated.**
- (viii) **prepare training programme for upgrading the skills of personnel at all levels so as to achieve full utilisation of manpower and efficient personnel management.**
- (ix) **make an accurate assessment of the costs of the services which are rendered to various types of users, and consider the institution of fees when and where appropriate. Revenue generated from a solid waste programme should be fed back into the service. Funds from this source would be utilised to finance manpower development along with other expenditure.**  
1979
- (x) **make recommendations to strengthen existing health rules and regulations to conform with modern standards and practices, and to establish criteria for the storage, collection and disposal of solid waste.**  
1980

**12.6 Each Government will establish a working relationship with community groups in order to secure their active and sustained participation in all aspects of solid waste disposal programmes. Contact with those groups could be through the health educators, community development officers and other persons who normally work with community groups.**

**1980**

**12.7 Existing solid waste management systems are not self-supporting, but it is necessary that attempts be made to make them at least partly so.**

As a consequence, each country should analyse its solid waste operations carefully, in order to determine where it is feasible to institute the payment of fees. In addition, an approach should be made to lending agencies to point out the need for involvement in effective solid waste management programmes in order to effect meaningful improvements in the quality of life.

**1979**

**12.8 Each country should examine its proposals for environmental health development, including solid waste management, and decide on the best method of securing public health engineering expertise in the various areas which are now under study. The following procedure lends itself to easy implementation:**

- (a) provide engineering and support staff to the Ministry of Health to enable it to exercise regulatory powers in solid waste management and indeed, all areas of environmental health;**
- (b) where the need has been demonstrated, but financial limitations prevent employment of staff, then seek financial assistance for a regional shared service under a technical assistance programme for a limited period, with some local contribution for the establishment of a solid waste programme.**

**1979**

### **13. INDUSTRIAL WASTES, PESTICIDES, BEACH POLLUTION**

**13.1** It is recognised that there is a definite need to devise a multisectoral framework for ensuring adequate management of the environment with respect to industrial wastes, beach pollution and pesticides.

**13.2** Each Ministry or Department of Health shall put up proposals to Government for establishing a committee composed of personnel from legal, agricultural, health and other relevant ministries to undertake, as a matter of priority, a thorough review of all pertinent legislation in the Region with a view to:

- (i) identifying the gaps in existing legislation;
- (ii) updating the legislation in the light of new knowledge in the short term;
- (iii) redrafting all the relevant legislation in the long term, and
- (iv) establishing guidelines and standards for maintaining a healthy environment, specifically to:
  - (a) control
    - (i) the use of pesticides
    - (ii) the excessive use of fertilisers on land to prevent the inordinate increase of nitrate nitrogen in water resources;
  - (b) prevent pollution of catchments, rivers, and water courses from toxic effluents of any kind from industrial plants, and set limits to the level of any toxic elements in any effluent;
  - (c) control the discharge of industrial effluents to public sewers, where these exist or are to be built, and authorise appropriate charges for conveyance and treatment;
  - (d) compel an industrial developer to treat toxic industrial wastes before discharge, and until it complies with biochemical oxygen demand and suspended solid standard set, or by any method of pollution assessment that may be devised.

February 1979

**13.3** The CARICOM Secretariat shall alert Member Countries to the existence of the advisory capabilities in the area of pesticides at CARDI, Trinidad, and further urge those Member States who have not already done so, to utilise this facility for obtaining expert advice on:

- (a) the contents of relevant legislation, being considered for enactment;
- (b) setting up the machinery necessary for implementation of pesticide control measures.

1982

**13.4** The pollution of the beaches and territorial waters of the countries within the Caribbean both by liquid and solid wastes and also by oil and ship discharges, threaten the

quality of the beaches and are inimical to the marine ecosystem in coastal zones. This can adversely affect the health, economic viability, and food resources of the Region, so it is recommended that the following procedures be adopted.

13.5 Each country should take the necessary steps to ensure that wastewater is only discharged to the sea through diffusers on long outfalls, after it has been at least screened and comminuted. Preferably, it should be subjected to primary treatment and disinfection.

In addition, the outfalls should be on sites where detailed studies of wind direction and current flows have established that the discharges will flow seaward, thus minimising the possibility of pollution of the beach or coastal waters.

1985

13.6 Each Government should take steps to support the formulation of international agreements to control pollution of the sea generally and in particular the Caribbean Sea, specifically to conduct research into the pollution from land-based sources, oil discharges, toxic and radioactive materials and their effects on marine life.

1982

13.7 Each Government, and especially those with interest in the fish and shellfish industry, should initiate action to protect fish and shellfish from harm that can be traced to toxic chemical or other industrial discharges, dumping of liquid or solid waste and sludge, by creating regulatory agencies. It is also proposed that the training of nationals to acquire knowledge of the marine environment be pursued with some diligence.

1982

13.8 Each Government should urge the United Nations and appropriate specialised agencies, such as the International Oceanographic Commission, to initiate immediately steps to control the discharge of pollutants such as oil from vessels engaged in international commerce.

1980

13.9 Each Government shall take cognisance of the Joint UNEP/ECLA Caribbean Environment Project (CEP) which was designed to develop a Plan of Action by 1980 for management of the total environment in the wider Caribbean and given active support to this project, during the development of the plan and in the evaluation and implementation phases.

1979

13.10 A necessary prerequisite to the prevention of serious environmental degradation in the Caribbean and the consequent deterioration of the health of the population, is the adoption of a clear-cut policy vis-a-vis the effects of industrial and agricultural development. Each Government shall, therefore, take a policy decision to:

- (i) approach international funding agencies for financial assistance in the form of loans and/or grants to be managed by the Caribbean Development Bank, specifically for the funding of Environmental Health Projects;
- (ii) ensure that in industrial and agricultural project proposals, sufficient attention is given to the environmental implications of the particular development;
- (iii) ensure that when dealing with any type of development and/or construction project which may adversely affect the environment, an environmental impact assessment is undertaken promptly in order to be satisfied that all the real costs of the project are borne by the developer/construction agent.

1979

13.11 Ideally, in order to implement this policy, the following specialist personnel would be required in the subject areas indicated, but not all at the same time. They should work in multi-disciplinary teams, the composition of which would depend upon the problems to be studied.

**(i) Impact of Industry on Health and the Environment (including industrial waste)**

- Public Health Engineers
- Industrial/Chemical engineers
- Ecologists
- Marine Biologists
- Public Health Personnel (epidemiologists)
- Environmental Engineers and Scientists
- Behavioural Scientists (Anthropologists/sociologists)
- Vector Biologist
- Information Systems/Communications Specialists

**(ii) Chemical contamination of Environment — Health effects of chemical and pesticides.**

- Toxicologist/epidemiologist
- Entomologist
- Analytical chemists
- Sanitary inspectors for monitoring educators and extension officers

**(iii) Other Consultants**

- Meteorologist
- Oceanographer
- Geographer
- Forestry experts
- Soil engineers
- Hydrologists
- Biology/Zoology specialists
- Veterinarians

## 14. COMMUNITY PARTICIPATION AND EDUCATION

14.1 It is known that most Governments have established ministries which deal with social affairs, co-operatives, education, community development; and public health education is undertaken by the Ministry of Health. It is proposed that priority must now be given to the promotion and strengthening of health education services, and the establishment of closer co-operation not only between the social development and community organisations, but also with those responsible for industrial and economic development.

14.2 Each Government should, therefore, set up a committee of staff members working in the various subject areas mentioned above, to liaise with the environmental health agencies in order to prepare specific programmes for community health education and the active participation of all sections of the community, within the limits of their technical capabilities, in environmental health programmes.

1980

14.3 Each country shall ensure that the education of communities in environmental health matters becomes an integral part of the national education policy. These should take the following forms:

- (a) the inclusion of environmental health education subjects on the curricula of all schools throughout the Region.

September 1981

the inclusion of environmental health education on the curricula of all Teacher Training Institutions in the Region.

September 1980

the inclusion of the subject of Environmental Health on the list of subjects to be examined by CXC at the end of all secondary schools programmes.

September 1981

- (d) the active encouragement of service and/or voluntary organisations to promote community education and participation in environmental health, and the establishment of an effective communication system between environmental health agencies, and all civic and service organisations.

1979

14.4 In order to generate general awareness and to involve the public in the Environmental Health Strategy, each Government should plan a public education programme in environmental health to be commenced in June 1980, ideally on World Environmental Day.

14.5 It is emphasised that the success of any programme being formulated depends upon its complete acceptance by the community which is to benefit from its implementation. It is, therefore, wise to obtain their involvement as early as possible.

14.6 Governments should encourage community participation in all environmental health activities from the conceptual stage through implementation, and make serious efforts to maintain their continued support.

1979

## 15. REGIONAL PROGRAMMES

15.1 In the initial stages at least, the indications are that the regional and sub-regional programmes should be limited to those considered absolutely necessary for achieving effective utilisation of available resources.

15.2 Some of the projects that meet the above criteria are:

- (a) Manpower Development and Training of environmental health personnel;
- (b) Establishment of a Commonwealth Caribbean Environmental Health Institute;
- (c) Public Health Engineering Units to serve a group of countries until each country is able to support its own administrative structure;
- (d) Technical co-operation as outlined in Strategy 10.5;
- (e) Water Quality Laboratory Service as detailed in Strategy 10.10.

15.3 Responsibilities of the proposed organisations have been proposed in the strategy. These are not by any means exhaustive, and their forms and structure are matters for detailed study by the organisations responsible for implementation, acting in consultation with the various Governments.

15.4 The Lesser Developed Countries have been experiencing difficulties in obtaining funds to install wastewater collection and disposal systems. In at least two countries feasibility studies and plans have been prepared for implementation. In these cases there is ample justification for the installation of these facilities, and as is well known, while negotiations continue, the cost of implementation escalates steadily. A determined effort should, therefore, be made to find a solution to the problem.

Each country should, therefore, ask the CARICOM Secretariat and PAHO/WHO to meet with organisations which are interested in environmental health development in the Caribbean, in order to investigate the problem outlined above, prepare guidelines and suggest concrete proposals for obtaining financial support which can be applied regionally.

15.5 As a matter of priority, an inventory of resources, personnel, and facilities is crucial for the further development in the field of environmental health in the Caribbean.

In order to facilitate this exercise, a specialist (or, preferably a small group of specialists) should be engaged to compile the inventory of personnel and facilities. The terms of reference of this individual (or group) should include:

- (a) soliciting the support of existing institutions operating in the Region with the view to obtaining information regarding regional resource personnel, facilities, and
- (b) making recommendations on:
  - (i) the establishment of an appropriate data collection system;
  - (ii) the establishment of a formal system for monitoring environmental factors in an effort to assess environmental quality and an infrastructure to provide for the enforcement of legislation;
  - (iii) the establishment of a data bank consisting of:

- an inventory of resource personnel;
  - an inventory of resource of technical facilities;
  - an inventory of technical data based on the documented experiences of other countries;
- (iv) the phasing of manpower absorption based on the examination and projection of needs, manpower training, and the short-term use of manpower from outside the Region where necessary;
- (v) the development of a surveillance system for on-going monitoring of environmental health indicators and of impacts;
- (vi) the establishment of a system for monitoring and prevention of adverse health effects in respect of personnel involved in the regular use of pesticides, as well as its impact on the ecosystem;
- (vii) the development of a phased project based on priority needs giving due consideration to the financial implications in terms of capital and recurrent expenditure.

15.6 It is important that both of the above recommendations should be reviewed and evaluated in the context of cost-effective considerations, both short term and long term.

1980

15.7 Each Government will participate in and meet the local expenses within its own country of a biennial review of environmental health improvement, the status of programmes and degree of accomplishment, by the Caribbean Community Secretariat, Pan American Health Organisation/World Health Organisation and representatives of Agencies contributing to environmental health development.

Starting date: 1981

## 16 . CARIBBEAN ENVIRONMENTAL HEALTH INSTITUTE

**16.1** Each country should request the Secretary-General of the Caribbean Community Secretariat to consult with the Pan American Health Organisation/World Health Organisation, United Nations Environment Programme, University of the West Indies, University of Guyana, and other interested United Nations agencies to initiate action on the establishment of a Commonwealth Caribbean Environmental Health Institute, with initial responsibilities for the promotion of safe environmental health conditions in the area. The organisation will be responsive to the needs of CARICOM Governments who are to contribute to its upkeep. Its aim and objectives should be as follows:

- (i) Assessment of present environmental conditions by, for example, undertaking baseline studies in land, sea and air.
- (ii) Training of regional personnel in environmental health particularly in the LDCs, and
  - (a) identifying manpower and training needs in the Region;
  - (b) proposing manpower development and training programmes in management, engineering, technical and operational grades to ensure a constant supply of workers.
- iii) (a) Providing expert advice on measures to be taken to prevent pollution of the environment from any source, and for its protection specifically in the areas of water supply, liquid and solid wastes, pesticides and beach pollution.
  - (b) Recommending for adoption model legislation and administrative structures of organisations, for effective local or sub-regional management in these areas.
- (iv) Carrying out research and technical studies in hydrology, water resource development, planning, use of local materials and any other relevant matters.
- (v) Identifying a regional pool of experts in environmental health.
- (vi) Providing technical assistance in undertaking feasibility studies and preparing projects for financial assistance.
- (vii) Developing environmental health information systems and education programmes, both general and technical, in order to create public awareness by increasing the spread of knowledge.
- (viii) Preparing guidelines for regional action to deal with major and minor oil spills in, and to prevent continuing pollution of the Caribbean Sea by uncontrolled dumping of wastes.
- (ix) Designing model environmental health legislation for the Caribbean countries.
- (x) Any other relevant function.

**16.2** However, there is the need for a detailed feasibility study on the Environmental Health Institute. Hence, the Caribbean Community Secretariat should:—

- (i) Prepare profiles on regional institutions in the Caribbean and Latin America concerned with the delivery capability in environmental health services of management, training, education, research, information, community participation, planning and impact assessment, in relation to environmental health.

March 1979

- (ii) Appoint consultants, preferably experts from the Caribbean in environmental health, to prepare working documents on possible alternative models for a suitable Caribbean Environmental Health Body. These consultants should:-

- (a) Study available facilities in the Region, including those in St. Lucia, which can be utilised for the establishment of an Environmental Health Institute;
- (b) Assess the needs of the Caribbean Region, with particular emphasis on the LDCs, in the environmental health area;
- (c) Consider the scope and functions of a strategically located Caribbean Environmental Health Institute or focal point for co-ordinating and assisting in regional development in environmental health;
- (d) Suggest roles for major institutions in the Region which are engaged in related activities to form an environmental health network;
- (e) Indicate present and possible sources of funding for the planned development of environmental health programmes in the Caribbean Region with special attention to the Caribbean Environmental Health Institute.
- (f) Prepare a report on their findings and make recommendations.

May 1979

**16.3** If the feasibility reports indicate that the establishment of the Environmental Health Institute is feasible, then each Government should take urgent action to ensure that the Institute becomes operational, as an essential part of the regional environmental health network.

1981

## 17. IMPLEMENTATION

17.1 In environmental health and sanitation as in any other area, if effective achievements are to be made, certain basic conditions must be fulfilled. In this instance, three of them have been selected:

- (a) The participating Governments must firmly express their intentions to provide sanitary facilities in clear policy statements.
- (b) Money must be made available.
- (c) The prospective users must wish and see the need for sanitary facilities, that is, there must be community participation and acceptability.

17.2 Admittedly, it is increasingly difficult to get all these conditions present. The question of the setting of priorities, costs of implementation compared to anticipated achievements, and the real difficulties of assessing improvements in the quality of life often defy easy acceptance.

17.3 However, the environmental health problems will not simply disappear. In fact, they will worsen, if not tackled with vigour. It is therefore suggested that the CARICOM Secretariat should:

- (a) invite Member Governments to approve:
  - (i) the provisions of the Strategy and publish policy statements on environmental health;
  - (ii) the formation of a Caribbean Co-ordinating Working Group for Environmental Health to implement the provisions of the Strategy, and to generally play a catalytic role, at least initially, in all environmental health activities in the area.
  - (iii) The group will consist of representatives of CARICOM Member States, Caribbean Development Bank, Pan American Health Organisation/World Health Organisation, UNEP/ECLA Caribbean Environment Project, and other Agencies as may be considered appropriate;
- (b) carry out investigations into the activities of Aid Agencies and donor countries in an attempt to find out what monies can be made available to environmental health programmes and on what terms. This information will then be transmitted to Governments with such recommendations as are considered necessary;
- (c) assist in obtaining management and engineering expertise in project planning, preparation, and supervision of construction when requested by Governments;
- (d) supply to Governments, for implementation, details of proposals in the Strategy of a regional or national nature.

17.4 Member Governments should adopt the Strategy and take indicated measures to implement its provisions subject, of course, to any alterations to suit local conditions that may be considered necessary.

## **18. PLAN OF ACTION FOR CARICOM MEMBER COUNTRIES**

**18.1 In order to facilitate action to implement the Strategy proposals, Member Countries are being requested to take the steps indicated below:**

- (i) Adopt a firm policy to pursue at the regional and national levels, improvements in environmental health designed to achieve specified goals in water supply, liquid waste and excreta disposal, solid waste, industrial waste, beach pollution and pesticides.**
- (ii) Provide financial and other logistics support, as a matter of urgency for the following activities:**
  - (a) a Caribbean Training Programme for improving the technical and managerial capability, and the skills of all workers in the environmental health sector;**
  - (b) an in-depth study into all the implications of the establishment of a Caribbean Environmental Health Institute.**
- (iii) Agree to the establishment of a Co-ordinating Working Group in Environmental Health which will stimulate regional efforts in the implementation of the Strategy proposals, and lay the basis for Caribbean collaboration in environmental health management in the Region.**
- (iv) Participate in the preparations for, and support the establishment of, a Caribbean Environmental Health Institute which will prepare and implement improvement programmes in training, management, research, monitoring, engineering design and project preparation, legislation and any other relevant topic.**
- (v) Adopt a plan designed to eliminate the outstanding national environmental hazards using the resources available, and seeking assistance either bilaterally or regionally from donor countries or lending agencies to supplement these resources. For example, the Strategy proposals made in 10.1 and 11.6 are achievable, and absolutely crucial to the achievement of a healthy community.**
- (vi) Include environmental health topics in the entire educational system and use other suitable methods to inform the public, and thus obtain their full participation in the implementation of environmental health programmes.**
- (vii) Recognise the need for, and ensure the provision of environmental health assessments in national development planning, and industrialisation programmes.**

## CONCLUSION

As a conclusion, the following quotation\* is made for study:

**"One of the major priorities for extending sanitary facilities and hygienic practice is to raise the level of human health, to prolong life, and to prevent the ever present insults to safe and comfortable existence. In these objectives, we must be eternally reminded that man is an endangered species in the regions of present concern, by a host of familiar and unfamiliar environmental hazards long conquered or unknown in the highly developed world.**

The fact is illustrated, even if over-simplified, by the record that infections, parasitic, and respiratory diseases account for 43.7% of all deaths in developing countries. Only 10.8% occur in developed regions. A contrary picture appears with cancer and diseases of the circulatory systems. They are slowly increasing even in less favoured countries. In the latter, they account for 18.5, while in industrialised areas they represent 47.4% of all deaths.

Reduction or elimination of cholera, typhoid, dysentery, residual diarrhoea, protozoal disease, flies and mosquitoes remain the major battle grounds for the sanitarian for a long time to come. Promise of more effective vaccines, antibiotics, and drug therapies does little, even if successful, to eliminate the necessity of literally "building out" these diseases and their vectors by sanitary facilities and their understanding use".

**\*Abel Wolman  
The Johns Hopkins University  
Baltimore, Maryland,  
U.S.A.**

**ENVIRONMENTAL HEALTH STRATEGY  
CONFERENCE/WORKSHOP, GRENADA  
9 - 13 OCTOBER 1978**

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**Mr. N. Carefoot** — Project Manager  
Caribbean Basin Water Management Programme



## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

### APPENDIX II

Country: Antigua

	General Conditions	Remarks
Water Supply	Water source: surface water dams and well. Coverage 40% house connection, 56% standpipe, 4% individual catchment proposals for replacing mains over 50 years.	Extension of supplies to development areas, dams, treatment works, transmission mains estimated EC\$13 million. US\$.5 million tentative amount for loans (CDB).
Sewage Excreta Disposal	Served by septic tanks and pit and bucket latrines in St. John's; 15% rural populations not served, 6 package sewage treatment plants in operation.	Central wastewater collection and disposal system necessary for St. John's; tentative \$1.5 M. US earmarked by CDB.
Solid Waste Management	Crude tipping in lowlands, project bulldozer assigned to Ministry of Works, not usually available. Collection inadequate, need more vehicles.	Need some management improvements, authority to start rate collection and more autonomy by Ministry in operation.
Recognition and control of environmental hazards	Limited beach pollution due to discharge of inadequately treated sewage from package treatment plants. Oil pollution on several eastern beaches. Pollution at marines from live-abroad watercraft.	Criteria, guidelines and standards of bathing water and of design operation and maintenance of package sewage treatment plants are needed. Holding tanks and other devices needed for live-aboard watercraft.
General information Population: 72,400 Area: 442 Km <sup>2</sup> Density: 158/sq. Km <sup>2</sup> Natural rate of increase: 1.4%		

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

### APPENDIX II

Country: Bahamas

#### General Conditions

#### Remarks

#### Water Supply

Ground water, shallow slit wells.  
Urban areas: 90% population,  
house connections (H.C); 10%  
standpipe.  
Rural areas: 35% H.C, 40%  
standpipe.  
Salinity: high, 20-55% more  
than 600ppm.

Water chlorinated, not  
filtered. Estimated 100 samples  
collected monthly.  
Bacteriological and salinity  
analyses. Government supplies  
75% positive, private 68%  
Reverse osmosis desalination  
plant provides 0.5 million gallons  
daily.

#### Sewage Excreta Disposal

Urban areas: public sewer and  
septic tanks 97%; 3% served by  
privies.

No figures available for rural  
areas (Family Islands). New  
Providence requires wastewater  
system, treatment and disposal.

#### Solid Waste Management

New Providence: New  
pulverisation plant completed;  
acceptable landfill.  
Grand Bahamas (Freeport area):  
landfill and burning; marginal.  
Family Islands: burning and  
small open tips. Some marginal.  
50% of premises without storage  
containers.

New Providence:  
Staffing/management of  
pulverisation plant need  
strengthening. Plant still being  
de-bugged. Fee paying system  
instituted.

#### Recognition and control of environmental hazards

Sewage disposal into deep wells,  
720' deep poses risks to  
underground water supplies.  
Littering and unauthorised  
dumping of solid waste  
widespread. Oil pollution of  
beaches observed.

Wastewater collection, treatment  
and disposal systems required to  
eliminate risk of pollution of  
water supplies. Good solid waste  
management practices should be  
instituted. Oil Pollution regional  
problem.

#### General information

Population: 24,000 (1977)

Area: 13,934.1 Km<sup>2</sup>

Density: 10.7/Km<sup>2</sup>

Natural rate of increase: 3.5% (1975)

DEPARTMENT OF HEALTH  
 BARBADOS  
 WATER SUPPLY  
 AND SEWERAGE  
 DIVISION  
 ST. JOHN'S

**SUMMARY**  
**COUNTRY PROFILE**  
**ENVIRONMENTAL HEALTH ASSESSMENT**

**APPENDIX II**  
**Country: Barbados**

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Water Supply	General Conditions	Remarks
Sewage Excreta Disposal	Coverage: 76% house connection and 24% standpipe throughout Barbados, 100% access in rural areas. Source: ground water exclusively, leak detection survey in progress.	Main water problem: protection of ground water. Sources: salinity on the increase in wells on the West Coast. Nitrate level 20-30 mg/l
Solid Waste Management	Complete coverage in urban and rural areas by septic tanks and pit latrines and suck wells - over-flow of septic tank in drainage gutters.	Pollution of ground water from sewage and pit latrines. Inadequate maintenance of package sewage treatment plants. Wastewater collection and disposal system for Bridgetown; tenders called for.
Recognition and control of environmental hazards	Improper storage of refuse, dumping in alleyways - main solid waste shredder under construction.	Inter-relationship and management problems, proper utilization of modern collection fleet is the weakest point. Solid waste from cruise ships dumped at sea.
General information Population: 245,000 Area: 431 Km <sup>2</sup> Density: 568/Km <sup>2</sup> Natural rate of increase: 0.6%	Signs of beach pollution due to discharge of untreated or inadequately treated sewage into coastal waters. Oil pollution extensive on beaches on the east side of island.	Criteria, guidelines and standards of bathing water quality and of design, operation and maintenance of package sewage treatment plants.

DEPARTMENT OF ENVIRONMENTAL  
HEALTH AND SAFETY  
MINISTRY OF HEALTH  
BELMOPAN, BELIZE  
GENERAL INFORMATION

DEPARTMENT OF ENVIRONMENTAL  
HEALTH AND SAFETY  
MINISTRY OF HEALTH  
BELMOPAN, BELIZE

**SUMMARY**  
**COUNTRY PROFILE**  
**ENVIRONMENTAL HEALTH ASSESSMENT**

**APPENDIX II**  
**Country: Belize**

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**Water Supply**

**General Conditions**

**Remarks**

Source: wells, rainwater catchments Coverage: 45% urban, 25% rural population served.  
Belmopan: 100% house connection

CIDA proposals for extension being considered for implementation. Improvement in chlorination service required. Revision of rate structure.

**Sewage Excreta Disposal**

Sewage disposal poor in urban area and rural areas. High percentage without any facility.

Discharge of sewage in canal creates septic conditions in Town. Could be improved with Community effort -- need latrine programme.

**Solid Waste Management**

Improper disposal and collection of solid wastes, storage adequate, collection irregular.

Application for better management principles. Site preparation, equipment acquisition required, financial support needed. Difficulty experienced in obtaining spare parts for vehicles, major overhaul of maintenance operations indicated.

**Recognition and control of environmental hazards**

Beach pollution from discharge of liquid and solid wastes into canals leading to the sea.

Public information programmes required, also revision of health legislation to control major waste discharges.

**General information**  
Population: 140,000  
Area: 22,965 Km<sup>2</sup>  
Density: 6/Km<sup>2</sup>  
Natural rate of increase: 3.1%

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Bermuda

	General Conditions	Remarks
Water Supply	Mainly individual household tanks supplied by own roof catchment. Supplemented by trucked supplies from Government or private licensed wells. Desalination plants at a number of commercial establishments. Piped brackish water available in some parts of the Island for non-potable purposes.	Water Authority set up under provisions of the Water Resources Act 1975 to control exploitation of ground water resources. Drinking water standards revised and updated. Well water supplies under regular surveillance by Government.
Sewage Excreta Disposal	Mainly individual household cesspits. Cities of Hamilton and St. George, and certain other areas are sewered; sewage discharged to sea.	Pollution control regulations proposed to protect ground water resources. Present sewage treatment and disposal standards under review.
Solid Waste Management	Regular organized collection and disposal service by P. W. Dept. Refuse subjected to pulverisation treatment, deposited on inland dump. Intermittent pollution and nuisance problems.	Revised methods needed to reduce bulk of deposited material and extend dump life.
Recognition and control of environmental hazards	Some residential areas lack adequate water storage facilities, flush toilets and proper sewage disposal. Increasing nitrate levels in ground water supplies. Oil pollution on beaches. Vector (mosquito) control.	Housing up-grading proposals under active consideration. Long-term extension plans for certain sewered areas. Nitrate levels in ground water supplies closely monitored. Studies continuing into oil pollution and control. Maintenance of "Aedes aegypti-free" PAHO certification.
General information Population: 56,000 Area: 21 sq. miles Density: 2,666/sq. mile Natural Increase: 0.8%		

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SECRETARY OF STATE  
ST. JOHN'S, DOMINICA

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Dominica

	General Conditions	Remarks
Water Supply	Coverage: 24% house connection; 56% standpipe — EC\$4.6M. spent Phase I and II — master plan. Additional \$1.0M. required for completion. Phase II — watershed management problem — high incidence waterborne disease.	EC\$10.0M. for Phase III. Total programme calls for 22 water supplies to cover 97% — population (1993). Need improvement watershed management and quality control. US\$0.79M. period — 1973-77, (CDB) US\$75.0M. projected Phase II.
Sewage Excreta Disposal	Estimate 10,000 houses without any facility — sewage system in Roseau discharges in coastal waters without treatment.	Extension of central sewage facility for Roseau and Portsmouth indicated. Secondary treatment for wastewater Canefield and Goodwill.
Solid Waste Management	Poor collection and disposal practice — lack of equipment. Dump near sea along road — Roseau.	Need landfill improvement practices. Relocation of disposal site serving Roseau.
Recognition and control of environmental hazards	Pesticide problems. Limited beach pollution due to poor solid waste and untreated sewage discharge.	Guidelines for controlling the use of chemicals in agriculture.
General information		
Population:	75,000	
Area:	751 Km <sup>2</sup>	
Density:	100/Km <sup>2</sup>	
Natural rate of increase:	1.1%	

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Grenada

UNEP/WHO/UNEP  
ENVIRONMENTAL HEALTH ASSESSMENT  
PROGRAMME  
Phase I: 1985-1986  
Phase II: 1987-1988  
Phase III: 1989-1990

#### General Conditions

#### Remarks

#### Water Supply

All supplies from surface water and springs — small dams and reservoir provide inadequate storage — 50 year-old distribution systems — high water loss — 88% coverage — 38% house connect. — 50% standpipe.

Reforestation and erosion problems, inadequately treated water storage, sophisticated water plant does not function properly at times, maintenance problems.  
\$5.0M. improvement programme being financed by CIDA and CDB.

#### Sewage Excreta Disposal

Existing sewage system discharge through outfall — package sewage treatment — plant not operating satisfactorily, long standing problems — poorly constructed latrines in rural areas.

Old sewage ejector needs replacement, outfall broken, discharge sewage close to shore — Grand Anse area need central sewage system, feasibility study completed — septic tanks cleaned manually, tanker available but defective.

#### Solid Waste Management

Five dump sites — poor siting and planning — dumping at sea — no heavy equipment.

Inadequate number of collection vehicles, indiscriminate dumping of refuse in drains reported. Improved method of solid waste management badly needed.

#### Recognition and control of environmental hazards

Visual beach pollution due to discharge of inadequately treated sewage from package treatment plants and outfalls. Solid waste dumped into coastal waters.

Criteria, guidelines and standards of bathing water and of design, operation and maintenance of package sewage treatment plants.

#### General information

Population: 96,000  
Area: 344 Km<sup>2</sup>  
Density: 279/Km<sup>2</sup>  
Natural rate of increase: 0.4%

REMARKS

THIS IS A SUMMARY OF THE  
 INFORMATION CONTAINED  
 IN THE REPORT OF THE  
 ENVIRONMENTAL HEALTH ASSESSMENT  
 FOR GUYANA

**SUMMARY**  
**COUNTRY PROFILE**  
**ENVIRONMENTAL HEALTH ASSESSMENT**

**APPENDIX II**  
**Country: Guyana**

**General Conditions**

**Remarks**

**Water Supply**

Coverage: 96% urban, 72% rural, severe water problems in Linden area.  
 Difficulty experienced in financing development plans; poor quality control in rural areas.

Severe operation and maintenance problems; new filter for iron removal not operating properly. Evidence of water shortage in Georgetown mainly due to power supply problems.

**Sewage Excreta Disposal**

Sewerage system, Georgetown old, (30%). Pipes in poor condition. Other part of town septic tanks discharging in drainage canal, 7% not served.

Feasibility study for extension of sewerage carried out. Cannot be implemented due to lack of funds.

**Solid Waste Management**

Old dilapidated incinerator, sanitary landfill right in middle of city — poor site management, New Amsterdam and Linden.

Several studies carried out but no implementation due to lack of funds.

**Recognition and control of environmental hazards**

Dust pollution in bauxite processing area — industrial waste from sugar and rum manufacture disposed in trenches. A few factories under construction.  
 Increased use of pesticide in rice industry.

Very high cost of electro-static precipitator makes improvement not possible.  
 Other methods less effective and cheaper could be considered — public health personnel need upgrading to deal with environmental problems.

**General information...**

Population: 809,000  
 Area: 214,969 Km<sup>2</sup>  
 Density: 4/Km<sup>2</sup>  
 Natural rate of increase: 2.2%

ENVIRONMENTAL

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Jamaica

	General Conditions	Remarks
Water Supply	Coverage 98% house connection in Kingston. 36% house connection in rural areas. 50% through standpipe — have special water quality inspectors. Rural water programme in planning.	Total expenditure in construction totalled \$25.6M. outside Kingston — 15% external financing (IADB) Kingston \$24.1M. five-year period. Major problems in operation and maintenance.
Sewage Excreta Disposal	15% coverage in Kingston. Sewage system also in Montego Bay. Over 70 small package plants in operation — 5% without access sanitary facilities.	Sewage extension project in progress; poor operation of small sewage treatment plants; training of operations personnel urgent.
Solid Waste Management	Indiscriminate dumping in some areas — poor planning of disposal sites — operation and labour problems.	No clear assignment of authority for planning in Kingston — comprehensive solid waste plan being commissioned — poor public attitude re dumping of waste.
Recognition and control of environmental hazards	Industrial waste problems with bauxite-alumina plants. Some beaches in vicinity of Kingston highly polluted from untreated sewage in Kingston harbour.	Have created Environmental Control Division and Natural Resources Conservation Department for environmental management — Regulations require sewage discharge beyond reef line in coastal areas. Secondary sewage treatment needed for Kingston.
General information		
Population: 2,014,000		
Area: 10,991 Km <sup>2</sup>		
Density: 183/Km <sup>2</sup>		
Natural rate of increase: 1.7%		

STATE OF JAMAICA  
COMMUNITY DEVELOPMENT

21/11/71

DEPARTMENT OF HEALTH  
BATHSTON, MONTSERRAT  
VISIT: 201 1111  
POPULATION: 12,160  
GENERAL INFORMATION

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Montserrat

DEPARTMENT OF HEALTH  
BATHSTON, MONTSERRAT  
VISIT: 201 1111  
POPULATION: 12,160  
GENERAL INFORMATION

#### Water Supply

**General Conditions**  
Coverage: 70% with access — development programmes. Presently extending storage capacity. Source — wells and springs.

**Remarks**  
No increase in population, Development programme financed by CIDA. Cost EC\$7.5M. estimated cost for extending distribution system EC\$3.75M

#### Sewage Excreta Disposal

Septic tank and pit latrines only — 24% without facilities.

Need a programme for rural excreta disposal. Sewerage system should be considered for Plymouth.

#### Solid Waste Management

Sanitary landfill — operation satisfactory — bulldozer available.

Good example of solid waste management for small islands.

#### Recognition and control of environmental hazards

Localized beach pollution reputed from poor excreta disposal practice and oil.

Revision of Health Legislation required.

#### General Information

Population: 12,160

Area: 98 Km<sup>2</sup>

Density: 133/Km<sup>2</sup>

Natural rate of increase: 1.6%

DEPARTMENT OF HEALTH  
BATHSTON, MONTSERRAT  
VISIT: 201 1111  
POPULATION: 12,160  
GENERAL INFORMATION

DEPARTMENT OF HEALTH

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: St. Kitts/Nevis/Anguilla

#### General Conditions

#### Remarks

#### Water Supply

Coverage 40% house connection;  
50% standpipe. Source: surface  
water and wells — water being  
trucked in Nevis, rural waters not  
treated; chlorination needed.  
Shortage of water in dry season.

Have master plan for  
development. CIDA assistance  
EC\$4.2M. — ground water  
investigation Basseterre UNDP  
project — new wells with CIDA  
assistance.

#### Sewage Excreta Disposal

Mainly septic tank and pit  
latrines — 2 sewage treatment  
plants for hotels.  
Coverage: 80% septic tanks.  
Latrine — 9% not served.

\$1M. projected amount  
involvement CDB — water  
department needs more  
autonomy. Converted slow sand  
filter to rapid sand-algae  
problems in sedimentation tank.

#### Solid Waste Management

Collection satisfactory — crude  
dumping in mangrove swamp.  
Site management needs  
improving.

Have on-going latrine programme  
— need planning for development  
Basseterre — developer taking  
piecemeal approach for sewage  
disposal.

#### Recognition and control of environmental hazards

Need Regulations for approval of  
subdivisions with agricultural  
development; ground water  
resources needed monitoring —  
other wastes — brewery and soft  
drink manufacture.

Six vehicles provided by CIDA.  
Twenty acres of mangrove areas  
filled may have environmental  
impact.

#### General information

Population: 66,000  
Area: 357 Km<sup>2</sup>  
Density: 184/Km<sup>2</sup>  
Natural rate of increase: 0.3%

Staff needs further training to  
deal with environmental matters  
— need basic water quality  
laboratory.

DISTRICT: ST. LUCIA  
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**SUMMARY**

**COUNTRY PROFILE  
ENVIRONMENTAL HEALTH ASSESSMENT**

**APPENDIX II  
Country: St. Lucia**

	<b>General Conditions</b>	<b>Remarks</b>
<b>Water Supply</b>	Coverage: house connection 34%; standpipe 42%. High pumping cost — severe water restriction in dry period.	Increased rate of deforestation 1973-77 water supply loan — CDB US\$428,000. Project Bank Involvement Phase II — \$500,000; shortage of skilled manpower; need to improve chlorination; development of Vieux Fort affected by water.
<b>Sewage Excreta Disposal</b>	Sewage system in small section of Castries — discharging in harbour; Hotel with small package plants poorly operated.	Extension of Castries system — required — CDB approved \$388,000. Problem with 250-bed hospital sewerage; septic tank system in unsuitable soil causing pollution — Rockefeller Foundation funding latrines programme for control of Bilharziasis — suitable for general use.
<b>Solid Waste Disposal</b>	Within Castries collection fairly good — poor in other areas — disposal by sanitary landfill — operating practice deficient — disposal poor in other areas.	Problem of abandoned cars. Need better planning of disposal site. Need improvement in solid waste management and extension of services outside Castries.
<b>Recognition and control of environmental hazards</b>	Limited beach pollution due to discharge of inadequately treated sewage from package treatment plants. Many tar balls on beaches on the eastern side. Untreated sewage discharged into harbour at Castries. Some solid wastes discharged directly into coastal waters.	Criteria, guidelines and standards of bathing waters and of design, operation and maintenance of package sewage treatment plants are needed. Improved method of solid waste management needed. Sewage treatment plant needed to serve Castries.
<b>General information</b> Population: 108,000 Area: 616 Km <sup>2</sup> Density: 175/Km <sup>2</sup> Natural rate of increase: 0.5%	<p>             ENVIRONMENTAL HEALTH ASSESSMENT              SOCIAL ASPECTS              ST. LUCIA           </p>	

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## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: St. Vincent

	General Conditions	Remarks
Water Supply	Coverage: house connection 25%, stand-pipe 65%, no supply 5%. Supply has serious deficiency — old distribution system in Kingstown — excessive leakage — inadequately treated water storage — poor quality during rainfalls.	Erosion problem in watersheds. High rate of deforestation. Administration needs considerable improvement. Need leak detection survey. Operations and maintenance problems.
Sewage Excreta Disposal	Centralized system in small section of Kingstown with primary treatment and chlorination not operational — one small package plant. Coverage: septic tanks 20%; pit latrines 75%; no facility 5%.	System not fully utilized only 44 commercial connections. Financial assistance for completion required. Latrine programme discontinued.
Solid Waste Management	Collection system adequate in Kingstown and othe; main towns — sanitary landfill badly operated — no cover material.	Maintenance of vehicles carried out by others — availability of trucks unpredictable — no equipment for compaction of solid waste.
Recognition and control of environmental hazards	Unsatisfactory. Untreated sewage flows into harbour. Solid Waste dumped into sea	Management under public health officers sufficient to control operations, lack of financial support.
General information		
Population: 93,000		
Area: 388 Km <sup>2</sup>		
Density: 240/Km <sup>2</sup>		
Natural rate of increase: 0.9%		

EMANUCIPATED ...  
LOCAL ...

...

## SUMMARY

### COUNTRY PROFILE ENVIRONMENTAL HEALTH ASSESSMENT

APPENDIX II  
Country: Trinidad and Tobago

	General Conditions	Remarks
Water Supply	Coverage urban 50% house connection; 47% standpipe — supply in Port-of-Spain inadequate.	Large water supply projects under construction to complement water demand in areas in North and South Trinidad. New training centre established with UNDP assistance. Technical assistance through IADB for management improvement.
Sewage Excreta Disposal	45% urban area connected to sewerage — 97% rural area with adequate disposal.	Some pumping station and package treatment plant troubles.
Solid Waste Management	Six open burning dumps which need upgrading and converted to sanitary landfill.	National solid waste plan proposed will require 1-2 years to implement. Considerable training required for site improvement.
Recognition and control of environmental hazards	Rapid industrialization gives rise to environmental problems; lack of environmental management; some oil pollution reported.	Need to improve infrastructure to deal with environmental management especially in industrial development zones.
General information		
Population: 1,096,000		
Area: 5,128 Km <sup>2</sup>		
Density: 214/Km <sup>2</sup>		
Natural rate of increase: 1.8%		

**EXTRACT FROM DECLARATION ON HEALTH  
FOR THE CARIBBEAN COMMUNITY  
BY THE CONFERENCE OF MINISTERS RESPONSIBLE FOR HEALTH  
1978  
(OBJECTIVES)**

**Environmental Health**

**General**

Carry out, as far as practicable, the recommendations of the Workshop on Environmental Health Strategy conducted in Grenada in October, 1978, setting up an implementation mechanism and carrying out a feasibility study of a proposed Caribbean Environmental Health Institute in St. Lucia.

**Drinking Water Supplies**

Provide piped water, safe for drinking, inside the house, for twenty-four hours a day, to every citizen in the Caribbean Community.

**Excreta Disposal**

Provide approved facilities for excreta disposal to every household in the Community.

**Safety of Food**

Develop food safety policies in each country and for the Community as a whole in order to prevent contamination and chemical or biological adulteration and thus reduce human illness and economic loss.

Stimulate awareness of the importance of food quality for the health of the consumer, promote health education programmes for the general public and for executives and other personnel in the food industry, emphasising the need for strict observance of the rules of hygiene in food factories, warehouses, markets, shops, restaurants and houses and for accurate labelling of packaged foodstuffs.

**Solid Waste**

Procure the adoption by each country of a system of management of solid waste adapted to its needs, including efficient collection, treatment and disposal, improved by institutional development, the training of staff, educational work to obtain community participation and the necessary legislation.

**Pollution**

Develop programmes for the early detection, prevention and control of pollution of water, air and soil (chemical, e.g., industrial waste; physical, e.g., radiation; biological, e.g., excreta).

**Housing and Human Settlements**

Improve housing and health conditions in human settlements and promote the health and psycho-social aspects of town and country planning, attempting to prevent and solve the health problems of industrial development and urbanisation.

### **The Health of Workers**

Develop a programme, integrated within the general health services, to promote the health of the working population, control occupational health risks and procure the humanisation of work.

### **Pesticide Control**

Prepare a programme in each country and in the Community as a whole for pesticide control, enacting legislation, harmonising such legislation with that in the rest of the Community, and promote cooperation of the Ministry of Health with the Ministry of Agriculture and other agencies concerned with pesticide control.

### **Traffic and other Accidents**

In order to reduce the number of deaths and the amount of disability caused by traffic and other accidents, promote a coordinated programme that takes account of the multiple nature of accident causes and the need for collaboration among various ministries such as the Ministries of Health, Labour, Transport and Education.

### **Disaster Preparedness**

Promote disaster preparedness as an integral part of regional development planning and procure the full participation of each health administration in national pre-disaster planning and preparedness in the health aspects.