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Sanitation in Developing Countries

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International Development Research Centre  
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Postal Address: Box 8500, Ottawa, Canada K1G 3H9  
Head Office: 60 Queen Street, Ottawa

IDRC, Ottawa CA

IDRC-168e

Sanitation in developing countries : proceedings of a workshop on training held in Lobatse, Botswana, 14-20 August 1980. Ottawa, Ont., IDRC, 1981. 172 p. : ill.

/IDRC publication/, /sanitation/, /waste waters/, /waste disposal/, /appropriate technology/, /health education/, /Africa/ — /sanitation services/, /waste treatment/, /methane/, /disease transmission/, /water supply/, /water pollution/, /health services/, /auxiliary health workers/, /civil engineering/, /vocational training/, /resistance to change/, /financial aspects/.

UDC: 628.2/.6(6)

ISBN: 0-88936-293-9

Microfiche edition available



**IDRC-168e**

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## **Foreword**

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The regions of East and Southern Africa are areas where the scarcity of adequately trained personnel is acute and there is a lack of information on newly developed low-cost technologies.

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The regional workshops were not intended to be an end in themselves but were planned to be followed by small, national training workshops carried out by the participants in their own countries. The aim of the workshops was to further disseminate the information on low-cost technologies and discuss the implementation of curricula changes and training needs recommended at the regional meetings.

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## Participants

- J.E. Attew** Head, Department of Civil Engineering, Botswana Polytechnic, Private Bag 0061, Gaborone, Botswana
- F.K. Bangula** District Health Inspector, Dowa Hospital, P.O. Box 25, Dowa, Malawi
- B. Bellard** Senior Engineer, Ministry of Local Government and Lands, Private Bag 006, Gaborone, Botswana
- W.G. Bomba** Health Education Coordinator, Ministry of Health, P.O. Box 30377, Lilongwe 3, Malawi
- B. Brandberg** Architect, Building Engineer, National Directorate of Housing, c/o United Nations Development Programme, C.P. 4595, Maputo, Mozambique
- L.V. Brynolf** Senior Water Engineer (Pollution), Department of Water Affairs, P.O. Box 128, Gaborone, Botswana
- Richard Carothers** Research Associate, Department of Mechanical Engineering, University of Waterloo, Waterloo, Canada
- P.A. Chindamba** Health Superintendent, Ministry of Health, P.O. Box 30377, Lilongwe 3, Malawi
- S.H.D. Chizenga** Health Educationist, Ministry of Health, Health Education Unit, P.O. Box 65219, Dar es Salaam, Tanzania
- Araya Demissie** Head, Department of Health Education and Training, Ministry of Health, P.O. Box 1234, Addis Ababa, Ethiopia
- Ron Droste** Assistant Professor, Department of Civil Engineering, Water Engineering Group, University of Ottawa, Ottawa, Canada
- J. Gecaga** Lecturer, Department of Civil Engineering, University of Nairobi, P.O. Box 30197, Nairobi, Kenya
- Dawit Getachew** Team Leader, Economist, National Revolutionary Development Campaign and Central Planning Supreme Council, P.O. Box 1037, Addis Ababa, Ethiopia
- Michael Graham** Head, Technical Editing Unit, International Development Research Centre, P.O. Box 8500, Ottawa, Canada
- M. Jeremias** Technical Assistant, National Directorate of Housing, Ministry of Public Works and Housing, Maputo, Mozambique
- J. Kaoma** Civil Engineer, National Housing Authority, P.O. Box 50074, Lusaka, Zambia
- Kassa Kinde** Acting Head, Environmental Health Division, Ministry of Health, P.O. Box 1234, Addis Ababa, Ethiopia
- S.M. Kulaba** Director, Centre of Housing Studies, Ardhi Institute, P.O. Box 35124, Dar es Salaam, Tanzania
- Michael G. McGarry** Associate Director, Health Sciences Division, International Development Research Centre, P.O. Box 8500, Ottawa, Canada
- M. Madzonga** NBCC Secretary, BRIDEC, Private Bag 0062, Gaborone, Botswana

- G.P. Malikebu** Acting Principal (School of Hygiene), Ministry of Health,  
P.O. Box 122, Zomba, Malawi
- P.M. Matiting** Project Manager (Designate), Lobatse Town Council,  
P.O. Box 27, Lobatse, Botswana
- N. Mbere** Sociologist, Ministry of Local Government and Lands, Private  
Bag 006, Gaborone, Botswana
- I.K. Medi** Headmaster, Blantyre Secondary School, Private Bag 10,  
Blantyre, Malawi
- I.A. Mnzava** Coordinator, Primary Health and School Feeding Programmes,  
Ministry of National Education, P.O. Box 9121, Dar es Salaam, Tanzania
- N.K. Momoti** Senior Inspector of Schools In-Service Education, Molepolole  
Education Centre, P.O. Box 87, Molepolole, Botswana
- P.M. Mosalele** Health Assistant, Regional Health Office, P.O. Box 105,  
Lobatse, Botswana
- A.W.C. Munyimbili** Regional Health Inspector, Ministry of Health, Regional  
Health Office, Private Bag 1, Mzuzu, Malawi
- F.Z. Njau** Director of Sewerage and Drainage, Ministry of Lands and Urban  
Development, P.O. Box 9132, Dar es Salaam, Tanzania
- M.E. Petlane** Chief Health Educator, Ministry of Health, P.O. Box 514,  
Maseru 100, Lesotho
- B.L. Pilane** Nursing Sister, Family Welfare Educator/Instructor, Ministry of  
Health, Private Bag 0038, Gaborone, Botswana
- T.A. Pule** Health Inspector, Ministry of Health, P.O. Box 105, Lobatse,  
Botswana
- H.W. Rutachunzibwa** Principal Training Officer, Ardhi Ministry,  
P.O. Box 9132, Dar es Salaam, Tanzania
- Eric J. Schiller** Associate Professor, Department of Civil Engineering, Water  
Engineering Group, University of Ottawa, Ottawa, Canada
- J.B. Sibiya** Chief Health Inspector, Ministry of Health, Private Bag 0038,  
Gaborone, Botswana
- E.K. Simbeye** Principal Health Officer, Ministry of Health, P.O. Box 9083,  
Dar es Salaam, Tanzania
- Alemayehu Teferra** Dean, Faculty of Technology, University of Addis Ababa,  
P.O. Box 385, Addis Ababa, Ethiopia
- Aragaw Truneh** General Manager, Addis Ababa Water and Sewerage  
Authority, P.O. Box 1505, Addis Ababa, Ethiopia
- J.G. Wilson** Senior Public Health Engineer, Ministry of Local Government  
and Lands, Private Bag 006, Gaborone, Botswana
- Beyene Wolde-Gabriel** Manager, Urban Water and Sewerage Agency,  
P.O. Box 5744, Addis Ababa, Ethiopia

# Use of Dry Pit Latrines in Rural and Urban Ethiopia

K. Kinde<sup>1</sup>

Ethiopia is situated in northeastern Africa, close to the equator. Because the altitude varies from 90 m below sea level (Danakil depression) to over 4500 m above sea level (the Semien Mountains), climatic conditions range from hot desert to cold mountain. The country is 1 225 000 km<sup>2</sup> in area and is very fertile, with a large proportion of arable land. It also has one of the most rugged terrains in the world, however, which makes communication difficult.

A population census has never been conducted, but two sample surveys and various studies have shown that its 30 million people are of highly diversified ethnic origins and speak over 50 languages. Almost 90% of the population live in rural areas and about 95% of those are engaged in agriculture and animal husbandry. Only about 15% of the population lives within a reasonable distance from organized health services.

Preventable diseases and malnutrition, in particular, cause heavy morbidity and very high mortality. It has been constantly affirmed by public health experts that about 80% of the health problems of the country could be prevented through relatively simple public health measures, such as improvement of environmental sanitation, sound personal hygiene practice, health education, and mass vaccination.

Better health for the Ethiopian masses, particularly the rural masses, has been one of the themes of the revolution. Based on this, the Ministry of Health has started reo-

rienting the health policies and programs of the country. Thus, programs oriented toward the rural masses, based on more prevention, self-reliance, and mass participation, are stressed.

As a member of the international community, Ethiopia is committed to the present United Nations declarations of "health for all by the year 2000" as a goal, and "primary health care" and the "International Drinking Water and Sanitation Decade" as strategies to attain the goal.

A key to the realization of these ambitions, policies, and challenges is the provision, to all people, of basic health services, in general, and preventive health services, in particular, placing more emphasis on the proper disposal of human wastes.

## Use of Dry Pit Latrines in Rural and Semiurban Ethiopia

Provision of a sanitary excreta disposal system is listed by the World Health Organization (WHO) expert committee on environmental sanitation (1954) among the first basic steps that should be taken toward ensuring a safe environment in rural areas and small communities.

In Ethiopia, as in many developing countries, faecal-borne illnesses are the most formidable public health problems, even though the number of deaths due to these diseases is not exactly known. However, recent surveys carried out within the country have shown that all elements of rural sanitation are more or less lacking and indiscrimi-

<sup>1</sup>Acting Head, Environmental Health Division, Ministry of Health, Addis Ababa, Ethiopia.

nate fouling of the soil with human excrement is common and as a result gastrointestinal diseases rank high among the most important communicable diseases.

To alleviate this health problem through environmental control, the most satisfactory method of excreta disposal is, of course, a waterborne excreta disposal system, but it will not be possible to install such a system in rural and semiurban Ethiopia for many years to come.

As an alternative, a sanitary pit latrine human waste disposal system is as effective as the other methods in controlling faecal-borne diseases and is cheap to build, easy to maintain, and within the reach of the communities. Therefore, a pit latrine excreta disposal system was found to be an appropriate system for the rural and urban fringe Ethiopian communities.

Realizing the importance of sanitary latrines for rural Ethiopians, the Ethiopian government, in collaboration with the donor agencies (multilateral and bilateral), established a public health college and training centre at Gondar, Ethiopia, in 1954 to train a team of middle-level health workers (health officers, community nurses, and sanitarians), with the objective of solving the public health problems of rural and semiurban communities. The first group of health workers graduated in 1958 and were used to staff district health centres. It was then that organized community sanitation services started, with the required organizational structure to carry out a successful preventive and promotive health service program, emphasis being put on, among other things, the development of sanitary pit latrines in rural areas and small communities through local participation.

After more than two decades, the public health program and excreta disposal systems in rural areas failed to show any significant improvement commensurate with the duration of service. In the villages, sanitary pit latrines are very rare and open field defecation and urination is a common practice. Proper assessment of excreta disposal means in rural communities has not been carried out, but a sample survey made in most of the administrative regions has

shown that about 1% of the rural population uses pit latrine excreta disposal systems. Even this meagre number of latrines is not properly designed, constructed, and maintained.

In general, the health education and pit latrine construction program that has been carried out in Ethiopia for the last 20 years produced no significant change in the health conditions of the masses, even though a reliable study has not been conducted to assess the situation. This condition is attributed to the fact that the latrine construction, use, and maintenance program has not yet received the attention it deserves from the government, as well as the community served. As a result, the Ethiopian rural and semiurban communities continue to suffer from avoidable filth-borne diseases with the consequent heavy loss of lives and lowered productivity of the population.

The sanitation problems of the Ethiopian communities are mainly related to the programs of education (general and/or health), organization, and the proper design and construction of latrines. Some of the barriers to the success of the pit latrine construction program are: (1) most communities have not had a chance to learn about the germ causation of disease and to realize the need to stop faecal-borne diseases through the use of latrines; (2) communities that have a habit of using open fields for defecation and urination resist change; (3) the availability of space (open fields) in rural areas for defecation and urination; (4) the nature of the work of villagers, particularly males and children, which is usually in the field (farming and herding), encourages open-field excreta disposal; (5) many villagers have never seen a latrine and thus are not interested in constructing one; (6) when villagers have seen a latrine, often it has been poorly maintained and is located in public places, and it has left an impression of being something foul and dirty; (7) footrests are uncomfortable and sometimes dirty compared with open-field practices; (8) the user is exposed to contaminated water when the groundwater level is high or the pit is open to rain or storm-water runoff; (9) accidents associated with poorly constructed and

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- F.K. Bangula** District Health Inspector, Dowa Hospital, P.O. Box 25, Dowa, Malawi
- B. Bellard** Senior Engineer, Ministry of Local Government and Lands, Private Bag 006, Gaborone, Botswana
- W.G. Bomba** Health Education Coordinator, Ministry of Health, P.O. Box 30377, Lilongwe 3, Malawi
- B. Brandberg** Architect, Building Engineer, National Directorate of Housing, c/o United Nations Development Programme, C.P. 4595, Maputo, Mozambique
- L.V. Brynolf** Senior Water Engineer (Pollution), Department of Water Affairs, P.O. Box 128, Gaborone, Botswana
- Richard Carothers** Research Associate, Department of Mechanical Engineering, University of Waterloo, Waterloo, Canada
- P.A. Chindamba** Health Superintendent, Ministry of Health, P.O. Box 30377, Lilongwe 3, Malawi
- S.H.D. Chizenga** Health Educationist, Ministry of Health, Health Education Unit, P.O. Box 65219, Dar es Salaam, Tanzania
- Araya Demissie** Head, Department of Health Education and Training, Ministry of Health, P.O. Box 1234, Addis Ababa, Ethiopia
- Ron Droste** Assistant Professor, Department of Civil Engineering, Water Engineering Group, University of Ottawa, Ottawa, Canada
- J. Gecaga** Lecturer, Department of Civil Engineering, University of Nairobi, P.O. Box 30197, Nairobi, Kenya
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- M. Jeremias** Technical Assistant, National Directorate of Housing, Ministry of Public Works and Housing, Maputo, Mozambique
- J. Kaoma** Civil Engineer, National Housing Authority, P.O. Box 50074, Lusaka, Zambia
- Kassa Kinde** Acting Head, Environmental Health Division, Ministry of Health, P.O. Box 1234, Addis Ababa, Ethiopia
- S.M. Kulaba** Director, Centre of Housing Studies, Ardhi Institute, P.O. Box 35124, Dar es Salaam, Tanzania
- Michael G. McGarry** Associate Director, Health Sciences Division, International Development Research Centre, P.O. Box 8500, Ottawa, Canada
- M. Madzonga** NBCC Secretary, BRIDEC, Private Bag 0062, Gaborone, Botswana

- G.P. Malikebu** Acting Principal (School of Hygiene), Ministry of Health,  
P.O. Box 122, Zomba, Malawi
- P.M. Matiting** Project Manager (Designate), Lobatse Town Council,  
P.O. Box 27, Lobatse, Botswana
- N. Mbere** Sociologist, Ministry of Local Government and Lands, Private  
Bag 006, Gaborone, Botswana
- I.K. Medi** Headmaster, Blantyre Secondary School, Private Bag 10,  
Blantyre, Malawi
- I.A. Mnzava** Coordinator, Primary Health and School Feeding Programmes,  
Ministry of National Education, P.O. Box 9121, Dar es Salaam, Tanzania
- N.K. Momoti** Senior Inspector of Schools In-Service Education, Molepolole  
Education Centre, P.O. Box 87, Molepolole, Botswana
- P.M. Mosalele** Health Assistant, Regional Health Office, P.O. Box 105,  
Lobatse, Botswana
- A.W.C. Munyimbili** Regional Health Inspector, Ministry of Health, Regional  
Health Office, Private Bag 1, Mzuzu, Malawi
- F.Z. Njau** Director of Sewerage and Drainage, Ministry of Lands and Urban  
Development, P.O. Box 9132, Dar es Salaam, Tanzania
- M.E. Petlane** Chief Health Educator, Ministry of Health, P.O. Box 514,  
Maseru 100, Lesotho
- B.L. Pilane** Nursing Sister, Family Welfare Educator/Instructor, Ministry of  
Health, Private Bag 0038, Gaborone, Botswana
- T.A. Pule** Health Inspector, Ministry of Health, P.O. Box 105, Lobatse,  
Botswana
- H.W. Rutachunzibwa** Principal Training Officer, Ardhi Ministry,  
P.O. Box 9132, Dar es Salaam, Tanzania
- Eric J. Schiller** Associate Professor, Department of Civil Engineering, Water  
Engineering Group, University of Ottawa, Ottawa, Canada
- J.B. Sibiya** Chief Health Inspector, Ministry of Health, Private Bag 0038,  
Gaborone, Botswana
- E.K. Simbeye** Principal Health Officer, Ministry of Health, P.O. Box 9083,  
Dar es Salaam, Tanzania
- Alemayehu Teferra** Dean, Faculty of Technology, University of Addis Ababa,  
P.O. Box 385, Addis Ababa, Ethiopia
- Aragaw Truneh** General Manager, Addis Ababa Water and Sewerage  
Authority, P.O. Box 1505, Addis Ababa, Ethiopia
- J.G. Wilson** Senior Public Health Engineer, Ministry of Local Government  
and Lands, Private Bag 006, Gaborone, Botswana
- Beyene Wolde-Gabriel** Manager, Urban Water and Sewerage Agency,  
P.O. Box 5744, Addis Ababa, Ethiopia



# Use of Dry Pit Latrines in Rural and Urban Ethiopia

K. Kinde<sup>1</sup>

Ethiopia is situated in northeastern Africa, close to the equator. Because the altitude varies from 90 m below sea level (Danakil depression) to over 4500 m above sea level (the Semien Mountains), climatic conditions range from hot desert to cold mountain. The country is 1 225 000 km<sup>2</sup> in area and is very fertile, with a large proportion of arable land. It also has one of the most rugged terrains in the world, however, which makes communication difficult.

A population census has never been conducted, but two sample surveys and various studies have shown that its 30 million people are of highly diversified ethnic origins and speak over 50 languages. Almost 90% of the population live in rural areas and about 95% of those are engaged in agriculture and animal husbandry. Only about 15% of the population lives within a reasonable distance from organized health services.

Preventable diseases and malnutrition, in particular, cause heavy morbidity and very high mortality. It has been constantly affirmed by public health experts that about 80% of the health problems of the country could be prevented through relatively simple public health measures, such as improvement of environmental sanitation, sound personal hygiene practice, health education, and mass vaccination.

Better health for the Ethiopian masses, particularly the rural masses, has been one of the themes of the revolution. Based on this, the Ministry of Health has started reo-

rienting the health policies and programs of the country. Thus, programs oriented toward the rural masses, based on more prevention, self-reliance, and mass participation, are stressed.

As a member of the international community, Ethiopia is committed to the present United Nations declarations of "health for all by the year 2000" as a goal, and "primary health care" and the "International Drinking Water and Sanitation Decade" as strategies to attain the goal.

A key to the realization of these ambitions, policies, and challenges is the provision, to all people, of basic health services, in general, and preventive health services, in particular, placing more emphasis on the proper disposal of human wastes.

## Use of Dry Pit Latrines in Rural and Semiurban Ethiopia

Provision of a sanitary excreta disposal system is listed by the World Health Organization (WHO) expert committee on environmental sanitation (1954) among the first basic steps that should be taken toward ensuring a safe environment in rural areas and small communities.

In Ethiopia, as in many developing countries, faecal-borne illnesses are the most formidable public health problems, even though the number of deaths due to these diseases is not exactly known. However, recent surveys carried out within the country have shown that all elements of rural sanitation are more or less lacking and indiscrimi-

<sup>1</sup>Acting Head, Environmental Health Division, Ministry of Health, Addis Ababa, Ethiopia.

nate fouling of the soil with human excrement is common and as a result gastrointestinal diseases rank high among the most important communicable diseases.

To alleviate this health problem through environmental control, the most satisfactory method of excreta disposal is, of course, a waterborne excreta disposal system, but it will not be possible to install such a system in rural and semiurban Ethiopia for many years to come.

As an alternative, a sanitary pit latrine human waste disposal system is as effective as the other methods in controlling faecal-borne diseases and is cheap to build, easy to maintain, and within the reach of the communities. Therefore, a pit latrine excreta disposal system was found to be an appropriate system for the rural and urban fringe Ethiopian communities.

Realizing the importance of sanitary latrines for rural Ethiopians, the Ethiopian government, in collaboration with the donor agencies (multilateral and bilateral), established a public health college and training centre at Gondar, Ethiopia, in 1954 to train a team of middle-level health workers (health officers, community nurses, and sanitarians), with the objective of solving the public health problems of rural and semiurban communities. The first group of health workers graduated in 1958 and were used to staff district health centres. It was then that organized community sanitation services started, with the required organizational structure to carry out a successful preventive and promotive health service program, emphasis being put on, among other things, the development of sanitary pit latrines in rural areas and small communities through local participation.

After more than two decades, the public health program and excreta disposal systems in rural areas failed to show any significant improvement commensurate with the duration of service. In the villages, sanitary pit latrines are very rare and open field defecation and urination is a common practice. Proper assessment of excreta disposal means in rural communities has not been carried out, but a sample survey made in most of the administrative regions has

shown that about 1% of the rural population uses pit latrine excreta disposal systems. Even this meagre number of latrines is not properly designed, constructed, and maintained.

In general, the health education and pit latrine construction program that has been carried out in Ethiopia for the last 20 years produced no significant change in the health conditions of the masses, even though a reliable study has not been conducted to assess the situation. This condition is attributed to the fact that the latrine construction, use, and maintenance program has not yet received the attention it deserves from the government, as well as the community served. As a result, the Ethiopian rural and semiurban communities continue to suffer from avoidable filth-borne diseases with the consequent heavy loss of lives and lowered productivity of the population.

The sanitation problems of the Ethiopian communities are mainly related to the programs of education (general and/or health), organization, and the proper design and construction of latrines. Some of the barriers to the success of the pit latrine construction program are: (1) most communities have not had a chance to learn about the germ causation of disease and to realize the need to stop faecal-borne diseases through the use of latrines; (2) communities that have a habit of using open fields for defecation and urination resist change; (3) the availability of space (open fields) in rural areas for defecation and urination; (4) the nature of the work of villagers, particularly males and children, which is usually in the field (farming and herding), encourages open-field excreta disposal; (5) many villagers have never seen a latrine and thus are not interested in constructing one; (6) when villagers have seen a latrine, often it has been poorly maintained and is located in public places, and it has left an impression of being something foul and dirty; (7) footrests are uncomfortable and sometimes dirty compared with open-field practices; (8) the user is exposed to contaminated water when the groundwater level is high or the pit is open to rain or storm-water runoff; (9) accidents associated with poorly constructed and

poorly maintained latrines; (10) opposite sexes and/or different religious groups sometimes do not like to share the same facility; (11) the faecal material is visible, particularly when the pit aperture is uncovered or the pit is about to be filled; (12) the latrine has a bad odour when it is constructed close to a dwelling; (13) flies gather about the latrine; (14) construction and maintenance are expensive and difficult for people with low incomes; (15) even if they want a latrine, the communities often do not know how to construct and maintain a sanitary latrine properly; (16) lack of construction materials and tools; (17) lack of administrative procedures to ensure quick supply of proper materials where they are needed; (18) lack of concentration of efforts on latrine problems; (19) lack of careful guidance, supervision, and evaluation of field sanitation workers caused by a lack of finance and transport facilities; (20) lack of an adequate number of well-trained technical personnel; and (21) in some places, rocky soil formations and high water levels.

### **Use of Dry Pit Latrines in Urban Ethiopia**

Practices and problems associated with dry pit latrines in towns are in many instances similar to those in rural areas. The difference is the type and gravity of the problem encountered as a result of urbanization. In addition to some of the problems related to pit latrine construction, use, and maintenance mentioned for rural communities, the urban communities are faced with problems of poor town planning and plot allocation, lack of space to construct pit latrines, landlord-tenant conflicts in cases of rented houses (before the revolution), lack of open fields for defecation and urination in comparison with rural areas, the diversified social and economic nature of the town, and the type of work which is usually carried out in the town.

In principle, in every town the municipalities are responsible for providing and maintaining suitable public latrines for the

communities at places such as markets and bus stations. In practice, however, public latrine development in urban centres is an absolute failure, due to a lack of maintenance, abuse by the users, and irresponsibility of the municipalities to operate and maintain the facilities.

In towns where waterborne excreta disposal systems are nonexistent, all private houses are required to have proper privies on their premises. However, the majority of these facilities are not functioning well due to the reasons already mentioned.

### **Conclusions**

Prerevolution health workers tried to form health councils, within the communities, to be responsible for health matters in a certain locality and to activate health services. The program failed, however, because the representatives on the council belonged to the landlord class.

The revolution, through its formation of various associations (urban dwellers, farmers, women's youth, all Ethiopian workers), has created a healthy atmosphere whereby the people organized themselves to solve their own health and sanitation problems. A situation where health cadres could make a better approach to the community, identify health and sanitation problems of the community, disseminate health education, and provide useful demonstrations of sanitary facilities was created. The Ministry of Health has taken a revolutionary measure in reorienting the health delivery system of the nation by strengthening the existing one and introducing a new system with a new health cadre, a community health agent, as a base for the health manpower pyramid. The new approach to health service by the Ministry of Health is supplemented by the countrywide campaign against illiteracy launched by the Ministry of Education.

All efforts made since the revolution have had a positive effect on the health delivery system, in general, and public health service, in particular. A case in point is a great number of dry pit latrines constructed by the

people in some of the administrative regions, yet more endeavours are expected to tackle the health and sanitation problems of the communities.

The barriers to the expansion of sanitary dry pit latrine system development in rural and urban Ethiopia, as elsewhere in developing countries, are many. Some are socioeconomic in nature, others are administrative in nature, and still others are of an engineering nature.

To overcome these hindrances, coordinated and concerted efforts by concerned

agencies must be put forward to organize the communities so that they solve their problems on their own; to educate (general and health) the communities in order to raise the level of understanding about germ theory; to guide the communities; and to evaluate and reevaluate the public health activities carried out in the communities. To promote these activities, sound planning and programming of the sanitation activities of the communities are not only necessary but essential.

# Pit Latrines in Botswana

J.G. Wilson<sup>1</sup>

Botswana is an arid country characterized by a very low population density, a few small but rapidly growing urban areas, and a cattle population of five times the human population. Apart from the indigenous simple pit latrine, low-cost sanitation developments date back to the early 1970s, when the government undertook initial work on fiberglass aqua privies. The prototype had various technical problems and in 1976 the government, together with the International Development Research Centre (IDRC), Canada, undertook an investigation of alternative forms of low-cost sanitation by constructing and testing single pit latrines: ventilated improved pit (VIP) latrines, Reed odourless earth closets (ROEC) (a variation of the VIP latrine employing an asbestos cement seat with a chute built integrally into an offset ventilated pit), cement-block aqua privies (single chamber with soakaway), and composting toilets.

The objective of this paper is to focus upon particular technical and sociological problems that have been associated with the introduction of sanitation programs in Botswana. It was not written to detract from the overall success that the Government of Botswana has had in its implementation of such programs but rather to create an awareness of potential problems that could act as a base from which discussion could be generated with respect to the need for appropriately trained manpower within the sanitation sector.

<sup>1</sup>Senior Public Health Engineer, Ministry of Local Government and Lands, Gaborone, Botswana.

## The Pit Latrine

Conventional pit latrines abound in all parts of Botswana but many suffer from major structural faults. Poorly constructed pit latrines can become offensive due to odours and the attraction of flies and mosquitoes. Often, latrines are constructed directly upon coarse-grained "running" sand or unstable black cotton soil. If coupled with heavy latrine superstructures, these soils lead to collapsing of the slab and superstructure into the pit (Fig. 1). Solid rock, outcropping at or near the ground surface, and laterite soils, interspersed with layers of impermeable stiff clay, make excavation difficult and limit soakaways. Overcoming these problems can be difficult and expensive. The result is that many people prefer to defecate in the bush.



Fig. 1. Result of pit latrine built without foundations on black cotton soil.

Another major problem with the conventional pit latrine is the difficulty experienced in emptying it successfully. In urban areas, where plot sizes are restricted, a permanent pit is preferred. When emptying becomes necessary, the plotholder is required to add water to the pit contents to form a slurry in order to facilitate emptying by suction using the council vacuum tanker. This not only constitutes a major health hazard, because the only access to the pit is through the seat unit, but also the adding of large quantities of water to the pit accelerates erosion of the pit walls, leading to the collapse of the superstructure.

To overcome these problems, the ROEC was developed in South Africa and has been used in Botswana around the Molepolole area for more than 20 years (Fig. 2). The advantage of this latrine is in the utilization of a chute that funnels excreta and urine into a chamber to the rear of the superstructure. The problem of the superstructure collapsing into the pit is, therefore, overcome. An additional advantage is the ability to empty the pit by removing access covers at the rear of the superstructure. The chute, in conjunction with a ventilation stack, encourages vigorous air circulation within the pit, thereby removing odours and discouraging the attraction of flies. A high standard of construction is required, however, particu-

larly in forming the joints between the cover slabs, as a close fit is required to prevent access by flies. If poorly constructed, the latrine can become a centre for unsanitary conditions. A certain degree of user maintenance is required to maintain hygienic conditions, e.g., experience has shown that the chute of the ROEC is subject to fouling by excreta. The plotholder, therefore, is required to obtain a long-handled brush to clean the chute. Observations have revealed, however, that either the brush is not obtained and cleaning is, therefore, not carried out on a regular basis or excessive amounts of water are used to clean the chute, resulting in flooding of the pit. In an effort to eliminate these problems the ROEC has been modified. In the revised design there is no chute; instead, the rear end of the pit has been extended just below the superstructure so that faeces from the seat can drop directly into the pit. This modification of the ROEC has been called the ventilated improved pit (VIP) latrine (Fig. 3). The VIP latrine has a high degree of user acceptance and user maintenance requirements are low. The standard of construction, however, must remain high for reasons similar to those given for the ROEC.

Even a modified single pit latrine has certain disadvantages, the most important

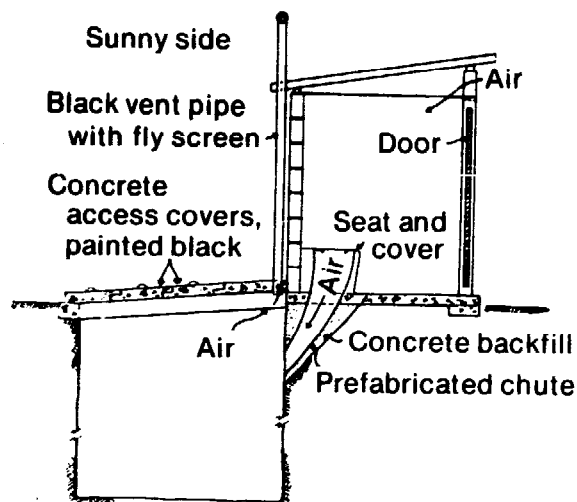


Fig. 2. Reed odourless earth closet (ROEC) pit latrine. (After R.A. Boydell, formerly with the Ministry of Local Government and Lands, Botswana.)

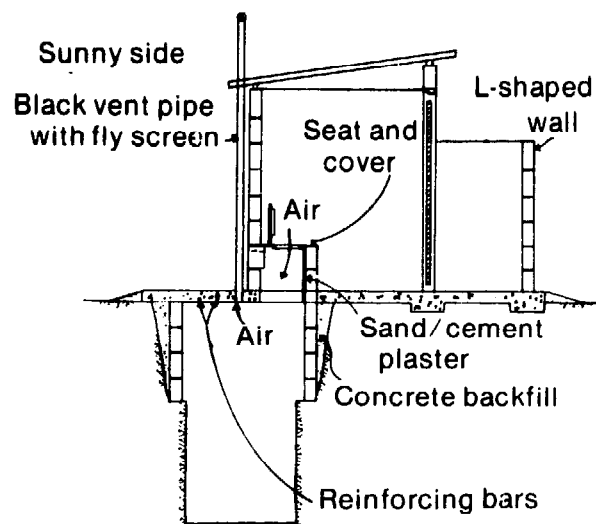


Fig. 3. Ventilated improved pit (VIP) latrine. (After R.A. Boydell, formerly with the Ministry of Local Government and Lands, Botswana.)

being that when it is emptied the contents of the pit include fresh faeces, which if deposited in the vicinity of the latrine as a result of careless emptying can create unhygienic conditions.

Recent work carried out in Botswana has indicated that groundwater pollution can occur from pit latrines installed in areas when unsuitable ground conditions exist. In areas with fissured rock or other types of highly permeable material or where pits penetrate the water table, high nitrate levels and high bacterial counts can occur and could present a danger to human health. In areas where such hazards exist, it is important that a safe water supply is made available from an uncontaminated source if pit latrines are the only affordable method of excreta disposal.

Investigations and experimental work presently being planned in Botswana to obtain further information on pit latrine operation include optimization of the venting of pits, together with experimentation with different fly and mosquito screens, and experimentation with thin fiberglass disposable pit liners as substructures to pits constructed in areas with unstable ground conditions, such as the Kalahari sands.

Botswana has made considerable strides toward developing sound long-term sanitation strategies. A number of aspects remain unresolved but the government is committed to make progress within the sanitation sector over the next decade, bringing improved health and well-being to a small but rapidly growing population.

# Pit Latrines in Malawi

A.W.C. Munyimbili<sup>1</sup>

According to a World Health Organization publication produced in 1958, a pit latrine consists of a hand-dug hole in the ground covered with either a squatting plate or a slab provided with a riser or seat. A superstructure or house is then built around it. The pit should be 36–40 in. (90–100 cm) wide, with its length depending upon the number of holes provided. The depth is usually 8 ft (2.4 m) but would vary from 6–16 ft (1.8–4.9 m). In Malawi, at present, 6 ft (1.8 m) would be regarded as being shallow enough to encourage the breeding of flies during the initial stages of use of the pit latrine.

On the day of independence (6 July 1964), it was evident that to a certain extent the pit latrine and its measurements, as mentioned above, were acceptable. Figure 1 shows the

design of the few pit latrines that were prevalent in Malawi at that time.

It should be noted that the idea of building and using a pit latrine was not acceptable to all Malawian villagers. Some of the problems related to the use of pit latrines can be attributed to taboos, politics, or the topographical aspects of various locations in Malawi.

## What Went Wrong?

It was not acceptable for a male villager to use the pit-latrines facilities with his female child. It was unbecoming for a father-in-law or mother-in-law to use the same pit-latrines facilities with the daughter-in-law or son-in-law respectively. It should be realized that if you were a son-in-law or daughter-in-law,

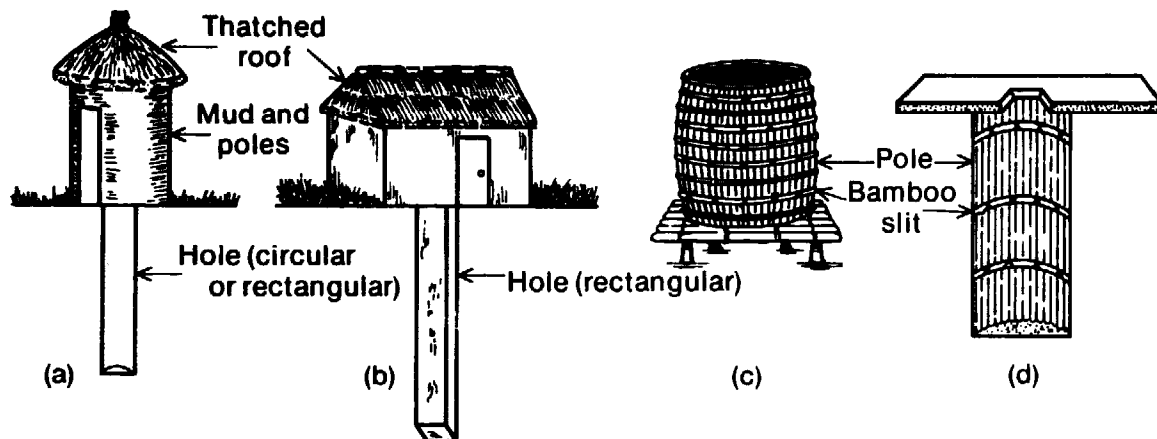


Fig. 1. (a, b) Village pit latrines in Malawi at the time of independence. (c) Nkhokwe pit latrine used in sandy soils. (d) Pit latrine designed for use in waterlogged areas, e.g., rice irrigated areas.

<sup>1</sup>Regional Health Inspector, Ministry of Health, Mzuzu, Malawi.



your safest time of self-help or attending to nature was when you were free and alone somewhere in the bush. It should also be noted that the above traditional education was the responsibility of the elders of the villages to inculcate into the minds of the would-be sons- and daughters-in-law and the impact of this training was great. In some communities, traditional religion forbade one from possessing a pit latrine.

Thus, traditional culture paid little interest or attention to community development and social welfare services or to any interrelationship between development and those persons who tried to initiate changes.

### **Who Was to Blame?**

At the time of Malawi's independence, those people advocating the use of pit latrines presented a distorted image of the value of the latrines. It was assumed that what was good for one part of the country (or one district) was good for the entire country and all of its people. A villager or a subsistence farmer was considered a villain, an inhibitor of change or development, if they did not possess a pit latrine. They were, therefore, taken to court, and fined or imprisoned. Most of the villagers who were taken to court had not had the purpose and importance of latrinization properly explained to them. Consequently, the minority of early adopters were regarded as agents of the devil by the majority of skeptics or traditionalists, i.e., if you possessed a pit latrine, sanctions were imposed by your peer group.

### **Introducing Change**

The postindependence government realized that development or *change* could not be facilitated unless the people concerned were involved in its planning and execution. The government noted that local participation aroused greater interest, awareness, and satisfaction among the people. For example, a man leaving his family to participate in the deliberations about latrine construction and

use is bound to discuss the subject with his family and neighbours when he returns from the meeting. This creates greater awareness about the program within the community and the program, therefore, does not come as a surprise to the people.

At the time of introducing this approach, government departments such as health, agriculture, community development and social welfare, forestry, and veterinary services lacked adequate numbers of professionals at upper-management levels and technologists in the field (front-line workers). To fill this shortage of personnel, the government embarked upon training programs (in some cases with external aid) to such an extent that at present there is a front-line worker in most of the areas or communities in Malawi from each of the above-mentioned departments.

In order to introduce changes, certain personnel are given the responsibility of diagnosing and isolating the priority problems of communities; helping the communities to implement changes; helping the community to accept changes regardless of differences in acceptance rates; spreading new ideas; and of providing information to individuals or families on the health aspects related to the changes.

### **Front-Line Workers of the Department of Public Health**

Health assistants and disease surveillance aides concentrate on, among other things, sanitation. Thus, they are primarily concerned with the safety of rural water supplies and latrinization. Rural water supply protection (as opposed to latrinization) receives the attention, as well as aid, of various departments including the health department. Latrinization is primarily handled by the Department of Health through village health committees.

### **Cholera Outbreak, 1973**

Generally, the Ministry of Health was responsible for the treatment of cholera cases during this outbreak. As preventive treat-

ment, antibiotics (e.g., tetracycline) were used and shallow wells were chlorinated with a prepared stock solution. Health education was intensified by front-line workers regarding the provision and use of pit latrines.

It was noted that in districts inland from Lake Malawi, which stretches along almost the entire eastern border of the country, the anticholera measures mentioned above were successful, except in some of those districts that bordered the lake and in which sandy and clayey soils abound, coupled with a high water table. Pit latrines constructed according to the specifications outlined at the beginning of this paper collapsed easily, thus frustrating the efforts of the villagers and encouraging them to use the nearby bush to relieve themselves. As a result, cholera outbreaks in these districts continued to occur.

In an effort to prevent future outbreaks of cholera, district health inspectors were requested to analyze the use of pit latrines in their areas. The survey that was carried out revealed that the major sanitary problems in an area were the existence of contaminated water, bilharzia, hookworm, and cholera and the lack of pit latrines. The reasons for the lack of pit latrines were attributed to laziness on the part of the people, a lack of understanding (health education) on the benefits of latrines, conflict with traditional beliefs and taboos, and collapsing of existing pit latrines. It was determined that collapsing of pit latrines was caused by flooding, high water tables, sandy soil, and poor construction techniques. Thus, the survey indicated that the lack of pit latrines due to their collapsing as a result of poor construction techniques was the major problem within a district.

It was found that the poor construction techniques included problems with construction of the pit, floor, and superstructure and problems with the siting of the latrine itself.

Improved methods of constructing the pit included the use of drums, poles, the Nkhokwe, and construction of a circular pit with smooth straight sides. Some of the improved methods of constructing the floor

included the use of medium-sized poles that would extend 1.5 ft (0.45 m) beyond the edge of the pit and the use of good-quality mud for smearing. When constructing the superstructure, the walls should be made of strong poles and be mudded well; the roof should be thatched with thick strong grass and should overhang the walls by 1.5 ft (0.45 m) to repel and keep rainwater away from the hut; and the soil around the base of the hut should be graded to allow water to run away from the hut. In terms of the location of pit latrines, they should not be constructed in the following areas: on old ash pits; on or near old pit-latrines sites; near riverbanks or beaches. If possible, pit latrines should be situated on firm soil overlying weaker soil.

It was found, from this survey, that by focusing attention on improved construction techniques, the problem of a lack of pit latrines could be solved, which, in turn, would go a long way toward combating cholera and all other major sanitary problems within a district. The use of different styles of pit latrines and their results are given in Table 1.

The responsibility of "selling" the improved technology to the public lies with the village health committees. The disease surveillance aides who work at the village level make returns to the health assistants who, in turn, report any sanitary improvements to the district health inspector.

Present observations indicate that round holes and floors made of poles extending 1.5 ft (0.45 m) beyond the edge of the hole are the preferred methods of pit latrine construction. The Nkhokwe construction method is preferred over the use of drums because drums are difficult to obtain. The use of one drum in a square hole with a superstructure of bamboo and leaves has been abandoned completely.

### **Ventilated Pit Latrine**

In integrated basic services areas for sanitation and primary health care programs and in land reorganization schemes, village health committees, in consultation with front-line workers from the Ministry of

Table 1. Research with different styles of pit latrines and results to date.

Style	Date of construction	Location	Soil conditions	Remarks
Nkhokwe, round hole	September 1978	Village	Sandy	Superstructure of thatched roof and mud and poles wall. Mud and poles floor. Doing very well
Three drums, round hole	October 1978	Hospital	Sandy	Superstructure of iron sheets. Concrete slab floor. In splendid condition
Pit latrine with poles, square hole	August 1977	Rice scheme	Clay; high water table	Superstructure of mud and poles with thatched roof. Floor of logs and mud. Still doing well, even in water-logged area
Two drums, round hole	August 1978	Village	Sandy; high water table	Superstructure and floor of mud and poles. Filled up quickly due to small capacity of drums and high usage. Lasted 4 months
Plain pit, round hole	October 1978	Village	Sandy	Superstructure of mud. Floor of logs and mud. Did well in dry season but collapsed in rains due to poor construction. Logs on floor were too short, just reaching edge of hole. Had little support. Roof leaked also
Three drums, round hole	October 1977	Village	Sandy	Superstructure of mud. Thatch and log floor. Filled sides between drums and hole with coarse gravel, stones, and sand. Doing very well. Poor roofing allows rain to enter
Two drums, round hole	October 1977	Village	Sandy	Superstructure of mud and thatch. Mud and log floor. Filled sides between drums and hole with coarse gravel, sand, and stones. Working well. With better superstructure it could last a long time
Two drums	July 1978	Village	Sandy	Superstructure of mud and thatch. Mud and log floor. Filled sides between drums and hole with gravel, stone, and sand. It has held up well
Nkhokwe, round	November 1978	Village (poles not available)	Sandy; high water table	Superstructure of adobe, with thatched roof. Floor of mud and logs. Holding up well despite high water table and sandy soil
One drum, square hole	December 1978 (rains) (temporary)	Shopping centre and market	Sandy; high water table	Superstructure of bamboo and leaves. Latrine is raised a few feet off the ground to give it more pit area. Does well but fills up quickly

Health, have successfully constructed model (ventilated) pit latrines which are being welcomed by the public at large.

The ventilated pit latrine has either a thatched or iron roof. The walls are Pesse de

terre, which makes it possible for the partition wall to be aligned with the vent (bamboo or iron sheet). The floor is a concrete slab with a vent hole provided. A round hole should be dug not less than 15 ft (4.6 m) deep

in order to discourage the breeding of flies. The aim of providing a vent pipe is to remove offensive odours from the faecal matter and reduce the chances of flies breeding.

### **Conclusions**

In rural communities, the manner in which people are encouraged to use pit latrines is more important than the latrine itself. Identification of diseases that are brought about due to a lack of pit latrines

should, as far as possible, be brought to light by village health committees where local leaders' voices prevail. When selecting an appropriate type of pit latrine for an area, use should be made of local expertise and materials, with little emphasis on services offered from outside. The front-line worker should live in the village with the people and gain their confidence and then work only as a link between latrinization technology and the people. Thus, by involving the community, latrinization in Malawi has evolved as a response to a *real* need.

# Housing Sanitation, Mozambique

B. Brandberg<sup>1</sup> and M. Jeremias<sup>2</sup>

During colonial times little interest was paid to the sanitation situation of the majority of the Mozambican people. After gaining independence in 1975, however, the Ministry of Health started a national campaign for latrine construction. The campaign was launched with the support of the mass media and was in many areas very successful. In Maputo, for example, almost every family now has its own latrine.

The experiences from the latrine campaign were very positive, but it was apparent that technically, many problems were not yet solved. Special difficulties arose, for example, in areas with high groundwater tables or with loose or rocky ground. It was also found that latrine covers, constructed mainly of pieces of wood covered with soil, were unhygienic and often fell into the pit. A program for a sanitation development project, therefore, was jointly established by the National Directorate of Housing, the National Directorate of Water, and the National Directorate of Preventive Medicine.

## Three Aspects of Sanitation

Sanitation has many aspects. In this project three were considered: the safety aspect; the ecological aspect; and the comfort aspect.

<sup>1</sup>Architect, Building Engineer, National Directorate of Housing, Maputo, Mozambique.

<sup>2</sup>Technical Assistant, National Directorate of Housing, Maputo, Mozambique.

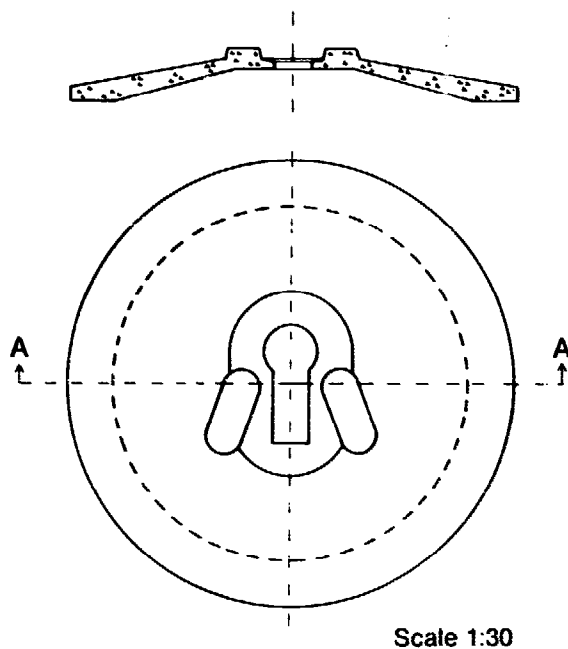
## The Safety Aspect

As mentioned earlier, the latrines that have been built by the people in the past have experienced hygienic and technical problems. The first task, therefore, was to develop a pit slab that was easy to keep clean and would not be destroyed by rotting and termites.

To meet these requirements, a round slab of nonreinforced concrete was developed (Fig. 1). By giving it a slightly conical form, the slab only required a thickness of a few centimetres. The fact that it was given a round form facilitated local transport by rolling and also inspired the builders to dig round pits, which are preferable for soil stability reasons. Different materials were considered for making the slab, but non-reinforced concrete was the most competitive. The possibility of industrial production using asbestos cement (Iusalite) is also being considered.

The first slabs were made at a factory for prefabricated concrete products. In transporting the slabs from the factory to the sites where they were to be installed, however, many of them were broken. To solve this problem a workshop was set up to produce the slabs locally. Using simple moulds, a mason and two assistants can make eight slabs per day.

In order to prevent accidents, each slab is test loaded with 4-6 persons standing on top of it, depending upon the diameter. In spite of this, however, cracks have appeared in a few cases after the testing, due to carelessness in transporting the slabs. If reinforc-



*Fig. 1. Plan and cross-sectional views of slab of nonreinforced concrete used for conventional pit latrines. The ratio of cement : river sand : 1/4 in. stone used to make the cement mixture is 1:2:1.5. When tested, the slab supported the weight of 9 people but failed with 10. Every slab is tested and must support the weight of six people before it can be put over a pit and used.*

ing steel had been easily obtainable, a ring of reinforcement around the edge of the slab would have been useful for transportation purposes.

In order to get an idea of the appropriateness of the slabs, they were offered for sale to the general population for the price of producing them. So far, the sales have not been very successful and the reason is unknown because the inhabitants themselves had stressed the need for the slabs and nobody has yet said that they are too expensive.

The next step in the project was to design suitable types of latrines for special conditions. In this area, the new slabs have been very useful. For loose and unstable soils, different types of lining were used to hold up the wall of the pits. Good results have been achieved using cement blocks laid with open joints. The round form eliminates the need for mortar in the joints so that the lining is

easy to erect. Experimental lining of only the upper part of the pit proved to be less successful unless executed with scrupulous control, which would be difficult to achieve in a large-scale project.

Lined pits also allowed for increased diameter. This has been used in areas with high groundwater tables to achieve a reasonable volume with a reduced depth. For these areas, the lining has also been used to raise the cover about 40 cm above ground level. In areas where groundwater is not used for household purposes, no effort has been made to ensure that the pits do not reach the water table.

Vietnamese double-vault compost latrines, built completely above ground, will also be tried. These are particularly appropriate for areas with high groundwater tables that are liable to flood conventional pits.

Another approach to limit the problem of covering the pit has been the introduction of borehole latrines. To compensate for the low capacity, due to the small pit diameter, they have been constructed to a depth of 8 m. Usually, two or three are constructed at the same time for the same family. Diameters of 30 cm are presently being used. Smaller diameters have been shown to fill up too quickly.

### **The Ecological Aspect**

Enormous amounts of natural fertilizers are produced each day by people carrying out their bodily functions. In cities, these potential fertilizers are washed away by sewage systems into the sea or are otherwise made difficult or impossible to use. At the same time as this wastage of natural fertilizers is continuing, Mozambique is having difficulty in providing food for its urban population.

To meet this situation, a number of compost latrines have been constructed. These are mainly ordinary pit latrines with a reduced volume, constructed two and two, side by side, to be used alternately.

It is supposed that a compost period of 6 months would be sufficient to eliminate the risk of parasite transmission. From an agricultural point of view 12 months could also be considered. Medical tests are continually conducted as part of the project experiment. In accordance with results from other sanitation projects, ascaris egg viability is used as an indicator of pathogen neutralization.

It is hoped that the excavation of the compost or neutralized faecal matter will meet the agricultural difficulties, but the project has not yet advanced to the stage of a latrine being ready for emptying. In some cases, however, people have spontaneously emptied old latrines to use the contents as fertilizer.

Some of the borehole latrines have also been constructed so that after a period of neutralization they can be rebored for reuse of both the contents and the hole. For areas with sandy soil and low groundwater tables this seems to be a simple and cheap solution.

### **The Comfort Aspect**

From the comfort point of view, few sanitary solutions can compete with the conventional flush toilet. For areas where water supply is a problem, as it is in most Mozambican cities, solutions with less water consumption are highly desirable. Also, the conventional flush toilet frequently causes hygienic difficulties because the effluent is voluminous and often highly polluting. For clay or fine sandy soils, infiltration can be difficult and can lead to surface streams of raw sewage. High groundwater tables and insufficient natural infiltration of the sewage can lead to serious pollution of wells.

Alternative sanitary solutions with corresponding comfort will be studied in the future stages of the project. This is particularly important because Mozambique, in the coming years, will have to build a considerable number of new houses all over the country for foreign technicians and other people involved in national development.

## The PIP and REC II Latrines

J.G. Wilson<sup>1</sup>

The rate of urbanization in Botswana is one of the highest in the world and is, at present, approximately 15% per annum. The government is actively engaged in a process of upgrading existing squatter settlements and undertaking site and service developments to the extent that this now constitutes approximately 70% of all housing production. Being acutely aware of the need for appropriate sanitation, the government, in conjunction with the Building Research Establishment, England, has developed a twin-pit ventilated improved pit (VIP) latrine that could be the most appropriate form of sanitation for use in upgraded and site and service areas.

In urban areas, it is not always possible to abandon a full pit and dig a new one. The conventional single-pit latrine (modified or unmodified) can cause serious health hazards when being emptied. In order to overcome this, a new approach to pit latrine technology has been tried.

The permanent improved pit (PIP) latrine (Figs. 1, 2) and the revised earth closet II (REC II) (Fig. 3) have both been conceived for the purpose of providing a permanent unit that can be emptied as required. This can be achieved by providing double pits that are used alternately. The contents are retained within the sealed pit long enough for pathogens to die and when the contents are removed they are harmless and inoffensive.

Botswana, along with many other African countries, does not have a history of reusing

<sup>1</sup>Senior Public Health Engineer, Ministry of Local Government and Lands, Gaborone, Botswana.

excreta. Therefore, the resulting friable humus, though useful as a fertilizer, will initially be removed from the site by the council.

At present, the PIP latrine remains as a prototype at the Building Research Establishment to verify construction details and to investigate the effectiveness of alternative pit ventilation arrangements. The REC II, however, has already been constructed in quantity in Botswana. To date, approximately 2000 have been constructed by con-

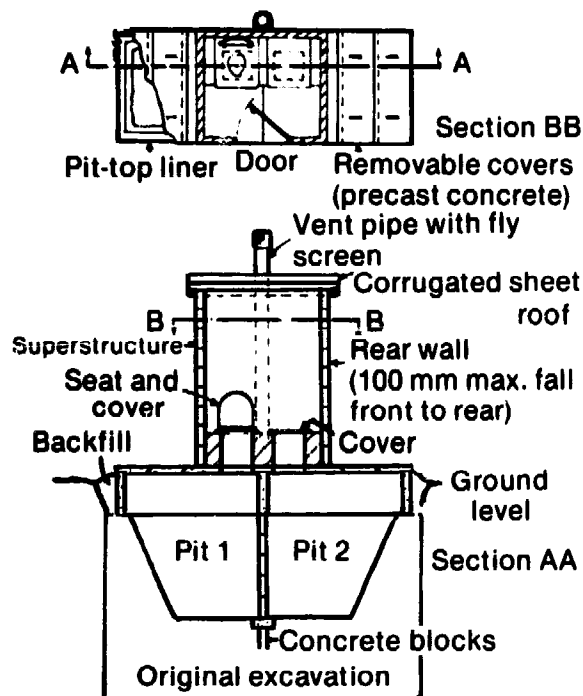


Fig. 1. Permanent improved pit (PIP) latrine type A. (After R.F. Carroll, Building Research Establishment, England. Note: Pit top supported by cast in situ concrete liner 100 mm thick, forming two compartments, each having an effective volume of 1.5 m<sup>3</sup>.)



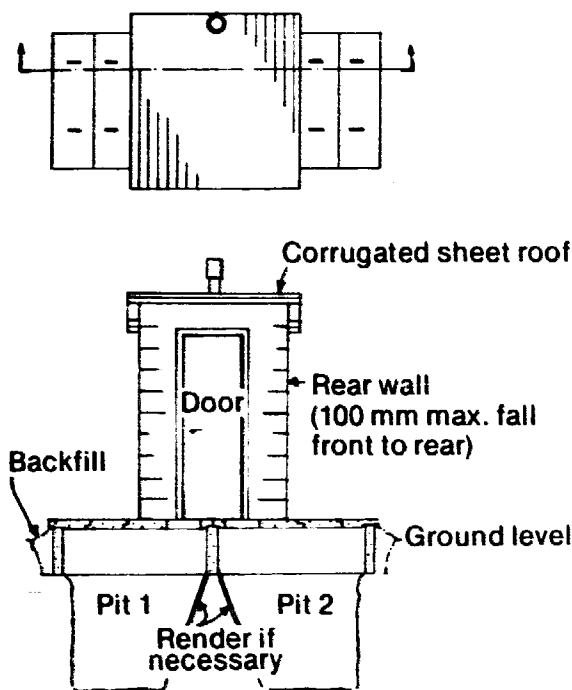


Fig. 2. Permanent improved pit (PIP) latrine type B. (After R.F. Carroll, Building Research Establishment, England. Note: Unspecified details are similar to those given in Fig. 1.)

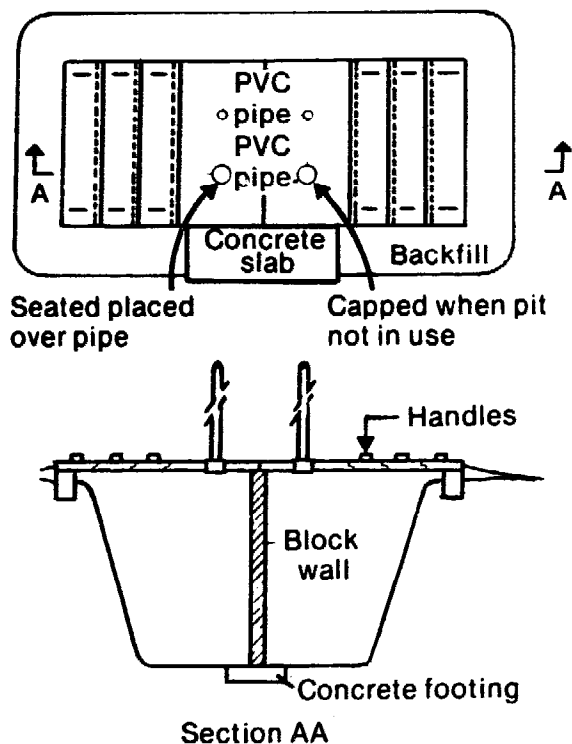


Fig. 3. Plan and cross-sectional views of twin-pit VIP latrine (REC II).

tractors in site and service and upgraded areas in Gaborone. Demonstration models have now been constructed in Francistown and Selebi Pikwe and it is proposed that between 3000 and 4000 will eventually be constructed in these towns.

The main features of the PIP and REC II latrines (Carroll 1980) are: (1) small double pits, each with an effective volume of 1.5 m<sup>3</sup>; (2) supported pit tops and superstructure; (3) ventilated pits to reduce odour and attraction of insects; (4) mechanized or manual emptying; (5) 2 year retention period; (6) 3-4 year emptying cycle; and (7) pit contents once decomposed, harmless and inoffensive, to be used as fertilizer.

Because of the intensive housing construction program, the government has committed itself to invest heavily in this sanitation solution in urban areas. It is aware, however, that there are other important factors associated with the program that must be considered in order for it to succeed. The most important of these are affordability, emptying procedures, and health education.

The first of these is dealt with in greater detail in another paper (see Bellard). It can be said, however, that it is the government's policy to provide a latrine substructure to each plot at a cost that can be afforded by each plholder. It is the plholder's responsibility, however, to construct an approved superstructure and to purchase the locally made fiberglass seat unit.

Having introduced REC II latrines, the government now has 3 years (the time of the first emptying cycle) to complete its proposals with regard to emptying procedures. At present, it is proposed that emptying trials be conducted in conjunction with the Building Research Establishment using a machine that works on a high volume air-flow principle and draws all types of material, ranging from light dry material to wet sludge, according to the groundwater conditions in the pit at the time of emptying.

At the same time, it is becoming very apparent that health education with regard to pit-latrines usage is of prime importance. For the REC II program to succeed and be acceptable to the plholder, a health educa-

tion program must commence immediately. The following are examples of problems that are already occurring:

(1) Latrines are not being completed by the plottolders and, therefore, the government investment is not being utilized because the plottolders do not appreciate the advantages of having a latrine. As far as the plottolder is concerned, the bush is nearby and convenient and does not cost anything, whereas a superstructure does.

(2) Plottolders claim that the pits are too small and will fill too quickly. They do not fully understand the operating principles of the latrine.

(3) Some plottolders have removed the cap from the second pit so children may defecate into the second pit, thereby using two pits at the same time. The plottolder has

also been known to use the latrine to wash in and then drain the water into the second pit, thereby flooding it.

Some of these problems will be overcome by slightly modifying the design of the substructure. Acceptance and correct usage and maintenance by the plottolder, however, are of prime importance if this sanitation program is to succeed. If it does not succeed, then apart from the loss of investment, it is the future health of the plottolders that is at stake and, therefore, emphasis must be placed upon increased health education, together with adequate manpower to supervise the implementation of the project.

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Carroll, R.F. 1980. Improving the pit latrine. Presented at the 6th Water and Engineering in Developing Countries Conference, March 1980, Loughborough, England.

# On-Site Excreta Disposal Technologies

E.K. Simbeye<sup>1</sup>

Human wastes can be both dangerous and useful. Proper disposal of faeces will minimize the spread of many diseases transmitted through contact with the skin or through food and drink contaminated with excreta. Such diseases include hookworm, ascariasis, schistosomiasis, typhoid fever, dysentery, amoebiasis, cholera, and other worm diseases. Well-prepared and well-treated excreta will make good manure, which could be an asset to small farmers.

For many years people in developing countries of the world have regarded sewerage systems as the best method of dealing with excreta. Indeed, it is the most sophisticated and hygienic method but it is also the most expensive technology. A lot of water is required for this type of system to perform well, yet water is both scarce and expensive. The gravity of the situation is more evident in rural areas.

As the world gets poorer, people are now turning to conventional, but simple and relatively cheap, technologies. Many low-cost technologies have been developed and are being tried. Improved pit latrines, compost latrines, pour flush aqua privies, and septic tank latrines are among the low-cost technologies.

This paper will discuss on-site disposal systems. These are the systems that do not require transportation. Three types of on-site dry latrines (ventilated improved latrines) will be discussed: the direct vented pit; offset vented pit; and compost latrines.

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<sup>1</sup>Principal Health Officer, Ministry of Health, Dar es Salaam, Tanzania.

## Vented Pit Latrines

The pit can either be circular or square in shape. A round pit is normally preferred. The pit is about 240 cm deep and 90–110 cm in diameter. It can be lined or unlined depending upon the soil structure. In weak soils (loam or sandy soils) it must be lined. This will guard against cave-in and will also minimize the chances of fouling the groundwater. The lining can be cement blocks, burnt bricks, stabilized earth blocks, concrete rings, or metal sheeting.

In digging the pit it has been found that it is advantageous to start by providing a collar around the pit. The vented pit latrines experimented with in Tanzania were square in shape, 100 cm × 100 cm × 240 cm. The collar helped in getting the sides straight and prevented the top portion of the pit from falling in. These pits were unlined.

The collar was reinforced with two iron bars 6 mm in diameter. One layer of brick was built on top of the collar to make a plinth on which the stance would stand. The pit stance can be made of wood (plywood), reinforced concrete, or ferro-cement. The platform must be durable and easily cleaned. In our experiment we used both marine plywood (1.8 cm thick) and ferro-cement (1.8 cm). Ferro-cement, besides being cheap and easily made locally, was found to be durable and strong. It requires a weight of 340 kg to break the slab. The slab must fit tightly to prevent passage of flies. In the vented pit, the slab (platform) has two holes: one of them for squatting (defecation) and the second hole, which is 20 cm in diameter, is fitted with a vent pipe 15 cm in diameter

and about 250 cm high. The top of the vent pipe is belled outwards to about 30 cm and the aperture so made is covered with wire gauze to prevent the escape of flies and mosquitoes. Aluminum wire mesh has been found to be more durable because it does not corrode quickly. Fiberglass mesh could be another alternative.

The superstructure provides privacy and protects the user from the sun and rain. It can be made of any material: mud bricks, burnt bricks, or wooden poles, with a thatched roof or corrugated metal sheet roof. The superstructure must be high enough to permit the user to perform the function comfortably. Low and short superstructures should be discouraged. A door opening inwards must be provided as well.

The vented pit latrine operates anaerobically. The foul gases produced during decomposition are vented away through the flue provided. This type of latrine is odour free and if properly maintained can be free of flies. Normally, only excreta enters the pit. To perform well, the contents of the pit should not be too dry.

The vented pit latrine is designed for a single operation, i.e., it is a discontinuous system. Once filled, it has to be abandoned and a new one constructed. It can be emptied but after a long time of rest. Various designs have been developed recently to facilitate easy emptying of the contents and also to facilitate reuse of the latrine.

Because it is practically odour free, it should be safe to locate the offset pit latrine close to the house, but preferably at least 8 m away in townships, depending upon the plot size, and at least 20 m away in rural areas. The latrines should not be too far as this will deter their use by small children or at night by adults, which will defeat the purpose of the latrine.

Pit latrines are normally not sealed at the bottom and infiltration is likely, particularly in permeable soils. If they are located close (less than 50 m) to wells, they become potential health hazards because the water will become polluted. Alternatively, they should be placed downstream of any water source.

Pit latrines are the most common features in developing countries. This is true of Tan-

zania. In the past, people have been held back from using latrines due to tribal customs and taboos. This problem is now decreasing and in urban centres it is almost nonexistent. With health education, people accept pit latrines very readily. Because of their simplicity, pit latrines are easy and less costly to maintain. The small area of the squatting slab renders it easy to clean. The superstructure, if made of durable materials, will also require very little care. The door hinges may get loose quickly and these would require extra care. This is also true with the wooden hole cover, especially the handle. Pit latrines are best if provided on an individual household basis. Communal latrines pose problems in their upkeep. No one feels responsible to clean it and it may remain dirty for long periods of time. It then becomes a nuisance and a health hazard to the users.

### **The Offset Vented Pit (Reid Odourless Earth Closet, ROEC)**

This consists of two separate units, the defecation unit and the holding (receiving) unit, connected by a short length of piping, the chute, set at an angle of between 50° and 60° to the horizontal. The defecation unit forms the shelter or the superstructure. Here again, this can be constructed with any suitable material. A door is also essential. The floor, cast in situ, is made of concrete, with a keyhole shaped defecation aperture. A room 90 cm long and 80 cm wide is quite adequate.

The holding unit can either be a lined tank or lined on the sides with an unsealed bottom. Again, this will depend upon the nature of the soil and the groundwater level. Lined pits should have weep holes for seepage. The tank is 200 cm long, 100 cm wide, and has a minimum depth of 240 cm. The depth is measured from the bottom of the chute to the pit floor. Heavy-duty concrete covers are required for the top of the tank. A vent pipe 15 cm in diameter is fitted on the fixed slab. The other slabs are lip-jointed and are provided with metal handles for easy removal. The top of the vent pipe is covered with

suitable mosquito gauze. This will prevent flies and mosquitoes from escaping when they are drawn up by the draught of air through the chute.

The ROEC works like a vented pit latrine. It is anaerobic in action and gases are vented away through the vent pipe. It is, therefore, odourless as its name implies. The unit can withstand some abuses in usage. It can tolerate the addition of water. Care, however, should be taken not to have too much water. The unit is acceptable to many people and was most liked by people who use water for anal cleansing. People have tended to use the enclosure as a bathroom but because of its small space, it has managed to discourage users from taking baths in them.

The floor of the ROEC is fixed and very easily kept clean. Most ROECs tested in Tanzania were always found very clean. The only problem arose with the chute. It gets fouled and if neglected can be a nuisance. By using a long-handled brush or by pushing small bundles of grass, the chute's surface can be kept clean. Like the vented pit, extra care is required for the door and its hinges. It will be of interest to note that of the 16 ROECs built and tested in Tanzania, 5 collapsed after being in use for between 6 and 16 months. One unit collapsed because of faulty construction and this was replaced with a better constructed unit. The others collapsed as a result of heavy rains and high groundwater tables. They were constructed in unstable soil. One probable reason for the collapse is the size of the walls of the receptacles. The units were constructed with blocks measuring 390 mm × 190 mm × 50 mm. The 50 mm thick wall does not appear to be strong enough to withstand the soil pressure. It is suggested that for the ROEC, bricks or blocks with a thickness of between 150 mm and 230 mm should be used.

### **Improved ROEC**

Experience has shown here and elsewhere that the chute of the ROEC is subject to fouling by excreta. This fouling tends to undermine the hygienic properties of the ROEC. To eliminate such fouling, the design of the ROEC has been modified. In

the revised design, the chute is omitted. Instead, the near end of the pit has been extended just below the superstructure so that excreta from the pedestal seat or squatting slab can drop directly into the pit. This modified ROEC has been named the vented indirect pit latrine (VIP). Another modification of the ROEC is the alternating VIP latrine. Here, the pedestal seat or squatting plate in each toilet room or cubical has two openings. Each opening leads to one of two adjacent indirect pits. Thus, behind the latrine are two adjacent pits, each with a corresponding toilet seat or squatting plate opening within the same toilet room.

During operation, only one pit is used at a time. When the first pit becomes full, the second pit is brought into use. When the second pit becomes full, the decomposed contents of the first pit are removed for possible use in agriculture, and the emptied pit is returned to use again. The size of the pits should be such that the contents in them should remain for at least 2 years before being removed. In this way, the destruction of pathogens will be ensured. The alternating VIP should be regarded as a permanent latrine. It is, however, more costly to construct than the ROEC and the VIP latrine. It can be observed that communal use is also applicable. In this case, the number of pits is one more than the number of toilet cubicles. If the pits are numbered sequentially from one end they can be divided into two sets, namely, odd-numbered pits and even-numbered pits. In operation, either the odd-numbered or the even-numbered pits are used at any given time. When a member of one set of pits becomes full, all members are put off use, and the other set is brought into use. Hence, these two sets of pits are used alternately. These modified alternatives are currently being tried in Ghana and Botswana.

### **Composting Toilets**

There are two basic types of composting toilets: continuous and batch (alternating). Continuous composters are developments of a Swedish design known as the "mult-

rum." The composting chamber, which is situated immediately below the toilet seat or squatting plate, has a sloping floor above which are suspended inverted "U" or "V" shaped channels. In some cases these channels are omitted for ventilation purposes.

The multrum is a two-chambered unit. The two chambers are separated by a baffle wall which is built a few centimetres clear of the floor, thus providing a passage for the accumulating and decomposing compost in the upper chamber to slide down through into the lower, humus chamber. The floor is laid at an angle of between 25 and 30° with the horizontal. It has been found that with a slope less than 25° the compost does not slide fast enough, whereas above 30°, the compost slides too fast, to the extent that the humus nearly always contains fresh excreta. The humus is supposed to be the end product of decomposition of the compost and if properly managed should resemble black soil. The construction of the slanting floor at the required angle requires an expert artisan who may not be easily available in rural areas. The floor can be either concrete or brick lined. The walls of the multrum may also be constructed with adobe, burnt bricks, cement blocks, or stabilized earth blocks. The little spaces left between the joints would form weeping holes for seepage of excess liquid. The two chambers mentioned above have covers placed on top. The top chamber has a squatting plate with a defecation hole. The lower chamber has a solid (without hole) cover. These covers can be made of plywood, reinforced concrete, or stabilized ferro-cement. In our test units, plywood (1-8 cm thick) and ferro-cement (1.8 cm thick) were used.

Ventilation of the multrum is achieved by a flue inserted on the side of a wall below the squatting stance. The metal vent pipe has a right-angle bend fitted into the wall and a vertical pipe is extended above the roof. The belled top end is covered with mosquito wire gauze to stop insects from escaping. In addition to the vertical flue, one or two small vents are inserted in the wall above the ground level. These vents are also screened. It has been observed that metal screens get rusted too quickly, whereas nylon wire is

eaten by cockroaches. Perhaps the best screening material would be aluminum gauze or fiberglass. The problem with vent holes is that they are easily tampered with by small children and also they tend to be blocked by fly pupae. It is advisable that vents be omitted; ventilation could be achieved through the hole in the squatting slab.

### **The Utafiti Latrine**

This is a modified multrum that is currently being tested in Tanzania. Structurally the Utafiti latrine is basically the same as the multrum. There is no difference in its performance compared with the multrum; although the Utafiti latrine may be a little larger. Two special features that make the Utafiti different from the multrum are (1) the squatting slab incorporates a flap-trapped pan or chute and (2) "U" or "V" shaped conduits are provided. The floor of the Utafiti can be open or sealed. The absorption trench provided for the disposal of excess liquid is optional. It is not required for people who use toilet paper (as opposed to water) for anal cleaning. One thing worth noting is the problem of keeping the flap-trapped pan or chute clean. In the first instance, the pan is too small and easily fouled. The chute has the same drawback as that in the ROEC. It requires a lot of health education for users. The best cleaning material for the fouled chute is refuse and particularly a hip of grass pushed into the pit.

Continuous composting latrines work aerobically. Because of the presence of the vent pipe, the latrine is virtually odourless. For the latrine to work efficiently a lot of organic materials, e.g., grass, peelings (fruits), husks of grain, sawdust, and ashes must be added to the latrine. The compost latrine will not function well if it is too watery. Of course, the contents should not be too dry either. It is recommended that the moisture content should be between 40 and 60%. With the right moisture content and a lot of decomposable materials (a large hip), bacterial activity in the compost can raise the compost temperature to a level (50-60°C) that will eliminate pathogens in the

compost. The performance of the multrums in Tanzania was not very encouraging. In many cases, the compost was too wet and the humus was actually sludge. This excessive water content was due to water that was used to clean the anal parts and sometimes to water used to clean the squatting stance. Very little refuse was added. The temperatures in most units were just ambient.

Because of the sloping nature of the floor of the multrum or Utafiti latrine, the composters must be constructed below ground level (usually 1 m). However, because it is lined and has a sealed floor, the chances of groundwater being contaminated are small. If the pit must be unlined and open on the bottom, particularly in impermeable soils, the normal and recommended precautions, insofar as siting in relation to wells, should be adhered to. Composting latrines are practically odour free but should, nevertheless, be sited as far as possible from the kitchen and the house to minimize the possibility of cockroaches finding their way from the receptacle to food and kitchen utensils.

Composting latrines are relatively new to the African people and particularly to Tanzanians. In operating the composter, a lot of organic materials (grass, straw, sawdust) are required. These may be lacking in urban areas. In some cases, because of taboos, people are not happy with the need to "keep on adding grass" into the pit. Again, humus has to be removed periodically. Many people loathe the idea of touching faeces and it, therefore, becomes a problem in removing the humus, particularly if it is "sludge." Participants in our test units in the country have managed to remove the humus, but this has not been without prolonged health education and persuasion. They have also used the humus as fertilizer in their gardens with great enthusiasm. For people who use water for anal cleaning, compost latrines are not cherished. If given the choice, they prefer VIP or ROEC type latrines. If a composter is to be used properly, it is recommended that a bath place (room) should be provided adjacent to the latrine (with a door leading to it).

As pointed out with regard to the VIP and the ROEC, the main problem is the main-

tenance of the vent pipe. This corrodes very quickly. It has to be replaced many times which is costly. It has been suggested that to tackle this problem it would be advisable to use things such as cast iron, PVC piping, or bricks. These items, of course, are durable but very costly. One observation of misuse of the latrines, and this is true of the batch system (modified Gopuri), is the tipping of refuse or organic matter into the humus chamber. This defeats the purpose of the composting toilet. It is suggested that covers for the humus chamber should be fixed with cement mortar, because lime mortar is rather weak for this purpose.

### **Batch (Alternating/Double-Vault) Composters**

Double-vault composting (DVC) toilets are the most common type of batch composting latrines. There are many designs but all have common features: (1) They have two adjacent vaults: one is used until it is about three-quarters full, covered with grass, filled with earth, and then sealed; the other vault is then used. When the second vault becomes full, the contents of first vault are removed and the vault used again. The vaults are, thus, used alternately. (2) They have vent pipes that extend above the roof and remove foul gases from the latrine. (3) Organic refuse, including ashes, must be added into the vault.

There are no standard designs and the sizes of the vaults are not well specified. Compost latrines are shallow and are designed to serve households. The vaults are, therefore, just adequate to accommodate excreta for 6-8 people for 6-8 months. The size of the vaults could range between 0.3 and 0.9 m<sup>3</sup>.

The construction materials are the same as those for continuous composting latrines, i.e., bricks, concrete blocks, or stones can be used. Double-vault latrines may either be lined and sealed at the bottom or may be lined and left open at the bottom. Decomposition in the sealed vaults takes much longer than in the open vault. Whereas in the sealed vault the liquid (urine plus excess water for anal cleaning and slab cleaning) is retained much longer, in the open pit the

liquid infiltrates into the soil. The moisture content in such open vaults is more conducive to bacterial activities than in the sealed vaults.

The squatting slab can be made from wood (plywood is best), reinforced concrete, or ferro-cement. Cement slabs are preferred because they discourage growth of hookworm larvae. The slab must have a hole large enough to avoid fouling of the sides but small enough to prevent children from falling into the vault. The DVC toilet works anaerobically and produces foul gases.

It is essential that the gases are removed. The problem with the metal vent pipes currently being used is that they rust very fast, particularly at the bend. The gases from the latrine are very corrosive.

Alternating or double-vault latrines are the most versatile types. They can be used under difficult soil and groundwater conditions. In this case, they may be the only choice. Where the groundwater table is high or the soil is impermeable or unsuitable, the double-vault latrine is recommended. The latrine can virtually be built above the ground (for a sealed unit) or just a few centimetres below ground (for an unsealed unit). The location of the latrine in relation to the house is the same as for the continuous composting toilet.

Batch composters perform well when the moisture content of the compost is between 40 and 60% and the carbon/nitrogen ratio between 15:1 and 30:1. It is essential, therefore, that very little water is put into the vault and a lot of easily biodegradable organic wastes, such as sawdust, grass, and vegetable wastes, are regularly added into the vault to maintain a suitable carbon/nitrogen ratio in the compost pile. If these two conditions are followed, the maintenance problems are minimal, i.e., only the vent pipe and screening material need to be cared for.

Composting toilets are comparatively new innovations in many African countries including Tanzania. The conditions required to enable the latrine to produce compost are not easily followed and many people loathe working with composted humus, which many people still regard as

faeces. The acceptability of the composters by people is, therefore, still questionable. It is suggested that households that participated in our trial units accepted the latrine because they wanted a latrine. After all, they were going to get the services free. More time is needed to be able to evaluate this aspect.

### **Health Aspect of Composting and Refuse**

Ventilation of vaults reduces odours and fly nuisances considerably, and if the squatting plate is kept clean, double-vault composting toilets do not pose significant risks to health. Provided each vault can store excreta for 1 year, the composted humus can be safely handled and used on the land. Microbiological studies carried out in Tanzania on the compost have shown that there is considerable reduction in the coliform bacteria. Thus, the humus in the compost latrine contains no more pathogenic organisms than the soil on the ground around the households. A triple-vault composter (TVC) would make the humus much safer. With regard to reuse of the humus, only three households were surveyed. They used the humus in their gardens and they have made very favourable remarks.

### **General Remarks on Compost Latrines as Experienced in Tanzania**

As indicated, compost latrines are a very new technology in this country. People are more familiar with pit latrines. There are only 57 compost latrines in the country; of these, 44 are continuous and 13 are double-vault latrines. All of these were experimental units. No new ones have been built. The performance of continuous composters was not satisfactory. Poor operational maintenance was the main cause of failure. People used too much water for anal cleansing and also for cleaning the stance (if they had to). Therefore, the compost was too wet and so was the humus. Temperatures in the compost heap were just ambient, so that many pathogenic bacteria could not be eliminated. Perhaps the reduction of the coliforms was



due to the length of time the humus remained in the vault. Many users considered it as an unnecessary bother to keep putting organic matter in the latrine vaults. There was, therefore, very little material to provide the carbon and nitrogen necessary for bacterial activity. The double-vault composters, however, did work out well. Four of the composters produced good dry humus. With these composters, the removal of the humus was not a problem, but the people had to be educated and persuaded. The people did accept the composters but the acceptance could well be due to the fact that they did not have to pay for the latrines and they needed them anyway. Nonetheless, with the passage of time and continual health education, many households will probably opt for the compost latrine. A compost latrine, in addition to being an excreta disposal unit, is also a refuse (garbage) disposal unit. If used

well, household refuse collection and disposal would be very much facilitated. Furthermore, a compost latrine has the advantage over a pit latrine of being shallow and in this respect things, including children, falling into them can easily be retrieved.

### **Conclusions**

Pit latrines (VIP) and composting toilets are low-cost technologies that are cheap to construct and to maintain. Many people can afford to own them. Furthermore, people are accepting their use. It is a pity that in the past more emphasis was put on the supply of water than on sanitation. Water alone cannot improve the health of the people. Both water and excreta disposal systems must be provided together if the health of the people is to be significantly improved.

# Anaerobic Digestion as a Rural Sanitation Option

R. Carothers<sup>1</sup>

Anaerobic digestion refers to the process of fermentation of organic materials in a nonoxygen environment. This can be artificially stimulated inside airtight containers, usually of masonry or metal construction, that are called anaerobic digesters or biogas plants. The biogas label stems from the mixture of methane and carbon dioxide that is produced during the fermentation. Although the rate of digestion can be affected by a variety of factors, three basic stages occur. The liquid slurry is first broken down into soluble compounds, such as sugars, through the action of enzymes. Secondly, facultative anaerobic bacteria produce volatile fatty acids and some alcohols, carbon dioxide, ammonia, and hydrogen. Lastly, strictly anaerobic bacteria produce combustible methane gas.

The sanitation interest in anaerobic digestion arises because during the process the lack of oxygen, presence of free ammonia, temperature effects, and other factors cause a drastic reduction in the numbers of pathogenic bacteria and parasitic ova. Also, the effluent does not normally attract flies and can be made unsuitable for the breeding of mosquito larvae. Use of anaerobic digestion as a means of waste treatment has additional benefits in reducing the amount of suspended solids and in eliminating noxious odours.

Other applications of anaerobic digestion have also been of interest. The production of nitrogen-rich fertilizers through the anaero-

bic digestion of animal manure and vegetable matter has been a concern for those wishing to improve soil fertility. More recently, much publicity has been given to the use of anaerobic digestion as an energy source where the resulting methane gas is used for cooking, lighting, or replacing diesel fuel in engines. Biologists have studied anaerobic digestion in animals, particularly in ruminants. Because of the varied applications of anaerobic digestion, work has sometimes been carried out in one discipline in isolation from or in ignorance of previous or simultaneous work in other fields. It has been pointed out that this, along with the emotional appeal of particularly the small-scale anaerobic energy-fertilizer-sanitation system, has led to the lack of a systematic approach, in many instances, in evaluating anaerobic digestion in the light of other options. Clearly, there are advantages to be gained from anaerobic digestion but in any particular instance benefits should be weighed against possible problems such as investment costs, management level, and the need for support services. The Chinese, who have the greatest experience with small-scale anaerobic digesters feel that rural biogas digesters are 30% technique and 70% management. Technically proven systems, even with extensive government-sponsored support services, can run into problems in practical use.

## Historical View

Early records of combustion from naturally occurring anaerobic digestion date back 2000 years. More scientific work follow-

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<sup>1</sup>Research Associate, Department of Mechanical Engineering, University of Waterloo, Waterloo, Canada.

ed Volta's observation of marsh gas during the latter part of the 16th century. By the mid-1800s, anaerobic digestion in septic tanks began as a means of sewage purification, but systems allowing for the collection of gas were developed only at the end of the century. The Matunga Leper Asylum in India became one of the earliest demonstration sites for a practical, multipurpose use of anaerobic digestion. In 1897, gas was collected from septic tank type digesters and used for cooking and lighting. Later, an engine was also operated on the gas and used to pump sewage.

European interest in anaerobic digestion was largely concerned with using the process as a means of sewage treatment, although the applications for fertilizer and energy production were also explored but generally these were seen as uneconomic and impractical, particularly on a small scale. The use of anaerobic digestion in India and China, where most plants are presently operating, arose primarily from interests in fertilizers and energy, although China is also encouraging the use of anaerobic digesters to process human excreta.

## Regional Efforts

### Europe

In Europe, the interest in anaerobic digestion was greatest during the 1940s. Between 500 and 1000 plants were operated in France but results were not well documented. Generally, it seemed that much of the work extolling the virtues of small-scale anaerobic digestion as a means of fertilizer and energy production was not rigorously carried out and the economics at the time seemed questionable. Several academic studies undertaken in West Germany indicated that collection of methane gas for energy purposes was rarely economic and even the use of the process for fertilizer production was brought under question. Most anaerobic digesters did not store the effluent under anaerobic conditions, resulting in a decline in the nitrogen content of the effluent before being used in the fields.

Although somewhat similar work was carried out in other parts of Europe, interest in anaerobic digestion as a means of fertilizer and energy production declined during the 1950s, although the process was seen as useful in the treatment of sewage.

### India

In India during the 1930s, anaerobic digestion was seen as a means of improving the nitrogen content of fertilizers. With the depletion of local firewood supplies in the early 1950s and the increasing use of cow dung as a substitute fuel, anaerobic digestion was seen as a means of providing energy for cooking as well as high-grade fertilizer. The physical and economic environments of India in which developments in anaerobic digestion began were different from those in Europe. Early efforts, however, were unsuccessful. Of the 500 plants built with government assistance in 1955, all were later abandoned due to a variety of technical and economic problems including lack of sufficient cow dung, low rates of gas production, and low efficiencies of cheap stoves and lights.

Further research and development work was carried out on gas plants and appliances during the 1960s and a program of government grants, loans, and technical servicing was introduced. The basic biogas plant design, however, continued to be that adopted by the Khadi Village Industries Commission during the mid-1950s. This consisted of a divided fermentation chamber, floating gas cap, and inlet and outlet pipes (Fig. 1). The gas produced is stored at constant pressure under the floating cap system with feeding and effluent removal carried out daily. By 1970, an estimated 3000 plants had been established but this rose dramatically to 50000 by 1978, partly in response to the general escalation in costs of other energy sources.

Despite the widespread dissemination of biogas plants in India, problems still remain. There are some doubts as to whether the Indian-type plants would be economically justifiable without government subsidy, although these conditions are changing with the rising costs of other energy sources. The

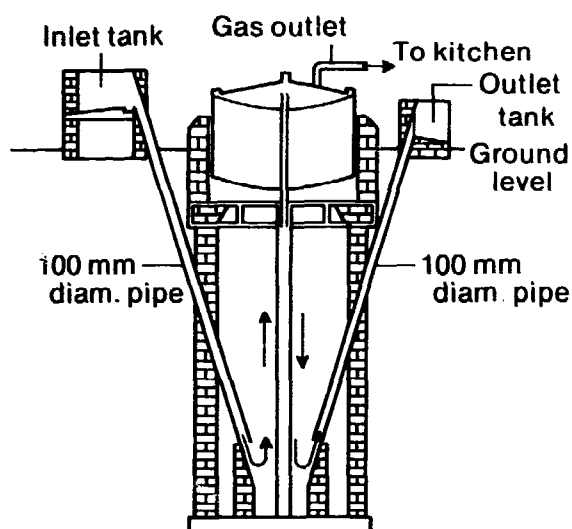


Fig. 1. Design of anaerobic digester used in India (Khadi Village Industries Commission design, 1953).

Indian plants are unable to store the effluent under anaerobic conditions and so some of the potential benefit is lost as nitrogen escapes during the storage period. Some of the smaller farmers operating biogas plants have difficulty in securing sufficient quantities of cow dung, whereas the poorer peasants who continue to burn dung directly compete for a diminishing supply of fuel.

The areas of India where biogas plants have operated most successfully are those where functional extension programs exist. These advise an interested farmer as to the size of plant and amount of feed material required, the financial assistance programs that are available, and later on how to operate, maintain, and repair the plants. Where this support service has not existed the biogas plants have not fared as well.

### China

The application of anaerobic digestion within China began in the 1950s with a view toward using the fertilizer, energy, and sanitation aspects of the process. Although early efforts were not encouraging, improvements in low-cost construction techniques coupled with efficient government extension and service programs have led to the establishment of 7 million biogas plants since 1970. The majority of these are rural digesters that

are set up to provide fertilizer, energy for cooking and lighting, and to improve public hygiene. Larger plants have been built to supply fuel for diesel power plants.

The Chinese-type rural anaerobic digesters are entirely of masonry construction (Fig. 2). Elimination of the moveable gas cap reduces costs and corrosion problems but means that the gas is stored under variable pressure and must be regulated. Also, the masonry dome can be a source of leakage problems. These plants are normally fed daily with a mixture of animal manure, human excreta, and vegetable matter. The vegetable matter increases the carbon/nitrogen ratio of the slurry, providing a more optimum balance of nutrients for the bacteria. Although this results in a higher gas output per unit digester volume, it also increases the rate of sludge buildup. The rural Chinese plants are emptied and desludged twice a year, but this practice matches well with the times of peak fertilizer demand, when sludge as well as normal effluent are applied to the fields.

### Sanitation Aspects of the Chinese Anaerobic Digesters

#### Sedimentation

The ova of hookworm, ascaris, and schistosoma are denser than the slurry and, therefore, settle out to the bottom. After 20 h, 95% of the ova have settled, with the remainder on the surface attached to floating material. The effluent removed from the middle layer of the digester (Fig. 2) is largely free from these ova. However, sedimentation does not solve problems encountered during desludging.

#### Temperature

The effect of temperature in destroying bacteria and ova would be far greater if the digesters were heated to the thermophilic range (53°C) for anaerobic digestion or even to the mesophilic range (37°C), but in practice the rural digesters are operated at ambient temperatures (10–29°C) because heating the digesters would significantly increase management difficulties. Under ambient temperature conditions, the ova of schistosoma and hookworm die within a 100

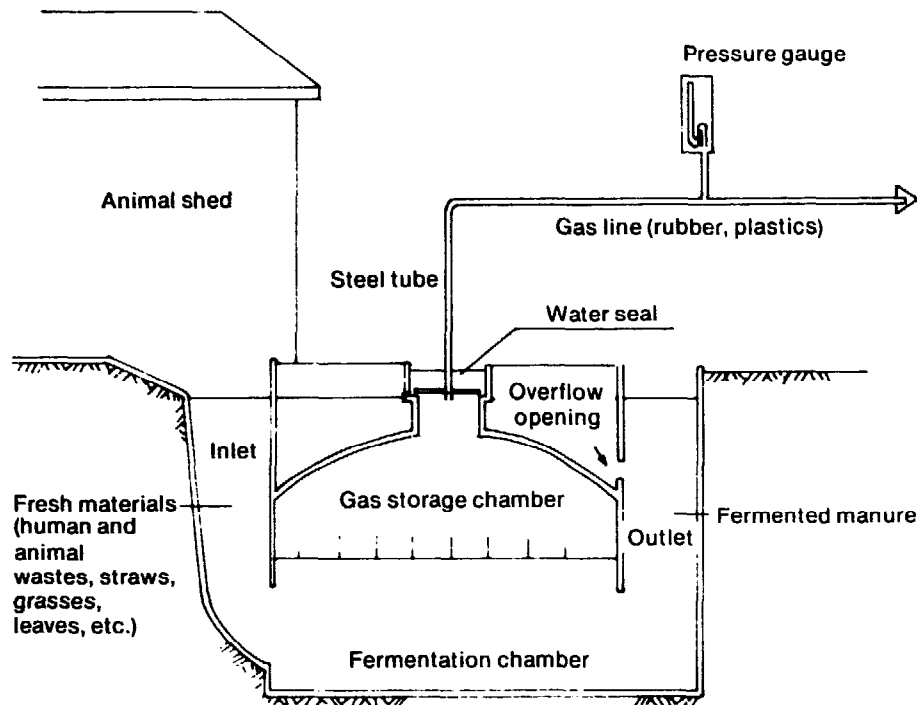


Fig. 2. Chinese anaerobic digester of masonry construction.

day retention period but those of ascaris are reduced to only 53% of their original level. The shigella flexner and leptospira are destroyed and the *E. coli* markedly reduced.

#### Free Ammonia

Free ammonia, produced during fermentation, can permeate the egg shell and cell membranes and kill ova and bacteria. With a level of 0.2% free ammonia, the ova of *schistosoma* and ascaris would be expected to die in 2-3 weeks. However, the ammonia levels in rural digesters are normally about 0.07% and as a result the ova, particularly of ascaris, survive considerably longer.

#### Anaerobic Conditions

Due to the anaerobic conditions within the digester, leptospira are unable to grow and under absolute anaerobic conditions hookworm ova can survive only 9 days, whereas those of ascaris die off after 100 days retention.

#### Effluent

The effluent from anaerobic digesters does not attract flies and through the addition of algae (which increase the pH) can be

made unsuitable for the breeding of mosquito larvae.

The general conclusion of the Chinese is that the use of anaerobic digesters in rural areas offers a major improvement in sanitation and public health, but that some ova may survive the digestion process, particularly if the retention time is less than 100 days. Three methods for further treating the effluent are suggested as a means of rendering the effluent safe for handling: high-temperature composting, mixing with chemical fertilizers (ammonia and urea), or pressing with a mixture of soil into granules.

Surveys carried out in certain areas before and after the installation of anaerobic digesters showed that hookworm infestation of the population dropped to one-third of its original level (64% to 23%) and a similar reduction was found with cases of enteritis and bacillary dysentery.

#### Botswana

Work on anaerobic digestion was started at the Rural Industries Innovation Centre (RIIC) in Botswana as a means of providing

energy for diesel pumps at boreholes that provide water for cattle. Tests with a Chinese-type digester have shown encouraging results, e.g., 15% of the dung produced by a herd should provide sufficient energy to pump enough water from a depth of 100 m to meet the water requirements of the cattle.

An extensive survey carried out during 1977 by the RIIC extension service showed water supply to be by far the major concern of most rural dwellers; hence, the RIIC's focus on energy for pumping water. Rural sanitation was also a frequent issue, though seen as less important, and, therefore, the sanitation aspects of anaerobic digestion have been considered.

Through village interviews it was found that most people realized that a "lack of toilets leads to the spread of disease," though this in itself did not seem sufficient motivation for building a toilet. Convenience seemed a stronger motivating factor for those who could afford to pay the construction costs. These costs acted as a deterrent, because those people without toilets suggested an expenditure of P15-P20 (P1.00 = U.S.\$1.27) would be reasonable, but the style of pit toilets preferred cost on the order of P200.

The specific request that led to the start of work on small anaerobic sanitation systems came from an individual who needed an above-ground toilet system, because underlying bedrock made the digging of a pit impossible. A small anaerobic digester was designed for this purpose with a view to keeping the management of the system as simple as possible. The users were advised to add no additional vegetable material or animal manure and only a small amount of water after defecation (about 0.5 litres). Further dilution would come from the inclusion of urine. The small amount of dilution with clean water was suggested so that there would not be a temptation to use grey water that could be contaminated with detergents or other agents harmful to the anaerobic bacteria inside the digester (Fig. 3).

This system has been operating successfully for 2 years without desludging, although this will become necessary at some

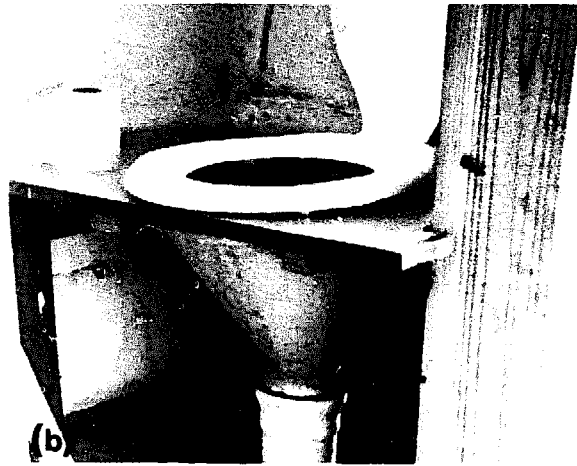
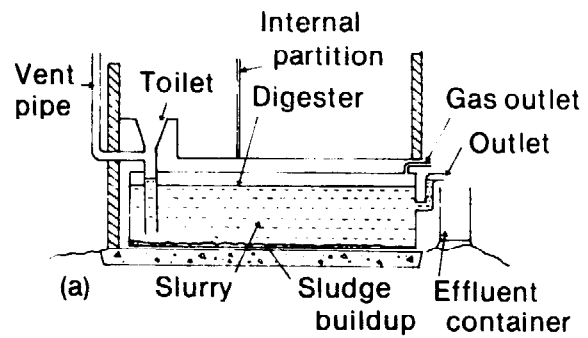


Fig. 3. (a) Original small-scale anaerobic sanitation system. (b) Toilet. (c) Outlet and small gas storage facility.

time in the future. The effluent, which is virtually odour free, is removed weekly and used either as a fertilizer on trees and grass or discarded. The amount of gas produced was small and normally vented into the atmosphere, but the users did install a small gas collection system for occasional use.

Tests carried out at the Kanye and Gaborone hospital laboratories have suggested that the effluent would be safe to handle, although the users have been cautioned to do this carefully.

Although this first system was acceptable to the users, the need to remove the effluent was a strong deterrent for most other people and the use of the effluent as a fertilizer was unacceptable. There were even stronger feelings against the use of the gas produced for cooking, although use for lighting could be considered.

The second design of an anaerobic sanitation system allowed the effluent to soak away automatically (Fig. 4). Grey water from the household would be added to the effluent after it comes out of the digester to allow for sufficient dilution in the drain. In houses without an indoor drain, users would need to add grey water to the system through an outside drain.

Although the digesters built so far have not had to be desludged and the frequency at which this would be required is likely to be at least several years, it is unlikely that users would be willing to carry out the desludging operation themselves. It is anticipated that a service program for this purpose would need to be established.

Costs of construction of the small concrete digester could be close to those of existing pit latrines but the addition of the seepage drain is likely to increase costs another 50-100%.

Construction of the digesters was carried out prior to receiving information from China and as a result the plants are undersized and do not make optimum use of the sedimentation feature. For a 100 day retention period with minimal dilution, a family of five would require a digester with a capacity of at least 1 m<sup>3</sup>.

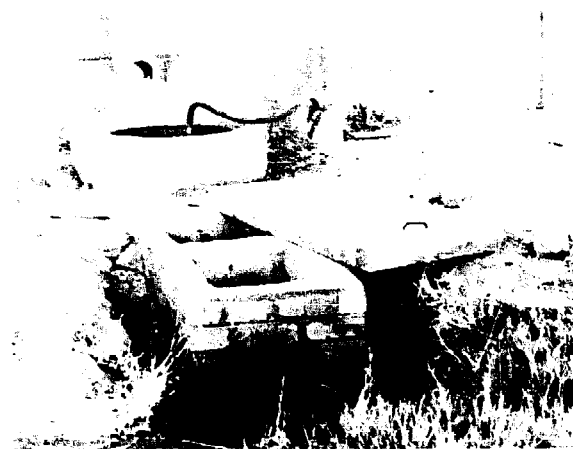
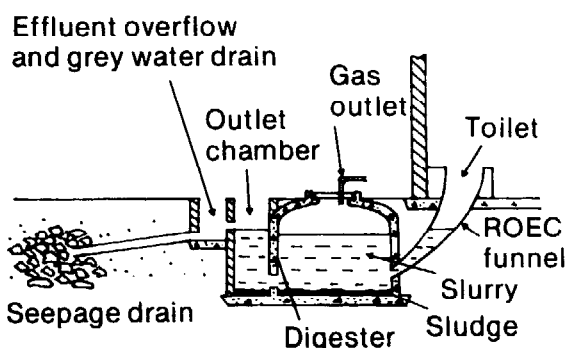


Fig. 4. Anaerobic digester with seepage drain. Photo shows digester, outlet chamber, and overflow drain. Note that the seepage drain has not yet been installed.

### Motivation

In Botswana, there seems to be little in the way of motivating factors to encourage the individual to adopt anaerobic sanitation systems. The installation cost is likely to be higher than that of existing pit latrines and the possible economic benefits in terms of fertilizer or energy (small in any case) production are unlikely to be used for social reasons. In some cases where underlying rock, sand, or high water tables make pit toilets impossible, small anaerobic digesters could provide an answer.

Environmental pollution is more likely to be a motivating factor at government level. It is likely that pit toilets will be the first stage in the process of improving rural sanitation but this will still leave the problem of groundwater pollution. The small-scale anaerobic digester, if introduced at a later stage, could play a role in reducing this

pollution without requiring large amounts of clean water.

From discussions held with the administrative staff of the hospital at Kanye, concerns about environmental pollution, including problems of noxious odours, warrant consideration of anaerobic digesters as sanitation systems. In this case, use of the energy and fertilizer aspects of the process could be more easily realized.

In continuing work with anaerobic digestion, primarily as an energy source for pumping water, the RIIC has submitted a request to the People's Democratic Republic of China for assistance. As part of this program it is planned to build and test the sanitation benefits of an anaerobic digester specifically designed for use at an institution.



# Zambia's Experience with Aqua Privies

J. Kaoma<sup>1</sup>

Industrialization in Zambia in the 1950s resulted in a massive influx of migrant labour. It was mostly the indigenous population that moved from the rural areas into the recently established urban areas. As the urban population grew, however, the problems associated with overcrowding, such as water supply and excreta disposal, emerged. In order to prevent outbreaks of communicable diseases it became necessary to install cheap and well-organized excreta disposal systems in areas of low-cost housing.

Before the introduction of self-topping aqua privies, four systems of sanitation were used in the townships of Zambia (at that time, Northern Rhodesia). The systems included pit latrines; pail latrines; conventional aqua privies; and waterborne sanitation systems. Of the four systems, only aqua privies will be discussed in this paper.

There are three types of aqua privies: (1) conventional, with soakaways; (2) self-topping, with soakaways; and (3) self-topping, sewerred. The second and third types are simple modifications of the conventional aqua privy. They are modified to dispose of household wastewater (sullage).

## The Conventional Aqua Privy

Essentially, the conventional aqua privy consists of the superstructure (for privacy), the squatting slab or plate, a small (septic) tank situated immediately below the squat-

ting slab, an overflow from the tank, and soakaways. A vent pipe is usually provided also. The squatting slab has a built-in drop pipe called the chute. The diameter of the chute varies from 100–150 mm. The water level in the tank is allowed to come within 100–150 mm above the bottom of the chute. In this way a water seal is maintained between the squatting slab and the tank contents. If the aqua privy is to function properly, the water seal must be maintained at all times. It requires the user to add sufficient water, 4 gallons (18 litres) per day, through the chute to replace any losses. The water is normally drawn from a nearby communal standpipe.

Human wastes are discharged directly through the chute into the tank. Here, the organic solids are acted upon by anaerobic bacteria to form gases and semiliquids. The overflow from the tank is disposed of in a soakaway. The inorganic matter settles to the bottom of the tank by sedimentation.

Desludging of the tank is required. The frequency of desludging depends upon the size of the tank and the rate of use. Normally, the tank is desludged when it is two-thirds full.

## Problems with the Conventional Aqua Privy

With the exception of the waterborne sanitation system, all of the other sanitation systems installed failed to operate effectively. The conventional aqua privy failed for the following reasons:

(1) Failure on the part of the users to maintain the water seal. Users were either

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<sup>1</sup>Civil Engineer, National Housing Authority, Lusaka, Zambia.

unaware of the importance of maintaining the seal or they disliked being seen carrying water into the toilet. Failure to maintain the water seal transformed the aqua privies into shallow pit latrines. Human wastes, therefore, became exposed to rodents and insects. Nuisances in the form of odours followed.

(2) Failure of the soakaways due to impervious soils; porous soils becoming clogged by organic matter; and seasonal high water tables.

(3) The system could not dispose of the household wastewater because it was not designed to cope with this form of waste.

### **Need for a Cheaper but More Effective Sanitation System**

Although the waterborne sanitation system (WC type) was successful, it was not possible at the time to install it in areas of low-cost housing. The majority of people in low-cost housing areas had relatively undeveloped skills, which resulted in low productivity, small incomes, and, therefore, low rent-paying capacities. Communal sanitation facilities, even the conventional waterborne sanitation systems, are rarely acceptable. Extensive supervision and the employment of attendants must be resorted to if even a minimum standard of cleanliness is to be maintained.

Faced with the need to overcome these problems, it became necessary to investigate methods of developing a cheaper, but more effective, system of sanitation for low-cost high-density housing areas. In this regard, an analysis of the merits and faults of the existing systems was made by the then African Housing Board. From this survey, a system based on aqua privies that incorporate most of the advantages of waterborne sanitation systems evolved.

### **The Self-Topping Aqua Privy System**

This system is designed to:

(1) Discharge all the wastewater from the household into the aqua privy and in this way retain the seal around the chute.

(2) Eliminate the use of soakaways by discharging the effluent from the aqua privy tank into sewers which take it to stabilization ponds. Where ground conditions permit the use of soakaways, the effluent from a number of tanks could be collected by a common sewer connected to a common septic tank with soakaways. Gradual change to a fully sewered system could then be undertaken at a later date.

(3) Use the aqua privy as a sedimentation tank for all the inorganic solids and to pre-treat the organic solids so that they will be in a form suitable for transportation in the sewers.

A supply of piped water was to be made available to the ablution units.

### **Description**

When the building serves two families it is usually placed across the common boundary; where it serves three or four families it is placed on the corner junction of the plots. The building is located away from the house for the following reasons: (1) the economic advantage gained by combining more than one unit and reducing the number of lengths of connections to the sewer; and (2) a natural reluctance of the people to have the latrines attached to the houses and their tradition of doing the household washing outside.

### **Ablution and Latrine Cubicles**

In the plan under consideration, the ablution (washroom) and latrine cubicles have a common door and are placed at right angles to each other. This arrangement was selected to avoid passing under or squatting under a water drip if and when a shower was installed. The floors of the cubicles are sloped to provide good drainage toward the drainage pipe in the ablution cubicle and the squatting plate in the latrine cubicle. The wastewater from the ablution cubicle discharges into the aqua privy tank through a pipe terminating 10 cm below the surface of the tank (Fig. 1).

### **Household Washing Facilities**

The washing facilities are under the cover of the roof. Each family has its own wash-

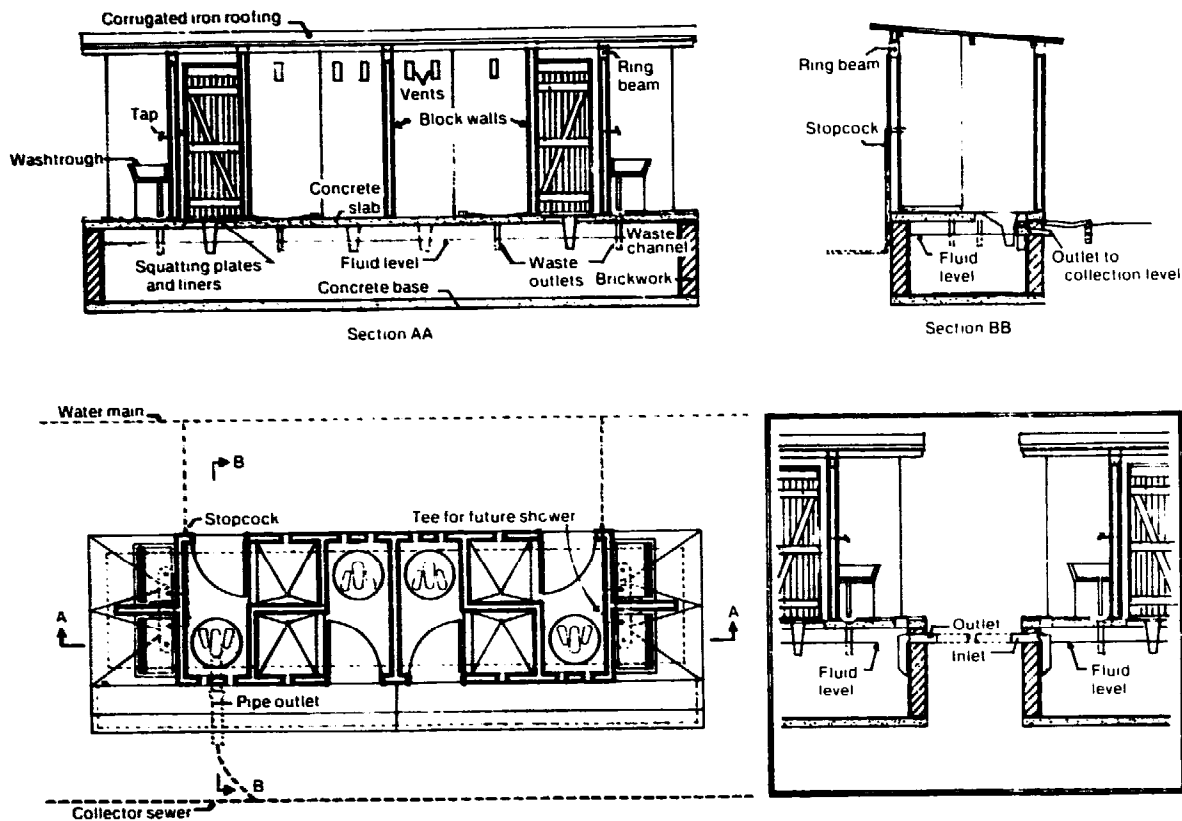


Fig. 1. Layout of sanitation block.

trough separated from that of its neighbours. The wastewater from the troughs discharges into the tank below through a vertical pipe. Blockages are infrequent and easily removed from a vertical pipe by rodding. In previous designs equipped with a trap in the pipe, blockages frequently occurred with debris or sand (commonly used for pot scouring). Consequently, trapped pipes were discontinued.

### Squatting Plate and Chute

The top of the tank is covered with a concrete slab into which is set the requisite number of 24 in. (61 cm) diameter manhole frames in which are placed the squatting plates. The squatting plate has an opening with two suitably located footpads cast into it. The footpads are raised above the surface of the plate and to facilitate drainage the plate is graded down toward the opening. To the underside of the squatting plate a chute of stainless steel or other corrosion-resistant material is fixed by means of an airtight

joint. Because odours are undesirable and attract flies, it is essential to ensure that there is no gas leakage from the tank. The outlet from the tank to the sewer is located below one of the squatting plates to facilitate clearing any blockage. This squatting plate is removable and serves as a manhole cover providing access to the tank. External tank manholes are not recommended unless fitted with relatively heavy covers because light covers are sometimes lifted and the tank used for garbage disposal.

### The Tank

The tank is placed below the building and its width is the same as that of the building, the longitudinal walls of the building bear directly upon the walls of the tank. The tank extends beyond the end walls of the building so that wastewater from a washing trough can drain into it directly from above. The floor of the tank, which also forms a foundation for the whole superstructure, consists of concrete 4 in. (10 cm) thick. By making the

tank an integral part of the building, the foundations are simplified and differential settlement is reduced. In earlier designs, smaller tanks were used, but it has been found that the present design, with its larger tank, costs no more, gives a better quality effluent due to the longer retention time, and the tank has a longer life before desludging becomes necessary.

### **Stabilization Ponds**

The aqua privy effluent is easily treated in stabilization ponds because the anaerobic decomposition in the aqua privy tank has already reduced the biological oxygen demand (BOD) concentration appreciably. The gain from this pretreatment is that the number of people per acre whose effluent can be treated in the ponds is very high. Moreover, because neither stones nor sand are present in the effluent, the inlet arrangements to the ponds treating aqua privy effluent are very simple.

## **Discussion of the System**

Each family has its own water tap, latrine, ablution cubicle, and washtrough and each family has the responsibility of keeping its own unit clean. The system requires nothing beyond the normal household activities to keep it functioning properly and the simplest hygiene practice to keep it clean. The system disposes of all the liquid waste and excreta from the household.

### **Costs**

#### **Installation Costs**

The cost of each sanitation unit comprising latrine, ablution, and washing facilities is approximately the same as that of a unit having a flush latrine and washbasins discharging directly into a sewer. There is, therefore, no saving here. There are, however, some savings on sewer lines and stabilization ponds. As velocities of flow and the size of sewer pipes are reduced, the cost of excavation is reduced also. There is no need to drain to a central disposal site because each drainage area can have its own small

stabilization pond system. This will invariably reduce the length and the diameter of the main sewer. Also, the stabilization ponds can be sited very near the houses because a correctly designed series of ponds is odourless.

#### **Maintenance Costs**

Apart from periodically desludging the tanks when they are two-thirds full, the maintenance costs are minimal, requiring only regular inspection by unskilled personnel. At the ponds, almost no maintenance work is required. Should desludging be neglected, however, serious problems may arise.

#### **Water Consumption**

The aqua privy system, as compared with the flush system (WC), is economic in terms of water consumption because only wastewater is used to transport the waste products. Piped water may not be necessary for the proper functioning of the system. In this case, the aqua privies may be connected in series. Wastewater from a communal stand-pipe, which is located at the head of the series, is introduced into the first tank. The use of series-connected aqua privies reduces the cost of sewers and fittings, but this may be offset to a degree by the increased depth necessary for the tank to provide adequate coverage for the connecting sewers. Where water is plentiful and cheap, a flush system may be installed in each cubicle, draining into the tank underneath.

### **Recent Experience with Existing Installations**

Self-topping aqua privies were installed in nine local townships plus several other small settlements in the late 1950s and early 1960s. The primary pond with the smallest surface area is at Kafue. It is 1/60th of an acre in extent, treating effluent from a school septic tank servicing 120 people. The largest primary pond is three acres in extent in the Matero suburb, Lusaka, treating aqua privy effluent from over 10 000 people. A recent survey into the performance of these self-

topping aqua privies, almost 20 years after installation, was conducted by the National Housing Authority with funds from the International Development Research Centre (IDRC). A summary of the findings and conclusions for two areas, Lusaka and Ndola, follows.

### **Lusaka**

The main survey areas were Matero and Balovale.

#### **Sewered Aqua Privies in Matero**

Matero is a large municipal housing area with a population of about 34 000. There were 1156 self-topping sewer aqua privies installed in Matero in the early 1960s. The toilets are constructed in blocks of four, each with a washtrough and an external tap. The mean household size in Matero was found to be 6.34 and because each household has its own toilet it was assumed that the average number of users was not much higher than 7.0. Of the units selected for inspection, 2 were rated very clean; 22 clean; 23 fair; 1 dirty; and 1 very dirty. Because of individual responsibility a number of units were kept clean.

In terms of the performance of the system at the time, 7 had blocked tanks and 43 were in good working order. Thirty-nine of the users recalled a problem with their units during the previous year. In all cases interviewed, a blocked or full tank was reported to the Lusaka city council. Of the people who were able to remember how the council dealt with their situation, 15 reported that no action was taken; 3 that action was taken immediately; 3 that action was taken within 1 week; 3 that action was taken within 1 month; and 2 that action was taken after 3 months. Twenty-four people reported that the problem of blocked tanks had since recurred, which could be attributed to the claim of 15 respondents that only part of the contents of the tanks were emptied by the tanker. Fewer people had experienced problems with their units in the period from 5 years to 1 year prior to the survey (23 as opposed to 37 in the last year), suggesting that the sludge buildup had recently reached a critical state.

It was found that users did not react favourably to the system because: 3 were very satisfied; 8 satisfied; 9 had no particular reaction; and 23 were very dissatisfied. When asked to give opinions on other systems they knew of, 10 mentioned pit latrines as being worse and 39 discussed water closets, which all but 1 regarded as being better. Twenty suggested or were in favour of the toilet being part of the house; 2 people were against this idea. Sixteen people were prepared to say how much they would pay for their ideal toilet system, the mean sum being K3.00 (K1 = U.S. \$1.3) per month. This is not enough, however, to cover the cost of upgrading.

#### **Aqua Privies Leading to Soakaways in Balovale**

Balovale is a small residential area consisting of 80 houses near old Kamwala in Lusaka. In 1954, toilet blocks, each containing 12 cubicles, were built to provide sanitation for the residents. The system consists of a series of self-topping aqua privies leading to soakaways. A communal standpipe is provided at the head of each series so that spillage from the standpipe is led into the first tank, thereby maintaining the water seal in all of the units.

The investigating team found that: (1) the majority of soakaways were not functioning; (2) sludge buildup as high as the aperture of the toilets had hardened in some cases; and (3) the sink and concrete washing slab were blocked and overflowing.

Although each household has its own toilet cubicle, there is no way of locking the door. As a result, passersby frequently use the units, exercising less care in the process than the residents would normally do. Of the 20 toilets inspected, 1 was very clean; 7 clean; 10 fair; and 2 very dirty. From these figures, the survey team concluded or assumed that the lamentable state of the toilets is due to negligence by the city council's Health Department.

All of the 20 respondents had suffered from blockages in their toilets during the previous year. Although 60% of them said that the council had acted upon their complaint within 1 month, no one recalled the

council acting immediately or even within 1 week. Furthermore, they claimed that the vacuum tanker pumped out only part of the contents of the tanks, with the result that 19 of the 20 suffered a recurrence of the problem.

Nineteen of the users were very dissatisfied with their toilets and no one could think of anything to be said in favour of the system. When asked about other types of toilets known to them, four people favoured pit latrines; two mentioned pail and pit latrines as being worse; two preferred the aqua privies in Matero; and the rest favoured WCs. The mean monthly sum which they were prepared to pay for a WC was K1.11.

### **Ndola**

The main survey area was Kabushi, also a large municipal housing area.

#### **Sewered Aqua Privies in Kabushi**

There were 863 self-topping sewered aqua privies installed in Kabushi suburb in the late 1950s. The toilets are built either as individual units or in pairs. Double units have one washtrough shared by two households. A high-level water tap is installed additionally inside each toilet cubicle for cleaning purposes (some users have converted this into a shower). The effluent from each tank is sewered to a communal septic tank with soakaways. A gradual change to a fully sewered system is planned. The mean household size was 7.0 persons.

Again, units were selected at random for interview. It was found that 6 were very clean; 14 clean; 19 fair; 7 dirty; and 2 very dirty. When compared to the Matero units, it was found that the additional tap served no purpose.

With regard to the performance of the system at the time, 17 tanks were full and 23 were in good working order. Thirty-six users recalled a problem with their units during the previous year. The major complaints were blocked tanks and soakaways. The council dealt with individual complaints as follows: 3, action taken immediately; 3, action delayed 1 week; 15, action delayed 1 month; 3, action delayed 1-3 months; 4, action delayed 3 months; and 22, no action

taken. Sixteen users reported that the problem of blocked tanks had since recurred. Twenty-seven users did not experience any problems in the period 1-5 years prior to the survey.

As with the Matero aqua privy systems, fewer users than might have been expected claimed to be satisfied with their toilets: 7 were very satisfied; 9 satisfied; 6 gave no reaction; 11 were dissatisfied; and 16 very dissatisfied. With regard to other toilet systems known, 39 users regarded pit latrines as being worse but preferred WCs. Eighty percent of those interviewed preferred the toilet to be part of the house. The mean monthly sum which they were prepared to pay for a WC was K1.73.

### **Conclusions**

In theory, the sewered aqua privy systems are supposed to function properly. In practice, however, this is not the case. Two factors may be responsible for this:

(1) The design of the system requires modifications. Experience from Matero suggests that in the design stage, population and flow estimates should be extremely liberal. Within 5 years of installation, the Matero units caused problems because the average household size had been greatly underestimated so that predicted flows were inaccurate. In addition, push-on taps were replaced by turning taps, increasing the flow by 43%. As a result, the original 100 mm diameter sewers could not cope and they had to be replaced with 150 mm diameter pipes at extra expense.

(2) The second factor involved periodic desludging of tanks. When this is not done or when the sludge is allowed to exceed the set maximum, serious problems arise. The Balovale aqua privies are an example.

It was clear from the survey that the tenants were not happy with the units, although when maintained properly they function quite well. Self-topping aqua privies sewered to soakaways were found to be unsatisfactory because of the marked tendency of these soakaways to become blocked. Self-topping sewered aqua privies

are a better and more effective system when the design is done properly and desludging is carried out when necessary. When each unit is shared by two houses, there is a reduction of control over the cleanliness of the toilet by each household. It is recommended that such an arrangement be discontinued.

In recent designs of low-cost housing, by municipal councils and local authorities,

aqua privies have been replaced by conventional water closets that discharge wastes into sewers (where they exist) or into shared septic tanks. One reason for this, among others, may be the problem associated with emptying the aqua privy tanks, which the municipalities have been faced with. In self-built low-cost houses, however, supervised self-built pit latrines are being encouraged.

# The Botswana Aqua Privy

J.G. Wilson<sup>1</sup>

Low-cost sanitation developments in Botswana date back to the early 1970s, when the government undertook initial work on fiberglass aqua privies. The prototype, called the Apec privy, had various technical problems, including flexing of the floor under load, an ill-designed sitting pedestal, and a superstructure that was uncomfortably confining while not offering sufficient privacy because of the large ventilation gaps at the top and bottom of the door. This resulted, in 1975, in the government officially banning any further installation of the Apec privy (Blackmore et al. 1978).

## The Botswana "Type B" Aqua Privy

As part of the investigation into alternative forms of low-cost sanitation, the government, together with the International Development Research Centre (IDRC), Canada, developed the "type B" aqua privy (Fig. 1). Conceived around the necessity for a household to bring onto the plot, regardless of the distance to the source, a minimum volume of water for domestic purposes, the "type B" aqua privy simultaneously overcame the problem of sullage disposal and the need for aqua chamber topping up through a reuse facility. Based on the Vaal Potteries Spiraflo Aqua Pan, the "type B" aqua privy incorporated one of two alternative washing fittings, an internal handbasin/external wash through, plumbed into the flushing rim of the pan, whose hydraulic design

<sup>1</sup>Senior Public Health Engineer, Ministry of Local Government and Lands, Gaborone, Botswana.

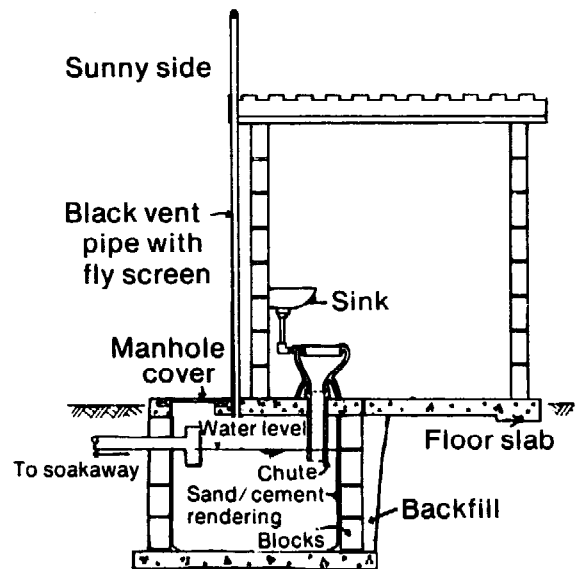


Fig. 1. Botswana type B aqua privy. (After R.A. Boydell, formerly with the Ministry of Local Government and Lands, Botswana.)

characteristics encourage a spiral scouring movement of the water when flushed from the fitment, around the ceramic wall and chute, before discharging into the chamber (Blackmore 1978).

A great advantage of the unit is its suitability for being upgraded at a later date. If the householder can afford a water connection, a conventional flushing cistern may be plumbed into the pan. In addition, the overflow from the tank can be connected to a piped drainage system if such a system subsequently becomes available.

However, since its general acceptance, certain user and technical problems have occasionally occurred. The most common problem is the rejection of the unit by some people on the grounds that the tank is too



small; an assumption, based on the belief that the aqua privy operates in a similar manner as the pit latrine, that is incorrect. The inability to add at least 5 litres of water per day to the tank to maintain the water level is another problem. This lack of user maintenance is partially blamed on the lack of suitably close standpipes in some areas and also partially on the belief in secrecy when using the toilet (being seen carrying water to a toilet divulges the secret and causes acute embarrassment to the individual). A further problem has been the belief by some that any water placed in the wash-basin attached to the aqua privy immediately becomes contaminated and, therefore, people are very reluctant to use this facility, preferring to use a completely separate container instead.

Technical problems encountered include ensuring that the tank is and remains watertight, together with preventing the rubber connection between the sullage drainpipe and the Spiraflo Aqua Pan from perishing; maintaining a fly screen; and ensuring that the soakaway does not become clogged.

The government appreciates the applicability of such systems, particularly in development areas that will eventually become upgraded and is, therefore, actively seeking

methods to overcome these problems. In 1977, it was found that the cost of waterborne sewerage in Botswana was almost twice the cost of aqua-privy systems (S.E. Daher, personal communication, 1977) and, therefore, an on-site system should be considered as being the most appropriate, at present, to cope with the high rate of urban development.

It has not been the intention of this paper to create the impression that the aqua privy, as used in Botswana, is a failure. In fact, the opposite is prevalent wherever the aqua privy is in use. Botswana has learned from its past mistakes of introducing a sanitation unit before fully evaluating whether or not it was technically and culturally acceptable. As the government increases its manpower in the various disciplines of the sanitation sector, such mistakes are not repeated and sound economical, technical, and culturally acceptable sanitation programs are being implemented.

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# Septic Tanks

Beyene Wolde-Gabriel<sup>1</sup>

The aim of this paper is not to give technical details about septic tanks, which are available in many reference books, but rather to point out some problems related to the use of septic tanks and to suggest some areas of development that require more attention.

The septic tank was first introduced as a method of treating urban sewage in 1895 by Donald Cameron of England. Following its introduction, use of the septic tank by municipalities became widespread. Most cities have since replaced their septic tanks with modern systems that treat large quantities of sewage, but the septic tank remains the most effective and practical method of dealing with human excreta in the rural areas of developed countries.

The septic tank is only one unit in the sewage disposal system, which must also include measures for collecting and transporting the sewage to the tank and for purification and disposal of the effluent. The septic tank is a settling tank where solids are retained long enough to allow them to be disintegrated by bacterial action.

Because the effluent from a septic tank is as much of a health hazard as the human excreta itself, it must be carefully and efficiently disposed of. Effective disposal depends upon the choice of the system, its design and construction, regular removal of sludge buildup from the walls of the tank, and proper maintenance of the entire system.

In the absence of an adequate convention-

al sewerage system, the septic tank is the alternative sanitation system that is usually chosen to serve individual dwellings (that can afford it), groups of dwellings, hospitals, apartments, hotels, restaurants, different institutions, and factories. If sewers become available at a later date, the septic tank effluent can be discharged into the sewers if the level of service provided by the septic system does not meet acceptable standards.

Excreta disposal by means of a septic tank requires: (1) the availability of significant amounts of water; (2) cistern-flushed toilets with a water seal; (3) an appropriate effluent disposal system (usually percolation through soil with suitable characteristics); and (4) the periodic removal of sludge from the tank.

The term "septic tank" is also used to describe: (1) tanks that do not have watertight bottoms and are situated on permeable soil (or soil that is assumed to be permeable) or directly upon seepage pits; (2) tanks that are connected to storm-water drainage pipes, open channels or trenches, or open trenches that are dug for effluent disposal; and (3) tanks that are built near the banks of rivers or streams and operated in such a way that the effluent is discharged into them continuously (whether the water course is dry or not) and the sludge is disposed of during the rainy season into the rivers and streams. These last two cases, however, aid in the pollution of waterways and are, therefore, a health hazard.

Where inefficiency exists, the problem is most frequently associated with the effluent. This is because design and construction of

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<sup>1</sup>Manager, Urban Water and Sewerage Agency, Addis Ababa, Ethiopia.

the effluent disposal system are not given due consideration and emphasis. Design and construction of the tank is normally not a problem but there are instances where construction and design details do not receive sufficient attention. Failure of well-designed and well-constructed systems occurs not only because of a lack of proper operation and maintenance but also because of a lack of appreciation of the need for proper operation and maintenance activities. It is important that the entire system is properly maintained.

Maintenance of septic systems can be unpleasant and dangerous. Attempts have to be made to reduce the unpleasantness and to take preventive measures to protect the health of those whose work brings them into continuous and direct contact with sources of infection. Vacuum trucks are commonly used for removing accumulated sludge, but depending upon the topography of the area and the layout and width of streets, there are

occasions when the vacuum trucks do not have access to the septic tank.

Sufficient literature is available describing the design of the tank itself and the effluent disposal system. The design must be customized to the location by sizing the tank, based on the anticipated load and frequency of sludge removal, and sizing the tile disposal field, based on the permeability of the soil. Cost estimates can then be made depending upon the choice of materials. Designs of soakaway pits and percolation filters are not as standardized. In areas with impervious soils, however, septic tanks with seepage pits or tile fields are not feasible.

Even though the construction cost is "high" to "very high" and the land requirement is large, this system is a suitable alternative for certain areas in urban communities of developing countries. The choice should be made after considering all possible alternatives and evaluating their respective advantages and disadvantages.

# Sanitary Situation in Addis Ababa

Aragaw Trunch<sup>1</sup>

## Features of the City

Addis Ababa covers an area of 218 km<sup>2</sup>, but a large portion of this is still rural in character. The real urban area scarcely covers 100 km<sup>2</sup>, with a large part of that under construction. The streams flowing through the city have made deep cuts in the site, particularly in the north, where the general slope of the land averages 6%.

As a general trend, new industries and warehouses are being set up in the southern part of the city and residential villas are developing both eastward and westward. Construction of traditional houses escapes planning control. In the centre of the town, poor residential quarters are becoming overcrowded and the poor sanitary conditions in these areas are deteriorating each year as the population density increases.

## Sanitary Conditions and Practices

### Private Practices

Construction methods used in traditional houses, which are much the same as in the countryside villages, are not suitable for modern sanitary facilities. There is no accommodation for the removal of wastewaters and human excreta. The solid wastes are dumped in the immediate surroundings of the houses and sometimes burned when they accumulate.

Many dry pit latrines have been constructed in recent years, with a vast majority of

the population now using this means of excreta disposal. Due to the concentration and the consequent lack of space, however, the pit latrines are usually situated close to places where food is stored and prepared. Most of these places are accessible to flies and rodents. During the rainy season, the latrines often fill with storm water and the filth is spread all over the ground. This also results in the groundwater being highly polluted, which has caused 800 out of 836 private wells to be contaminated.

The modern villas and other recently constructed buildings have water-flush toilets. Most of these systems use cesspools and septic tanks. These should provide for effective removal of the wastes from within the buildings and protection of the occupants, but many of these systems do not work properly. Because of impermeable soils and improper design, the soakaway pits and leaching beds overflow and the effluent runs along the ground, again creating health hazards to the surroundings.

Large institutions such as colleges, hospitals, industries, police and army camps, international complexes, gas depots, hotels, and high-rise apartment buildings all generate large amounts of waste. Septic tanks are ineffective for buildings of this size in urban areas. The waste flow from these places is either leached into the groundwater or is discharged into storm drains or directly into the streams.

### Public Toilet Facilities

Efforts are being made by the municipality to supply public toilet facilities to the

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<sup>1</sup>General Manager, Addis Ababa Water and Sewerage Authority, Addis Ababa, Ethiopia.

population. The existing constructions have been appropriately located near places where people congregate, such as market areas, bus terminals, and churches. Unfortunately, these facilities are frequently not kept clean. The municipality contemplates increasing the number of such toilet facilities. The idea of building "sanitary centres," which include not only toilet facilities but also showers and washbasins for laundry purposes, was expected to curb the common practice of washing clothes with polluted water from rivers, but so far this has not materialized.

### **Liquid-Waste Collection and Disposal**

This practice refers to the collection of liquid wastes (night soils) that are accumulated in private or public cesspools and septic tanks. The Addis Ababa Water Supply and Sewerage Authority (AAWSA), municipality, housing agency, and police and army departments have their own fleet of vacuum trucks. The total number of trucks is less than 30. Based on the AAWSA's practice, each truck makes an average of 6-8 trips daily. Each pickup is invoiced: 25 Birr (U.S. \$12) for emptying liquid wastes from either cesspools or septic tanks and 30 Birr (U.S. \$14) for semiliquid wastes from latrines. This operation not only is inadequate but is becoming more expensive than revenues generated. The inadequate provision of vacuum trucks makes it very difficult to cope with the high number of cesspools and septic tanks that become filled and overflow, particularly during the 3 month rainy season. The liquid wastes carried by these vacuum trucks are poured on open fields at a public garbage dumping site not far from the city itself.

### **Refuse Collection and Disposal**

There are about 30 garbage trucks operated by the municipality. Some are covered dump-type with sliding panels and others are tipper-trucks with detachable tip and hydraulic equipment to lift or lay it down on the ground.

The covered trucks collect the solid wastes throughout the town wherever streets allow

them to go. Each of them makes a maximum of 6 trips per day. Their capacity ranges from 6-7 m<sup>3</sup>. The tipper-trucks mainly serve hotels, schools, and hospitals. They carry 5-6 loads daily. About 50 detachable units serve as public dustbins that are left in a spot until they are full and then are picked up and carried to the dumping area. The present solid-waste disposal system cannot be compared with proper sanitary landfill. Dust, paper, metal sheets, glasses, plastic scraps, etc., are spread over a large area because shredding is not provided.

### **Existing Drains and Sewers**

Due to the topography and the number of streams in the city, removal of storm water was not a problem until recent years, when the town centre began to build up. The city has undergone many changes. New roads and improved existing ones are provided with concrete drainage pipes. In the core of the city, old roads were provided with sewers whose outlets are seen on the banks of the streams and rivers. It is regrettable that no document showing the locations and characteristics of these sewers is available because there were many instances where excavations for high-rise building foundations damaged and blocked old sewers. From the few documents that are available, it appears that the drains are combined sewer systems constructed with concrete pipes, rectangular canals with masonry walls and flat concrete covers, and inverted horseshoe sewers with a concrete base and masonry vaults.

## **The New Sewerage Project**

### **The Approach**

The sanitary situation briefly described above led to a feasibility study of a sewerage system. The study divided the city into 52 zones and attempted to determine the sewerage requirement based mainly on the evolution of building construction and water consumption over an analysis period of 15 years (1970-1985). This approach considered the following factors for each zone: (1)

number of modern housing units; (2) number of traditional housing units served by a connection to the water supply system; (3) modern housing unit's total water consumption during the year; (4) total yearly water consumption of traditional house units served by connections to the water system; (5) annual average water consumption per modern housing unit and per traditional housing unit served by connection to the water system, and (6) number of liquid-waste loads transported by vacuum trucks. After the above basic data were collected, disposal methods were proposed and areas were selected.

A separate sanitary network for domestic sewage collection and disposal was proposed. Due to the 9 month dry season, during which the river and stream flows are either low or dry, it is difficult to pour raw sewage into the river, and owing to the sharp contour of the ground in the city, interceptors and main sewers, if built, should follow most of the river's windings, which implies long distances and large dimensions. Because the existing drains and sewers do not have sand-settling chambers and their invert has no cunette for the conveyance of the dry season sewage and because of the enormous disproportion between storm and domestic flows, it would require intricate works and a large capacity sewage treatment plant, which would be subject to operational difficulties if combined sewers were designed.

At present, the treatment processes most employed throughout the world may be systematically classified into two categories: (1) the oxidization pond process, where the degradation of pollutants is obtained by natural biological action facilitated by favourable environmental conditions and (2) the activated sludge process, where the natural degradation of pollutants is accelerated in industrial-type plants. Oxidation ponds are particularly economic when a large, flat land surface is available. The conventional activated sludge process, on the other hand, involves delicate and costly equipment, high power consumption, and skilled operation.

### **The Design Period**

In the case of Addis Ababa, sewage treatment employing primary treatment followed by oxidation ponds was found to be the least expensive alternative. The details of the system designed are: (1) primary treatment, including thorough screening and comminution of coarse solids, followed by sedimentation tanks equipped with sludge scrapers and (2) sludge treatment by means of staged lagoons with final disposal of mineralized sludge.

The project was designed with respect to 1985 waste disposal requirements of the selected areas. The treatment plant will serve a population of 110 000 inhabitants; taking the discharge of the main water consumers into consideration, this is equivalent to a population of 200 000. (The surface area required is 20 ha.) The land available at present will allow expansion of the treatment facility to treat effluent from 400 000 inhabitants.

### **The Network**

The network consists of 36 km of primary mains and interceptors with a diameter of 0.9 m and 78 km of secondary lines with a diameter of 0.20 m. Connections are 0.15 m diameter. The minimum gradients adopted were 0.3% for primary lines, interceptors, and connections and 0.5% for secondary lines. Manholes allowing access for cleaning and maintenance operations are at maximum intervals of 70 m within this framework and they are also provided at each change in direction of gradient of a sewer line. Because of the presence of underground water in many parts of the city, due to impervious soils at shallow depths, watertight tubes with rubber ring joints are used.

### **Problems of the Sewerage Services of the City**

The authority has two sewerage systems: sewage truck collections, with 11 vacuum trucks, and the new sewerage system that is under construction. Their respective problems are described in the following sections.

## **Sewage Truck Collections**

The efficiency of this service is handicapped by the location of septic tanks and cesspools, requiring careful and time-consuming manoeuvring by the driver in positioning the truck, and the use of numerous lengths of suction pipe to reach the depository. Some cesspools are holes, often containing materials that clog the suction pipes even after the contents have been diluted with water. Neither the authority nor any other governmental agency has exercised effective control over the location and standards of construction for cesspools and septic tanks.

## **The New Sewerage System**

At this time, the rate at which customers will be connected to and make use of the new system once it is operative cannot be forecast with any precision, nor can the quantity and characteristics of the wastes they will generate.

Total financial costs are becoming exorbitant. An attempt to develop a tariff structure that can recover the capital investment and the direct cost of running and maintaining the system has shown that the estimated tariff is beyond the inhabitants' ability to pay for the service and might discourage people from using the system. A partial solution would be charging that part of the tariff component covering only the direct costs (operating and maintenance) but again the nation, as such, would bear the heavy investment cost. Moreover, even if the partial solution is adopted and additional uses encouraged, the greater majority of the inhabitants (80-90%) would still not be served by the network system. Securing a huge fund to complete the network over the city is beyond the economy of the nation. It has become extremely urgent, therefore, for the authority to find additional sewerage or

excreta collection and disposal solutions that could be operationally incorporated into the sewerage project currently under construction.

## **Explorations**

Some factors to be considered in resolving some of the problems are:

(1) The equipment and crew time required to empty a dry cesspool, in some instances, take as much as 15 times longer than pumping a well-constructed septic tank. It should be pointed out, however, that it is predominantly in the lower-income residences where the poorly located and maintained cesspools require the extra crew and equipment time. A considerable travelling distance is involved for each truck to dump its load at the new treatment plant. Therefore, a possibility of unloading trucks into several wastewater dumping stations, to be integrated into the new sewer system within the city, should be investigated. The stations might require water points to dilute night soil discharges.

(2) In general, disposing of domestic sewerage by tank vacuum trucks has a high operating cost that is certain to be affected by world petroleum prices, the cost of the trucks required for this operation, and rising labour costs. Some community planning concepts that might alter and reduce the costs are: (a) the development of neighbourhood restroom, shower, and laundry facilities with septic tanks that can easily be emptied on a route schedule set for septic service trucks or, wherever possible, connected directly to the sewerage network and (b) the start of redevelopment plans for housing and sanitary facilities in private homes or for serving homes in a compound area.

# **Sewerage and Low-Cost Sanitation: A Solution to Sanitation Problems in Developing Countries**

**Frederick Z. Njau<sup>1</sup>**

Among the ever-increasing problems within urban areas of developing countries is that of sanitation, i.e., the safe disposal of wastewaters and, in particular, human excreta. Conventional sewerage, although the safest and most hygienic method of disposing of human excreta, remains the most expensive method and generally serves the needs of only a small percentage of the population.

Solutions aimed at reducing mortality and morbidity through the provision of hygienic disposal methods for the masses are required. This paper will discuss a combination of sewerage and low-cost sanitation systems as a possible solution to sanitation problems with reference to case studies of four urban towns in Tanzania.

## **The Concept of Sewerage and Low-Cost Sanitation**

In most developing countries, life is bordering the subsistence level, with the majority of the people being very poor, productivity of labour is low, and unemployment is high. Experience within towns and cities in developing countries has shown that it is not possible to provide conventional sewerage systems for most of the people because of the high initial capital costs involved, which exceed the supply of available

resources, particularly the foreign exchange component.

For a sewerage system to be effective it must be affordable by all, i.e., installation costs must cover the sewer mains, laterals, and property connections. Because the capital costs cannot be met by the governments of poor nations and the household plumbing costs cannot be met by the individual households, conventional sewerage systems only operate at 20–30% of their capacity.

The concept that conventional sewerage systems are the only safe method of disposing of wastes has been held rigidly in the minds of most sanitary engineers in developing countries who forget that other low-cost systems exist that are affordable by more people and at the same time provide the same level of hygiene and service as any other conventional sewerage system. These other systems include the ventilated improved pit (VIP) latrine or in Ghana, the vented indirect pit; the Reed odourless earth closet (ROEC); the pour flush latrine; and the aqua privy. Some of these systems have been tried in India, Ghana, Botswana, and Tanzania with some degree of success.

The concept of combining sewerage and low-cost sanitation systems in Tanzania as a solution to sanitation problems was first introduced by Dr R. Feachem of the Technology Advisory Group (TAG) of the World Bank for United Nations Development Programme (UNDP) project GLO/78/006. In this project, the original terms of reference proposed the use of a conventional sewerage

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<sup>1</sup>Director of Sewerage and Drainage, Ministry of Lands and Urban Development, Dar es Salaam, Tanzania.



system. After consultation with the TAG, however, the terms of reference were amended to include a low-cost sanitation component in view of the high cost of the sewerage system. Providing a conventional water-borne sewerage system for everybody within the urban areas of Tanzania would cost between TSh50 000 and TSh100 000 (U.S.\$6100 and U.S.\$12 200) per plot connection, whereas the cost of low-cost sanitation might be between TSh3000 and TSh5000 (U.S.\$365 and U.S.\$610).

Implementation of a low-cost sanitation program has its problems due to the habits and traditions of the individual users. For a program to be effective, it must carry with it the necessary "software" elements. The "software" elements are in their final stage of preparation and will soon be available for implementation. A few demonstration units are under construction in the city of Dar es Salaam, Tanzania, under a UNDP project.

### Comparison of Costs: Sewerage Combined with Low-Cost Sanitation

Surveys carried out by different consultants in five towns within Tanzania, namely

Dar es Salaam, Morogoro, Moshi, Arusha, and Mwanza, indicate that the sums of money required for the implementation of sewerage systems are colossal, particularly when the system serves such a small proportion of the population in comparison to that served by low-cost sanitation (Table 1).

### Why Combine Sewerage and Low-Cost Sanitation?

It is evident that the low incomes in developing countries make it difficult for households to connect to sewerage systems and experience has shown that where there are sewers adjacent to properties, the connection rate is very small (10-20% in Tanzania) and this could be the case elsewhere. Those people who are in areas served by sewerage systems but cannot afford to have their households connected to the systems must be provided with an affordable alternative. The only solution is low-cost sanitation systems. A survey carried out by the low-cost sanitation unit of the Ministry of Lands, Housing and Urban Development indicates the need for providing alternative systems in order to solve sanitation problems within urban areas.

Table 1. Comparison of costs: sewerage combined with sanitation.

Level of service	Stage I (1979-1984)				Population served
	Local		Foreign		
	TSh	U.S.\$	TSh	U.S.\$	
<b>Morogoro <sup>a</sup></b>					
Sewerage	10.5	1.3	4.5	0.55	8700
Low-cost sanitation	10.4	1.27	2.6	0.32	78000
<b>Moshi</b>					
Sewerage	30.6	3.73	17.8	2.17	—
Low-cost sanitation	10.3	1.26	1.2	0.15	35000
<b>Arusha</b>					
Sewerage	31.06	3.79	7.77	0.95	29000
Low-cost sanitation	11.2	1.36	2.8	0.34	40000
<b>Dar es Salaam</b>					
Sewerage	199.8	24.4	30.1	3.7	—
Low-cost sanitation	46.0	5.6	33.7	4.1	—

NOTE: All numerical values are in millions.

<sup>a</sup>At present, there is no sewerage system in this town.

### **Conclusion**

In an effort to promote the welfare and well-being of the urban poor in developing countries, an appropriate program of sani-

tation is desirable. A combination of sewerage and low-cost sanitation systems is the only solution as long as these systems are acceptable and properly used.

# Sullage Disposal in Urban Centres

Frederick Z. Njau<sup>1</sup>

The problem of sullage disposal within the urban areas of most developing nations is as old as history itself. This problem, though visible, has received little, if any, attention, perhaps due to the fact that it is not a derivative of human excreta and, hence, in the minds of most people is harmless despite the intolerable nuisance of smell and providing breeding grounds for many waterborne diseases. As yet, no concrete solutions have been put forward for safe disposal of sullage in urban areas. The solutions discussed in this paper will be based partly on the experiences of others and partly on theoretical solutions.

## Existing Disposal Methods: Their Advantages and Disadvantages

Sullage, as defined here, refers to all domestic wastewaters other than toilet wastes. The volumes of sullage generated will normally depend upon water consumption. The problem of sullage disposal, therefore, will be most prominent in those households not connected to sewerage or septic tank soakaway systems, i.e., those using low-cost sanitation systems. The volumes, therefore, will vary between those households obtaining water from public standpipes and using pit latrines or compost toilets, and those with a single water tap on site and using pit latrines.

In broad terms, there are six sullage disposal methods: (1) disposal on the ground

within the compound; (2) disposal on the ground outside the compound; (3) on-site disposal, into ground seepage pits; (4) on-site disposal into pit latrines; (5) disposal into open drains; and (6) disposal into covered drains or sewers.

Disposal of sullage by some of these methods may have associated health risks. Throwing sullage on the ground creates wet, muddy conditions that may provide breeding sites for mosquitoes. If the soils are permeable and evaporation is high, however, this practice may be tolerable. The only danger likely to occur from disposal of sullage into properly designed underground soakaway pits is that of groundwater contamination. The problem is less likely to occur with sullage disposal in comparison with the disposal of sewage in this manner and is, therefore, acceptable. Similarly, disposal of sullage into pit latrines creates no greater risk than increasing the depth of seepage and, hence, contamination of deeper groundwater. This method, however, will also require frequent emptying of the pit and possible collapse of improperly lined pits. Sullage discharged into open drains during the dry season does not flow away and where ponding is likely would result in the existence of offensive odours and areas where mosquitoes would breed. Disposal of sullage into closed drains or sewers presents no health problem but may be expensive and unjustified.

## Recommendations

The only safe and hygienic method of sul-

<sup>1</sup>Director of Sewerage and Drainage, Ministry of Lands and Urban Development, Dar es Salaam, Tanzania.

lage disposal, other than through a sewer system, is to construct a soakaway pit on site or off site, depending upon the land available and the soil conditions. A soakaway pit

lined with open blockwork is recommended for soils with low permeability in order that it may be emptied without causing structural damage.

## **Technology: Discussion**

### **Pit Latrines**

The initial stages of discussion centred on technical aspects of latrines and educating people to build latrines properly. Two of the countries noted that although latrinization programs were in existence through the Ministry of Health, the health workers were not trained in latrine design, with consequent problems of collapsing and unpleasant odours being associated with the latrines. Latrinization programs suffer from the lack of trained personnel and a link between front-line workers and headquarters. Radio and newspapers are heavily used in an attempt to educate the populace.

There is no chance of identifying one latrine design as being suitable for the whole population due to cultural differences, availability of materials, and other conditions such as groundwater table levels. It was pointed out that in firm soils a borehole is most suitable but in the case of high groundwater tables a larger diameter pit is necessary. The Vietnamese latrine, which is built above ground, was not accepted because people did not believe that the faeces were neutralized.

The use of black vent pipes was questioned. In theory, these absorb heat from the sun (to promote this the pipe should be on the north side), transfer the heat to the air, and thus cause the air to rise. This causes air circulation, with benefits of odour removal and water evaporation. Experiments were being planned to determine how effective black pipes were compared with other pipes. A suitable netting for the pipe top has not been found: plastic and galvanized screens deteriorate due to ultraviolet light and rusting, respectively, and stainless steel netting is too expensive.

The need for a cover over the toilet or hole was questioned. It was suggested that the purpose of the cover was to prevent light from entering the pit and thus make it unattractive to flies. Experiments are needed to determine for which design a cover is needed.

The delegation from Botswana was asked about the costs of their elaborate latrines. They noted that latrines with no foundation, pit lining, or slab may be stable at first but the pit walls collapse in time without support. The costs for a ventilated improved pit (VIP) latrine were about P100-P150 (U.S.\$135-U.S.\$203) for the superstructure and P200-P250 (U.S.\$270-U.S.\$338) for the substructure, which represents about 0.25-0.33 of the house costs in urban areas. It was felt that these costs were justified in comparison with a cheaper conventional pit latrine because the VIP latrine was a lasting structure. It was pointed out that 70-80% of the population is rural and that these costs are out-of-reach for these people. It was agreed that some form of subsidy would be needed for the rural population. The substructure would be provided and the owner would be responsible for building the superstructure. Also, cheaper linings were being examined and the people were encouraged to make their own bricks.

The discussion then turned to the superstructure itself. In Mozambique, the open spaces were preferred for defecation and thus a fence constructed from available materials was built around the pit. In Botswana, however, the privacy offered by the enclosed structures was preferred. With people moving into urban areas at a rate of 15% per year, small compact structures were needed in the squatter areas.

### **Compost Latrines**

The cost of compost latrines of the type used in Botswana was noted to be high and subsidies would need to be provided for plottolders to be able to afford them. General results from the limited studies available on compost latrines have shown that the people are refusing to empty them by hand. Use of a vacuum truck (Vactor) is beginning to be looked into but the costs and success of this approach are not documented at this time. It was noted that the Vactor can handle the dry solid wastes found in compost latrine bins. In rural areas, only the Vietnamese or other double-vault modifications would be feasible pending the people's acceptance of humus.

### **Biogas**

In household units, what is done with the gas? Because there is so little produced it is vented. Odours were not a problem in units with a water seal but in the case of the Reed odourless earth closet (ROEC) design, the chutes may allow an odour problem to occur. Further study is needed to prove or disprove this. The costs of a 1 m<sup>3</sup> digester were of the order of P50 (U.S.\$68).

### **Aqua Privies**

In providing costly and different means of excreta disposal, has the government adequately consulted the people to determine their choice? The underlying reason for the failure of some of the more sophisticated technologies, such as aqua privies, is not the difficulty in convincing and training the people to use them but in understanding the people and giving them what they really desire. The government or engineer has only a limited number of technical options and a standardized design has to be made for large numbers of people, which limits the people's choices. Regardless of their choice, the aqua privy is probably too sophisticated for the people's first latrinization experience. The other major reason for the rejection of aqua privies is their expense.

### **Pour Flush Latrines**

One of the major problems with pour flush latrines is clogging due to the use of newspaper and cardboard when toilet paper shortages occur. These undesirable papers could be left in a can but this causes a health hazard, accompanied by malodour, flies, and unsightly conditions. One advantage of the pour flush models is the water seal, which prevents gases from escaping and, therefore, no venting is required. Use of this type of toilet in rural situations is only feasible

when water is readily available or the culture uses water for anal cleansing, in which case water will be obtained whether it is needed for the latrine or not.

### **Sewerage, Septic Tanks, and Sullage Collection**

The Tanzanian integrated low-cost sanitation sewerage scheme was the main topic of discussion. The first few questions asked how the low-cost sanitation options were chosen. The pit latrine was adopted wholesale based on surveys that showed existing latrines to be well used and clean. The consultants were asked to incorporate this alternative for the urban poor into the overall sanitation scheme. The cost of a VIP latrine that meets all Tanzanian standards is about 2500 Sh (U.S.\$300), which is affordable by most Tanzanians.

At the very least, a pit latrine is strongly encouraged for all Tanzanian households because it does lessen the danger of cholera and other diseases. Households in a sewered area would be required to hook up to the sewer unless they had a septic tank or aqua privy with a large enough drainage area.

Cost recovery was another issue. The most commonly proposed and acceptable cost recovery scheme was to assess charges based on water usage because most taps are metered in Tanzania. For pit latrines, a direct sanitation charge may be assessed or the cost may be part of land charges. The cost of low-cost sanitation could definitely be borne by the people because the design lifetime of a pit latrine is 15 years and capital costs were about 1 million shillings (U.S.\$120 000) for 78 000 people.

### **Technology Applicability**

Again, the question of letting the people choose the technology or imposing a technology upon them was raised. Because it is not possible for the people to knowledgeably dictate technologies, an integrated technical-sociological approach is needed. It was also commented that there may sometimes be an element of force or education required for the good of the people. The local health officials must encourage sanitation and enforce the laws because learning the hard way is not appropriate.

# Disease Transmission

G.P. Malikebu<sup>1</sup>

Man is the reservoir of most of the diseases that destroy or incapacitate him. Diseases such as cholera, typhoid and paratyphoid fevers, the dysenteries, infantile diarrhoea, hookworm diseases, ascariasis, bilharziasis, and other similar intestinal infections and parasitic infestations are the cause of tremendous losses of life and debility.

Unsanitary disposal of faeces and urine is one of the most common sources of infection. Disease germs leaving the body pass back into food or water via flies, which carry the filth on their legs and contaminate food; dust, which is blown about; water, passing over contaminated ground; and the hands of those who handle food.

In the transmission of these diseases from the sick or from carriers to the healthy person, the chain of events may be summarized as follows: the excreta (focus of infection) is transmitted via hands, water, insects, or soil onto the food and/or drink of the healthy person, who then contracts the disease and becomes debilitated or dies.

## Cholera

Cholera is an intestinal disease characterized by sudden onset, and profuse watery stools and vomiting resulting in rapid dehydration. Death occurs within a few hours of the onset. Cholera is one of the pestilential diseases.

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<sup>1</sup>Acting Principal (School of Hygiene), Ministry of Health, Zomba, Malawi.

## Mode of Transmission

The causative organism of cholera leaves the body of the victim in the faeces and vomited material. Infection may be transmitted from person to person directly as a result of handling patients or handling infected material, or by flies that have landed on the faeces or vomited material and then landed on food. The chief vehicle of transmission during epidemic outbreaks is contaminated water supplies. Cholera germs have to be ingested and there is a high mortality in untreated cases.

## Malawi Experience

In Malawi, the first cholera outbreak occurred in September 1973. The very first case was that of a person who attended the funeral of a relative in neighbouring Mozambique. Not knowing that the cause of death had been cholera, the person, upon return to his village, developed diarrhoea and subsequently died from severe diarrhoea and vomiting. Because the people of the village had never seen a case of cholera before they did not become alarmed until several neighbours developed similar symptoms and died. By the time it was positively diagnosed as cholera, several lives had been lost.

During the first days of the outbreak, everybody was concerned with treatment. Preventive measures were not emphasized until World Health Organization (WHO) experts arrived to help. The chain of transmission had to be revealed and the source of infection established.

The factors that had to be studied were: (1) cholera is transmitted by ingesting



through the mouth (via food, drink, or other material) vibrio cholera or cholera organisms from the faeces or vomitus of a victim; (2) at a funeral there is a lot of food cooked and communal eating; (3) hands are used for eating and everybody washes their hands in the same bowl no matter how dirty the water becomes; (4) food is rarely covered because it is served and prepared in large containers; (5) drinking water is never boiled or treated in any way; and (6) the number of latrines is negligible or nonexistent in many villages. When all of these factors are considered, it is no wonder that the cholera outbreak became an epidemic within a short period of time.

In an effort to contain the epidemic, the following policy was drawn up and followed:

(1) Effective treatment of cases. Quick rehydration (with Ringer's lactate) and the proper dosage of broadbase spectrum antibiotics (e.g., tetracycline hydrochloride).

(2) Contact tracing and prophylaxis. All persons coming in contact with a cholera victim had to be traced and given prophylactic treatment. This measure was used to check if others within the family were carriers.

(3) Restrict movement. The infected districts were placed on quarantine and anyone leaving the infected area had to receive prophylactic treatment.

(4) Mass vaccination. The people within infected districts were vaccinated en masse, but soon it was discovered that some of those people vaccinated developed cholera.

(5) Health education. This was carried out by health personnel, politicians, regional religious leaders, and traditional leaders. To bring the information to the people, leaflets were printed explaining what cholera was, the signs and symptoms of the disease, how it is transmitted, and how to prevent it. The leaflets were printed both in English and Chichewa.

(6) Short-term control measures. In order to prevent the spreading of the disease, pre-cooked foods sold in open markets were prohibited, all local markets were inspected daily for cleanliness and any nuisances found were quickly abated, and domestic

water supplies were chlorinated by a team of cholera assistants that was recruited to supervise the pot-to-pot chlorination of the water.

(7) Long-term control measures. As stated earlier, cholera organisms infect the human being through the mouth, leave the body in the faeces, and are transmitted through the agency of flies, water, food, and hands. It was resolved, therefore, that a latrine-building program be launched together with efforts to improve sanitary conditions within villages.

In implementing the program, it was generally agreed that the local people should become involved. They had seen the results of cholera and were ready to accept any measure introduced to prevent further cholera outbreaks. This marked the birth of health committees. The main job of the health committee was to see to it that every household had and used a latrine.

In villages with a high percentage of latrines it was found that once the health committee control teams began overseeing the usage of the latrines, it did not take long before the situation returned to normal. In villages with a low percentage of latrines, however, it was very difficult to contain the outbreak. It was not until the number of latrines increased that a decline in the number of cases was noticeable.

It was also observed that the most dangerous element in the transmission of cholera was the carrier state. This was discovered by one of the WHO experts who was carrying out cholera surveillance in one part of the country. A carrier is a person who contracts the disease and does not develop the signs and symptoms of the disease, but can infect others.

In a village where there are no latrines, flies will carry the vibrio cholera organisms from the faeces that a carrier has deposited on the bare ground and deposit them onto the food of susceptible villagers, thus causing an outbreak. If a person who has come in contact with a cholera victim is swabbed for laboratory testing, it can be determined whether or not the carrier is cholera positive. Thus, it was ruled that anyone coming in contact with a cholera

victim should be swabbed and laboratory tested as soon as the first case appears within a locality so that the sources of infection can be established quickly (e.g., if the carrier had a latrine, the infected faeces would not be exposed to flies, storm water, etc., and the disease could be contained easily if it was found to have affected only the family of the carrier).

### **Bilharziasis (Schistosomiasis)**

This disease is characterized by inflammation of the bladder, the passage of blood in the urine, ulceration of the wall of the rectum, and the passage of blood and mucus with the stool.

#### **Mode of Transmission**

The male and female adult worms associated with this disease live in the veins of the bladder and rectum. The female lays her eggs in enormous numbers in these veins and the eggs penetrate the bladder and rectum walls finding their way out in the urine and faeces. If the faeces are deposited on dry ground the eggs soon die, but if they reach water they hatch almost immediately, releasing small embryos called miracidia. These swim about in the water searching for an intermediate host, a specific type of snail. If no snail is found they die in about 1 day, but if they meet a suitable snail they bore into it and undergo a complete change. They emerge as cercariae. These swim about in the water and enter the human skin once in contact with it. Thus, once they penetrate the skin the person is infected. The heads of the cercariae find their way through the tissues to the portal vein, where they develop into adult worms. When mature, they copulate and the female begins the life cycle again by producing vast numbers of eggs. The complications associated with this highly debilitating disease are anaemia, ascites, malnutrition, and sterility.

#### **Malawi Experience**

In Malawi, at present, there is a national bilharzia project in progress. The following

discussion, however, will deal with one of the pilot projects at the Kasinthula irrigated rice scheme.

The project started in 1975 for the purpose of increasing the production of rice and, therefore, the income of the farmers. Soon after the establishment of the scheme, it was discovered that the largest number of patients coming to the outpatients department were suffering from bilharzia. The program, therefore, began a survey of the entire scheme for: (1) the presence of snails; (2) the infectivity of humans; and (3) the infectivity of snails. Once all three were established, control measures had to be implemented. The control measures adopted were: (1) all infected persons had to be treated; (2) health education programs had to be launched; (3) public pit latrines had to be provided for use by small landowners; and (4) molluscicides were used in the entire canal complex.

The infection rate at the scheme was found to be 80%. After all four measures were jointly implemented, the incidence of the disease dropped drastically. After 3 months the infection rate was well below 30%. Now, the infection rate is less than 20%. The results at Kasinthula have been so impressive that new irrigation schemes are being launched with the bilharzia program included.

The provision of latrines at the Kasinthula rice scheme was welcomed by the farmers, but the distance one had to go in order to urinate was a problem. This prompted fouling of water courses with urine, thus connecting the chain of transmission. As mentioned earlier, this is the most direct method of bilharzia transmission. A method, therefore, had to be found to cater to urination. In this regard, the project staff devised a simple form of urinal for use on the scheme. The closer proximity of these urinals encouraged their use and eliminated the need for a long walk to the latrine.

There are several factors that influence bilharzia transmission in Malawi: (1) bilharzia is so endemic that for one to go for treatment the disease must have reached such a chronic stage that complications have

set in; (2) bathing and swimming in bilharzia-infected bodies of water, by both adults and children, are very common; (3) it takes a long time to complete the course of treatment currently being administered for bilharzia and owing to its side effects many patients do not complete the treatment; and (4) drinking of untreated water from infected sources is common.

### **Hookworm (Ankylostomiasis)**

Ankylostomiasis is caused by flatworms. They are parasitic and live in the intestines of humans. They suck blood, which leads to anaemia, breathlessness, wasting, swelling of the feet, and mental lethargy.

#### **Mode of Transmission**

The adult worms live in the intestines of humans. They produce eggs that are passed from the body in the faeces. The eggs, if deposited on warm and damp soil hatch in 1-2 days. The larvae feed upon the faeces and develop. After some time, they mature and cling to the damp earth or wet grass until bare human skin touches them. They penetrate the skin immediately and get into the lymphatic vessels and to the circulatory system and they enter the lungs. They are then coughed up and swallowed, thereby entering the stomach and the small intestines, where they cling and start the blood-sucking process over again,

producing toxic substances. The female worms, when fertilized, pass eggs into the gut in enormous numbers, and these are again passed from the body in the faeces.

#### **Malawi Experience**

The factors that influence hookworm transmission in Malawi are: (1) because Malawi is an agricultural country, farmers are always in contact with infected soil; (2) there is a lack of pit latrines and wastes are not disposed of in a sanitary manner; and (3) treatment is not sought until it is too late.

There are no specific programs dealing with hookworm diseases in Malawi but health education topics do include hookworm, particularly at under the age of five clinics and prenatal clinics.

Before the cholera outbreak, hookworm and bilharzia were the two diseases that were being used to advocate the building of latrines in Malawi. It was difficult for a village to see the dangers of bilharzia and hookworm but at the mention of cholera, everyone realized that there was danger.

As mentioned earlier, excreta is the main cause of infection and through different agencies humans are infected by a multitude of diseases. It is important, therefore, that economical means of breaking the chain of transmission be developed without violating the social or cultural views of the communities to be served.

## Sanitation and Disease Transmission

J.B. Sibiya<sup>1</sup>

Primary health care includes eight essential components: (1) education on prevailing health problems (the foundation of ill-health and methods of preventing and controlling it); (2) prevention and control of endemic diseases; (3) appropriate treatment of common diseases and injuries; (4) provision of essential drugs; (5) maternal and child care, including family planning; (6) immunization against major infectious diseases; (7) adequate food supply and proper nutrition; and (8) adequate safe water supply and basic sanitation facilities. In the vast rural and urban areas of Third World countries, however, many human settlements still lack adequate safe water supplies and basic sanitation facilities. Diseases related to unsanitary conditions are caused by microbes and chemicals. The chemicals that in high concentrations can pose a health hazard are fluorides and nitrates. The most serious problems, however, are caused by a variety of microbes: bacteria that cause cholera, typhoid, and bacillary dysentery; viruses that cause poliomyelitis and infectious hepatitis; protozoa that cause amoebic dysentery and giardiasis; and helminths that cause ascariasis, ancylostomiasis, and schistosomiasis.

The lack of safe water supplies and basic sanitation facilities coupled with malnutrition, poor and inadequate housing, and other socioeconomic factors, particularly poverty, have resulted in high morbidity and mortality within communities in Third World countries.

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<sup>1</sup>Chief Health Inspector, Ministry of Health, Gaborone, Botswana.

These are the people who suffer most from the unavailability of facilities for safe water supplies and safe disposal of excreta because they lack not only the means to obtain such facilities but also the information and technology to reduce the ill effects of unsanitary living conditions, which lower their productivity and their enjoyment of a healthy life. The problem is particularly tragic because it is the children who are the most vulnerable.

Thus, any practical method, in terms of economy, acceptability, and adaptability to the environment, that can be developed for dealing with this problem would be welcomed and its effective application would, hopefully, show a decline in water- and sanitation-related diseases in the long term.

The awareness of the need for safe water supplies and basic sanitation facilities is becoming greater as Third World countries receive guidance from the World Health Organization (WHO) and financial assistance from countries such as the United Kingdom, Canada, Sweden, and the United States and from organizations such as the World Bank and the United Nations Children's Fund (UNICEF). All of these groups are assisting Third World countries to attain the objectives of the International Drinking Water Supply and Sanitation Decade, in particular, and the objectives of "health for all" by the year 2000, in general.

The transmission of water- and sanitation-related diseases may be divided into four categories: (1) waterborne infections, e.g., typhoid, cholera, dysentery (bacillary and amoebic), gastroenteritis, other diarrheal diseases, and infectious

Table 1. Number of patients treated for diagnosed sanitation/water related diseases in Botswana in 1977.

Diagnosis	Outpatients	Inpatients	Total	Deaths
Enteritis and other diarrheal diseases	66893	2205	69098	108
Skin infections	77744	1323	79067	1
Scabies	11800	—	11800	—
Eye infections	40447	296	40743	—
Infective and parasitic diseases	4797	171	4968	—
Malaria	4105	194	4299	7
Schistosomiasis	1031	37	1068	—
Infectious hepatitis	286	100	386	6
Bacillary and amoebic dysentery	—	253	253	11
Typhoid fever	—	6	6	2

Table 2. Prevalence of schistosomiasis by district in Botswana (1976-1978).

District	Number tested			Number positive		
	Male	Female	Total	Male	Female	Total
<i>Schistosoma haematobium</i>						
Southern	1061	1406	2467	25	24	49
Chobe	137	152	289	25	22	47
Ngamiland	1024	951	1975	9	2	11
South East	762	803	1565	52	18	70
Kweneng	535	848	1383	8	8	16
Central	2948	3440	6388	82	45	127
North East	656	640	1296	2	2	4
Kgatleng	2433	3198	5631	349	365	714
<i>Schistosoma mansoni</i>						
Ngamiland and Chobe	100	109	209	29	22	51

hepatitis; (2) water-washed infections, e.g., skin infections such as scabies, yaws, and leprosy and eye infections such as trachoma and conjunctivitis; (3) water-based infections, e.g., schistosomiasis and guinea worm; and (4) water-related infections (some vector-borne diseases are caused by vectors that breed in water), e.g., onchocerciasis, malaria, filariasis, yellow fever, and human trypanosomiasis. Table 1 shows the extent of these diseases.

The livelihood of the majority of rural populations in the developing countries is

based on subsistence farming coupled, in some cases, with fishing and this has resulted in the spread of diseases such as schistosomiasis, in particular, as extensive broad irrigation schemes are initiated for food production (see Table 2).

A number of water- and sanitation-related diseases are spread by flies that carry infectious organisms from excreta and contaminate prepared foodstuffs that are not hygienically stored. The ingestion of such contaminated foodstuffs then leads to infection. Domestic water supplies obtained

**from rivers or other unprotected sources that have been polluted with infected human excreta are another source of infection.**

**The prevalence of diseases caused by unsanitary conditions will, therefore, only be reduced if and when communities in**

**Third World countries have adequate safe water supplies and adequate and safe methods of disposing of human wastes. This presents a great challenge to Third World countries for the future.**

# **Water Pollution and Sanitation in Botswana**

**L.V. Brynolf<sup>1</sup>**

## **Water Supply and Sewerage in Urban Areas**

About 150 000 people or about 18% of the population of Botswana live in the urban centres of Gaborone, Lobatse, Francistown, and Selebi Pikwe. The Water Utilities Corporation (WUC), a wholly state-owned parastatal organization, is responsible for water supply in these centres. In addition to the urban centres, there is a small mining town, Orapa, with a considerable water consumption due to the presence of a mining company. The water source for these urban water supplies is mainly surface water, contained in dams and given adequate treatment before use. Francistown is an exception to this rule. At present, it utilizes water from boreholes within the township. However, a new water source, the Shashe Dam, will soon be in use.

Only the high- and medium-priced housing areas of Gaborone, Selebi Pikwe, and Orapa are connected to waterborne sewerage systems, with subsequent treatment of the wastewater in oxidation ponds. The remainder of the urban population is served by individual facilities such as septic tanks or pit latrines. In squatter areas, a large part of the population does not have access to any toilet system. The limited sanitary facilities available in these areas are likely to pollute the groundwater under the towns and the surface water at the outlet

points of ponds. However, they will normally not pose any threat to the water supply systems of the urban areas.

## **Water Supply and Sanitation in Rural Areas**

The rural population in Botswana amounts to approximately 700 000 people. There are 15 major villages with about 150 000 people and there are another 110 intermediate villages (with more than 500 people) and perhaps 200 small villages with an estimated population of 250 people in each village. The remainder of the rural population stays at the lands and cattle post areas.

Water supplies have now been provided by the Department of Water Affairs for all of the major villages and about half of the smaller villages. According to the development plan, all villages will be supplied with water by 1985. Nearly all these water supplies are dependent upon groundwater.

In the villages, there is no waterborne sanitation except within some government buildings, schools, and hospitals. Methods of human waste disposal range from aqua privies and pit latrines to retreats in the bush, the latter method being the most common. It should be noted that there are also plenty of cattle in and around the villages and as a result there is a considerable risk of pollution to the public water supply that is drawn from boreholes. In fact, a number of boreholes have been abandoned because the water in them is polluted.

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<sup>1</sup>Senior Water Engineer (Pollution), Department of Water Affairs, Gaborone, Botswana.

## Indicators of Pollution in Water Supplies

The greatest danger associated with drinking water is that it may recently have become contaminated by sewage or by human excrement; even the dangers of animal pollution must not be overlooked. If such contamination has occurred very recently and if it has been caused by any carrier of such infectious diseases as enteric fever or dysentery, the water may contain the living pathogens of these diseases. Cases of these diseases may then result from the drinking of such water.

Although modern bacteriological methods have made it possible to detect pathogenic bacteria in wastewater, it is not practicable, as a routine procedure, to attempt to isolate them from samples of drinking water. When pathogenic organisms are present in faeces or sewage, they are almost always greatly outnumbered by the normal excremental organisms, and these organisms are easier to detect in water. If they are not found in the water it can, in general, be inferred that disease-producing organisms are also absent, and the use of normal excremental organisms as an indicator of faecal pollution in itself introduces a margin of safety.

The organisms most commonly used as indicators of pollution are *E. coli* and the coliform group as a whole. *E. coli* is undoubtedly of faecal origin, whereas other members of the coliform group may or may not be of faecal origin. From a practical point of view, it should be assumed that they are all of faecal origin, providing a further margin of safety. Faecal streptococci may be of value in confirming the faecal nature of pollution in doubtful cases. It has been stated that it would be possible to differentiate between faecal pollution from animals and humans due to the ratio between faecal coliforms and faecal streptococci. Humans would have a ratio of above 4, whereas animals would have a ratio of less than 0.7. There is no reason to believe that this is a general rule. Differences in nutrition will distort this ratio, as well as

differences between various groups of humans and animals.

Nitrate is another important indicator of faecal pollution in drinking water. In particular, changes in nitrate concentration (as well as the concentration of chlorides) could be suspected as being a sign of pollution that may be of faecal origin. In some countries, heavy soil fertilization may be the cause of nitrates spreading, but this is not the case in Botswana. The nitrate could also be of mineral origin. In some cases, increased nitrate levels will only indicate contamination with bovine faeces, which will constitute a relatively small risk of humans contracting animal diseases. In the villages, however, the presence of nitrate may indicate human faecal pollution.

## Standards and Control of Water Quality

An acceptable public water supply should not have any faecal coliforms and not more than 10 total coliforms per 100 ml. If total coliforms appear repeatedly, it should be considered as an indication of pollution and the source of the total coliforms should be determined and removed.

Nitrate is to be considered not only as an indicator of pollution but also as a health hazard itself, among other things, through the possible formation of methemoglobin in the blood. Unless the nitrate concentration in the water is very high, the substance will not be toxic enough to endanger the health of adults and older children. However, formula-fed infants younger than 3-6 months of age are very susceptible to being affected by nitrates. The World Health Organization (WHO) has set a standard of a maximum of 45 mg  $\text{NO}_3$ /litre in drinking water for children below the age of 1 year. In a WHO report published in 1962, the maximum acceptable daily intakes of nitrite and nitrate were set at 0.4 mg  $\text{NaNO}_2$  and 5 mg  $\text{NaNO}_3$  per kilogram body weight.

The WUC controls the quality of water in urban water supplies by chlorinating the water before its distribution. The water supplies in the major villages are operated



and maintained by the Department of Water Affairs (DWA). Chlorination has been carried out in these supplies since studies revealed that high levels of nitrate and varying numbers of coliforms might occur. The water supplies in smaller villages are managed by the district councils and they are not, generally, chlorinated. Staff from the Department of Water Affairs (water quality laboratory) carry out routine sampling and testing of the untreated and the distributed water in the major villages. This monitoring of drinking water is extended to the smaller villages as far as manpower constraints permit. The analyses normally carried out by the DWA water quality laboratory are: pH, conductivity, total dissolved solids (TDS), chloride, nitrate, free chlorine (on site), total coliforms, and faecal coliforms.

### **Some Studies on Sanitation and Water Pollution**

Several studies on sanitation, water supply, and pollution have been carried out in Botswana. In May and June 1977, an evaluation was made by SWECO of the water schemes in 9 major villages and 22 rural villages. Water samples from 29 of the villages were analysed. In 9 of the 29 villages, water with more than 45 mg NO<sub>3</sub>/litre was found. Low values were found in 10 villages and were found to correspond with low concentrations of TDS and very low hardness values. High nitrate values were found mainly in hard waters with relatively high amounts of TDS. The first group included mainly river and sandy river waters, whereas the second group consisted of groundwater. It should be noted that high levels of nitrate also contribute to the TDS and that acidification caused by nitrification is usually compensated for by an increase in hardness. Bacteriological examination of water from boreholes did not show any correlation between high nitrate concentrations and bacterial contamination.

In June 1978, a detailed study was carried

out of one borehole in Mochudi. The water from the borehole had a high nitrate content (over 500 mg NO<sub>3</sub>/litre) and pit latrines were found to be situated nearby. The study showed an extremely high transportation rate into the borehole of tracers, such as lithium chloride, that were put into the pit latrines.

Bacteriological investigations were carried out in July 1978 on water from boreholes, well points, and standpipes in Ramotswa, Molepolole, Kanye, Palapye, Serowe, and Mahalapye, all of which are major villages in eastern Botswana. Almost without exception, the water contained unacceptably high levels of faecal bacterial contamination. Despite the fact that *E. coli* was largely absent from the water, *Salmonella* and some other possible pathogens were reported.

In conjunction with the bacteriological study, water samples were collected simultaneously and tested for nitrate, nitrite, and ammonia. The survey was conducted in order to establish the relationship between chemical and bacterial contamination of selected groundwater supplies. The results of the study indicated that there was no positive correlation between nitrate and faecal coliform concentrations in the water supplies tested. The study clearly demonstrated that some of the worst bacterial pollution occurred in waters with very low nitrate concentrations.

At the end of 1978, a group of consultants studied the correlation between nitrate in drinking water in Botswana and the health of the consumers. According to the findings of the team, nitrate contamination of drinking water did not seem to have any serious impact on health. Bacterial pollution, however, was considered to be a more serious health hazard and quite prevalent. A recent study in Namibia proved that in that country nitrate pollution had an impact on health. Obviously, this field must be studied further.

A new microbiological water quality study has now been proposed and will, if

approved, be carried out between 1980 and 1982. It has been proposed that a country-wide study of the degree of faecal contamination of different sources of water in Botswana be carried out. The study would include the relationship between different indicators of faecal bacteriological pollution and their correlation to different waterborne/water-related pathogens, their survival, and transportation characteristics in water and soil. The study would also include the role of water-spread diseases related to other methods of transmission in communities with limited sanitation facilities.

## Conclusions

There is probably widespread contamination by sanitary waste in the groundwater supplies of Botswana and remedial action is urgently needed. New boreholes will have to be sited away from the villages and they will require adequate protection areas. Boreholes that are already polluted will have to be protected against further pollution or be replaced. There is also a need for a competent assessment of the existing state of pollution, of the effect of pollution on human health, and of a proposal for relevant indicators of pollution.

# Primary School Health Education in Tanzania

I.A. Mnzava<sup>1</sup>

## Historical Perspective

Health education has always been a significant component of the Tanzanian school curriculum. Simple rules of health together with a constant check on the application of these rules has been a common feature of the health curriculum. Every schoolchild has been expected to accept and follow the normal health practices. School health practices have supplemented and complemented the health practices followed at home. Eating habits, toilet habits, cleanliness, care of the hair, care of the teeth, care of clothing, and disposal of sputum are some of the fundamental health practices that have been stressed. Personal care when one has been attacked by a common cold or flu is another area of personal hygiene that is covered. Personal care during bodily changes and the necessary care at puberty among girls are other areas that have attracted considerable attention.

In 1959, the Department of Education issued a new curriculum for middle schools that included, among other things, content and methods for the teaching of domestic science in African girls' schools, standard V-VIII. Because the health and welfare of the home were considered to depend upon the housewife, the syllabus was basically designed for girls. Boys had a handwork syllabus designed specifically for them. In standard I-IV there was a common hygiene syllabus for all.

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<sup>1</sup>Coordinator, Primary Health and School Feeding Programmes, Ministry of National Education, Dar es Salaam, Tanzania.

The aim of the domestic science course was to see to it that children appreciated cleanliness, set higher standards of home life, and acquired knowledge and skills and definite ideas pertaining to the running of their own home and the development of the community at large.

## Turning Point

After independence in 1961, the emphasis placed on health education continued. However, health practices were viewed in terms of advancement of the human race rather than an enclave jealously guarded and owned by the white race. Some topics in the old syllabus were carried over into the new syllabus but with different aims and approaches. The topics were no longer interpreted as the metamorphosis of a black man to a white man. They were taken and interpreted as cosmopolitan health norms. Hence, there was a much more positive response to whatever was taught. These advancements were always associated with the newly gained independence. New syllabi were developed with new approaches, after which seminars and workshops were held to expound the new ideas and their possible implementation.

The syllabus focused on the country's three greatest problems: ignorance, poverty, and disease. At first glance, one may feel that health education need only be concerned with disease. However, the three are interrelated and the improvement of health on a national scale requires the eradication of all three.

A program was needed that would reach all of the people, from primary school-children to adults. Schoolteachers had an important part to play in this program. Students were to learn not only what vitamins and minerals were but also they had to be persuaded to eat the foods that contain vitamins and minerals. Children were to learn what malnutrition is and how it harms them and the nation as a whole. They had to practice what they had learned about nutrition. The teacher, in addition to teaching, had the responsibility of visiting the homes of pupils, setting high standards for the pupils to copy, beginning a school feeding program, and many other activities geared toward improving the health of the students and the nation at large.

In terms of health practices, the teacher discussed not only commercial practices but also equivalent local practices, e.g., the use of local shrub toothbrushes like the "mdaa," instead of a commercial toothbrush; cooling water in clay pots as opposed to in refrigerators; and digging ditches for refuse disposal and later covering them with soil as an alternative to using incinerators.

### **The Present**

There are 10 000 primary schools in Tanzania with an enrollment of 3 million students. All pupils take 7 years of primary education, standard I-VII.

Tanzania's education policy reached a turning point when education for self-reliance was declared as the new education policy. This came about with the awareness that in order for self-reliance activities to succeed, energetic workers who could work at full production were needed. As a result, massive health campaigns were launched. Health education was carried out at almost all levels of formal education, except at the university level. Community programs for adults were started through mass media. Sanitation and nutrition were also introduced in maternal and child care clinics. Principles of sanitation were learned through self-reliance projects such as the construction of latrines and digging wells for new villages.

### **Community Schools and Basic Services**

In a pilot project at Kwamsisi, Tanga Region, northeastern Tanzania, after successful interaction between the villagers and the school, it was decided that the project should be expanded to another 35 primary schools. The results were so encouraging that the Ministry of National Education took the bold step of turning all primary schools in Dodoma and Singida regions into community schools. The government has, furthermore, decided that all primary schools will become community schools in 1982.

The significant feature of the community school is that much of the curriculum is village oriented. The school and the village have a mutual existence. In the activities carried out so far, the school has gained from the village and the village has gained from the school. For example, a water project for the school is, in fact, a water project for the village. The development of such a basic service has a very large environmental impact. The village and the school both learn that close attention is paid to the siting of a water supply in relation to soil types and proximity of latrines. Both the school and the village learn that without toilets, or with toilets that are built without consideration of water seepage, water contamination and insect breeding grounds have a detrimental impact on health. It is expected that bad cultural habits relating to the disposal of human waste will change with the implementation of health education programs. For example, in school the life history of the mosquito and its association with malaria are taught simultaneously so that steps can be taken to prevent the spreading of malaria within a village. When the village development committee makes seed, fertilizer, and vermin control projections the estimates include the needs of the primary school. Such considerations are important because the community knows that it is their responsibility to provide meals to their children whether it be midday meals or evening meals. The success of a school food-producing project is, therefore, a

success of both the school and the village in becoming self-reliant. It is, therefore, a common sight within the village primary schools for one to see several hectares of maize and vegetable gardens. In many schools, one can also observe pigs, cattle, and fishponds. On special days set aside by the village to do some productive work in the school, one may find the parents working hand in hand with the schoolchildren in the school shamba or even building a school pit latrine.

The whole idea of mutual interaction rules out exploitation of one group by another; the school should not exploit the village and the village should not exploit the school.

It should also be noted that even though the government is keen to provide the basic services of education, water, and health, most of the resources should come from the people themselves because the majority of them are now living in organized and registered villages. Experience has shown that if everything is provided during the initial stages of a project, the initiative of the village people will be lost. Thus, some villages and their schools will forge ahead with their health and educational programs, whereas others will lag behind, relying upon local initiative and resources to augment the meagre resources provided by the government.

### **School Feeding Program**

It is the ministry's intention that the basic services should include a school feeding program. With the new policy, more stress was placed on feeding schoolchildren from whatever resources were available locally instead of depending upon outside aid. This meant that the school and local community had to produce food for the school feeding program.

To help meet the goal of this program, each school in rural areas has a shamba where the students work 5-9 h each week as part of their school and extracurricular activities in order to supplement other available food resources for the midday meal at school.

At present, very few schools produce enough food to provide one meal a day for the pupils. The parents who supplement the food sometimes fail to do so due to a lack of sufficient food resulting from drought. Inflation has also hindered successful school feeding programs. The government is currently laying the groundwork for more organized school health and school feeding programs. As well, plans are under way with the Food and Agriculture Organization of the United Nations (FAO) to create a 5 year program to train school feeding program managers.

### **Health Instruction in Primary Schools**

Formal health instruction is offered in the domestic sciences in primary schools. The emphasis is focused on personal health. Other areas of study are related to care and cleaning of the home and surroundings, sewing, preparation of food, and first aid. Two periods per week are scheduled for standard I-IV and four periods per week are scheduled for standard V-VII. At present, all pupils in primary school are taught domestic science.

In the new health education syllabus the emphasis is placed upon building new knowledge based upon practical experience, e.g., (1) students are required to keep track of the health activities they do at home; (2) vegetable gardens are grown before cookery lessons begin, hence, stressing self-reliance; (3) emphasis on the need for protein promoted the keeping of poultry and fishponds in self-reliance programs; (4) teachers are required to set a good example for the community to follow in terms of proper dress, healthy family surroundings around the home, and active participation in community affairs; (5) students are more aware of their own state of health; (6) the midday meal helps to provide a balanced diet; and (7) Tanzanian recipes get priority over foreign recipes.

### **Health Services**

The Ministry of Health has a school health program whose main purpose is to

reach every primary schoolchild and provide the necessary health services. At present, only schools within the city or near the hospital, dispensary, or health centre can receive the services. Plans have been made, however, to expand this program, through financial aid from the United States Agency for International Development (USAID), to provide a nurse for every six schools. This 5 year program will begin in September 1980.

There are also plans to train primary schoolteachers to screen pupils for health defects. This training will provide preventive services to primary schoolchildren. By acquiring new skills, the teachers will be in a better position to establish a good working relationship with health service personnel and to develop a greater awareness of health in the overall educational process.

### **Health Activities in Primary Schools**

A primary schoolchild's day begins very early. Because almost all primary schools are day schools, most children report to

school as early as 7:00 a.m. Activities for each individual are well programed to ensure that health education is not a series of lessons, but rather a part of the student's life. Early morning activities include: general cleanliness of the classrooms; cleanliness of the school compound; cleaning of the latrines; refuse disposal; care of the school garden; care of the animals; the sale of garden produce; and collection and preparation of materials for the midday meal. Following these activities are physical education and the morning parade. A daily inspection is made of the work done and a flag is awarded to the best village. There is also a daily inspection of the pupils, with each teacher inspecting his/her group. On one day the emphasis may be placed on clean clothes, another day on clean, well-kept hair, and another day on clean nails, etc. The school is kept clean by grouping the pupils into villages. Each village is then responsible for a certain area at the school for the week. Lists of duties are altered weekly so that no pupil has an arduous task for too long, e.g., cleaning the latrine.

# Health Education in Primary Schools in Malawi

I.K. Medi<sup>1</sup>

## Malawi's Educational System

The educational system in Malawi is based on three levels: primary, secondary, and postsecondary. Primary education has an 8 year duration and terminates with the Primary School Leaving Certificate national examination. The official entry age is 6 years, although this is not strictly observed. Primary schools are administered by Local Education Authorities (LEA), of which there is one in every district. The central government is represented on these LEAs by district education officers. There are more than 2200 primary schools with a total enrollment of 700 000 pupils.

Secondary education lasts for 4 years, with an intervening Junior Certificate national examination at the end of the first 2 years. The majority of the students who pass this examination are selected to complete the remaining 2 years of the program. Secondary education terminates with the Malawi Certificate of Education (MCE) public examination. Entry into secondary school from primary school is highly competitive due to the limited enrollment of secondary schools. Secondary education is administered by the central government.

Postsecondary education includes teacher training, technical, vocational, and university education. Teacher training courses include a T3 course for those students with a Junior Certificate and a T2 course for those with a MCE. Both of these courses run for 2 years and train only primary schoolteachers.

Teachers for postprimary school educational institutions are trained at the University of Malawi.

## Health Education in the Primary Schools

### Aims and Objectives

Malawi considers itself to be at war with disease in order to improve the general standard of health of its population. This war is waged through a multifaceted approach of community developmental, educational, health, and social programs. The educational program is designed so that everyone who goes through the educational system is trained in the best ways to recognize, prevent, and fight disease. As it happens, everyone who goes through this system must start with primary school first. However, due to a high drop-out rate and a limited enrollment in postprimary institutions, a large number of children do not proceed beyond the primary stage. For this reason, an effective health education program within the schools must be aimed at the primary schoolchild.

Throughout the program the emphasis is on: (1) acquisition of some basic knowledge on health and health-related topics relevant to everyday life; (2) development of positive attitudes toward good health practices; and (3) development of some basic practical skills related to good health practices.

### Syllabi

The syllabi are graded from the lower to the upper classes. Thus, in the lower classes

<sup>1</sup>Headmaster, Blantyre Secondary School, Blantyre, Malawi.

practical aspects of personal hygiene; clean attractive surroundings; and safety measures, including road safety, are stressed as a necessary part of training in health education. In the upper classes, the syllabi are broader and deeper in scope and include more solid academic work. They cover such topics as diseases (specific), their causes, effects on the body, and their control measures; nutrition, food, and food hygiene; child care and practical home nursing; first aid; and community and public health services. Throughout the course the teaching method emphasizes pupil activity and involvement. At the end of the 8 years of primary education the students write a national examination.

### **Teaching Materials**

Teachers use teaching handbooks prepared by the Ministry of Education. These handbooks provide not only detailed guidelines on how to handle each lesson unit but also background information on each topic. Because reference materials are very limited in most primary schools, particularly in the rural areas, the handbooks are a valuable resource material for a great many teachers, in spite of their inherent limitations. In addition to this, teachers are encouraged to invite outside speakers who are experts in their field to give supplementary instruction on any part of the syllabus, particularly those subject areas in which the teachers themselves are not very knowledgeable.

Visits to places of interest, such as sewage systems, are also encouraged. Teachers are also advised to take advantage of the radio broadcast programs dealing with health education. The programs are produced by the Broadcasting Unit of the Malawi Correspondence College. Most primary schools are provided with radios for this purpose. Health education in the primary schools is allotted three periods of 30-35 min each per week.

### **Constraints on the Teaching of Health Education**

Although no evaluation exercise has, so far, been undertaken to determine the effectiveness of this program, there is no doubt that the program has aroused an adequate awareness, in the minds of the primary school leavers, of the importance of health education in everyday life. Its teaching in schools, however, is to a great extent limited by the scarcity and insufficiency (when available) of the teacher's handbooks. In addition, since sex education is not taught in Malawian schools, certain areas which touch upon this topic, e.g., child care, which is very important for girls, are difficult to teach. Some research on the influence of traditional beliefs on health education is also needed. Lack of suitable apparatus in many schools also imposes further limitations, particularly for the practical aspects of this program.



# **Health Education Delivery System in Environmental Health Programs in Malawi**

**Winson G. Bomba<sup>1</sup>**

The health education approaches and strategies used in sanitation programs in Malawi will be discussed in another paper (see p. 101). This paper, therefore, will only focus on the delivery system of environmental health education in Malawi. Five levels of sanitation education responsibilities will be described: village, area, district, regional, and national.

Rural sanitation is principally the responsibility of the Ministry of Health. Extension workers from other ministries, e.g., the Ministry of Community Development, Ministry of Local Government, Ministry of Agriculture, Ministry of Natural Resources, and the Ministry of Education, play a significant role in sanitation education in collaboration with the Ministry of Health.

The population is reached through a network of about 500 prenatal and 900 child clinics, health centres, hospitals, and village health committees. The formation, composition, and functions of the village health committees in Malawi are discussed in another paper and, therefore, will not be discussed here. The most significant fact about the village health committees is that they are largely composed of the villagers themselves and village headmen are the chairmen. Health workers and other extension workers merely act as facilitators and/or resource persons.

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<sup>1</sup>Health Education Coordinator, Ministry of Health, Lilongwe, Malawi.

## **Village Level**

The surveillance assistant is responsible for environmental health at the village level. This person is a member of the community who is trained in environmental and personal hygiene. The main function of the position is to teach people all aspects of environmental health.

The surveillance assistant is assisted at this level by the maternal and child health assistant (Ministry of Health); homecraft worker (Ministry of Local Government); agricultural field assistant (Ministry of Agriculture); and primary schoolteachers (Ministry of Education). In the very near future, the Ministry of Health will introduce another category of village health worker: a primary health worker (PHW).

All of these village-level extension workers do their work in close collaboration with the village health committees. In areas where the village health committees have not yet been formed, health matters are handled by village action committees, which are village-based committees composed largely of members of the community. The main purpose of the village action committees is to promote the people's participation in self-help projects.

## **Area Level**

A health assistant is responsible for the environmental health of an area. The functions of this position, among others, are to teach the people about environmental

health matters, including the use of latrines, and to supervise the surveillance assistants. An area contains several villages, hence, many village health committees would be under the authority of one health assistant.

The health assistant is assisted by other extension workers such as medical assistants, enrolled nurses and midwives (Ministry of Health), and community development assistants (Ministry of Community Development).

These extension workers are also members of area action committees, whose chairmen are traditional chiefs. Again, the composition of the area action committee is largely made up of members of the community: leaders, chiefs, and other elected people from within the community. Matters that cannot be handled by the village health committees are referred to the area action committee.

The health personnel at this level operate from a health subcentre. According to the 15 year development health plan, each health subcentre is to serve 10 000 people. Health subcentres are staffed by medical assistants, health assistants, and enrolled nurses and midwives.

### **District Level**

Environmental health at the district level is the responsibility of a district health inspector. This person supervises the health assistants and surveillance assistants in their district. In addition, they initiate health education campaigns and seminars and training courses for field staff and members of health committees. The district health inspector is assisted by other extension workers such as public health nurses, clinical officers (Ministry of Health); district community development officers (Ministry of Community Development); and agricultural extension officers (Ministry of Agriculture).

Every district in the country has a district development committee (DDC). The district commissioner is the chairman. Members of the DDC include all heads of departments at the district level (including health

inspectors), members of parliament of the district, district political officials, traditional chiefs, and the chairman and clerk of the district council. The DDC deals with all development matters in the district, including sanitation issues, e.g., water supplies and programs/projects dealing with the use of latrines. Issues that cannot be resolved by area action committees are referred to the DDC. If the district development committee cannot handle the matter, it is referred to the Development Division of the Office of the President and Cabinet and/or the secretary for health in the case of health matters.

In addition to the DDC, each district council has a public health committee, among other committees, which is largely composed of ward councillors from within the district. District health inspectors are members and technical advisors to such committees. Through the district council and public health committees, district health inspectors are able to exert their influence upon and involve district council machinery in various environmental health programs throughout the district.

The health inspectors and other health extension workers at the district level operate from district hospitals or primary health centres. The staff at a primary health centre includes a clinical officer, health inspector, registered nurse/midwife, public health nurse, senior medical assistant, and health assistant. According to the 15 year development health plan, a primary health centre (rural hospital) is designed to cater to 50 000 people.

### **Regional Level**

A regional health inspector is responsible for the environmental health of a region. A region incorporates from 5-10 districts. Health inspectors in a region are answerable to the regional health inspector who operates from a regional health office other than a hospital. Among other things, the regional health inspector controls funds for sanitation programs in their region and maintains a building team composed of builders, carpenters, plumbers, painters, and labour-

ers that are deployed within the region to carry out any necessary construction work, including the construction of latrines, slabs, and structures.

### **National Level**

The regional health inspectors report to the health superintendent at the Ministry of Health headquarters. The health superintendent then becomes responsible for environmental health at the national level.

At Ministry of Health headquarters, there is also a Health Extension Unit whose main function is to support all preventive health programs through the use of teaching materials and professional advice on health education methodology. In addition, the unit is responsible for public health education through mass media, e.g., radio, cinema, and posters. The health education activities conducted by the field extension workers are supplemented by 12 health broadcasts weekly (Monday to Saturday).

### **The Role of Other Agencies**

The Mission Medical Services, known as the Private Hospital Association of Malawi (PHAM), play a role in sanitation education. The primary concern of the PHAM is curative service; however, their preventive

role is coordinated with that of the government, particularly with regard to health education of patients and mothers at prenatal and child clinics. In this regard, teaching materials produced by the Health Extension Unit of the Ministry of Health are distributed to the PHAM health units free of charge.

Sanitation in urban areas is the responsibility of the Ministry of Local Government through city and municipal councils. The Ministry of Works and Supplies is involved in the sewerage engineering aspects. City and municipal councils employ their own health inspectors and health assistants who ensure that health bylaws are complied with.

### **Conclusions**

The improvement of sanitation is the concern of many agencies within Malawi, both government and private. Consequently, the approach to the use of latrines is interdisciplinary.

The Ministry of Health is responsible for rural sanitation and is greatly assisted by other ministries. The involvement of local communities in environmental health programs is achieved through committees at village, area, and district levels. This system enlists maximum participation of the people and has proved very useful.

# Rural Health Services in Ethiopia

Araya Demissie<sup>1</sup>

The health status of Ethiopians is among the worst within the developing countries. Ethiopia has an infant mortality of 155-200/1000, child mortality of 247/1000, and maternal mortality of 20/1000, which is 20, 50, and 20 times greater than the respective rates within developed countries. Sixty percent of all deaths occur among children less than 5 years of age and mothers and life expectancy is estimated at 43-44 years in comparison with a life expectancy of greater than 70 years in developed countries. Because of the generally unhygienic living conditions of the rural people, who constitute over 80% of the population of the country, and a lack of knowledge and means to take appropriate measures to deal with health problems, Ethiopia harbours a variety of infectious diseases. About 80% of the health problems are caused by communicable diseases, which could be prevented by the implementation of such technically simple measures as improving water sources, providing a safe method of disposing of human wastes, controlling insect vectors, providing vaccinations, and changing the health habits of the people, particularly their personal hygiene.

In such a situation, priority should be given to the control of communicable diseases and nutritional disorders through appropriate measures such as environmental sanitation, vaccination, health and nutrition education, and disease surveillance activities in order to improve the

health of the population. This paper will describe the measures being taken to solve the health problems in the rural areas of Ethiopia.

## Organization of Rural Health Services

The most important mechanism for the delivery of health services in rural Ethiopia is the basic health service system, which involves a network of health centres and health stations throughout the country. Since 1979, a primary health care unit at the village level has been included in the basic health service network.

### Kebele Health Service (Primary Health Care Unit)

This is the smallest unit in the health care delivery system. A kebele has an area of 20 gashas (1 gasha = 40 ha). The minimum number of families living in a kebele is about 80, or approximately 400 people. Much emphasis is placed on this level of service, which is intended to reach the majority of the rural masses. The health service at this level is administered and financed by the farmers' association. The kebele health worker is recruited by the farmers' association from among their members according to the ability and desire of the individual candidate to serve the community.

The emphasis of the health service at the kebele level is on environmental and personal hygiene; health and nutrition education; and organizing the community to take action, such as protecting springs and

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<sup>1</sup>Head, Department of Health Education and Training, Ministry of Health, Addis Ababa, Ethiopia.

digging community wells in order to obtain relatively clean and safe water. Each household is encouraged to dig a pit latrine for excreta disposal and for the disposal of other household wastes.

### **Woreda (Subdistrict) Health Service**

The woreda is an administrative sub-district composed of several kebeles. The health infrastructure at the woreda level is called a "health station" and is more complex than that of the kebele. It is staffed by two health assistants whose training is more intensive and longer in duration than the training of the kebele health worker. The health station provides preventive, promotive, and curative services to the people. Environmental sanitation and health education are the main programs of the health station, as well as providing treatment to sick people. In addition to providing basic health services, the woreda health unit is expected to provide guidance, supervision, and training to kebele health workers.

### **Awraja (District) Health Service**

The awraja is the highest level of the basic health service network. The awraja health service unit is called a "health centre." There are about 115 of these in Ethiopia at the present time. They are staffed by at least one health officer, who is also the head of the health centre; two or three community nurses; two sanitarians; at least five health assistants; and other administrative staff.

The main activities of the health centre are: diagnosing and treating patients; epidemic control; maternal and child health services; special programs for tuberculosis and leprosy control; school health services; prison health services; health education to the public; and environmental sanitation, including spring and well protection and pit-latrines construction. In addition to these activities, the health centre has to deal with the administration, coordination of activities, supervision, and training of the woreda and kebele health workers. It also serves as a referral centre.

## **Training Health Personnel for the Rural Health Service**

### **Training Community Health Agents**

Community health agents are selected from and by the farmers' association from among their members. The criteria for selection are: (1) ability to read and write and understand the Amharic language; (2) membership and active participation in community affairs; (3) positive attitude toward health activities; and (4) preferably not more than 45 years of age. The training takes place in the nearby health centre (awraja health service unit).

The curriculum for training community health agents is based on an objective analysis of the major health problems and on what can be done at the village level to raise the health standard of the people. In developing the curriculum, the focus was on the role of the community health agents, i.e., creating an awareness within the community and directing, organizing, and mobilizing the community to participate in health activities.

The duration of the training is 3 months, with half of the time being used for classroom instruction and the other half for practical training. The courses include environmental sanitation, control and prevention of major communicable diseases, nutrition, health education, maternal and child care, diagnosis and treatment of minor ailments, first aid, and collection and reporting of health statistics.

The curriculum is carefully designed to assess the knowledge and skill acquired and also to indicate a change in attitude. An attempt has been made to clearly identify the knowledge and skill expected to be acquired in a particular field. At the completion of each subject the student is given oral, written, and practical examinations and at the end of the training program an overall evaluation is made.

### **Training Health Assistants (Woreda Health Workers)**

Health assistants are recruited and trained by the Ministry of Health at the central

level. The criteria for selection are: (1) completion of the 8th-9th grade; (2) good academic standing in science subjects; (3) not less than 18 and not more than 30 years of age; and (4) passing of the entrance examination and interviews. The training takes place at the health assistant training centres located in 10 of the 14 provinces. The duration of the course is 1.5 years.

The course includes a variety of subjects such as anatomy and physiology, microbiology, nursing art, diagnosis and treatment of the most common communicable diseases and other minor ailments, maternal and child health care, environmental and personal hygiene, and health education. Theoretical and practical lessons are given in an integrated manner; however, a great proportion of the time is allocated to the practical lessons.

#### **Training Health Centre Staff (Awraja Health Service)**

Because of the complex and diverse nature of the functions of a health centre, it is necessary to train different types of health personnel who will work as a team to achieve one goal, that goal being an efficient and economical system of health service delivery to the people. The most important members of the health team in a health centre are the health officer, who is also the team leader; the community nurse; and the sanitarian. These three categories of health personnel are trained in the Public Health College and Training Center located in Gondar administrative region.

To qualify for health officer training, one has to complete the 12th grade of education and pass the Ethiopian school-leaving certificate examination, which is also a requirement for university admission. The duration of the health officer training program is 4 years, the fourth year being an internship period during which students spend their time receiving practical training in the field and in different health institutions.

The curriculum for health officers consists of basic sciences, such as biology,

chemistry, and physics; social sciences, such as sociology and psychology; clinical medicine and public health, including environmental sanitation and health education, maternal and child health, and control of communicable diseases; and organization and administration of rural health services.

To qualify for training in the community nursing program, the applicant must have completed a minimum of 10th grade education and must pass the entrance examination and interviews. The duration of the training is 3 years, with the third year being an internship period for practical training and field experience.

The curriculum for a community nurse consists mainly of clinical and public health nursing, including maternal and child health and midwifery for attending a normal delivery. Communicable disease control, nutrition, environmental sanitation, and health education methodology are also taught in some detail. The practical training includes home visits to cases such as pre- and post-natal women; school health practice; practical nutrition, such as demonstrating to mothers how to feed their babies; health education; and environmental sanitation.

The entrance requirements for the sanitarian course are the same as those for a community nurse. The duration of the course is 3 years, with the third year again being used as an internship period to gain practical field experience.

The curriculum for the training of the sanitarian consists of basic and social sciences, including applied mathematics in the first year. The greatest portion of the curriculum, however, is in the field of environmental sanitation, which includes water supply and hydraulics; excreta; sewage disposal; refuse collection and disposal; insect and rodent control; housing, school, public building, and industrial hygiene; and meat, milk, and food control. The sanitarian is also taught about health education. In addition, a course on the "principle of the workshop" (elements of carpentry, masonry, plumbing, etc.) is given to the sanitarian students.

## **Health Education Activities in Rural Areas**

Because no health service is successful or complete without having an educational component, one of the important programs of the rural basic health service network in Ethiopia is health education. As mentioned earlier, all categories of health worker trained for the rural health service are also trained in the methodology of health education. This is following the principle that "every health worker should be a health educator," so that they can add the dimension of education to the specific duties they are assigned, regardless of whether it is curative or preventive work.

### **Health Education Activities at the Kebele Level**

As specified in the job description, one of the most important functions of the kebele health worker is disseminating health information to the members of the community. The emphasis of health education at this level is on environmental sanitation and personal hygiene. It includes such topics as the importance of having latrines for excreta disposal and their proper use, proper disposal of household wastes (garbage), the eradication of flies and their breeding grounds, the importance of clean water to health, and how to protect springs and wells using available local resources and technology in order to obtain clean water.

In order to make health education more relevant, the kebele health worker uses properly constructed latrines, waste disposal pits, and protected springs for demonstration purposes. Also, the community is organized, from time to time, to carry out sanitation campaigns within the village. During these campaigns, the people within the community clean their villages and protect their water sources from being contaminated by animal and other wastes.

### **Health Education Activities at the Woreda Level (Health Station)**

At this level, health education activities

are similar to those at the kebele level, except that they involve larger areas of the community. In addition, the woreda health workers supervise the health education activities of the kebele health workers and give them technical guidance and on-the-job training.

### **Health Education Activities at the Awraja Level (Health Centre)**

At this level, the health education activity is concerned more with the supervision and coordination of the health education programs of the woreda and kebele health services. The health officer and the sanitarian periodically go out to the woreda and kebele health service areas to supervise and provide technical guidance with regard to the health education activities carried out at the village level. The health centre also organizes seminars and refresher courses for the health assistants and the kebele health workers.

### **Support for Health Education at the Central Level**

At the central headquarters of the Ministry of Health, there is a health education unit that is responsible for the planning and coordination of health education activities throughout the country. It is also responsible for the training of health personnel in health education; for the production of visual aids such as posters, pamphlets, and films; and for applied studies and research. The staff of the central unit give expert advice to the health education coordinators at the provincial health departments.

At the central level, there is an audio-visual mobile unit that, when called by the provincial health education coordinator, goes into the field to show health education films relevant to the specific health problems of the area. Visual aids such as posters and models are also distributed from the central unit to all of the rural health centres, health stations, and the kebele health units.

# **Health Education, an Essential Component in the Promotion of Health, with Emphasis on Rural Sanitation**

**Saidi H.D. Chizenga<sup>1</sup>**

Human behaviour plays a big part in the aetiology and epidemiology of many of the diseases of greatest importance to society. It means, therefore, that in the promotion of health and prevention of diseases the effectiveness of modern public health measures is ultimately dependent upon the health consciousness of policy makers and citizens, and the preparedness of every person to help themselves by making the best use of available knowledge and health services.

If we aim to attain a level of health that will permit the entire world population to lead a socially and economically productive life by the year 2000, health education should form an integral part of the entire system of primary health care. Health care should be based on practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families in communities through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination.

Studies at different levels have shown that well over 60% of the common intestinal diseases in rural areas could be reduced to a minimum with proper disposal of human excreta, and correspondingly, the remaining 40% could be reduced with ample safe water supplies and personal hygiene. Urban popu-

lations have benefitted from medical science and technology, but rural and peri-urban populations experience quite a different situation, for in many areas there is no systematized form of health services.

## **Health Education**

Many doctors, working as individuals and in groups, have made several attempts to publish information about health for the general public or for special groups between 1762 and 1835. The aim was to give advice about health and diseases, based on the general principle that information and demonstrations of how to better conditions would, in the course of time, be adequate to improve them. Since that time, health education has steadily gained in importance from the early years of the 20th century to the present.

### **The Establishment of Health Education Services in Tanzania**

The Health Education Unit of Tanzania is a functional department within the Ministry of Health headquarters. It was established in 1957, with a staff of four, including one medical officer, a nurse, and two other people with printing skills. The main activities of the unit were designing and printing posters and leaflets and distributing them to the rural regions and to voluntary agency hospitals. Later, as the unit grew larger in terms of manpower and facilities, it became involved in seminars and health education

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<sup>1</sup>Health Educationist, Ministry of Health, Health Education Unit, Dar es Salaam, Tanzania.



pilot projects. In 1960, the unit started a project against schistosomiasis, in addition to several other projects. Today, the unit has 48 workers.

### **Functions of the Health Education Unit**

The Health Education Unit, which operates under the leadership of the director for preventive services, has the following functions: (1) demonstration of health education skills; (2) provision of orientation and training in health education for preservice and in-service health workers, with priority being given to the training of health personnel holding key positions in training institutions or in other programs concerned with training; (3) provision of orientation and training in health education for school-teachers, agricultural extension workers, social workers, and other community development workers, including political leaders and administrators; (4) collection of information about resources for health education; (5) collection of information about the peoples' knowledge, attitudes, and practices related to health problems; (6) development of basic health education materials for use in health programs; (7) management and direction of short- and long-range development of health education service in accordance with the health problems, policies, priorities, and services of the Ministry of Health; (8) evaluation of the health education objectives and requirements of national health programs and helping to plan the health education activities needed to achieve these objectives; (9) assisting other health personnel to select approaches for planning and conducting continuing education and various other types of education and training programs; (10) assisting staff within the ministry to keep abreast of new developments in health education methodology and related fields of education; (11) participating with the relevant national educational authorities and their professional workers in planning the health education aspects of teacher preparation and school programs and helping to plan in-service education programs for teachers; (12) identification of opportunities and methods by which the

Ministry of Health could collaborate on matters of health education with other ministries, professional associations, voluntary agencies, and other groups in an effort to meet national health goals; (13) encouraging universities, where appropriate, to establish special curricula or departments of health education and assisting them to strengthen health education in relevant existing courses; (14) designing, coordinating, and conducting field studies in behaviour, health education concepts, methods, and media relevant to health education practice and provision of training in the conduct of such studies; (15) identification of problem areas in health education needing studies and research and promotion of studies and research by universities and other competent groups; (16) interpretation to the public of the problems, plans, programs, and achievements of the Ministry of Health through appropriate channels of communication such as the press, radio, and professional publications, including journals; and (17) promotion of technical coordination and collaboration with international organizations, including voluntary agencies, on the health education aspects of health programs.

### **Health Education of Children and Young People**

Explaining to younger generations the importance of building a healthy society is vital. School health education programs offer learning opportunities for the children. It is important that those who are involved in the education of children and young people receive adequate initial training. For the purpose of this paper, the children should learn more about human excreta disposal, in addition to accident prevention, general cleanliness, personal hygiene, preparation for puberty and family life, and education about smoking, drugs, and alcohol.

Although school health services have, as yet, not been spread widely throughout Tanzania, the services are offered through practical demonstrations and the use of mass media.

## **Health Education to Groups**

Groups such as women's groups, clubs, religious groups, and other similar groups are easy to approach as prospects for receiving health education programs. They are easy to approach because they are already organized for a common interest.

## **Community Participation in Health Education Activities**

### **The Importance of Involvement**

Self-reliance and social awareness are key factors in human development. Community participation in deciding upon policies and planning, implementing, and evaluating development programs is now a widely accepted practice. Community participation is the process by which individuals and families assume responsibility for their own health and welfare and for those of the community, and develop the capacity to contribute to their own development and that of the community.

Complete community participation cannot be achieved without involving the local leaders at the very early stages of introducing any health education program. These leaders include political, administrative, departmental, and religious leaders, as well as other influential people such as the village healer or the head of the popular dance troop. At the operational level, the people are involved in the actual planning, implementation, and evaluation of the program. Involvement should be geared toward a feeling of concern. The people should feel that the problem is theirs and that they are in a position to solve it through their own efforts, utilizing local resources as much as possible.

### **Self-Reliance**

Life in rural areas has forced people to become self-reliant and to depend upon their own skills and efforts. Rural people know one another better than people living in cities. Rural people meet quite often, talk more to one another, and can work together more easily within their communities. In

many parts of Africa, rural people work together to build schools and clinics, improve roads, and protect their streams, wells, and springs. This spirit of cooperation can promote rapid rural health improvement through health education. Rural health improvement depends upon: (1) health services that are closely related to the needs and ways of life of rural people; (2) good understanding and cooperation between health services staff and the people; and (3) coordinating and organizing community resources for a better livelihood.

## **Health Education Staff Training**

Health education is a profession by itself. It can be acquired through training, usually by people who have had experience in some kind of health or teaching duties.

Tanzania started using health educationists in 1976. In addition, all persons engaged in public health work, be it preventive or curative, must have received an adequate amount of health education knowledge as part of their initial training.

### **Present Manpower**

#### **Health Education Specialists**

Tanzania has only four MPH (health education) degree holders, one of whom is now the director for preventive services.

#### **Health Educationists**

There are eight Advanced Diploma in Health Education (ADHE) graduates who qualified between October 1975 and June 1980 for mainland Tanzania and the islands. These people and the Master's Degree holders attended university courses on the sponsorship of the World Health Organization. Two of the eight ADHE graduates are in the islands of Zanzibar and Pemba. Two other graduates have been assigned to the country's two schools of hygiene. The remaining four are stationed in the Health Education Unit, one as the head of the unit.

There are now about 265 health officers and about 650 health assistants. All of these people are health educators. The rate at which the number of health officers is

increasing is very slow, and to make matters worse, a number of health officers leave the profession to join other fields, such as the medical profession, due to more attractive salaries. The enrollment for training is 35 per year (15 preservice and 20 upgraders). Some are dismissed due to poor performance during the course and some fail their final examinations. The yearly number of graduates ranges from 20-25. The basic reason for the low rate of growth in the number of health officers is the small enrollment of trainees.

### **Manpower Requirements**

Six health education specialists with a Master's Degree in health education, three to be stationed at the Ministry of Health headquarters and the remainder in the three consultant hospitals within the country, are required. Their duties will consist of designing health education programs at national and zonal levels and research work.

The requirements for health educationists with the ADHE are: Health Education Unit, 5; schools of hygiene, 2; zonal consultant hospitals, 3; city of Dar es Salaam and the municipalities of Tanga, Mwanza, Dodoma, and Arusha, 4.

The rate of production of health assistants does not seem to be too slow, however, it must be constant so that 100-120 can begin employment every year. By 1990, there will be one health assistant in 1650 of the 2500 wards, each serving a population of 5000-10 000.

It is recommended that training facilities be increased, even if doing so would require asking for external training assistance in whatever form was necessary. The primary objective is to provide sufficient staff to meet the goals of the Water and Sanitation Decade.

### **Case Studies**

#### **"Mtu ni Afya"**

The 1973-1974 environmental health campaign in Tanzania, popularly known as

"Mtu ni Afya" (man is health) was a milestone for the promotion of health within the country. In this campaign, mass mobilization was the backbone of its achievement. This national health campaign involved everyone in the country. Small radio-listening groups met and discussed specific topics based on the guidance provided by the radio programs. Participants were engaged in physical activities to improve their health conditions. What was very important was that at the end of the campaign, people had developed an awareness and desire to improve their health conditions.

#### **Handing over Responsibilities to the Local People**

Experience has shown that achievements made during many campaigns do not last long, depending upon how much responsibility is left on the shoulders of the local people. In an environmental health program started in 1979, which operated as a follow-up to the "Mtu ni Afya" campaign, workshops, rather than seminars, are held in villages. A 3-4 day workshop is held in a village selected by the local leaders. The participants, who are local leaders of 5-8 villages, identify a number of health problems in their own areas. They set out priorities and plan for implementation and evaluation on certain problems.

It is traditional, probably everywhere, that some kinds of closing ceremonies are held at the end of seminars. In Tanzania today, however, health education seminars organized by the Health Education Unit normally close with an activity such as digging a latrine, cleaning a well, or clearing the bush within the hospital area or the local court building. At one workshop in Nachingwea, in the southern part of Tanzania, the district party secretary wound up the workshop by planting a fruit tree. Malnutrition was one of the problems in that area identified by members of the workshop. There was a total of 21 trees planted that evening and they included some pawpaw, guava, and orange trees.

### Latrine Construction Project at Nyamoli Village

In 1976, an agricultural and fishing village, Nyamoli, situated about 4 km offshore in Lake Tanganyika, in Kigoma Region, began an anti-worm infection campaign. At the beginning of the campaign, the number of latrines within the village was 56. This was only 9.9% of the total number of 564 households. There were 116 households without latrines and the other 392 households had unserviceable latrines.

Seminars for the village leaders and public meetings were held for educational purposes. The villagers were taught how to construct suitable pit latrines, in particular how to cast a concrete slab. Cement and welded mesh, for making the concrete slabs, were the only material aids required from outside of the village. The rest of the materials needed to complete a latrine, including labour, were met by the villagers themselves. In December 1979 there were 348 serviceable latrines for 350 households.

In examining the population to determine the worm-infection rate, 340 people out of 737 examined showed positive results. Table 1 shows the different types of parasites as they affected different age groups.

#### The Improved Pit and Compost Latrines

Because these two types of latrines provide for ventilation facilities, they stand a good chance of acceptance by communities

that dislike the smell of human excreta. Some communities dislike the basic idea of the pit latrine because the user is bound to smell the waste in the latrine for the entire time they remain inside. The argument against latrines is that one does not smell the faeces very strongly if defecation is carried out in the open air. During a latrine construction campaign in the Shinyanga Region of Tanzania, near Lake Victoria, it was found in one area that all pit latrine shelters, measuring about 1.5 m<sup>2</sup> and built of sun-dried bricks, had at least eight 12 cm × 12 cm holes through three of the four walls. In fact, the walls were almost honeycombed and the whole purpose of screening was defeated. There was, however, a maximum circulation of air within the latrine to reduce the foul smell to a minimum. This is one area where the ventilated pit latrine would be accepted without many difficulties.

The compost latrine is acceptable in communities where there is a need to fertilize the soil and the local people traditionally use night soil to fertilize their farms. Such communities are found in China as well as in some parts of Africa.

### Mass Media

Radio Tanzania Dar es Salaam offers ample airspace for health programs. In addition to the ordinary health education programs for the general public, there is a school health education program that is

Table 1. Worm-infection distribution in the village of Nyamoli in 1975.

Parasite	Worm-infestation load in various age-groups		
	1-4 years	5-15 years	>15 years
Hookworm ova	57	70	65
Ascaris ova	22	47	28
Trichuris trichiura	2	2	1
Enterobius vermicularis	7	5	11
Strongyloides stercoralis	2	10	5
Schistosoma mansoni	2	—	2
Taenia saginata	—	2	—

aired during school hours. The teacher should remain with the children at this time, however, to ensure that they listen to the radio program.

Use of the press is also very important. The language most commonly spoken by the local population should be used in this case. During national campaigns, mass media should cooperate in offering maximum coverage of events, but in such a way that the end result is positively educational and not detrimental.

## **Research**

Research work should be a component of health education. Researchers may be required to work in a small area within a defined region, where a specific disease seems to be almost impossible to combat, whereas common measures have succeeded in eliminating the same problem in other areas. Research, therefore, is essential before any planning, but further research may be required on individual problems.

# Water Supply and Sanitation in Lesotho

M.E. Petlane<sup>1</sup>

## Policy and Present Status

The policy of the Government of Lesotho on water supply and sanitation is outlined in the responsibilities of a number of government ministries whose activities include water and sanitation. The Ministry of Health and Social Welfare promotes personal and environmental health to prevent and control communicable diseases, the most notable of which are waterborne and sanitation-related diseases such as typhoid (enteric) fever, schistosomiasis (bilharzia), bacillary dysentery, and gastroenteritis in children under the age of 5 years. The Ministry of Rural Development designs programs to ensure that social and economic benefits reach the poor and that government action assists the poor to help themselves. Although the Ministry of Rural Development is responsible for a variety of rural projects, its major and dominant activity is rural water supply, primarily on a self-help basis. The ministry is also involved in rural sanitation, as part of a nationwide integrated hygiene program. The Water and Sewerage Branch of the Ministry of Water, Energy and Mining is responsible for development, operation, and maintenance of urban water supply and sewerage schemes in Lesotho. The Ministry of Interior is responsible for excreta and refuse disposal in urban areas.

Basically, the policy of the Government of Lesotho on drinking water and sanitation is

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<sup>1</sup>Chief Health Educator, Ministry of Health, Maseru, Lesotho.

to make these services available to both urban and rural communities through different government ministries; the self-help approach being used wherever feasible. The government's social objectives are reflected in the water sector policies in the Third Plan (1980-1985) objectives, which are to increase social welfare; promote social justice; protect the land and water resource base and exploit it to the fullest extent; and ensure deeper involvement and fuller participation of the community in national development. The plan also emphasizes the need to enhance the well-being of the rural population.

A proposal has already been made that various government ministries and departments involved in water and sanitation meet under the chairmanship of the Central Planning and Development Office. An interministerial action committee was established in 1976 to monitor the primary school sanitation project. This committee was comprised of representatives from the Ministry of Health (convener and chairmanship), Ministry of Interior, Ministry of Education, Ministry of Rural Development, and the United Nations Development Programme (UNDP). This committee has been inactive for some time but its reestablishment is being considered.

## Urban Water Supply

Lesotho has 10 administrative districts. Each town has its own urban water supply for which the Water and Sewerage Branch of the Ministry of Water, Energy and Mining is responsible. The supply in most of the

towns is generally from different sources, including springs, boreholes, streams, storage reservoirs, and run-of-river intakes. Water is supplied from these sources to standpipes or private connections; the latter are either metered or charged at a flat rate if unmetered. It has been estimated that in 1975, 57% (14 400) of Maseru's (the capital of Lesotho) population had access to treated piped water private connections; the remainder of the population had access to piped water at standpipes, private boreholes, or open water courses. At the end of 1974, the Maseru water supply comprised 2416 metered connections, 300 unmetered connections, and 33 public standpipes, which served about 6000 people. Details on other urban centres within other districts are not readily available.

### **Rural Water Supply**

Provision of water in rural areas is primarily the responsibility of the Ministry of Rural Development. Most water for consumption comes from springs or boreholes; gravity-fed systems are provided where feasible. The involvement of the Ministry of Health in the provision of water supplies in rural areas is primarily in the area of controlling outbreaks of water-related diseases. In 1975, it was estimated that there were less than 250 piped supplies serving 98 500 people or 8.9% of the rural population. Another 3% of the rural population had protected springs. At the end of the Second Plan period, i.e., the beginning of 1980, there were 330 water supply schemes serving about 126 000 people or 10.3% of the rural population.

### **Rural Sanitation**

A small number of relatively well-off households have individual pit latrines, possibly between 4 and 13% in the lowlands and 3% or less in the mountain areas. The current primary school sanitation project was supposed to cover 600 schools during phase 1 and phase 2 would cover other primary schools within the country. This project experienced serious difficulties, however, and became inactive when only

about 12.6% of the target had been reached. Efforts are underway to reactivate this project.

### **Urban Sanitation**

The present status of urban sanitation is well summarized as follows:<sup>2</sup> "Where sanitation exists in the urban areas, it is generally by either septic tank or pit latrines — in some cases by the bucket system. Maseru has a waterborne sewerage system which is in the final stages of major extensions. Currently, approximately 10 000 of the population in western and central Maseru are on the system. The new extension which has biological filtration, cold digestion and final effluent chlorination will cater for a 1988 connected population (in western and central Maseru) of 23 000 . . . . There is a fairly extensive bucket latrine system in Maseru run by the Ministry of Interior (Maseru town clerk office). There are 6000 buckets in Maseru (the population service is not currently known) . . . . The water and sewerage department operates a vacuum tanker service which serves a population of some 2500."

Water supply and sanitation are constrained by: (1) the organization, and in many instances the inaccessibility and size, of some villages will make installation and, in some cases, the operation of village water supplies, calculated on a per capita basis, prohibitively expensive; (2) in many parts of the country, particularly the mountain areas, the topography precludes reliance upon the low-cost earth toilet structure as a means of improving the state of sanitation in the villages; (3) there is poor organization and a lack of coordination within the water sector between participating agencies; (4) there is a shortage of funds for recurrent costs; (5) some villages derive their water from seasonal sources that run dry during certain periods; and (6) there is insufficient health education coverage and impact to create the necessary climate for health promoting hygienic measures.

<sup>2</sup>Extracted from a memorandum by G. Read, consultant, UNDP project GLO/78/006, dated 5 January 1979.

## **National Sector Plans for the Decade**

National development plans, which include water and sanitation sector activities, are prepared every 5 years. Annual plans are prepared for the capital development budget. In general, the objectives are to improve the general health status and social well-being of the underserved population, particularly the lower stratum. Specific objectives include: (1) during the third 5 year plan (1980-1985) the Ministry of Rural Development plans to construct 195 new water supplies and rebuild 83 existing schemes; (2) construction and maintenance capacities will be strengthened; (3) strengthening of planning and implementation of rural sanitation programs will be undertaken through a 3 year pilot project; (4) a nationwide integrated hygiene program will be designed, based on research from the 3 year pilot project; (5) health education programs will be strengthened and intensified: it is suggested that health education should provide information on growth and development of the individual; the relationship between the state of the environment and an individual's health; personal health practices; physical, social, mental, economic, and cultural factors and their affect on health; and protection and promotion of health as an individual, community, and international responsibility; (6) training of personnel for the water sector will be increased; and (7) the construction of water supply systems in 13 towns will be completed and the reticulation systems will be extended.

### **Policy Shifts Regarding Service Level**

There are definite policy shifts regarding service level as more and more emphasis is placed on correcting the imbalances between services rendered for the rural and peri-urban areas. There is also recognition of the need to create and strengthen a health delivery infrastructure that is more oriented and better suited to preventive, promotive, and rehabilitative health care. An integrated

approach to the provision of the basic services through primary health care is needed. These shifts auger well for sector development and the betterment of service levels.

### **Plans for Public Information**

Public information programs are designed primarily to involve project beneficiaries in all phases of program development and to correct the lack of information and knowledge regarding benefits that can accrue to communities that avail themselves of acceptable water supply and sanitation systems.

### **Health Education Support**

It is a well recognized fact that the provision of safe drinking water and sanitation systems in rural and other underserved areas is not enough unless complemented by health education for the people. Without such education, the incidence of waterborne and sanitation-related diseases is not likely to be reduced. It is for this reason that the planned rural water and sanitation programs include health education components in the form of technical assistance, training of local personnel, research, and other inputs intended to strengthen the Health Education Unit of the Ministry of Health.

### **Procedures for Project Identification**

At the village level, village development committees identify their needs and make a request to the district community development officer. In the case of water supply, the request is then passed on to the Ministry of Rural Development. Other development activities are coordinated by the district development committees, which are also responsible for securing the involvement of the people through their representatives. At the central level, ministries have planning units that coordinate sector plans for submission to the Central Planning and Development Office for approval and also to seek financing for approved projects.



## Mobilization of Internal Resources

### Allocation of Development Funds to the Sector

The allocation of development funds to the water sector is increasing in relation to the total national development budget due to the fact that water and sanitation are components of the basic infrastructure and also because of the government's policy to improve the health status and general well-being of the underserved population. It is not possible, however, to provide details of the extent of funds allocated to the sector due to the number of ministries and departments involved. Internal resources include self-help labour and other Government of Lesotho financial inputs. Table 1 indicates the financial inputs of the Government of Lesotho as reflected in the capital budget of financial year April 1978 to March 1979. A total of 1 654 900 maloti represents the Government of Lesotho funds in the budget for water and sewerage projects during the financial year 1978-1979. During the same year, total domestic resources amounted to 20 276 541 maloti. This means the sector was allocated 8.16% of the domestic resources.

## Recurrent Allocations for Operation and Maintenance

Recurrent costs for operations within the sector are partly borne by the consumer, particularly in urban areas where there are charges for water and sewerage services. In rural areas, village committees are responsible for the mobilization of resources for the maintenance of water systems. To determine the relationship between recurrent allocations and development funds is not possible at this time.

### Tariff Policy for the Sector

In urban areas, tariffs are levied for water consumed, where metered; for connecting sewerage disposal systems (where water carriage is provided); and for serving of septic conservancy tanks and buckets. Such tariffs are adjusted, as is economically and socially feasible, to cover, as much as possible, the operating and maintenance costs, including amortization of capital investments. In rural areas, the tariff policy is yet to be clearly defined. As far as meeting operating and maintenance costs, wherever possible, the government's position is that village committees should arrange for the generation of funds within the villages to meet such costs.

Table 1. Financial inputs of the Government of Lesotho in water supply and sanitation.

Ministry	Project	Total cost (maloti) (1 maloti = U.S.\$1.32)
Health	Nkau water supply	5000
Education	National University water and sewerage	226000
Interior Works	Sanitary services	233900
	Maseru sewerage	339000
	Maseru sewerage	300000
	Mafeteng reservoir	46000
	Township water supplies	273000
	Industrial sewer Seapoint reticulation	62000 20000
Rural Development	Village water supply	150000

## **Manpower Development**

The need to develop appropriately trained manpower at all levels is recognized. Efforts are being directed toward providing fellowships to local candidates to undertake studies in sector-related disciplines.

In Lesotho, there is a need to conduct a preliminary survey of existing manpower that can be used in sanitation programs. The need for training should then be quantified. The Ministry of Health, Environmental Health Section, is the key department responsible for the training of sanitation workers (health assistants). These multi-purpose health workers undergo a 2 year training program that includes germ theory, types of latrines and methods of installation, water supply in small communities, health education, and community organization skills. At present, 12 students are trained every 2 years. Of these, about four resign to go and work elsewhere and eight are posted in rural health centres and districts to take care of sanitation activities.

The Ministry of Community and Rural Development also produces a cadre called community development agents. These are high school graduates with "0" level or equivalent. The trainees undergo a 1-2 month program on community organization, village water supply, and latrine installation. This training is supported by regular workshops and seminars that are held locally and internationally. An average of about 10 graduates are produced every year. It is not known how many of these stay on the job. Also, the rate of upward mobility of these officers to become technicians is not clear.

### **Nurse Clinician Training**

With the technical and financial assistance of the United States Agency for International Development (USAID) (University of Hawaii), the Ministry of Health will be mounting a training course for this cadre of health worker. It is envisaged that there will be a strong preventive health component in the training of this cadre. They will be expected to, in addition to providing curative health services in a rural setting, be responsible for

the training and supervision of village health workers. This means that they will have to improve their knowledge and skills in order to teach villagers about sanitation and the provision of safe drinking water. The mechanism by which they will supervise village health workers is not clear, particularly when one considers the great demand for preventive health services in rural clinics where there is no doctor. Trainees are selected from those midwives who have had about 5 years of field experience in the profession.

### **Nurse Training Programs**

The Health Education Unit of the Ministry of Health has been involved in efforts to include a public health aspect in several nurse training as well as midwife programs. Lectures are given on health education methods, environmental health, nutrition, MCH, and other topics. Before these students graduate they are taken to a rural health centre to gain practical experience in community organization, latrine siting, and other areas. Four nurse training schools are beginning to adopt this approach in their programs. One school is under government supervision and the other three are under the supervision of mission hospitals. The mission hospitals are members of the Private Health Association of Lesotho (PHAL), which has a very close working relationship with the Health Education Unit of the Ministry of Health.

### **Agricultural Training College**

This college provides 2.5 year training courses for (1) extension workers who will be stationed in rural areas to advise farmers on farming methods and (2) home economics (nutrition) extension workers. The college has a 2 year diploma course for extension workers who have been in the field for some time. So far, health personnel have been giving lectures on environmental sanitation, human physiology and anatomy, and health education skills only to the home economics students. These other groups also need to be covered.

### **Health Education in Schools**

The teaching of health in schools has been incidental. The Ministry of Education

recognizes the need for health education as well as the provision of health services in schools. A national workshop on curriculum development was recently held and health was one area of emphasis. The National Teacher Training College (NTTC) is also seriously considering producing teachers better trained to teach health. Through close collaboration between the Ministry of Education and the Ministry of Health, two health texts have been developed. Posters and flip charts have been developed for use by teachers and students. The United Nations Children's Fund (UNICEF) provided funds for this purpose. Teachers' workshops on health have been held on an ad hoc basis. So far only one teacher has been trained by the Health Education Unit staff to teach health in the single ecumenical school (vocational school).

#### **In-Service Training and Workshops**

The following in-service training programs and workshops are being carried out: (1) the Health Education Unit has collaborated with the Ministry of Agriculture, Nutrition Section, to conduct in-service training for their home economic assistants in the field; (2) the United Nations Children's Fund has continued to assist the Ministry of Health to conduct public health orientation/ refresher courses for nurses in the field, with sanitation being one area of emphasis; (3) the Health Education Unit gives lectures and health education materials to community development agents during their workshops; (4) workshops are held for nurses and field workers by the Lesotho Family Planning Association (LFPA); and (5) training of nurses to work as village health worker teachers and the production of materials to be used by these village health workers when they are back in their villages is being carried out.

#### **Training Village Health Workers**

The Health Education Unit has worked with district health and related personnel, i.e., health inspectors, public health nurses, and home economics assistants, to help identify and train prospective village health workers. One specific area that has had to be

emphasized is latrine installation and safe water supply because of a high incidence of typhoid and dysentery in children. The Housing Corporation has sought input from the Health Education Unit to train a similar cadre of health service providers in the urban Maseru area, where a new type of latrine is to be experimented with.

#### **Additional Training Requirements**

Some of the additional training needs include: (1) additional and better organized training programs and in-service training for environmental health personnel (health inspectors, health assistants, etc.) and related staff dealing with different methods of latrine and water supply installations; this would help reestablish the school latrine project, funded by the United Nations Capital Development Fund, which was halted because of some technical and administrative problems late in 1979; (2) workshops for teachers on sanitation and health; and (3) workshops and seminars for health and other personnel engaged in the provision of sanitation services.

#### **Constraints Related to Technical Cooperation and Financial Assistance**

Some of the factors affecting technical cooperation and the provision of funding include: (1) recruitment of experienced personnel for the sector is sometimes difficult; (2) recruited personnel sometimes have difficulty in applying their skills in a country where the conditions differ from those they are familiar with; (3) accommodation for expatriate personnel has been a problem; (4) complicated disbursement procedures of some donors lead to delays in project implementation; (5) there is a lack of local managerial and administrative skills for project implementation; and (6) there is an inadequate implementation capacity at different levels.

Some of these difficulties could be eliminated through the following methods: (1) intensifying training of locals in relevant

fields; (2) if offered outside the country, training sites which have conditions similar to those that the individual will be working under upon completion of the training should be used; (3) project proposals should include staff accommodation; and (4) projects should, as much as possible, include strengthening of national planning and administrative capabilities.

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The author of this paper wishes to extend his indebtedness to all who furnished him with

material and other assistance without which this paper would not have been possible. The following are in the forefront of this acknowledgement: the Water and Sewerage Branch of the Ministry of Water, Energy and Mining; Planning Unit of the Ministry of Community and Rural Development; Planning Unit of the Ministry of Health and Social Welfare; Health Education Unit; Environmental Health Section; Deputy Permanent Secretary for Health; Senior Medical Officer of Health; Health Statistics Unit, environmental health; staff in Leribe; and others within the Ministry of Health for taking the brunt of the office chores during the preparation of this paper.

# **The Role of Health Education in Sanitation Programs**

**Winson G. Bomba<sup>1</sup>**

At first sight, health education and sanitation appear to be two different concepts. In the past, the design of environmental health interventions was characterized by an overwhelming emphasis on science and technology, with special reference to engineering technology. Although adequate attention must be paid to technology, the interaction between social forces and technology has created a simultaneous need for consideration of social, psychological, economic, and political variables in the design and operation of environmental health facilities (Pisharoti 1975).

Experience has shown that health education as a behavioural science has proved useful in bridging the gap between social forces and technology. Consequently, the use of health education as one of the variables in planning and implementing environmental health programs has received increasing recognition in the recent past.

Roberts (1970) suggests that throughout the world, health education is accepted as an integral part and a vital component of all public health and medical care programs. Pisharoti (1975) observed that various expert communities on environmental sanitation have stressed the need to incorporate health education as an integral part of planning their respective environmental health activities. He suggests further that: "Health education is not a

separate programme, but is a part of all health programmes which deal with the public . . . health programmes should be planned and implemented with the close co-operation of the public, and health education will be an integral part of such programmes."

## **Definition of Health Education**

There have been many attempts to define health education. For the purpose of this paper, the definition given by Steuart (1968) seems appropriate: "Health education is that component of health and medical programmes which consists of planned attempts to change individual, group, and community behaviour, with the objective of helping achieve curative, rehabilitative, disease preventive, and health promotive ends."

The principle objective of health education in environmental health programs is to help people to achieve good health through their own actions and efforts. This calls for change in a person's behaviour. A number of approaches have been tried to change a person's behaviour. Only two such approaches will be discussed in this paper.

## **The Legislation Approach**

The use of the law as a means of changing health behavioural practices has been tried in a number of countries with very little

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<sup>1</sup>Health Education Coordinator, Ministry of Health, Lilongwe, Malawi.

success. Roberts (1970) observes that: "Experience has shown that unless the people affected by legislation are educated to a point of readiness and acceptance, they become psychologically reactive. They seek evasion and counter the legislation." A similar observation is made by Pisharoti (1975) who points out that: "There are many instances where facilities built for excreta disposal remain unused. Sanitary regulations and rules are made, but adherence to them is often an exception since the police method of inspection and enforcement has not brought any change in people."

The sanitation program in Malawi dates back to 1922 when the colonial government appointed the first sanitary officer whose main duties were to ensure cleanliness in townships (Nyasaland Medical Department 1922). There was still not much done in rural areas.

In 1933, a Native Authorities Ordinance was passed, which gave the duly constituted traditional chief wide powers to issue orders regarding certain sanitary and hygiene measures to be taken by the people in their areas. The implementation of the powers given to chiefs by this ordinance has had negative effects on rural sanitation, particularly with regard to the use of latrines because the chiefs merely imposed the use of the latrines upon their people.

The negative effects of the big push by chiefs for the use of latrines were first reported in the annual report of the Nyasaland Medical Department (1937). The report states that "it is far easier to get the population to dig a latrine than to use it." In addition, the annual report of the Nyasaland Medical Department (1938) states: "While there are reports of the existence of a large number of latrines in many villages and it is today unusual to find a village without at least one latrine; it is unfortunately still true that in many cases, latrines are provided by the population mainly to conform with regulations and not for use."

The chiefs imposed the digging of pit latrines upon the people without explaining their purpose and the rationale behind the accompanying sanitation and hygiene rules. Failure to conform with the orders resulted

in fines or imprisonment. The pit latrine was soon associated with colonial enslavement rather than a means to improve upon the people's health. Obviously, it was the approach, not the principle, that was at fault.

It is interesting to note, however, that health authorities were able to ascertain that as far back as 1938 it was unusual to find a village without at least one pit latrine. This observation, if it can be believed, would imply that a pit latrine was no longer an innovation in most parts of Malawi after 1938.

Observations reported after 1938 continue to cite the presence of pit latrines in villages, although their usage was reported unsatisfactory. The annual medical report of the Nyasaland Medical Department (1948) states "the re-infestation rate (of ankylostomiasis) must be high, as latrines tend to be regarded as objects to show rather than conveniences to use." Austin (1952) points out that "a number of mass treatment campaigns, combined with drives to improve rural sanitation have been conducted in many areas over the past 20 years and latrines are now to be found in most villages."

The other side of the story is not as bad as one would assume when reading reports of this period. Not all pit latrines were left unused. In a survey conducted in Domasi area, Zomba District, in 1950-1951, Austin (1952) summarized one of the findings in this way: "it is estimated that 90% of the dwellings now have pit latrines and it appears that these are fairly well used." Subsequent reports from 1952 up to the time of the country's independence in 1964 speak of the abundance of pit latrines in villages but their use was unsatisfactory.

### **Educational or Participatory Approach**

Soon after independence, the government put a stop to the legislative approach and replaced it with an educational approach with maximum participation of the community.

According to the United Nations Economic and Social Council, there are three basic premises to consider when enlisting community participation: (1) people respect more those laws on which they have been consulted; (2) people identify strongly with programs they have helped to plan; and (3) people perform better in projects they have assisted in setting up. The postindependence approach toward the use of latrines was based on these premises.

Health education, therefore, was to be a major component in all programs encouraging the use of latrines. Consequently, intensive sanitation education programs were launched throughout the country. Extension workers from the Ministry of Health, Ministry of Community Development, Ministry of Local Government, and the Ministry of Agriculture were fully deployed: private organizations, such as mission hospitals, played some part; traditional and political leaders worked hand in hand with government; and village health committees, which were largely composed of ordinary villagers, were formed in most villages to work in close cooperation with various extension workers involved in rural health matters.

Teaching methods included face-to-face teaching situations at village meetings, clinics, health centres, and seminars. Mass media in the form of radio, health talks, posters and handouts, cinema shows, and exhibitions were also used.

Special health campaigns have been launched in special problem areas from time to time. These have taken the form of "health weeks" or "health months." Such campaigns are very common and popular to this day. During a health campaign aimed at promoting the use of latrines in an area, for instance, involvement of the local people constitutes the main activity. Extension workers, local leaders, and village health committee members are fully deployed to teach, assist, and discuss with people any aspect relating to the construction, repair, and use of pit latrines.

## **Social Aspects Associated with the Use of Latrines**

A good educational program on the use of latrines should take into account the social and cultural variables of the community for which the program is intended. This section will review some of the sociocultural variables experienced in Malawi. Although most of these are no longer being practiced by the majority of the people, their inclusion in this paper is intended to stimulate discussion and, hopefully, assist those sanitary workers still experiencing them in their work.

The consensus among most field health workers in Malawi is that resistance to the use of latrines was greatest in those areas with plenty of tall grass and bush. In such areas, people had, over the years, developed a habit of using the bush for defecation. It was allowed to grow in the vicinity of houses and/or villages. The idea of building a pit latrine for the same purpose was not easily understood. To most people, a pit latrine provided excellent privacy, but so did the bush. Moreover, it was much easier for one to disappear into the bush than to get involved in the strenuous job of constructing and maintaining a pit latrine. Matters were made worse by the fact that the health benefits of latrines were not sufficiently understood by the people. The people had to understand germ theory first, before they could fully appreciate the link between health and latrines.

Three educational strategies were adopted in solving this particular problem in the affected areas:

(1) People were taught about the transmission and control of excremental diseases. This enabled them to understand the health benefits of latrines.

(2) Pit latrines were promoted as status symbols. In areas where it was difficult to motivate people to use latrines in order to prevent the incidence of excremental diseases, emphasis was placed on the social prestige associated with latrines, i.e., a modern home has a latrine, progressive people use latrines, a latrine is a sign of progress.

(3) The indirect approach was also employed. People were encouraged to clear the bush and to keep the grass short around their houses and the vicinities of a village in order to reduce the inconvenience of mosquitoes. By keeping grass short to avoid mosquitoes, the community was depriving itself the convenience of immediate bush. Eventually, latrines were used for privacy.

In some areas, resistance to the use of latrines was due to fear of accidents, e.g., children falling into pit latrines. Such fears were based on a few accidents caused by constructional faults, e.g., the latrine holes were too big.

In some communities, particularly in predominantly Muslim areas, adolescent children are not allowed, by culture, to use the same pit latrine with their parents. Most families in such areas would have two pit latrines; one for the children or the children of several families would share one latrine communally.

One of the reasons for prohibiting children from using the same toilet with their parents is that pit latrines are regarded as a very private and secluded part of the home. Only intimate people could share its use. It is common practice in such communities for women to dry their sanitary pads on the pit latrine fences. It is, therefore, considered culturally improper for children to be exposed to these. Another possible reason may be that because traditional etiquette sees defecation as a shameful activity, people preferred to use the bush rather than pit latrines. It could be that similar traditional etiquette would prevent adults, particularly parents, from sharing a "shameful activity" with children.

Another reason for nonacceptance was fear of contracting disease. This reason was cited by field health workers working in one small area of the country. As a result of intensive health education in the area, however, the fears have died and have not been experienced for the past 5 years. The problems originally arose because people in the area believed that: (1) when one's faeces and urine were mixed with someone else's, one was liable to contract certain diseases; (2) air from the pit was dangerous and caused

chronic stomachaches, which were difficult to cure; and (3) when an enemy got hold of your faeces, they could bewitch you.

Surveys were carried out to establish the cause of the fears so that health education strategies could be developed. The investigations revealed that the people believed that elephantiasis and hydroceles were contracted through the mixing of faeces and urine.

The signs and symptoms of the chronic stomachaches, believed to have been caused by the air from the pit, resembled schistosomiasis and ankylostomiasis. The theory was that when one squats over the pit latrine hole, air from the pit gains entry to the stomach during the process of defecation.

The fear of witchcraft was difficult to handle. Through health education to individuals and group discussions, it was explained that if a pit latrine was used by more than one person, it would be difficult for someone's enemy to identify a particular faeces when they are all mixed in a pit.

The other fears were relatively easy to handle. People simply did not know how elephantiasis, hydroceles, schistosomiasis, and ankylostomiasis are contracted. The health education program placed special emphasis on providing information about these diseases. Once these fears were overcome, people were free to use pit latrines.

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## **Some Sociological Aspects of Sanitation Provision (with Particular Reference to Botswana)**

**Nomtuse Mbere<sup>1</sup>**

### **The Disease Pattern**

Compared with other developing countries, Botswana is a relatively healthy country. This is shown by: (1) a mortality of 137 per 1000, largely due to a low infant mortality of 103 per 1000 male and 91 per 1000 female births; (2) low worm infestation in excreta; (3) tropical diseases such as malaria are confined to the swampy areas of the north, tsetse flies are also found in this area; (4) bilharzia has been a problem for some time though not as serious as in some other countries; and (5) tuberculosis is a major health problem together with other respiratory diseases such as pneumonia, gastroenteritis, measles in children, and venereal diseases. The disease pattern is changing due to modernization and there will soon be obvious trends between urban and rural disease patterns; nonetheless, in the urban areas the incidence of the diseases of civilization is still very low.

### **Nutritional State**

Compared with other countries, the nutritional state of Botswana is still relatively good, even though Botswana is not endowed with naturally growing goods like matoke in Central Africa and plantain or yam in West Africa. Diseases from malnutrition, such as kwashiorkor and marasmus,

are very rare but there is chronic malnourishment due to an unbalanced diet. The nutritional state is also affected by the scarcity of rain or the fact that the rains are usually late, so in the end, the lower classes and rural masses, at times, depend upon food programs and the enriched powdered milk donated by some Canadian organizations; the latter being distributed by the Social Welfare Department. The droughts contribute to the fact that the nutritional state is never high.

All of these characteristics have a bearing on sanitation provision. Botswana is clearly divided into upper/middle and lower classes. The former are provided with water-borne sewerage, whereas for the latter, what are termed as cheap and socially acceptable sanitation facilities have to be found. The Government of Botswana is presently trying to bridge this gap.

If sanitation provision is to be acceptable, then one has to look at the social factors involved. These factors can be divided into external and internal factors (Jackson 1978). External factors are those exogenous to the particular community, e.g., lack or presence of government support. Internal factors are those affecting the acceptability of facilities.

### **External Factors**

These can be due to the larger social system and some people may not understand what role they have in the discussion of the social aspects of sanitation. It is the

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<sup>1</sup>Sociologist, Ministry of Local Government and Lands, Gaborone, Botswana.

author's contention, however, that if these external factors were ideal, then there would be minimal problems at the internal factors' level. Therefore, an examination of these factors is necessary. These external factors include the power structure, social stratification, and economic forces; the latter may be influenced by natural resources, investment, or foreign aid, resulting in limited or abundant national economic resources. Inept and inadequate planning and management, insufficient involvement on the part of the government, and a shortage of trained manpower further exacerbate problems with these external factors.

These factors are at a national or state level and governments approach them differently, but most of these factors must be overcome, if negative, before improvements in facilities can be implemented. The government must also make it its policy to improve facilities either from a health improvement standpoint, thereby attacking the lack of water and sanitation facilities and improving nutrition, or as a general policy of, for instance, urban development, where adequate housing and environmental sanitation form the basis of the policy.

There are, of course, other factors outside of these factors, e.g., the bureaucracy attached to foreign aid and the unattainable World Health Organization (WHO) resolution of "health for all by the year 2000," or the similarly unattainable United Nations declaration "The International Drinking Water Supply and Sanitation Decade (1981-1990)." As a result of these resolutions, international activity is widespread in these fields and as Feachem (1980) states, resolutions like this "provide a major international opportunity for progress...but it also brings with it a major risk. It focusses the spotlight upon one aspect of development and will mobilize substantial investment in drinking and sanitation programmes only." If, however, such international efforts result in convincing policy makers that adequate water and sanitation facilities rank high in importance, then the problems associated with planning, assigning priorities, and securing financial assistance can be pursued.

Some of these problems cannot be overcome immediately, e.g., the shortage of trained manpower, which can result in poor designs and inadequate operation and management, but an effort toward providing properly trained personnel needs to be a priority. These are a few of the external factors, some of which are universal, that need to be examined as well in an effort directed at the provision of sanitation facilities.

## Internal Factors

Internal factors directly affect the populations to be served. Efforts directed at social acceptability of the facilities have to take into account the individual's personal values and habits, the individual's own experiences, and the meaning attached to both of these. The inquiry must be aware that behaviour at the interpersonal level is guided by others, who, through networks of influence, define the socially acceptable and preferred behaviour. Thus, identification of such networks, whose influence and response will determine, in part, the users response, is essential. This can be achieved through different techniques.

The social factors that affect individuals may be:

(1) Poverty: The target population may be too poor to provide the latrines themselves.

(2) Education: The developing countries are characterized by a high rate of illiteracy and semi-illiteracy. The consequence is that sometimes people do not know how to use the facilities properly or may not even comprehend the relationship between an unsanitary environment or poor nutrition, and poor health. Latrines require frequent cleaning and maintenance, but people may not be aware of these requirements or how to meet them.

(3) Tradition and culture: Years of tradition and ingrained cultural practices may make it impossible to accept innovations.

(4) Physical environment: The quality of the physical environment of the users, including such factors as housing, transportation, refuse collection, and water

provision, will affect the acceptability of latrines.

These internal factors have to be considered before a project on sanitation provision is embarked upon. To what extent, then, were these social factors relevant to the Botswana project?

Firstly, Botswana is a dry country with a very low population density, so that provision of sanitation facilities was not necessarily a priority in the past. It was only with the rapid development of urban areas and a completely negative social acceptability of fibreglass aqua privies that the government decided to begin a low-cost sanitation project. In 1976, the government, together with the International Development Research Centre (IDRC), undertook an investigation into alternative forms of low-cost sanitation. This was done by testing improved pit latrines, Reed odourless earth closets (ROEC), type B's, and various composting latrines. The Ministry of Local Government and Lands (MLGL) is responsible for urban and rural developments and for developing sanitation as part of the new infrastructure. Therefore, it was logical to have the project based in this ministry.

A sociological survey was undertaken in all four urban areas to answer questions related to demography; epidemiology of what were perceived to be sanitation-related diseases; the physical environment of potential users, including distance to water facilities; refuse disposal; types of housing; and financial status of respondents. This was done using a sample survey with a structured questionnaire. Through informal interviews and in-depth discussions with potential users and other administrative personnel, questions on religious groups and their behaviour regarding sanitation, contributions of social welfare agencies, belief systems, and the influence of social networks were asked. Some replies were elicited.

The project personnel were semimulti-disciplinary in that there were two engineers, one health assistant, and one sociologist. As a result, a technical survey of existing sanitation provision was also undertaken by one of the engineers and the health assistant.

Samples of soil, urine, and excreta were obtained and analyzed. There were also fact-finding trips outside of Botswana. As a result of the information collected, prototypes were built and monitored. As a result of data from this monitoring period, four experimental units were selected, built in larger numbers, and monitored on a longer basis.

## Social Acceptability

There was the belief in the national model (Tonon 1978), in which the assumption is made that information directed to the selected population would produce changes in the knowledge level that would, in turn, influence daily practices and behaviour. The fact that users used the toilets would suggest that this assumption was correct, but the fact that children still do not use the facilities, men still urinate against the toilet walls, and some toilets were only maintained because of weekly monitoring, indicates that the assumption was wrong. One could argue that this was due to a lack of health education. To some extent this is true, but the logic that man acts in his own self-interest is at times not correct, otherwise, for instance, the people who know the health hazards associated with smoking and overeating would have abandoned these habits long ago. It doesn't necessarily follow, therefore, that knowledge results in correct behaviour. Under what circumstances, then, can information lead to behavioural change?

Most workers in African countries feel that if there is a felt need, then it follows that there will be a smooth behavioural change; but what such advocates forget is that the need may not be apparent to the individual who is ignorant, or even if the need is there the individual may lack the information or resources to achieve the goal. At present, some governments, perceiving that their populations are not aware of such needs, have decided unilaterally to supply the facilities needed. Some of these efforts are disastrous: the facilities are left unused, vandalized, or completely rejected. In these situations another approach can be tried where extension workers are, for instance,

used to demonstrate how a pit latrine is built, where to buy the building equipment, and what the costs are. The other approach presents the information in a socially acceptable manner, having taken cognizance of beliefs and customs. The initial sociological survey was taken with this last approach in mind and the data collected were used to design what would be socially acceptable latrines. The explanation that the units were experimental and were to help government choose what was acceptable to the people were effective. As a result, even units that were unknown could be tested, e.g., composting toilets, because the users knew that the decision to use them or not was theirs and that they could uproot them and build latrines of their choice if they so desired.

Another approach uses an educative model, which most vaccination campaigns use, but is more appropriate in rehousing or resettlement programs, where the behaviour to be changed is an integral part of the cultural system. Programs using this approach must realize the need to take cognizance of the motivation of those to be affected, i.e., the need for local involvement in the planning process and in the design of the program. The low-cost sanitation project wasn't of such magnitude or even at that level. The users were not required to help in any way and no contributions of costs or labour were elicited, so that the only motivation on the part of the potential users was their felt need to have a toilet and the motivation to cooperate with the researchers during the monitoring phase. One would expect that with such low motivation there would have been less support, but the results show that the project did get the necessary support from the users and it was, therefore, recognized that motivation is not always intrinsic to all human behaviour.

The centralization at government level was diffused by having an interim committee consisting of personnel involved in all aspects of sanitation; health personnel; council personnel; personnel from the Botswana Housing Corporation (BHC), a parastatal body; from water affairs; and from the works department. All of these

people had a say in the ongoing project and in the final recommendations.

At a lower level in the hierarchy, ward councillors, together with the users, were invited to seminars where they were shown how the different latrines functioned and were asked to suggest areas where some of the experimental units could be built.

### **Problems in the Botswana Project**

(1) If people are poor, then it is evident that the problem is in the social structure of the country. In this project, those people who could not afford cleaning materials for regular latrine maintenance were allotted brushes with long handles for cleaning the ROEC chutes. There is, of course, a danger of creating a dependency upon handouts among the poorer people, which the project personnel were well aware of, but the success of the project at times becomes the overriding criteria.

(2) A multidisciplinary team approach is usually very effective, even though technical people, such as engineers, may find it difficult to understand people from other disciplines. This project should have included personnel from the Health Education Unit, Department of Water Affairs, Adult Education Institute (for informal education), brigades for intermediate technology extension workers, and family welfare educators. In addition, some participation from the users themselves would have been of value.

(3) (a) Exposure of the potential population to the surrounding environment is also important. In the Botswana experience, exposure to developed South Africa and Zimbabwe influences the expectations of the people. As a result, expectations are very high in this region. This is indicated by the fact that in the initial sociological survey 100% of the respondents had the flush toilet as their first choice. With this in mind, the type B was designed and socially it is still highly acceptable, though there are people who do not like carrying the water for flushing. Whether technically, i.e., its high requirement of constant maintenance, and economically, i.e., very expensive, it is the

best toilet is a moot point if government is committed to an acceptable and hygienic toilet. (b) Communal toilets were rejected because of the fact that they are always misused, they do not provide enough privacy, and even the idea of sharing was not acceptable. (c) Building materials: all respondents preferred a concrete superstructure and sitting as opposed to squatting.

(4) Due to the semi-illiterate state of the potential users, it was inevitable that the social distance between users and project personnel would be large. Because educational strategies require intimate knowledge of the culture if they are to effect behavioural changes, not only through the cognitive structures but also through changes in experiences, values, roles, and interpersonal relations, it is necessary that the social distance between project personnel and users be small. It is, therefore, discouraging that certain governments are so committed to production of education certificates that their own experienced local workers, who understand the population because they are part of it, are excluded from training programs because they lack such certificates. If governments commit themselves to paraprofessionals who can be frequently exposed to seminars, workshops, and short upgrading courses, it would be easy to transfer some of their resources toward training a few highly skilled personnel. There is a lot to be said for a local engineer compared with an expatriate engineer because even though academically the approach might be similar, culturally they will remain different. This is not to advocate abandonment of highly skilled manpower, but the immediate problems in Africa, in general, may not need as many of these workers. The family welfare educator program, health assistant program, and some of the social welfare and extension worker programs are a step in the correct direction in Botswana.

(5) Maintenance: If maintenance, e.g., emptying the sludge or humus, threatens social acceptability, then some other agency must be approached to undertake such procedures even though this might add to maintenance costs. Therefore, because all compost toilets in this project would have

been socially unacceptable if users had to empty them, councils were approached to undertake this task. This does not mean that there were no other features of compost toilets that were not acceptable but with a high health education input these can easily be overcome; even if there are design and high groundwater table problems.

(6) Privacy: In most African societies, defecation is not a social occasion, even though a few women could be seen to leave in the early morning or late afternoon for a defecation site. The defecation process is private. The idea of carrying water to flush the aqua privies challenged this norm, resulting in the complete rejection of this toilet type. This problem was solved through the provision of a washtub to enable the toilet to be flushed from outside, or even using the water used for washing dirty clothes in the trough. This had an added value of making sure that the water was kept at the correct level.

Privacy in some countries may be exaggerated because of cultural taboos, e.g., the father-in-law - daughter-in-law avoidance taboo. The prevalence of such taboos in urban areas is likely to be minimal. Communal and public latrines also act against the need for privacy. If these latrines are continuously maintained, however, and there is no alternative provided due to a lack of financial resources or scarcity of land as in Asia, then these can be used. In Botswana, it would take a lot of persuasion and convincing for the people who could not afford their own latrine to use communal latrines. There are some old communal toilets in Bluetown in Francistown, but recently, the government hasn't constructed any except in schools, clinics, and refugee camps.

## Conclusions

Social acceptability is a concept that is suddenly in vogue simply because some earlier technical innovations that excluded it were a failure. This trend is to be welcomed because social and cultural beliefs and behaviours must be taken into consideration. If this approach is to be successful, a

multidisciplinary team in which contributions by individual members are accepted, debated, and finally incorporated into recommendations is a must, but if one discipline plays a dominating role, this will not auger well in the overall approach.

As much as social acceptability is concerned with knowing and understanding peoples' cultures and behaviours, it shouldn't be used by adherents of the traditional anthropological approach to revive their attempt to classify the so-called "primitive" peoples according to their different defecation habits.

Social acceptability is influenced both by external and internal factors. While not all external factors can be overcome, an effort toward remedies could have a positive impact on the internal factors. Education, as implicit throughout this paper, is likely to play a major role and should be directed at primary and high school children, supported by informal education for adults who are illiterate. This would help change some of the entrenched behavioural patterns.

Although this paper has not discussed rural areas, much of Africa is rural and these are the areas where most health education efforts need to concentrate.

Because there are few sociologists working in this field, it becomes necessary for them to coordinate their efforts, share experiences, and exchange information; for though there are minor cultural differences (in Africa), on the whole, these studies are relevant to other areas and countries. It will also be necessary for the sociologists to determine what the variables of social

acceptability are, and to take cognizance of their respondents' thoughts on social acceptability. We must not impose our views upon people; the process must be an exchange, only then can we avoid alienating the populations we are learning from.

If the teams are multidisciplinary, a stage could also be reached where not every survey will have to ask the same questions over and over. This would result in an ideal atmosphere where respondents are not tired and bored with the surveys. Similarly, experience has revealed that structured questionnaires do not provide all the necessary details. There is a lot to be said for informal in-depth studies, even though the data cannot be completely quantified or the study repeated with the same findings. This applies particularly to sensitive areas such as defecation behaviour.

Studies on social acceptability have a future because there is a lot of scope at the micro level of individual behaviour, at understanding the financial status of respondents, etc., as well as at the macro level of culture and social structure. It is, therefore, worthwhile to become involved in this field.

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## **Problems of Acceptability of Low-Cost Sanitation Programs**

**P.M. Matiting<sup>1</sup>**

Acceptability means that something new is being introduced, whether as an improvement of what has been used or as a new innovation.

Considering sanitation acceptability, some of the important variables influencing its acceptance by the local community must be known. Some of the important variables to be considered are (1) tradition and culture, (2) physical environment, (3) education, (4) agents of change, and (5) maintenance. All of these variables are interrelated and must be dealt with at the same time. Most of the sanitary units provided are mainly in squatter or site and service areas where the physical environment plays a major role.

When these experimental sanitary units were provided the physical environment was not taken into consideration. An example exists in a mining area in Selebi Pikwe where type B latrines were provided but, unfortunately, water is only drawn at night in this area after the demand for water for the mine has subsided. The area is surrounded by bush and there are a lot of open spaces that are used for defecation. In the corner of each plot a plastic shelter is made that is used mainly for urinating during the day.

When sanitation facilities were introduced to the people of Botswana, who in most cases did not have sanitary services before, health education was not emphasized. The people did not know why

they should have toilets. When monitoring these units it was observed that some of the ploholders cleaned the toilet to please the officers involved in the monitoring; when spot checks were made the toilet was found to be filthy.

This low-cost sanitation project required council health assistants to carry out the monitoring. It was found that these people went into the community and gave incorrect advice because they did not know how the units operated. This included the council sanitation staff who were responsible for emptying some of the units. An example of this problem occurred in Gaborone where the Town Council staff advised the owner to pour water into a double vault to facilitate emptying. Some people were advised to pour water into a Reed odourless earth closet (ROEC), which is supposed to be a dry toilet.

There are a few cases in Gaborone where sanitary units were rejected for valid reasons, which reflected bad planning. The ploholders were not involved in deciding what kind of toilet they wanted, it was simply imposed upon them. Because there was no follow-up on the project after the toilets were given to the ploholders, some toilets have not been used since 1976.

The maintenance of some of the units is quite demanding. For example, the ROEC requires a long brush for cleaning the chute, which is soiled in most of the toilets. To avoid seeing the dirt on the chute and the smell, the men and children prefer urinating on the side of the toilet. Again, Botswana considers defecation as something secret but

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<sup>1</sup>Project Manager (Designate), Lobatse Town Council, Lobatse, Botswana.

this is not possible with some of the units provided. Once other members of the family see a person pouring water into a type B trough they conclude that the person was defecating and this discourages people from using these units. A similar problem exists with a ROEC because one has to use a brush and some water to push down the dirt so the secret is then known.

The basic problem goes back to health education: people have to be taught that

defecation should not be taken as something secretive. The danger of not using the toilet should be highlighted, i.e., disease transmission should be explained to the individual.

In conclusion, the Sanitation Department within the Ministry of Local Government and Lands should hand over the low-cost sanitation project to the local authorities so that they can participate in an effort to make the project a success.



## Community/Household Participation

A.W.C. Munyimbili<sup>1</sup>

To introduce this paper it is useful to quote a paragraph from a paper presented by an officer from the Office of the President and Cabinet (Development Division) during our national seminar on primary health care, 30 October - 3 November 1978. This quote embodies the present practice of rural development in Malawi:

"Rural development is an essential and integral part in the overall Government effort to improve the living conditions of the ordinary man and woman in the village. Rural development entails the provision of basic services in rural areas aimed at raising the standard of living of the ordinary people so that they become productive elements of society. We in the Development Division of the Office of the President and Cabinet, with the financial assistance of both local and external donors, are committed to the provision of these basic facilities in the rural areas, which include roads, health facilities, schools and water through the agency of the District Development Committees which are established in all districts of the country. The District Development Committees have played and still are playing a vital role in this field. In our approach to rural development we recognise the fact that services are more effective if in their planning and implementation they take into account the interrelationship between health, water supply, nutrition, education, community development, social welfare services and also the interrelationships between these and other aspects of national development. It is also

recognised that careful, coordinated planning in rural development will save time, tempers, energy and funds when projects are in progress. Departmental differences can bring about the death of development. All departmental officers must play their part and work as a team if we are to succeed in solving the problems we are addressed to." This paragraph can best be explained by the organizational diagram shown in Fig. 1.

Village action committees are usually formed to carry out a specific task. When a problem is identified, e.g., lack of water, a subcommittee is formed to seek ways and means of solving it. If the solution to the problem is not within the scope of the village committee, it is referred to the area action committee and so on through the district development committee to the Development Division of the Office of the President and Cabinet.

Government instructions are then transmitted via the area action groups and village action groups to be disseminated at the grass roots level. All of the activities of the area and district development committees are coordinated at the national level by the national development committee.

### Why and How Local People are Involved in the Various Committees and Programs at Area and Village Levels

(1) The involvement of the people leads to commitment to the program, i.e., the people involved regard the program as theirs

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<sup>1</sup>Regional Health Inspector, Ministry of Health, Regional Health Office, Mzuzu, Malawi.

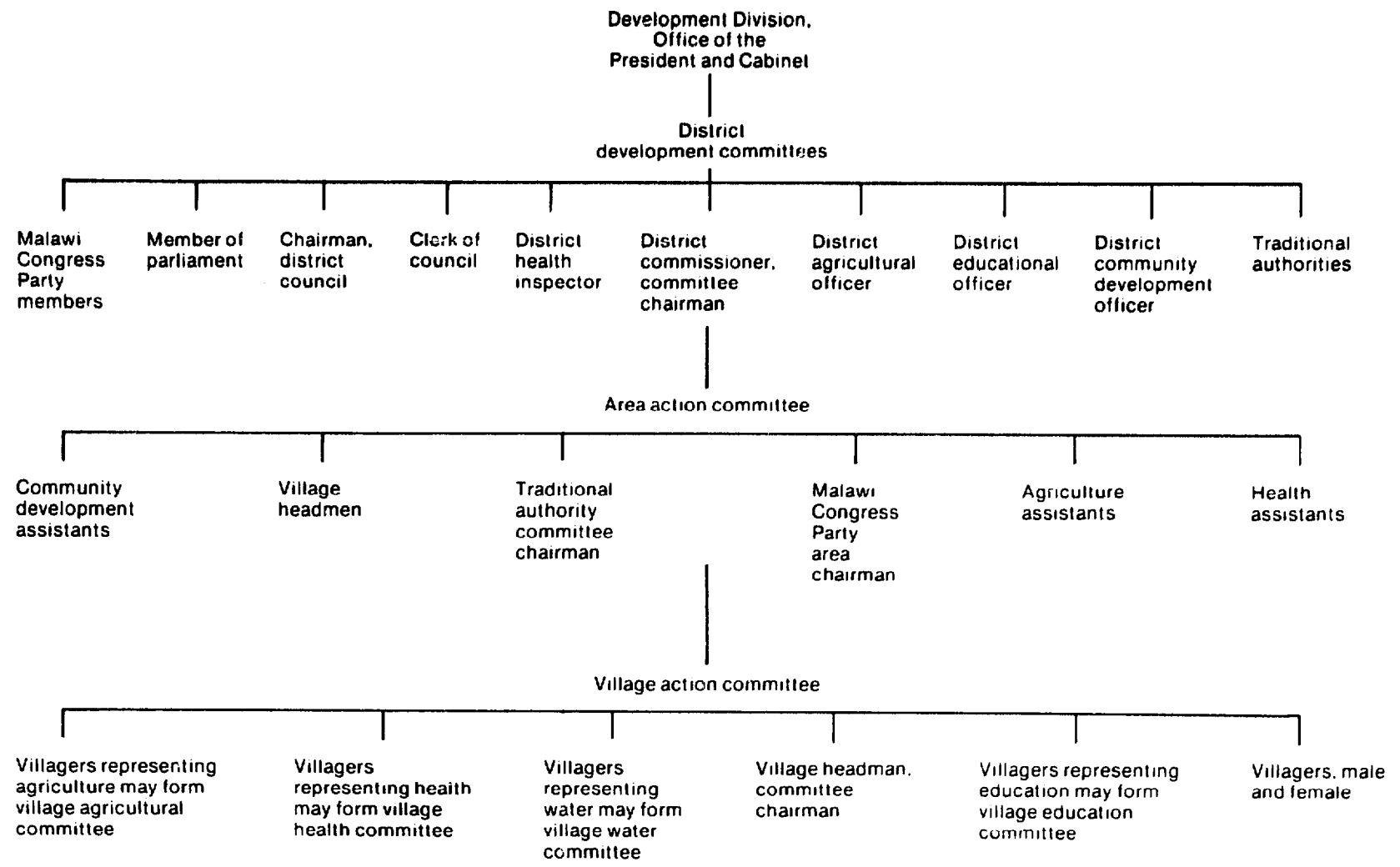


Fig. 1. Organization of Malawi Development Division.

and not as one that has been imposed upon them.

(2) When people are involved, it is a learning experience for them because the people involved are able to develop leadership skills and new attitudes that will help them convince others to accept the programs or innovations.

(3) The local people are more capable of identifying some of their problems and are more capable of identifying some of the possible solutions to their problems than someone from outside.

(4) Not all of the people can become involved in the planning of a program at the local level. Only a selected few, who represent the interests of the community, become involved. Although the selection of the people to be involved may vary from one area to another and one situation to another, there are general guidelines that need to be followed in the selection of these people: (a) they should be people who are interested in the activities of rural development; (b) they should already be in positions of leadership; and (c) preferably they should have special knowledge or resources to offer to the committee, e.g., a retired health officer or agricultural officer may have valuable ideas to offer to the committee.

As soon as the participating committee has been formed, it may be necessary that they undergo an orientation. This is necessary so that the members (1) become acquainted with each other; (2) get to know their own roles and responsibilities as well as the roles of their related committees, e.g., the community development officer or health inspector explains to the members what is involved in the work and its limitations; (3) set up the objectives and the limitations of the community; and (4) select the office bearers. Most of the committee members may not be familiar with what is involved in setting up a program. Training, therefore, may be necessary dealing with becoming effective leaders in their communities and the development of a program advocating change.

## Examples of Community Work

### The Increasing Problem of Domestic Water

With the growth in population and the increase in cultivation, rivers and wells are drying up earlier in the year, making water supply more and more of a problem.

#### Piped-Water Project

More than 2 million people in Malawi live near highlands and in the past have obtained water from the water holes of nearby rivers or streams.

In self-help gravity-piped water projects, the Ministry of Community Development, in cooperation with other ministries, e.g., the Ministry of Agriculture and the Ministry of Health, have developed a technique for motivating the people to dig trenches and also to construct tap aprons in their villages. The same approach was adopted for the construction of village wells.

Water committees were set up in each village. The leaders and all of the village headmen walked to the river to observe the intake, and also to determine where the pipe would go and to discuss the problem. Reluctantly, they agreed to dig the pipeline if the government would supply the pipe. The villagers were in doubt as to how water would flow without a mechanical device. When the pipeline was completed and carefully executed to ensure that every village got water, fears were dispelled.

#### Piped System

The piped system can be compared to the branches of a tree, where the branches get smaller and smaller as they get further from the source. In larger projects, there are as many as 600 taps radiating out from one source. Presently, there are 2000 village taps that the villagers themselves have installed by laying 900 mi (1450 km) of piping. These taps serve 300 000 rural people. Other areas are being served by piped-water schemes.

#### Village Health Committees

Like the village water committee or village agricultural committee, a village health committee could be described as a subcommittee of the village action com-

mittee, the former being charged with the responsibility of looking into activities pertaining to the improvement of village health, such as assessing the sanitary facilities in villages, health education, and infectious-disease control for diseases such as cholera, measles, typhoid, tuberculosis, and bilharzia.

#### **Guidelines for Village Health Committees**

A village health committee is a group of people who are elected by the community and approved by the local leaders for the purpose of leading, guiding, and helping people in all aspects of health improvements within the village. The members are elected to represent the people in the village and make decisions on their behalf. As mentioned earlier, not everyone can be involved in decision making. Those elected are considered to have the will to help everybody and not just themselves or just a few. They must be people who have a lot of initiative. Because the elected people will serve their community, it is important that they are elected by the community. They should not be nominated or selected by one man or woman despite any position they might hold in that particular village. The election system must be by vote (the counting of hands). The people elected must then be approved by local leaders, i.e., village headmen or the Malawi Congress Party chairman.

#### **Why have Village Health Committees?**

Since the outbreak of cholera in Malawi in 1973, more methods and efforts to control the disease are being tried in the field. The methods applied are aimed at improving village sanitation. These include the provision of safe water supplies, proper pit latrines, provision and use of refuse pits, and teaching people simple rules of personal hygiene. One way of doing this is to establish village health committees. This idea has been put into effect since 1974. The committees work as tools to extend health activities in the villages and rural areas as a whole.

The duties of a village health committee may be summarized as follows: (1) to report on any infectious disease outbreak within

the village; (2) to organize people during health campaigns and health education meetings; (3) to see to it that gastroenteritis/cholera patients and any other patients are taken to treatment centres without delay; (4) to encourage and increase local participation in rural health programs through the committee's network; (5) to let people know that they are part and parcel of health improvements in the village; (6) to help identify the health problems within the village; (7) to help the health staff in the field to carry out their activities properly; (8) to be responsible for the provision of accommodation to health staff, e.g., cholera assistants, during an infectious disease outbreak in the area; and (9) to be responsible for water chlorination in the villages, e.g., wells and pot-to-pot chlorination.

#### **How to Conduct Elections**

The entire village is involved in the election and this is the only stage where an entire community is assembled to choose the leaders from among themselves. The village headman and Malawi Congress Party chairman (branch) should conduct the elections under the guidance of a technical assistant. The two former leaders must ask the technical assistant to explain fully all details about the election and the committee. This should be done before the election and the explanation should include election procedures, i.e., one vote per person; qualifications required by officers and members; and the importance of the committee within the village.

The village headman and the Malawi Congress Party chairman for the branch should be members of the committee, because these people are already heads of the village and the committee will work under the umbrella of the two leaders. Any other members in the village are eligible to be elected. Thus, the elected members of the village health committee consist of chairman, vice chairman, secretary, vice secretary, treasurer, and vice treasurer.

Four of these people should be women. In addition to the elected positions, the following people should always be part of the committee: the village headman; Malawi Congress Party branch chairman; technical assistant, e.g., health assistant, cholera

assistant; and medical assistant or maternal and child health assistant.

### **Examples of the Responsibilities of the Village Health Committees**

Members of the village health committees are subjected to a growing awareness of health problems because of increasing population and settlements in the rural areas. They are briefed on the problems that hinder the conversion of villagers from traditional beliefs to new technical approaches to health problems and they foster a sense of responsibility within the community during the control of infectious diseases or when living conditions are dangerous to health. The success of any vaccination campaigns, such as vaccinations against measles or polio, cannot succeed effectively if their respective purposes are not fully explained by the village health committee members to the people of the communities. For example, in supplemental piped-water schemes, the Ministry of Health emphasizes that through the village health committees, as many communities as possible should gain access to safe and clean water and discourages communities from obtaining their drinking water from suspicious sources such as rivers

or dams. Thus, it is an easy and logical step for these committees to undertake the construction of a protected spring or well if they are given suitable assistance to enable them to do so. The technical assistant, with the help of the committee, works out an estimate of the entire well or spring project, i.e., what the village health committee will do and what the government will supply.

### **Conclusions**

This paper has shown in detail how the community is involved at all levels, utilizing the existing leadership structure. The importance of a motivated field staff, who are the link between the government and the people and who provide the necessary supervision, has also been stressed. As a result of this involvement and because of its basic importance to the success of the program, a sense of pride and ownership in the project is generated within the local community.

It should also be noted that rural committees have been cautious of innovations until these innovations have been tried and shown to be appropriate to rural conditions; something that has taken years to do by the departments and people concerned through trial and error methods.

## Applied Community Participation in Sanitation Provision

Nomtuse Mberé<sup>1</sup>

To begin with, it is not at all clear what is meant by the word community. Is it a geographical concept, a social concept of a network of persons and institutions characterized by social solidarity, or at a micro level by the family network; the latter feasible only in those areas characterized by the homogeneity of an extended family. Would community participation, therefore, mean the involvement of members of the communities described above? If we are not clear what a community is, how clear are we of what community participation is? Community participation according to Feachem (1980) is a vague term used to mean different things. Interpretations given to community participation may even assume other concepts such as "self-help," "self-reliance," and "user choice." Unfortunately, many of the advocates of these concepts are people who have never been involved in community participation. The question, therefore, is why advocate community participation.

It is usually assumed that community participation is a less expensive way of bringing about beneficial developments in a community. Upon analyzing the characteristics of the communities in which participation is desired it will be seen that they are characterized by such social problems as poverty, unemployment, undereducation, residential mobility, inadequate housing, delinquency, crime, and poor health. It is further acknowledged that the identification

of the clustering of all these problems is important in considering community participation. In other words, community participation is usually strongly advocated in those countries characterized as underdeveloped.

At a superstructural level, one observes two trends in the application of community participation. Firstly, there is that practiced in those countries whose political ideology is socialist; one would assume that in these countries the ideal usage of community participation is adhered to and, therefore, no further discussion of this application will be presented in this paper. Secondly, there is that practiced in those countries characterized by gross inequalities. It is this trend that the author considers to be a misuse of the term community participation.

The structure of these countries is such that there are some affluent areas. The residents of these areas are never required to involve themselves in community participation, e.g., in this case provision of services such as sanitation. Services in these areas are usually provided by governments and the residents would pay for the services.

The residents required to become involved in community participation are the less affluent people who cannot afford to pay for services and yet need them just the same. These residents must, therefore, work together as a whole in order to reduce the cost of providing the services required by the community.

Traditionally and customarily, most developing countries were characterized by some form of community participation; it

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<sup>1</sup>Sociologist, Ministry of Local Government and Lands, Gaborone, Botswana.

was in their culture. Thus, the only thing new and fashionable about community participation is that it is being exploited as a vehicle to bring about social change. Some of these programs of social change become unacceptable because they require behavioural and cultural changes. The initiators of change, aware of the need for social acceptability of their projects, will then, under the cloak of democracy, require the community in need to demonstrate what Feachem (1980) documents as "felt needs," "local perceptions," "bottom up planning," "motivation," "latent development potential," "catalytic development inputs," and "integrated development at the village level," thereby bringing about the community participation component of the project. If one examines the 5 year development plans of these countries, it will be seen that these catch phrases abound. There is no explicit meaning of these concepts in most cases.

In this paper, community participation will be discussed within the context of sanitation. There are well-documented studies of community participation in water provision (Feachem et al. 1978; Caincross et al., in press) but before an attempt is made to discuss community participation within the context of sanitation provision it is worthwhile to look at four of the five overriding problems discussed by Feachem (1980).

### **Practicability**

If the "ideal" definition of community participation is adhered to, there would be no need to stress concepts such as "bottom up planning" or "felt needs," but if, as in the context of this paper, it is assumed that this is not the case, would the fact that these communities do not come up with "felt needs" mean that they do not require these services? How feasible is it to require an underpopulated village with extensive fields that can be used for defecation and an ideal climate to destroy bacteria to demonstrate felt needs for sanitation provision. Because most of the community participants need to

be residents of such a village, how is it possible to have skilled manpower from the village capable of understanding all of the intricacies of planning and implementing such programs? Governments, therefore, must take the initiative and provide manpower and economic resources, but the community itself can contribute by raising funds and selecting manpower for training. Thus, the process should work both ways. At times, because of some of these problems, what commenced as a community project ends up being a governmental one, or it stretches over such a long period that it is abandoned. For community participation to be practicable, skilled manpower, economic resources, and technical skills are a must, unless a project is to be run over a lengthy period, in which case some in-service training may be available.

### **Relevance**

As mentioned earlier, community participation in affluent areas is virtually nonexistent, but even in those less affluent communities, if local government is efficient in realizing the needs of local communities and has enough skilled manpower, some of the projects can easily be undertaken by local government structures, thereby making community participation also irrelevant in such cases. Feachem (1980) argues that community participation has never been a major component of water supply or sanitation development in industrialized countries; why then is it urged in others? How many areas in the U.S.A. and Europe run and maintain their own sanitation and water facilities and how many could without continuing support from local or central government? It would seem that the relevance of community participation is not immune to challenge.

### **Cost**

Community participation is alleged to cut the costs of certain projects, but how much cost can be cut if the community has to import building materials, has no transport

of its own, and no skilled manpower? Costs and cost effectiveness have to be compared between underpopulated and overpopulated areas, and within urban and rural areas. It can be found that there is no real saving. It may be that community participation in terms of cost effectiveness may result in structures that are poorly constructed, not functioning properly, and not even maintained in the long term. The problem is that most donor agencies want to see structures constructed within a specified time period so that they can be relieved of their commitments. Africa must have numerous examples of so-called community participation built structures that were abandoned after a number of years to be recommenced by another donor agency that purports to have an appropriate technology that works and is cheap. The other point that is usually overlooked is that these communities themselves are not static, they are modernizing and the residents themselves end up requesting the best and most expensive flush toilets instead of pit latrines, for instance.

### **Political Context**

It has already been pointed out that underlying community participation are different political ideologies. In those countries whose governments are sincere in their commitment to provide equitable distribution of resources and services, community participation need not be problematic; but in others the residents of the communities themselves are sometimes opposed to government policies and will not be willing to engage in such projects which they conceive as palliative attempts at dealing with fundamental problems that need real curative decisions. In such cases, the residents may refuse to participate or may even try to sabotage such projects.

### **Aims of Community Participation: How they can be Achieved and Some of the Problems Involved**

#### **Community Involvement**

The community can be involved at the initial stages by defining its "felt need." This

is done by requesting the project, e.g., sanitation in this case, and making it a priority. The community need not only request the project but may also be required to show some capability of being able to fulfil some of the project's requirements in terms of providing voluntary labour. This results in a response from the government or aid agency to the "felt need." Some of the basic concepts, then, are:

(1) Self-help: Self-help, in theory, should make economic sense, but due to construction delays, higher supervision required, low voluntary labour turnout, rapid turnovers, conflicts within the community, and problems in implementation due to insufficient technical support that does not support the householders, the perceived economic benefit is never achieved. If the sanitation units are not to stretch beyond the household's capabilities, then certain criteria must be met: (a) Economic: The units must be affordable by the community or householder not only at the construction stage but over the entire life of the units, thereby minimizing both operational and repair costs. (b) Social acceptability: Early in the project, it must be established that the technology itself will be socially appropriate, well-designed, and hygienic; and the people themselves will want to use it and be able to maintain it. Acceptance of the technology means that undesirable user behaviour may be circumvented. Social and behavioural obstacles can be overcome by the promotion of local leadership which is also one of the aims of community participation.

(2) Local leadership: This can be achieved through local committees, e.g., village committees. If village committees are going to be involved, then methodology has to be developed to stimulate committee involvement in all stages of planning, construction, maintenance, and usage. The village committee's other functions would include organization of labour and of community helpers to aid project personnel in census taking, social and soil surveys, and gathering locally available construction materials. At times, there are problems in using village committees: (a) disputes between villages,



although such competition can be beneficial; (b) lack of manpower to enforce decisions; (c) procedures and responsibilities of committees and members are poorly understood; and (d) lack of training. In order to overcome these problems a greater degree of control over the development of these activities is necessary and training of committee members in administrative and technical skills is necessary.

(3) **Education:** There are different levels in the educational component of projects: (a) skilled workers: sewerage and construction engineers, sociologists, anthropologists, adult education personnel; (b) middle-level workers: sanitarians, e.g., health inspectors; and (c) field workers: the personnel who are in constant contact with the community, e.g., sanitation assistants and family welfare educators. All of these are required personnel and they need education and training. Training itself can be at the intermediate technology level where even some of the members of the village committee can be selected for such training. The most important educational input should be directed at the community and this can be achieved by (a) having activities such as health and hygiene information built into the project; (b) project personnel, with help from adult education personnel, using video cassettes and radio-listening group techniques; (c) conducting educational campaigns in schools; and (d) using a multidisciplinary team approach. A successful educational component will result in well-designed, well-constructed, and acceptable units, which will be maintained, used by all members of the household, and will result in health benefits.

(4) **Health benefits:** The benefits to be gained are: (a) less morbidity; (b) improvements to the environment, i.e., no pollution, and if compost is used from the composting latrines, a better looking environment or better yields from the vegetable gardens; (c) avoidance of accidents caused by poorly constructed structures resulting in, for instance, children falling into pit latrines; and (d) hygiene patterns that have not existed before, e.g., proper use of sanitation

units, proper maintenance, etc., could now be achieved.

If most or all of these criteria are met and the problems surrounding them overcome, then there is a chance that the project will be a success. A successful experience on the part of the community in introducing a service is likely to encourage other new development initiatives. It should be noted, however, that it doesn't necessarily follow that such initiative will result in a self-sustaining chain of development projects because there may not be enough resources, leadership cooperation, or economic resources within the community for prolonged involvement. Similarly, unsuccessful and unsatisfactory experience in community participation may result in the rejection of future proposals for new projects.

Community participation, if accepted as a workable concept, depends upon community resources. Support systems in the form of family structures, groups, social networks, religious groups, social welfare agencies, and social and political clubs exist within the geographical area identified as the community and are all very important for community participation.

## Conclusions

Community participation and intermediate technology are concepts that are usually found together. It is assumed that these two concepts, because of perceived financial benefits, should be applied extensively. I would also presume that both the United Nations, in declaring the "International Drinking Water and Sanitation Decade" and the World Health Organization (WHO) resolution of "health for all by the year 2000" will redouble their efforts in the intensification of the application of these concepts with the hope that such impossible resolutions can be achieved. The developing countries, with the knowledge that an opportunity exists for progress in their basic environmental health services, will outdo each other with glorified projects that have inbuilt "community participation" for aid; but as Feachem (1980) states, in the end, all this largely depends upon "the nature and

political stance of these governments and upon the economic relations between these governments and other governments." For those countries whose governments have strong political commitments to such projects and have adequate national resources, the prospects are good, but if the opposite exists then the prospects are bleak. I would align myself with such an argument and hope that the concept of community participation is not misused because if properly used, it can be a very powerful tool.

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# Financial Aspects of Sanitation

Dawit Getachew<sup>1</sup>

In a broad sense, sanitation relates to personal hygiene, food hygiene, solid-waste disposal, environmental protection, and excreta and wastewater disposal. This paper, however, will deal only with excreta disposal.

Today throughout the world, about 1.1 billion people are without adequate water supplies; and an even greater proportion lack basic excreta disposal facilities. In order to redress this regrettable situation the United Nations has declared the decade (1981-1990) to be the International Drinking Water and Sanitation Decade. The primary objective of the decade is to provide potable water and sanitation for all. Taking the world population growth rate into account, about 2 billion people will have to be provided with adequate water supply and sanitation by 1990. Certainly, the task is enormous and the financial requirement is horrendous.

Many developing countries have already begun to take measures aimed at implementing the action plans endorsed by the United Nations Conference of Mar del Plata (March 1977). Furthermore, rapid assessment of the present situation with regard to the water supply and sanitation sector has been undertaken by many of the developing countries in close collaboration with the World Health Organization (WHO) and the World Bank. This exercise was intended to get a general view of the existing conditions

and to identify the assistance and actions necessary at the country level. A consultative meeting of intergovernmental agencies, development banks, official development aid agencies, and missions of governments was convened in November 1978. At this meeting, although donors did not pledge money, they expressed their preparedness to expand the frame of cooperation with governments of developing countries for the achievement of the decade's goals.

It is against this background that the financing aspects of sanitation will be discussed in broad terms here. This paper has two parts. The first part focuses on financing from the broad perspective; in the second part an attempt is made to examine the cost implications of a typical rural sanitary scheme (dry pit latrine) and a modern sewerage system as they relate to practical experiences in Ethiopia.

## Sanitation Planning and Financing Issues

The development process involves the direct interrelationships of the social and economic fabrics of a society. Sanitary development is an integral part of overall socioeconomic development. Invariably, where the level of economic development is low, the sanitary conditions are also bound to be poor. While some of the causes for the slow economic development of the developing countries are internal and may be indigenous, others are definitely externally induced by developed countries. The sanit-

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<sup>1</sup>Team Leader, Economist, National Revolutionary Development Campaign and Central Planning Supreme Council, Addis Ababa, Ethiopia.

ary conditions could be improved within the existing socioeconomic structure; yet it is not conceivable to imagine that the goals of the decade will be achieved unless the pattern of world economic development permits a faster rate of economic development in the developing countries.

In general, investable funds are scarce in developing countries and the needs are great. There are many competing sectors including education, agriculture, and industry—the propellers of development—which are usually accorded higher priority than sanitation. As a consequence, sanitation is often ignored. In any case, should developing countries, where other basic necessities are not adequately met, aggressively embark upon sanitary programs to meet the goals of the decade? Will it be economically rational and socially sound to allocate funds more generously to the sanitation sector? Opinions could vary widely regarding these issues but certainly many of us could agree to the idea that some sort of balance should be maintained among the various competing sectors within an economy.

#### **Problems in the Sanitation Sector**

There are several factors that affect the level of investment in sanitation programs. Only the major ones which are common to most of the developing countries are mentioned here: (1) weakness in preparation of plans and well-conceived projects, as well as poor implementation capacity; (2) inadequate emphasis on public sanitary education; (3) deficiency in proper support services such as training of manpower; (4) poor community participation resulting from cultural upbringing and taboos as well as a lack of knowledge on the benefits of sanitary services; and (5) shortage of funds from domestic and external sources. Unless these problems are resolved, the situation with respect to sanitation in the developing countries will have very little chance of improvement during the decade.

#### **Sanitation Program Planning Issues**

In very broad terms, sanitation planning is the process by which the most appropriate

sanitation technology for a given condition is identified, designed, funded, and implemented. The issues that relate to planning of sanitary programs can be broad in range. Thus, only the major features of planning in the sanitation sector will be discussed.

#### **Determination of Investment Projects**

This is best handled in the planning stage of a particular sector. With regard to sanitation "worst-first" strategy, health risks, per capita cost, equity, size of population, acceptability of the service, and community participation should be taken into account as appropriate. However, there is one practical problem: project benefits or the economic and social impacts of the investment in sanitation cannot be measured because they are not usually quantifiable; consequently, there is no satisfactory means of allocating funds among alternative projects. In the field of utilities, in general, the effort to apply cost-benefit analysis has tended, so far, to be impractical. Hence, decisions are often made on social, health, and other considerations and the choice among alternative projects is made on the basis of a "least-cost" or "cost-effective" approach. Here, the benefits attributable to sanitary projects are not converted into monetary values; only the cost elements are analyzed and compared. The "least-cost" methodology presupposes that the alternative projects have identical benefits or levels of service, which is not usually the case. Because of this, the methodology does not provide the complete information required to select a project that is economically optimal. However, it could provide a basis for comparison that reflects the cost trade-offs of the alternative projects having different levels of service.

#### **Shadow Pricing**

In order to make a meaningful comparison of cost-effective alternatives one needs to resort to the application of shadow prices. The main objective of shadow pricing the cost elements of sanitation is to estimate the cost of the service, which reflects the opportunity cost to the national economy. There are two basic steps involved in this exercise. The first step is to identify all cost

items regardless of who incurs them. The second step concerns itself with prices that should be used to evaluate the cost items. Often, because of import and export taxes and other taxes, or due to the sociopolitical objectives of the government, market prices have little relation with the actual economic costs. Thus, it is essential to adjust the market prices so that the costs will represent the opportunity cost to the economy. However, the calculation of shadow prices is a difficult task and planners and engineers involved in sanitary-program planning are not expected to calculate them. They should, rather, check with the ministry responsible for planning the national economy if such shadow prices are available. The main items that qualify for shadow pricing are unskilled labour wages, foreign exchange, and opportunity cost of capital.

#### **Financial Plan**

The economic costs are useful for making comparisons and decisions; however, because the costs are to be incurred in financial terms it is necessary to determine the financial costs using market prices and draw a financial plan. Hence, arrangements will have to be made for financing the project. The sources and amount, as well as the scheduling of funds, will have to be identified prior to the implementation of the program. The financial requirements for the operation and maintenance of the system should also be taken into account.

#### **Choice of Technology**

At the level of project planning, choice of technology becomes very important because of its implications, particularly on cost, feasibility, repeatability, and acceptability. For developing countries, where the greater portion of the populace is without adequate sanitary services, as a first step toward improving the situation focus should be made on increasing the coverage rather than the quality. To this end, attention should be given to the selection of the more simple and affordable technology. The choice of technology should be made on the basis of economic costs rather than financial costs. If, however, the communities are able and willing to pay the full economic cost of a more costly technology, they should be at

liberty to select that technology. World Bank experts have undertaken field studies in 39 communities and 14 countries around the world and they have broadly classified sanitation services into five types of household systems and 4 community systems. The household systems include: pit latrines, pour-flush toilets, composting toilets, aqua privies, and septic tanks. The community sanitation systems comprise: bucket latrines, vault toilets with vacuum cart collection, communal facilities, and sewerage. Among the household systems, the most "cost-effective" and common technology, particularly for the rural areas, is the pit latrine. When properly constructed and maintained, apart from the saving in investment cost, such schemes could also meet public health standards. Of the communal systems, the sewerage system could be necessary, particularly in areas with a high density of high-rise buildings and people. Thus, there are equally effective technologies for application in many urban and almost all rural areas.

#### **Economies of Scale**

The "lumpiness" of investment in sanitation programs could pose a serious financial problem, particularly to individual users. It should, however, be noted that consideration of economies of scale is relevant to investment decisions. In urban areas, the per capita cost of waste disposal facilities will decline, generally, as the size of the scheme is increased. However, the savings made by constructing large-scale treatment plants could be offset as a result of increased costs of transportation if truck-collected excreta or other solid wastes are to be transported long distances for treatment or if long-distance sewer pipes are to be constructed. In rural areas, the situation is quite different. Because of the small population and relatively lower per capita income of the rural populace, on the one hand, and the low per capita water consumption and the possibility of developing simple sanitary schemes, on the other, it will be economically undesirable to construct sewerage systems. However, other forms of communal facilities more appropriate to rural areas could be characterized by economies of scale.

### **Linking Sanitation and Water Supply Programs**

There is a very close relationship between sanitation and water supply programs. They are both important aspects of primary health care. For urban areas and particularly with sewerage service, adequate water supply is a prerequisite. There cannot be any sanitary service without water. Consequently, effort should be made at the planning stage and when making investment decisions to link the sanitary program with water supply programs because they are complementary to each other. In rural areas, where water is usually the felt need, it is possible to successfully relate sanitation with water supply simultaneously. The rigidity of functional responsibilities among agencies, however, often acts as a barrier to the planning and implementation of such mutually supportive programs. Health agencies could also have a crucial role in the effort to integrate the water supply and sanitation services as part of primary health care because such linkage could accrue maximum health and socioeconomic benefits. It will, therefore, be necessary to formulate explicit procedures for coordinating the planning and programming of the water supply, sanitation, and also the health sectors to be jointly funded and implemented.

### **Financial Resource Constraints**

Very general estimates based on the existing per capita costs reveal that during the decade about U.S.\$300 U.S.\$600 billion will be required for sewerage. To that, one could also add the needs for rural sanitation. However, as mentioned earlier, one of the major constraints in the sanitation sector is inadequate financial resources, both from domestic and external sources.

### **Domestic Sources**

There are two sources of financing sanitary programs. The first is the government organ and the second is the user. Nevertheless, partly because of the low priority given to the sanitary sector and partly due to the lack of capacity, investable funds made available to the sanitation sector in develop-

ing countries are negligible, even when compared with the allocation of funds to the water supply sector. Thus, the share for the sanitary sector is very low and for the future the allocation ought to be augmented lest the goals of the decade remain unattainable.

### **External Sources**

Technical and economic assistance have been extended and will continue to be provided to developing countries. However, neither the amount nor the conditions of available assistance are impressive, particularly when viewed in light of the needs of the developing countries. Table I gives some insight regarding the estimated external inputs to the water and sanitation sectors in 1979.

It can be observed from Table I that the share for rural water supply and sanitation is extremely low. Although information is not readily available, one can suspect that out of the U.S.\$290.5 million more than 70% could be allocated for rural water supply, which means that the sanitation sector alone accounts for less than U.S.\$87 million. Even then, the bureaucratic procedures or the requirements for "high standard formalities" by the donors, on the one hand, and the poor absorptive capacity of the recipient countries, on the other, have tended to result in poor utilization of these resources. Hence, new approaches have to be adopted that could result in the flow of substantial international and bilateral funds under more favourable and flexible conditions.

### **Who Should Pay the Cost of Sanitation?**

From the previous discussions, it has been noted that the requirements for sanitary service are large and that there are financial limitations from domestic and external sources. This situation will certainly present a serious problem to developing countries. The question, therefore, as to how to finance the sanitary programs and who should pay the cost, becomes relevant. For the sake of simplicity this issue will be discussed in relation to rural sanitation and urban sanitation separately.

In the case of rural sanitation, financing of a sanitation program or other infrastruc-

Table I. External inputs to the water and sanitation sectors in 1979.

Financing agency	Total input (million U.S.\$)	Rural		Urban	
		Million U.S. \$	%	Million U.S. \$	%
World Bank	1000	100	10	900	90
Regional banks	500	50	10	450	90
Organization of Petroleum Exporting Countries (OPEC)	300	30	10	270	90
Bilateral	400	120	30	280	70
United Nations Children's Fund (UNICEF)	25	25	100	—	—
World Health Organization (WHO)	20	15	75	5	25
Other United Nations nongovernment organizations	55	50.3	90	4.5	10
<b>Total</b>	<b>2300</b>	<b>290.5</b>	<b>12</b>	<b>2009.5</b>	<b>88</b>

tural facility depends upon the economic conditions in a given community or country. In general, the direct users are expected to pay the full cost of the service, but in rural areas the incomes of the people are relatively low, living conditions are poor, and the appreciation for sanitary service is inadequate. In view of these considerations, it is reasonable to make the following financing arrangements. For the initial investment, the communities in nucleated areas should contribute from 25-50% when it is possible to organize them; so that they can have communal sanitary systems. The balance should be contributed either from the local government or the central government, depending upon the level of financial autonomy of the local governments. Of course, the government could also seek external assistance to provide funds for the construction of sanitary schemes.

It needs to be emphasized, however, that for the extension of rural sanitation, the organization and mobilization of communities, as well as public education, will be more important than the financing. The issue of tariffs is totally irrelevant to rural sanitation. As to the operation and maintenance, the communities or the individual households should assume the entire responsibility. In any case, the cost of operation and maintenance of pit latrines is

minimal. For individual household sanitation, where financial assistance is required, the local government or the central government should contribute through the relevant agency in the form of construction materials up to 25% of the cost. Again, the responsibility of maintenance rests entirely on the individual households.

The justification for such subsidies to rural sanitation emanates from the consideration that they will improve the health standards of the poor; support and induce the low-income people to develop and make use of the sanitary facilities; and promote, to some extent, income redistribution in favour of the poor. It should, however, be remembered that subsidies come either from other users or from the general taxpayers. If it comes from the latter, the additional tax should be carefully designed not to affect the low-income group.

In the case of urban sanitation, there are different considerations that need to be taken into account to arrange financing for the construction, as well as operation and maintenance. Firstly, urban sewerage systems usually involve lumpy investment: the per capita investment cost ranges from U.S.\$150-U.S.\$600. Secondly, the beneficiaries of such systems are those who could afford to have flush toilets using relatively high volumes of water. Thirdly, because of

the risk of epidemics in urban areas with high population densities, it could be necessary to have a central system or sub-systems of sewerage facilities. In view of these considerations, one is inclined to suggest that, generally, the beneficiaries of the sewerage or other types of facilities should pay the full economic cost. The agencies responsible for the provision of such facilities should have the legal power to charge the users. The tariffs could be designed in such a way that protects the low-income group without penalizing the agency. The amount of revenues to be generated should cover the cost of operation and maintenance as well as replacement and expansion. Although the willingness to pay should be considered, at times it might be necessary to charge higher tariffs than people are willing to pay. Hence, connection to the sewerage system ought to be compulsory. Should any consideration of subsidies for urban sanitation be entertained it has to be strongly justifiable or it should be consciously applied to meet the sociopolitical objectives of governments.

There are, however, two things that should be noted in the setting of sewerage tariffs. Firstly, it should be ascertained that the sewerage system, which is intended to serve the people, is constructed at the lowest possible cost employing the most "appropriate technology." Secondly, it should be ensured that the system will make a positive contribution to the improvement of health conditions of a given community. Unless these conditions are fulfilled, there will be no justification for charging users the economic cost of the facility, which is likely to be high.

### **Toward Improving Financing**

At this juncture, it might be appropriate to discuss briefly the actions required to improve the financing situation in the sanitation sector, with a view to meeting the objectives of the decade. Regarding resources from domestic sources, the following course of action should be considered: (1) increasing the overall budgetary allocation from government sources, giving attention to the segments of the population with the greatest need for sanitary services: (2)

mobilization of funds for sanitary programs from users, tariffs to be charged for the urban sewerage system or subsidies to be provided for the urban and rural sanitation need to reflect the ability to pay of the various categories of users; (3) encouraging and mobilizing local communities to contribute in cash and in kind; (4) promoting a massive national campaign for self-help construction of pit latrines in rural areas; and (5) intensification of user sanitary education programs, particularly in rural areas. Furthermore, loans and credits with low interest rates and long repayment periods should be sought from external sources to finance major urban sanitation programs, whereas for the rural and urban fringe areas, assistance needs to be procured. The following selected measures, however, are essential for effectively attracting funds from external sources: (1) formulation of long-term and short-term plans for the sanitation sector, this needs to be integrated with the national plan; (2) selection of projects and preparation of preinvestment studies; and (3) strengthening the absorptive capacity of the relevant government institutions.

### **Financial Cost Implications**

So far, we have discussed the issue of financing sanitary programs from a rather broad perspective. We shall now examine briefly the cost implications of a typical rural sanitary scheme (dry pit latrine) and a modern sewerage system, as they relate to practical experiences in Ethiopia.

For a dry pit latrine (family size), with a capacity of 3 m<sup>3</sup> and having an economic life of 10 years, the actual financial cost or the financial cost estimate is as follows:

Cost items	U.S.\$
Excavation (U.S.\$2.50/m <sup>3</sup> )	7.50
Base (1 m <sup>3</sup> ) (U.S.\$2.50/m <sup>3</sup> )	2.50
16 logs for floor (U.S.\$1/log)	16.00
4 logs for roof (U.S.\$1/log)	4.00
9 wooden stands for walls (U.S.\$1/stand)	9.00
Labour for the superstructure	10.00
11 corrugated iron sheets (U.S.\$5/sheet)	55.00
3 kg of nails (U.S.\$0.50/kg)	1.50
<b>Total cost</b>	<b>105.50</b>



In this case, as the financial cost will be almost equal to the economic cost, it is not worth estimating the shadow prices and calculating the exact economic cost. It should, however, be pointed out that the actual financial cost varies depending upon various conditions, including the availability of construction materials such as wooden stands and logs at the site. Under a favourable situation, where the pit latrine is constructed by the household itself using mainly locally available construction materials, the financial requirement will be virtually nothing. The issue of maintenance, although often neglected, also deserves consideration in cost analyses. Usually, the annual cost of maintenance of pit latrines amounts to about 10% of the initial investment cost. However, when it is maintained by the household itself, using locally available materials, the financial cost is almost zero.

It can be concluded that financing for the extension of pit latrines cannot be the main hindrance toward improving the rural sanitary system. It is recognized that without the active participation of the direct beneficiaries there is no easy way of changing the situation and improving the health standards of the rural populace. In Ethiopia, the Ministry of Health is responsible for public sanitary education as well as for providing materials and other support services. More important, however, will be the role played by the ministry to create awareness on the part of the local communities, peasants' associations, and producers' cooperatives so that they will, in turn, have a crucial role to play in improving the sanitary situation in the country.

### Urban Sanitation

With the exception of Asmara and part of Addis Ababa, all towns in Ethiopia are without sewerage systems. A small proportion of households have their own individual excreta disposal facilities; the rest are totally without proper means of sanitation. We shall now examine the cost implications of the Addis Ababa sewerage project which is under construction.

Phase I of the project is being constructed in two stages. Stage I comprises mainly the construction of a sewage treatment plant, laying of 50 km of primary and secondary sewer pipes, and the construction of an office building. The overall cost of the construction of these components of the project will be about U.S.\$10.4 million, of which nearly 80% is in foreign exchange, and the balance is local. Stage II of phase I, which consists of laying 51 km of major and minor sewer pipes, is estimated to cost U.S.\$10.9 million. The source of financing of phase I of the project is as follows (in U.S.\$1000):

	Stage I	Stage II	Total
External loan	5500	8300	13800
Government loan	3000	2600	5600
Own fund	1900	—	1900
Total	10400	10900	21300

The Addis Ababa Water and Sewerage Authority (AAWSA), which is responsible for the development of the city's water supply and sanitation, is currently faced with serious financial problems. As a consequence, its contribution for phase I of the sewerage project accounts for only 8.9% of the total cost.

When phase I of the project is fully completed, by 1982, it is expected to serve about 100 000 people or its equivalent, mainly in the southern part of the city. Because of practical problems, however, one can doubt if 100 000 people could be served by this project. Even assuming that the planned target will be achieved, the per capita investment cost for phase I of the project will be about U.S. \$213, which could be regarded as on the high side considering the level of development of the country. If the cost of foreign exchange is shadow priced, the economic per capita cost will be even higher than U.S. \$213.

There was no tariff study for the sewer system when the decision was reached to implement the project. Recently, however, a consulting firm was hired to undertake financial and tariff studies for the water as well as the sewer system. According to the

studies the estimated operating expenses and revenues for the new sewer system for the first 4 years of operation are as follows (in U.S. \$1000):

Year	Estimated income	Estimated cost	Surplus (deficit)	Cumulative surplus (deficit)
1980/81	373	1080	(707)	(707)
1981/82	673	1104	(431)	(1138)
1982/83	971	1134	(163)	(1301)
1983/84	1271	1164	107	(1194)
Total	3288	4482	(1194)	

Source: AAWSA Finance, 1979, Table V-8.

The data of the table are drawn assuming that the water tariff will be raised from U.S.\$0.25/m<sup>3</sup> (present rate) to U.S.\$0.40/m<sup>3</sup> and the new customers of the sewer system will be charged an additional U.S.\$0.45/m<sup>3</sup> for water discharged into the system. These charges do not include the connection fees, which are to be borne by the new customers. Even then, as shown in the above table, a deficit of U.S.\$1 301 000 is anticipated during the first 3 years of operation. The authority is not in a position to absorb this deficit. Considering this situation and in anticipation of public reaction to the proposed sewer tariff, the consultants recommended that the principal and interest on the loans of the new sewer system should be assumed by the national government. In this case the sanitary sewer tariff could be reduced from U.S.\$0.45/m<sup>3</sup> to U.S.\$0.25/m<sup>3</sup> and the deficit could be eliminated.

This proposal brings into mind a serious question: should the government subsidize such facilities at the expense of foregoing investment in other sectors that benefit the poor? There is not an easy answer to this question because there are several variables including social, economic, and political considerations. In general, however, the issue of subsidy needs to be analyzed care-

fully when deciding who should pay the cost of sanitation.

## Conclusions

There is a strong relationship between the level of economic development and the level of sanitary service standards. Considering the present level of development it will be unrealistic to expect that developing countries will achieve 100% provision of sanitary services during the decade. Yet some positive progress could be made provided serious effort is put to the determination of investment projects; choice of technology; arranging and provision of adequate funds both from local and external services; carrying out of public sanitary education and mobilization of communities; and integration of water supply, sanitation, and health programs.

It is noted from the Ethiopian situation that excreta disposal practices, particularly in rural areas, are part of the cultural outlook and level of development. Hence, the effort of the Ministry of Health will have to be stepped up to provide the necessary training to make the rural communities conscious of the importance of proper sanitary service. Once this is effectively done, the issue of extension and construction of pit latrines will be a matter that can be left entirely to the rural communities.

Concerning the Addis Ababa sewerage project, we have observed that it is costly. In a country where per capita income is U.S.\$110 and investable funds are very scarce it would be undesirable to encourage the expansion of such sewerage systems. The nation just cannot afford to keep on providing subsidies to such facilities. Thus, we have to shift emphasis from capital intensive sewerage systems to alternative technologies that require minimum capital.

# **Financing of Low-Cost Sanitation Schemes in the Urban Areas of Botswana**

**Brian Bellard<sup>1</sup>**

Since independence in 1966, the rate of urban growth in Botswana has increased steadily as a result of rural dwellers moving into towns in search of higher earnings and better living conditions and also as a result of a very high birthrate, particularly in urban areas.

Fortunately, this growth has been at a steady rate and with two notable exceptions town councils have, with government assistance, been able to sustain development at a sufficiently high level so as to avoid the occurrence of squatter areas becoming a serious problem. The two squatter areas that did develop prior to the commencement of major development were in Gaborone and Francistown and have now been upgraded to a standard similar to the new urban developments.

## **Government Policies**

The Government of Botswana has a declared policy concerning urban development stating that such development should not encourage urban growth. To achieve this aim, dwellers in urban areas must be required to pay for the services they receive. The government also has a policy requiring that a fundamental principle of planning should be the primacy of access to services for the poor. To achieve these policies it is necessary to avoid polarization of large blocks of low-cost development by encour-

aging the integration of various standards, including high- and low-cost housing, site and service areas, and commercial development, all within each major block.

## **General Standards of Infrastructure in Site and Service Areas**

In general, the standards adopted by government have been as follows: (1) roads: primary, double seal coat; secondary, single seal coat or gravel; tertiary, scraped earth; (2) water supply: standpipe ratio of approximately 1 for every 20 plots; (3) sanitation: approved "low-cost" system (only sub-structure provided).

## **Funding of Urban Development Projects**

Financing for these projects comes from various sources, e.g., the Broadhurst II development in Gaborone received grants from the United Kingdom, Canadian International Development Agency (CIDA), and the Economic Development Foundation (EDF); a loan from the United States Agency for International Development (USAID); and also Botswana government domestic development funds. To enable such a project to be self-financing, a cross subsidy system is operated whereby about two-thirds of the costs of infrastructure development for site and service are recovered by plot sales in the commercial, industrial, and high- and medium-priced resident-

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<sup>1</sup>Senior Engineer, Ministry of Local Government and Lands, Gaborone, Botswana.

ial areas. This reduces the amount of funds to be on-lent to the town council and to be recovered by way of a service levy. In this way, the service levy has been kept at a reasonable level of affordability in most areas. There is a default rate of about 30% in most towns but this is thought to be the result of poor legislation, which provides little power to recover unpaid levies. This legislation is now being amended and it is hoped that default rates will be reduced to less than 5%, i.e., only those who show genuine hardship will be able to default.

In addition to the service levy, a plot-holder will also have a monthly commitment to repay any building material loan that may have been taken out with the town council (maximum loan P600 (P1 = U.S.\$0.74)) in order to construct a house and sanitation unit superstructure.

Some later projects, notably the urban II developments in Selebi Pikwe and Francistown, have relied heavily on loans (World Bank) and this results in a much greater proportion of funds being on-lent to council for recovery by levies, even after cross subsidies have been taken into account. The government is currently looking into this situation to see how such costs can best be recovered without setting service levies at such a high level that there would be little chance of recovery irrespective of the legislation in force.

Unfortunately, to further complicate the situation, lending agencies have been reluctant to allow a realistic amount within their loans for the provision of sanitation units and it has, therefore, fallen upon the government to provide funds for these from domestic sources. Once again, to keep the service levy as low as possible the terms of this financing have had to be considered in detail.

### **Financing for Sanitation Units: Urban II Project**

The appraisal report for this project included P70 per plot, for each of the 6500 plots, for the provision of a sanitation unit substructure of an approved type. The

current costs for the various types of sanitation units suggested for urban areas are indicated in Table 1.

The number of sanitation units to be provided in this particular project is 9050, as opposed to the 6500 in the original assessment. The total includes some units not provided under the earlier urban I project. The estimated costs for the 9050 units are:

Unit	Unit cost	Cost of 9050 units (1 pula = U.S.\$0.74)
VIP	173	P1583750
ROEC	275	P2488750
REC II	275	P2488750
Type B	425	P3846250

In order to provide a framework for reaching a decision on this matter, the following principles are being adhered to: (1) a unit shall be provided on 85% of the plots as part of the infrastructure development; (2) on the remaining 15%, the plot-holders should be given the opportunity to install an acceptable system of their choice (waterborne or septic tanks as these plots will be chosen near main services or in areas with good soakage characteristics); (3) the type of unit selected must balance capital construction costs against recurrent servicing costs to prevent town councils from becoming burdened with hard to service units; and (4) the cost recovery scheme must be affordable by at least 80% of the plot-holders, which according to statistics indicates an income level of P300 per annum.

An analysis of the impact of cost recovery must take into account all aspects of the levy charge and not simply the cost of the sanitation units alone. Unfortunately, current studies of levy costs are not yet concluded, but it is estimated that this will not be less than P5.25 per month per plot, exclusive of the sanitation unit.

If the levy, exclusive of the sanitation unit, is P5.25 per month and the goal is to find a solution affordable by a family with an income of P300 per annum, it will be necessary to consider the implications of the government providing this financing to

Table 1. Costs of sanitation units for use in urban areas.

Type	Substructure costs (1 pula = U.S.\$0.74)	Comments
Vented pit (VIP)	P175	Cheapest solution, but not regarded as particularly suitable for urban conditions. Major difficulties are those of emptying, particularly when a concrete superstructure is erected. In rural areas a new pit is usually dug and the slab and superstructure, constructed of indigenous materials, are moved when necessary
Reed odourless earth closet (ROEC)	P275	Soiling of the chute is a problem, leading to excessive water usage in a dry system. Emptying difficulties are overcome (i.e., pit is offset), but councils have to respond immediately once unit is full
Revised earth closet (REC II)	P275	A double-pit system yet to be finally proved but now being widely accepted as the best option, given suitable ground conditions. When the first pit is full the seat is moved, thereby giving councils time to respond for emptying. Pits are offset
Type B (aqua privy)	P425	Particularly suitable where groundwater pollution is a problem. Can be upgraded to sewered system. Easily emptied by councils

Table 2. Annual income required to meet various levels of sanitation and building material loans. <sup>a</sup>

Interest rate	Sanitation loan		Building material loan (pula)					
	Loan (pula)	Grant (pula)	100	200	300	400	500	600
4%	275	0	398	447	495	544	593	642
	175	100	362	411	460	509	557	606
	75	200	327	376	424	473	522	570
	0	275	300	349	398	446	495	544
6%	275	0	412	460	509	558	607	655
	175	100	371	420	469	517	566	615
	75	200	331	379	428	477	525	574
	0	275	300	349	398	446	495	544
9%	275	0	434	483	532	580	629	678
	175	100	385	434	483	532	580	629
	75	200	335	384	433	488	531	580
	0	275	300	349	398	446	495	544

<sup>a</sup>Calculations based on a P5.25 (1 pula = U.S.\$0.74) levy being in force (e.g., a levy of P5.25 plus a 9% sanitation loan for P275 and a building material loan of P600 requires an annual income of P678).

councils partially by grant and partially by loan.

In addition to the service levy, a plot-holder is also required to repay any building material loan taken out to cover the cost of materials for the construction of his dwelling and sanitation unit superstructure. The current maximum loan is P600 and the

average loan is about P450, the loan having to be repaid over 15 years at an interest rate of 9%.

It is essential, therefore, that a plot-holder in a site and service area be able to afford to repay, out of his income, both the service levy and a reasonable building material loan. Table 2 shows the annual income

required to meet various levels of building material and sanitation loans.

Because of low incomes, not everyone is able to afford a starter house on this basis. There are two methods, therefore, of overcoming this problem: (1) by giving a direct grant, which would be contrary to government policy, or (2) by reducing standards. In order to avoid the grant situation, four possibilities have been examined to reduce costs in relation to sanitation: (1) Eliminate sanitation units from development plans. This was rejected as totally undesirable. (2) Use direct labour construction teams. Experience has shown that the councils' own labour force is generally no less expensive than contractors. (3) Use more "self-help" labour in the construction of sanitation units. This method results in increased supervision and overheads, as well as delays, which all result in pushing up costs even further. (4) Build to reduced standards. With the cost of the units varying widely according to type, this solution must be carefully considered with respect to recurring costs.

In order to achieve all of these objectives, a proposal was made to the Ministry of Finance that the following plan should be adopted for the urban II project:

(1) Proposed unit: REC II (double pit).

(2) General description and advantages of plan: (a) a total of 9050 units are to be installed by contract at a cost of P275 per unit; (b) the plots will have a unit installed at the time of allocation; (c) the unit can easily be serviced and has the lowest recurrent costs; (d) all units can be installed within 6 months; and (e) there are no special staffing requirements or problems.

(3) Proposed financial basis: (a) government grant of P100 per plot to councils; (b) government provides a P105 per plot loan at 4% over 15 years; (c) exist-

ing World Bank funding of P70 per plot, for 6500 plots, to be passed to councils at 3% over 15 years, and (d) government to provide an additional loan of P70 per plot at 3% over 15 years for the 2550 plots not covered under (c).

(4) Affordability: assuming a P5.25 levy and the above loan requirements (i.e., P105 at 4% over 15 years; P70 at 3% over 15 years), an annual income of P314 would be required; an additional P600 building material loan would bring the required income up to P600.

(5) Total additional funds required: 3% + 4% loans, P1 128 750; grant, P905 000; for a total of P2 033 750. Assuming that 10% of the 9050 plots will elect to install their own waterborne or other systems, the amount of additional funds required is P1 830 375.

## Conclusions

The recommendation made is to change government policy, to a certain extent, on the subsidization of urban development. However, the subsidy has been restricted solely and specifically to the sanitation unit and it is not proposed that this become a general policy, but be adopted only where there is insufficient financing available through donor funding or cross subsidies to provide a sanitation unit of desirable standard and at the same time keep the service levy to an affordable level.

The proposed plan allows for the service levy and sanitation loan to be within the financial ability of 80% of the population. At the lower end of the scale only a very small amount of building material loan would be affordable, but a P100 loan is usually sufficient for an initial one-room dwelling and this should be affordable with an annual income of P400.

## **Training Implications within the Sanitation Sector in Tanzania**

**H.W. Rutachunzibwa<sup>1</sup>**

In an attempt to meet the goals of the United Nations Drinking Water and Sanitation Decade (1981-1990), Tanzania has committed itself to providing safe sanitation systems and hygienic education to the entire population by 1990. This commitment arises from the incidence of water-based diseases, mostly sewerage oriented, which has resulted in several thousand deaths due to cholera since 1974. The Tanzanian government has set up the Sewerage and Drainage Division within the Ministry of Lands, Housing and Urban Development (ARDHI Ministry) to ensure the implementation of this commitment. This calls for an improved and well-maintained nonwaterborne sewerage system by 1990 that the majority of the population can afford. This undertaking requires highly trained personnel, and a survey of the existing trained manpower reveals that only two public health engineers and a few health officers are available. Currently, Tanzania does not have suitable facilities to train these cadres. In order to satisfy the needs of the 17 million people living in Tanzania (2 million in urban and 15 million in rural areas), Tanzania must undertake a serious training program to meet its projected manpower requirements for 1981-1990, which consist of 350 public health engineers, 240 health officers, 660 extension officers, and 110 health educators.

Training programs, practices, and techniques relevant to these needs, therefore, must be planned and implemented. Care

must be taken in the design of these programs to ensure their relevance to the country's policies and to the particular circumstances of the country. In pursuance of this, closer links should be built up through the training process between the training institutions and the public agencies concerned with sanitation programs. All training should include the use of effective teaching methods such as case studies, sanitation techniques, and the like. This broadly covers professional training, training for middle management and supervisors, technicians, extension staff, trainers, in-service training seminars, and workshops.

### **Training Professionals**

The purpose of training this cadre is to ensure implementation of sanitation projects in the ARDHI Ministry by 1990, which is currently being undertaken by expatriate consultants. This involves training of civil/public health engineers. It is estimated that 50 students must train every year for the next 4 years in a 4 year diploma/degree course. Presently, there are no adequate training facilities in Tanzania. To alleviate this problem it is proposed that a new Department of Public Health Engineering be set up at the ARDHI Institute, Dar es Salaam, whereby candidates who have completed Form 6 would undergo a 3-4 year diploma course. The initial enrollment would be 25 in 1981-1982 and by the year 1990-1991 it will have produced about 100 graduates. In addition to this, Tanzania

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<sup>1</sup>Principal Training Officer, Ardhi Ministry, Dar es Salaam, Tanzania.

should look into the training of this cadre outside of the country. The Ministry of Water, Energy, and Minerals (MAJI) has managed to train 100 civil engineers in India at the University of Roorkee through external funding at a cost of about TSh 320 000 per student for a period of 4 years. The ARDHI Ministry could follow a similar course of action. Alternatively, the University of Dar es Salaam or the Technical College of Dar es Salaam could be asked to undertake a postgraduate diploma course in public health engineering. However, this proposal depends upon the availability of funds and civil engineers.

### **Training of Middle Management Staff**

This includes training of health officers and assistant health officers. Up to this time, it has been the prerogative of the Ministry of Health (AFYA Ministry) to train this cadre for 3 years, but in view of the limited training facilities, the annual enrollment has been restricted to 25 students. However, extension of this program has been made possible by introducing an upgrading course for health assistants to the status of health officers at Tanga. This is a 2 year program and the annual enrollment is 20 students. In addition, the Faculty of Medicine, Dar es Salaam, could be asked to consider expanding the existing facilities to double the enrollment to 50. Other training facilities could be sought from outside Tanzania by external funding from bilateral agencies. International health education centres such as Ibadan University, Nigeria, have been identified as suitable for training this cadre. International organizations such as the Swedish International Authority (SIDA), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Programme (UNDP), Norwegian Agency for International Development (NORAD), and the Danish International Development Agency (DANIDA) should be requested to help in this undertaking.

### **Training of Extension Officers**

The sanitation program will fail without the support of an extension team. This will provide the link between the town and rural councils, the party, and the beneficiaries/owners. The extension team will help in promoting the choo kizuri scheme/campaign by liaising with: (1) the beneficiaries/owners in order to assist the households in evaluating their existing sanitary disposal systems and where necessary identifying the approach the owners should take to construct improved ventilated pit latrines; (2) the government financial body to explore the possibility of a loan to help the owners if they so desire; (3) the town councils to register the owners and obtain for the owners improved designs suitable for the particular site conditions; (4) the fundis (artisans) who will undertake the construction of choo kizuri; (5) the town council building inspectors who will approve the construction; (6) the party members and the ten cell leaders who will ensure that the scheme is suitably promoted and implemented in their district; and (7) the Ministry of Education and AFYA to ensure that a health education program is implemented in their district.

The number of health extension officers required by the ARDHI Ministry will be of the order of 120 for urban and 540 for rural areas. Training of this cadre would be on-the-job training and refresher courses. Form 6 leavers (who failed to qualify for university entry) would be suitable for this training. They should be trained by health officers and health educators to understand their liaison role in the sanitation program.

### **Health Educators**

The role of a health educator should be to train schoolteachers, lecturers at adult education centres, and others responsible for disseminating information relating to sanitation, and to restructure and review the school curricula from time to time. Training of this cadre should be under the jurisdiction of the Ministry of National Education



(ELIMU Ministry). A health officer with several years experience would undertake a diploma course in health education at Tanga Medical Training Centre, established for this purpose. The health officer will be assigned to a teacher training college or ELIMU and will be required to train teachers for primary schools and also to see that the knowledge gained is passed on to schoolchildren and eventually disseminated to the masses.

### **Urban and Rural Fundis**

The role of the fundis in the sanitation sector is the construction of pit latrines. This cadre should be trained by vocational training centres as a part of the program in the building sector, with particular emphasis on pit latrine construction. Upon completion of the program, a fundi should be registered as a pit latrine builder and be responsible to the health officer, who should ensure that the standards are maintained. Failure to maintain the required standards should mean deregistration.

### **In-Service Training Seminars and Workshops**

If the implementation of sanitation programs is to be properly understood, seminars and workshops for all categories of personnel from the managerial level to the extension worker are essential. There is also a need to hold seminars and workshops to bring together management officials and policy makers and other community leaders in order to explain fully any points which may not be understood by any group and to create a better working climate.

### **Technical Assistance**

In order to improve the quality of life of all mankind, more developed countries should provide assistance to less developed countries, i.e., transfer of appropriate technologies to these countries by providing skilled personnel as teachers. These should

be properly oriented and provided with counterpart staff. Funds should be made available with which to set up training institutions. However, developing countries should not depend entirely on developed countries. They should pull together their own scarce resources and establish regional training centres and other institutions.

### **School Curricula**

School leavers in developing countries constitute a significant segment of the community. Most of these are absorbed readily in productive jobs and occupations. School curricula should be carefully redesigned so that a student leaving school is equipped with the appropriate knowledge and skill required to play a part in society, by disseminating the acquired information to the people.

### **Use of Public Communication Media**

Health education should also be made available to the people through mass media. Programs for radio and television should be introduced. Government and nongovernment publications and posters should also be employed to realize this end. In this connection extension officers should also play an important role, as teachers in this kind of education, by using films and other audiovisual aids. Because of their proximity to the people at the grass-roots level, they should be fully involved in the training process.

### **Manuals of Guidance**

There should be manuals of guidance for councillors and community leaders in the field of sanitation. These should be produced and reviewed from time to time in the light of low-cost sanitation recommendations.

## **Conclusions**

By implementing these training proposals during the Water and Sanitation Decade, it is anticipated that: (1) the majority of the people will be provided with good sanitation facilities by the year 1990; (2) water-based diseases, such as hookworm, typhoid,

dysentery, and cholera, will be greatly reduced; (3) well-treated and well-prepared excreta will be utilized as manure by peasant farmers; (4) biogas produced from excreta will be utilized to provide energy for households and for small-scale industries; and (5) average life expectation of the people will be increased.

# **Health Manpower Planning and Training**

**P. A. Chindamba<sup>1</sup>**

In Malawi, the Department of Personnel Management and Training deals with all major training programs in government and other related bodies. All ministries are required to make reference to this department for their training requirements. This department, therefore, acts as the Central Manpower Planning and Training Office.

Individual ministries, however, plan their manpower requirements according to their programs and activities that fall under their responsibilities. Likewise, the Ministry of Health, which is responsible for human health, has its own manpower development programs that are geared toward the improvement of human health. This paper, therefore, will deal mainly with health manpower.

## **Health Manpower Problems**

The problems involved in the task of making and keeping people healthy, either as individuals or as a community, overwhelm the resources available for solving them. Even in countries classified as rich or developed, the availability of adequate trained personnel, medical supplies, logistics, and other factors concerned with the delivery of health care services has always left plenty of room for further improvement. Of all of these elements, the health manpower problem is the most decisive, the most costly, and the most difficult to solve.

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<sup>1</sup>Health Superintendent, Ministry of Health, Lilongwe, Malawi.

In developing countries it is certainly the most challenging of the difficulties to be faced.

There was a time when it was thought that the health problems of developing African countries could be solved only by developing health services along the same lines as those in industrialized countries and, consequently, all attempts at encouraging indigenous health practices were frowned upon. After practical lessons learned through failures, it has been admitted that despite modern well-equipped health institutions, the health problems of the developing countries cannot be solved if the people, most of whom live in isolated rural areas, are not adequately covered with the appropriate health infrastructure.

## **Health Manpower Planning: Malawi Approach**

Very few countries, where large numbers of the sick people must be looked after, can afford to train and use specialized professional and technical health personnel in their health services. A natural development, therefore, has been to place emphasis on prevention and also defining the duties of personnel on the traditional health team, so that the few highly skilled and most costly professionals can delegate the less-technical aspects of their work to the auxiliary personnel who are in closer contact with the rural health problems.

This has led to a revolutionary concept in the composition of the accepted health team

and the training programs conducted locally and geared for the rural health situation. With this kind of approach, practically every health professional category has its auxiliary partner now trained locally. Even more significant is the fact that every community, particularly in the rural areas, is being motivated and trained to appreciate and manage its own health problems as advocated in the World Health Organization's (WHO) global plan of "health for the people, by the people." According to observations, this strategy has provided a breakthrough for many developing countries, enabling them to rise up to the task of providing the basic health services for their population by using their own human and other resources in association with the necessary appropriate technology.

In Malawi, there is the same spectrum of diseases that exists in other developing countries of the tropics. Most of these are preventable and arise because of the way in which people within the communities live, i.e., in the grip of unsanitary surroundings, poverty, and inadequate health knowledge.

There are also a number of other problems that plague health-care delivery services. One is the distribution of the population, 90% of whom live in rural areas and most of those in communities of under 1000 people. With such a pattern, it becomes immediately clear that there are limits to the health facilities one can provide for each rural community, bearing in mind the financial and trained human resources of the country.

Based on the above fundamentals, the Ministry of Health has accepted the practical view that a satisfactory and efficient health service can be provided by locally trained personnel. A systematic approach involves defining the health needs, determining the number of categories of personnel required, and defining the job assignments and the necessary training.

The ultimate aim is to have a manpower structure that is pyramidal, with large numbers of the least-costly trained personnel at the bottom and a few of the professionals at the top, so that the simple health problems are filtered out and handled by

lower-level personnel and the difficult problems are left to be dealt with by the highly trained cadres at the top.

### **National Health Plan**

When Malawi became independent, it introduced a 5 year health plan (1964-1969). Its major emphasis was on health manpower development. To illustrate this, training of health inspectors at the Malawi Polytechnic and state registered nurses at the Kamuzu College of Nursing was started for the first time in 1965.

Later, in 1971, a 15 year national health plan was drawn up that emphasized, among other things: (1) strengthening the preventive services, e.g., maternal and child health services; (2) health manpower development, e.g., introduction of local courses for various cadres; and (3) laying guidelines for providing health facilities, i.e., (a) population 50 000, primary health centre; population 10 000, health subcentre; population 2000, health post; (b) distance: 10 mi (16 km) limit between two health units; and (c) proposed staffing: health post: one maternal and child health assistant; health subcentre: one senior medical assistant, one medical assistant, two enrolled nurse/midwives, one health assistant, one homecraft worker; primary health centre: one senior clinical officer, one clinical officer, two medical assistants, one state registered nurse/midwife, three enrolled nurse/midwives, one senior health assistant, one health assistant, one community nurse; village level: cholera assistants and village health committees; district level (district hospital): two medical officers, two clinical officers, eight medical assistants, one nursing sister, one public health nurse, three staff nurses, 16 enrolled nurse/midwives, two health inspectors, one senior health assistant, two health assistants, one pharmacy assistant, one laboratory assistant, one dental assistant. This staffing pattern clearly indicates that there is a lot to be accomplished in terms of manpower development if the health plan is to be successful. To meet this commitment the Ministry of Health is using some of the following training programs:

(1) Training of doctors: There is no medical faculty or school in the country and there is not likely to be one in the near future. Therefore, all of the training in this field is done outside of the country. This program, however, is not without difficulties.

(2) Health inspectors diploma course: The Polytechnic College of the University of Malawi runs a diploma course for health inspectors. The duration of the course is 3 years.

(3) Training of health assistants: The Ministry of Health has a School of Hygiene in Zomba for training health assistants. The duration of the course is 2 years.

(4) Training of medical assistants: Medical assistants are required in large numbers and are used to give leadership to the health team at the health subcentre level. In the absence of enough medical officers, they are required to undertake the curative work load up to the district hospital level. They are trained for 3 years at the Medical Assistants Training School in Blantyre. The desired annual enrollment is 40 trainees.

(5) Training of clinical officers: Clinical officers fall between the doctor and medical assistant. They are trained for 4 years at the newly established Medical Auxiliary Training School in Lilongwe. The first group of 23 trainees graduated from this school in June 1980. Other courses offered at this school include those for laboratory assistants and pharmacy assistants.

(6) Training of state registered nurse/midwives: Since September 1979, this training has been run under the University of Malawi and is conducted at the new Kamuzu College of Nursing in Lilongwe, adjacent to the Kamuzu Central Hospital. The period of training is 4 years. The desired annual enrollment is 60 students.

(7) Training of enrolled nurse/midwives: These people are now trained at the nursing school premises in Blantyre, adjacent to Queen Elizabeth Central Hospital. The program consists of 3 years of general nursing and midwifery. The target enrollment is 60 students. This training is also conducted by a few of the mission hospitals.

(8) Maternal and child health assistants: These people are initially trained for 1 year by the Ministry of Agriculture, for community development activities, after which time the training is taken over by the Ministry of Health, which provides 2 months of training in maternal and child health activities, which includes training in nutrition and hygiene.

(9) Cholera assistants: This cadre will be dealt with in another paper.

(10) Primary health worker (and village health committees): This is a new training program which is just in its infancy stage. It too will be dealt with in another paper.

### **Impact of Training on Sanitation**

As is the case in most developing countries, well over 75% of the diseases that occur among the rural communities could be prevented through good sanitation. The Ministry of Health has, therefore, insisted that the promotion of good sanitation be the responsibility of every health worker. To this end, sanitation subjects are included in all of the training programs. Sanitation subjects are also included in training programs that are run by other ministries, e.g., the training of community development assistants, homecraft workers, and agricultural extension workers.

### **Conclusions**

At present, the population of Malawi is approximately 5 million and will reach 6.5 million by 1988. To meet the health needs of 6.5 million people, the projected number of health institutions of various categories required as per the 15 year national health plan will be: primary health centres, 130; health subcentres, 520; and health posts, 2080.

These figures indicate that the need for properly trained personnel will continue to grow in the future and, therefore, training programs will have to be continued and strengthened. It must be realized, however, that this task cannot be undertaken without

**proper management of available financial resources, which, unfortunately, are judged to be inadequate.**

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**This paper was compiled with some contribu-**

**tions from sections of the report from the National Primary Health Care Seminar held in Lilongwe, Malawi (30 October - 3 November 1978) and the report from the WHO National Health Planning Mission of 24 May - 18 September 1971.**

## **Software: Discussion**

### **Operation and Maintenance**

A comment was made that it was useful to have latrines smell because it would encourage people to cover them with lids and, therefore, they would not need the added expense of a vent pipe. This was strongly rejected because it was felt that people would not use a smelly latrine at all. Other methods such as using ashes to reduce odours were mentioned. The use of black pipes compared with using pipes of other colours is being researched in Tanzania and Botswana to see if significant airflow rate changes are observed.

Workable solutions for high water tables were discussed. The compost latrines are only 1 m deep and should not be allowed to get wet from groundwater seepage. There is still a problem with people not wanting to handle faeces, which can only be solved through education and informing them that the humus has value as fertilizer.

### **Disease Transmission and Groundwater Pollution**

Most of the discussion was centred on water contamination. The first question asked about solutions to the problem of high salt concentrations in a water supply. It was pointed out that salt removal is costly, high technology. Solar or other means of distillation may be feasible for small quantities of drinking water for humans only; cattle can withstand higher salt concentrations. Usually, another source must be found or a highly concentrated source could be mixed with another less-concentrated source to produce acceptable water in adequate quantities.

The complex issue of contaminated water and water supply in areas where water and funds are scarce was discussed further. An example from Ethiopia was used to illustrate the problem. Of 850 wells in Addis Ababa, 800 were closed due to their failure to provide water that met World Health Organization (WHO) standards. This led to a very expensive project that cost U.S. \$50 million to bring in water from other sources. The country could not afford this financial outlay and as a result water shortages and hardship were brought upon the people. An improvement in the situation may have been gained by installing properly built and used latrines. For Addis Ababa, the water brought in from outside was still contaminated because the water was accessible to contamination in the distribution system and the homes.

Instead of closing the wells and spending huge amounts of money on alternate sources, the money would have been better spent teaching the people the rudiments of sanitation and proper excreta disposal. Proper hygiene in the home is the basic issue. The applicability of WHO standards to these situations was thought to be doubtful.

Table 1. Rural sanitation personnel training levels.

Country	Title	Population served	Posting	Training	Entry qualifications
Ethiopia	Village health worker		Village health unit	3 months	Literacy
	Subdistrict health worker		Health care		8 years
	Sanitation		Awraja health centre	3 years	10 years
	Civil engineer			4 years	12 years
Tanzania	Village health worker	200-500	Village	3-4 months	Literacy
	Health orderly	2000	Ward	On-the-job	
	Health assistant	5000-10000	Health centre or division	2 years	Primary school (7 years)
	Health officer	20000	District health centre	3 years	Form IV
	Civil engineer			4 years	A level
Malawi	Primary health worker	200-500	Village	12 weeks (plus refresher)	Literacy
	Health assistant	10000 (area)	Health subcentre	2 years	Junior certificate
	Senior health assistant	50000	Primary health centre	Promoted health assistant	Junior certificate



	<b>Health inspector</b>	<b>District</b>	<b>District health hospital</b>	<b>3 years</b>	<b>O level</b>
				<b>4 years in future</b>	<b>A level</b>
<b>Botswana</b>	<b>Family welfare worker</b>	<b>500</b>	<b>Village</b>	<b>11 weeks</b>	<b>Literacy (7 years)</b>
	<b>Health assistant</b>		<b>Health subcentre</b>	<b>2 years</b>	<b>Junior certificate</b>
	<b>Health inspector</b>		<b>Regional health office</b>	<b>3 years (abroad)</b> <b>Abroad</b>	<b>O level</b>
<b>Lesotho</b>	<b>Village health worker</b>	<b>100-300</b>	<b>Village</b>	<b>2 weeks (plus refresher)</b>	<b>Literacy</b>
	<b>Health assistant</b>	<b>10000 plus</b>	<b>Health centre or hospital</b>	<b>2 years</b>	<b>Junior certificate</b>
	<b>Senior health assistant</b>	<b>10000-40000</b>	<b>District or regional hospital</b>	<b>Refresher courses (1 year)</b>	
	<b>Health inspector</b>	<b>40000</b>	<b>Regional hospital</b>	<b>3 years (abroad)</b> <b>Abroad</b>	<b>A level (COC)</b>

Notes: The University of Nairobi offers a 3 year course in civil engineering (entry qualifications: A level education). The course includes options in water and wastewater engineering. A diploma course (1 year) in water and wastewater engineering is available to graduate civil engineers. A Master of Science (2 years) in environmental health engineering is also offered.

The guidelines for building a latrine where groundwater is the water supply were reviewed. The safe distance from the latrine pit bottom to the groundwater table was suggested to be 1.5 m and the latrine should be about 30 m from the borehole.

### **Primary School Health Education**

The training of teachers and primary school education in Tanzania were discussed. All teachers receive training in health education but it is only part of home economics sessions given two periods per week. The instruction may be provided by a person from the Ministry of Health (MOH) but beyond this the relationship between the MOH and primary health education is tenuous. The primary role of the MOH is the provision of medical services, although in the future it is planned to provide schools with nurses who are health educators.

It was commented that sanitary facilities in primary schools in many countries are often inadequate. Proper latrines are usually provided but the lack of soap or water makes it impossible to provide a proper demonstration of hygienic practices. Sanitation is given too low a priority. The lack of health inspectors to visit homes and schools does not promote reinforcement of the principles learned at school by the children. There is a need for syllabi to be drawn up by both the Ministry of Health and the Ministry of Education, working together with parents to draw up an effective local program.

### **Ministry of Health Education**

The first stages of the discussion were concerned with health personnel organization in each of the countries. Table 1 identifies positions and responsibilities within each country.

Radio programs were used to disseminate information. There was a general feeling that the programs were listened to with beneficial results; however, only limited audiences could be reached due to the many different languages within each country.

The need for evaluation units to assess health programs and provide feedback was emphasized.

### **Social Aspects and Community Participation**

The representatives from Botswana were asked for their overall impression of the success of the toilets being tried. Where health assistants were working with the community the units were working well. Any change from old habits will have problems of acceptance but these can be lessened by the manner in which the change is introduced. Toilets that can be emptied are necessary in urban areas and are most practical on a long-term basis.

In order for the technologies to be accepted, it is essential to involve the community headman. He should be educated to the problem and then help to introduce the change rather than using an educated outsider who will be regarded with suspicion. In this way the headman will be responsible for motivating the people. The traditional healer must also be included in the planning. It was commented that effective community participation comes

about when the health worker or engineer knows the people and the people have been educated as to their needs. Then, the entire community and health personnel will be working toward a common goal.

In Malawi, the primary health care worker is chosen by the community but a desire for upgrading causes them to leave the villages for more lucrative positions in urban centres. It was noted that the number of workers doing this was not high at present. No solutions to this problem were brought out.

It was suggested that an element of force may be required for the people's own good. It was countered that direct force is not usually successful and that a strong state organization would provide the force of social pressure.

The training of engineers or other personnel should not take place outside the country. If this is not possible the training should at least be given within Africa. The emphasis placed on engineers was thought to be too high: in urban areas only one engineer is needed for 10 000 people, whereas in rural areas the engineering requirements drop to one engineer per 100 000 people. For every engineer, however, about 100 technicians are needed. It was also mentioned that engineers should have a greater knowledge of public health engineering.

The discussion then moved to the relationship between sanitation and development. Funds for sanitation and water supply are in competition with funds for agricultural and industrial development. Sanitation is a component of agricultural and industrial development in terms of lost man-hours and the cost of medical treatment but it does not directly produce any output. It was commented that diversion of resources to sanitation at the initial stages produces immediate benefits of a healthful existence to the population while they grow in other areas of development.

# Training of Civil Engineers in Kenya

J. Gecaga<sup>1</sup>

The Department of Civil Engineering is one of the oldest departments within the University of Nairobi, with records dating back to 1956, when it was then part of the Royal Technical College of Nairobi. The 3 year Bachelor of Science (B.Sc.) program that is offered forms part of the professional engineer's education (which consists of a university course plus 3 years or more of apprenticeship and training). A B.Sc. is the basic acceptable academic qualification required for registering as a graduate engineer with the Kenya Engineers Registration Board. The industrial training of graduate engineers is carried out by industry. The primary employers of civil engineering graduates include the Ministry of Works; the Ministry of Water Development; municipalities; and consulting and contracting firms. Since the establishment of the degree course, the department has produced over 600 graduates up to 1979; over half of them Kenyans. The current average annual output is between 50 and 60 graduates.

Due to an acute shortage of specialists in the fields of water supply and sewage disposal, the department has embarked upon the following postgraduate programs: a Master of Science (M.Sc.) program in environmental health engineering and a postgraduate diploma program in water and wastewater engineering. Postgraduate work in other areas has been carried out mainly through research and the writing of a thesis. Several postgraduate programs involving

coursework, examinations, and preparation of a thesis are planned for the future in other disciplines.

This paper will examine some of the design criteria and constraints in the development of civil engineering training programs in developing countries, with particular reference to Kenya. Emphasis will be placed on the training of professionals in the fields of water supply and sewage disposal.

## Undergraduate Curriculum

The design of undergraduate engineering curricula has received considerable attention within Europe but there appear to be few criteria for the design of curricula within developing countries. If curricula are designed on purely educational criteria, then little attention need be paid to any difference that may exist between industrialized and nonindustrialized countries. If, however, engineering graduates are expected to play a major role in the technological development of developing countries, then curriculum design must be subject to engineering as well as education criteria. Thus, it is important to examine the relevant engineering industry and the directions it may take within the next 5-10 years.

It is worthwhile to examine the type of engineering education given at universities. In general, engineering curricula are modeled after those found in Europe. When the Department of Civil Engineering was started in Nairobi, it was, in fact, offering external degrees of the University of London.

<sup>1</sup>Lecturer, Department of Civil Engineering, University of Nairobi, Nairobi, Kenya.

Since that time, the format has not changed significantly. In general, little attention is given to design, i.e., the creation of structures to fulfill a function. The implicit objective of university courses seems to be the production of researchers. The appointment and promotion of staff is based upon research criteria and it is almost impossible to appoint experienced engineers because they seldom have research qualifications. The objective is, naturally, to emphasize the importance of research to the role of the university. As long as this continues to be the primary objective, it will be very difficult for engineering faculties to take into account the needs of the engineering industry when designing their curricula. It is worthwhile, therefore, to examine the differences between science and technology and the application of research-oriented motivations to the needs of developing countries.

The objective of science is the furtherance of knowledge. Its methods are analytical and its central theme is research. The end product is a research paper, after which the scientist has no further responsibility. A good research paper, adding to existing knowledge, brings kudos to all concerned, even if the knowledge is of *no* practical value.

Technology, on the other hand, is concerned with designing, constructing, and maintaining objects that will serve the people. The methods are synthetic, in the main, and the central theme of technology is design. The technologist is also concerned with the economics, utility, and management of projects. The technologists responsibility ends when the project is completed and functioning properly.

This means that the motivation of a technologist is quite different from that of a science and engineering graduate who is given a largely analytical education and emerges with the approach of a scientist. If adequate industry does not exist to re-educate these graduates, this attitude will remain and the engineering graduates will find it difficult to execute projects. The civil engineer in a developing country covers a wider range of subject matter (because there are few specialists) but generally in less

depth (because there is less sophistication) and must possess considerable knowledge about materials (because the supporting industries providing these materials are usually very poor in terms of quality control). Designers in developing countries, therefore, if they are to use locally available skills and maximize the use of local materials with poor quality control, must take this into account when designing projects. This is more difficult and time consuming than creating designs for use by highly skilled technicians using good-quality materials. It is probably for this reason that overseas consultants prefer to use international contractors and imported materials, if possible.

The analytically trained graduates currently emerging from universities cannot execute projects without sound practical training and it seems fairly certain that facilities capable of providing such training are inadequate and are decreasing in number. The long-term consequence will be poorly trained engineers, considerable wastage of money, and, probably, an increasing number of unemployable graduates.

#### **Current Method of Producing Professional Engineers**

The student who is admitted to the Department of Civil Engineering at the University of Nairobi is exposed to a reasonably wide and sound analytical engineering education. During vacation periods, the student may or may not be able to obtain employment within engineering firms. In recognition of the need for practical training in engineering education, the 4th practical training term was introduced to act as a basis upon which future practical training could be developed. Due to a lack of facilities and staff, however, this objective has not been achieved.

After successful completion of the degree course, the graduate engineer joins industry to receive practical training. In some cases the graduate undergoes well-organized and well-supervised practical training; in other cases the training may be haphazard or non-existent. Regardless of the quality of the

practical training received, the graduate's immediate goal is to pass the professional interview for registration or for corporate membership in a professional body in the shortest time possible. In many countries, including Kenya, the shortest period during which the graduate is expected to have acquired the necessary practical experience for registration is 3 years.

Because this method of producing professional engineers has been operating in Kenya for some time, it is possible to determine the degree of its success. In this method the employer is responsible for providing the necessary practical training and developing the graduate engineer according to the requirements of the industry. In some cases, however, the employer may not be equipped to provide adequate training facilities and an effective continuous assessment system to ensure proper utilization of the training period. As a result, cases of graduates who have spent 3 years in the field and cannot produce a technical drawing they can call their own are quite common.

### **Integrated Engineering Training**

In general, integrated engineering training may be achieved by either incorporating the practical training component into the undergraduate course, thereby lengthening the duration of the degree course, or by introducing academic sessions during the postgraduate training period.

#### **Introduction of Practical Training into the Undergraduate Course**

In this system of engineering education, practical training is considered as an integral part of the undergraduate program. After a certain period of academic training, students are assigned to industries to receive practical training. Guidance and supervision are undertaken by staff from the university and industry. The practical training is assessed and considered as part of the degree course. The practical training periods are organized such that the training is related to the subjects already covered in the academic course. The length of the practical training periods allows for sufficient cover-

age of practical aspects of the academic subjects already covered.

The advantages of this method are: (1) undergraduates undergo a streamlined practical training program where close supervision, proper guidance, and assessment of the quality of training are ensured; (2) each undergraduate has the opportunity to get involved in a variety of schemes; and (3) the graduate is able to adjust to the requirements of industry relatively quickly due to the experience gained during the practical training period.

The disadvantages of this method are: (1) the length of time required to obtain the degree would be increased, thereby implying that the time (and hence financial) input toward producing a graduate would be high; (2) it is difficult to find industries with suitable practical training facilities and training officers; and (3) undergraduates are normally concerned with passing their examinations and, therefore, tend to view the practical training exercises for their academic value rather than how they relate to future practical applications.

#### **Introduction of Academic Sessions into the Postgraduate Training Period**

In this system, the undergraduate undergoes the usual academic training in the university and after graduating joins industry for practical training. During the practical training period, the graduate would attend courses offered by institutions either during evenings or for full-time periods, each of which may last several weeks. These courses would normally be designed to expose the graduate engineer to the latest techniques of the profession. The courses may be general or specialized in nature.

The advantages of this method are: (1) the graduate engineer is more professionally mature at this level of training and appreciates the necessity of acquiring new techniques; and (2) the graduate is able to appreciate and discuss case studies more easily as a result of having been involved in similar projects during the practical training period.

The disadvantages of this method are: (1) not all graduates are likely to have the same

experience base; (2) many industries would not be anxious to part with graduates for extended periods of time once they have started being productive; (3) organization for such courses is difficult because experts from many fields would normally be required for the courses to succeed; and (4) because examinations, based on course material, cannot be given easily, there is a likelihood of laxity developing on the part of the graduates.

### **Specialized Training in Water Supply and Sewerage**

In 1970, the Kenyan government established a goal of bringing the benefits of a safe water supply, sufficient to meet the requirements for livestock and domestic consumption, to the entire population by the year 2000. By 1977, about 30% of the entire population had access to an improved water supply. The total water development expenditure in the current development plan (1978/79 - 1982/83) is estimated at K£200 million (U.S.\$548 million). Although this target may not be achieved, it shows the government commitment to this basic infrastructure.

The ministry's total manpower requirements, excluding casuals and trainees, are projected to increase from 7800 to a staff of 14 110 over the same period. The key cadres in which there will be major increases are engineers, geologists and hydrologists, accountants and personnel staff, water inspectors, water bailiffs, surveyors, and many subordinate staff categories including, in particular, patrolmen, pump attendants, water operators, drivers, artisans, clerks, storemen, water guards, and mechanics.

### **Courses Offered Within the Department of Civil Engineering**

#### **Undergraduate Courses**

During the undergraduate program

previously described, the following basic courses are offered as components of the B.Sc. degree: hydrology and public health engineering; and public health engineering II, which includes microbial processes, chemical processes, and physical processes as related to water supply.

#### **Postgraduate Courses**

The department is currently running two courses in the field of water supply and wastewater disposal: a 2 year M.Sc. course was started in 1976 and a 1 year diploma course in water and wastewater engineering was started in 1979. There are 17 students currently registered in the two courses.

#### **Ongoing Research**

With the assistance of several donor agencies, the department is involved in the following research activities: slow-sand filtration; stabilization ponds; defluoridation; and solar distillation. Both staff and students participate in the research work.

### **Conclusions**

In designing a curriculum for both undergraduate and postgraduate studies, it is essential to make a thorough appraisal of the country's level of technology and its specific requirements in terms of manpower. Failure to do so may result in the training of personnel who contribute very little to the technological development of the country, in spite of the relatively large financial investments required for university education. Also, efforts should be made to incorporate practical training into all levels of university education because the graduates are, in most cases, expected to become productive very soon after graduation.

# Sanitary Engineering Education in the Faculty of Technology, Addis Ababa University

Alemayehu Teferra<sup>1</sup>

## Historical Background

The Faculty of Technology (formerly the College of Engineering), recognizing the importance of sanitary engineering, offered a three-credit course known as "water supply and sanitation" for 1 academic year in the final year of its Bachelor of Science (B.Sc.) civil engineering program, which was formally started in 1955. The first civil engineering graduates had about 100 h of lectures in water supply and sanitation. Because of the lack of laboratory facilities, however, the lectures were not supplemented with practical training. As part of the program, students visited water treatment plants but because the city did not have a sewerage system, the students did not have the opportunity to inspect a sewerage treatment plant.

## Present Situation

After the faculty moved to its present campus, in 1969, its curriculum was revised for a second time, in 1975. The time allotted to sanitary engineering courses within the framework of general civil engineering education was increased at this time.

At present, the Faculty of Technology offers to third year civil engineering students

a one-semester, three-credit course in water supply and sewerage. Beginning in the fourth year, all civil engineering students will opt either for hydraulic engineering or structural engineering. Those students opting for hydraulic engineering would be required to take a three-credit course on water supply and treatment in the first semester and another three-credit course on sewerage and sewerage treatment in the second semester of the final year.

Because of the lack of laboratory facilities and technicians in the field of sanitary engineering, laboratory training is limited. In order to alleviate the serious shortage of sanitary engineers, a sum of U.S.\$340 000 has been placed at the disposal of the Faculty of Technology to establish a sanitary engineering laboratory under the auspices of the United Nations Development Programme - Ethiopia Technical Assistance Program. This favourable condition encouraged the faculty to include a sanitary engineering option within the framework of its graduate program, which began in September 1979 in the Civil Engineering Department. The courses offered include sanitary chemistry and biology, advanced water treatment design, design of water supply and wastewater systems, a sanitary engineering laboratory course, and advanced sewage treatment. Depending upon the success of staff development and the amount of additional funding available to expand the laboratory facilities, the faculty hopes to open a Department of Sanitary Engineering in the very near future.

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<sup>1</sup>Dean, Faculty of Technology, University of Addis Ababa, Addis Ababa, Ethiopia.



## The Training of Health Inspectors in Malawi

P. A. Chindamba<sup>1</sup>

When Malawi became independent in 1964, it introduced a 5 year health plan (1964-1969). This health plan placed emphasis on health manpower development and, consequently, the training of health inspectors, among others, was started in 1965.

Before this course was started, the only health inspectors in the country were those who manned the three regional health offices in Blantyre, Lilongwe, and Mzuzu (Mzimba) and the School of Hygiene. These were all expatriates. Environmental sanitation work from the district level downwards was the responsibility of health assistants.

It, therefore, became compelling for the Ministry of Health, in conjunction with the University of Malawi, to start the training of health inspectors. It was realized that unless there was a cadre of health personnel well trained to effectively deal with the problems of sanitation, it would be difficult to fulfill the objective of the country's health policy, which was "to raise the level of health of all of its people through a network of sound health facilities capable of promoting health; preventing, reducing, and curing disease; protecting life; and promoting general well-being and increased productivity."

In most developing countries, despite relatively good geographical coverage of curative care, the fact remains that most of the commonly treated ailments at rural

dispensaries stem from the almost complete lack of basic sanitary measures. For example, many children between the age of 1 and 17 years suffer from intestinal parasites, and this is a direct result of poor sanitation.

The present disease pattern has necessitated that the work of the environmental health staff be of wide application and varied, thus calling for very extensive training. Health inspectors have the enormous task of trying to improve the health of the people by raising their standard of hygiene and sanitation. They are concerned with the improvement of housing, protection of water sources from contamination, eradication of disease-carrying vectors, hygiene of food, programs encouraging the use of latrines, and many other problems. In fact, they are concerned with almost everything that even remotely affects the prevention of disease and promotion of good health.

### The Course

Two types of health inspector courses are conducted within the country: the diploma course in public health inspection and the certificate course in public health inspection.

The diploma course is of 3 years duration and entrants to this course must have completed 4 years of secondary school education and have obtained the required minimum entry qualification, which is a

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<sup>1</sup>Health Superintendent, Ministry of Health, Lilongwe, Malawi.

Malawi Certificate of Education or its equivalent, with good grades in science subjects as well as English and mathematics. The annual enrollment varies between 10 and 16 students. Selection for this course is carried out by the University of Malawi in close liaison with the Ministry of Health regarding the numbers required for enrollment.

The certificate course is of 2 years duration. This is an upgrading course and entrants are qualified health assistants who have served for not less than 2 years and have acquired the minimum entry qualifications for the course. Selection for this course is carried out by the Department of Personnel Management and Training on behalf of the Ministry of Health. The average annual enrollment is 10 students.

### **Course Content**

The diploma training course is based on the Royal Society of Health Diploma and includes the following subjects: sanitary engineering, mathematics, physics, chemistry, biology, microbiology, building construction, public health administration, English, social studies, food hygiene, infectious-disease control, and hygiene of buildings. In addition, the student receives 4.5 months of practical training during each of the second and third years when they are assigned to central and local government departments.

### **Output**

Since the training of health inspectors began, 6 diploma courses have been conducted, producing 69 diploma health inspectors, and 3 upgrading courses have been completed, producing 32 certificate health inspectors, giving a total of 101 graduates. Of this figure, about 66% are in the Ministry of Health, 18% in the local government, and 16% in the private sector.

Training programs such as these are largely dependent upon and affected by whatever financial resources are available. In this regard, since 1978, when the last group of diploma health inspectors qualified, there have been no further graduates to date. Plans are under way, however, to resume the course in 1981.

### **Conclusions**

It is considered that the training of health inspectors in Malawi has been a great success and has had a remarkable impact on the delivery of health care. Their role as initiators, as well as custodians of good health practices, has been felt by a good percentage of the rural communities in various circumstances. Special programs such as maternal and child health (MCH), tuberculosis control, leprosy control, and health extension have benefitted a great deal from the services of health inspectors. It is the ministry's wish that the enrollment in this course increase so as to be able to cover the rural communities effectively.

# **Training of Health Assistants in Malawi**

**G.P. Malikebu<sup>1</sup>**

The training of health assistants in Malawi dates back to the 1930s. During the 1930s these health personnel were known as sanitary inspectors. It seems that the sanitary inspector used to enforce sanitary regulations within the villages, particularly the digging of latrines. It is often alleged that these inspectors used to dip sticks into the latrines to determine whether or not they were being used. The owners of those found not in use were brought to court and fined. There is no mention of any form of participation by the community/villagers in the entire exercise, except their being told to dig latrines and use them. Obviously, these sanitary inspectors became very unpopular within the villages and during the struggle for independence, attacks on the methods employed by inspectors in implementing hygiene were among the grievances voiced at rallies.

The present duties of health assistants include: inspection of domestic houses, factories, government buildings, public buildings, and housing estates; inspection of meat and other foods at markets (local villages), shops, and canteens; ensuring that immunization of children under 5 years of age and international travellers is carried out, as well as overseeing immunization campaigns and programs; maintaining control of communicable diseases; providing health education in schools/training centres, to hospital outpatients and in-

patients, and to villages (health committees); and protection of drinking water supplies. The training of health assistants has been geared not only to conform with these duties but also to prepare the students for any other public health activity which may crop up in the future, either in the form of campaigns, projects, or programs.

## **Syllabus**

Topics covered in the training of health assistants include: prevention of disease; water supplies; sanitation; refuse storage, collection, and disposal; vector control; malaria control; disinfection; health education; statistics; offensive trades; anatomy and physiology; nutrition; food hygiene; food and meat inspection; lighting; air and ventilation; village housing and planning; inspections and reports; building construction; and office organization.

## **Candidates**

Candidates suitable for training as health assistants are required to be male persons not more than 25 years of age and have a Malawi Junior Certificate (or 2 years of secondary school education) or its equivalent, with passes in English, mathematics, and general science or physics with chemistry and biology (in addition, any person with relevant experience in public health work is also considered).

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<sup>1</sup>Acting Principal (School of Hygiene), Ministry of Health, Zomba, Malawi.

## **Training**

Training takes place at the School of Hygiene in Zomba. The duration of the training is 2 years. There is also a period of 6 weeks for practical fieldwork, during which students are assigned to work with experienced health assistants who are under the supervision of a health inspector. During this period, the trainees gain some insights for their future careers. Activities during fieldwork cover such jobs as water protection, building construction, immunization, disinfestation, health education, meat inspection, premises and village inspections, and routine office work.

## **Evaluation**

At the end of their course, the students take their final examination. The examination board is set up/chaired by the chief health inspector, with representatives from the University Polytechnic, local government (council), and the Ministry of Health. The principal acts as the secretary. This

board sets the examination and invigilators are appointed to supervise the examination. The successful candidates are awarded the Ministry of Health, Health Assistant Certificate.

## **Future Prospects**

Health assistants have only two ranks, that of technical assistant and senior technical assistant, but any health assistant who studies privately and succeeds in obtaining relevant subjects at the ordinary level gets selected for a 2 year upgrading course which is offered by the University Polytechnic and qualifies one for promotion to the T/O level. From there they could become a health inspector.

## **Tutors**

Some subjects are covered by experts in those fields but the basic public health subjects are taught by experienced health inspectors who have had many years of experience in the field.

# **Training of Primary Health Care Workers: A Personal Account**

**Fred K. Bangula<sup>1</sup>**

Primary health care is a practical approach to making essential health care services accessible to individuals and families in their community in an acceptable and affordable way. This is accomplished with the full participation of the community, a process in which individuals and families can assume the responsibility for their own health and welfare and for that of the community.

The primary health care approach has evolved over many years, partly in the light of experience, both positive and negative, that has been gained from knowledge of basic health services in a number of countries. It means much more than the mere extension of basic health services, however, primary health care has a social and developmental dimension that if properly applied will influence the way in which the entire health care system functions.

## **Primary Health Care in Malawi**

Malawi is carrying out primary health care services through established and existing health programs such as tuberculosis control; leprosy control; an expanded program on immunization; and most important of all, the maternal and child health program. Through the maternal and child health program, static, as well as mobile, prenatal and under 5 years of age

clinics have grown and have been established throughout the country. In Malawi, the number one priority is rural development, i.e., to deliver to villagers the basic services that they need. Hence, the main objective of the Malawi primary health care concept is to make basic health services available to everyone.

Before proceeding further, I would like to elaborate on my practical experience in the field of primary health care. After working in my district for nearly 3 years, I was instructed by the Ministry of Health to begin a primary health care program. This program, in which sanitation was to be an integral part, was to be based on an integrated basic service approach and include other government ministries. Previous experience in other related health programs has indicated that primary health care depends largely upon community participation. Furthermore, when sufficient time is taken to clearly explain activities in detail from the outset, village communities respond and assume their responsibilities and participate fully.

The first task, therefore, was to establish a dialogue with the community leaders to discuss health and sanitation. In this regard, the district development committee was approached and with these community leaders forming the committee, health and other disciplines, such as agriculture, community development, and education, and traditional leaders were integrated. This committee reviews and decides upon all development activities that need to be carried out within the district. It was during

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<sup>1</sup>District Health Inspector, Dowa Hospital, Dowa, Malawi.

our dialogue that a better understanding of the communities' views, the reasons for their views, the level of their aspirations, and the pattern of their organization and communication was acquired.

Three program areas were selected in my district and the planning started in May 1979. Under the supervision of the district development committee, three area health committees and 28 village health committees were formed. The health committee members were elected by their own community and were given the responsibility of working with the district health staff in leading, guiding, and helping in all aspects of health improvement. To promote community participation, every endeavour was made to obtain the cooperation of the community leaders so that public opinion could be led in a positive direction.

The next phase of the plan was to carry out a sanitation survey. The survey would provide the necessary information about the current level of village sanitation and would be a basis for future planning for training primary health care workers. In 6 weeks, three selected areas were covered on a house to house and village to village basis. The sanitation survey revealed that although community participation in self-help projects for communal use, such as schools, churches, clinics, and roads, was excellent, household development measures, particularly pit latrines, were not up to the same standard. The building of pit latrines using locally available materials is a very economical and efficient way to dispose of excreta and prevent the spreading of communicable diseases. This makes them very important for sanitation purposes. Previous efforts to encourage the use of pit latrines, however, have been inadequate. Pit latrines were often built following official direction without explanation. People were not made to understand the value of the latrines nor their role in preventing transmissible diseases. In other words, the reluctance to build pit latrines was not due solely to technical reasons, but was due to a lack of proper health education to influence the change of cultural traditions toward adopting pit latrines. Official direction to

build pit latrines without health education as a guide did not work. Similarly, the lack of health education in many countries has contributed to the fact that: (1) some children are malnourished even though nutritious food is found growing in their area; and (2) some communities are suffering from easily preventable diseases. The need for community health education led to the development of the third phase of the primary health care program. At this stage, activities centred around health education.

### **Development of Training for Health Committees in Dowa**

There are four main levels upon which the training program is focused: the village, rural health post, health centre, and the district hospital. Of these four levels, the village is the most important. It is at the village level that the village health committee functions, representing the point of contact between the health staff and the local community. The four main responsibilities of the village health committees are: (1) to identify community health needs or problems; (2) to interpret health programs; (3) to support and assist in carrying out the community health education program; and (4) to initiate and support the carrying out of self-help projects or programs.

The training of the village health committees was very informal and was aimed at preparing them to stimulate individual efforts toward observing sanitary precautions.

The primary health worker works very closely with the village health committee and gets support both from other health workers and from the committee itself. Therefore, in order to make village health committee members conversant with the work of the primary health worker, they are given orientation training in all aspects of health and sanitation, which the primary health workers also cover in their training. In addition, training reemphasized their responsibility to keep the local population informed of disease prevalence and to report

health problems promptly to the nearest health centre. Like many countries, however, Malawi needs to expand health education by concentrating on the primary health care workers training program. It is through the primary health care worker that the gap, wherever it exists, between the trained and qualified health staff and the people in the rural areas can be narrowed.

The district hospital will be an overall management and supervisory body of primary health care services. The government medical officer of the district will act as the head and be assisted by the district health inspector. The staff at the health centre, in addition to their normal curative, preventive, and promotive services, will supervise and support the primary health care worker in the field. The primary health care worker is the final link in the chain and will work hand in hand guiding and supporting the village health committee and the villagers themselves.

### **The Training of Primary Health Care Workers**

In considering a training program, two questions immediately come to mind: (1) Whom should you train? (2) How should you train them? In attempting to answer these questions, it was decided that the training program should aim at training members of the village community. In this way, the knowledge and skills they acquire during the training sessions will be used to promote and maintain the health of members of their own community, as well as to give relief during emergencies and for minor ailments.

The training of primary health care workers will not be uniform; much will depend upon the particular form of primary health care to be delivered. The primary health care workers, the skills these workers will require, and, therefore, their training will vary throughout the country and throughout the world. For our program, both the primary health care workers and the village health committees will be trained in a manner that will enable them to adequately respond to the tasks that will be

asked of them. Regardless of their level of skill, however, it is important that they understand the real needs of the community and that they gain the confidence of that community. This implies that the primary health care worker should reside in the community in which they are to serve and preferably be chosen by that same community.

A primary health care worker, who is elected by the health committee and lives within the community, should be given short and simple training. For cases where some primary health care workers may not like to remain away from their village for too long a time, particularly if they are attending a residential course, it is suggested that the training for a residential course not be more than 1 week and not more than 3 weeks for a nonresidential course. In essence, although an instructional program for a primary health care worker should answer the village health problems, it may not, at the beginning, be structured to respond to all of the identified village health problems. The training can gradually be extended over the years to cover additional tasks as required. This, of course, is built on a foundation of knowledge and skill that the primary health care worker has previously gained.

### **Designing a Curriculum for Primary Health Care Workers**

In designing a curriculum for a training program in areas or in countries where such a program does not already exist, it is of vital importance that a preliminary investigation within the area be carried out, as was done in Dowa. The investigation should determine: (1) the health needs of the community; (2) the target of health care; (3) the available human and material resources; and (4) the local traditions and occupations.

All of these factors and many more will influence the instructional situation of the primary health care worker and help him/her to prepare for the kinds of activity that will respond to the expressed needs of the community. For example, from a health survey the following could have been identified as village health problems: (1)

poor environmental sanitation; (2) poor family health care; (3) lack of community participation; and (4) the presence of communicable diseases.

From these identified village health problems, one could draw up job responsibilities for the primary health care worker as follows: (1) improve the environmental sanitation of the village; (2) improve the family health care services; (3) mobilize the community to take action to improve and maintain their own health; and (4) control communicable diseases.

Under each of these job responsibilities one can draw up several tasks that need to be carried out by the primary health care worker, the sum of which may be beyond his/her capabilities. It follows, therefore, that a planner of an instructional program should structure the program to be both meaningful and relevant. It is very important that a curriculum not be overloaded and should impart only simple, practical, and precise knowledge so that the skills can immediately be put to use. Therefore, an instructor will have to be selective in choosing what to teach the primary health care students. For example, in Malawi the national syllabus for the training of primary health care workers has recently been completed. The syllabus endeavours to respond to nearly all village health problems, both simply and concisely, by dealing with the following eight topics: (1) care of children under 5 years of age; (2) promotion of proper nutrition; (3) prenatal, maternity, and postnatal care; (4) control of common diseases; (5) sanitation; (6) first aid; (7) basic oral health care; and (8) rural development.

### **The Training Environment**

The success of a training program depends to a large extent upon its organization. Instructors should try to live a rural life with the primary health care trainees because cordial relations between the instructor and the trainee are essential. Instructors should be easily understood and friendly, with qualities that enable them to

inquire about the needs of their students, including the trainees reactions to the course, to the meals, and to other matters. In addition to the coursework, there should be free time for recreation in the evenings for the residential courses.

### **Instructional Program Evaluation**

Program evaluation is one of the most important parts of a training program. It can be broadly categorized into classroom and on-the-job field evaluations. In the classroom, trainees are asked to answer questions or to carry out demonstrations at the end of each teaching session to give instructors an opportunity to evaluate the knowledge and skills gained during the training. In the field, instructors or supervisors make visits to the village in which the primary health care worker is stationed. Such follow-ups will reveal what the graduate primary health care worker is doing, what she/he is not doing, or what they are not doing well. Consequent to the follow-up, additional training or refresher courses can be planned accordingly. Program evaluation is also of vital importance to the instructors themselves, as it affords them the opportunity to make adjustments to existing and future instructional programs.

### **Conclusions**

To ensure that the expectations of the primary health care worker are fulfilled, the traditional hospital orientated curative outlook must embrace this comprehensive approach. Supervisors must keep in close communication to meet the needs of the primary health care worker or community interest and participation may dwindle and reduce the program's effectiveness. The training, and subsequently the work of the primary health care worker, rests upon proper coordination and support from all levels; be it from the Ministry of Health or from any other discipline with whom the common goal of human development is shared.



## Brigades in Botswana<sup>1</sup>

Developing countries normally give priority to educational programs based on Western European practice. The objectives of these programs are eradication of illiteracy and creation of a well-educated minority with an urban orientation. This type of educational system has achieved much but has created problems for the emerging states of Africa. One disadvantage has been the removal of the spirit of self-reliance, self-confidence, and independence that may occur when rural connections are severed, or when opportunities for achievement are limited.

The brigade movement of Botswana, which began in 1965 in Serowe, is a unique attempt to overcome some shortcomings of the formal education system. The fundamental principles of the movement are: (1) provide vocational training for primary school leavers outside the formal education system; (2) gear training primarily to the needs of the local area: the general aim of rural development is to be achieved by offering training for gainful employment; (3) combine training and productive work so that the sale of produce is used to help cover costs of training (the principle of "cost-covering" applies to recurrent costs such as production costs; overheads, such as administration and marketing; training expenses; and depreciation); and (4) ensure that academic and vocational training lead to the adoption of development-oriented values, attitudes, knowledge, and skills.

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<sup>1</sup>The subject of BRIDEC was discussed by Martin Madzonga. This short note is based on edited excerpts from *Botswana's Brigades*, published by BRIDEC, Ministry of Education, 1979.

### Financing

Botswana's brigade centres are independent and legally autonomous units. They have always needed to be financially viable. Because of this fact, brigades have had to look for much funding outside of Botswana. Sources of capital funding can be classified into two general groupings: (1) internal sources generated by brigades themselves from successful commercial activities; and (2) external agency grants or loans to the government for the brigades (e.g., Mennonite Central Committee, Novib, Hivos) — procedures have been developed by the National Brigade Coordinating Committee, Secretary of the Ministry of Education, to process requests by individual centres for capital assistance. Project requests fall into one of three categories: (1) self-supporting projects where no government assistance is required; (2) projects where government approval in principle is required in order for the brigade itself to obtain donor funds; and (3) projects which require government technical or financial assistance.

### Training

Although the ultimate aim of the brigades has been rural development, the vehicle has been vocational training. Unlike European or North American countries where technical/vocational education is directly state-supported, the brigades have attempted to cover their training costs through the production of goods or services.

The original training-production time formula remains 20-80%, e.g., the equivalent of 1 day/week is reserved for "training."

Here, training is used in the restricted sense of academic upgrading and trade theory. Academic subjects such as mathematics, English, development studies, and science may be studied in the classroom up to 4 h/week. Trade theory lessons are reinforced with up to 1.5 days/week of practical applications in the workshop or practice yard.

However, training for most brigades has been interpreted to consider production as on-the-job training. For many brigade managers, training and production are inseparable. Many positive values and attitudes can be learned from production.

Training for textile brigades lasts 1 year; for farmers' brigades, 2 years; and for the rest (builders, carpenters, mechanic-fitters, electricians, plumbers, etc.), training for 3 years culminates in the appropriate government trade test. In 1979, brigade centres had 1282 trainees in the following categories: builders 552, carpenters 162, textiles 94, mechanical 101, electrical 38, farming 63, plumbing 3, drafting 6, catering 12, advanced farming 20, advanced building 30, bookkeeping 21, leatherwork 36, printing 7, forestry 22, and others 115.

Brigade training can be considered successful by (at least) two criteria: large numbers pass the relevant trades tests at the end of their training; and employment rates of graduates, notably in the construction trades, are quite high. Nevertheless, there are a number of difficulties in attempting to provide more efficient training. This is where the government's role comes in.

### **Role of Government**

Since its inception, the brigade movement has enabled a large number of young people to acquire skills and to feel that they are making a constructive contribution to the development of Botswana. At the same time, brigades have been labouring under a number of handicaps. One serious problem has been the relegation of training to a secondary position, as compared with production, because of the need to cover costs.

The government recognizes the important part brigades are playing in national development, especially in rural areas where many of the skills taught were previously almost totally absent. Particularly since 1974, the government has made a concerted effort to support the further development of the brigade movement, primarily by attempting to raise training levels. This supportive effort is concentrated in five main areas: (1) provision of funds for certain categories of approved capital projects; (2) annual training subsidies to certain brigades; (3) appropriate upgrading courses for brigade staff; (4) development of suitable curricula for the different types of brigades; and (5) inspection and advisory reports on the activities of individual brigade centres.

### **Brigade Development Centre (BRIDEC)**

If the brigades are going to continue to be able to contribute to Botswana's development goals, it is important to increase the quality of training and production within the brigades. The fundamental approach to raise the quality of training and production is to upgrade the professional and administrative staff. To solve the need for continuously upgrading brigade personnel in all categories, a Brigade Development Centre (BRIDEC) is being built in Gaborone. The main objectives of BRIDEC are to: (1) act as a focal point to which all brigades can look for assistance and as a "powerhouse" for the consolidation and development of the brigade movement; (2) act as a conference centre where meetings of brigade employees and possibly trainees are organized; and (3) coordinate the basic training and upgrading of brigade staff by identifying suitable institutions, or by offering its own extension services. Phase I of the construction (offices and classrooms) has been completed. Phase II, the construction of boarding facilities, conference hall, etc., began in early 1979.

# **Botswana Polytechnic and its Involvement in the Teaching of Sanitation**

**J.E. Attew<sup>1</sup>**

## **The Polytechnic**

The Botswana Polytechnic is located in Gaborone, the capital of Botswana. It is probably the youngest Polytechnic in Africa, having evolved in 1979 from the National Centre for Vocational Training. It consists of three departments: electrical engineering (50 students), mechanical engineering (100 students), and civil engineering (100 students). City and Guilds courses are used throughout, as well as specialist short courses designed to suit the requirements of industry. The majority of the City and Guilds courses are specifically written for the overseas countries in which they are normally offered, and they include local practical training within the syllabus.

There are 250 full-time students in residence within hostels at the Polytechnic. Being the only such establishment in Botswana, students attend from towns and villages throughout the country.

The academic staff number 35, made up of 20 expatriates and 15 local counterparts. A sincere effort is being made to use local teachers but an aversion to teaching seems to prevail within the people of Botswana. This is due to the fact that with the proper qualifications, more money can be obtained in the private sector and in the past, personnel attending overseas upgrading courses have been lost to the private sector upon their graduation.

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<sup>1</sup>Head, Department of Civil Engineering, Botswana Polytechnic, Gaborone, Botswana.

## **The Courses**

The courses currently offered are at the craft and technician levels, but in the future, only technician and higher-level courses will be offered. There is no strict academic year and courses commence as and when staff and resources become available. The constraining factor on the expansion of courses is the scarcity of trained manpower, i.e., qualified lecturers.

The specified entry qualifications are Form 3 (3 years of secondary school education) for entry to craft courses and Form 5 (5 years of secondary school education), with a General Certificate of Education (GCE) "0" level pass in mathematics, science, and English, for the technician courses.

Over the last few years, these standards have risen and it is now common to find craft students who have completed Form 5.

When a new course is about to commence, a notice is placed in the *Daily News* stating the nature of the course and when applicants may attend the Polytechnic for an interview. Generally, about 75 applicants arrive to be interviewed for the 16 available places in any particular course. (Sixteen is the maximum number of students that can safely be accommodated in the workshop areas.) Because interest is high, it is crucial that more courses be started and more places be made available for enrollment in the courses, thereby satisfying the need for technical education advancement in Botswana.

## **Education in Sanitation**

Although the importance of teaching about sanitation systems is appreciated, only three courses are currently offered that deal with this subject.

### **Plumbing Craft Certificate**

The course leading to a Plumbing Craft Certificate is a 2 year, full-time course of study whose syllabus is specifically designed for overseas countries. It includes the writing of two theory papers, one of which is written in Botswana and includes questions on local practices.

### **Blocklaying, Bricklaying, and Concreting Craft Certificate**

This is a 2 year, full-time course of study, again specifically designed for overseas countries, but in this instance, the opportunity to receive local practical training is not offered, the argument being that in this discipline tropical practices are similar worldwide.

### **Construction Technician's Certificate**

This course takes 3 years to complete. The first year is spent in full-time attendance at the Polytechnic, at the end of which a series of examinations are taken. The second year

is spent in industry, working with the organization that is sponsoring the student to attend the course. The final year is again spent in attendance at the Polytechnic. At the end of the third year, final examinations are taken.

The syllabus is not written specifically for overseas countries but City and Guilds are in the process of revising the course to make it more suitable for use in developing countries. This course is no longer available in the United Kingdom, having been replaced by Technical Education Council courses.

## **Conclusions**

Current sanitation studies are concerned with modern waterborne systems of disposal instead of addressing the real need for rural, low-cost sanitation systems. The City and Guilds, however, are very flexible and are willing to accept recommendations from developing countries for curriculum modifications.

The need for training in low-cost sanitation systems at the Botswana Polytechnic is very apparent and advice will be taken as to the most effective way of improving the situation. It is recommended that thought should be given to the commencement of a certificate course in public health engineering that could be made available to successful construction technician students.

# **Ethiopian Sanitation Sector Institutional Responsibility**

**Beyene Wolde-Gabriel<sup>1</sup>**

The institutions that are involved in sanitation services within Ethiopia and their areas of responsibility are as follows:

The Ministry of Urban Development and Housing is responsible for the provision of septic tanks for its housing projects. It also requires cooperatives and individuals to include sanitary collection facilities in their housing construction.

The Addis Ababa Water and Sewerage Authority provides vacuum trucks for emptying septic tanks and pit latrines and the Municipality of Addis Ababa provides trucks for solid-waste disposal.

The Municipality of Asmara is responsible for managing the sewer system of the city as well as providing for solid-waste disposal. Other municipalities are legally responsible for their own sanitation services, however, they are not capable of providing full service.

The Ministry of Health provides public health education, gives advice on the construction of pit latrines, and inspects existing sanitary facilities in rural areas.

## **Training**

The training of sanitary technicians and other sanitation-related professionals is carried out by the Ministry of Health and

the university. The courses offered by the Department of Civil Engineering of Addis Ababa University include water supply and sewerage in the third year and sewerage and sewage treatment in the fourth year of the civil engineering program. The courses offered by the Department of Building Technology of Addis Ababa University include water supply and sanitation in the diploma course and the Municipal Technical College includes water and sanitation in its courses. Sanitation activities, in general, are being strengthened by the recent introduction of the "community health agent."

## **Reorganization**

The institutional setup of the water sector is being reorganized. Within the framework of this reorganization, a proposal has been made for the establishment of an Ethiopian Water Supply Authority. If the proposal is implemented, this authority would be responsible for water supply and sanitation.

With regard to the International Drinking Water Supply and Sanitation Decade, the National Action Committee will be responsible for the coordination and supervision of decade activities.

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<sup>1</sup>Manager, Urban Water and Sewerage Agency, Addis Ababa, Ethiopia.

## **Training: Discussion**

### **Craft Level Training**

The procedure used in Botswana for setting up a brigade training (BRIDEC) group was explained. The village council must first do the planning and then request a brigade. The government BRIDEC group then evaluates the merits of the proposal based upon whether or not the village or area population can support the brigade on a continuing basis. If there are a large number of people leaving school without any employable skill, BRIDEC may try to establish a brigade. The government provides the initial funding for training and materials after which the brigade should become self-supporting.

## **Workshop Conclusions**

### **Technology Group**

It is very important to convince governments of the importance of sanitation and, where appropriate, recommend that the social benefits of sanitation have priority over the economic benefits.

Public awareness of the importance of sanitation is a priority and this can be achieved through a variety of ways. Knowledge of sanitation, hygiene, and basic operation and maintenance of sanitation units could be introduced into school curricula. At the same time, other existing institutions could be developed and similar knowledge could be imported through existing adult literacy and education programs. The use of media such as radio and poster campaigns is desirable. It is understood that operating higher educational courses is very expensive, and full utilization of existing courses must be made. In this context, it is recognised that existing courses that cover the water sector also cover sanitation. In general, however, there is insufficient emphasis on health matters and this should be rectified.

Representatives from government bodies must be made aware of the broader aspects of the sanitation field and develop a united approach. Therefore, it would be desirable if paradisciplines were developed as this would partially alleviate the shortage of manpower and by doing so implement sanitation programs more quickly.

Manpower requirements to build pit latrines would consist of a junior health assistant, a technician, local craftsmen, and unskilled labourers. The technician must have a working knowledge of concrete and steel together with a structural appreciation, which would include an appreciation of soil conditions. Because the technology level is relatively low, this working knowledge does not have to be high and, therefore, a trained foreman would be ideal for this position. Craftsmanship is usually available and all that is required at this level is guidance in the appropriate technology, which would come from the technician/foreman.

Central standardization is desirable as this will lead to speedy implementation of schemes and improvements in the quality of the construction. If manpower is in short supply, then standardization would also partially relieve the problem. An engineer, however, would have to be retained in order to monitor and evaluate standard designs and also to design specific projects if the standard designs are not applicable. Standards should include specifications, details of all possible construction materials, and bills of quantities.

Incentives to retain staff associated with the sanitation sector might include material incentives and a clearly defined scheme of service. In some countries, however, this might not be appropriate and motivation to achieve a sense of duty might be the best approach in these areas.

It is generally agreed that an overall specific sanitation method or technology cannot be recommended as it depends very much upon an individual country's

economic situation and upon local conditions. In general, however, a combination of a waterborne sewerage system together with a low-cost sanitation program is best suited for towns and cities. The waterborne system is most applicable in commercial centres, industrial areas, and well-planned urban developments, where high water usage guarantees the acceptance of the waterborne system. In rural areas, where there is low water usage, a non-waterborne system is most appropriate. Consideration must be given, however, to the introduction of systems that are acceptable to the users and government bodies must be careful not to impose methods of technology upon the recipients without first being assured by the recipient of their acceptability.

Payment for any sanitation program must be determined according to the social or economic priorities of each government.

### **Recommendations**

(1) In order to develop national sanitation programs, governments must place more emphasis on the social benefits gained through such programs than on the economic benefits and subsidies for initial capital costs should be considered on the basis of the social and economic objectives of the specific countries.

(2) Sanitation and hygiene should be introduced into school curricula.

(3) The full utilization of all existing educational institutions to impart knowledge of sanitation and hygiene must be made. In particular, appropriate health technologies must be introduced into the curricula of all educational institutions including universities, colleges of technology, and further education institutions.

(4) Funds from donor countries and agencies should be used to establish a central institution for sanitation and health studies, which would be open to all East and Southern African countries, as well as to strengthen existing facilities in individual countries.

(5) The introduction of training program paradisciplines and closer cooperation of government ministries associated with the sanitation and health fields are desirable. To shorten the length of training periods and make better use of available personnel, training courses which upgrade and broaden the capacities of middle-level persons are desirable. An example of such personnel is the paramedic; consideration should also be given to the parasanitary engineer.

(6) Standard designs for appropriate technological options must be made.

(7) Individual countries must provide their own incentive schemes to attract and retain staff in the sanitation sector.

(8) In towns and cities, the combining of waterborne sewerage systems with affordable low-cost sanitation options should be considered.

(9) In rural areas, acceptable and affordable low-cost sanitation solutions must be introduced.

(10) Sanitation and health education programs should be introduced on a nationwide basis through the use of mass media.

### **Software Group**

Water can be given to people in both rural and urban areas but this alone will not improve their health. Water is the main vehicle of disease transmission when contaminated with excreta. Sanitation is also necessary to improve the health of the people. Sanitation includes the proper use of water and protection from



contamination in the home. Sanitation improvements need to be implemented in conjunction with water supply delivery. It is, therefore, necessary to integrate the two services. In many governments, however, responsibilities for water and sanitation are divided. If one ministry was in charge of both the problem of their integration would be facilitated. As it is now, each ministry has its own priorities and programs; seldom are there any effective joint activities. To solve this problem it would be desirable to form such mechanisms as national action committees for integrated water supply and sanitation delivery. Integration should go further to include primary health care.

A national action committee is desirable but this should be extended down through the administrative structure to the village level. Examples of committees that would be desirable include regional, district, and area or ward level action committees. These would be concerned with water and sanitation, which would impinge on and include primary health care services. At the village level, the water committees (where they are established) and health committees should be coordinated to assist integration of the delivery of the services.

It is recognized that children under the age of 5 years are the main sufferers and casualties of diarrheal diseases and that the focus of the sanitation programs should be on them, household sanitation in particular.

The problem is due to the poor design of latrines and the fact that children may fall into the pit. Also, families having many children fear the early filling of their latrines. Therefore, children in many areas do not use the latrine and defecate either inside or around the premises. Parental ignorance is the source of the problem and the best target for its solution. Mothers become used to handling the faeces and do not believe them to be a health hazard. Therefore, they tend not to take precautions against the spread of faecal matter in the home other than removing the stools from the immediate household by throwing them into the nearest bush, into the latrine, or leaving them to be eaten by chickens and pigs.

Changing hygiene habits is a long process that can be only accomplished through continuing health education, particularly for the mother. Health education should be the responsibility of every health and community development worker, including the public health nurse, maternal child care workers, and environmental health staff.

Educating the people about the technologies that are being used should also be a continuous process, aimed at good maintenance of the latrines. This should be carried out by the relevant extension workers in the community, i.e., village sanitation promoters together with the people themselves.

The health authorities should be responsible for middle-level management and support for these village health educators. Adult health education must also be carried out in addition to school health education programs in order to sustain the knowledge and ensure its use at all age levels within the community.

The user should be educated not only in how the latrine should be maintained but also how it functions. They should be familiar with its design and principles of operation. This will facilitate its continued and proper maintenance.

### **Recommendations**

Based on the discussions it was observed that community participation is essential at all levels of program development, i.e., planning, implementation, and evaluation, and that an interdisciplinary approach is necessary to involve all sectors responsible for running the community; that the integration of water

supply and sanitation programs is important in order to improve the health status of the people; and that intensification of health education is essential for the prevention and control of disease brought about by unsanitary conditions. From these observations the following recommendations were made.

(1) Health education in formal and nonformal institutions should be stressed so that the population as a whole becomes aware of the importance of sanitation and water supply programs in the prevention and control of disease.

(2) Health committees, if they are nonexistent, should be formed in defined areas so that they can be the channel through which the community can become involved in water and sanitation programs.

(3) In those countries where water and sanitation agencies are separate agencies there should be interministerial coordination at all levels, with the intention of integrating water and sanitation programs to improve the health status of the people.

## **Training Group**

There is a need for postgraduate engineers in public health engineering or sanitary engineering. In the absence of these, upgraded civil engineers would suffice. For example, Tanzania has three sanitary engineers (many countries have more). The situation calls for increased training at the postgraduate level. At the engineering technician level there are also major deficits. These could be termed sanitary technicians. Polytechnic or the normal technician courses offered within the region would best be modified or reoriented to include sanitation in order to better service this sector. At both the technician and engineering levels there is a need to provide "training for trainers," i.e., the engineer and technician should graduate knowing how to be trainers themselves; to train instructors who will then be responsible for training others at the artisan levels.

The need for increased artisan training at all levels is recognized. The entry requirements, however, for artisan courses need to be clearly defined, which will facilitate upgrading through to the technician level if the graduate artisan so desires. There have been problems encountered with upgrading illiterate but good artisans. At all levels of artisan, technician, and engineer, public health training is required. This would include germ theory and facilitate all levels becoming agents of change for improved sanitation and health.

The meeting stressed the need to include a strong component of health education within the schoolteachers training. This would give teachers interested in specializing in teaching health in primary and secondary schools a background for doing so. In most countries there are seldom adequate numbers of qualified teachers in most rural schools. Subject specialists (in health/sanitation) within the school system would provide a link between health authorities and the school system. The health authorities could then be drawn upon to assist in specialized subjects as the need arises.

Most countries in this region lack specific policy directives related to the provision of health facilities and services for schooling in sanitation and health. Standards need to be set regarding the water and sanitation material to be included within school health curricula and also for teacher qualifications before health/sanitation education in schools can be made effective.

Health and sanitation personnel at all levels from village health worker and artisan through to health inspector (health officer) and sanitary engineer should

be regarded as training resources and be used to educate the people in sanitation. Some countries have demonstrated that these are two streams of personnel (i.e., engineering and health personnel) working in this field which appear appropriate to other countries as long as there are effective linkages between them. The engineering personnel include artisans, technician civil engineers, and sanitary engineers. The health personnel, usually working within ministries of health, include village health workers, health assistants, and health inspectors (health officer) and public health nurses, health educators, and sociologists who work under the medical officer of health. To be most effective, particularly in training, these streams need to be linked together to improve their impact on the public's health. They should also assist other ministries by sharing their expertise, e.g., the health inspector or health officer could become involved in primary schoolteacher training courses. Another example would be the use of environmental health personnel in training agricultural extension officers within the Ministry of Agriculture or community development officers within the Ministry of Rural Development or Ministry of Community Development.

Refresher courses need to be established as backup to formal training courses at practically all levels, both within the country and within the region, depending upon the level of personnel taking the refresher course. In some cases external expertise will be required for such refresher courses and seminars.

Continued training after graduation should include use of mass media, aimed especially at the lower personnel levels. Continued education at these and higher levels will require the development of manuals, texts, and audiovisual materials. The latter should be developed locally but could benefit from examples drawn from outside the region.

Monitoring and evaluation mechanisms are needed and should be established in conjunction with training courses at all levels. Whenever possible use should be made of independent evaluators external to the ministries or even external to the countries or region concerned. In particular, this applies to higher levels of education, particularly when these are being used as regional or international training resources. These should be evaluated according to the needs of all countries concerned with the training course.

## **Recommendations**

(1) In relation to health and sanitation education in schools: (a) Health education should be a component of the training of teachers of primary and secondary schools. (b) Health education emphasizing sanitation should be one of the priorities in the curricula of primary and secondary schools. (c) As many schools in the region suffer from a lack of sanitation facilities, all schools should be provided with adequate toilet facilities and safe water supplies. These facilities should be regularly inspected by the inspectors who are advised by health personnel and who should provide continued support to the inspection program. (d) Local health inspectors (health officers) should maintain contact with the schools through parent-teacher associations and school boards in addition to being available to assist teachers in student training. (e) Appropriate design criteria for school sanitation facilities need to be established where they do not exist. Where they do exist they should be enforced, particularly in cases of new school construction. (f) Environmental health staff such as health inspectors (health officers) should be resource persons for teacher training programs.

(2) Sanitation education programs should be monitored and evaluated on a continuing basis by health educators using available data from the sociologist and statistician.

(3) There is need for evaluation of training programs to determine their relevance to the needs of the region. This applies particularly to professional education levels.

(4) Developing countries should place more emphasis on training programs and utilize the existing facilities within the country or region. Where there are no facilities, international organizations could be asked to assist.

(5) During this Sanitation Decade governments should be encouraged to review current public health legislation as related to sanitation in order to improve such legislation or introduce new legislation where appropriate.