Instructor's Guide

Low Cost Sanitation

LOW COST SANITATION

Instructor's Guide

For additional information please write to
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GENERAL INFORMATION FOR THE INSTRUCTOR

Module Use and Content

The "Low Cost Sanitation" module may be used as an independent instructional unit, or in conjunction with the other modules in EDI's two-week seminar on "Water Supply and Sanitation."

The module includes the following presentation materials:

- An Instructor Guide
- A Participant Manual
- A slide/tape program
- Suggested supplementary materials

Time Required

The module requires approximately three hours to complete.

Participant Manual and Instructor Guide

The Participant Manual contains all the information and instructions required to complete the module activities.

The Instructor Guide is organized so that Instructor Notes appear on the left-hand pages, opposite the Participant Manual pages printed on the right. (The Participant Manual pages in the Instructor Guide are identical to those in the actual Participant Manual.) The Instructor Notes include suggested time requirements, steps for conducting the module activities, discussion guidelines and suggestions on presentation. The time requirements are approximate, but following the suggested times will ensure that the module does not require more than three hours to complete.

The Instructor Guide and Participant Manual both contain reference copies of the visuals and the narrative text from the slide/tape program.

Slide/Tape Program

Most of the instructional content for this module is presented in the slide/tape program, "Low Cost Sanitation." The slide/tape program includes 35 mm slides synchronized with the narration on the accompanying audiocassette. The module package includes two identical tapes, one of which is simply a back-up duplicate. The slides are inserted in a carousel tray that most projectors will accommodate. The narration on the audiocassette is pulsed with audible tones. These tones are cues that the slide projector should be advanced immediately to the next slide. The narration is recorded on Side 1 of the audiocassette; Side 2 is blank.

Suggested Supplementary Materials

The two volumes cited below have been selected as supplementary materials for the module to assist the instructor:

> "Appropriate Sanitation Alternatives", World Bank Studies in Water Supply and Sanitation; Volume 1: A Technical and Economic Appraisal and Volume 2: A Planning and Design Manual, (Baltimore, Maryland: The Johns Hopkins University Press, 1982).

The instructor may reproduce portions of the materials for use by the participants or the two volumes may be distributed to each participant. References to the two volumes in the Instructor Notes indicate the location of additional content material relevant to the topic being discussed.

Equipment and Materials

Presentation of the module by an instructor to a group of participants requires the equipment and materials listed below:

For the instructor:

- One copy of the Instructor Guide
- A flipchart easel, pad and markers, or chalkboard and chalk
- One copy of the slide/tape program (slides and one audiocassette)
- One slide projector and white projection screen
- One audiocassette player
- One copy of the supplementary materials

For the participants:

- A copy of the Participant Manual for each participant
- Paper and pencils for each participant

Optional:

- Copies of the supplementary materials for each participant

Instructor Preparation

The "Low Cost Sanitation" module is not a self-instructional program. It requires an instructor who is well versed in the various issues of the water supply and sanitation sector.

Instructor preparation involves a review of the Instructor Guide to become familiar with the topics, sequence of activities and the content of the presentations. It is also useful to preview the slide tape program in order to become familiar with the content and the synchronization of the slide with the audio-cassette. If possible, the program should be previewed on the equipment that will be used during the actual presentation.

Equipment and Facilities Preparation

Preparation of the audiocassette for play requires rewinding it completely to the beginning and ensuring that the cassette is loaded into the player with "Side 1" showing at the top.

Preparation of the carousel tray of slides for viewing requires four steps. First, it is important to ensure that all the slides are inserted into the tray in sequential order, with the printed numbers showing at the top right corner, along the outer edge of the carousel tray. Second, the black plastic lock ring must be turned in the direction of the arrow marked "Lock" until the ring is secured on the tray. Third, the tray is placed in operating position by lowering it onto the projector and turning it clockwise until the tray drops down securely. Fourth, the projector must be advanced so the first slide, the title slide, appears on the screen.

Operation of the slide projector and audiocassette player should be checked prior to the presentation. At that time, it is advisable to arrange for power cords required to operate the projector and cassette player, extension cords and extra projector bulbs. It is also useful to determine who should be contacted if assistance is needed from an engineer or audiovisual specialist.

It is important to check that each participant will be able to see and hear the slide/tape program easily. To view the slides clearly, overhead and back lighting should be kept to a minimum.

INSTRUCTOR NOTES

Introduction — Time Required: 15 minutes

(Reference: Volume 1, A Technical and Economic Appraisal, "An Overview," pp. 3-8.)

The "Low Cost Sanitation" module provides a general orientation to four key elements of selecting, planning, and implementing sanitation projects. The module is divided into four parts. Each part includes a segment of the slide/tape program, discussions to reinforce important concepts, and activities to assist participants in applying these concepts to their own communities.

Most of the activities involve discussions that are conducted best in small groups of four to seven participants.

1. Refer participants to the Introduction in their manuals. Review the purpose of the module and the topic outline with them. If you know their specific interests in terms of the sanitation needs of their communities, relate the content of the module to those needs.

2. Introduce Part I of the slide/tape program and inform participants that it is the first of four parts. Explain that Part I includes an overview of the module and a discussion of health, water and sanitation. Part I of the slide/tape program is approximately twelve minutes in length.

3. Explain that participants will not have to take extensive notes during the slide/tape program because copies of the visuals and narrative text from the slide/tape program are provided in their manuals.

4. Turn on the equipment and make sure the title slide is projected when the music at the start of the program begins. When you hear the first tone, advance the slide projector immediately to the next slide. Continue advancing the slides at the sound of the tone until the narrator announces the end of Part I and you see a corresponding message projected on the screen.

Introduction

The "Low Cost Sanitation" module has been designed for individuals who have a role in the selection, planning, and implementation of sanitation projects in their communities.

The topics covered in the module are listed below.

Part I

- Overview of the module

- Health, water and sanitation
- Health improvement priorities
- Environmental classification of excreted infections and the role of sanitation

Part II

- Sanitation technologies
- Classification of sanitation systems
- Priorities for sanitation improvement
- Comparison of systems
- Information needed for the selection and design of sanitation systems
- Technically feasible sanitation sequences

Part III

- Cost comparison and selection
- Economic feasibility and financial affordability
- Economic and financial costing

Part IV

- Planning and implementing sanitation projects
- Project phases, community participation and institutional linkage
- Health education strategies

INSTRUCTOR NOTES

PART I: HEALTH, WATER AND SANITATION

Discussion of Health Improvement Priorities — Time required: 25 minutes

(Reference: Volume 1, A Technical and Economic Appraisal, "Public Health Aspects," pp.67-76)

1. After participants have viewed the first part of the slide/tape program, ask them if they have any questions about the content.

2. Reinforce the main concepts that improved health is the principal objective of sanitation investments and that improvements in sanitation must be accompanied by hygiene education and safe water supplies in order to yield full benefits.

3. Refer participants to the discussion questions in their manuals. Ask them to take fifteen minutes to record individual responses to each question and then to discuss them with the other members of their group. Instruct the group to select a representative who will summarize the group's discussion.

4. After fifteen minutes, stop the discussion. Ask the representative of each group to summarize the discussion. You or the group's representative can record the key points on the flipchart or board.

5. The major purpose of the discussion is to help participants recognize the extent to which their communities' health problems stem from water-, excreta-, and hygiene-related diseases. Second, it is important that they understand the transmission routes of these diseases in the community. Third, participants should try to identify measures that could be taken to interrupt disease transmission in the community. Participants with experience in successful sanitation programs should be encouraged to describe these to the other participants.

PART I: HEALTH, WATER AND SANITATION

Discussion of Health Improvement Priorities

These questions are provided to stimulate discussion of the content presented in the slide/tape program.

1. What are the major health problems in your urban communities? In your rural communities?

2. To what extent do the communities' health problems stem from water-related, excreta-related and hygiene-related diseases? How are these diseases typically transmitted in the community?

3. What control measures are necessary in order to interrupt the transmission of the diseases? What agencies and staff should participate in carrying out these measures?

4. What control measures have been used successfully in the past to interrupt the transmission of water-, excreta-, or hygiene-related diseases in your communities?

5. What problems or obstacles are likely to occur in implementing the control measures you identified? What steps would be necessary to prevent or overcome them?

Environmental Classification of Excreted Infections and the Role of Sanitation

Time required: 5 minutes

(Reference: Volume 2, A Planning and Design Manual, pp. 11-22)

1. Explain to participants that the remainder of the module will focus on sanitation. For this reason, it is important that participants understand specifically how excreta are related to disease.

2. Refer participants to the chart on page P-3 in their manuals. Remind them that the list of infections on the chart is the same as the one shown in the first part of the slide/tape program.

3. Summarize that excreta are related to human disease in two ways:

   - First, agents of many infections escape from the body in excreta and may eventually reach other people. These are called excreted infections. (A number of these can reside in both humans and animals.)

   - Second, poor disposal encourages the breeding of insects that may become vectors for pathogens.

   It is also important for participants to understand that, very often, individuals involved in transmitting an infection may show little or no sign of disease.

4. Explain that the classification chart on page P-3 groups excreted infections according to their common transmission routes. The chart, therefore, is useful in predicting how sanitation improvements will affect the incidence of the disease.

5. Review the chart with participants and point out that providing toilets will contribute to the interruption of disease transmission in five of the six categories.

6. Refer participants to the flipchart or board where you recorded health improvement priorities from the previous discussion. If the chart in the participants' manual includes diseases they identified, point them out and emphasize the control measures indicated. If the control measures that participants identified in the previous discussion were incomplete, point out which ones should be added.

7. Introduce the second part of the slide/tape program, "Sanitation Technologies," which is approximately eleven minutes in length.

Environmental Classification of Excreted Infections and the Role of Sanitation

DISEASE	ENVIRONMENTAL TRANSMISSION FOCUS	MAJOR CONTROL FOCUS
Amebiasis Balantidiasis Enterobiasis Enteroviral infection Giardiasis Hymenolepiasis Rotaviral infection	Personal Domestic	Domestic water supply Health education Improved housing ● Provision of toilets
Campylobacter infection Cholera Pathogenic Escherichia Coli Salmonellosis Shigellosis Typhoid Yersiniosis	Personal Domestic Water Crops	Domestic water supply Health education Improved housing ● Provision of toilets Treatment of excreta before discharge or reuse
Ascariasis Hookworm infection Strongyloidiasis Trichuriasis	Yard Field Crops	● Provision of toilets Treatment of excreta before land application
Taeniasis	Yard Field Fodder	● Provision of toilets Treatment of excreta before land application Cooking; meat inspection
Clonorchiasis Diphyllobothriasis Fascioliasis Fasciolopsiasis Gastrodiscoidiasis Heterophyiasis Metagonimiasis Paragonimiasis Schistosomiasis	Water	● Provision of toilets Treatment of excreta before discharge Control of animal reservoirs Cooking
Bancroftian filariasis and infections listed above for which flies and cockroaches can be vectors	Various fecally contaminated sites in which insects breed	Identification and elimination of suitable insect breeding sites

INSTRUCTOR NOTES

PART II: SANITATION TECHNOLOGIES

Classification of Sanitation Systems — Time required: 5 minutes

(Reference: Volume 1, A Technical and Economic Appraisal, pp. 11-18;
Volume 2, A Planning and Design Manual, pp. 61-121)

1. After participants have viewed the second part of the slide/tape program, ask them if they have any questions about the content.

2. Emphasize that the slide/tape program described only three of the many low cost sanitation systems available for use in developing countries.

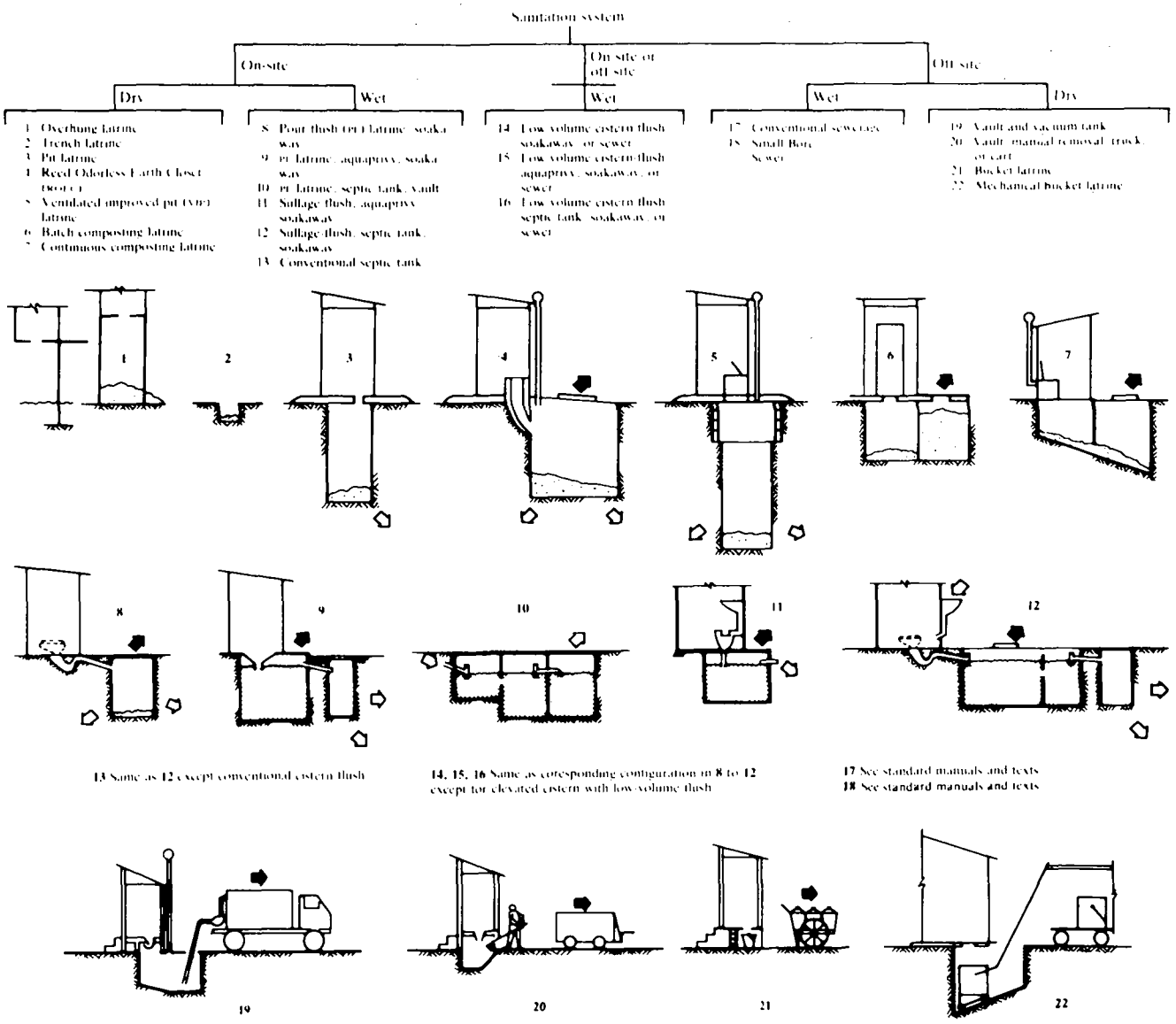
3. Refer participants to the classification chart on page P-4 in their manuals. Point out the three systems that were discussed in the slide/tape program: the VIP, the pour-flush and the small bore sewer. Explain that the chart is based on research conducted by the World Bank to identify alternatives to the unimproved pit latrine and conventional water-borne sewerage.

4. Direct participants' attention to the categories indicated at the top of the chart. Explain that sanitation systems are divided into two major categories: On-site systems which store excreta on the household plot; and off-site systems which require the removal of excreta for treatment or disposal. The two major categories are futher subdivided into dry and wet systems. Wet systems use water for flushing; dry systems do not.

PART II: SANITATION TECHNOLOGIES

Classification of Sanitation Systems

There are many sanitation systems that can provide full health benefits. The process of comparing and selecting sanitation systems begins with identification of the alternatives suitable for use in developing countries. The chart below illustrates a number of them, including the three presented in the slide/tape program.



13 Same as 12 except conventional cistern flush

14, 15, 16 Same as corresponding configuration in 8 to 12 except for elevated cistern with low-volume flush

17 See standard manuals and texts
18 See standard manuals and texts

: Movement of liquids, ♦ movement of solids
Source: The World Bank *Water Supply and Waste Disposal*, Poverty and Basic Needs Series (Washington, D.C., September 1980)

Discussion of Priorities for Sanitation Improvement

Time required: 20 minutes

1. Refer participants to the discussion questions in their manuals. Ask them to record individual responses to each question and then to discuss them with the other members of their group. Instruct them to select a representative who will summarize their discussion.

2. The purpose of the discussion is to help participants identify opportunities for sanitation improvements in their communities. Participants should also be able to identify the low cost alternative systems that could be appropriate to their communities' needs. It is important that participants who have had experience with the use of low cost alternatives describe how these systems were selected and installed, what results were achieved through their use, any problems that occurred and how they were resolved.

3. Stop the discussion after ten minutes. Ask a representative of each group to summarize the discussion. You or the representative can list key points on the flipchart or board.

Discussion of Priorities for Sanitation Improvement

These questions are designed to stimulate discussion about your communities' sanitation systems and the opportunities for improving community health through low cost alternative systems.

1. What percentage of the population in your communities rely on unimproved pit latrines? What are the problems associated with them?

2. What low cost sanitation systems are currently in use in your urban communities? In rural communities?

3. What has been the experience with these systems? How were they selected and installed? What benefits or successes resulted from their use? What problems occurred and what solutions were implemented?

4. What are the major improvement opportunities for sanitation systems in your communities? Which low-cost alternatives would be appropriate?

5. What problems or obstacles do you see in identifying, selecting and implementing improved sanitation systems? What preventive measures or solutions could overcome the problems?

Comparison of Technologies

Time required:
5 minutes

(Reference: Volume 2, A Planning and Design Manual, pp. 39-45.)

1. Refer participants to the chart on page P-6 in their manuals. Explain that a common approach to making comparisons of sanitation systems is to define some comparative criteria and then evaluate each alternative system against the stated criteria. Explain that the chart is a convenient, nontechnical summary of a range of nine systems (including those discussed in the slide/tape program) against twelve commonly used criteria.

2. Ask participants who have had experience with the use of these systems in their communities to add to the comments on the chart and to offer their personal observations.

Comparison of Technologies

The chart below is a convenient, nontechnical summary of nine alternative systems compared against twelve criteria.

Sanitation technology	*Rural application*	*Urban application*	*Construction cost*	*Operating cost*	*Ease of construction*	*Self-help potential*	*Water requirement*	*Required soil conditions*	*Complementary off-site investment*	*Reuse potential*	*Health benefits*	*Institutional requirements*
Ventilated improved pit (VIP) latrines and Reed Odorless Earth Closets (ROECS)	Suitable	Suitable in L-M-density areas	L	L	Very easy except in wet or rocky ground	H	None	**Stable permeable soil; groundwater at least 1 meter below surface**[b]	None	L	Good	L
Pour-flush (PF) toilets	Suitable	Suitable in L-M-density areas	L	L	Easy	H	Water near toilet	**Stable permeable soil; groundwater at least 1 meter below surface**[b]	None	L	Very good	L
Double vault composting (DVC) toilets	Suitable	**Suitable in L-M density areas**	M	L	**Very easy except in wet or rocky ground**	H	None	None (can be built above ground)	None	H	Good	L
Self-topping aquaprivy	Suitable	Suitable in L-M-density areas	M	L	Requires some skilled labor	H	Water near toilet	Permeable soil; groundwater at least 1 meter below surface[b]	Treatment facilities for sludge	M	Very good	L
Septic tank	Suitable for rural institutions	Suitable in L-M-density areas	H	H	Requires some skilled labor	L	Water piped to house and toilet	**Permeable soil; groundwater at least 1 meter below surface**[b]	Off-site treatment facilities for sludge	M	Very good	L
Three-stage septic tanks	Suitable	Suitable in L-M-density areas	M	L	Requires some skilled labor	H	Water near toilet	**Permeable soil; groundwater at least 1 meter below surface**[b]	Treatment facilities for sludge	M	Very good	L
Vault toilets and cartage	Not suitable	Suitable	M	H	Requires some skilled labor	H (for vault construction)	Water near toilet	**None (can be built above ground)**	Treatment facilities for night soil	H	Very good	VH
Sewered PF toilets, septic tanks, aquaprivies	Not suitable	Suitable	H	M	**Requires skilled engineer builder**	L	Water piped to house and toilet	**None**	Sewers and treatment facilities	H	Very good	H
Sewerage	Not suitable	Suitable	VH	H	Requires skilled engineer builder	L	Water piped to house and toilet	**None**	Sewers and treatment facilities	H	Very good	H

Note: L, low; M, medium; H, high; VH, very high.

a. On- or off-site sullage disposal facilities are required for nonsewered technologies with water service levels in excess of 50 to 100 lcd, depending on population density.

b. If groundwater is less than 1 meter below the surface, a plinth can be built.

Information Needed for the Selection and Design of Sanitation Systems

Time Required: 20 minutes

(Reference: Volume 2, A Planning and Design Manual, pp. 46-51)

1. Explain to participants that once different sanitation systems have been compared, the one that is most appropriate to the needs and resources of the community must be selected. The selection criteria used should be based on a combination of technical, economic and social criteria. Ultimately, the selection decision should identify the system that is the cheapest, technically feasible alternative which consumers prefer, can afford and will maintain. Moreover, the system should be realistically manageable by the local authority that will operate and maintain the system.

2. Refer participants to the checklist on page P-7 in their manuals. Point out that the checklist includes general information items that typically must be considered, but that the list is not comprehensive or targeted specifically to their communities. Ask participants to generate a list of information items that they believe are important to include. Instruct them to work with the other members of their group to generate a more complete list.

3. The purpose of the activity is to assist participants to identify the information items that are most relevant to their own communities, including resources, needs, cultural norms, past experience with sanitation systems use practices and unique requirements.

4. Stop the discussion after ten minutes. Ask a representative of each group to present the items they listed. Record these on the flipchart or board, adding new items to the list as the group representatives present their results. Invite participants to comment on the items presented by other groups. Also encourage participants to amend their lists with additional items the other groups identified.

Checklist for Information Needed for Selection and Design of Sanitation Systems

Climate Conditions

- o Temperature ranges

Others: _____

_____

_____

_____

Site Conditions

- o Soil stability
- o Water table fluctuations

Others: _____

_____

_____

_____

Environmental Factors

- o Existing water supply levels
- o Existing facilities for excreta disposal, sullage removal, and storm drainage

Others: _____

_____

_____

_____

Population Factors

- o Numbers, present and projected
- o Density and growth patterns
- o Housing type and occupancy rates
- o Income levels

Others: _____

_____

_____

_____

Sociocultural Factors

- o People's perceptions of present situation
- o Interest in change or resistance to change
- o Reasons for acceptance or rejection of past upgrading attempts

Others: _____

_____

_____

_____

Institutional Framework

- o Allocation of authority or responsibility
- o Effectiveness of institutions or local authority

Others: _____

_____

_____

_____

Technically Feasible Sanitation Sequences

Time required: 10 minutes

(Reference: Volume 2, A Planning and Design Manual, pp. 52-57.)

1. Begin by reminding participants that all sanitation systems can provide the health benefits commonly associated with waterborne sewerage systems, albeit at difference levels of convenience. The decision facing communities is not a choice between different levels of health and sanitation, but rather, a choice between service levels and affordability. This choice is made easier by the fact that systems can be upgraded over time to achieve higher standards of service that keep pace with the communities' ability to pay.

2. Refer participants to the chart of upgrading sequences on page P-8 in their manuals. Point out that the sequence indicated by the solid line is the one presented in the slide/tape program. The other sequences on the chart are representative and feasible alternatives, all of which take into account gradual improvements in the level of water supply service.

3. Review the chart with participants, pointing out that none of the sequences necessarily leads to conventional sewerage. Emphasize that this is not because sewerage is not a good alternative, but because the system is not requisite to high levels of service and full health benefits. A community, therefore, can choose one of the low cost sanitation alternatives knowing that the system can be upgraded in a predetermined sequence of improvements, toward the ultimate level of desired convenience.

4. Invite participants to comment on any upgrading sequences that have been implemented successfully and to describe factors that contributed to their success. Ask the participants to determine whether any of the sequences on the chart would be compatible with their communities' needs and resources.

5. Introduce Part III of the slide/tape program, "Cost Comparison and Selection." This part of the slide/tape program is approximately eleven minutes in length.

Technically Feasible Sanitation Sequences

SANITATION SYSTEM (Diagram Number on Classification Chart on Page P-4)	LEVEL OF WATER SERVICE		
	Hand Carried	Yard Tap	House Connection
Double Vault Composting Toilet (6,7)	●	●	●
Pourflush, Septic Tank and Vault (10)		●	●
Vacuum Truck and Vault (19)		●	●
Ventilated Improved Pit Latrine (5)	●	●	
Reed Odorless Closet (4)	●	●	
Pourflush with Soakaway (8)	●*	●	●
Small Bore Sewered Pourflush (18)		●**	●
Conventional Sewerage (17)			●

* Feasible if sufficient pourflush water will be hand carried.
** Feasible if total wastewater flow exceeds 50 liters per capita daily.

INSTRUCTOR NOTES

PART III: COST COMPARISON AND SELECTION

Dicussion of Economic Feasibility and Financial Affordability — Time required: 20 minutes

(Reference: Volume 1, A Technical and Economic Appraisal, pp. 50-65)

1. After participants view the third part of the slide/tape program, ask them if they have any questions about the content presented in the slide/tape program.

2. Reinforce the following key concepts. The purpose of deriving economic costs is to make a meaningful least cost comparison among alternatives. This comparison is useful to planners, policymakers and analysts. The community's consumers, however, are much more interested in financial costs: that is, what they will have to pay for a system over time.

   Economic costs are based on the physical conditions and resources of the community, including the abundance or scarcity of labor and water. Financial costs, on the other hand, are often entirely subject to considerations such as interest rate policies, loan maturities and government subsidies. To promote economically efficient allocation of resources and financially sound selection of sanitation systems, both economic and financial costs must be considered.

3. Refer participants to the discussion questions on page P-9 in their manuals. Ask them to record individual responses to the questions and then to discuss them with the other members of their group. Instruct them to select a representative who will summarize the group's discussion.

4. The purpose of the discussion is to assist participants to apply criteria of economic feasibility and financial affordability to the selection of sanitation systems.

5. Stop the participants' discussion after ten minutes. Ask a representative of each group to summarize the discussion. You or the representative can record key points on the flipchart or board.

PART III: COST COMPARISON AND SELECTION

Discussion of Economical Feasibility and Financial Affordability

1. How much do the various income groups in your communities pay for sanitation at the present time?

   - o Low income?
   - o Moderate income?
   - o Higher income?

2. What tariffs or taxes are assessed for sanitation service at the present time?

3. What would low and moderate income groups be willing to pay for sanitation?

4. What are representative construction and maintenance costs of the sanitation systems currently in use?

5. In past planning efforts, how have the sanitation systems been evaluated in terms of economic feasibility and financial affordability? Who provided inputs and data for decision-making? What additional steps or inputs would be desirable in economic and financial costing of systems for your communities?

INSTRUCTOR NOTES

Economic and Financial Costing Exercise

Time Required:
35 minutes

1. Introduce the next activity by telling participants that they will now have an opportunity to apply the principles of economic and financial costing to a case study stituation.

2. Instruct participants to read the case study background information on page P-10 in their manuals. Then tell them to turn to the next page.

Economic and Financial Costing Exercise

The following exercise will help you apply the concepts of economic and financial costing to a case study situation. First, read the background material on this page. Then turn to the next page and follow the instructions to complete the exercise.

Background Information: A rural community, located in an area with sandy soils, has neither piped water nor sanitary excreta disposal. The area has 3,000 inhabitants and the average household size is 6 persons. The per capita income level is approximately US $100.

The community is considering a piped water supply system with either house connections or public standpipes. The piped water supply system will cost US $125 per capita. The public standpipes will cust US $50 per capita. Per capita water consumption is projected to be 100 liters per day with a piped water supply, and 20 liters per day for public standpipes (excluding washing). Operating costs are estimated at US $0.20 per cubic meter consumed.

The sanitation alternatives currently under consideration are ventilated improved pit latrines and pourflush toilets. The costs in US$ for both are as follows:

	Initial Investment Costs	Annual Operations and Maintenance Costs
VIP	$ 130	--
Pourflush	$ 70	$ 10

The community estimates it can receive a total of US $150,000 in subsidies to contribute toward the investment costs for either system. It estimates that another $40,000 can be raised as initial consumer contributions.

3. Tell participants to follow the instructions and work in their small groups to answer the questions provided on page P-11 in their manuals. Explain that the purpose of the exercise is for each group to decide which low cost alternative the community should pursue.

4. The questions provided are intended to guide their analysis. You can encourage them to consider other criteria in making their final recommendation to the community.

5. Stop the discussion after 10 minutes. Ask a representative of each group to present its final recommendation and the supporting data.

6. If the groups' recommendations were not based on the following computations and analysis, present the information below:

   SOLUTION: The problem is to find the levels of water supply and sanitation services that are commensurate with the population's financial means while producing most health benefits.

   There are 3000 people and an average of 6 persons per household. Thus a total of 500 households will require water and sanitation. The water supply can initially not cost more than $190,000. Assume the population will receive standpipes at $50 per capita, or $300 per household and ventilated improved pit latrines at $130 each. Then the initial investment will be 500 · (300 + 130) = $215,000. This amount exceeds the available $190,000.

   Assume instead the community will receive standpipes at $300 per household and pour flush toilets at $70 per household. The total initial investment cost will then be 500 · 370 = $185,000 which is within the community's means.

   It should be checked that the community can pay for the annual operating and maintenance costs out of its income. Recurrent costs for water per household will be 6 · 0.02 · 0.02 · 365 or about $9 annually. The recurrent costs for the pour-flush toilet including water for flushing will be $10 annually. The total annual cost per household is $19, or about 3.2% of the annual household income of $600. This is an acceptable financial burden.

7. Introduce Part IV of the slide/tape program, "Planning and Implementation," which is approximately five minutes in length.

Economic and Financial Costing Exercise (continued)

Instructions: Work with the members of your group to answer the questions listed below and to perform the calculations required to arrive at your recommendation to the community on the best alternative to select.

1. Are the VIP and the pourflush viable alternatives for the community based on its location?

2. What will each household have to pay per year for a VIP system? For a pourflush system?

3. Which system would you recommend to the community? Why? What would they cost each household? Would you suggest any other alternatives?

4. Would you consider potential upgrading sequences in your decision? How would you present the benefits and costs associated with them?

5. What is your final recommendation to the community and how would you present the costs associated with your proposed alternative?

PART IV: PLANNING AND IMPLEMENTATION

Discussion of Project Phases, Community Participation and Institutional Linkage

Time required: 25 minutes

(Reference: Vol. 1, A Technical and Economic Appraisal, pp. 85-96; Vol. 2, A Planning and Design Manual, pp. 23-26)

1. After participants have viewed the fourth part of the slide/tape program, ask them if they have any questions about the content.

2. Refer participants to the dicussion questions on page P-12 in their manuals. Ask them to record individual responses to the questions and then to discuss them with the other members of their group. Instruct them to select a representative who will summarize their discussion.

3. The purpose of the discussion is to assist participants to identify the successes and problems associated with past projects so they can then determine what steps and strategies are important to include when carrying out future projects.

4. Stop the discussion after ten minutes. Ask a representative of each group to summarize key points made during the discussion. You or the representative can record key points on the flipchart or board.

5. Emphasize that failure to involve the community in sanitation planning and implementation can result in the failure of the project. Moreover, many aspects of community participation depend upon and influence institutional structures. For these reasons,it is important to ensure that participants identify steps and alternatives for effective community participation and institutional linkage, such as those listed below.

   Community Involvement
   - o Preliminary interviews with local leaders, officials, teachers, religious leaders and householders to identify user attitudes.
   - o Community questionnaire and structured interviews to obtain specific information about willingness to pay, preferences, water and sanitation practices, attitudes about convenience, visibility, removal of wastes and importance attached to local autonomy versus responsibility assumed by local authorities or institutions.
   - o Meetings with the community to discuss alternative systems, their costs and features relative to desired service levels and upgrading.
   - o Community organization of project construction and, later, operations and maintenance under local leadership.

   Institutional Linkage
   - o Establishment of a central support unit, a support unit in existing regional agencies or an independent support unit.
   - o Identification of design and operating standards and criteria for surveys, management training and assistance in operations and maintenance.
   - o Training of community workers in low cost systems, hygiene promotion, health education, nutrition and community organization.
   - o Implementation of prototype projects for demonstration and training.
   - o Administration of technical assistance, distribution of spare parts, and operations and maintenance support.

Discussion of Project Phases, Community Involvement and Institutional Linkage

These questions are designed to stimulate further discussion of effective strategies for project planning and implementation.

1. Consider past sanitation projects undertaken in your communities. How were these projects selected? To what extent did the community take an active role in the initial phase?

2. Were feasibility studies undertaken? To what extent did an analysis of technical, economic, financial, social and institutional factors contribute to a decision about which project(s) to pursue?

3. How was project implementation and construction carried out? How were community members, local authorities and institutions involved?

4. How were operations and maintenance activities organized and conducted? How were responsibilities assigned among community members, local authorities and institutions?

5. To what activities or efforts would you attribute the project's successes? What were the major problems encountered?

6. How could future projects build upon past successes while ensuring that past problems did not recur? What steps would be necessary to take and who would have to be involved?

Discussion of Health Education Strategies

Time required: 10 minutes

1. Remind participants that the most effective strategy for improving community health is one that includes improved hygiene practices in addition to safe water supplies and safe excreta disposal. For this reason, sanitation projects must be accompanied by a health education program to promote good hygiene.

2. Refer participants to the questions on page P-12 in their manuals. Ask them to record individual responses to the questions and then to discuss them with the other members of their group. Instruct them to select a representative who will summarize their discussion.

3. The purpose of the discussion is to provide participants with a wide range of alternative suggestions on how to carry out health education in their communities. Participants who know of past successful health education efforts should be encouraged to describe them so that other participants may gain from their experience.

4. Stop the discussion after five minutes. Ask each group representative to summarize the discussion. You or the representative can record key points on the flipchart or board. Encourage participants to amend their own lists with additional suggestions provided by the other groups.

Discussion of Health Education Strategies

The following questions are provided to stimulate discussion of alternatives for promoting health education in your communities.

1. How is health education to improve hygiene practices currently provided in your communities? What institutions, agencies, medical centers and educational groups contribute to health education?

2. What results have past efforts achieved in terms of improving hygiene practices?

3. What other efforts or strategies could be undertaken to improve hygiene practices further? Would the implementation of new sanitation systems require any additional health education efforts?

"LOW COST SANITATION"

SLIDE/TAPE PROGRAM VISUALS AND NARRATION

LOW COST SANITATION - PART I

1. 

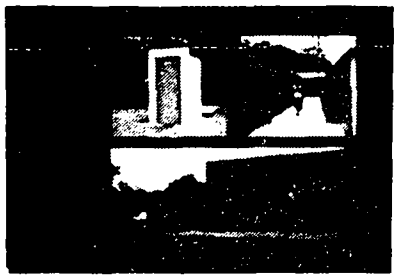
TITLE SLIDE: Low Cost Sanitation

2. 

NARRATOR:
All over the world, people live in different environments..under different kinds of conditions.

3. 

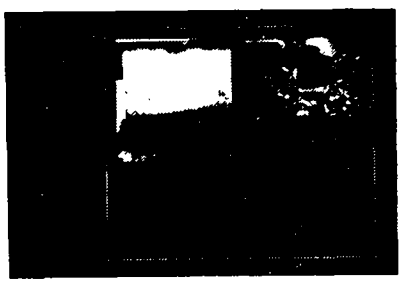
But they all have two needs in common.... a safe water supply for drinking and for hygiene...

4. 

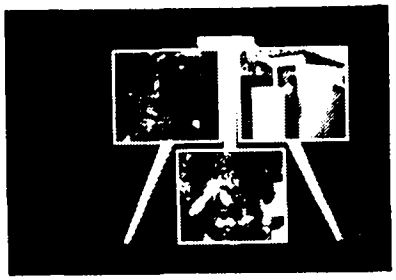
... and some form of sanitation to protect the community from diseases caused by human excreta.

5. 

Yet today, one out of every three people... or over a billion individuals... in developing countries lack adequate access to safe water. Unsafe water can spread disease; and inadequate or distant water sources waste productive time.

6. 

An equal number of people... again, over a billion... do not have adequate sanitation. This lack of sanitary excreta disposal causes transmission of disease from infected to healthy persons in the community --- and, in so doing, reduces the potential benefits of a safe water supply.

7. 

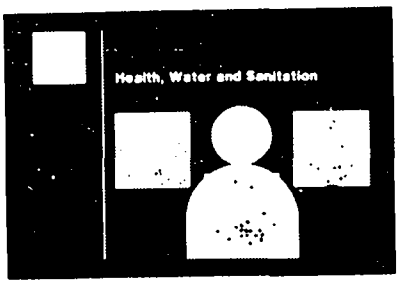
Just as a tripod needs three legs for support, better community health requires an integrated three-part strategy, including:
- ample amounts of safe water;
- sanitary excreta disposal; and
- improved hygiene practices.

8. 

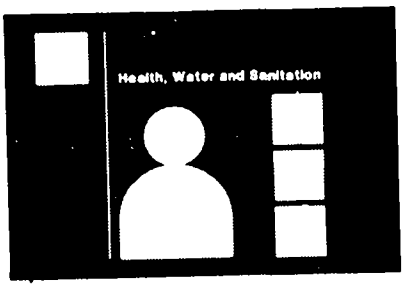
This program will focus primarily on one of the elements... providing sanitary excreta disposal through low-cost sanitation systems.

9. 

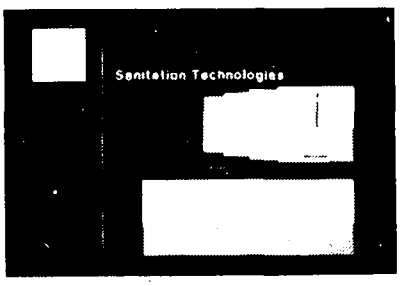
Specifically, the four parts of the program will describe the main elements in planning for a community's sanitation needs.

10. 

The first is the relationship between health, water, and sanitation. In the first part, we'll see how diseases are transmitted through unsafe water, insanitary excreta disposal, and poor hygiene. It is important to understand how diseases spread...

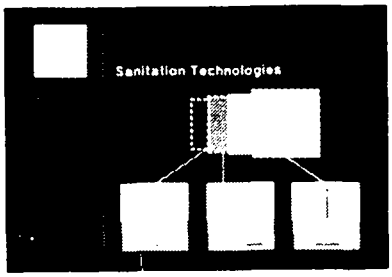
11. 

... In order to see how improved sanitation, along with safe water and better hygiene, can interrupt disease transmission routes.

12. 

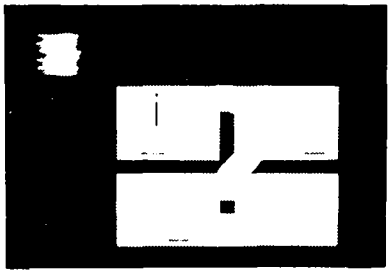
The second consideration is the choice of a sanitation technology. There are many technically feasible sanitation alternatives to conventional sewerage.

13.



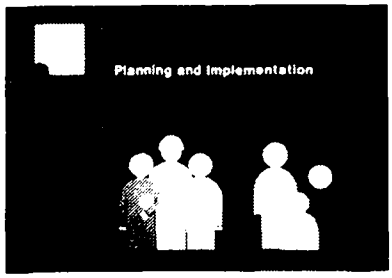
The second part of the program describes the features of three low cost alternatives that can provide full health benefits while avoiding the high cost of conventional sewerage.

14.

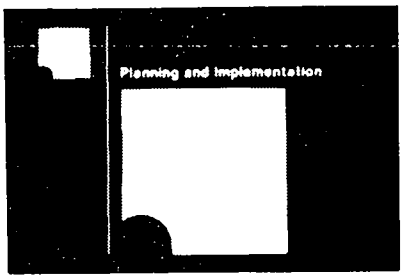


The third element in planning for sanitation is to identify which sanitation technologies will be economically feasible and financially affordable. So, the third part of the program presents some criteria for comparing costs in order to select the most appropriate technology for any community.

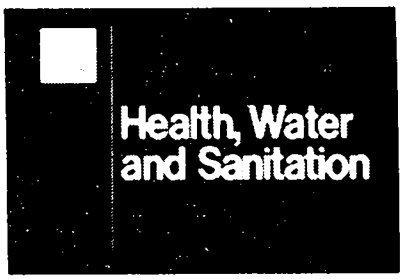
15.



The last part of the program, dealing with the planning and implementation of sanitation projects, reviews the key phases of the project cycle and the required institutional and community involvement.

16. 

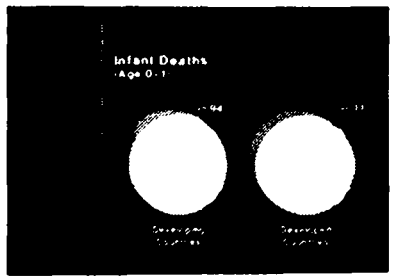
Health education to improve hygiene practices is especially critical for investments in improved water and sanitation to actually yield the intended benefits. For this reason, the program concludes with a discussion of some elements of a health education strategy.

17. 

Now, let's turn our attention to the relationship between health, water and sanitation.

18. 

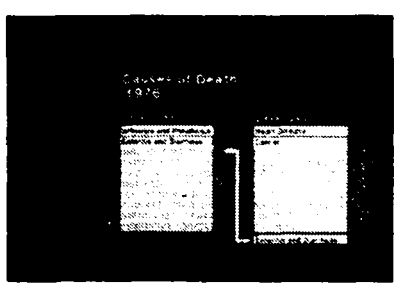
Improved community health is the main reason for investing in better water and sanitation systems.

19. 

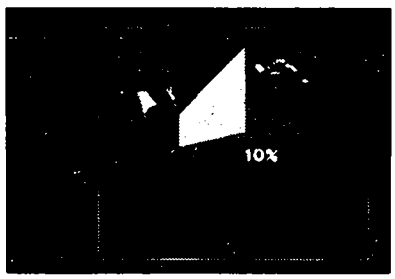
Mortality statistics illustrate the magnitude of the health problem in developing countries today. For example, in 1980, an average of 94 out of every 1000 babies born alive did not survive until their first birthday. In many developed countries, the corresponding number was only 11 out of every 1000 babies born alive.

20. 

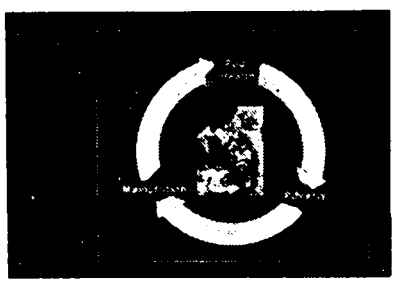
Diseases resulting from unsafe water, inadequate sanitation and poor hygiene account for a significant share of all deaths in developing countries today. To illustrate this point...

21. 

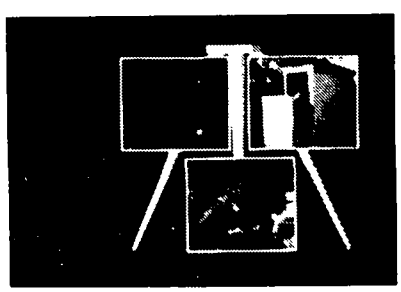
In 1976, infections related to poor water, sanitation and hygiene were the primary cause of death in many developing countries, when coupled with malnutrition and respiratory diseases. Yet, in most developed countries, these infections were well below the tenth cause of death.

22. 

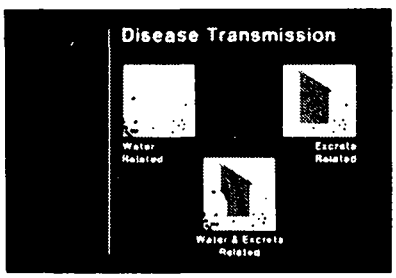
In addition to the alarming mortality rates, it is estimated that people in developing countries lose 10% of their productive time because of diseases related to poor water, sanitation, and hygiene. An unhealthy population cannot achieve economic development...

23. 

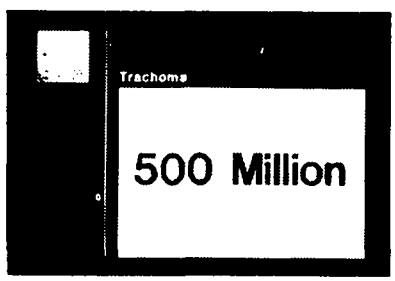
... and, as a result, low-income families often become trapped in a vicious cycle of poor health, poverty, and malnutrition.

24. 

Recent studies have clearly indicated that improved community health requires a combined approach, including safe water, sanitary excreta disposal, and good hygiene.

25. 

In order to see how water and sanitation projects can lead to improved health, we will review the transmission routes of three different types of diseases: water-related, excreta-related, and those that are both water and excreta-related. All 3 types are also hygiene related.

26. 

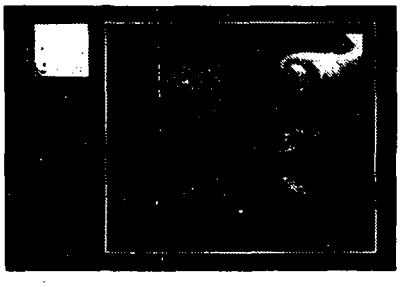
First, Trachoma, one of the water-related diseases. At any one time, it affects 500 million people all over the world.

27. 

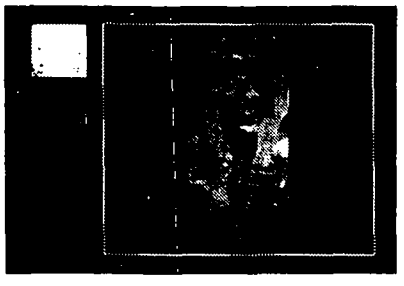
It is most common in countries where malnutrition and unhygienic conditions prevail. It occurs because people do not have enough water for washing and do not practice good personal hygiene.

28. 

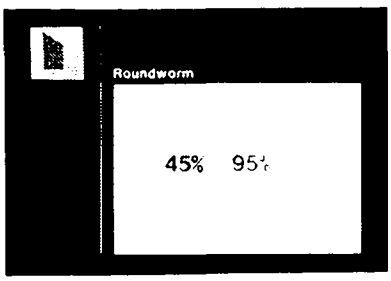
Trachoma causes great suffering. It leads to impaired vision and, in many cases, results in blindness.

29. 

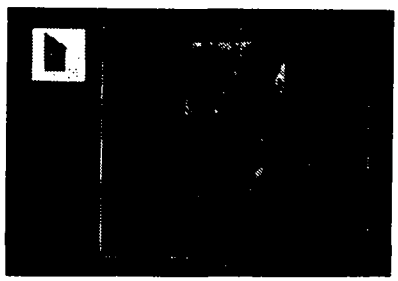
Trachoma is caused by a microbe that infects the eyes, making them sore and inflamed, and eventually causes the cornea to become opaque. Eye ointment can cure trachoma over time...

30. 

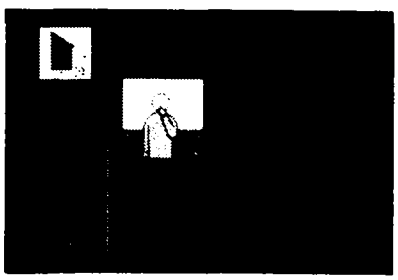
but interrupting the transmission of this disease requires plentiful water and good personal hygiene.

31. 

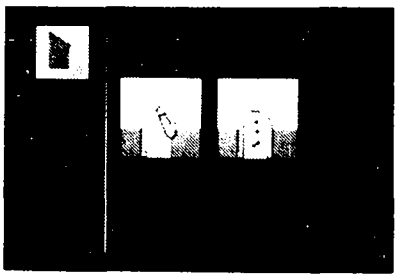
A second type of disease is excreta-related. One example is Ascariasis caused by the roundworm. In Central America, 45% of the population is infected with it at any one time. In parts of Africa, up to 95% of the people have been infected with the roundworm at some point in their lives.

32. 

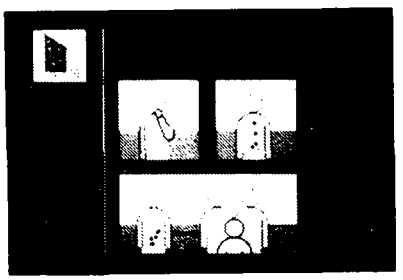
The roundworm is a parasite transmitted primarily through insanitary disposal of excreta. It is especially common in children.

33. 

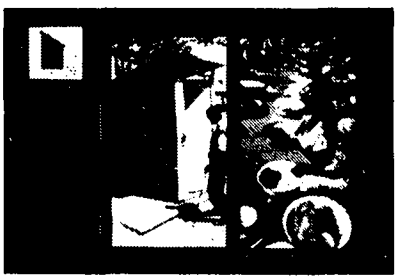
Transmission begins when the roundworm egg is passed in human excreta onto the soil, where it matures over a period of weeks. Children playing on the ground may get the eggs on their hands and unknowingly swallow them.

34. 

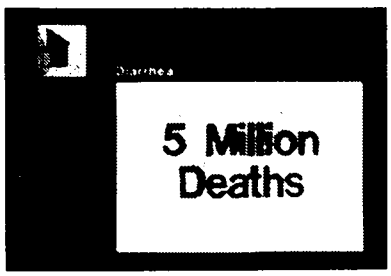
The life cycle of the roundworm is completed in the body. There, the worm saps food and energy and may obstruct the intestines of the infected person.

35. 

The infected person, in turn, passes the roundworm eggs in excreta. If there are no safe sanitation facilities, others can become infected and the cycle continues.

36. 

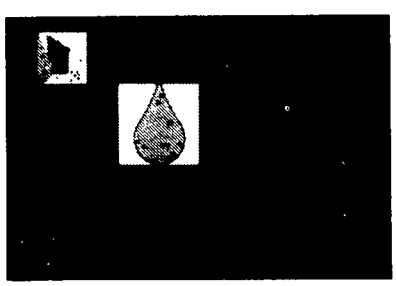
Interruption of the roundworm's transmission route requires hygienic disposal of excreta and improved hygiene practices, (such as washing the hands before eating) to prevent the eggs from being swallowed and to remove dirt or soil that may contain roundworm eggs.

37. 

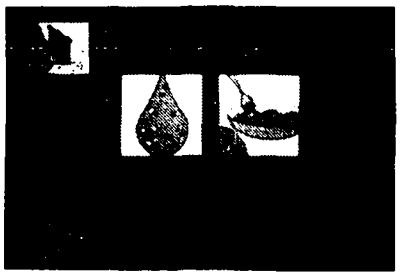
A third type of disease comprises those related both to water and excreta. The diarrheal infections are examples of this type. Every year in developing countries, as many as 5 million children die from diarrhea.

38. 

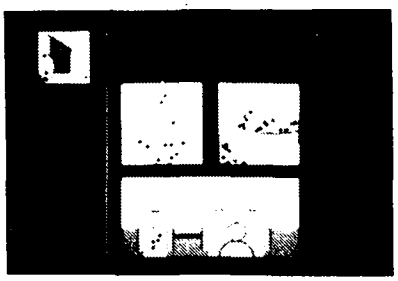
Diarrhea is a major symptom of serious intestinal infections. Children suffer the most. 90% of all child deaths in the world occur in Africa and Asia, and a large proportion of these deaths are caused by diarrhea-related infections.

39. 

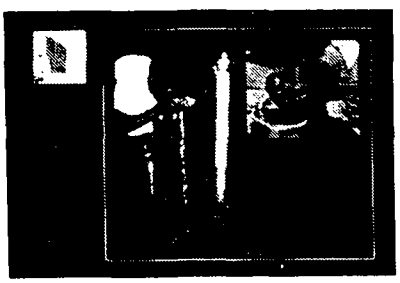
The diarrhea-causing viruses, protozoa, or bacteria are passed in large numbers in human excreta and can infect others. There are three common transmission routes. The first is a water source that is contaminated with human or animal feces.

40. 

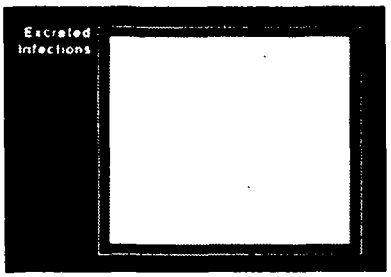
The second is via food that has become contaminated.

41. 

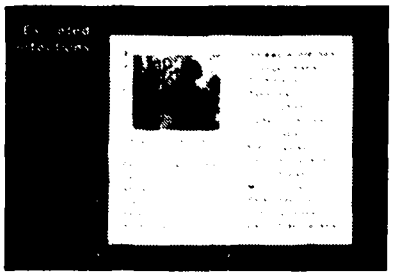
The third type of transmission occurs through direct contact... from person to person via contaminated hands, utensils or other objects.

42. 

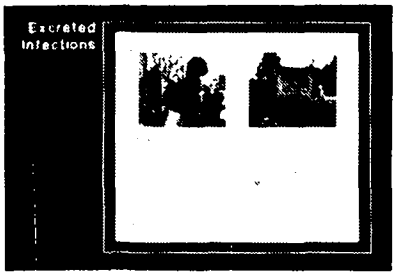
For this reason, the provision of ample, clean water for drinking and for personal hygiene is as important as sanitary excreta disposal for interrupting the spread of diarrheal infections.

43. 

Many different kinds of infections, including all of these, can be prevented by a combination of three elements:

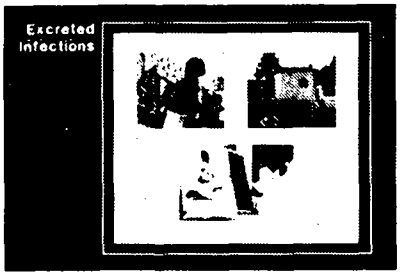
44. 

First, safe water for drinking, cooking and cleansing.

45. 

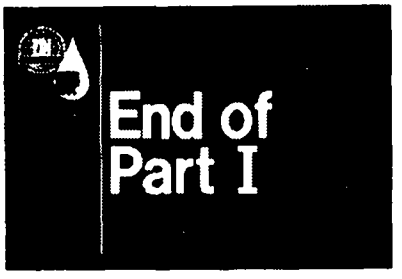
Second, sanitary excreta disposal to prevent the contamination of the environment by the agents of disease.

46.



Third, health education to improve water use practices, to promote hygiene and to encourage sanitary disposal of excreta throughout the community.

47.



This concludes our review of the health aspects of water and sanitation. In the following part, we will examine some alternative technologies for the sanitary disposal of excreta.

(End of Part I)

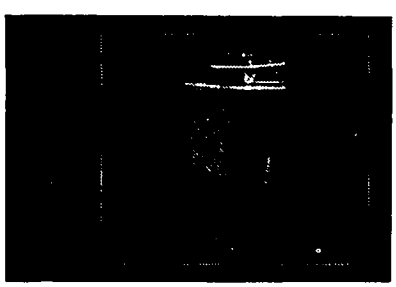
LOW COST SANITATION - PART II

48. 

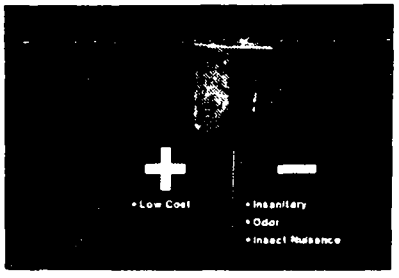
This part of the program presents some of the low-cost sanitation technologies that safely dispose of human excreta.

49. 

In most parts of the world, excreta disposal systems are represented by two extremes, the pit latrine and conventional sewerage.

50. 

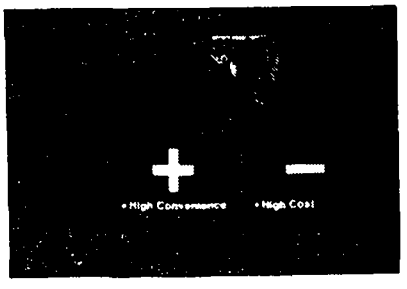
On one hand, the pit latrine remains the most commonly used facility in developing countries.

51. 

Although it has the advantages of being inexpensive to build and maintain, it is often quite insanitary. The odor problem and the serious insect nuisance discourage its use... and if people do not use a system, few health benefits will result.

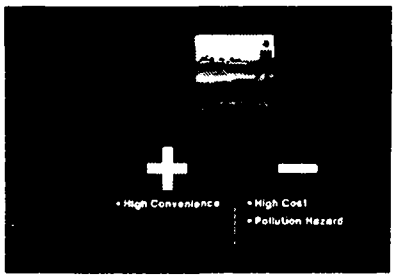
52. 

At the other extreme is conventional sewerage. Here, large amounts of water are required to flush away wastes that are carried in sewage pipes and eventually to a natural water body, such as a river or the sea.

53. 

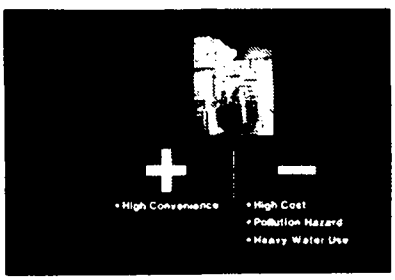
The convenience of sewerage is undoubtedly high, but this advantage is off-set by its very high cost.

54.



Furthermore, in the absence of sanitary treatment, serious pollution and health hazards are simply transferred from the individual household to the receiving water body, where the pollution may cause even greater harm.

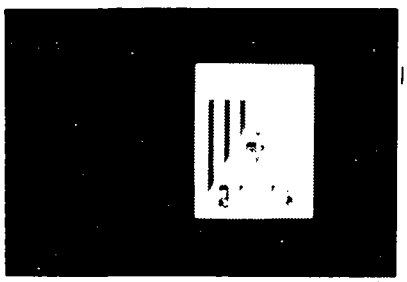
55.



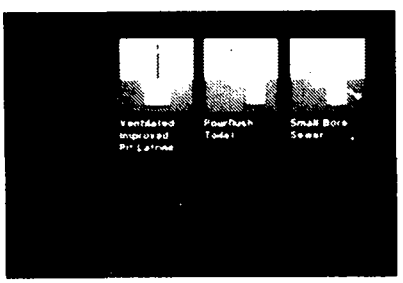
Another disadvantage of sewerage is that it requires a costly indoor water supply and large amounts of water for flushing. Without a reliable and widely distributed water supply, sewerage systems cannot function properly. They will clog and eventually fall into disuse.

56.

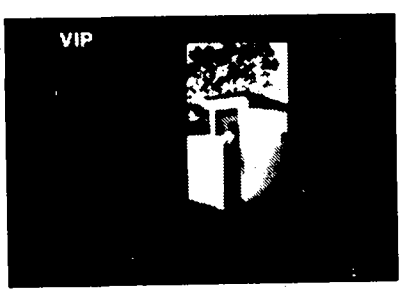
Until recently, there have been few universally-known technologies that could provide intermediate solutions between the two extremes of cheap but insanitary pit latrines and high cost sewerage.

57. 

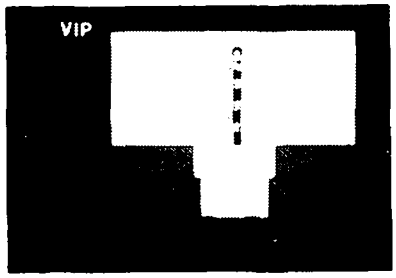
In preparing for the International Water Supply and Sanitation Decade, the World Bank examined the sanitation technologies in use around the world and identified a number of them for further study.

58. 

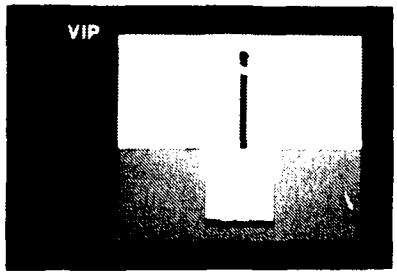
Among the intermediate technologies, three offer the most promise: the ventilated improved pit latrine; the pourflush toilet; and the small-bore sewer system.

59. 

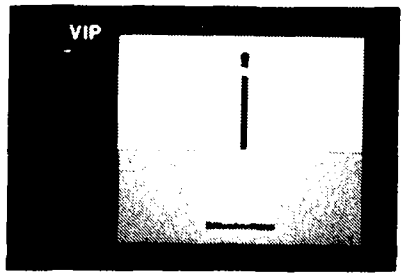
First, the ventilated improved pit latrine, or VIP. It is the next step up from a conventional pit latrine.

60. 

In a VIP latrine, an external vent pipe is added to exhaust foul air from the pit. The pipe is painted black to collect heat. As the sun heats the pipe, the air rises and carries odors out of the latrine enclosure.

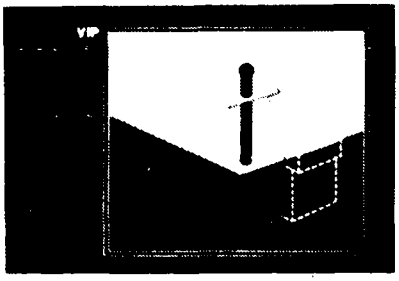
61. 

To control the insect nuisance, the vent pipe is topped with a gauze screen. Insects bred in the pit are drawn to the light at the top of the vent pipe, where they are held until they die.

62. 

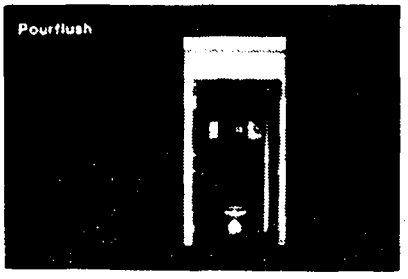
The pit under a basic VIP is slightly offset. This facilitates emptying the pit.

63.



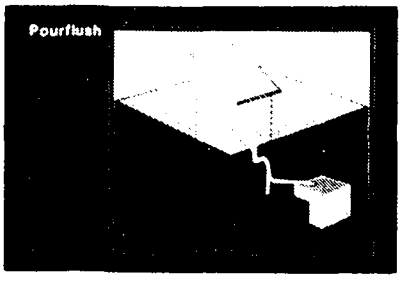
In more densely populated areas, where it is impractical to move the latrine enclosure when the pit is full, another option is to construct the VIP with two pits, dug side by side. When one pit is full, the latrine enclosure is moved over the second pit. Then, the contents of the first pit are left to digest for at least a year before they are removed.

64.

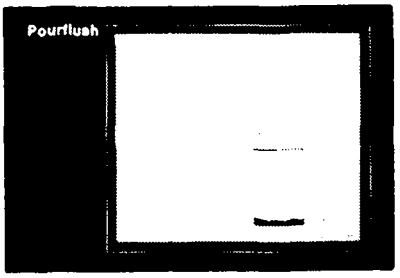


A second low-cost sanitation alternative is the pourflush toilet.

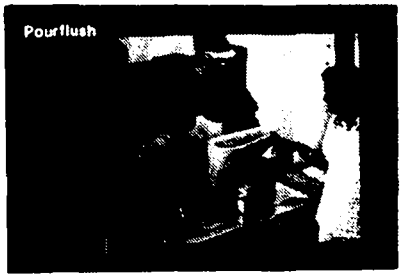
65.



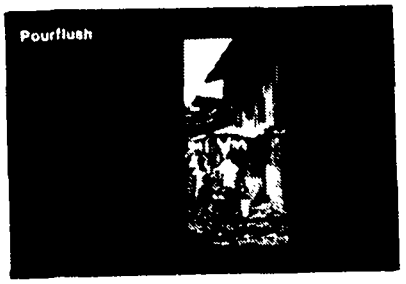
The pourflush is a water flushed toilet. Here, a water seal is added beneath the squatting plate. About two liters of water, poured by hand, flush excreta into one of two pits. The water seal prevents odors and insects from entering the toilet enclosure from the pits.

66. 

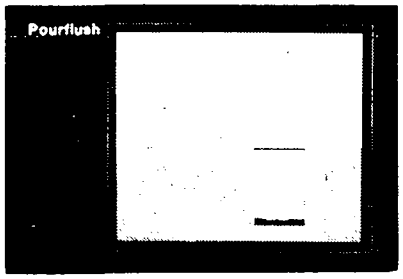
The pourflush can be installed inside the home because it is free of odor and insect problems. It is, therefore, a low cost toilet which also provides indoor privacy.

67. 

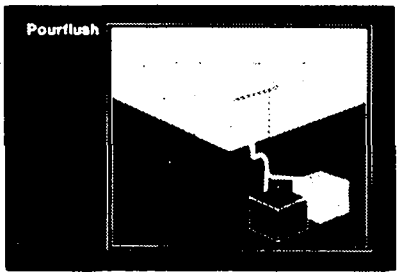
The materials used in constructing the pourflush are locally produced and inexpensive. The bowl can be ceramic, fiberglass, or cast by local masons using cement mortar.

68. 

In areas where water needs to be hand carried some distance, the pourflush may be a less realistic option than the pit latrine, if householders are unwilling to carry all the water needed for flushing.

69. 

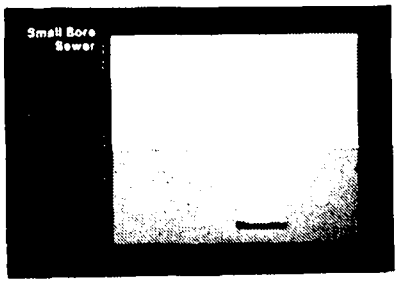
Effective functioning of the water seal requires sufficient water for flushing and keeping the seal from becoming blocked by solid materials. The pourflush has been found acceptable where water is used for anal cleansing.

70. 

The two pits are used alternately. When one pit is full, the other is put into operation. While the second pit is being used, the contents of the first are left to digest and dry. Eventually, the digested contents are used for land fill or fertilizer.

71. 

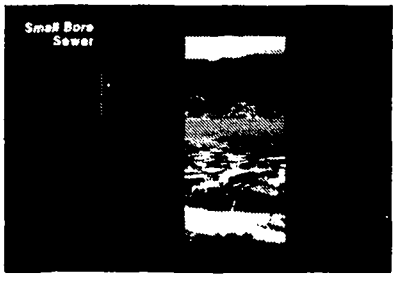
The third system we will examine is small bore sewerage. It can be installed in houses that are fully plumbed.

72. 

This alternative features a toilet and flush system. It is comparable in convenience to a conventional sewerage system. The toilet may be equipped with a manually flushed bowl (such as the one used in a pourflush) or with a conventional cistern flush. In either case, the excreta flows to an interceptor tank where the solids settle to the bottom. The waste-waters overflow into the small bore sewer in the street, which then transports the wastewater to a sewage treatment site.

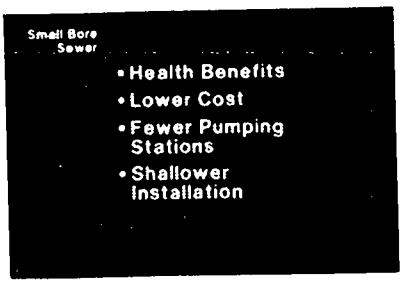
73. 

In those urban areas where land is inexpensive, sewage can be treated cheaply in oxidation ponds located outside the city.

74. 

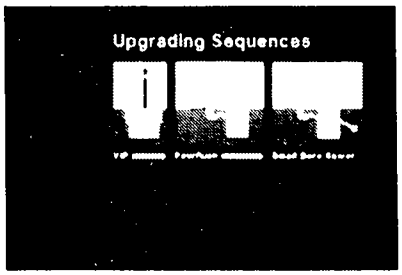
The small-bore sewer system is especially suitable in densely populated areas where houses are connected to the water system, since the system provides most of the benefits of conventional sewerage at significantly lower cost.

75.



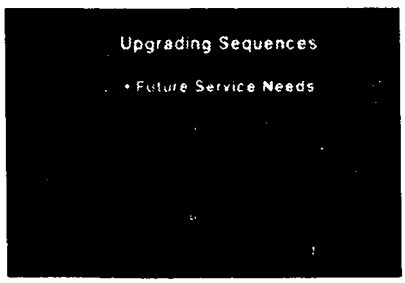
Specifically, it can dispose of all the household wastewaters and provide full health benefits at a lower cost. The system requires fewer pumping stations and manholes. Furthermore, because the pipes are smaller in diameter, they do not have to be buried as deeply.

76.



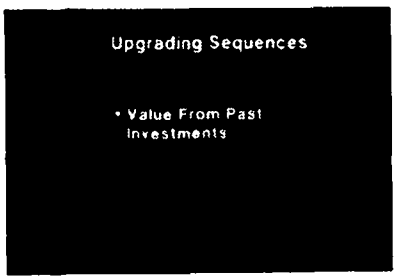
Sanitation systems, including the three just discussed, can be designed sequentially, where each system is an improvement over the preceding one. The step by step improvements are made as the community's expectations and economic conditions permit. Planning for future upgrading helps to minimize the costs of a sanitation system over the long run.

77.



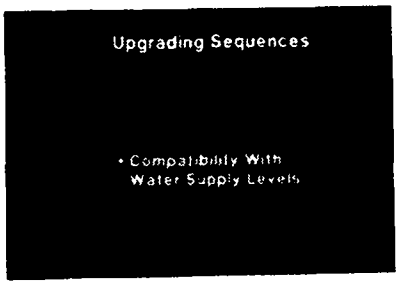
There are three factors to remember when selecting sanitation technologies with upgrading in mind. First, the system selected today should be able to keep pace with the community's future service needs.

78.



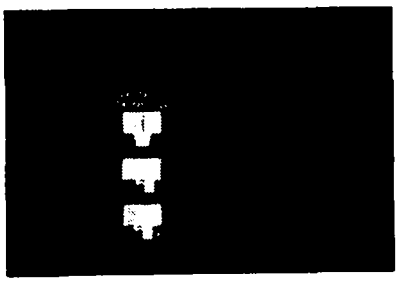
Second, sanitation systems should be selected so the community derives maximum value from past investments.

79.

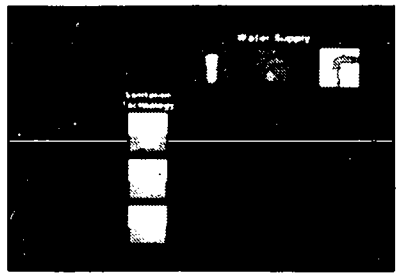


Third, sanitation systems should be compatible with water supply development. In other words, as the community's water consumption increases, the sanitation system should be able to dispose of the additional amounts of wastewater.

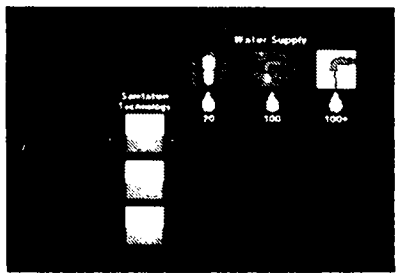
80.



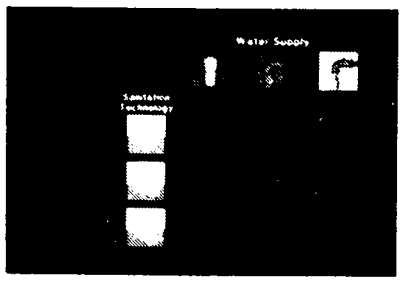
Now, let's take a look at one possible upgrading sequence. This one includes the VIP, the Pourflush, and the Pourflush with a small-bore sewer.

81. 

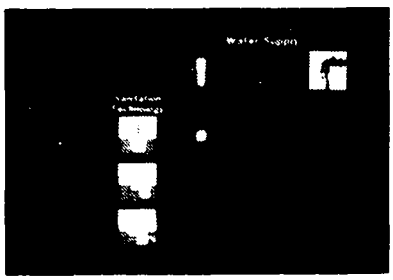
First of all, upgrading must take water service levels into account; that is: whether water is hand-carried, provided through a yard tap, or, available through a house connection.

82. 

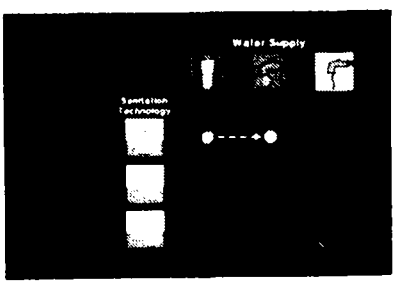
For example, consumers who carry their water themselves will rarely use more than 20 liters per capita per day. But those with yard taps may use as much as 100 liters. And, with indoor house connections, per capita water use may increase well beyond 100 liters per day.

83. 

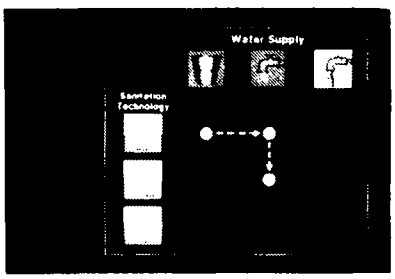
This upgrading sequence begins with a household that has a ventilated improved pit latrine. Water is hand-carried from a well or from a standpipe.

84. 

If a piped water supply is then brought to the yard, the householder will need to dispose of the additional wastewater. He may do so through roughly made soakaways or through open gutters. Excreta will still be disposed of in the VIP.

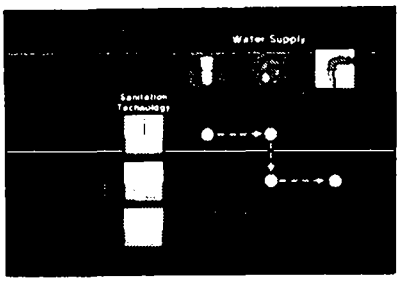
85. 

Later, the VIP can be replaced by a pourflush, using most of the old building materials from the existing superstructure. The purchase of a toilet bowl and pipes, and the construction of the pits are the only additional costs.

86. 

The next step in the upgrading sequence is piped water into the home. For example, a cistern flush system may be added to the pourflush toilet, or a shower and a wash basin may be installed inside the house. These additions will increase the wastewater to be evacuated, so that the soakaway alone will not be able to absorb the increased wastes.

87.

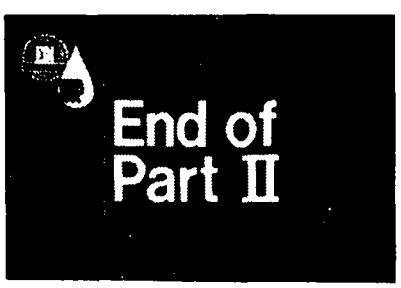


In this case, a small bore sewer can then be installed with an interceptor tank that replaces the pits. This completes the upgrading sequence.

88.

The sanitation systems and the upgrading sequence just discussed represent only a portion of a broader range of alternatives. There are many others which can accommodate the diverse needs of different communities in developing countries all over the world and provide them with the health benefits they need.

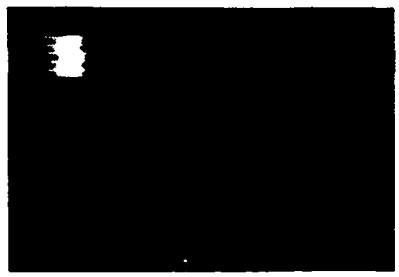
89.



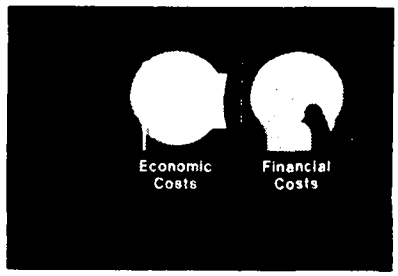
This concludes the second part of the program. In the next part, we will review the economic and financial cost comparison of various sanitation technologies.

(End of Part II)

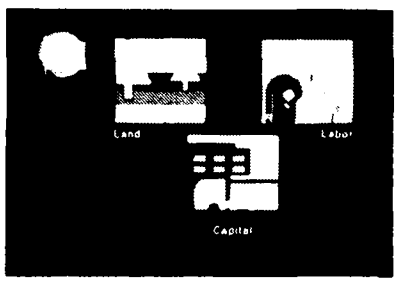
LOW COST SANITATION - PART III

90. 

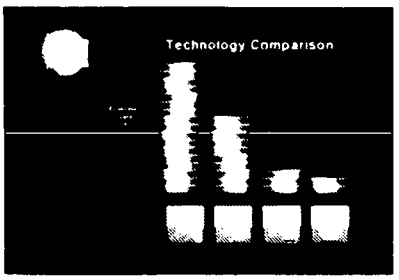
This part of the program outlines some criteria for comparing the costs of sanitation technologies.

91. 

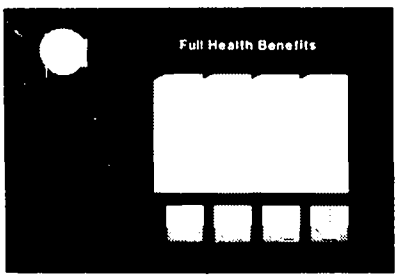
Specifically, this involves the comparison of two types of costs: economic costs that are borne by the country or society as a whole... and financial costs, those paid by consumers.

92. 

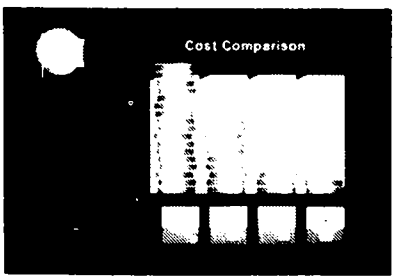
First, let's discuss economic costs. Economic costs measure the value of all resources used up by a sanitation project, such as land, labor, and capital.

93. 

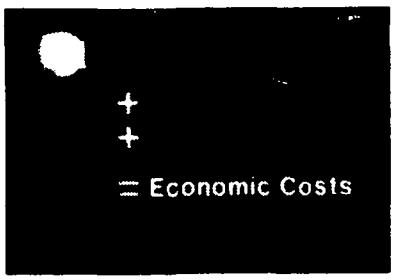
The purpose of deriving economic costs is to make a meaningful least cost comparison among the technology alternatives.

94. 

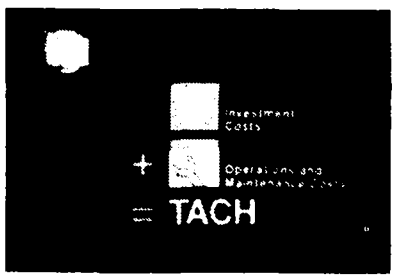
In other words, the economically favored technology is the one that yields full health benefits at the lowest possible economic cost. However, the benefits of sanitation are difficult to quantify and compare. When properly constructed and operated, the VIP, the pour-flush, the small bore sewer system, and conventional sewerage can all provide full health benefits.

95. 

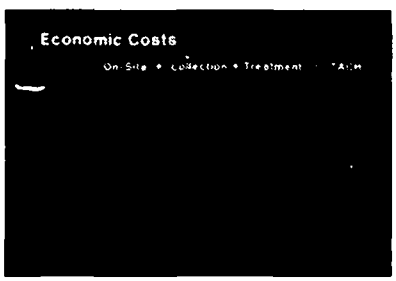
We, therefore, compare only the total economic costs of alternative technologies, all of which we assume can provide similar health benefits.

96. 

To compute economic costs, we add all the costs borne by utilities, by consumers, and by other groups.

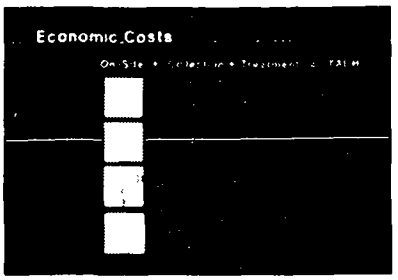
97. 

The most useful figure for comparison of economic costs is the total annual cost per household or TACH. It is computed by adding investment costs plus the costs of operations and maintenance over the lifetime of the project. These costs then are expressed on an annual basis.

98. 

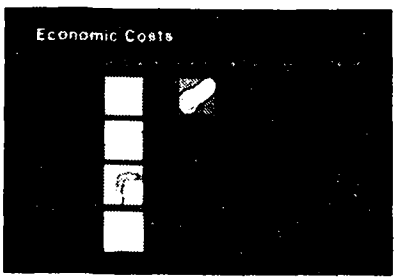
The TACH, or the total annual costs for investment and for operations and maintenance, will normally fall into three categories: the on-site costs to the household, the costs of collecting wastes, and the costs of treating them.

99.



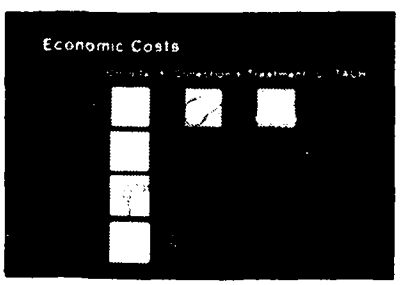
On-site costs include the initial investments for a system, such as the superstructure for a VIP, the toilet bowl for a pourflush, or the indoor plumbing for sewerage systems. On-site costs also include recurrent expenses for operating the system, such as the cost of water used for flushing.

100.



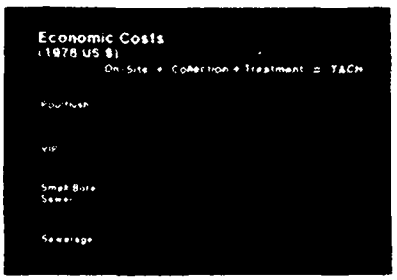
Collection costs are those incurred to transport the wastes from the household to a treatment site. Pipes are an example of one type of collection cost.

101.



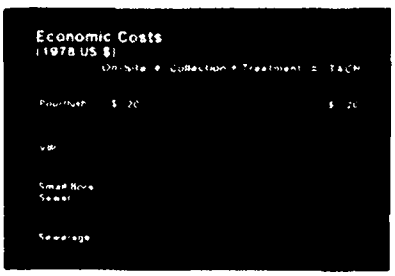
Treatment costs are those necessary to eliminate the health risks of the waste. Maintaining an oxidation pond is one example of this type of cost.

102.



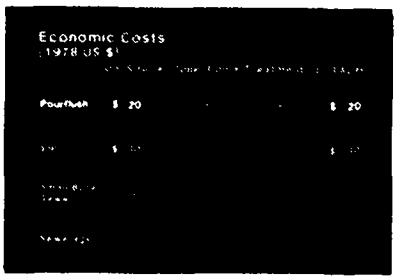
Now, let's review the on-site, collection and treatment costs for the pourflush toilet, the VIP, the small-bore sewered pourflush, and conventional sewerage.

103.



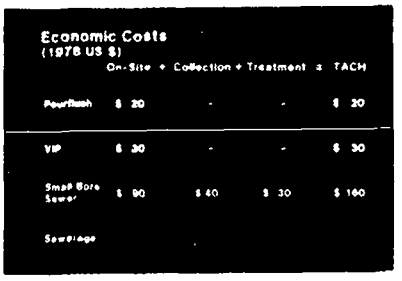
First, the basic pour-flush toilet. The total annual costs include only on-site expenses, since this technology does not require any collection, or treatment offsite. Studies have estimated the on-site costs at about 20 U.S. dollars in 1978 prices.

104.



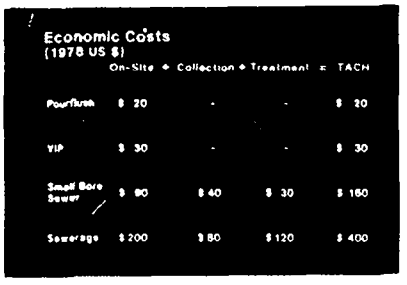
Similarly, costs for a ventilated improved pit latrine are limited to on-site costs, with negligible expenses for collection and treatment. The total annual household costs are estimated at 30 US$ in 1978 prices.

105.



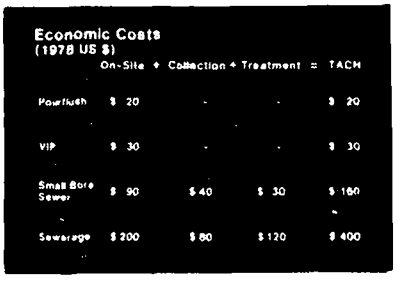
In contrast, the small-bore sewered pourflush incurs costs in all three categories. This is because it requires indoor plumbing, a sewage pipe network, and treatment in oxidation ponds. The higher water requirement also boosts the annual operating costs. The total annual costs per household for this system are estimated at $160.

106.



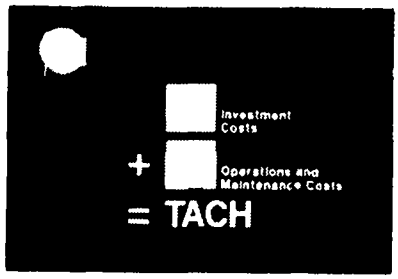
Finally, conventional sewerage also incurs the highest costs in each category, since it requires indoor plumbing, large diameter sewers, complex treatment facilities and substantial amounts of water. The total annual household costs are estimated at $400.

107.



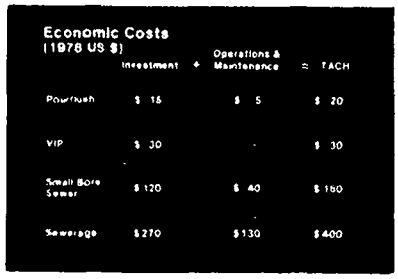
These four sanitation systems can all provide similar health benefits. Yet, the chart depicts some dramatic differences among the costs associated with each. For example, conventional sewerage, although more convenient, will not necessarily yield greater health benefits than a pourflush toilet, but will cost 20 times as much.

108.



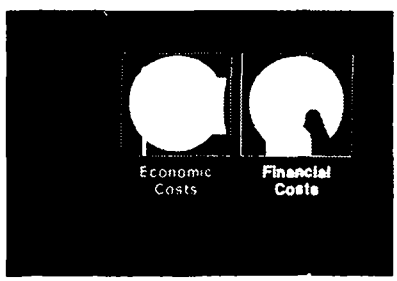
When assessing the economic feasibility of various technologies, it is also important to divide the total annual costs into one-time, investment costs and recurrent costs for operations and maintenance, so we can analyze them separately.

109.



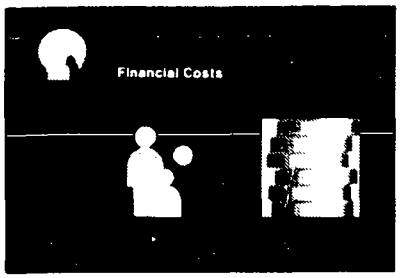
This chart shows the investment and the operations and maintenance costs of four systems. The VIP is the only one which has no operations and maintenance expenses. The other three systems incur operations and maintenance costs, including the expense of water for flushing. This expense is often overlooked in preparing estimates, but must be included in order to make economic cost comparisons accurate and realistic.

110.



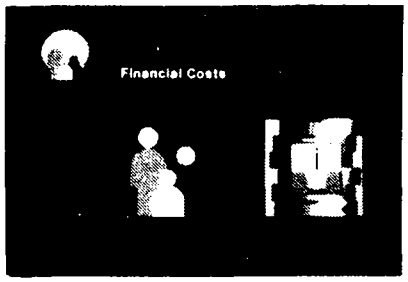
Now, let's turn our attention to financial costs.

111.



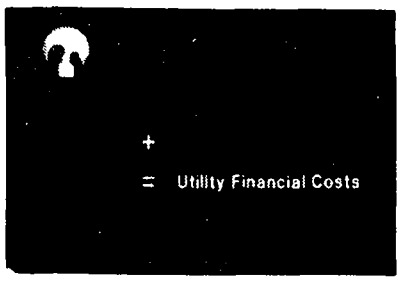
Financial costs are those paid by the consumer. So, it is important to select a technology that the consumer can afford.

112.



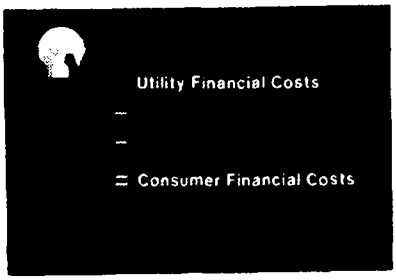
Specifically, the consumer is interested in how much he will have to pay for a new system and how the payments can be spread over time. Let's review how annual financial costs to consumers are computed.

113.



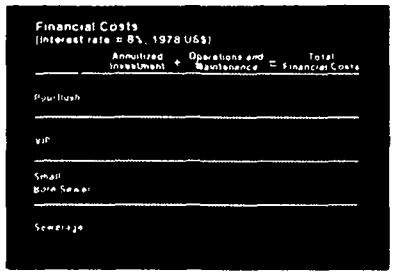
We begin with the utility's financial costs. These include annuitized investment costs based on loan maturities and interest rates. To investment costs, we add yearly costs for operations and maintenance.

114.



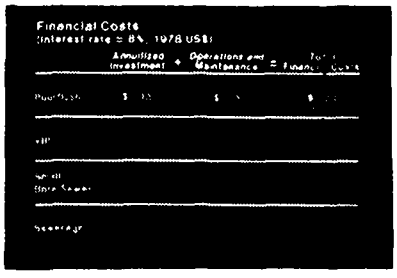
From the utility's financial costs, we subtract any government subsidies and any initial contributions by consumers. The remainder is what consumers will have to pay, or their financial costs.

115.

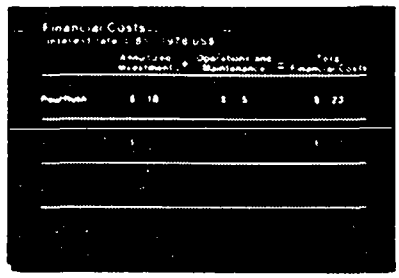


So, the total financial costs to consumers include all annuitized investment costs and recurrent operations and maintenance costs not paid by utilities, government or any other sources.

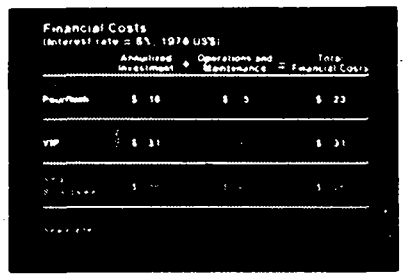
116.



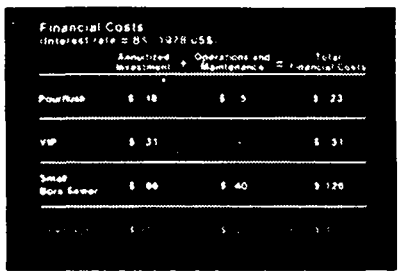
Now, let's examine the financial costs of four sanitation systems, beginning with the pourflush. Assuming that loans will be repaid over a period of 5 years at an interest rate of 8%, the annuitized investment of a pourflush toilet amounts to $18. When we add annual operations and maintenance costs estimated at $5, the total annual financial cost per household of a pourflush is $23.

117. 

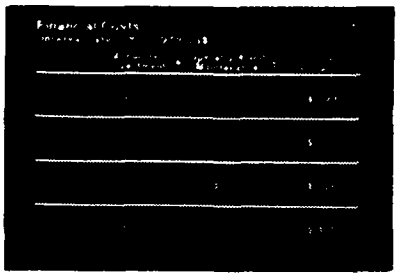
Next, the VIP. With loan repayments over 5 years at an interest rate of 8%, annuitized investment costs for a VIP are about $31. Since the VIP's operations and maintenance costs are negligible, the total financial costs are $31.

118. 

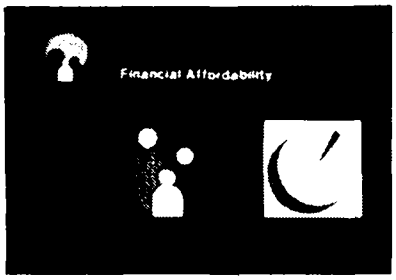
For the small-bore sewered pourflush, loan repayment over 10 years is more realistic. The annuitized investment cost is approximately $86 and annual operations and maintenance costs are estimated at $40. So, the total financial costs for this system are $126.

119. 

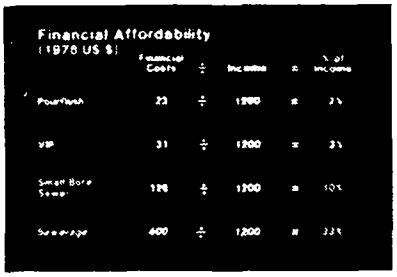
For the more expensive conventional sewerage system, the loan repayment period is likely to be extended to 20 years. The annuitized investment costs for this system average $270, to which we add annual operations and maintenance costs of approximately $130. The total financial costs, therefore, are $400 per year.

120. 

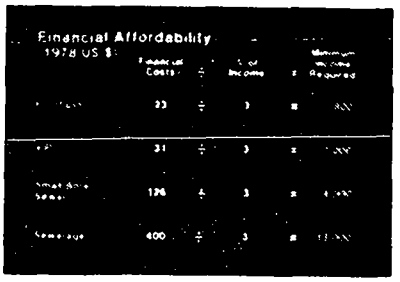
As the chart shows, there is quite a difference among the financial costs for these four systems. Clearly, not all may be affordable to the consumers. Therefore, after computing total financial costs, we must determine whether they are affordable to consumers.

121. 

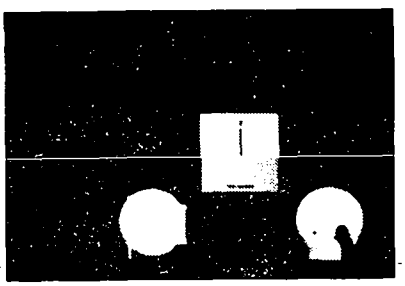
Financial affordability should always be based on a comparison of total yearly financial costs of each technology against the household's annual income. In general, no household should pay more than 3% of its income for a sanitation system.

122. 

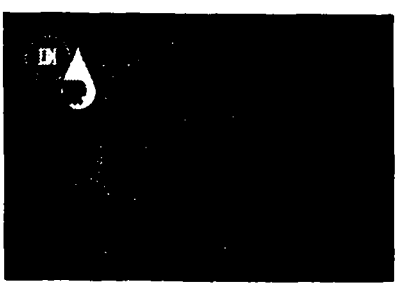
For example, if we apply the 3% rule to a low-income household earning $1200 a year, we see that only the VIP and pourflush systems will be affordable. The other two systems would require the household to pay well over 3% of its income, which is considered excessive.

123. 

Another way of assessing affordability is to compute what income level is required to make a system affordable. As the chart shows, for conventional sewerage to be financially affordable, a household's income would have to be $13,000 a year, unless subsidies or other financial assistance were available.

124. 

In summary, once technically appropriate systems have been identified, an economic cost comparison helps us determine the least cost alternative. Then, a financial cost comparison permits us to assess the affordability to consumers. Both criteria are important in selecting the most efficient and realistic solution to a community's sanitation needs.

125. 

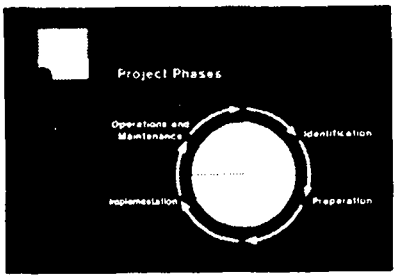
This concludes our discussion of cost comparison and selection. In the next part, we will review some elements of planning and implementing sanitation projects.

(End of Part III)

LOW COST SANITATION - PART IV

126. 

In this part of the program we will review the planning and implementation of sanitation projects ... including the important role of health education.

127. 

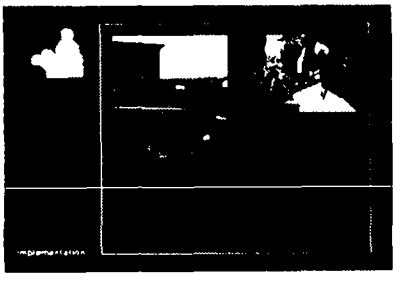
Once technically feasible sanitation alternatives have been identified, and their financial and economic costs determined, each sanitation project must go through four phases: identification, preparation, implementation, and operations and maintenance.

128. 

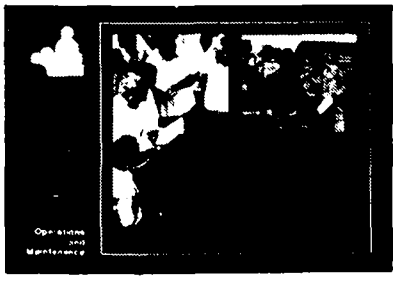
During the identification phase, objectives are set for the level of service desired. At this point, active community involvement is critical. Through formal and informal discussions, community members themselves identify those projects that they feel are most important ... projects in which the community has a strong personal interest.

129. 

Next, the project moves into the preparation phase. A key element in this phase is a thorough feasibility analysis of all the technical, economic, financial, social and institutional factors. The feasibility analysis, in turn, is used to decide which projects are most realistic to pursue.

130. 

Once projects have been defined, the third phase, implementation, begins. This phase encompasses activities from financial investment to actual construction. Project management is critical at this stage to monitor progress and to revise plans, if necessary.

131. 

The last phase, operations and maintenance, includes frequent evaluation of the performance of a new system, and periodic identification of improvements so new systems generate maximum benefits.

132. 

In all phases of the project cycle, health education activities to improve hygiene are critical. Investments in improved water and sanitation systems will produce few of the intended benefits unless they are supported by good hygiene practices.

133. 

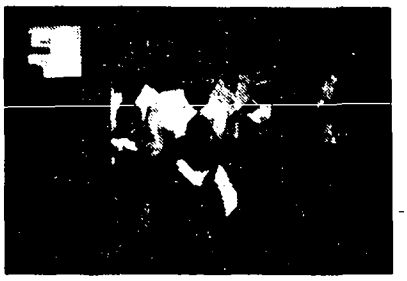
The primary function of health education is to teach the community about diseases. Specifically, the community needs to understand how diseases are transmitted, and how they can be eradicated or controlled through hygienic practices, improved water use and better excreta disposal practices.

134. 

Sometimes, health education must be directed at changing old customs or cultural norms that influence sanitation practices to make them more hygienic.

135. 

Effective health education also requires collaboration among government or local institutions, the community, and health specialists. For example, most governments provide health care programs that operate through clinics and other medical facilities. These resources can be used to promote health education in the community.

136. 

Then, too, maternal and child clinics typically conduct some types of educational programs which offer other opportunities to teach and reinforce improved hygiene practices.

137. 

But the greatest potential for making long term changes in hygiene and water use practices resides within the schools. Here we find the most receptive audience of all...children at a formative age.

138. 

Educating them is also a means of bringing information about hygiene practices into the home, to other family members.

139. 

After all, the children are the leaders and parents of tomorrow. Providing them with the means to a healthy, productive life is an investment in the community's future.

140. 

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