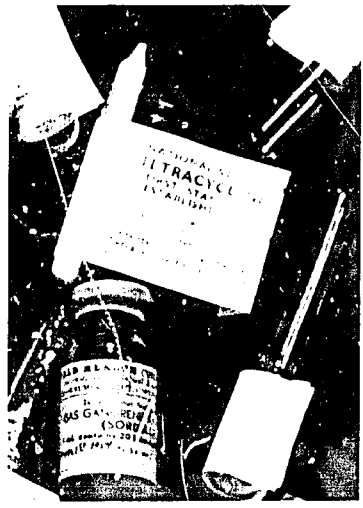
No. 4

ENVIRONMENTAL SANITATION AND INTEGRATED HEALTH DELIVERY PROGRAMS

Charles S. Pineo, David W. Schnare, and G. Wade Miller



MONOGRAPH SERIES
AMERICAN PUBLIC HEALTH ASSOCIATION INTERNATIONAL HEALTH PROGRAMS

ENVIRONMENTAL SANITATION AND INTEGRATED HEALTH DELIVERY PROGRAMS

by
Charles S. Pineo
David W. Schnare, M.S.P.H., Ph.D.
G. Wade Miller

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PREFACE

It has been clear for many years that one of the most basic and fundamental aspects of primary prevention involves environmental sanitation and safe and potable water. Because efforts in community water supply lend themselves to technology-intensive approaches, public health workers have tended to take what has been the path of comparatively least resistance and concentrate on this aspect of preventive endeavor. Experience is showing, however, that efforts to increase availability of water alone can actually result in a deterioration of health conditions in a community unless attention is also paid to drainage, solid waste disposal, and environmental health problems. In arid areas of the world, increased water for people also usually results in increased wastewater for disease-bearing insect vectors as well, and the end result often trades one bad state of affairs for another when only water is given attention.

One of the disarming features of this fourth monograph in the present series is the ease with which the reader will be able to absorb the insights of Pineo et al. as they address the issue of environmental sanitation in primary health care programs. Out of a long career Pineo, with the able assistance of his colleagues, has written a monograph that is reasoned, reasonable and optimistic. The difficulties that must be overcome in implementing environmental health programs represent a considerable challenge that is person-intensive and requires activities directed towards changing behavior. The authors appreciate this, and the reader must not lose sight of that aspect of the problem in this clear outline of how to develop environmental sanitation programs.

The Office of Health of the Agency for International Development has been pleased at the warm response and the many supportive letters and comments that have been generated by earlier monographs in this series. We are equally certain this latest volume in the series will be greeted in a similar manner and welcome your views.

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FOREWORD

As the movement to achieve more adequate levels of health for all by the year 2000 gains momentum, a greater effort is being made to find appropriate solutions to the complex problems of expanding and extending health care.

Given the heavy burden of illness, the scarcity of resources, and the lack of adequate input of previous systems, it is increasingly apparent that new approaches must be found. With the recognition that conventional patterns of curative, hospital-based high technology medicine do not offer adequate solutions, more emphasis is being placed on the promotion of health through more integrated action programs covering health care, sanitation, education, agriculture, and transportation, and renewed emphasis on the participation of individuals and communities. Simultaneously, the need for using previously untapped resources is being stressed.

The effort poses numerous challenges and points up many unanswered questions, unsolved problems, inadequate information sources, and unexplored issues.

In addressing this subject, the American Public Health Association has established a Health Information Exchange through which it generates, collects, analyzes, and disseminates information on issues in health care delivery. As a part of this effort, a monograph series has been initiated to review some of the critical subjects, such as comprehensive planning, manpower development, financing, environmental aspects of health programs, and mobilization of the private sector. The aim is to synthesize available knowledge in a format of interest and use to individuals concerned with the planning and implementation of health care programs.

The effects of inadequate and dangerous water supplies and the lack of sanitation in developing countries were major topics at the 1977 U.N. Water Conference in Mar del Plata, Argentina. It is estimated that over one billion people in rural areas and two hundred million in urban areas do not have reasonable access to a clean water supply, sanitary excreta disposal, or adequate housing; consume food that has been handled under insanitary conditions; and are subject to the ravages of disease that these

conditions promote. To try to reverse this situation, the United Nations designated the 1980s the "International Drinking Water Supply and Sanitation Decade." The effort was launched formally on November 10, 1980. Although the technical and monetary resources of donor countries and U.N. agencies will be coordinated, the success of the effort will depend to a great extent on the commitment of the developing countries themselves, the priorities they attach to these activities, and the support they provide.

This monograph presents information useful in developing and strengthening environmental sanitation programs that become part of an integrated health delivery system. Developing countries adopted the approach described in this report at the 1978 conference on Primary Health Care in Alma-Ata, U.S.S.R. Health personnel in developing countries should be able to use this information to assess their current status, analyze their problems, design programs, build institutional infrastructures, train needed manpower, and develop technology appropriate to their individual situations. The authors also address the vital role of the community itself and of community health workers. The monograph is intended for program planners, heads of environmental health units, and health workers at all levels involved in efforts to improve environmental health programs.

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AUTHORS' PROFILES

Charles S. Pineo is a sanitary engineer who has spent almost 20 years in Latin America helping to develop health and sanitation programs in which the U.S. Government provided technical assistance. He has served as Chief of the Worldwide Community Water Supply and Sanitation Division of the U.S. Agency for International Development and now works as a consultant for various international development agencies. He has directed water supply and sanitation projects in Togo, Benin, Chad, Upper Volta, Kenya, Korea, Malaysia, Bangladesh, Colombia, and the Dominican Republic, among other countries. Mr. Pineo has also written (or co-authored) several publications on water supply and sanitation in Latin America.

David W. Schnare, M.S.P.H., Ph.D., is a management policy analyst in the Office of Drinking Water, U.S. Environmental Protection Agency. He is concerned primarily with developing national programs and assessing the impact of Federal programs on small and rural communities. He has published studies on bureaucracies, the economics of water supply, benefit-cost analysis, and technology transfer into foreign cultures. He has contributed to several private and government studies and participated in symposia on environmental sanitation and health.

G. Wade Miller is vice president of an environmental engineering firm. His experiences in water supply, wastewater treatment and disposal, and other environmental issues have spanned many functional areas: technology development and assessment, international technology transfer, policy development, local water program management, and institutional and financial analysis. He has approximately forty publications to his credit, most of which deal with one or more of the subjects noted above. In his role as a principal in a consulting firm, Mr. Miller is involved in several Federal programs designed to improve water supplies in the United States.

INTRODUCTION

The challenge to improve environmental health confronts every nation in the world. The physical, social, economic, and organizational conditions often vary widely within a country, and certainly among countries. There is, of course, no single approach to meeting a challenge, but hard-won, field-tested experience can guide the interested health official to practical and workable techniques whose success has been proven throughout the world.

This monograph can be used as a practical reference and as a guide to technical sources on environmental health. The first chapter describes the significance and general aspects of environmental health. Chiefs of environmental health units may wish to use the information to better understand these health programs and to reflect on their own nation's success and current challenges. The second chapter introduces the iterative cycle of program development, implementation, and each of the elements that can give the workers' current efforts the punch they need to break through impasses and overcome obstacles. The third chapter discusses the importance of action through local programs. In reading this material, the program chief and especially the program planner can gain insights into the vital importance of local involvement. The final section includes a bibliography of source materials that the planner and health worker may need to improve or solidify their understanding of technical matters—the backbone of environmental health programs—and a list of international organizations involved in environmental health research or programs.

Naturally, environmental health is only one aspect of a larger issue, the integrated health delivery program. The success of an environmental program is often linked directly to its role in a broader health strategy. Readers are encouraged to make these linkages while considering the material presented here and its application to their own national health delivery system. Such study will reveal those areas that may need to be addressed to promote and guarantee a successful environmental health program.

The monograph is more than a practical reference. It is a study of the role of the recipients of environmental health services. The problems facing chief health officers may be awesome, but are surely no greater than those citizens may face: unsafe drinking water, an infection-laden home or workplace, lack of privacy, and shortened expected lifespan. Any improvement in these areas is a major success for the program and its staff. That basic goal—improvement—is not only an aim of the authors, but the aim of every successful environmental health program.

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Significance of a Healthy Environment

The 1978 International Conference on Primary Health Care, held in Alma-Ata, U.S.S.R., reaffirmed that good health is a fundamental human right and its attainment a most important worldwide social goal, the realization of which requires the interaction of the health sector with many other social and economic factors. The conference emphasized that good health is the state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity. It is a clear goal of all peoples to move toward good health step by step, attacking first those areas, such as environmental health, that would improve most quickly the condition of the general population.

In assessing the importance of a healthy environment, one need only compare the people who live in desperate conditions with those who do not. One cannot call the water supply safe in a community in which more than one of every four infants dies before age three. Water-borne diseases rob children of precious food, leaving them stunted and malnourished, their bellies distended. Whole communities are destroyed by cholera, typhoid, and hepatitis because they have no excreta disposal systems. Adult workers are afflicted with onchocerciasis, stilled by sleeping sickness, incapacitated or killed by malaria, because of microorganisms carried by the vectors that share their environment.

Although conditions often appear to be better in cities, urban areas can be just as dangerous. Children with scabies or lice either do not have access to enough clean water or are not aware of personal hygiene practices. Workers who fail to use protective equipment in the workplace expose themselves to deadly industrial chemicals, frequently at the cost of their health and jobs. Students who have access to schools, but who are exposed to air pollutants that dull their minds and scar their lungs, are robbed of opportunities to learn.

In an unsafe environment, national health programs can suffer as much as a newborn infant. In a healthy environment villagers are most apt to understand the causes of diseases and how to avoid them. The sick will go to a public health facility. Attention can be given to prevention, immuni-

zation campaigns, family planning, nutrition, and continuing health education programs. The same programs in an unhealthy environment will be frustrated at every turn. A child nursed to health will be reinfected within days. Children who are sick and living in abject poverty require enormous care, leaving mothers little time to improve family health through educational programs.

In an unhealthy environment, a program must aim to help the community understand the advantages of a healthy environment and show it how to improve existing conditions. This is in addition to the obligation of a national health delivery program to eliminate persistent and common diseases. The health program has to be taken to the villagers. A primary health care worker from the village must be incorporated into a network of workers who deliver services to individual villagers, whether they live in an urban or rural setting.

Without a well directed national health delivery program that includes environmental sanitation, unnecessary human suffering and death occur. These are tolls paid not only by individuals, but also by families and, in some regions, by entire tribes or communities. The unsafe environment is the single greatest barrier to a productive community and healthy population. It prevents access to education, employment, housing, and comfort.

Agricultural self-sufficiency is impossible in a nation where adult workers suffering from water-borne infectious disease are absent half of the time. Industrialization cannot proceed if adequate housing and sanitary washing facilities are unavailable. Urban areas cannot provide a safe-haven from disease if there is no waste disposal system or rodent control program and if the population is uneducated.

These are the difficult lessons an industrializing world civilization has already learned. Nearly half the nations of the world have infant mortality rates greater than 10 percent and average life expectancies of less than 46 years. The per capita income in these countries is less than $500 per year. (See Figures 1-3.) Lest the reader think that mortality is high because income is low, consider the status of the oil-rich developing countries. Although per capita income is high, life expectancy and the infant mortality rate are equal to life expectancy and infant mortality in countries with one-tenth the income.

In simple terms, nations without successful environmental health programs are condemned to poverty, disease, and starvation. No political war of liberation, no land reform program, no religious revival, no cultural revolution will rid a country of poverty, disease, or starvation unless an equally significant improvement in environmental health is made.

Elements of Environmental Health

Environmental health issues exist on three levels. The first level deals with health effects; the second with comfort, convenience, efficiency, and

Health Versus Incomes

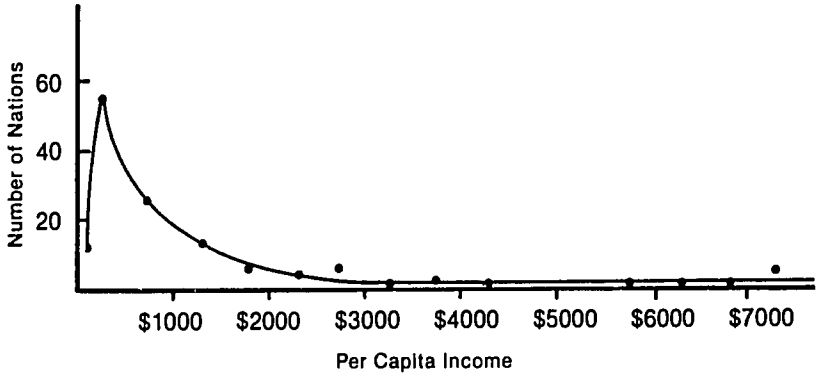

Figure 1

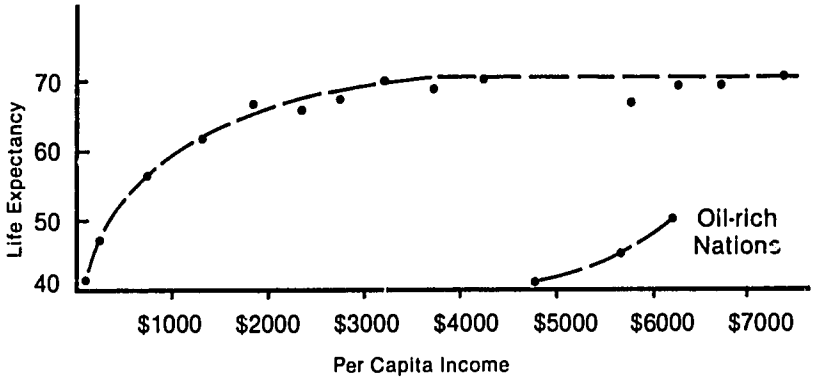

Figure 2

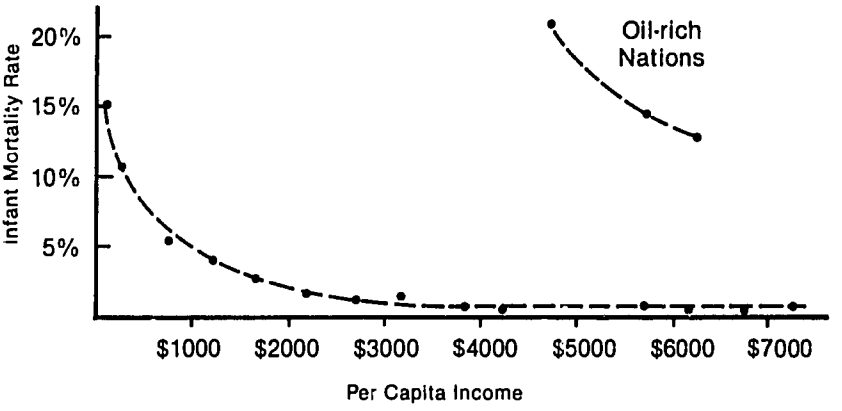

Figure 3

Source: *World Almanac*, 1980

esthetics; the third with natural resources and ecosystems.* Environmental health programs that do not address each level while attempting to improve particular conditions fail. Populations who need assistance act on all three levels and do not respond to programs that they perceive as being too narrow or insensitive to important factors.

The First Level: Health Effects

The causes of poor health fall into three basic categories. In order of international significance, they are: biological pathogens, toxic chemicals, and uncontrolled physical energy. Environmental health programs seek to disrupt or eliminate these causes through man-made adjustments to the environment. The majority of such changes are intended to affect biological pathogens, because they are by far the most prevalent health threat and tend to have a more immediate impact on the population.

Biological pathogens cause infectious or parasitic diseases resulting in physical deformity, malnutrition, severe disease, and death. Table 1 lists many common diseases and the environmental change needed to break the disease cycle. Of the diseases listed, nearly half are attributable to water, food, or soil contaminated by human excreta. About one-fourth are caused by disease-carrying mosquitoes, blackflies, or fleas.

Toxic chemicals, unlike biological pathogens, can be controlled relatively easily, at the point of use or at the point of discharge into the environment. In rural settings, these chemicals may appear as pesticides or fertilizers. In the urban setting, they may be the products or byproducts of a wide variety of industrial processes that emit wastes, or they may occur naturally. The health effects are usually specific to the chemical; it may be years before they appear as a disease agent. The four environmental exposure routes for humans are air, food, drinking water, and occupational environment. Historic air pollution disasters, such as the 1952 London Fog, which lasted five days and killed over 2800 people, may occur when uncontrolled air emissions mix with unusual meteorological conditions and unfortunate geography. Less dramatic events occur with greater regularity where populations are downwind of industrial plants that regularly emit specific contaminants. For example, power plants emit sulfur dioxide, and smelters emit fluorides. Natural events such as volcanic eruptions or forest fires can affect large groups of people with airborne insults. Farming practices in which chemical sprays or dusts are used will affect nearby populations.

Chemicals reach food through fertilization, food processing, and storage. The significant increase in organic chemical use, for everything from plastic wrappers to heat exchange liquids, has increased the risk to health

*This disaggregation was developed by Emil T. Chanlett, Professor of Sanitary Engineering, and is discussed in depth in his excellent reference text, *Environmental Protection*, McGraw-Hill, 1973.

Table 1

Environmental Action to Control or Prevent Disease

	Changes Needed to Break Cycle						
DISEASE	Excreta Disposal	Water Purification	Water Avoidance	Food Sanitation	Personal Hygiene	Immunization	Insect Protection
Vector-Borne Parasitic Diseases							
Malaria							X
Schistosomiasis	X	X	X		X		
Filariasis							X
Onchocerciasis							X
Trypanosomiasis							X
GASTROINTESTINAL INFECTIONS, INCLUDING INTESTINAL PARASITES							
Typhoid fever	X	X		X			
Bacillary and amoebic dysentery	X	X		X			
Hookworm and amoebic dysentery	X	X					
Ascaris	X	X					
Cholera	X	X					
Pinworm	X	X					
Viral gastroenteritis	X	X					
OTHER INFECTIOUS DISEASES							
Hepatitis	X	X		X	X		
Trichinosis	X				X		
Trachoma				X			X
Yellow Fever							X
Dengue							X

that exposure to these chemicals entails. In Japan, 1,000 people and over 700,000 chickens were affected when cooking oil was contaminated by polychlorinated biphenyl (PBC) leaking from a pipe against which the oil passed during preparation. Fish and birds can also ingest and concentrate chemicals, exposing humans who consume the tainted animals to much higher doses than are found in the environment. Similarly, some plants will concentrate chemicals, especially when wastewater is used to irrigate lands or sewage is used to fertilize crops.

Surface water can be chemically contaminated when waste is discharged into streams, rivers, and lakes. Although some rivers have the volume to

accept waste matter, others may be overwhelmed when an area is industrialized, swelling the level of organic and inorganic contamination. Ground water can also become contaminated. Chemical waste released into pits, ponds, and lagoons will leach into the ground. Some disposal methods, such as those used in oil production, inject wastes directly into ground water supplies. Agricultural chemicals introduced into the soil become part of the runoff that ultimately reaches rivers and lakes. Mining practices and construction projects can open natural mineral formations that pollute waters through the action of rain or runoff. In addition, naturally formed chemicals (e.g., arsenic and radium) may coexist with ground water in drilled and dug wells. To protect against these chemical water pollutants, the World Health Organization (WHO) has established recommended drinking water standards. (See Table 2.)

Occupational exposure to toxic chemicals is common to almost every job setting imaginable. Miners breathe the dust and gases of the formation in which they work. Black lung disease is prevalent among coal miners, and many uranium mine workers develop cancer following exposure to radon gas. Fluorides released from smelting plants cause bone and tooth diseases. Brown lung disease and emphysema frequently strike workers in cotton mills. Asbestos workers develop mesothelioma, and

Table 2

World Health Organization Standards for Potable Water

Constituent	Criterion	
Lead (as Pb)	0.1 mg/l	
Selenium (as Se)	0.05 mg/l	Maximum
Arsenic (as As)	0.2 mg/l	allowable
Chromium (as Cr^{6+})	0.05 mg/l	concentration
Cyanide (as CN^-)	0.01 mg/l	
	Permissible	Excessive
Total solids	500 mg/l	1,500 mg/l
Color	5 units	50 units
Turbidity	5 units	25 units
Taste	Unobjectionable	.....
Odor	Unobjectionable	.....
Iron (Fe)	0.3 mg/l	1.0 mg/l
Manganese (Mn)	0.1 mg/l	0.5 mg/l
Copper (Cu)	1.0 mg/l	1.5 mg/l
Zinc (Zn)	5.0 mg/l	15 mg/l
Calcium (Ca)	75 mg/l	200 mg/l
Magnesium (Mg)	50 mg/l	150 mg/l
Sulfate (SO_4)	200 mg/l	400 mg/l
Chloride (Cl)	200 mg/l	600 mg/l
pH	7.0-8.5	(6.5 or) 9.2
(Mg + Na)SO_4	500 mg/l	1,000 mg/l
Phenolics	0.001 mg/l	0.002 mg/l
α emitters	10^{-9} c/ml	.....

those who also smoke dramatically increase their chances of contracting lung cancer.

Occupational exposure to toxic chemicals is not peculiar to industrial or urban settings. Some field workers who come in contact with pesticides during and shortly after spraying have had difficulty producing healthy children. Farmers who must handle the same chemicals have had similar problems. Rural craftsmen may also be at risk. Modern dyes and paints can be toxic if misused; clays, which make up ceramic glazes, contain lead and cadmium; blacksmith forges produce noxious fumes.

The list of chemicals that are toxic to man is extremely long. With the growth of the organic chemicals industry, new risks emerge almost daily. Nearly all of the chemicals have useful purposes, and when introduced into a country's economy, they may spur important advances. For example, PVC plastic pipe, which is used in drinking water distribution systems, is cheap and durable and, until recently, contained excessive amounts of vinyl chloride (monomer). Aluminum products can be useful in many industrial sectors, but if aluminum production is not monitored with environmental (air pollution) controls, crops can be destroyed and the health of people who live downwind from the plant adversely affected.

The tradeoffs between economic growth and good environmental health must be considered before introducing chemicals into the environment. The director of environmental health can reduce the toxic effects of chemicals by acting before chemicals are introduced into the economy. Despite such forward thinking, chemicals will be mishandled, misused, or disposed of improperly. As the risks to health arise, knowledge of the symptoms of chemical-related disease will become increasingly important. (See Appendix 1.)

The third group of environmental dangers is produced by unwarranted physical energy, usually either radiations or noise. These dangers are found in underdeveloped and rural settings infrequently and will not be stressed in this monograph. As technology advances, energy production (e.g., the development of nuclear power) increases; so, too, do the dangers of stray energy. But through diligent government effort during the planning stages, the risks to health and life can be reduced, if not entirely eliminated. As sophisticated technologies begin to appear, sensitivity to changing public health measures is appropriate.

First-Level Technologies

The various environmental health measures used to attack these first-level diseases are designed to stop the transmission of biological disease, to control chemical discharge, or to reduce the production of unwanted energy.

The first of these measures is isolation and disposal of human sewage. The single most effective measure used to reduce the incidence of typhoid

in nineteenth century London was the relocation of the water supply intake above the point where sewage wastes entered the river. The lessons of protecting the population from exposure to human fecal waste are hard won in both urban and rural settings. One of the most dramatic outbreaks of disease occurred in New Delhi, India, in 1955-1956, when a mechanical boom isolating the water supply intake from sewage discharge was left out of position and 29,300 people contracted infectious hepatitis.

Excreta disposal systems can be as simple as pit privies or as complex as major urban sewer systems and treatment plants. Table 1 illustrates the importance of depositing excreta where disease organisms will not be recycled to man. Disease organisms must be further isolated by breaking the vicious cycle through which they are carried by various vectors, rivers, ponds, food, and soil. (See Appendix 1; some references describe the basic techniques to control and isolate sewage waste.)

The development of a safe drinking water supply is equally important. A safe water supply is free of the bacterial, viral, and parasitic organisms that cause most disease in populations in developing nations. Polluted water can reinfect humans with disease organisms if it is not properly treated or if it does not remain protected before use. The best way to maintain water quality is to distribute safe water through a piped system from the source directly to the interior of the home. Kept under positive pressure, these water lines are nearly impervious to contamination. However, the community may not be able to bear the cost of piping water to every house. Fountains, taps, or wells that serve several homes are much less expensive, but, unfortunately, water must be carried to the home and stored in bottles or containers. To maintain good health, the bottles and jugs must be kept clean, covered, and unexposed to disease organisms.

Another benefit of piping water to the home is that more water can be used for general sanitation and personal hygiene. The incidence of water-washed diseases can be reduced dramatically simply by bathing regularly in safe water. If other than home taps are used, a community facility for safe bathing should be constructed, assuming plans for such a facility meet the pre-existing social and institutional needs of the community.

The purpose of a safe water supply is to provide an adequate quantity of high quality water that prevents the transmission of disease.

After safe water and adequate excreta disposal, there are a number of first-level technologies that address the important but less frequently found causes of a disease. The purpose of food sanitation, a group of technologies, is similar to that of water supply protection. Food is protected from infectious organisms. Washing fresh vegetables and fruits in potable water before eating them can dramatically decrease the incidence of amoebic dysentery and several other parasitic diseases. Fully cooking fish and meat will destory viral and parasitic diseases. Refrigerating fresh foods, milk, and eggs will prevent rapid bacterial infestation. Storing

foods in tightly covered containers and in tightly closed cupboards will reduce the risk of contamination from disease-carrying insects and rodents.

Proper disposal of solid wastes will decrease the opportunity for disease-carrying vectors to propagate. Sanitary landfills, incinerators, and compost systems reduce the breeding grounds available to flies and insects. They also help control plague and rabies carried by rodents, dogs, and other small animals. The home and the community or neighborhood can be "environmentally ordered" and the incidence of disease reduced when solid wastes are disposed of properly. Among the secondary benefits are more usable space and more pleasant surroundings.

Beyond these technologies, which directly control disease in the home, there are many pollution-controlling devices that improve the quality of environmental wastes discharged into rivers, streams, the air, and the land, as well as in the workplace. A discussion of these devices is too long to include in this monograph, but the references in Appendix 1 cover the basics of many of these industrial technologies.

A description of two other first-level technologies will round out this discussion of health-related engineering: laboratory support and environmental health planning. Laboratory support is essential; it tells whether or not new or existing technologies are working. The microbiological quality of drinking water is determined by the laboratory support unit. So, too, is the disease state of the populace. The unit is usually based in a central facility, or at regional headquarters, but some laboratory tests can now be made in the field. In all cases, such laboratory support often contributes to the success or failure of a program, because it not only measures the physical quality of the environment but provides for a regular working relationship between the local program and environmental health professionals.

The planning process is a first-level technology. If improvements in environmental health are not planned and vigorously pursued, they will not occur. Environmental protection is a crucial task that must be done. It must be planned and guided to fruition. Without planning, guidance, and action, people continue to get sick, infants die, and national economies fail.

The Second Level: Efficiency and Esthetics

The presence of disease may be less obvious than the presence of odors, tastes, sights, heat, noise, light, or ease of movement. For this reason, this second level of the environment cannot be ignored when instituting first-level measures. Field engineers hear too often that piped and treated water systems are underused because the water is "light," whereas pond water is "nice and heavy" and "sits better" in the stomach; or that treated water tastes "horrible" (because it is cholorinated), but that the unpro-

tected well water at home is "much nicer," even if it is sometimes muddy. To many people, whether educated or not, urban or rural, the familia is more acceptable than the safe.

Second-level effects, such as taste or temperature, are subjective. What is acceptable to one person or community may be completely unacceptable to another. Even slight changes in an environment may be enough to cause associated changes in behavior that have an impact on health. Second-level effects can be exploited successfully. In Guatemala, for example, a drinking water supply was constructed and chlorine added to disinfect it. Health workers and local officials worked together to institute this wanted change, making it a community effort. The chlorine taste was quickly associated with safety in drinking water. Field hands chose to carry the water to distant fields rather than drink the water available in the fields that did not have a chlorine taste.

Only a little thought given to technological change will make it successful. Unfortunately, second-level effects have been the cause of more failed than successful projects, as the following example shows. A series of wells were drilled in several small villages in Thailand, each topped with a hand pump. These wells replaced a surface water supply that was dirty and a considerable distance (1.5 miles) from the community center. Two years after the wells were drilled, few were in use. Drainage away from the wells was inadequate, causing a filthy mud hole that attracted undesirable animals and made access to the pump difficult, if not impossible. This secondary effect precluded villager satisfaction of a first-level health improvement. A second reason given was that the water was "light."

Experience shows that it is the local worker and the villagers themselves who are the best guide to determining which second-level effects are important and which methods should be used to achieve them. To ignore second-level effects is to ensure failure. Hence, the role of the local health worker will be examined at length in the monograph. (For a deeper discussion of second-level effects, see E. T. Chanlett, *Environmental Protection*, McGraw-Hill, 1973.)

The Third Level: Natural Resources and Ecosystems

The preservation of natural resources and ecosystems is not the rich man's avocation of little interest to developing countries. Ecosystems change constantly. For millions of species of life, they represent the most efficient solution to overcoming the threat of non-survival. Changing one basic parameter may drastically alter the ecosystem and produce far less desirable results. In a South American village, for example, when all shade cover on the breeding grounds of mosquitoes was removed, the biting pest-mosquito was also removed, but the malaria-transmitting mosquito took its place. Malaria mosquitoes were eradicated when ocean salt water was released into a fresh water swamp, but brackish-water pest-

squitoes replaced them. Pesticide-resistant flies, biomagnified toxic stes, algae blooms, and rapid eutrophication of lakes may result when effort is made to alter an ecosystem. Any one change can have a major pact on human health.

A consideration of these three levels of effects is essential to any effort to prove health through environmental improvement. Environmental alth planners and directors should be encouraged to consider every et of the environment and of society before instituting change and exre every opportunity of drawing upon the most knowledgeable scienes, as well as the local population, for the best information.

ENVIRONMENTAL HEALTH PROGRAMS

Good health is the state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity. However, when trying to improve the health of a nation, the control and eventual eradication of disease and infirmity should be the first priority. When disease and infirmity are under control, and the people in "reasonable health," the goal of attaining good health can be pursued. Health conditions cannot, of course, be improved at once. The worst health problem must be found, attacked, and handled, and then the next worst problem, and so on. There will never be a scarcity of such problems, no matter how developed the nation. Therefore, improvement is gradual; it comes in stages. Environmental health programs, too, must be initiated in phases.

Any successful program follows an upward spiral. Health needs and wants are determined; a program to meet these needs is planned and implemented using national resources. National resources are used also to measure the program's success. After they are implemented, programs begin to evolve. They can be designed to become self-sufficient and are usually institutionalized. When they have improved a health condition, a new cycle begins and new problems are addressed.

This chapter describes the four steps in the life cycle of an environmental health program: A need is identified; a program is planned; the program is implemented; the program is then evaluated, its successes acclaimed, and its weaknesses corrected. This cycle applies to all levels of government. National needs may be assessed differently than local needs, but both must be evaluated to improve health. This chapter focuses on problems large and small, and should be of interest to every level of health official.

The material presented below deals with the basics of administration and management. The most elegant theories and internationally recognized scholars surround these two subjects. However, at rock bottom, the two most basic elements of a program are its goals and common-sense application. Success is measured in healthy people, not in numbers or types of studies, reports, or plans, nor in facilities installed but not used and maintained.

Evaluating Environmental Health Needs

Usually, those who are involved in implementing program activities and delivering services immediately recognize problems and needs. It is usu-

ally obvious to them that materials to build more water supply systems, spraying teams to eliminate vectors' breeding sites, and vehicles to transport personnel to work sites are the basic needs. The importance of allocating scarce resources for collecting and analyzing information may not be obvious, however; it is precisely because resources are limited that systematic planning based on reliable information is important. Needs must be documented for those who allocate resources. Without such documentation, the worst problems go unresolved, perhaps even unnoticed. Given hard data in a useful format, responsible decision makers cannot ignore problems, though they may find it easier to reject "non-problems." Hard data verify a real need, as well as make available resources to meet that need. Data are essential to those trying to obtain international support for their programs.

There are many sources and types of data, and important information can be overlooked. Several types of required technical data and their sources are described below. They are the major data elements.

Population Data

Population data are data on the number of inhabitants, their age, sex, ethnic background, occupation, place of origin, urbanization, and patterns of migration. These basic demographic characteristics are critical to health planning since they are used to calculate the rates and ratios of many categories of health statistics, such as birth rate, morbidity rate, or ratio of providers to services. Population data are derived from periodic censuses and from official records of vital events, such as births, deaths, and marriages. The information is usually organized into the categories of age, sex, residence, marital status, ethnic group, and place of residence.

Only official population data should be used, and the date of the data should always be indicated. Confusion results when different agencies use different data. Unfortunately, national censuses are usually carried out only once every ten years, and recent trends must be analyzed to project population growth. Official projections should be used when available.

To develop an environmental health program, the listing of villages and towns by region or state should be broken down into various population clusters; for example: 50 - 99, 100 - 499, 500 - 999, 1000 - 1999, 2000 - 4999, 5000 - 9999, and 10,000 or more, or some other grouping that meets the needs of the program. The listing should give the population of each place recorded in the most recent census and the projected population expected at the end of a ten-year period. It may be possible to identify transient populations at villages or camps (e.g., migrant crop harvest camps, religious shrines) where such populations gather regularly.

The analytical need for population data is obvious, but the need for common sense is even more important. The "population" is the sole reason for environmental health programs. Population data listed in a table

or charted on maps are the basic tools of the planner. Population data correlated with health data and current resource allocations reveal dramatically basic needs. Without these data it is impossible to determine need.

Mortality

Data on the causes of death are among the most available, reliable, and useful of all types of health information. They are used to delineate major categories of problems, identify trends, and help monitor the efficacy of health programs. Annual mortality rates are usually presented for:

—the population as a whole (Crude Rate, or CDR);
—infants under one year of age (Infant Mortality Rate, or IMR); and
—women whose deaths are related to pregnancy (Maternal Mortality Rate, or MMR).

Other age-specific mortality rates can also be calculated; for example: the mortality rate for children 1-5 years of age or for adults over 65. The infant mortality rate is a sensitive indicator; it is useful to environmental health planners because it tends to reflect deficiences in sanitary conditions and nutritional status. The diagram of infant mortality presented on page 3 shows just how valuable these data can be in identifying the areas most in need of health resources. The data are just as effective in identifying national or regional needs.

Morbidity

Information on illness and disease is even more useful than mortality data. Unfortunately, this type of data is less easily obtainable and is usually less reliable than mortality data. Furthermore, diseases are unrecognized or unreported, particularly in rural areas, marginal urban neighborhoods, and among transient populations. Those sectors of the population that are the poorest usually are the least represented in the available data. Special efforts must be made to collect more information on these groups.

WHO has developed a system for classifying diseases, injuries, and causes of death that is being used in many countries. (See Table 3.) Data aggregated according to this system can be very useful in obtaining a general health profile and making preliminary estimates of major health problems. Unfortunately, accurate data on most of the infectious diseases for which preventive environmental control programs are needed are frequently unavailable. The exceptions are data on the incidence of smallpox (now eradicated but still under surveillance) and malaria, which is being effectively controlled in many formerly endemic areas. Good information systems, including specially designed epidemiological surveys, play a major role in the design and implementation of control programs for these diseases and underscore the importance of this aspect of environmental health planning. Planners, however, have difficulty estimating prevalence

and incidence rates for most diseases. Regional household surveys are needed for this reason.

Analytically, illness is measured by two different methods: incidence and prevalence.

$$\text{Incidence} = \frac{\text{Number of new cases of a disease during the year}}{\text{Estimated population at mid-year}} \times 1{,}000$$

The population figure in the denominator may be the total for the country or region as a whole, but incidence rates frequently are limited to those groups within the population that experience has shown to be most at risk. The group in the "most-at-risk" category may be age- or sex-specific, rural or urban; it may also represent the total population within a geographical zone where certain diseases are known to be endemic.

$$\text{Prevalence} = \frac{\text{Number of cases of a specific disease known to exist at a given time}}{\text{Estimated population at that time}} \times 1{,}000$$

Again, the figures used to calculate prevalence may be nationwide, regional, age- or sex-specific. A planner needs both incidence and prevalence rates to understand the scale of health problems created by long- or short-term illnesses, such as schistosomiasis or malaria. With short-term diseases, the prevalence may be low, only 10 in 100,000 at any point in time, but the incidence may be very high, perhaps 100 new cases each year for 100,000 people. For long-term diseases, the reverse is true: few new cases each year, but many people ill at any one time.

As with all data, these illness rates have little meaning unless they are compared from region to region or state to state. The high values will jump out at the analyst. A careful examination of regional or state health statistics will indicate, for example, variations from area to area in the incidence of water-borne, water-washed diseases and will probably support the need to strengthen the water supply and excreta disposal activities of the environmental program. Regional health statistics can be used to pinpoint where such diseases as onchocerciasis, schistosomiasis, and malaria are most prevalent, and to indicate areas where programs specific to these diseases should be carried out. Common sense should guide any analysis of morbidity and mortality data. If the prevalence of tuberculosis in the southwest region is 50 per 100,000 and 45 per 100,000 in the northeast, the degree of the disease may be the same in both areas. At best, disease rates are always estimates. One should examine carefully all data, and

Table 3

Major Categories of Diseases, Injuries, and Causes of Death in the International Statistical Classification*

Type		International Classification of Disease Numbers
I	Infective and Parasitic Diseases	000-136
II	Neoplasms	140-239
III	Endocrine, Nutritional, and Metabolic Diseases	240-279
IV	Diseases of Blood and Blood-Forming Organs	280-289
V	Mental Disorders	290-315
VI	Diseases of the Nervous System and Sense Organs	320-389
VII	Diseases of the Circulatory System	390-458
VIII	Diseases of the Respiratory System	460-519
IX	Diseases of the Digestive System	520-577
X	Diseases of the Genito-Urinary System	580-629
XI	Complications of Pregnancy, Childbirth, and the Puerperium	630-678
XII	Diseases of the Skin and Subcutaneous Tissue	680-709
XIII	Diseases of the Musculoskeletal System and Connective Tissue	710-738
XIV	Congenital Anomalies	740-759
XV	Certain Causes of Perinatal Morbidity and Mortality	760-779
XVI	Symptoms and Ill-Defined Conditions	780-796
EXVII	Accidents, Poisonings, and Violence (External Cause)	E800-E999
NXVII	Accidents, Poisonings, and Violence (Nature of Injury)	N800-N999

*8th Revision.

Source: World Health Organization, 1967.

look for significant differences. If all regions are approximately the same, either better data are needed or some other characteristic must be used in deciding where limited resources should go.

Without a regional analysis, a planner will have only a general national picture of conditions in a country. That general measure of health status is, of course, valuable as an historical indicator of success for a national health program and should be calculated and recorded.

Another valuable source of information is the corps of health and medical professionals who travel within a country or region. These people see many different groups but rarely record the health status of their patients so that the data can be analyzed. These health professionals can be queried, but, more important, they can be easily trained to make brief counts of disease cases and record general conditions from area to area. With this knowledge, those areas most in need can be quickly identified, specialized surveys made, and the data used to chart the base case and the

improvements made after environmental health programs are implemented.

Common sense has shown that it often takes little knowledge to identify the worst health problems but an amazing effort to show that improvements—subtle and gradual as they are—have been made. The best measure of health is the ability of the people to lead a productive life. An increase in adult labor hours attributed to a schistosomiasis eradication program is a better measure of health than an increase in grams of protein uptake in food absorption tests.

Agriculture and Economic Status

There are close correlations between economic conditions and the health status of a population. Where data on the health status are lacking, it may be possible to identify important unrecognized problems by analyzing economic or agricultural data. Employment, or more often unemployment, statistics may be available; these can be compared with health data to determine whether whole groups of potential disease pools have been missed by the health data systems. Transient populations, as well as human disease reservoirs, can be similarly identified.

Future problems can be predicted and plans made to correct them when economic data show that growth in an area is likely. For example, when the Aswan Dam was built to provide electrical power and an industrial base for Egypt, planners could have predicted that a diverse new population would move to the area, bringing with it diseases rarely encountered there before. A thoughtful environmental engineer might also have predicted that the reservoir behind the dam would be a potential haven for many disease vectors. With good planning, disease could have been controlled from the start. Unfortunately for the Egyptian population that did move to the Aswan area, no such effective planning was undertaken and schistosomiasis became endemic in all groups almost immediately.

Other economic data can be useful in determining which types of technology should be applied to an environmental health problem. If an area is known to have low wages with high unemployment, it will be immediately obvious that the area cannot support a fully piped water supply system with taps in each house. By establishing strong ties to agencies that collect and analyze economic data, the environmental health planner can acquire important insights.

Ecological Conditions (Natural and Man-Made)

Reliable information on environmental conditions for health planning is generally more difficult to obtain and analyze than data on health status, health services, or economic conditions. In many cases, the problem is not the lack of data, but its dispersal throughout many agencies and

its coverage of several undistinguished technical areas. To assess ecological conditions fully, the data analyst must work closely with professionals in geography, engineering, agriculture, entomology, public health, and other specialties.

Data on the natural environment include information on the geographical and climatic features of the country and its subregions, and the major ecological and climatic zones into which it may usefully be divided. An analysis of the extent to which existing political, administrative, and cultural divisions are consistent with variations in ecological conditions will help the planner decide how to organize certain programs, such as vector control programs. For example, a planner might choose between actual administrative structures or designing new programs. The major categories of data are sources and supplies of both surface and ground water; soil status; types and distribution of plant and animal life, including parasites; location of vector habitats; seasonal weather patterns; and temperature and humidity.

The example on page 10 of the South American village shows the importance of this type of data to planning programs. A program that replaces one disease with another as ecological habitats are changed does not improve health. Although data on climate may be readily available, data on the ecological habitat must be gathered in the field by specialists. Experience shows that field visits are vital to a successful program.

Man-made water supply and waste disposal systems, transportation and communication systems, and chemical inputs to soils and water supplies are part of existing health and agricultural programs, and the significance of data on these systems is so obvious that the subject need not be discussed here. It should be pointed out, however, that the presence of a man-made improvement does not guarantee that it will be used or will remain in working condition. One must distinguish carefully real conditions. Field investigations often are needed to determine these.

Social and Cultural Data

Social and cultural data indicate the distribution and percentages of ethnic groups and are inventories of these groups' beliefs and practices that are most related to environmental health and personal hygiene conditions. Data on variations in the patterns of social organization, forms of leadership, economic activities, caste systems, and divisions of labor should also be collected. Detailed sociocultural data are needed to plan specific programs and projects. An overview of the major social and cultural features of a nation can be prepared in consultation with social scientists, environmental health field personnel, and local officials. Data about social groups must include information on local villagers' interest and participation in development activities.

Existing Programs

Information on the plans and organization of other development programs in the public and private sectors is often useful. Information on the full range of health resources and services, including assessments of past programs and future plans, must be reviewed carefully. Documents that describe the activities of national and international development agencies in agriculture, education, nutrition, public works, public health and community development are valuable sources of data for the environmental health planner. Once familiar with the programs and development strategies of the various agencies, the planner should try to meet with staff in the ministries to discuss the possibility of cooperating on projects. The need to coordinate activities is particularly important when trying to implement strategies requiring community participation.

The environmental health planner should review regional and other multi-agency development plans and programs, since these often provide guidelines for cooperative efforts and facilitate the introduction of environmental health concerns. The review of existing information from many sources may be exhausting and time-consuming, but it can be accomplished in a relatively short period of time once the information is obtained. The planner will be able to skim the contents of most documents and concentrate only on those parts of reports relevant to environmental health issues. By taking the time to become familiar with the goals and objectives of other agencies, the environmental health planner will be in a much stronger position to convince administrators of other sector programs of the need to consider the effects of programs on the environment and health.

A word of caution must be interjected. For political reasons, many administrators are reluctant to devote time and resources to making information on their programs public, and when required to do so, may modify the results or reorganize—that is, distort—the data to reflect accomplishments. There are other reasons for inaccuracies in official data, and environmental health planners should be aware of the possibility of deliberate errors. They should check the reliability of information that is crucial to decision making.

Sources of Information

Given the wide range of information required for planning and the limited funds available for data collection, one must rely heavily on existing written sources. These sources should yield acceptable information during the preplanning and sector assessment stages, but once the planner begins to design specific programs and projects for a region, province, or local village, additional data must be collected and analyzed.

International development agencies, whether multilateral or bilateral,

frequently send teams of experts to help design and implement projects. They have the ability to summarize background and statistical information on environmental health issues, and many are expert in the design of water supply and waste disposal systems and housing and disease control programs to meet the needs of the people to be served.

In addition to reports on environmental and health programs, many agencies prepare reports on the environment and social impact of programs. Thus, documents prepared for agricultural, transport, energy, education, and public works projects often contain statements on the projects' effects on the people and the environment in which they live. These papers should be available from the technical offices of multinational agencies and from planning ministries or planning departments within a country. Among the major development agencies that prepare such reports are the World Health Organization, the United Nations Development Programme, other specialized U.N. agencies, the World Bank and regional development banks for Africa, Latin America, and Asia. Other sources are the development offices in foreign aid missions that coordinate bilateral assistance programs for the United States (Agency for International Development), the United Kingdom, Sweden, France, and other countries.

Planning ministries and planning departments can provide the most up-to-date information on their plans and programs, although as many as two or three years may have elapsed between data collection and analysis and publication. In many cases, the annual budgets of these agencies are the best sources of current information. In addition, annual reports, budgets, and planning documents prepared by provincial and district offices and by the offices of regional planning and development agencies are useful. For those developing area-specific programs and projects, the information obtained at these lower levels may be more relevant than the data available in the country's capital.

In recent years, departments and agencies concerned with population problems have significantly improved their methods of collecting and analyzing census data, which are vital to development planning in all sectors. In addition to information on age, sex, and residence, these agencies also collect and analyze data on economic status, demographic trends, education, health, and the availability of water supply and excreta disposal facilities.

Many departments responsible for geographic research now support units that collect and analyze information on topography, soils, water, and plant and animal life. Frequently, these units take aerial and satellite photographs that they then use to prepare maps that clearly summarize information on many subjects. In addition to basic geographic data, the maps outline population distribution and the location of roads, schools, health centers, and other public works. Some also include demarcations

of zones of zoonotic and human diseases. The following list of other sources may prove helpful; these groups often collect information that exists nowhere else. The sources are:

—statistical units in the Ministry of Health;
—offices responsible for nutrition surveys;
—military services;
—police and traffic services;
—hospitals, health centers, and special clinics;
—large corporations and industrial enterprises:
—pharmaceutical industries;
—special registries (e.g., specific disease, the handicapped);
—health and life insurance companies;
—universities, technical colleges, and special training centers;
—private voluntary organizations (e.g., Red Cross or Red Lion);
—professional organizations (medical, health, engineering, manufacturing, commerce); and
—labor organizations.

Program and project planning at any level usually requires that a special effort be made to analyze data from existing sources and to collect new information. In too many instances, however, planners and administrators confronted with the difficulties of obtaining materials from other agencies, or unaware of the existence of information, initiate their own research programs. In too many cases, the data they collect duplicate information collected by others, and their effort is, furthermore, time consuming and costly. Community leaders often report that the Census Bureau, the Ministry of Education, the Ministry of Agriculture, and a nutrition office conduct investigations in a single area, duplicating each other's work. For this reason, the environmental health planner must systematically obtain and organize data from other agencies before committing excessive resources to new research. This may be time-consuming early in the planning process and will slow down the design of specific projects, but in the long run it should prove extremely useful. By collecting and analyzing the information produced by others, planners will not only be able to use more efficiently the limited funds for research, but they will also be better able to evaluate environmental and health problems of other development projects. This will facilitate the planning of coordinated initiatives.

Regardless of the quality and comprehensiveness of data from other sources, the environmental health planner will probably need additional ecological, health, sociocultural, and technical information. The collection and analysis of these data normally require professional assistance, the many aspects of which cannot be discussed in this monograph.

Perhaps the best source of information for planning is the analysis of the successes and failures of past and current interventions. If the strengths and weaknesses of previous plans, management systems, imple-

mentation, operation and maintenance activities, and monitoring efforts are identified, in all probability the same mistakes will not be repeated, and the program will enjoy greater successes. Nonetheless, we point out, the same mistakes are repeated, time and again. This may be because planners and administrators are pressured to "get something done." If the tendency to look ahead without studying the past is not changed, the cycle of errors and failures will inevitably be repeated, and the "wheel will be reinvented" needlessly many times.

The research methods used in evaluation and planning are similar. Both rely on survey questionnaires, systematic observation, and interviews with program and project staff and with individuals from the project areas (the intended beneficiaries). The types of questions asked and observations made will vary with the type and scale of problem, so that particular research strategies and methods can be designed only after the problems and issues have been clearly defined. (See Appendix 1.)

Setting Priorities

A review of the various data discussed above will reveal those target areas that need assistance (i.e., areas in which environmental health programs should be implemented). There never have been nor will there ever be enough resources to solve all the problems that exist. Therefore, the list of needed programs must be ordered so that the limited resources that are available can be used effectively and efficiently.

Several mechanisms can be used to rank a list of potential programs. It would be inappropriate to suggest one over others, because each decision maker must take into account unique circumstances. One of the simplest is to rank the list by estimated health improvement. For example, programs could be ordered by number of lives saved, or cases of disease cured or prevented. If the relationship of health to program is not clear, improvement could be measured by size of impact, that is, number of people reached or number of services offered. What this approach does not consider is the relative cost of the various programs. For this reason, programs are ordered by cost. This step has little value; it simply breaks out the costs of the programs. This cost breakdown may be useful if resources are allocated and a small portion is left over. The clever administrator will know which programs might be able to use such marginal resources.

A comparison of costs and benefits is more useful than a simple ranking of health effectiveness. The principle is that when a program's benefits are greater than the costs to implement it, the program is worthwhile, and the program with the greatest benefit per cost unit is worth doing first. This principle can be translated into the following benefit-cost (B/C) ratio:

$$\frac{\text{Benefit (dollars)}}{\text{Costs (dollars)}} = \text{B/C ratio}$$

If the ratio is greater than 1.0, the program is worth implementing. If a ratio is determined for each potential program, the programs could be ranked with the largest ratio at the top of the list. This approach considers both the impact of the program and its costs.

Though simple in concept, benefit-cost analysis is difficult to use. One must make sure that all benefits and costs are included. For example, in counting the costs of a well-drilling project, the costs of labor, equipment, and support are added, but administrative costs (paperwork costs of loans, etc.) are often forgotten. If these are included for one project but not another, the B/C ratios cannot be compared properly. Similarly, some benefits are often left out, and the result is the same.

Quantifying benefits is also difficult. What is the value of a human life saved by an environmental health program? (Papers on the analysis of costs and benefits are referenced in Appendix 1.) Some international assistance programs require benefit analyses before they will fund programs.

In ranking programs by B/C ratios, no matter how rough the estimates of benefits and costs, the planner can obtain a special insight into the value of competing environmental health programs. However, not even this powerful approach captures what many nations consider the most important ranking factor: politics.

Few academicians believe political factors should play a role in deciding where scarce resources are applied. However, few experienced health program directors are willing to ignore the politics of resource allocation. It is not the intent of this monograph to either encourage or discourage the use of political factors when ranking environmental health programs. Politics are a fact of life. They are more important in some situations than in others. One point should be kept in mind: several political forces or representatives will keep their interests high on the list, but usually only the health director is aware of the priority of environmental health needs. When one can be matched to the other, resources are obtained more easily. When political interests are not matched to priorities, hard data, including health statistics, become particularly important.

Developing Environmental Health Programs

Two attributes are essential to the successful development of environmental health programs: a basic understanding of organizational management and a willingness to deal with details. The basic elements of program development are similar to those in health and other development agencies. Other sectors consider ecological and sociocultural factors, but generally they have neither an interest in nor the staff needed to carry out a detailed multidisciplinary study. Thus, agricultural extension and road building programs will always consider a range of technical, environmental, and sociocultural factors, but these factors usually will be

evaluated in the context of limited disciplinary perspectives and objectives. In contrast, environmental health, perhaps to a degree greater than any other aspect of development, crosscuts spheres of action circumscribed by other sectors and requires an in-depth, professional analysis of ecological conditions and human behavior. To understand the breadth of problems encountered when developing environmental health programs, a simple but powerful management tool, the Admin Scale, is used. This tool gives perspective to the basic program development task.

The Admin Scale is a tool that gives a sequence and relative seniority of administrative components. The abbreviated Admin Scale shown in Table 4 is worked out until all the components are in full agreement. When any one part of the scale is out of agreement, programs fail, valuable final products do not appear, and goals are not satisfied. The most basic management action is knowing the Admin Scale of the activity and keeping it in alignment.

Table 4

Example of an Admin Scale for Development of a Water Supply Program

	THE ADMIN SCALE*
	GOALS
	PURPOSES
	POLICY
	PLANS
	PROGRAMS
	PROJECTS
	ORDERS
	IDEAL SCENES
	STATS (Measure of Program Effectiveness)
	VALUABLE FINAL PRODUCTS
GOAL:	Decrease Water-Borne Disease
PURPOSE:	Provide Safe Drinking Water
POLICY:	Directorate of Public Health Engineering will carry out a national rural water supply and sanitation program, using local assistance.
PLANS:	Drill 50,000 wells a year until all 65,000 villages are supplied with safe water.
PROGRAMS:	—
PROJECTS:	—
ORDERS:	—
IDEAL SCENE:	A well-drilling and maintenance program which is making yearly advances toward provision of safe drinking water for the nation.
STATS:	Percent of villages with safe and adequate drinking water supplies maintained by the village.
VALUABLE FINAL PRODUCT:	Safe and reliable drinking water supplies.

*Hubbard, L. R., *Organization Executive Course*, volume 7 Permild and Rosengreen, 1957.

When designing and implementing detailed environmental health programs, the planner should keep an updated Admin Scale close at hand. Programs must be directly aligned with basic goals, purposes, policies, and plans. These are senior to the program, and must be known and fully understood before the program can be developed. Every program has an Admin Scale, whether or not it is written or clearly defined. The key to successful program planning and implementation is understanding this scale. Naturally, some elements of programs are quite detailed and beyond the interest of the most senior management staff or the most junior field workers. Nonetheless, anyone involved in a program should understand its Admin Scale.

Some words of caution are appropriate. There is a gap between the availability of a simple tool like the Admin Scale and its use in the complex and often confusing environment of national policymakers. Most people take for granted the stated goals of maximizing good health and minimizing the undesirable impact on the environment. But it is for just this reason that these goals should be examined carefully. At first glance, they reflect the goals and objectives, about which there is no serious debate, contained in U.N. and national policy documents. In practice, the allocation of international and national development funds shows environmental health goals have a much lower priority than industrial growth, increased agricultural output, national defense, transportation, and education. Neither a junior environmental health planner nor perhaps even a national Minister of Health can align national goals with national programs under these conditions. The incongruities must be recognized and addressed as the program is being planned. If it becomes obvious that a program will fail because broad national programs are not compatible, more effort should be devoted to other programs until conditions change. Of course, the most senior health directors must do whatever they can to align national goals and budgets so that their staff are not defeated before they begin their work.

With these broad perspectives in mind, a program planner can design a complete and workable program that covers the smallest detail. Detailed planning is important for two reasons. The plan must guide and support the program as it is implemented, but it must also support the ranking of programs and the allocation of budgeted resources. (The entire planning process is discussed in the literature in great detail; see Appendix 1.) The planner's basic tasks are to describe detailed projects, provide the instructions to carry them out, calculate statistics on program effectiveness, and identify the valuable final products.

The planning process revolves around five basic questions: What is the desired end result? What specific activities including those for operation and maintenance must be undertaken to accomplish that result? What organization will be required at the national, regional, and local levels? What kinds of specialists and non-specialists are needed (or available) to

conduct the required activities? What training is required for the various personnel involved? The final planning document will specify the costs of the required manpower, equipment, and supplies. It will indicate how the program will be carried out and supervised and who will be responsible for it. It will describe how the program will be implemented and on what schedule. Outside assistance will be identified and its provision described. The participation of beneficiaries of the program will be discussed, and the method for evaluating the results specified. The plan also will describe how program or campaign facilities will be maintained. This information is particularly important for a water supply and sanitation program and for most other interventions in environmental health.

Table 5 lists the important sections of a program plan in the order in which they are often discussed. Entire books have been written on each section (some are noted in Appendix 1). This monograph will not cover each segment in detail but will concentrate on several aspects of the planning process.

The discussion of need is usually based on a review of available data. Special surveys or questionnaires may be needed before detailed planning can begin. Experience has shown that programs fail in the absence of important preliminary planning. Planning, too, is somewhat useless if need is not understood clearly. As in all other segments of environmental health, the local perspective is essential.

The section of a program plan that describes alternative approaches is the central component. Various alternatives should be discussed to reflect the full range of strategies available. For example, some environmental health interventions can be carried out using a campaign approach and a "one-shot" project or "once-a-year" program. Another choice might be a long-term program, of which a health education program is a good example. To be effective, the program should be continuous and cover all aspects of environmental health for both children and adults. From time to time some particular aspect of environmental health can be emphasized

Table 5

Basic Outline of a Program Plan

I.	Overall Goal (Admin Scale)
II.	Program Purpose (Statement of Need)
III.	Alternative Approaches (and Recommendations)
IV.	Cost Analyses (Budget)
	• Manpower
	• Equipment and Supplies
V.	Administration Plan
VI.	Implementation, Operation, and Maintenance Schedule
VII.	Financing Plan*
VIII.	Evaluation Plan

*If appropriate

and a special campaign, say, a vaccination campaign, launched. To change people's attitudes toward and understanding of the basic fundamentals of good health, a continuous health education program is needed. A health education plan would have to include alternatives that discuss the positive and negative attributes of both long-range programs and short-term campaigns, and describe the specific activities required for each strategy.

Another important strategy is program coverage. Every effort should be made to ensure that the program reaches all the people for whom it is planned. Planners will have to determine what type of material should be used, how the material should be used to reach all the beneficiaries, what logistics, personnel, material, and equipment will be required to carry out the program, and what the program will cost.

A number of factors control coverage. For example, is the problem local, regional, or national? How large is the budget and will it support the program? Is the manpower pool needed to carry out the intervention sufficient and can that manpower be trained to carry out its responsibilities? Is the capability of the existing organizational structure sufficient to implement the needed coverage? If the program requires community involvement, are the beneficiaries willing to participate? A "real-world" example highlights some of these considerations. For a malaria control program one could choose to launch a mosquito control campaign that would cover those areas where the vector is a problem, or a regional or nationwide prophylactic program that would reach all children and adults.

Another strategy concerns the comprehensiveness of the intervention. Frequently, an intervention (e.g., a rural water supply program) may cover only one aspect of environmental health. However, to produce effective health benefits, the intervention must include a sanitary excreta disposal element and a health education component to ensure that facilities are properly used and maintained. Whatever the intervention, it should be supported by a continuous health education program.

The alternatives must address the role of local village residents and workers and integration with other health initiatives. Local action alternatives are discussed elsewhere in this monograph. A program plan should reflect the careful consideration of these alternatives. The importance of local responsibility for programs and projects cannot be overemphasized.

The integration of an environmental health program with other health and non-health programs should be discussed fully in the section on alternatives. The discussion may reveal that existing labor pools are available to implement the program or that integrating the health program with some other program, such as defense or transportation, will improve its chances of securing an adequate budget. Integration with other programs usually leads to better use of resources, a larger pool of professionals, and the completion of a larger number of environmental health programs.

Two negative aspects should be noted. The health program may be overshadowed by other programs to which it is linked, and it may be difficult to coordinate separate programs. Health goals must be recognizable at all times so that the health program is not ignored and its resources not used for other purposes.

The speed with which a program is carried out depends on the type or magnitude of the problem and the availability of resources. A cholera or yellow fever control campaign should be carried out as expeditiously as possible to prevent the disease from spreading. A rural water supply and excreta disposal program generally is less urgently needed. The speed with which it is conducted will depend on other factors, such as availability of funds, trained manpower, equipment and materials, and logistical support. No program should be allowed to drag on indefinitely. Inflation alone is enough reason to avoid falling behind schedule. A situation is not improved when villager interest in an improved water supply system is aroused and the pipe trenches dug long before the pipe is delivered and the pipe fitter available to help lay it. Specialists such as engineers know how long tasks take and how long one must wait to receive ordered parts. They should be consulted before a schedule is planned.

The sections of a plan that deal with costs and financing are important to senior managers because they indicate what resources must be allocated to the planned program. Most developing nations allocate between two percent and nine percent of their budgets to health. Specific estimates on the percentage of funds used for environmental activities are difficult to make, but a review of the figures for several Latin American and African nations indicates that between 5 percent and 15 percent of the health budget is devoted to environmental health. These figures should be considered as a minimum percentage of the health budget. These figures do not take into account public works and education budgets, which may include programs that indirectly achieve environmental health goals.

Although the goals of environmental health are an accepted part of a framework of basic human values, they tend to have a lower priority than goals in other sectors and sometimes conflict with those goals. This is often true of large-scale hydroelectric and irrigation projects that are planned and implemented with little regard for their impact on the environment or on the health status of populations. Even health sector administrators who control budgeting and planning activities tend to give priority to the expansion of curative facilities. It is the responsibility of the environmental health administrator to determine how policies, plans, programs, and projects can be modified to contribute to the achievement of goals. The key to achieving goals is to influence budget decisions. A well documented program budget is needed to ensure that a plan is funded sufficiently.

It is common practice to request far more resources than are needed. The logic is that since only a portion of the request is likely to be granted,

partial funding must be sufficient. The need for and use of this ploy varies from situation to situation. It is wise to have several plans "on the shelf" so that if an overstated budget is granted, the resources will not be wasted on overdesigning a technical solution. (This is commonly called "gold-plating.")

Resource needs are estimated during the planning process. The estimate should be based on the expert advice of engineers and program administrators. Educated and trained manpower is needed to implement a program successfully. That component must be covered in the program plan. Similarly, the materials, land, or buildings needed must be identified and rental or purchasing costs listed. Occasionally, a national or regional resource (e.g., well-drilling rigs or laboratory facilities) may be listed in the budget. The number of days of use and a time period should be noted in the budget. In brief, the required manpower, money, and materials must be delineated in a program plan. Attention to these details will ensure that all essential program resources are available when needed.

Resource needs should be broken out by source. A national budget request may be submitted with a regional request, but the amount requested from each source should be clear. Both national and possible international funding should be considered. Similarly, local contributions should be specified and viewed with as much importance as the contributions of other sources. The success or failure of an environmental health project may depend on local input, which, for this reason, should receive the same careful and dedicated attention that regional or national budget requests receive.

Administration and Politics

"It isn't what you know, but who you know that counts!" This is a time-worn cliche which has often been proved true. When designing an environmental health program, the planner must know or be familiar with the work of three categories of people: program financers, administrators and supervisors; the health ministry lawyer; and local, regional, and national politicians and opinion leaders.

The health program plan must be sensitive to the actual administrative network that will help implement the program. A regional hospital unit that is treating a population with malaria will not require or use the same manpower, procedures and relationships as a military service implementing the same project. A well developed program plan is sensitive to these differences, describes them in the section on alternatives, and reflects them in the recommendations and budget.

The plan should specify the relationship between the financing administrative network implementing the program and the politicians or opinion leaders. If the planner believes that the relationship is a potential source of trouble, he should include in the plan a strategy to resolve or

reduce the impact of the conflict. Those controlling the finances as well as politicians and opinion leaders are powerful enough and influential enough to prevent a group from planning a program, and they can alter a program once it has begun.

"Political intelligence" is needed to prepare an effective program plan. The people who can most accurately predict how programs will be viewed are those who help plan or administer them—the staff or senior health ministry officials (national politicians) and regional and local opinion leaders and politicians. Other regional and local administrators may also be contacted. This information is often difficult to obtain. The director of environmental health can assist his staff by developing this information whenever possible. Each politician or opinion leader is, of course, unique. Each has his own interests and may or may not be persuaded to support a program. It may be necessary to make special presentations on program benefits or modify the program to obtain support. To ignore important individuals is to ignore both an opportunity to obtain information and support and a potential source of problems. One approach is to invite their participation on an advisory committee.

In addition to the administrative network and important political groups, legal requirements may have an impact on the conduct of an environmental health program. The planner must be aware of regulations and prepare a plan sensitive to them. Legal issues may be local, state, regional, national, or international in scope. For example, an excreta disposal system may be required if a safe water supply is developed using international assistance. At a lower level of government, many individuals may have to approve a nationally-funded insect spraying program before it can be initiated. The planner who establishes a close working relationship with legal advisors or who is knowledgeable about various health regulations and restrictions can quickly prepare a plan and ensure that it reflects the appropriate legal considerations. It may be necessary to amend existing legislation or even develop new legislation to provide the necessary authorization for the program.

Foreign Resources

The writing of this monograph coincided with the beginning of the "International Drinking Water Supply and Sanitation Decade." During this decade, environmental health will receive more attention in national and international programs. The health director and program planner cannot afford to ignore these new initiatives, or other existing programs. Foreign donors often attach restrictions to the resources they commit, and substantial paperwork is required. These resources may be vital to a program unable to obtain sufficient local funding. Furthermore, the expertise and manpower on which the success of an environmental health program depends can be obtained through international programs. These experts

can be especially helpful in developing training programs for supervisors or health professionals and, through an exchange of information, can help local health professionals take advantage of opportunities to improve their skills. Once collegial ties are established, international friendships can pay dividends for years into the future.

Appendix 2 is a list of several international agencies that offer assistance. The Office of the Foreign Minister may know of other programs, especially those of close national allies. Unless self-dependence is an important national policy and an expected goal of the program, the health director or program planner should consider foreign resources when preparing a program plan.

Program Implementation and Administration

Once an environmental health program has been conceptualized and its design completed, the planner can turn to its implementation and administration. In the past, the tendency has been to use too large a portion of available resources to cover capital costs, and thus leave too few funds to operate the program properly. The World Bank reports that annual recurring costs of rural social development projects amount to about 4 percent of capital costs.[1] When planning an environmental health program, these recurring costs must be considered.

The operation, maintenance, and administration of a program are the third of three major building blocks of a program. The first two steps are planning and usually construction. Operation and maintenance of an established program is often its weakest link. Several conditions must be satisfied before a program will operate smoothly:

1. There must be sufficient funds to design, operate, and maintain the program.
2. There must be sufficient trained manpower, at national and regional levels and at the village or community level. According to a 1979 Pan American Health Organization (PAHO) paper, in the Americas alone, approximately 400,000 people will have to be trained in the water and sanitation field to meet the goals of the "International Drinking Water Supply and Sanitation Decade."[2] This trained manpower must include professional engineers and planners, as well as village workers.
3. Engineers and program planners must introduce into the system prescribed and designed "appropriate technologies." The term "appropriate technology" is jargon frequently used in international health; it is a reminder that some technologies, no matter how well conceptualized and installed, often do not meet the requirements of a given situation.

4. National and regional offices must be established and run by skilled professionals.
5. A local infrastructure must exist or be created. This infrastructure should be able to run daily utility operations with the assistance and backstopping of regional and national offices.

Seldom are all of these conditions met. Each local situation must be evaluated on its own merits, case by case. The structure and administration of the program will depend on a number of factors—size, coverage, skill levels available at the local level, etc.

The remainder of this section deals with program administration, organization, staffing, and the roles and responsibilities of key program personnel.

Program Administration

The type of administration needed for an environmental health program depends on the size of the program. If it is a large program, such as a national or regional rural water supply program with international financing, a separate administrative structure within the department responsible for the program may be needed. If the program is small, without any large components, the existing administrative structure should be adequate to administer the program or can be sufficiently strengthened to do so. The following discussion is limited to the use of a separate administrative structure.

At the national level, a competent administrator should direct the administrative section, which will consist of several units, each with separate responsibilities. The administrative office probably will have an administrative section with a few separate units; the responsibilities of the units will be combined at the national level. The administrative office at the national level should have the following units:

1. *Financing Unit With Several Subunits*

   The subunits will be responsible for budgeting, control of funds, payroll, accounting, internal auditing, and billing and collection (if the program charges for water use or medical services).

   The financing unit and its subunits should be located in the national office. Some of the subunits (e.g., the billing and collection subunit) may be needed at the regional level. In the Dominican Republic, billing and collection is handled by zone offices; the treasurer of the local water system collects monthly the charges to the villages. In Malaysia, where house connections are metered, the meter reader from the state office computes the bill as he reads the meter and leaves it with the occupant of the house. The owner or occupant then goes to the state office to pay the bill.

2. *Personnel Unit With Subunit for Training*

The personnel unit and the training subunit will be located in the national office. This unit will prepare job descriptions and recruit personnel; maintain personnel records; and receive and communicate information about internationally- and nationally-financed scholarships in environmental health. (Many opportunities for training are lost because the opportunities for scholarships are not known.) The unit will seek possible candidates, process them, and keep a record on their progress during and after training.

3. *Materials, Supplies, and Equipment Unit*

This unit should be responsible for all aspects of purchasing, warehousing, and distribution. The unit and its subunits should be located in an office at the national level with regional offices as well. It is a customary practice to authorize regional offices to make local purchases, generally within a certain expenditure limit. Local expenditures may also be authorized, but within prescribed limits.

The regional offices usually assume responsibility for the warehouses in which supplies are stored while the program is being implemented. Usually, supplies are distributed from the central warehouse to regional warehouses and then to the field. Sometimes, the supply vendor is instructed to deliver the material directly to the regional warehouses. The local water committee usually is responsible for receiving and storing the materials it uses.

Regardless of where the materials and supplies are stored, their receipt and distribution must be controlled carefully. Haphazard handling of materials and equipment can lead to pilfering and the loss of needed materials.

4. *Transportation Unit*

This unit includes two subunits, one which is responsible for the use of vehicles and one which is responsible for vehicle maintenance. If few vehicles are used, a local mechanic or shop should handle maintenance. Simple maintenance can be carried out at the regional level, while the more extensive work can be carried out at the national level.

If the program is large and requires many vehicles, it may be more feasible for the program to operate its own repair shops, at both the national and regional levels. It also may be possible to have the work done by another agency, such as Public Works or Agriculture. However, these shops may be so burdened with their own repair work that they will not be able to service outside vehicles promptly.

5. *Operation and Maintenance (O&M) Unit*

This unit is particularly important for a rural water supply program. Its place in the administrative structure is discussed below.

Because the success of any water supply program depends on the operation and maintenance of program facilities, operation and maintenance should be given a high priority. There should be a well organized unit at the central level to coordinate and supervise field activities. The maintenance shops at the national and regional levels may be combined with existing vehicle maintenance shops, or new shops should be built specifically to maintain water supply equipment. The maintenance shops should be equipped to do the necessary repair work; they should not, however, be expected to rewind an electric motor or perform similar jobs or other complex tasks that should be the responsibility of personnel at the national level. No unit should attempt to handle an operation, maintenance, or repair problem that is beyond its capacity. The central unit should handle more complicated work using the facilities in its own shop or in a commercial shop.

In some situations—for example, in areas where there are a number of gravity systems or wells with hand pumps—operation and maintenance personnel may be able to serve more than one region. The team should inspect each installation at least once a month and be available during an emergency.

In addition to the regional brigade, each system should employ a person to operate and maintain the system, regardless of its simplicity. This person could be employed part-time if the system is simple and not very large. The employee might be responsible for a number of systems located closely together or supplied by a central source. In the latter case, a person should be hired to monitor each system's functions. System operators should be selected and trained as the systems are being installed.

Organizational Structure: Definition and Staffing

The objective of any integrated health project or program is to provide, at reasonable cost, maximum benefits to the greatest number of people over the longest period of time possible. The beneficiaries of a project will have the greatest interest in making sure the objective is met. The project should be developed so that the beneficiaries will readily appreciate the benefits they will receive and understand their obligations and be willing to make the expected contributions (money, labor, materials, etc.).

Regardless of the program's organizational structure, two groups of individuals are almost always involved in a project: the villagers who will be

the beneficiaries of the project and the national agency that will help deliver the services to the beneficiaries. The villagers will, preferably, be represented by a local committee, either a water supply and sanitation committee, a local health committee, or some other type of committee with which and through which the national agency may work. The national agency may conduct the program from the national office with the local committee's help, or work through decentralized offices in regions or through some other subdivision. In some countries there may be several levels of responsibility and authority; in Bangladesh, for example, there are 4 divisions, 19 districts, 62 sub-districts, 413 *thanas*, and 4,600 unions to reach 65,000 villages.

The responsibilities of an authority at each level must be clearly defined and should be specified in writing. By defining clearly the extent of the authority of each office, the person involved, and his specific responsibilities, the problems of organizational politics can be minimized or eliminated entirely before a program or campaign begins, and productivity and effectiveness will be increased.

1. *Responsibilities*

The responsibilities of the different levels are determined by the type of organizational structure used and the type of program developed. In a country where strong local committees are supported by regional offices, much responsibility will be assigned to both the committees and the regional offices. The national office will be responsible for preparing guidelines, standards, and manuals, and designing complicated systems; preparing program plans and budgets; handling administrative matters and purchasing and storage; supervising progress; and providing evaluation and preparing consolidated reports on program progress and related matters.

The regional office should be charged with implementing the various projects under the program. It should be responsible for preparing studies and simple system designs; helping the villages organize local committees and maintaining contact with the village through those committees; supervising construction, operation, and maintenance activities in villages; providing backup for operation and maintenance (with O&M technical assistance) and keeping stocks of spare parts and materials; training local committee members and operators; storing and distributing materials and equipment for construction; collecting each month from the local committee treasurer the revenues from water charges and distributing those funds according to agency regulations; and performing other duties as assigned by the national office.

The regional office should maintain close contact with the regional of-

fices of the Ministry of Health and help coordinate their water supply activities with the sanitation and health education activities of the ministry.

The size and make-up of the regional staff depend on the number of villages for which the office is responsible and the phase in which the program is operating. The office should be headed by a sanitary engineer who receives support from an administrative office. A group of promoters should be used to maintain contact with the villages during preliminary and construction phases. Commercial agents may be substituted for promoters after construction is completed. (With some retraining, a promoter can become a commercial agent.) At least one person should be responsible for O&M; this person should supervise and provide backup support for the local operators. With the assistance of an administrative officer, he should also be responsible for the storage and distribution of materials and equipment.

In countries where the program is not decentralized, the national office will have to perform the tasks required of regional offices.

The villagers should understand clearly their responsibilities. The promoter can do several things to help the villagers understand and carry out those responsibilities. In turn, the villagers should let the regional offices know they want a safe water supply and a sanitary system, or other environmental health projects. In requesting assistance, the villagers should provide tangible evidence of their willingness to cooperate with project staff in project development. They should be willing to participate—in preliminary planning as well as in providing manpower and local materials when needed—and share the capital and operating costs of the project if they can.

The local committee should have at least five members: a president, an assistant, a treasurer, an administrator, and, preferably, a project promoter assigned by the regional office (who may be replaced by a commercial agent/manager after construction is completed). In some countries, such as Mexico or Colombia, the duties of each committee member are covered by a set of regulations developed by the water supply agency. Either the treasurer or operator collects the water charges. The collector often is authorized to retain 10 percent of the collections.

The local committee should be responsible for all details at the local level. Preferably, the committee should ask the villagers as a group to determine the type of project they want or need or to select a feasible alternative approach. The regional engineer will explain to the villagers the possible alternatives, and the capital and O&M costs required to implement them.

The committee should take charge of the contributions the village agrees to provide. The committee should organize the villagers, who will then provide local labor, local materials, financial contributions, transportation, rights of way, etc.

2. *Authority (Resource Control)*

The responsibilities assigned to each level of the program determine the degree of authority. This authority should be clearly defined and understood.

The authority for purchasing and distributing all the materials for the program may rest with the national office. An alternative is to authorize the regional office to purchase materials and supplies within certain financial limitations and guidelines. The local committee should be authorized to make minor purchases.

The local committee may be authorized to keep all or a portion of the money collected for water charges. In some countries, all the money collected in the villages must be deposited in the national treasury and money for O&M budgeted at the national level. The committee sometimes retains funds to pay for O&M; the remainder goes to the regional office, where it is placed in a revolving fund or used to finance regional administrative costs.

3. *Supervision*

Lack of adequate supervision is probably one of the major reasons that programs are not completed on time; workmanship is shoddy; projects are not carried out according to plans and specifications; operation and maintenance is inadequate; billing and collection practices are ineffective; financial and material control is poor; and other procedures in every phase of a program or project are inefficient. Supervisory functions are often hampered by lack of transportation. Supervisors are unable to check on activities as often as they should. The budget for a program should include funds for supervisory personnel as well as logistical support.

Usually, the head of a department or section supervises the personnel assigned to that department or section. If the national agency is decentralized, the decentralized office is supervised by the next highest office. The national department in charge of operation and maintenance is responsible for supervising regional O&M offices; these, in turn, supervise the operation and maintenance procedures in villages. The national office should monitor frequently activities in the villages.

The president of the local village committee is responsible for supervising the activities of committee members and may ask the regional office for assistance. When local operation and maintenance personnel cannot solve a problem, they call on the regional couterpart for assistance. (Requests are normally channeled through the president of the local committee.)

4. *Progress Reports*

A uniform reporting system must be used to control adequately many projects. The system should provide sufficient information for adequate control, but not require information that might be interesting but unnecessary.

A progress report is a tool, not an end in itself. The most convenient way to report information is to use a form with a space for each item to be reported. Each space should clearly indicate what information is required and in what unit it should be reported. If the form requires data in centimeters, the data should be reported in centimeters, not inches. Some items cannot be quantified, and must be described. It is difficult to correlate these data with other data in reports from other projects and then combine the information into a single unified report. Narrative reporting should not be encouraged.

A progress report loses its value if it is not submitted on time. The summary of a project does not convey program progress well and should not be substituted for a missing report. In some countries a penalty is charged if a report is not submitted on time. In Argentina, where an incentive plan has been used to stimulate the implementation of the rural water supply program, the submission of reports on time is an indicator of progress and a factor that determines the size of the bonus each program worker receives. Care must be taken to avoid falsification of data for personal gain.

Reports should be checked and consolidated at each level. The reports from villages should be checked by regional staff responsible for supervising village work. The reports from the several villages should then be correlated and summarized by regional staff before they are forwarded to the next highest level and finally submitted to the national offices, which prepare the consolidated final program report. Whenever possible, reports should include graphs on which actual progress is plotted against scheduled progress curves. The graphs are useful in comparing actual and planned progress.

Reports should be used, not merely filed away. Problems and lack of progress should be noted. An effort should be made to correct problems. Recommendations should be reviewed for validity and implemented if they have merit. Such suggestions should be acknowledged to let the people in the field know that their efforts are appreciated and that they are not operating in a vacuum.

All too often the results of tests on water quality samples that are rushed in carefully protected containers to a laboratory are noted in reports that are meticulously filed away. No further action is taken, even though the results may indicate gross pollution. Reports should be analyzed and steps taken to correct what may be an environmental hazard.

Reporting should be a two-way activity. Those who prepare reports should be told whether and how they are being used. Suggestions should be reviewed and anomalous situations checked. It is quite discouraging for a conscientious worker to make a useful suggestion only to have it ignored by the supervisor.

The information gathered from reports should be compared with anticipated progress in construction, planned expenditures, and the purpose of the project. The information should be useful in developing similar programs or in expanding programs. A carefully prepared report can be a useful tool, particularly when it has been checked for accuracy.

5. *Recruitment*

Well trained manpower is one of the key elements of any program or campaign. Skilled, experienced, and interested program staff help ensure the success of a program. A clear statement of the capacities and training required and a job description should be prepared before recruitment begins. Candidates who do not possess the desired qualifications, particularly experience, should have the capacity and desire to learn. A training program specific to the needs of the job should be offered.

One inducement that the recruiter should be able to offer is an adequate salary. An adequate salary will not only attract candidates, but will retain them after they have been trained. A second inducement is opportunity for advancement, and training to work toward advancement.

Candidates for a number of types of jobs should be recruited from the village. For example, the pump operator could be recruited from the village and trained while the system is being installed. The promoter also could be recruited from the village in which the project is operating or from a village in the work area. Rural school teachers are good candidates for the position of promoter.

There is a lack of candidates for the position of intermediate-level technician (or implementer). This person works in a regional office and is responsible for translating the designer's plan into a finished product. A trained engineer is not needed to fill this position for the majority of small rural water supply and sanitation projects. The implementer must be trained to carry out his specific duties but should not have to know unnecessary information. He should be supervised by an engineer.

In Malaysia, an ingenious staffing system is being used. Some engineering positions for water supply and sanitation programs are located in the state public works departments (PWDs). The national PWD sends members of its staff to work in the state departments. Under this system, the national PWD supplies state offices with well qualified people. The system also encourages national and state offices to establish and maintain close relationships.

Operation and Maintenance of Environmental Health Programs

One of the first things to consider when planning and designing an environmental health program are the long-range implications and requirements of the program. Will the input from the program require additional work or attention after the program is completed? Will a follow-up to the rodent control program/campaign be needed so that more progress can be made? What will happen to the sanitary privies once the villagers' initial enthusiasm diminishes? What must be done to maintain control when the malaria eradication program reaches the control stage? How should the rural water supply systems installed as part of a regional or national water supply program be operated and maintained? (This question is particularly important.)

These considerations are frequently neglected during the design stage. The result is hundreds of rural water supply systems that cannot operate because no provision was made to maintain the hand pumps or gasoline pumps installed as part of the systems. Chlorinators all over the world have been rendered useless because a broken part cannot be replaced or because chlorine is unavailable. Outbreaks of malaria and yellow fever are occurring because control measures have not been monitored rigorously.

The need to plan and provide for the necessary operation and maintenance procedures is apparent. The first step is to design the components of the program so that they can be operated and maintained by the available manpower and at a cost that the beneficiaries and the agency overseeing the operation and maintenance of the facilities can afford. It is useless to design a rural water supply system that uses gasoline or diesel engines if neither the villagers nor the water supply agency can finance the cost of the fuel. Bilateral and international agencies have helped design and install gasoline-operated engines in Tanzania and other countries that could not pay the cost of the fuel. After several years of operation, the engines went out of service because neither the national agency nor the local water committee could pay for the fuel. As this example shows, operation and maintenance requirements should be considered when selecting a technology for a program.

The program plan should specify how program facilities should be operated and maintained. Full advantage should be taken of the potential manpower capabilities at the village level that can be developed through adequate training. Arrangements should be made to select, train, and compensate facility operators and maintenance staff. Adequate supplies and replacement parts should be distributed to the villages.

Responsible programs must go farther. Local operators must have an outside resource to assist them when facing problems they cannot solve. Resource persons should be located in a regional office where they can be reached easily by the village operators. A competent sanitarian or

engineer from a regional office should supervise the operators and help perform maintenance procedures in which the operators have not been trained. The regional office should make an inventory of repair parts and use it to supplement the local supply.

Preventive Maintenance Procedures

When a facility is installed, a basic manual should be provided to the person responsible for operating and maintaining the facility. The manual should include diagrams and explain operation and maintenance procedures as simply as possible. The operator should help prepare the manual, if possible. Step-by-step instructions and supplemental explanations should be provided. The manuals should list the tools that will be needed; these tools (and a method for safeguarding them) should be provided to the operator. The manual also should underline safety requirements and prescribe methods for meeting those requirements. It should stress the importance and objectives of safe water and sanitary excreta disposal and indicate how these objectives can be accomplished.

The manual should be prepared only after a step-by-step field analysis of each procedure has been made. If the manual covers food sanitation, the procedures should be analyzed in the market as well as in the home. If the manual covers rodent control, the procedures should be analyzed in the market, homes, and other areas where rats are likely to congregate.

After the procedures have been designed, they should be tested by those for whom the manuals were prepared. The manuals should be used as textbooks for the trainees and as guides for the trainers.

Often it is possible to obtain a copy of a manual used in another region or country and adopt it for use in a given program. The U.S. Agency for International Development is preparing a series of fact sheets that will be useful in writing manuals on various procedures. The World Health Organization and the World Bank as well as other organizations have prepared a number of manuals on rural water supply and sanitation needs for the use of central and regional offices. The local or regional representatives of such organizations should be contacted for additional information.

Roles and Responsibilities

The importance of defining the roles and responsibilities of each individual agency at each operating level cannot be overemphasized. The responsibilities of the various offices of the agency developing the program must be clearly defined at the outset and should be stated in writing to avoid misunderstandings. The specific responsibility and degree of authority should be defined. Sometimes the local water committee will be authorized to purchase small repair parts, the total value of which will be

fixed, say, at $25; the regional office may be able to purchase repair parts and equipment costing less than $500; all other purchases would have to be made through the national office.

The user may be required to pay for the water supply service he receives. The fee may be based on a metered measurement or may be a flat rate. The fees may be collected by a member of the local water committee, which is authorized to retain money to pay for the operation and maintenance of the system. The remainder of the funds are forwarded to the regional or national office. In some countries, the money must go to the national treasury; funds for operation and maintenance are then allocated from the annual budget. These are the kinds of details that must be defined and set forth during preliminary project planning. Villagers and agency staff must know what procedures will be used and who will be responsible for each aspect of the program. The suggested O&M responsibilities of the community, community health workers, and regional offices are outlined below.

1. *Community Responsibilities*

The operation and maintenance of a rural water supply system may be the responsibility of the water supply committee of the village; the water supply agency responsible for the program (directed by a regional or national office); an agency created especially for the purpose; or a combination of the above.

When the community alone is responsible for operating and maintaining the water supply system, the village appoints a water supply committee (or some similar committee) to perform the job. In some countries, the responsibilities of the committee are not clearly defined; in others the functions of the committee and of individual members are defined specifically in a document approved by the national government.

Often, the water supply committee is a branch of the existing health committee responsible for the community water supply project. The health committee usually is a local extension of the nearest health center of the Ministry of Health and helps the health center implement its programs and campaigns in the community.

2. *Duties of Community Health Workers*

The community health worker (CHW) will probably have little responsibility for the operation and maintenance of a local water supply facility, but will play a vital role in helping the villagers appreciate the advantages of safe water supply and sanitary excreta disposal systems. The CHW can help the villagers take care of their own installations. The householder is solely responsible for maintaining the pit privy, but the CHW can show how to keep it clean and sanitary.

The CHW will have an important role to play in the continuation of health center and health post campaigns and programs sponsored by the Ministry of Health.

3. *Regional and National Support*

The regional office has a dual role in the operation and maintenance of a water supply system. It supervises the operation and maintenance procedures performed in the villages to ensure that the installation is properly operated and maintained. It is a backup resource for the village facility and operator. The regional office will help make major repairs when a local operator is incapable of solving a problem. It also will maintain a supply of more complicated and larger spare parts not stocked in a village warehouse.

A regional O&M brigade should be employed to carry out a preventive maintenance program. The brigade would visit each system once a month and supervise the operation and maintenance of village systems.

In areas served by preventive maintenance brigades equipped with the necessary spare parts, equipment, tools, and transportation to provide regular monthly services, fewer costly breakdowns occur, equipment is not out of service for long periods of time, and customers are more satisfied than those in countries where only ad hoc maintenance is provided. An effective preventive maintenance program is essential to successful long-term operation and maintenance of facilities. It ensures that they continue to provide the services for which they were designed and installed.

The national office plans the operation and maintenance program that the regional offices conduct; writes the necessary guidelines and prepares O&M procedural manuals; controls budgeting for financing operation and maintenance procedures; controls the purchase, storage, and distribution of the materials, supplies, and equipment required by the O&M program; and supervises regional O&M activities.

Tables 6-10 describe the responsibilities of units involved in the design and construction as well as the operation and maintenance of rural water supply systems in Peru, Colombia, Kenya, and Bangladesh. Responsibilities of the units vary widely from one country to another.

Program Evaluation and Improvement

The planners of an environmental health program are concerned about its eventual effectiveness, and they usually establish a clear-cut set of objectives against which the program's effectiveness can be measured during the development phase and after the program has become operational. To measure the effectiveness of sub-objectives and program tasks performed during the development stage, a steady stream of data from engineers and administrators is needed. These data must be forwarded to program planners at regular intervals.

Table 6

Operation and Maintenance of Peruvian Rural Water Supply System

Administrative Unit	Studies/Designs	Construction	Operation/Maintenance
CENTRAL OFFICE			
Projects Division	Prepares studies and designs.		
Promotion 1 Engineer 2 Health Educators 2 Auxiliaries	Helps organize administrative committee in community.	Supervises auxiliary promoter.	
Works Division	Assists in contract presentation to community.	Supervises zone engineer; maintains construction cost data.	
Administration Unit	Material, equipment, pipe bought through international bids; cement and steel, national purchase. No purchases at local level. General administrative services.		
Supervision of Services		In charge of house connection campaign; calculates water rates.	Assists with extensions, repairs; analyzes incomes from systems when information available.
Water Quality Control	Analyzes water from possible sources.		Responsible for chlorination program when used and for water quality control.
HEALTH ZONES and/or HOSPITAL AREAS			
Engineer (21 Civil Engineers 4 Sanitarians)	Helps auxiliary promoter with survey and organization of community.	In charge of construction.	No responsibility for O&M, except to instruct administrative committee in O&M duties.
Sanitation Technologists (18) (Assigned by hospital; paid by hospital)		No responsibility for construction phase	Assigned by regional doctor; supervises O&M; reviews accounts (if submitted); instructs operator in duties.

Table 7

Kenya Self-Help Projects: Harambee

Administrative Unit	Studies/Designs	Construction	Operation/Maintenance
CENTRAL OFFICE	Provides technical assistance and designs for more extensive and complicated schemes at request of local Water Committees.		
PROVINCIAL	May provide financial assistance for a self-help project.		
DISTRICT	District Development Commissioner (DDC) authorizes community to raise money for Harambee water supply project; technical assistance for simpler schemes may be provided by health inspectors, but assistance for more complicated schemes is obtained from the Water Department.	DDC supervises construction.	
COMMUNITY	There is a Community Development officer in each community. The community is completely responsible for organizing its own Water Committee, and initiating, financing, and carrying out Harambee water supply projects, with technical assistance from district, provincial and/or national levels. Proposed self-help schemes are requested from DDC, who gives permission to raise funds for project. Generally, approximately one-third of estimated cost of project must be on hand before necessary surveys and plans are made at DDC level. Financing may be obtained locally, from the national level, or directly from international and/or bilateral agencies.	Purchase of material and supplies is done by Water Committee, often in provincial capital. Most of work is carried out on self-help basis, with some work being done by subcontract. Contribution is often carried out in phases, depending on available financing, starting with the source; conduction line, storage tank, then major distribution lines, and watering points or kiosks, then installation of individual house connections and sometimes individual storage tanks. When construction is completed, the project belongs to the community.	The community is fully responsible for administration, operation, and maintenance of its own systems. Water rates are established by local Water Committee, which collects water bills, retaining the income to pay operation and maintenance costs.

Determining program effectiveness after a program has been completed is sometimes easier than measuring progress during development. A program should have as a general objective the improvement of the public health of a community. An assessment of the impact the program has had on the several health-related problems can be used to determine whether goals and objectives have been met. Improvements (e.g., reductions in morbidity, accidents, vector populations, and pollution levels, or increased compliance with health standards) will probably be tangible and visible.

Program administrators and field engineers may think that regular progress reports are marginally useful to planners. This is understandable; these persons are interested primarily in getting the job done as quickly and as efficiently as possible. However, to the program planner, these data are essential. It is only through use of these data that the planner can determine if the project is on schedule, if changes in scope or direction should be made, or if there are deficiencies in the program. Stated in management terms, the data reporting by field personnel and their subsequent use as a control tool form a control feedback loop that permits timely modification of programs.

To do a job properly and to make decisions about changes in program development and control, the environmental health planner and program manager must study systematically the programs over which they have operational control. To evaluate a program, they must prepare a project and program description; determine what information is needed for decision making; identify indicators and the data to be collected; collect data; analyze and interpret the data; and communicate the results.

Evaluation Criteria

The standards by which environmental health programs and projects are judged to be successes or failures may be viewed in terms of the following major dimensions: 1) the project or program objectives; 2) the side effects (positive and negative) produced; 3) the multiplier effects beyond the target population and target area; 4) the time needed to achieve objectives and sub-objectives; 5) the cost of the resources employed to obtain the objectives; 6) community participation and the institutionalization of change; and 7) the extent to which factors outside the project inputs contributed to the outcome.

Potential Results

The results of environmental health programs and projects normally fall into one of four major categories:

- *Changes in the beliefs and behavior of individuals and groups.* For example: 75 percent of the people know that drinking untreated water

Table 5

Kenya Government Projects

Administrative Unit	Studies/Designs	Construction	Operation/Maintenance
CENTRAL OFFICE Ministry of Water Development (MWD) Water Department (WD)	Pre-feasibility socioeconomic, topographic, population studies, soils and chemical analysis made. One-third of WD projects designed by department, remainder by contract; contract also supervises guidelines for studies and designs issued in 1971. Unit cost, averaged each year, based on tenders received, used to estimate project costs. Revised manual in preparation. Annual program and budget prepared, based on estimate of needs submitted by Provincial Development Committee.	WD maintains about 20 construction teams, assigns project coordinators to supervise monthly both construction teams and contractor. Simple construction manual is used. Contractors must be registered; are classified according to capability and capacity to handle projects. Completed projects accepted by WD and assigned to Prov. Water Engineer for operation and maintenance.	Responsible for operation and maintenance of approx. 63 Water Acts of 1975. Each system assigned a category, depending on cost of O&M and capacity of people to pay.
PROVINCIAL	Project reviewed by PDC to assure conformance with provincial development plans; submitted to WD for final decision.	Material and equipment for project built by direct labor purchased at provincial level (for contracts purchased by contractors as part of construction contract).	Provincial water engineer responsible for operation and maintenance through district engineer.

DISTRICT			
District Development Committee (DDC)	DDC screens requests for projects and submits to PDC for consideration before submitting to MWD.	Construction teams of WD and contractors supervised by site inspectors and by monthly visits of project coordination from WD. Emphasis on house connection.	Inspector visits each project regularly (once a week) and reports monthly on physical condition of systems; has no responsibility for financial aspects, cost of operation and maintenance, nor for collection for water services. Water bills prepared by district office but collections are responsibility of the district administration under direction of the Office of the President. No comparison is made of cost of O&M and actual income from systems.
COMMUNITY	Practically no promotion carried out at community level. Water Committee appointed for each water supply system. Committee develops request for water supply project and presents it to DDC. No community participation in project.	No community participation.	Report by Water Committee shows details of operation and maintenance; many data are theoretical; for instance, income from system is reported as what it should be, not actual amount received (Water Committee does not know how much is collected). Public kiosks are being closed or assigned to individuals who sell the water at Sh 0.5 per 20 liters.

Table 9

Operation and Maintenance of Rural Water Supply System in Bangladesh

Administrative Unit	Studies/Design	Construction	Operation/Maintenance
NATIONAL			
Chief Engineer (Department of Public Health Engineer)	Establishes distribution of tubewells. Programming, setting studies, budgeting, allocation to districts of all arrangements, and coordination with UNICEF ordering, scheduling, warehousing material and equipment through UNICEF. Material distributed directly from stores to Thana or Union. *Research on hand pumps adapting AID/Battelle pump to needs of Bangladesh.*		Spare parts for repairs supplied by stores to Thana.
DIVISION (4)			
Superintending Engineer	Allocates funds to districts.		
DISTRICT (19)			
Executive Engineer	Consolidates lists of tubewells and checks that selection made in accordance with regulations; allocates funds to Thana.	Makes contracts for installation of tubewells; authorizes payment for work done.	

SUB-DISTRICT (62) Assistant Engineer THANA (413) Sub-Assistant Engineer Mechanics (4)	Sub-assistant engineer assists in selection of sites for new wells; prepares list of sites and estimated costs.	S.A. engineer supervises tubewell installation; checks contractor bills for work done; delivers material to contractors; prepares monthly reports on progress.	*Mechanics responsible for maintaining pumps*
UNION (4,600)	Site Selection Committee set up to develop a list of tubewells needed. S.A. engineer and Union Chairman apply for the selected list to the executive engineer at district level.		
VILLAGE (65,000)	Villages apply to Union Site Selection Committee for tubewell. *Now regulation:* village must deposit ½ estimated cost of well with Union Chairman and sign contract.	All construction carried out by contractor (each contract covers about 20 wells). No participation by village. Formerly, wells were sunk by villagers.	Village assigns nearby householder to watch over pump. No charge for water.

Table 10

Operation and Maintenance of Rural Water Supply System in Colombia

Administrative Unit	Studies/Designs	Construction	Operation/Maintenance
CENTRAL OFFICE			
Studies and Construction Section	Prepares guidelines, manuals, plans; schedules Basic Rural Sanitation Program; establishes standards, purchases pipe fittings and distributes to section official; approves designs.	Coordinates construction activities.	
Supervision and Technical Assistance Section	Directs and supervises sectional offices responsible for implementing Basic Rural Sanitation Program.		
Promotion Section	Advises on process of organizing and motivating communities, and in training, prepares manual for promoters.		
SECTIONAL OFFICE (24)			
Engineering	Responsible for activities of sectional office, and for program implementation. Makes studies, surveys, prepares designs and plans. Obtains approval of Central Office.	Calculates water rate (varies to suit possibilities of community by varying time of loan repayment); supervises construction.	Supervises activities of administrative committee including O&M.

Promotion	Makes sanitation and socioeconomic studies; helps organize community and set up administrative committee. *Serves as Committee Secretary.* Assists in contract presentation to community.	Coordinates activities of administrative committee; controls receipt of material, labor, and funds contributed by community; participates in turning system over to community.	*Continues as secretary of administrative committee:* is liaison of Committee and Sectional Off. on O&M and administration of system.
Warehouse	*All purchases except pipe and fittings made at sectional office level.*	Makes small local purchases; responsible for storing and issuing equipment and materials.	
COMMUNITY	Contracts with national institute for construction of system.	Furnishes labor, local material, necessary land.	Pays monthly water rate (covering costs of O&M depreciation and repayment of 40% of capital cost of system during length of time agreed upon by community).
Administrative Committees	Administrative committee organized with help of promoter.	Coordinates cooperation of community; issues receipts for participation of individuals (Used as credit toward cost of house connection).	
Operator			Responsible for O&M of system; collects water rates when requested b committee.

may cause illness; 50 percent use latrines regularly; a community has the capacity to monitor and maintain the quality of its water supply.

- *Changes in health status.* For example: An 80 percent reduction in the incidence of new malaria cases and a 50 percent reduction in the rate of industrial accidents.
- *Changes in environmental status.* For example: decontamination of a water supply system; reduction of the vector population to level X.
- *Changes in capital resources.* For example: Construction of a dam; construction of facilities to train environmental health workers; the construction of 50 latrines.

If the program or project plan has been carefully developed and good records have been maintained, planning and evaluation will be relatively simple. But as most environmental health administrators and project managers will confirm, specific objectives are rarely documented systematically, little information on the project environment is available and, at best, only a limited explanation of the rationale linking objectives to activities is offered. Furthermore, when planning documents are available, they are seldom useful to evaluators because objectives are poorly delineated and too generalized.

Example of How to Establish Objectives

It may be useful to show how the objectives for a water supply project are established and how difficult it is to determine how the accomplishment of objectives will have an impact on health problems. The following example illustrates the problem of linking objectives to program tasks.

Consider the following objectives:

1. Increase the quantity and improve the quality of water available to the community;
2. Decrease the incidence of water-based disease;
3. Increase the production of agricultural land.

At first glance, these seem to be reasonable objectives for a water supply project. A close examination, however, reveals several problems. First, what is the priority (principal goal) of the project? If the goal is to increase the quantity of water, then it is primarily an engineering project, and construction objectives and activities must take priority. If the goal is to improve water quality, the collection of health information must take priority. In this case, the evaluators must review the information an administrator needs and uses to make decisions about resource allocation, to identify different types of diseases and transmission cycles, and to develop intervention strategies to monitor water quality and appropriately modify beliefs and behavior.

There is sufficient evidence in the literature to show that availability of a substantial quantity of water reduces the risk of contracting water-related

diseases and that linking objectives of quality and quantity without indicating which has priority will not help a project manager make decisions about resource allocation.

Another problem in the project document from which these objectives were taken is the lack of information on the types and prevalence of water-based diseases. In addition, although figures on the total land area were cited in the report from which this example was taken, there was no information on how production (at the time of the study) was limited by the lack of water. In fact, a review of other data indicated that the rainfall was adequate for the local crops and an increased water supply would not have had a significant impact on agricultural activities. In short, the analysis of the project document suggested that the major purpose in preparing the project plan was to get funds to build a new water system. Those involved in the planning had a limited knowledge of the project environment and had given little thought to setting specific objectives and evaluating the project during its implementation and after its completion.

In this situation, program administrators and project managers often find that documentation is inadequate. To design an evaluation their first step will be to determine, retrospectively, project objectives and to describe the activities that have been initiated or completed. The following information is needed to evaluate a program properly:

—a listing of goals and objectives;
—information on the project environment;
—a description of the problems and needs of the target population;
—a description of the project's history;
—a statement of the problems and needs of project personnel; and
—insights into the type and amount of community participation that can be expected.

Selection of Specific Types of Data

In order to gather program data for an evaluation, decisions first have to be made on what questions to ask regarding program effects and operations. Objectives should be as specific as possible so that results can be quantified. An objective such as "decreasing the prevalence of onchocerciasis" or "improving the quality of water supply" is nebulous and qualitative. Tangible results cannot be linked directly and quantitatively to such objectives.

A single individual or department should be responsible for coordinating data collection efforts. On small projects, this task may be part of the manager's administrative duties. For large programs, it may be assigned to a small research evaluation staff. Whereas the process of guiding and coordinating evaluation activities should be centralized, the data collection activities should be highly decentralized. With the assistance of the environmental health workers and project managers in

the villages, villagers involved in the surveillance of disease vectors, chauffeurs of project vehicles, and secretaries can participate in a carefully planned evaluation.

Data collection should be handled by people of the community—either the staff or the beneficiaries—involved in the development process. By participating in data collection activities, these individuals will become more aware of what is happening in the project and be able to provide critical insights into problems and accomplishments. The involvement of beneficiaries in data collection and analysis will facilitate the achievement of educational goals. The community should be asked to attend meetings at which program and project goals and operations are discussed.

The role of outside experts and evaluators may pose a problem for program and project managers. Funds for projects often come from international lending agencies; the presence of outside experts connected to these agencies should be expected. Outside experts are viewed often as the ones who *do the evaluation* and program managers therefore may neglect their responsibilities in this area. Outsiders could be treated as technical resources, people who can assist in planning an information system and who help conduct periodic evaluations. Their experience with other similar projects may be helpful. Furthermore, as outsiders, they may be able to introduce some objectivity into the evaluation process. A smoothly running information system will provide the information staff need to make decisions during the course of a program. Given such information, project staff will not be surprised by the findings and recommendations of the evaluation teams. Indeed, the evaluators, many of whom are trained in statistical analysis and evaluation, should be able to help the administrator solve some of the more difficult technical and organizational problems. If poor records are kept, outside evaluators will have a difficult time obtaining the data they need to answer key questions about objectives, resource allocation, and program results.

Programs and projects usually have many components, but they can be broken down into three stages: initiation, recurrent operations, and closure. New types of data and alternative data collection methods may be needed during the various stages of the program.

Analysis and Interpretation

Data analysis takes time and requires an expertise that is in short supply in most countries. One often finds sufficient data on environmental health activities but few reports that include more than a superficial analysis.

It is beyond the scope of this monograph to describe the many methods and techniques of data analysis. Several methods may be needed for a single project. Analysis almost always involves some statistical treatment of the data. Quantitative results should be presented as simply as possible

so that those who need the information can understand the significance of the data and interpret them properly.

Interpretation of program or project data involves more than the presentation of statistics. It includes a discussion of the relationship of activities to results, explains why all objectives are not accomplished or only partially accomplished, and describes other general circumstances affecting the operation or outcome of the project. It should consider unforeseen changes in the new ecological, social, and political environment and describe how these changes altered the outcome of the program.

Communication of Results

The final step in an evaluation is to decide to whom and how the findings should be communicated. The final report on the evaluation should be sent not only to the head of the ministry or the international donor agency, but to those with the greatest interest in and need for the information: project staff and beneficiaries. By sharing and discussing the results with these persons, the evaluators can obtain additional information on the project, which can then be used to improve the design of future programs. Furthermore, a professional and ethical issue is involved in making the reports widely available: Project participants have a right to know and comment on the evaluators' conclusions.

Use of Results

Evaluations are made to determine a program's effectiveness. The results of the evaluation should, therefore, not only be reported, but also be used as a feedback mechanism to control and improve the program. In this sense, the evaluation is a mechanism to provide feedback to program staff. Once a program is instituted, it may become obvious that original objectives have not been met. An evaluation can pinpoint deficiencies that can be corrected if resources are available.

HEALTH CARE THROUGH LOCAL ACTION

The preceding chapter contained a detailed discussion on the development of an environmental health program. In this chapter the authors concentrate on the implementation of such a program in villages or communities. The literature is replete with cases in which those who plan and implement programs did not consider the desires and wishes of the villagers themselves. This chapter includes a discussion of the village role and emphasizes community participation within the context of the total environmental health program.

Alternative Approaches to Organization: Centralization and Decentralization

In planning an environmental health program, various alternative approaches should be considered. The type, coverage, and length of the proposed program will indicate the most appropriate approach. The educational level and skills of the village populations that will be served are also important factors.

Some researchers believe that a program should be administered by a central agency; others think it should have a considerable amount of local or at least regional autonomy. Saunders and Warford[3] assert that the organization should:

—assure the technical and administrative reliability of the program; and,

—be as financially and economically efficient as possible.

The second condition implies that the villagers must express a "reasonable" level of interest and be willing to cooperate and participate in the program.

Other researchers believe that regardless of the type of environmental health program or the conditions under which it is operated, a decentralized approach is most effective. Experience has shown that this is indeed true. The closer staff are to those who will benefit from the program, the better the chance the program will succeed. The rural water supply program in the Dominican Republic is successful in part because it is carried out through six zone offices. This arrangement facilitates close, continuing contact with the people in the various villages. Close contact cannot possibly be maintained if the program is directed from a central office

in the national capital, even in a small country like the Dominican Republic. In larger countries, even the state capital may be too far from most of the villages to maintain constant contact.

One short intensive campaign, or a campaign that requires infrequent contact with villagers, can be carried out from a central office at the national level, but even then logistics alone may make it more convenient and less expensive to operate such a program from a regional or zone office.

Often a program or campaign will be carried out through existing facilities, such as health centers and health posts. Extensive programs, such as regional or national rural water supply or malaria eradication programs, are more effective if regional offices are established specifically for the program. While this approach requires additional staff, it has the advantage of making it possible to assign people with experience relevant to the program rather than being obliged to use existing staff who have other responsibilities. Sanitarians, for example, have diverse responsibilities and are often also assigned the full-time job of bringing a water supply program to the village in their area. The sanitarians should be able to handle the excreta disposal component of a water supply and sanitation program, but they should not be expected to have the skills and capabilities needed to develop an entire program.

The degree to which decentralization is practiced depends on the complexity (difficulty) of the proposed program, size of the country, and skill levels of the villagers. Most phases of a construction program probably can be administered efficiently at the national or regional level. Villagers should be involved fully in the operation and maintenance of the program and should help to construct facilities. Utilization of the village population lowers costs and increases the probability of community acceptance and appreciation of the new system.

If rural target populations are relatively backward, with few technical skills and little income and education, a more centralized organizational structure may be needed. In several countries in Latin America, use of local promoters, pump operators, revenue collectors, and bookkeepers has worked well. This same approach has not been successful in those areas in Africa where the income and education of the rural population are much lower than the income and educational level of Latin Americans.[4]

Community Involvement and Participation

Although the literature has stressed community participation and discussed it extensively, its value and application are still not fully appreciated. Moreover, a recent WHO document on this subject reported that community participation "has become so fashionable that many people are beginning to feel a certain aversion to it."[5] Because the concept

has remained abstract while being discussed and practiced, many people have been inclined to throw out the good with the bad.

One of the problems in understanding and practicing community participation is the failure to understand that it is highly site-specific. The skill levels, education, and economics of villages differ within and among countries. Given differing social and behavioral customs, planners, social anthropologists, and engineers must study a community carefully before prescribing a technological solution to a given problem. What works well in one situation may result in failure in a different social, cultural, and economic setting.

The term "community participation" should be defined before one discusses either the forms it takes or its advantages. Stated simply, community participation means serving the interests of villagers and helping them to cooperate and be involved in the planning and implementation of water and sanitation or other local programs. Roling has differentiated between three approaches to rural development.[6] The first two approaches, which he calls the "do to" and "do for" approaches, respectively, are characterized by the absence of any direct community participation in the decision process. The opposite of these two approaches occurs in community development programs that are based on the definition of "felt needs" of the community and the organization of cooperative action to meet those needs.

The degree and types of participation vary from situation to situation. White has developed a scale or hierarchy of community involvement in water supply programs.[7] The ten categories range from consultation by the outside agency conducting the program with the help of leaders to virtual self-reliance. The categories are:

1a. Consultation with community representatives, or leaders, to ensure that the program introduced by the outside agency is adapted to the needs of the community and avoids difficulties in implementation.

1b. Consultation with other members of the community or, specifically, the poor to ensure that the program meets their requirements.

2. A financial contribution by the community toward construction.

3. Self-help projects in which a specific group of beneficiaries contribute labor (perhaps also materials), especially in construction work, to reduce costs. There is a large input from the external agency.

4. Self-help projects in which the whole community collectively contributes labor (perhaps also materials), especially in construction work. There is also a large input from an external agency.

5. The training of one or a few community members to perform specialized tasks (e.g., village health worker, or operator of a slow sand filtration system).

6. Mass action: collective work aimed directly at an environmental change of general benefit, e.g., draining waste water (distinguished from self-help by the relative unimportance of any input by an external agency).
7. Collective commitment to change personal behavior, and collective social pressure for the realization of such changes (e.g., construction and use of a latrine, frequent handwashing with soap).
8. Self-reliance in the sense of the autonomous generation, within the community, of ideas and movements for the improvement of living conditions as opposed to stimulation by outside agents. The community may well have recourse to external agencies to help with implementation of these improvements.
9. Self-reliance in the sense of using only the efforts of the community members themselves and not appealing to outsiders for help.
10. Self-reliance in the sense of using local materials and manpower rather than collecting funds internally in order to purchase goods and services from outside, including increasing local capacity with this kind of self-reliance as a goal.

Advantages of Community Participation

There is a correlation between the success of a project and village participation and acceptance of a project. Stated simply, if the majority of a village population does not actively support the development of one or more functional systems, such as water or sanitary excreta disposal systems, the probability that the health and development goals of the community will be attained is greatly reduced.

Using a water system as an example, some of the advantages in involving a community in a project are:

1. The water system can be a highly prized and tangible asset of a community. It is a measurable, physical, and available addition.
2. Successful implementation (with village participation) may restore confidence in government actions previously viewed with suspicion.
3. Health benefits accruing to the community can be perceived by the villagers themselves.
4. Community participation may stimulate the creation of a community infrastructure that will last long after a project has been completed.

Constraints to Participation

There are a number of reasons why community involvement has not been successfully practiced to a wider extent. The persons or organiza-

tions running the program may fail to recognize that the views and social customs of the community to which the service is being delivered are vitally important. In too many cases, programs and systems have been conceptualized by planners and designed and constructed by engineers who have never consulted the villagers. According to White, it is a mistake to assume or define the effects on users (the program's impact) without careful investigation of that particular community.[8] A factor highly important to one culture may have little or no significance for another. (An example is the Swiss road construction firm that had to delay work in an Arab country because the toilet facilities for male and female employees had been built next to each other.)

Ignoring behavioral factors when selecting technologies can be a major impediment to program success. Behavioral factors may be cultural. They may also reflect users' lack of understanding about a program. The literature provides numerous examples and anecdotal evidence of this shortcoming by program planners. For example, a standpipe in Ethiopia was destroyed by the people living next to it because they objected to the noise; next to a new water tap installed in the Ryukyu Islands was a community towel with which all the children wiped their hands, thus spreading trachoma; communal latrines in Nigeria go unused.[9] Village misuse of facilities is common when the community has not participated in the project or planners have not considered or do not understand behavioral factors.

According to Johnson, the "technological misfit" remains the most forceful and highly visible dilemma in the Third World today.[10] Planners and engineers introduce and impose technologies that are either too sophisticated or impractical in the given environment. The most common error is prescribing equipment that requires too much operation and maintenance (spare parts and labor); technologies that are too expensive; equipment that is impractical; and use of labor-saving capital-intensive machinery in countries with massive unemployment.

One of the purposes of this monograph is to stress the importance of integration when planning and implementing an environmental health program. All too often, efforts that are not centrally coordinated are carried out, usually because of deficiencies in the original plan, inadequate staffing, or poor management.

Many of the constraints listed above are characterized by poor planning and an underestimation of the task of implementing service delivery systems in small villages that bear no resemblance to local communities in the so-called developed nations. Most of the problems are the result of lack of communication and the understanding that users must be an integral part of any program. When engineers and planners work together and involve villagers in planning and actual construction, a high degree of integration results.

Forms of Community Involvement

A project superimposed on villagers by a benevolent government will last only as long as the government supports and pushes the project if the villagers have not participated in it from the outset. Even a vaccination campaign requires the participation and cooperation of the villagers because everyone who must be vaccinated must be at the right place at the right time. The full involvement of the users is even more important when the project includes the kind of planning, construction, and operation and maintenance that is required for a water supply system.

Community involvement may take many forms. There is community "partnership" where members of the village (represented by a local committee) share responsibility with government representatives for the project—from its inception to its operation and maintenance. The villagers share not only in the planning, but in the actual implementation of the project. They provide local materials, unskilled labor, funds, and other contributions. This partnership is common in many countries, although actual local contributions vary from program to program.

In some countries the community assumes full responsibility for executing the project with the technical and financial assistance of the government. Small-scale rural water supply projects are being implemented in Kenya as part of the Harambee ("let's all pull together") movement. Villagers are stimulated to initiate their own projects after seeing what their neighbors have done to obtain a satisfactory water supply system on their own (with the technical assistance of the provincial and national offices of the Ministry of Water Development). A Water Committee representing the village borrows money from various provincial and national agencies to finance the project locally. The committee arranges for its own subcontractors, purchases its own materials, and arranges for the community to construct the facilities. When the system is completed, the Water Committee sets its own water rates and is responsible for operating and maintaining the system. This is a good example of a self-help project completed with the minor assistance and guidance of the government.

Community Development

Experience of many years in both developed and developing countries has demonstrated that projects of any type—agricultural, health, water supply and sanitation—that involve the community in planning, implementation, and operation and maintenance are the most successful projects in stimulating community development and continue to function long after outside assistance has been discontinued.

Organizing for Participation

In countries such as Korea, where the people in the rural communities have a long history of working together on community projects, or in

countries where community action committees exist, the community can be organized to participate in a water supply and sanitation project. Sometimes the existing organization will appoint its own members to a special committee that becomes responsible for the project or helps the community set up such a committee.

Sometimes the villagers will organize a community water supply and sanitation committee in response to the community's perceived need for an improvement in those facilities—the community's call for action. In other communities, the committee will be organized after a public health worker or a promoter from a regional office or from the central office of the rural water supply and sanitation agency has promoted a water supply and sanitation program. The committee members should be selected locally, according to custom and not necessarily by democratic vote.

A community action committee is necessary regardless of how it originates. It is the focal point of any community participation effort, and through it the outside agency may assist the community in meeting its water supply and sanitation needs. It is the point of contact between the outside agency and the community. The committee is important not only during the preliminary planning and construction phases of the project. It is even more important after facilities have been built, ensuring their continued operation and maintenance. In many countries, such as Mexico and Colombia, the responsibilities of the committee are specified in regulations issued by the agency responsible for the program.

The promoter from the regional office is often a member of the community water supply and sanitation committee, serving as a liaison between the two groups. The community health worker (CHW) may also be a member of the committee; where this is not the case, the CHW should work closely with the committee.

Stimulating Participation

Community participation may be stimulated in many different ways. It is most effective when stimulation comes from within the village itself. A nearby village that has solved its community water supply or sanitary excreta disposal problems by community action may be an example to others, stimulating them to try to solve their own problems. The self-help Harambee projects in Kenya have been particularly effective in stimulating similar projects in other villages. The nearest rural water supply and sanitation program office (which should be located near the communities in each region) can be stimulated to help the community help itself.

Community health workers should educate the community to recognize and understand the problems resulting from a polluted water supply and unsanitary excreta disposal practices. They should help the community make plans to solve its own problems. Health education should reach the community through CHWs and staff of the public health facilities (health

posts, health centers, clinics, public schools, etc.). A continuing program focused on the needs of the community, instead of a one-time campaign, should be initiated. It should reach children and adults, both male and female. The promoter and staff from the regional office of the community water supply and sanitation organization should make an effort to encourage community participation. They can point out problems to the community, suggest possible alternatives (and estimated costs) for solving those problems, and brief the villagers on the responsibilities they should assume.

As soon as villagers indicate an interest in improving their water supply and sanitation facilities, arrangements should be made with the promoter to mobilize the community for action. Since there may be only one promoter for every ten or twenty communities, a considerable amount of time may pass before the promoter can provide assistance. In the meantime, the promoter will probably advise the community on methods of organization and indicate the types of information needed from the village to implement a particular program. The promoter, working out of the regional office of the rural water supply and sanitation agency, is one of the most effective workers involved in water supply and sanitation programs in countries such as Colombia and the Dominican Republic.

To gain the support of villagers for a particular project or program, the promoter must understand the dynamics of the village itself. This is a careful, patient, and sometimes slow process. Stimulating participation requires listening to the opinions of village leaders and involving them in the planning process. Villagers may have their own opinions about problems, priorities, and objectives, and these may differ from the opinions of program planners. They may consider the reduction of time and energy in carrying water of utmost importance.

Schumacher cites an example of villagers' concern about the prevalence of typhoid[11] and the open discussions that followed. The villagers in this Lesotho project learned how to reduce the incidence of typhoid by using a new water supply. Their concerns were balanced against other priorities, such as making more water available for irrigating gardens or providing drinking water for animals.

Stimulating participation requires common-sense, two-way communication. Planners who are responsible for installing a particular system must make sure the system will meet the community's needs and satisfy its desires.

Perhaps the most problematical aspect of community participation (from the point of view of a project planner or administrator) is how and when to involve local (community-level) institutions in the different stages of program development. Project administrators often express tremendous frustrations when discussing their perceptions of local groups' lack of interest and cooperation in solving community problems. These planners and administrators often regard local institutions as obstacles to

development. Some community groups and village politicians will not support a proposed project, usually for good reason. They may oppose a project or be unwilling to cooperate because the implementing agency refuses to make a *careful and patient* effort to identify and involve local organizations. Furthermore, the agency may not have tied the proposed project directly to local goals.

Continuing Participation

Under the decentralized program approach, continuing village participation can be assured only if a local infrastructure is created to handle the operation and maintenance of a particular system and local people are trained to perform administrative functions.

Saunders and Warford have advocated three kinds of training programs.[12] There must be a training program for lower-level employees of the system—bill collectors, bookkeepers, and pump operators. Another training program is needed for community promoters. The promoters should become acquainted with the construction and operation procedures of the program, be equipped to organize villagers, and know the advantages of a given project. (All levels of workers should be able to discuss the benefits of a program.) An education or orientation program for the villagers who will receive services is also desirable. If the full impact of the program is to be realized, villagers must be trained and encouraged to use the system to its full capacity. This will discourage villagers from misusing or not using facilities they either do not accept or do not understand.

Specific Contributions to Improve the Health Environment

Health Education

A continuing health education program reaching all members of the community is absolutely essential to the achievement of a healthy environment.

Adequate Water Supply

With the assistance of the regional office of the community water supply and sanitation organization, the community can mobilize its own manpower, collect funds, and provide local materials to improve an existing water supply system or install a new one. The experience acquired during the effort will be useful in carrying out other community projects.

Water supply systems can be installed by contractors or administrators without community participation, and they can be operated and maintained by a water supply agency. However, the most effective way to ensure the continuing and efficient operation and maintenance of the system

is to involve the community in the project at the outset. Villagers should assume responsibility for the operation and maintenance of the system. Thousands of systems are not operating at all or are not providing the service for which they were designed because villagers are neither interested nor involved in their use. Some systems are too sophisticated, technically and financially, and do not meet the needs of the people. If the community is not consulted before the national office completes the final design, it will not have an opportunity to consider alternatives.

Sanitary Excreta Disposal

The installation of sanitary excreta disposal facilities, such as pit privies with concrete risers or water-seal squat plates, is particularly appropriate for community participation. The villagers can make the concrete slabs and risers or the water-seal squat plates and install them over pits that others have dug. The householders can build their own privy shelters with local materials. Outside sources would have to provide only cement and reinforcing steel for the concrete slabs (and technical assistance in the use of the steel).

A program to install excreta disposal facilities should be tied to the water supply program. By linking the privy project, which is not always a perceived need, to the water supply project, it is possible to obtain community support for and acceptance of both programs. In some countries, privies must be installed in a large percentage of households before a community can obtain assistance in installing a water supply system.

Solid Waste Disposal

The simple disposal of solid waste in a hand-dug pit, which is common in many rural areas, is essential to adequate environmental health. The villagers themselves can handle this task. The action committee need only request that householders bury their solid wastes. The CHW should encourage such action while conducting the continuing public health education program.

Food Sanitation

Food sanitation is a household responsibility. The community health worker can provide information on proper food handling and storage and guide the villagers in these matters. A sanitary inspector should visit the market place and slaughterhouse at least once a month to monitor sanitation practices in these establishments.

Vector and Rabies Control

It is the duty of the sanitarian to control vectors and rabies. The

sanitarian may direct concentrated campaigns against specific vectors threatening the health of villagers.

Housing

The sanitary inspector should advise the villagers on health problems involving housing. He should discourage use of materials that tend to harbor vermin and bugs and provide advice on materials and types of construction appropriate for the area. A campaign may be organized with the villagers to clean up and remodel existing housing developments. The sanitary inspector can participate in this activity. This campaign could be initiated by an official from the housing agency or by the community development organization.

Accidents

A number of people and agencies can assist in preventing accidents. The community health worker can advise villagers on accidents in the home. The agricultural extension worker can discuss accidents in the field and the use of farm equipment. The doctor or public health nurse can treat snake and insect bites and drug-induced illness.

Local Workers and Their Roles

In the preceding discussions, there have been a number of references to sanitary inspectors, community health workers, and promoters. These workers are designated in some countries by different names (e.g., sanitarian, facilitator, or health collaborator). A brief description of each of these workers is provided below. All of these people play an important role, particularly at the village level, in rural water supply and sanitation programs.

The health inspector or sanitarian usually works out of a health center under the supervision of a public health doctor. Both the doctor and staff of the environmental health department of the Ministry of Public Health provide technical guidance. Some, but not all, health inspectors have spent a year or more in training at a public health school. Unfortunately, some health inspector positions are filled by people with little training or interest in public health. Job applicants should be required to have certain qualifications and be able to carry out their assignments properly. If necessary, they should be required to take additional course work in public health to improve their skills. Health inspectors/sanitarians have many varied responsibilities: giving injections and inoculations; organizing and supervising privy programs in an assigned area; designing and installing simple water supply sources, such as shallow wells or captured springs; and responding to emergencies. Because of their many regular duties, sanitary inspectors are seldom able to assist in rural water supply

programs. For this reason, the position of promoter was created. Environmental health promoters should be recruited from the rural areas in which they will work. They must be carefully selected because they play a key role in the program, serving as a liaison between the rural water supply agency and the local community.

A candidate for the position may have to be a high school graduate. The required level of training varies from country to country. In the Dominican Republic, promoters attend a one-week indoctrination program at the central office of the rural water supply agency. They then spend three months in on-the-job training, working out of the regional office with an experienced promoter. Following this, they work with several assigned villages under the supervision of an engineer from the regional office of the rural water supply agency.

The promoter is probably the first person from the agency to discuss water supply problems with the community. If the community is interested and willing to cooperate, the necessary studies are initiated. An engineer is called in to suggest alternative solutions to problems. The promoter helps the community organize its water supply and sanitation committee and is closely involved with project staff until the project is completed.

After the system is installed, the promoter continues to serve as a liaison between the community and the regional office during the very important phase of operation and maintenance. At that time, the promoter may be replaced by a person who is not only familiar with the technical phases of the project, but who also is trained in administration and accounting. A promoter retrained for this position is called a commercial agent (in the Dominican Republic). The commercial agent is assigned a number of villages that must be visited once a month. The agent examines the accounts and the operation and maintenance of the system and reports conditions to the regional office. Supervision of each system is continuous.

Both the promoter and the sanitary inspector need adequate transportation to carry out their responsibilities. A car or jeep, a motorcycle, or horse or mule should be provided.

Community Health Workers (CHWs)

As it becomes more and more evident that full community identification with and participation in any rural development project are crucial to the success of the program, so it also becomes more evident that some type of community worker is needed. This person should come from the community and be the local contact for the government agency and the community. The villagers should select the CHW and the government agency should train the nominee to perform specific tasks. This approach ensures that the government has continuous contact with the village. Villagers can be sensitized to or be made aware of their health needs and of the methods that can be used to satisfy those needs if the village cooperates and the

government provides assistance. In some countries, CHWs perform their tasks voluntarily. In other countries, they are paid a nominal sum.

CHW training should be provided in the region in which the CHW will work. Training should be specific to the work of the CHW. Initial training should be as short as possible and be reinforced with frequent refresher courses, seminars, and workshops. The CHW should be provided with the manuals, supplies, drugs, and other materials needed to carry out the assigned duties. These materials should be provided regularly so that the work of the CHW is not hampered by the lack of supplies. Regular work and contact with social development teams will reinforce community health worker training.

The effectiveness of a CHW will depend not only on the personal interest and training of the CHW, but on the type of supervision received. A regional auxiliary nurse or a health educator (who, in turn, is supervised by staff at the national level) can supervise the CHW.

All too often CHWs are trained and returned to their respective villages without continuing supervision or adequate supplies. As a result, they lose their enthusiasm and the village fails to receive the expected benefits.

Technical assistance can be obtained from both the regional office and the promoter through specific programs (e.g., installation of a well and handpump or installation of latrines). When required, a mason or a plumber can be hired to assist the villagers in carrying out a program. Resource and training development teams can help organize the community and conduct health education programs (two important functions of the CHW).

The health education work of the CHW can be supplemented with seminars organized for the villagers in each region and strengthened by radio broadcasts at specified hours. The CHW can provide charts and illustrative material. Funds should be made available from correlated social motivation and development programs to finance these activities. For example, USAID has assisted the government of Nicaragua in developing a training course for CHWs. The course is known as "Programa Rural de Acción Comunitaria en Salud - 19" (PRACS).

Program Managers

The program manager or director of a rural water supply program should be an experienced sanitary engineer, regardless of whether the program is operated out of the Ministry of Health or some other agency. A civil engineer is knowledgeable about structural requirements, but may not be sufficiently aware of the health aspects of a program, which may be ignored when the program is implemented. Moreover, a civil engineer may be less interested in the community aspects of a program and more concerned with completing work. The director of the excreta disposal program may be a sanitary engineer or a sanitary inspector with considerable experience in environmental sanitation.

Both directors will operate out of the national or central office of the agency (or agencies) responsible for the programs. They will be responsible for planning their respective programs in accordance with the goals and guidelines set by their agencies. They will prepare schedules and budgets, set standards for the various phases of their programs, supervise the design of more complicated systems, and implement programs.

Both directors should be well qualified technically for their respective jobs and be able to organize and conduct complex programs. In some cases the incumbent director of a program may have the capacity to direct a small routine program but not be able to carry out the responsibilities for a larger, expanded program with goals similar to those set for the rural water supply and sanitation decade. In this case, it may be necessary to replace the director. An alternative would be to create a new department with specific responsibility for the expanded program. The existing department would then handle the other aspects of the environmental health program.

The program director is usually in charge of the national office, the individual sections of which handle the various aspects of the program such as programming, studies, design, construction, operation and maintenance, and evaluation. In an efficient program, responsibilities are decentralized to the regional offices through which the program is implemented under the continuing supervision of the central office. Each regional office is directed by a sanitary engineer for the water supply program and a sanitarian for the excreta disposal program. The promoters work out of these offices under the supervision of the directors.

For extensive rural water supply and excreta disposal programs, an intermediate-level technical person should be employed to supervise the actual implementation of the various projects under the regional directors. This technician might be called an "implementer" and should be trained to perform specific tasks. The implementer will ensure that the design prepared by the central or regional office is executed in the field and that the important technical and health aspects are not neglected.

Administrators

If the rural water supply and excreta disposal programs are operated from the same department (e.g., by the environmental health department of a Ministry of Health), one administrative section headed by an administrator should handle both programs. This section should handle all administrative matters, such as purchasing, warehousing, personnel, and billing and collection, and supervise those activities in the regional offices. If the programs are in separate departments or organizations, each may require its own administrative section headed by an administrator.

Administrators should be well trained and have administrative experience, preferably, but not necessarily, with the agency implementing

the program. An administrator usually comes under the direction and supervision of the program director.

Summary

As we move into the International Drinking Water Supply and Sanitation Decade, we have reasons to be optimistic. There is evidence to suggest that those who have been engaged in planning and instituting environmental sanitation programs as a part of health delivery systems for developing countries have moved up the "learning curve" to a point where we can now start to benefit from experiences. Some of these experiences have been negative for a number of reasons, some of which are discussed in this monograph. Yet substantial positive results are evident when one examines environmentally-related disease statistics for many Latin American, African, and Asian countries.

The launching of an International Drinking Water Supply and Sanitation Decade in itself suggests a new determination and dedication by international and national health organizations to achieve steady, even spectacular, results in the decade ahead.

Whereas this monograph does not pretend to contain all the solutions to problems encountered in developing integrated health delivery programs, it does reflect the learning of many years of field experience and training, learning that can be utilized by young medical doctors, sanitary engineers, and sanitarians who have just been given the responsibility of establishing a comprehensive program.

The monograph stresses such things as integration, coordination, decentralization, health education, promotion, and community participation. Even though these appear to be simple, common-sense concepts, practitioners know that often they are given only lip service.

Integration has been stressed because experience has shown that planners, engineers, program administrators, community health workers, and villagers must work together toward common goals. When planners do not solicit or receive needed feedback from engineers or the users themselves, the odds of a program becoming another misfit will increase appreciably.

Decentralization, health education, promotion, and community participation go hand in hand. There must be a program hierarchy and organization, and experience has shown that decentralization of authority and responsibility is essential to program success. Even in a small country, a national office is too far removed from many problems—logistically, operationally, and perhaps even culturally—to be effective.

Community participation also is essential to success. In the past, there has been a tendency to practice "supply push" rather than "demand pull." This practice has resulted in the development of systems that, in

many cases, have gone unused by villagers. The users must express a felt need and a willingness to participate in *project* development and operation if a program is to be successful.

There is a great need for more skilled workers at every level if the ambitious goals of "The Decade" are to be reached. Some of the persons who are involved in the development of health delivery and environmental sanitation programs are semi-retired and would like gracefully to wind down their participation. In many cases, these highly experienced persons cannot withdraw because of the dearth of talent available. A recent (1979) paper of the Pan American Health Organization (PAHO) estimates that 400,000 people will be needed in the 1980s to meet decade goals.

Another monograph in this series has dealt with financing, but it would be a serious omission not to mention resources. There are never enough resources available to do everything that is necessary. Thus, it is imperative that resources be allocated and utilized as efficiently and effectively as possible. International organizations such as UNDP, WHO, UNICEF, and the World Bank should work together with the bilateral agencies such as USAID, SIDA, CIDA, and others to ensure that no effort is duplicated. The job ahead is much too broad and challenging to allow resources to be misutilized or underutilized.

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Appendix 1

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The purpose of this section is to provide the environmental health director, planner, or professional with references to detailed discussions of topics addressed in the monograph. This is not an exhaustive listing, but a bibliography of those texts and papers that are not only practical and useful, but also complete, providing in-depth discussions.

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Appendix 2

LIST OF INTERNATIONAL ENVIRONMENTAL HEALTH ORGANIZATIONS

Note

There are many organizations that have an interest in environmental health in developing countries. The list provided in this appendix is not totally comprehensive, but it does identify those that have demonstrated a major commitment to the improvement of environmental health practices. Foreign ministries may already have liaisons with these organizations. Those relationships should be evaluated before new contacts are made.

International Reference Centre for Community Water Supply
Nw. Havenstraat 6, 2272AD Voorburg (The Hague), Netherlands

World Health Organization (WHO)
1211 Geneva 27, Switzerland

World Federation of Public Health Associations (WFPHA)
Secretariat
c/o American Public Health Association (APHA)
1015 15th St. N.W.
Washington, D.C. 20005, U.S.A.

The International Institute for Environment and Development (IIED)
27 Mortimer St., London, W1ArQW, U.K.

Water Resources, Land and Water Development Division
Food and Agricultural Organization of the U.N. (FAO)
Rome, Italy

International Development Research Centre (IDRC)
Ottawa, Canada

Organization for Economic Cooperation and Development (OECD)
Paris, France

Intermediate Technology Development Group
9, King St., London, U.K.

Pan American Health Organization
525 23rd St. N.W.
Washington, D.C. 20037, U.S.A.

U.S. Agency for International Development
Department of State
Washington, D.C. 20523, U.S.A.

Swedish International Development Authority
Stockholm, Sweden

Development Financing Agencies

World Bank
International Bank for Reconstruction and Development
1818 H St. N.W.
Washington, D.C. 20433 U.S.A.

Inter-American Development Bank
808 17th Street, N.W.
Washington, D.C. 20577, U.S.A.

African Development Bank
Abidjan, Ivory Coast

Asian Development Bank
Manila, Philippines

Caribbean Development Bank

Arab Bank for Economic Development in Africa

European Development Fund