ENVIRONMENTAL HEALTH PROJECT

APPLIED STUDY

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Behavior First:
A Minimum Package of
Environmental Health Behaviors
to Improve Child Health

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ACRONYMS

AIMI	Africa Integrated Malaria Initiative
ARI	acute respiratory infections
BASICS	Basic Support for Institutionalizing Child Survival
CDRC	Construction Resource and Development Centre
CIMEP	Community Involvement in the Management of Environmental Pollution
DHS	Demographic and Health Studies
EHP	Environmental Health Project (USAID-sponsored project, Washington, D.C., 1994-1999)
ITMs	insecticide-treated materials
NGO	nongovernmental organization
PHAST	Participatory Hygiene and Sanitation Transformation
SIDA	Swedish International Development Cooperation Agency
SOs	strategic objectives
SSU	Sanitation Support Unit
TAG	Technical Advisory Group
TIPs	trials of improved practices
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

In July 1998, the Environmental Health Project (EHP) convened a Technical Advisory Group (TAG) to assist in the development of a "Minimum Package" of environmental health-related behaviors to recommend for inclusion in Child Survival programs. Members of the TAG were Valerie Curtis from the London School of Hygiene and Tropical Medicine, Elizabeth Fox from USAID's Office of Health and Nutrition, Silvia Luciani from UNICEF, and Allen Kulakow, an independent social marketing consultant.

The TAG identified four key behaviors: (1) safely dispose of human feces, (2) consume safe water, (3) consume safe food, and (4) protect self and family from mosquitoes. The behaviors were selected on the basis of their relevance to child survival, potential health impact, and feasibility. The first three behaviors prevent diarrhea and the fourth, malaria. No behavior for the prevention of acute respiratory disease (ARI) was included in the package because not enough is known about the effectiveness of behaviors that have been proposed for ARI prevention.

The Minimum Package was developed within EHP's framework for behavior change, which defines the relationship between technologies and behaviors. Too often it is assumed that technologies are "silver bullets" that can solve health problems. However, in most cases, technologies in and of themselves—pumps, latrines, bednets—are not effective in preventing disease. Instead they should be seen as creating an enabling environment in which behavior change can take place. Ideally, the approach should be to (1) assess the disease transmission routes and risk factors for the target disease in a given community, (2) identify the behaviors that should be changed, and then (3) develop strategies for achieving the changes, including—but not limited to—introduction of new or improved technology. Strategies will also include communication, training, policy change, and community organization.

Behavior change occurs in two domains: the public or community domain and the private or domestic domain. Public-domain behaviors are collective actions that normally require organized, joint action, while private-domain behaviors are those that individuals or families themselves structure and organize. Achieving change in the Minimum Package behaviors requires action in both domains. For example, consuming safe water is a complex of actions that may include obtaining water from the least contaminated source, keeping water containers covered, using clean dippers (in the private domain), and building, managing, and maintaining community water supply (in the public domain). The specific actions will differ according to the situation.

The impact and feasibility of the four behaviors have been examined through applied research. Table A summarizes the major evidence of the impact and feasibility of the four behaviors.

Table A
Health Impact and Feasibility

Health Impact	Feasibility
Safely dispose of human feces	
* Presence of feces in family compounds in Papua New Guinea associated with a 48% increase in diarrhea (Bukenya & Nwokolo 1991). * Median reduction of 22% in diarrheal disease in 21 studies on the impact of sanitation (Esrey *et al.* 1991) * 24% reduction in diarrheal prevalence associated with latrines in Lesotho (Daniels *et al.* 1990).	* Properly disposing of fecal matter can have a significant impact on diarrhea prevalence, especially when done by the majority of families and where houses are close together. * Cost may limit some sanitary solutions, but most families can improve fecal matter disposal. * Public latrines or other sanitary solutions may be appropriate in settings such as markets, but maintenance and hygiene can be difficult.
Consume safe water	
* 22 of 43 studies of improved water supply showed reductions in diarrheal disease morbidity with a median reduction of 16%; 10 of 16 studies on improved *water quality* alone found positive impacts on diarrheal disease with a median reduction of 17%; 14 of 15 studies on *water quantity* alone reported positive impacts, with a median reduction of diarrheal disease prevalence of 27% (Esrey *et al.*1991). * Studies examining the combined impact of water and sanitation generally find greater impact than from water alone or sanitation alone. * Programs integrating water, excreta disposal, and hygiene education can achieve 35-50% reductions in diarrhea morbidity (Feachem 1984).	* Consuming safe water can reduce the risk of diarrhea, although facilitating increased water quantity is often even more important for health impact. * Willingness to purchase water depends partly on cost and alternative sources, as well as perceptions of water quality and convenience. * Although water improvements must be well planned, they are often feasible because of families' high demand for convenient water. * Community groups must be organized and sustained over time for management of a local water system (including financial management, protection against thievery, protection of water supply from fecal contamination) and for routine maintenance. * In areas with high fecal contamination, improved water supplies may bring little or no health improvements.

Health Impact	Feasibility
Consume safe food	
* Low scores for kitchen hygiene and overall household cleanliness were strongly associated with high risk of severe diarrhea in Manila, Philippines (Baltazar *et al.*1993). * Contaminated food accounts for an estimated 15-70% of diarrhea incidence (Esrey & Feachem 1989). * Evidence indicates that houseflies may transmit fecal contamination to food. A study among Israeli soldiers demonstrated a 64% reduction in housefly density through the use of yeast-baited fly traps and a 42% reduction in clinic visits for diarrhea (Cohen *et al.* 1991).	* While some practices, such as not consuming food that has a high risk of being highly contaminated, logically will prevent diarrhea, there is surprising little direct evidence of the effectiveness of some recommended practices to ensure consumption of safe food. * There is very good evidence for high contamination levels of baby-bottle nipples and pacifiers and in food that has sat for many hours and not been thoroughly reheated, so avoiding these dangers seems highly desirable. * Improving solid waste disposal requires household, community, and NGO or government support.
Protect self and family from mosquitoes	
* Trials of insecticide-treated nets or bednets (ITNs) in Africa reduced clinical episodes of malaria by 46% compared to controls with no nets and a 19% reduction in child mortality (USAID 1997). * An analysis of 10 field trials of ITNs found a 50% reduction in the incidence of malarial infections compared with no bednets (Choi *et al.* 1995). * Adding insecticide to kerosene lamps in Tanzania reduced mosquito bites by 44% and 78% in different kinds of lamps (Sharma *et al.* 1993 & Pates *et al.* 1997). * In Nepal, in one year community participation in cleaning vegetation from ponds, draining and filing, and cleaning and repairing irrigation canals resulted in 50% reduction in malaria cases compared with controls (Shrestha 1986).	* Feasibility of ITNs is high, particularly where they are already common and where families have some disposable income. * The community may organize retreatment sites and days, or this may be done by individual families using packets. * Environmental manipulation to reduce mosquito populations can be effective, depending on the local ecology. While the impact on mosquito bites can be high, the impact on malaria may be less, depending on the local vectors and their breeding and biting habits. * Draining breeding sites can reduce mosquito populations but must be repeated frequently. * Household efforts to reduce mosquito populations may be effective only if almost all households participate, or if houses are far apart. * Vector resistance to insecticides is a factor in large-scale spraying.

Proper handwashing is related to all diarrhea prevention behaviors in the Minimum Package. A number of studies have demonstrated that handwashing at appropriate times with appropriate technique can reduce overall diarrheal disease morbidity by 30% to 50% (Khan 1982, Clemens and Stanton 1987, Black *et al.* 1981).

In a separate activity in 1997, EHP developed environmental health-related indicators for the prevention of diarrheal disease, malaria, and ARI. Many of these can be appropriately applied to the Minimum Package. See EHP Activity Report #46: *Indicators for Programs to Prevent Diarrheal Disease, Malaria, and Acute Respiratory Infections.* For most projects it is sufficient to measure changes in the behaviors that research has shown to be effective in reducing morbidity and mortality. "Process" indicators may also be included if changes in degree of participation or similar goals are part of the project. Measuring health outcomes is desirable but not usually feasible.

Implementing behavioral change programs calls for a blend of social marketing and community capacity-building activities. Social marketing applies the principles of modern marketing modified by the application of the social sciences, to enhance the well-being of individuals and society. Community capacity building employs a range of training, mentoring, and organizational and other support activities to enable community groups to undertake joint activities. Several methodologies for behavioral change through community action have been developed. CIMEP (Community Involvement in the Management of Environmental Pollution) was developed by EHP, and the PHAST process (Participatory Hygiene and Sanitation Transformation) was developed jointly by WHO, SIDA, and UNDP.

The disciplined and professional approach to communications of social marketing is needed for prioritizing, motivating, and facilitating key behavior changes in the private domain and establishing positive social norms for individual participation in some public domain behaviors. Community assessment, planning, and action skills and the establishment of ties to local support groups are essential for behavior change in the public domain and important for the sustainability of new behaviors in both domains.

Programs to implement the Minimum Package will vary by location depending on baseline environmental conditions, the disease burden, existing infrastructure, current behaviors, available resources, and the scale and limitations of the proposed project. However, all implementation strategies will include a range of approaches including communication activities, training, provision of technology, community organizing, and the creation of an enabling policy and regulatory environment.

Behavior change is an element in most key EHP activities. Two activities in particular stand out. In peri-urban communities of Montego Bay, Jamaica, significant changes in hygiene-related behaviors were realized through a project combining construction of "sanitation solutions"—environmentally safe latrines and toilets—and hygiene education using both social marketing and community approaches. In peri-urban communities of two secondary cities in Tunisia, application of the CIMEP approach led to improvements in a range of environmental sanitation behaviors. Community and municipal capacity-building was combined with small-scale community projects to provide environmental sanitation technologies.

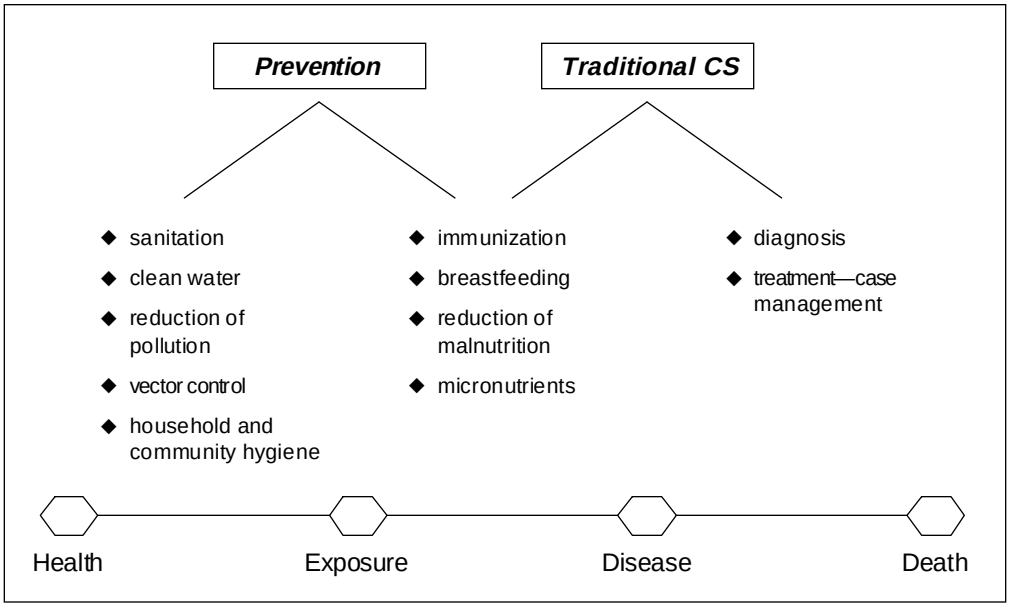
USAID-supported environmental health behavioral change programs can achieve more than improved health. They can also contribute significantly to results in two other strategic areas—protecting the environment and building democracy—and, like many development efforts, they can contribute indirectly to broad-based economic growth.

INTRODUCTION 1

Overview

The goal of the Environmental Health Project (EHP) is to prevent disease through improving poor environmental conditions and associated hygiene behaviors. As a project of the Office of Health and Nutrition, EHP contributes to the Agency's Child Survival efforts, which target diarrheal disease, malaria, and acute respiratory infections (ARI). EHP's efforts in preventing these environmentally related diseases complement both case management and clinic-based preventive activities. Figure 1-1 shows the relationship between environmental-health related prevention and the more traditional preventive activities that are part of the Child Survival package.

Figure 1-1
Range of Preventive Activities in Child Survival



Source: This figure was originated by Steven A. Esrey

Since its inception in 1994, EHP has provided USAID missions with technical assistance for activities that have significant behavioral change components. The crux of what EHP has learned about the role of behavior change in environmental health is discussed in this report, which considers four key behaviors—a Minimum Package—that have the potential to prevent diarrheal disease and malaria and therefore to contribute directly to Child Survival. The four behaviors are to

The crux of what EHP has learned about the role of behavior change in environmental health is that four key behaviors have the potential to prevent diarrheal disease and malaria and therefore to contribute directly to Child Survival.

- safely dispose of human feces;
- consume safe water;
- consume safe food; and
- protect self and family from mosquitoes.

EHP staff, with the advice and guidance of a Technical Advisory Group (TAG) convened in July 1998, selected the Minimum Package of behavoirs on the basis of potential health impact and feasibility. Members of the TAG were as follows:

- Valerie Curtis, London School of Hygiene and Tropical Medicine
- Elizabeth Fox, USAID, Office of Health and Nutrition, Child Survival Division
- Silvia Luciani, UNICEF, Program Communication/Social Mobilization Section
- Allen Kulakow, Social Marketing Consultant

EHP staff—May Yacoob, technical director for community participation and hygiene education; Patricia Billig, senior technical director; and Margo Kelly, the assistant activity manager who organized the TAG and managed follow-up activities leading to their report—also met with TAG. EHP subcontractor personnel from the Manoff Group—Mike Favin and Marcia Griffiths—prepared a draft version of this paper for discussion by the TAG and assisted in planning the two days of meetings. The TAG was facilitated by Joni Herman of the Training Resources Group, also an EHP subcontractor.

The TAG met for a full day July 9; on July 10, the following people joined the group for a presentation and discussion of the TAG's findings:

- John Austin, USAID, Office of Health and Nutrition, Environmental Health Division
- Massee Bateman, USAID, Office of Health and Nutrition, Child Survival Division
- Craig Hafner, Eddy Perez, Gene Brantly, and Diane Bendahmane from the EHP technical staff
- Kate Barba, USAID, Environment Center
- Paula Nersesian, BASICS
- Jennifer Sara, World Bank
- Eckhard Kleinau, John Snow, Inc.

Audience and Purpose

The purpose of this report is not to lay out a behavioral change program in detail; rather it attempts (1) to sort through a sometimes confusing array of environmental health behaviors that have been put forward and select a manageable package with high potential health impact and feasibility and (2) to provide a checklist of factors that must be taken into consideration when implementing the Minimum Package. The key audience for this report is USAID health officers and counterparts in USAID partner organizations and host-country governments seeking to maximize the impact of their child health programs.

How the Report Is Organized

Following this brief introduction are five chapters. Chapter 2 discusses the rationale for emphasizing behavioral change in environmental health and the "domains" in which behavioral change takes place; Chapter 3 presents the Minimum Package of behaviors; Chapter 4 summarizes the evidence of the package's efficacy, effectiveness, and feasibility and suggests appropriate indicators; Chapter 5 discusses the key programmatic elements of environmental health behavioral change programs; and Chapter 6 points to opportunities for implementing behavioral change programs in USAID's current environment.

BEHAVIOR FIRST 2

Why Behavior First?

In too many cases, latrines, improved water systems, or insecticide-treated bednets and other technologies have been provided in programs with no accompanying behavior change component.

Too often, the health impacts of environmental health interventions have been limited by the failure of program planners to understand and influence human behavior. (See Box 2-1 for a definition of behavoir). In too many cases, latrines, improved water systems, or insecticide-treated bednets and other technologies have been provided in programs with no accompanying behavior change component. The result is that the technologies have not been used as intended or have not been sustainable.

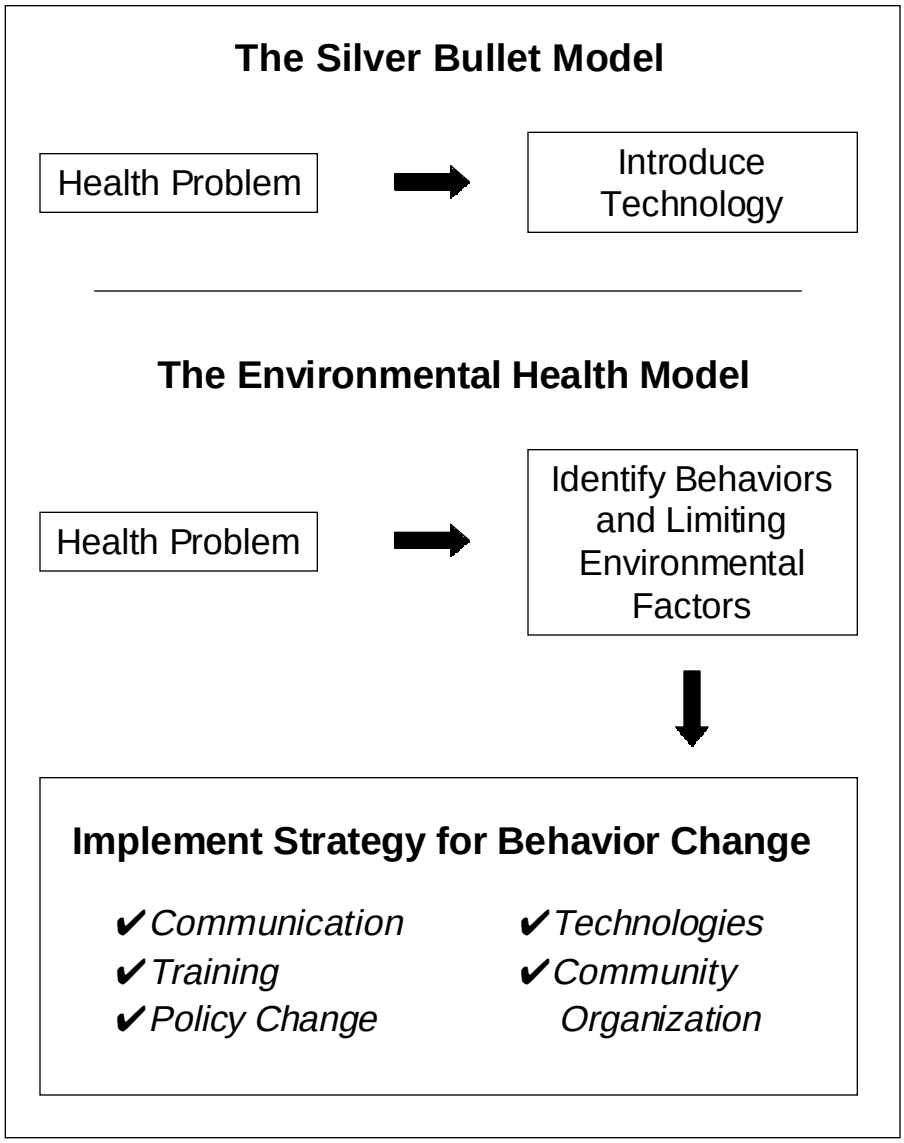
Technological improvements—from infrastructural improvements in water supply to more modest items such as water or food storage containers—have often been thought of as "silver bullets" that are sufficient to solve health problems. The silver bullet approach has lost much of its credibility, as research has demonstrated that technology alone is not sufficient. For example, an improved latrine has the potential to reduce diarrheal disease in a community, but it will have little effect on health if children continue to defecate in the open. Besides introducing technology, programs may need to address such areas as communication, policy change, institutional strengthening, and financing in order to achieve behavior change and health impact. This report focuses specifically on behavior change in disease prevention, through social marketing and community-based approaches.

The model for environmental health interventions that this report advocates begins with a process for identifying the target health problems and associated behaviors that need to be changed and then moves on to identify strategies for achieving the needed changes, including—but not limited to—introduction of new or improved technologies. (See Figure 2-1). The discredited "silver bullet" approach sees technology as *the* solution; the environmental health approach sees technology as *part* of the solution.

Box 2-1: What Is a Behavior

In this report "behavior is defined as an action or set of actions that an individual or group of individuals carries out routinely as part of their everyday life.

Figure 2-1
Relationship of Technology to Behavior Change



To have an impact on public health, a technology must be effective, selected on the basis of knowledge of current behavior, affordable, and used appropriately.

To have an impact on public health, a technology must be effective for addressing the problem, selected on the basis of knowledge of current behavior and user preferences, affordable, and used appropriately. Technologies such as latrines, water pumps, soap, improved water containers, affordable bednets, and less polluting cooking stoves should be considered as but one component of behavior-change strategies. Technology is one element (usually, but not always, an important one) that enables crucial behaviors to occur. (See Box 2-2 for specific examples in behavoir change).

Box 2-2: Behavior Change Is Needed to Achieve a Positive Health Impact

- The districts of EHP's diarrhea prevention program in Bolivia had relatively good water and sanitation infrastructure (appropriate technologies) but also high rates of diarrheal disease because poor water handling and hygiene behavior did not change with the introduction of improved water and sanitation.
- In Ecuador and Jamaica, EHP assistance involved new technologies (improved water storage containers and appropriate sanitary solutions), but changing behaviors was also part of strategy. These interventions resulted in impressive improvements in behaviors linked to cholera and other diarrheal diseases.
- In Zlatna, Romania, components of a lead-exposure abatement program that introduced no new technologies reduced blood lead levels among children by more than 30%. EHP facilitated a behavior-change process that, in less than two years, increased awareness about lead poisoning and how to avoid exposure from 17% to 78%. A significant percentage of families adopted new behaviors to protect themselves and their families from environmental lead: washing hands before meals and before entering the house, cutting fingernails three or more times per week, and washing toys. In addition, the community organized safer outdoor play areas for children.

The Domains of Behavior Change

In environmental health, behavior change occurs in two domains: the public or community domain and the private or domestic domain (Cairncross *et al.* 1996). The distinction between the two is not always sharp, and sometimes they overlap. Clearly both are important, because many private/domestic behaviors (such as using latrines and insecticide-treated bednets) have an impact on community health, and many environmental conditions that might be improved through collective action (such as mosquito-breeding sites or a poorly located, unprotected dump) affect the health of individuals. Often behavior change in both realms is needed.

Many private/domestic behaviors have an impact on community health, and many environmental conditions that might be improved through collective action affect the health of individuals.

Private-domain behaviors are normally actions that individuals or families themselves structure and organize. These include

- doing something in the home;
- doing something outside the home but in space recognized as the family's space (i.e., building, maintaining, and using a latrine; corralling the family animals);
- using and possibly purchasing some product or service that is available because of community or governmental action, or through the private sector (health services, a water system, an insecticide-treated bednet); and
- supporting new individual and family norms by either orally expressing support or modeling those behaviors.

Community behaviors are collective actions that require organized, joint action of people working together at the same time and place, normally in conjunction with municipalities or government authorities. They fall into three broad categories:

- Solving problems and making decisions. Community members assess, analyze, and organize to solve common problems and make decisions (e.g., to undertake a community project or to collaborate with an outside agency).
- Providing labor. Community volunteers participate in construction, drain swamps, dig dumps, and perform other related activities.
- Managing. Community volunteers manage social actions such as a water system or a community dump, either as a committee or on a rotating basis.

In general, the more existing structures communities have for joint action, the easier an outside group's task of facilitating community behavior change for environmental health.

Often, community action requires, or is clearly strengthened by, assistance from private or public organizations outside of the community. For example, one or more persons (e.g., community health volunteers) may be enlisted to help organize and motivate individual and joint actions. Such individuals normally need training and encouragement from outside groups to make them effective and to keep them active over time. In general, the more existing structures communities have for joint action, the easier an outside group's task of facilitating community behavior change for environmental health.

The Minimum Package of behaviors can be achieved if individuals acting alone and collectively take action and organize into community groups to participate in the creation, maintenance, financing, and appropriate use of communal services, such as safe water sources, sewers, garbage collection, and community "dipping" or reimpregnation of insecticide-treated mosquito nets. Individuals and families can make household environmental improvements and adopt new behaviors either related to the technologies or in response to a problem or risk. It is also important for individuals to support communitywide efforts to reduce risk factors, such as national spraying programs for malaria control.

If decision makers and workers are not sensitized or organized to respond to local environmental health concerns, the scale and magnitude of the health impact of an activity are limited.

To facilitate individual and collective actions, national, regional, and local government *decision makers* may need to provide resources and political support, or the staff of private organizations may need to support communities on a variety of environmental concerns. If decision makers and workers are not sensitized or organized to respond to local environmental health concerns, the scale and magnitude of the health impact of an activity are limited. Chapter 5, on implementation issues, discusses the need for an enabling institutional environment in which behavior change can take place.

3 THE MINIMUM PACKAGE OF ENVIRONMENTAL HEALTH BEHAVIORS AND RELEVANT INDICATORS

Criteria for the Minimum Package

The Minimum Package of preventive behaviors that address environmentally related diseases was selected on the basis of four criteria:

- Ability to reduce the number of disease-causing agents in the *environment* or protect individuals and families from contact with them
- Potential to improve *child survival* by reducing the prevalence of one or more of three major causes of childhood illness and death in developing countries—diarrheal disease, ARI, and malaria
- Proven *efficacy* in reducing childhood morbidity and/or mortality
- Proven *feasibility*, *effectiveness*, and *cost-effectiveness* in operational settings

Four basic behaviors contribute to preventing diarrhea and malaria—two target Child Survival program diseases.

In addition, the Minimum Package behaviors are consistent with the suggested priorities of the World Health Organization (WHO) and UNICEF, as expressed in the publication "Facts for Life" (published jointly by UNICEF, WHO, United Nations Educational, Scientific and Cultural Organization (UNESCO), and United Nations Population Fund (UNFPA).

The Four Behaviors in the Minimum Package

The four basic behaviors in the Minimum Package all contribute to preventing the root causes of target Child Survival program diseases. The first three behaviors are aimed at diarrheal disease; the fourth, at malaria. They are as follows:

- Safely dispose of human feces
- Consume safe water
- Consume safe food
- Protect self and family from mosquitoes

Why do no behaviors in the Minimum Package target ARI, another disease causing high mortality and morbidity among children? While there is evidence of an association between ARI among young children and indoor air pollution, largely from the use of biomass fuels for cooking and heating, the effectiveness of behaviors to reduce exposure to indoor air pollution is largely untested. After careful consideration, it was decided to defer inclusion of behaviors to prevent ARI.

Behavioral Clusters

Each behavior in the Minimum Package is actually a cluster of specific related behaviors, including actions in both the private and the public domains.

Table 3-1 lists the four behaviors and gives examples of specific activities that might be targeted in a program to promote behavoir change. The mix of activities depends on local conditions and practices. (Chapter 4 examines the evidence of effectiveness of the Minimum Package and discusses issues of feasibility.)

The objective is for every person in every family to use a safe sanitary solution that prevents fecal matter from entering the environment.

The first three behaviors are listed in priority order for preventing diarrhea. The first priority is the safe disposal of feces. The objective is for every person (including children) in every family to use a safe sanitary solution that prevents fecal matter from entering the environment. Consuming safe water is a complex of behaviors involved in obtaining, storing, treating, and using water for human consumption, and consuming safe food encompasses behaviors related to obtaining, storing, cooking, and washing food. Handwashing plays a key role in the first three clusters. It is an effective primary barrier to block ingestion of disease agents spread through fecal matter. Handwashing should take place after possible contact with fecal matter–especially child stools–and before handling food or water. Proper handwashing technique consists of using running (falling) water; using a cleansing agent such as soap, ash, or mud; rubbing hands all over at least three times; and shaking them dry in the air or drying them on a clean cloth.

Where malaria is a significant public health problem, protecting oneself and one's family from mosquitoes is a high-priority behavior. It can best be achieved through the consistent use year-round of insecticide-treated mosquito nets, especially by children under five and pregnant women. In some situations, families and communities can also take action to reduce mosquito populations through environmental control measures.

Table 3-1
Examples of Specific Actions That May Be Involved in Implementing the Minimum Package

Minimum Package	**Examples of Individual/Household Actions**	Minimum Package
Safely dispose of human feces	➥ Build (if needed), use, and keep clean an appropriate sanitary solution (latrine, etc.) ➥ Use diapers ➥ Wash diapers well and never reuse the water ➥ Dispose of diaper-washing water far from the house and water sources ➥ Wash hands after defecation or changing/cleaning the baby ➥ Remove children's feces from the home and safely dispose of them ➥ Prevent your baby or toddler from contacting human feces ➥ Teach children to use potties and latrines	➥ Safely dispose of human feces
Consume safe water	➥ Boil all water for drinking/cooking ➥ Chlorinate water for drinking/cooking ➥ Keep all water containers covered ➥ Keep water containers off the floor ➥ Use clean dippers and keep them hung or covered ➥ Obtain water for drinking/cooking from the least contaminated source available ➥ Use/purchase the safest available water supply	➥ Consume safe water
Consume safe food	➥ Wash hands before eating, feeding, or preparing food ➥ Cook food at high temperatures ➥ Before eating food cooked more than an hour before, reheat it ➥ Do not purchase, feed, or eat animal products that are old or smell bad (spoiled) ➥ Wash fruits and vegetables with safe water before feeding/eating ➥ Wash all kitchen surfaces, dishes, and utensils before use ➥ Cover food to keep off flies ➥ Do not use baby bottles or pacifiers	➥ Consume safe food
Protect self and family from mosquitoes	➥ Purchase an insecticide-treated mosquito net ➥ Hang the net so that mosquitoes have no way to reach people ➥ Make sure young children and pregnant women always use the nets ➥ Use bednets properly (fully covering people at peak biting hours, throughout the year) ➥ Refrain from washing the net frequently ➥ Redip nets when recommended, usually every 6 to 12 months ➥ If ITNs are unavailable, obtain and correctly use a non-treated net or other treated material (such as curtains) ➥ If you must sleep outside (e.g., to protect your crops), use a treated material or other measure to protect or repel ➥ If you cannot use a treated material, use other local or purchased technologies to reduce the mosquito population where people sleep (e.g., insecticides, coils, or smoke) ➥ Cooperate with the government spraying program	➥ Protect self and family from mosquitoes

Indicators

For evaluating most projects, it is sufficient to measure changes in the behaviors that research has shown to be effective in reducing morbidity and mortality. "Process" indicators showing changes in the degree of participation, decision making, consciousness raising, and empowerment may be included, if these are project goals. Measuring health outcomes, while not always possible, is desirable because it can demonstrate the impact of behavior change on health, thus reenforcing individual and community behavior change efforts. However, it is difficult to attribute improvements in health to any specific intervention when so many other phenomena (weather, currency, fluctuation, or a measles epidemic) could contribute to changes in health status (Cairncross 1990).

Measuring health outcomes is desirable because it can demonstrate the impact of behavior change on health, thus reenforcing individual and community behavior change efforts.

Programs have to be as practical as possible without compromising accuracy to produce a fair picture of the impact of a behavioral change program and how it might be improved.

Indicators should be *observable*, either directly or indirectly. However, many important behaviors are difficult or impossible to observe. Sometimes indirect evidence may be used, such as the condition and cleanliness of the latrine, the presence of cleansing material, or the condition of the path to the latrine. (Other examples are given in Box 3-1.) Handwashing behavior can be assessed by observing the presence of soap and water; by asking questions about who washes, when, and how; or by requesting a handwashing demonstration. Several hours of observation in a household would give more information, but behavior may change as a result of the presence of the observer (Curtis *et al.* 1993). Programs have to be as practical as possible without compromising accuracy to produce a fair picture of the impact of a behavioral change program and how it might be improved.

Box 3-1: Indicators in a Hygiene Education Project in Thailand

The project decided that the indicators should be ones that could be monitored routinely by someone with time and ability without offending or shaming anyone. Village development committees, sanitarians, and others should be able to take corrective action based on the information collected. The 10 indicators selected are given below; all are proxy indicators for behavioral change.

- Percent of the village population with access to a latrine for everyday use
- Percent of households with latrines kept clean on a regular basis
- Percent of school latrines kept clean and without smell every day
- Percent of school and household latrines with water and a dipper inside for flushing
- Percent of households and schools with soap or detergent available for washing hands
- Percent of households and school latrines with new picture stickers inside
- Percent of children aged four to six who are trained to use a latrine at all times
- Percent of households and village schools with access to clean drinking water
- Percent of rainwater jars that have covers
- Percent of rainwater jars that are always covered

Villages that reached targets for all indicators received a certificate from the Regional Sanitation Center (Simpson-Hebert in Cairncross and Kochar 1994).

In 1997 EHP convened another group of experts to propose a set of indicators for diarrheal disease, malaria, and ARI prevention. Indicators for behavioral change proposed by the experts are presented in Table 3-2.

Table 3-2
Suggested Minimum Package Indicators

Safely dispose of human feces	*Proportion of households:* • Where all family members 3 years or older usually use a sanitary facility for defecation • Where the feces of children under 3 are disposed of in a sanitary fashion • Where the house area and yard are free of human fecal contamination *Proportion of sanitary facilities:* • That appear to be in use • That are free of soiling with human feces
Consume safe water	*Proportion of households:* • That use water from an acceptable source for cooking and drinking • That have either in-house piped water or have a system of water collection, transport, storage, and access that maintains water free of contamination
Consume safe food	*Percent of infants 6 months and under:* • That are exclusively breastfed *Proportion of households:* • Where the mother reports washing her hands before preparing or serving food or feeding children • Where food is eaten within three hours of cooking • Where cups and spoons rather than bottles are used to feed infants and small children
Protect self and family from mosquitoes	*Proportion of households:* • That own and have correctly installed at least one bednet in their home • That have a bednet in good condition and state they slept under an insecticide-impregnated bednet the previous night • That have a bednet in good condition and state they have reimpregnated the net in the last six months. • That have a bednet distribution AND insecticide reimpregnation site within 10 km

In addition, the experts proposed the following indicators for handwashing. These relate to the three diarrheal disease prevention behaviors in the Minimum Package.

Proportion of households:

- where the mother (or caretaker) reports washing her hands at least once in the previous 24 hours on each of the four critical occasions
  - after defecation,
  - after cleaning babies' bottoms,
  - before eating or feeding, and
  - before preparing or handling food.
- where the mother (or caretaker) demonstrates all elements of adequate hand-washing technique
  - both hands cleansed with water and soap or ash,
  - rubbed at least three times, and
  - dried hygienically

Indicators for USAID's Africa Integrated Malaria Initiative (AIMI) are given below for the sake of comparison. Use of insecticide-treated mosquito nets (bednets) for malaria prevention is the centerpiece of AIMI, a joint program of USAID's Office of Health and Nutrition of the Bureau for Global Programs, Field Support and Research, and the Bureau for Africa. These indicators are similar to those developed by the experts convened by EHP:

- Proportion of households that own and have correctly installed at least one bednet in their homes
- Proportion of target population living in a household with a bednet in good condition for whom there is *objective evidence* that they slept under it the previous night
- Proportion of target population living in a household with a bednet in good condition who *state* that they slept under it the previous night
- Proportion of homeowners with a bednet in good condition who state that they have reimpregnated the net in the last six months

The indicators above and in Table 3-2 are not meant to be definitive, but they do suggest the kinds of indicators appropriate for tracking progress toward goals in the Minimum Package.

4 Evidence of Effectiveness and Feasibility of the Minimum Package

Range of Evidence

There is strong evidence of the potential impact of the four behavioral clusters that make up the Minimum Package, although problems with study design and interpretation exist. For example, findings from studies may be somewhat inconsistent, because the impact of a change in behavior depends on preintervention conditions, the presence of environmental health technologies, and other health-promoting practices. Also there are varying amounts of evidence for the efficacy of various specific behaviors. Some have been widely studied and others have not. For example, consistent, dose-related responses to such behaviors as proper use of insecticide-treated bednets and consistent and appropriate handwashing have been shown, but there is less clear and consistent evidence of the efficacy of other behaviors, such as, for example, consuming safe food. Similarly, there is a range of operational experience and evidence of effectiveness of various behaviors. Few malaria prevention programs exist, while diarrheal disease prevention programs are numerous—and a large number of them have been evaluated.

Findings from studies may be somewhat inconsistent, because the impact of a change in behavior depends on preintervention conditions, the presence of environmental health technologies, and other health-promoting practices.

Factors Affecting the Impact of Behavior Changes on Health

Although many improvements in environmentally related behaviors and technology have a positive impact on health, the relationships are not always clear and direct. The health impact of changes in behavior generally depends on three factors:

- ***The behaviors themselves.*** Some behaviors are more directly related than others to health impact. Improvements in handwashing and proper disposal of feces generally have a greater impact on health then, say, fencing animals or covering drinking water. However, while in general certain types of behaviors are the most important (see the discussion of the Minimum Package), the specific priority behaviors that need to be modified depend on the local epidemiology of disease.

- ***The magnitude of change in the behavior.*** Behavior change can range from a minor improvement to a major one. For example, moving from obtaining contaminated water far from the home to obtaining clean water in the home has a greater impact than making a lesser change in water convenience and quality; moving from cooking with dried animal dung to cooking with electricity has a much greater impact on indoor air pollution than moving from burning dried

twigs in a clay stove to burning wood in a metal stove; or moving from burning a mosquito coil to consistently using an insecticide-treated mosquito net has a greater impact on mosquito bites and malaria than moving from using an untreated to a treated net.

A single useful behavior change does not always guarantee a measurable health impact.

- ***The status of other behaviors and conditions that affect health.*** A single useful behavior change does not always guarantee a measurable health impact. Many behaviors are part of an interdependent "cluster" of behaviors. In other words, there are so many pathways for disease pathogens to enter the human body that blocking some but not others may not be protective to an individual or family. For example, boiling drinking water; storing it in a clean, covered container off the ground; removing water with a clean dipper; and drinking it from a clean glass or cup may all be necessary to obtain the hygienic benefits. Adopting only one or a few of these behaviors may be insufficient to have a measurable health impact on diarrhea. In addition, many important protective actions are necessary to complement changes in Minimum Package behaviors. For example, the negative effects of poor breastfeeding or immunization practices can mask any positive impact of improvements in water and sanitation behaviors.

An important recent analysis of the interdependence of environmental health behaviors by Van Derslice and Briscoe (1995) concludes that the impact of improving drinking water quality depends on levels of neighborhood sanitation: i.e., the higher the sanitation level, the greater the impact of water quality improvements, and vice versa. The impact of improvements in both water and sanitation could be expected to be greater than the sum of the effects of improving just water supply or just sanitation. This analysis states that "it is impossible to draw any policy conclusions from a study of the health impact of a single intervention," and also that too little impact is likely to be attributed to early interventions and too much to later interventions (p. 135). These arguments are consistent with McJunkin's earlier analysis (1983), which concluded that the relationship between improving water quality and quantity and health outcomes "is strictly quantifiable *a priori* only in the broadest sense (better water, better health) and varies widely with specific circumstances" (p. 93).

Summary of Evidence of Effectiveness

1. Safely Dispose of Human Feces

Effectiveness of Sanitation in Diarrheal Disease Reduction

Having access to and consistently using an acceptable sanitary solution (such as using a bathroom or latrine, or burying feces far from homes, water, and where people walk) are desirable household hygiene behaviors. A number of studies have shown that diarrhea incidence is higher in families not using latrines and/or not keeping their latrines clean (Boot and Cairncross 1993).

- A study of risk factors for diarrhea among children under five in urban Papua New Guinea found that the presence of feces in the compound was associated with a 48% increase in diarrhea, and presence of pigs associated with a 69%

increase, but presence of a standpipe was associated with a reduction in diarrhea morbidity of 56% (Bukenya and Nwokolo 1991).

- Esrey *et al.* (1990;1991) found some reduction in diarrheal disease in 21 of 30 studies examining the impact of sanitation. The median reduction was 22%. Reductions were greatest with flush toilets, although pit latrines also had positive impacts. The introduction of improved sanitation had the greatest impact among nonbreastfed infants.
- Findings of subsequent studies are consistent with Esrey's review. For example, Daniels *et al*. (1990) found a 24% reduction in diarrheal prevalence associated with latrines in Lesotho.
- Aziz *et al.* (1990) evaluated the impact of an integrated intervention project on diarrheal morbidity in children under five years in rural Bangladesh. The intervention included installation of handpumps (1 per 30 persons), maintenance of the handpumps, installation of double pit water-sealed latrines in 92% of households, maintenance of these latrines, and hygiene education on water use and sanitation practices, specifically promotion of exclusive use of the handpump water and use of latrines. As a result of these interventions, children in the study area experienced 25% fewer episodes of diarrhea than those in the control area. Increased distance from the household to the handpump was associated with an increased incidence of diarrhea, while the use of pit latrines, either directly by the child or for disposal of the child's feces, was associated with a lower incidence of diarrhea.

One family's building and using a latrine cannot have a good impact unless most of the other community households also consistently use latrines.

The impact of one family's building and using a latrine or other sanitary solution, however, varies by situation. Especially in densely populated areas, a good impact cannot be achieved unless most of the other community households also consistently use latrines.

Effectiveness of Sanitation Plus Other Interventions

Impact also depends on other family hygiene practices. Where people have good access to water and where they take other protective measures, such as breastfeeding and consistent handwashing, the impact of sanitation is likely to be less dramatic.

- In Esrey's analysis of data (1996) from eight countries, the reduction in diarrhea incidence was 44% for children under three in families having optimal sanitation but no improved water; 13% percent in families with intermediate water supplies, and 19% percent in families with optimal water.
- In Bangladesh, the presence of a pit or sanitary latrine showed no association with risk for shigellosis while the presence of a hanging latrine showed an increased risk. The authors concluded that "the apparent lack of protection associated with pit or sanitary family latrines could suggest that small numbers of such facilities in a highly contaminated environment are not sufficient to reduce pediatric shigellosis or that unhygienic behavioral practices may have countered the potential benefits of such latrines" (Ahmed *et al*. 1994, p. 861). This study may confirm the advantages of a more comprehensive approach to sanitation.

Sanitation Feasibility Issues

EHP's experience and the literature indicate that sanitation behavioral change programs typically need to address the following barriers:

- Construction of more acceptable sanitary solutions entails considerable expense (credit or contributed supplies may be required).
- Because people may believe that diarrhea has many causes and that contact with fecal matter is an insignificant or nonexistent cause, programs need to identify other motivations, such as prestige, social status, a private place to bathe, and the desire to please husbands or to eliminate unpleasant smells near the home.
- For cultural reasons, men and women may be reluctant to share a latrine.
- People may not believe that young children's feces are dangerous. Young children may be afraid to use latrines because they fear falling into the hole or being bitten by snakes or insects, particularly at night.
- Human feces in the environment may provide food for pigs and other animals.
- People may think that emptying or relocating a latrine and keeping it clean entails too much work.

The Special Case of Handwashing

Proper handwashing is related to all diarrhea prevention behaviors in the Minimum Package.

Proper handwashing is related to all diarrhea prevention behaviors in the Minimum Package. Hands come into direct contact with food and mouths, and washing hands well can greatly reduce the pathogens that people ingest via these contacts. The impact of handwashing is greatest when done at certain *optimal times* (especially after defecating and cleaning up a baby's defecation and before touching food or feeding a child) and when done thoroughly (using a cleansing agent [commercial or homemade soap, ashes, even mud] and rubbing well [at least three times]). Air drying or using a clean cloth (not drying hands on a dirty cloth) is also important.

A number of studies have demonstrated that handwashing can reduce overall diarrheal disease morbidity by 30 to 50%.

A number of studies have demonstrated that handwashing—at appropriate times, with soap, and an adequate volume of water—can reduce overall diarrheal disease morbidity by 30 to 50% (Khan 1982, Clemens and Stanton 1987, Black *et al.* 1981). The results of several of these studies follow:

- In the reviews by Esrey *et al.* (1985, 1990, 1991), six studies assessing hygiene interventions (with or without other environmental actions) showed reduction in diarrheal diseases of 32% to 43%.
- A review of handwashing with soap in a variety of settings found reductions in dysentery (shigella) of 35% and nondysentery of 37% among all age groups in urban Bangladesh; diarrhea in children in U.S. daycare centers of 48%; and diarrhea during its peak season among children under five in Guatemala of 32-36% (Feachem 1984).
- As part of a Central America handwashing initiative, two USAID projects (BASICS and EHP) commissioned 4,500 interviews in four countries. The findings implied a strong connection between correct handwashing and lower incidence of diarrhea as shown in Table 4-1. In Burma, a 30% reduction in diarrhea was reported when mothers and children were provided with soap and encouraged to wash their hands after defecation and before preparing meals (Aung and Thein 1989).
- An educational intervention in Bangladesh that emphasized proper handwashing before preparing food, defecating away from the house at a proper site, and

suitable disposal of waste and feces yielded a 26% reduction in the incidence of diarrhea (Khan 1982).

- A study conducted in Thailand (Pinfold and Horan 1996) tested two main behaviors: handwashing, especially before feeding a baby, cooking, and eating and after defecation or cleaning a baby's bottom; and washing dishes immediately after eating. A 39% reduction in diarrhea incidence was documented for young children in intervention villages, compared with control villages. Differences in effective handwashing (as measured by fingertip contamination) were less than differences in knowledge of messages. The best impact was achieved in villages with a stronger sense of community.

Table 4-1
Association between Mothers' Handwashing and Child Diarrhea

Survey responses of 4,500 mothers	Two-week recall of child <5 diarrhea
0 correct handwashings per day (n=2925)	23%
3 correct handwashings per day (n=270)	17%
5 correct handwashings per day (n=900)	12%
8 correct handwashings per day (n=405)	10%

Handwashing Feasibility Issues

Handwashing is easiest where families have good access to water. Where access is difficult, program and community action may be needed to build, manage, and maintain an improved community water supply. Many studies have shown that, because they facilitate handwashing and other important hygiene behaviors, in-house water supplies are associated with reduced rates of diarrhea (Boot and Cairncross 1993).

Studies have shown that, because they facilitate handwashing and other hygiene behaviors, in-house water supplies are associated with reduced rates of diarrhea.

People do not have to accept the concept of germs to accept the practice of handwashing. Caretakers may be motivated simply by a desire to reduce "dirt" or "contamination," particularly when the advice comes from a credible source. The potentially strong and demonstrable impact of good handwashing also favors its acceptance and continued practice. A small project in Lombok, Indonesia, used face-to-face communication to promote handwashing with soap. After four months, diarrhea prevalence had fallen by 89% and mothers reported that their children had grown fat. Even after free soap distribution was discontinued, handwashing enthusiasm and practice continued at high levels (79%) two years later (Wilson and Chandler 1993).

2. Consume Safe Water

Programs need to examine the entire complex of behaviors that influences what happens to water from the time it enters a home until the moment it is actually consumed.

Effectiveness of Safe Water in Diarrheal Disease Reduction

While there is some evidence of the impacts of improved water availability and quality on diarrhea incidence, the findings are not clear and consistent, most likely because of limitations in study design as well as the confounding effects of water-related and other practices related to diarrhea. The mere presence of water, for example, does not mean that people will take advantage of it to wash their hands consistently and well. Poor water storage and use practices, as well as other poor hygiene practices (e.g., use of baby bottles), can easily contaminate even clean water that is available conveniently. Programs need to examine the entire complex of behaviors that influences what happens to water from the time it enters a home until the moment it is actually consumed. Another factor may be the baseline water quality and quantity from which families are starting. Moving to the use of clean, convenient water from the use of a distant source of contaminated water should have more of an impact than making more modest improvements in convenience and quality.

- Esrey *et al.* (1985; 1991) reviewed 43 studies of the impact of water supply on diarrheal disease, 22 of which reported a reduction in diarrheal disease morbidity from improved water supply, with a median reduction of 16%. In nine studies assessing the impact of improved water supply on mortality, small reductions were found for selected (but not for all) age groups. In studies reporting a positive health benefit, the water supply was piped into or near the house, while in those that found no benefit, water was supplied through protected wells, tubewells, or standpipes.
- Of the 16 studies assessing improved water quality alone, 10 found positive impacts on health with a median reduction in disease prevalence of 17%. In areas with high fecal environmental contamination, there was little intervention impact from water supply. Of the 15 studies assessing water quantity alone, 14 reported positive impacts, with a median reduction in disease prevalence of 27%.

Based on such evidence, Esrey and others argue that quantity of water is more important than quality. This may be the case particularly where people have previously used minimal water and probably reused water for various purposes because of time and distance to obtain water or the expense of purchasing it. It is also important to note that increased water availability facilitates handwashing.

Studies that have examined the combined impact of water and sanitation improvements have generally found a greater impact than from a single intervention alone.

Safe Water Combined with Sanitation

Studies that have examined the combined impact of water and sanitation improvements have generally found a greater impact than from a single intervention alone. The following are some examples:

Summarizing the evidence available a decade ago, Feachem (1986) concluded, "Well-designed projects combining water supply, excreta disposal and hygiene education may achieve morbidity rate reductions of 35 to 50%. It is expected that, in any given project, the impact on diarrhoea mortality rates will be larger than that on diarrhoea morbidity rates, except in areas where other interventions, such as oral rehydration programmes, have substantially reduced the risk of death from diarrhea" (p.115).

- Esrey *et al. (*1985) reviewed 67 studies from 28 countries on the impact of water supply and sanitation on diarrhea, related infections, nutritional status, and mortality. They found median reductions in diarrheal morbidity of 22% from all studies and 27% in the better designed studies, with parallel morbidity findings of 21% and 30%. Reviews by Esrey *et al*. (1990;1991) of an additional 17 studies found similar impacts.
- The only study examining the effect of water and sanitation on mortality found an 82% reduction in infant mortality in homes where water and toilets had been introduced, as compared to homes without these facilities (Habicht *et al*. 1988).
- An analysis of secondary data comparing the importance of sanitation versus water (in this case, using nutritional status as an outcome) concluded that although both were important, sanitation was more so, albeit not at a statistically significant level (Bateman and Smith 1991). The impact of sanitation commonly looks greater because sanitation is usually added to an existing water program. Any initial improvement in health status reflects the effect of water alone, while the measurement of sanitation impact includes the combined effects of both interventions.
- Esrey's 1996 analysis of Demographic and Health Studies (DHS) data from the late 1980s from eight countries on three continents concluded, "Improvements in sanitation resulted in less diarrhea and in taller and heavier children with each of the three levels of water supply. Incremental benefits in sanitation were associated with less diarrhea and with additional increases in the weights and heights of children. The effects of improved sanitation were greater among urban dwellers than among rural dwellers. Health benefits from improved water were less pronounced than those for sanitation. Benefits from improved water occurred only when sanitation was improved and only when optimal water was present" (p. 608).

Safe Water Feasibility Issues

Where drinking water is believed to be quite contaminated, advising people to boil it or treat it with chlorine may make sense. However, these practices must be feasible: people must have the time and the fuel or the chlorine necessary. Some experts argue that in many circumstances boiling drinking water takes more time and resources than it is worth. "Telling people to boil their drinking water is...unrealistic and incomplete" (van Wijk and Murre n.d., p. 4). Clearly, promoting this practice depends on its feasibility as well as epidemiological conditions. Resources might be better directed at finding communal solutions to the contamination at the source.

Safe water practices must be feasible: for example, if household disinfection of water is recommended, people must have the time and the fuel or the chlorine necessary to boil or treat contaminated water.

Numerous behaviors, both household and community, are involved in supporting the availability of water in a community and then using the water in ways that protect family health. Communities often need to contribute labor for construction, organize themselves to operate and maintain the system (including protecting water from being wasted or stolen), and be willing to consistently purchase the community's improved water supply (as opposed to using a more contaminated alternative). It is very important that communities be linked to technical organizations (government or private) that can provide technical and financial assistance in water system operations and maintenance when needed.

It is very important that communities be linked to technical organizations (government or private) that can provide technical and financial assistance in water system operations and maintenance when needed.

Motivating families to treat their drinking water may or may not require teaching or convincing them about germs. If people believe that boiling water is advantageous for reasons other than destroying germs, these advantages should be used to

motivate action. There is no reason to change centuries-old beliefs about disease causation if there are other, acceptable motivations to more healthful behavior.

Where women (and possibly other community members) must spend many hours fetching water, a convenient water supply is normally a very high community priority and can motivate community action. Still, ethnic, family, and personal conflicts arise within communities, and links to outside assistance may be tenuous over time. People may not use new water systems as intended for numerous reasons: engrained customs of obtaining water elsewhere, the supposedly better taste or smell of other water, long lines to obtain water, or cost.

On the other hand, the availability of more convenient water has benefits for freeing up women's time for family care and facilitates handwashing, kitchen hygiene, and household gardening.

3. Consume Safe Food

Effectiveness of Safe Food in Diarrheal Disease Reduction

Food is a common vehicle for disease germs, accounting for an estimated 15 to 70% of diarrhea disease incidence. However, findings from studies examining the association between contaminated food products and diarrhea are not clear and consistent because of a number of study design issues (Esrey and Feachem 1989).

Studies that have assessed the impact of food hygiene programs on diarrheal disease are lacking, with the exception of those that demonstrate the effectiveness of weaning education (Ashworth and Feachem 1986). Only U.S. investigations have collected data on the practices most commonly responsible for bacterial food-borne diarrhea outbreaks. Practices associated with food-borne diarrhea outbreaks included improper holding temperatures (43%); inadequate cooking (21%); poor hygiene by food handlers (15%); contaminated equipment (9%); and unsafe food source (7%) (MacDonald and Griffin 1986).

Practices associated with food-borne diarrhea outbreaks included improper holding temperatures, inadequate cooking, poor hygiene by food handlers, contaminated equipment, and unsafe food source.

A case-control study in Manila correlated various home factors among children hospitalized with severe diarrhea. The analysis indicated that low scores for kitchen hygiene (cleanliness of food and water storage containers and the sanitary condition of the cooking and eating areas) and overall cleanliness (general appearance of the house, inside and out, and physical appearance of the mother/caretaker and the index child) were strongly associated with high risk of severe diarrhea (Baltazar et al., 1993).

Numerous studies show the extraordinary health benefits of exclusive or full breastfeeding over other food and feeding modes for young babies. Most find diarrhea and death rates on the order of 10 or 20 times greater among infants receiving little or no breastfeeding. In cases where breastfeeding has ended and cannot be restarted, it is preferable that the child be fed by cup and spoon rather than a bottle or feeder. Likewise, use of pacifiers (dummies), which frequently fall on the floor or in the dirt, are a major risk factor for young children, and should be strongly discouraged.

Esrey (1991) reviewed studies on the impact of fly control on the frequency of diarrhea. Data from seven studies revealed a median reduction of 40%. However, Esrey pointed out that many of the studies were flawed and argued that fly control is not sustainable. Levine and Levine (1991) reviewed the same studies and found that there was sufficient evidence of the transmission of shigellosis by flies to justify further studies to explore sustainable fly control measures. Since this second review,

a study among Israeli soldiers using simple yeast-baited fly traps demonstrated a 64% reduction in housefly density, a 42% reduction in clinic visits for diarrhea, and an 85% reduction of shigellosis (Cohen *et al*. 1991). In many settings, it seems appropriate to advise families to cover leftover food against flies. Household fly populations can also be reduced by keeping human and animal feces (including babies') and organic garbage outside and away from the house.

Safe Food Feasibility Issues

A number of the behaviors in the safe food cluster are much more feasible where families have easy access to water. Facilitating provision of convenient water where it is lacking may be a prerequisite for many hygiene improvements.

Facilitating provision of convenient water where it is lacking may be a prerequisite for many hygiene improvements.

Where women spend much of the day working outside the home, it may be the custom to prepare one large meal per day and to eat the leftovers later in the day. In such situations, an important behavior change may be to reheat the food thoroughly before consumption. Where the risk of cholera exists, this advice is particularly important, as is the warning to avoid eating street food that has not been recently cooked or reheated.

4. Protect Self and Family from Mosquitoes

Effectiveness of Insecticide Treated Materials in Malaria Prevention

The most effective behavior change to protect self and family from mosquitoes is to obtain and correctly use bednets or other materials impregnated with insecticides. Not only do these nets create a barrier between people and mosquitoes during the night but they also kill mosquitoes that land on them.

Since the 1980s, a series of studies have conclusively shown the efficacy of insecticide-treated mosquito nets and other materials (ITMs) in malaria prevention. ITMs are safe, and they reduce mosquito-human contact, thus reducing malaria transmission at the community level as well as reducing malaria-caused mortality and general child mortality. Studies on the use of ITMs have concluded the following:

Since the 1980s, a series of studies have conclusively shown the efficacy of insecticide-treated mosquito nets and other materials (ITMs) in malaria prevention.

- At the October 1997 bednet conference in Washington, D.C., Christian Lengeler summarized the findings of five recent African trials (in stable malaria areas). Using ITMs resulted in a 46% reduction of clinical episodes of malaria over control populations with no nets and a 37% reduction over controls with untreated nets; and a 19% reduction in child mortality, which translates into 5.6 deaths averted per year per thousand children protected (USAID 1997).
- A meta-analysis of 10 field trials of ITMs by Choi *et al*. (1995) found an overall advantage of 24% in treated over untreated nets and 50% in ITMs over no bednets in reducing the incidence of malarial infections. An additional health impact of ITMs was measured in Tanzania and the Thai-Burmese border—an over 50% reduction in anemia among young children and women (Premji *et al*. 1995, Shiff *et al.* 1996, Dolan *et al.* 1993).
- In Sichuan Province, China, several million families had bednets sprayed annually with deltamethrin. This achieved 100% mosquito mortality in areas sprayed for five years (Cheng *et al.* 1995).
- An 80% reduction among the 40,000 people in Vietnam using ITMs was measured (Malaria 1990).

- Use of ITMs in Latin America resulted in decreases in *falciparum* malaria from 40% to 4% (Brazil) and in average incidence from 6.5% to 2.3% (Colombia), from 21.6% to 5.3% (Ecuador), and from 8.3% to 3.7% in Peru (Zimmerman and Voorham 1997).

Besides issues of how to go to scale, an important question for current research is the extent to which ITMs delay acquisition of immunity.

Current research focuses on the effectiveness of ITMs in program settings and their long-term impact. Besides issues of how to go to scale, an important question for current research is the extent to which ITMs delay acquisition of immunity.

The strong consensus of studies is that the most effective practice is the correct use of treated bednets, then treated curtains, then untreated nets. Studies have found that other vehicles for insecticide have also had a positive impact:

- Adding insecticide to kerosene in lamps in Tanzania reduced mosquito bites by 44% and 78% in different types of lamps (Sharma *et al*. 1993, Pates *et al*. 1997).
- In Afghanistan, insecticide treatment of *chaddors* in which people sleep gave 50% protection against malaria, with no side effects (Rowland and Saleh 1997).

ITM Feasibility Issues

In addition to people's willingness and ability to obtain, correctly use, and retreat ITMs, several epidemiological factors impact on ITM efficacy:

- Temporal match between when people are in bed and when the main malaria vectors in the area bite most intensely (people may go to bed later in urban areas)
- Effectiveness of the insecticide against the prevalent malaria-carrying mosquitoes (if some are resistant)
- Effect of repeated washing of ITMs by mothers
- Overall levels of malaria transmission in the area—ITMs may be less effective in very high transmission areas because of greater out-of-net exposure or in very low transmission areas or seasons because use is reduced

For insecticide-treated bednets to have their optimal impact, families need to adopt a number of important behaviors ranging from correct use of the net to reimpregnation at specified intervals. Table 4-2 lists motivations and barriers to carrying out behaviors related to bednet use gleaned from the literature and EHP's formative research in Zambia.

Key behavioral change issues relating to ITMs are the following:

- Acquiring ITMs (planning for purchase cost)
- Using ITMs correctly (i.e., they must cover the bed adequately, and the most vulnerable family members must sleep under the nets)
- Using ITMs regularly
- Ensuring reimpregnation (includes decisions on frequency and insecticide safety)
- Seeking care for malaria

These issues must be taken into account when developing behavior change programs aimed at promoting ITMs.

Table 4-2
Motivations and Barriers for Bednet Use

***Motivations*:**	***Barriers*:**
• Reduction of malaria attacks and deaths • Reduction of nuisance mosquito bites • Protection from dropping roof debris (including snakes) and reduction of bites from bedbugs, lice, and other pests ("a good night's sleep") • More privacy for couples • Enhanced status (a bednet may be considered a prestige item) • Reduction of time lost from work • Lower expenditures for treatment, other preventive measures, and funerals	• Limited availability of bednets and insecticide for retreatment • Cost of insecticide-treated bednets and retreatment (substantial decline in dipping in the Gambia after charges were introduced) (Muller *et al.* 1997) • Poor understanding of how bednets will reduce malaria • Poor understanding of how to use and handle insecticide-treated bednets • Lack of motivation for using bednets during low-transmission season (in northern Ghana use in dry season was 20% vs. 99.7% in rainy season [Binka and Adongo 1997; Thomson *et al.*1996]) • Cultural practices that give father priority use of bednet as head of household (e.g., Bourgoing 1997) • Desire to keep net clean by washing (Kroeger *et al.* 1997, Binka and Adongo 1997) • Custom of spending time outdoors during peak biting times • Need to sleep in the fields to protect crops; • Belief that nets smell bad and/or can be dangerous to children

Although repellents and protective clothing help prevent people from being bitten during peak mosquito-biting hours, treated bednets are generally much more cost-effective than other protective measures within the home.

Other Malaria Prevention Activities

Personal Protection. Additional behaviors and practices that protect individuals from mosquitoes include the purchase and use of repellents, protective clothing, window and door screens, and mosquito coils. Although repellents and protective clothing help protect persons outdoors during peak mosquito-biting hours, treated bednets are generally much more cost-effective than other protective measures within the home. People may also burn such items as dried orange peels, dung, leaves, or plants to deter mosquitoes inside homes. The efficacy of burning may be limited, but if local knowledge strongly supports burning a particular substance, there is no reason to discourage this (while promoting ITMs).

Behavior change issues regarding personal protection relate to timing, safety, and proper use. It may be carried out by individual households using aerosol sprays or by institutions using residual insecticides on the inner walls of homes.

Combined programs have been effective—for example, in El Salvador, where malaria has been reduced by over 95% (Pan American Health Organization 1992). However, vector resistance to insecticides has been a factor since large-scale spraying was initiated in the 1950s. Today, long-term reliance on spraying is costly, as

newer insecticides are more expensive and greater quantities must be used. Control programs heavily dependent on spraying have poor prospects for sustainability unless they are linked to more efficient methods of application and protection.

Household Spraying. Spraying is a component of most traditional malaria programs, along with vector control, surveillance, treatment, and larviciding.

Individuals and families can reduce the mosquito population in and near their homes through house spraying. Decades of experience indicate that insecticide spraying can reduce mosquito populations in homes for six months or longer, unless local mosquitoes have developed resistance to the insecticide used. One simple practice that families can carry out is to cooperate with a government spraying program for mosquitoes. In a study in Zimbabwe, 21% of families did not allow sprayers access to some rooms in their homes (Vundule and Mharakurwa 1996).

Based on reports from the literature, Table 4-3 lists motivations and barriers to carrying out these behaviors.

Table 4-3
Motivations and Barriers for House Spraying

***Motivations*:**	***Barriers*:**
• Reduction of malaria attacks and deaths • Reduction of nuisance mosquito bites ("a good night's sleep") • Reduction of bites from bedbugs, lice, snakes, and other pests • Less time lost from work • Lower expenditures for treatment, other preventive measures (coils, etc.), and funerals	• Poor understanding of the purpose of spraying • Poor understanding of the relationship between spraying and mosquito bites and attacks • Distrust of spray team or sense of not being treated well by them • Lack of approval from local leaders • Disruption of normal activities • Dislike of insecticide smell • Fear of bad health effects on family

Environmental Management. Particularly in conjunction with other family and community actions, activities to eliminate vector breeding such as filling swamps, puddles, ditches, and potholes; or improving drainage in ditches and swamps to improve water flow, can be effective. Cutting down bushes near the home will help eliminate places where vector mosquitoes rest, and thus should reduce the mosquito population in and around the house. Before proposing any of the above practices, planners should consult with an entomologist to find out if the practices will affect the local mosquitoes carrying malaria, rather than nuisance mosquitoes, although planners and families may decide that reducing the general mosquito population is worthwhile.

Before proposing environmental management approaches for malaria prevention, planners should consult with an entomologist to find out if the approaches will affect the local mosquitoes carrying malaria.

- In Nepal, in one year, community participation in clearing vegetation from ponds, draining and filling in land depressions, and cleaning and repairing irrigation canals resulted in a one-third reduction of malaria cases from the baseline and a 50% reduction compared with controls that had no intervention (Shrestha 1996).

Table 4-4 lists motivations and barriers to carrying out environmental management activities.

Table 4-4
Motivations and Barriers for Environmental Management

***Motivations*:**	***Barriers*:**
• Reduction of mosquito nuisance • Reduction of vector densities • Reduction of community malaria burden	• Need for careful planning • Need for community motivation and organization • No immediate impact • May interfere with agricultural activities

Larviciding through Biological Control. The efficacy of larviciding (introducing mosquito pathogens or predators such as bacteria and larvivorous fish) can be as high as 95% in controlled trials in limited areas.

The efficacy of larviciding can be as high as 95% in controlled trials in limited areas.

- One recent study in Goa, India, reported lower slide positivity rates in experimental areas using a weekly application of a biolarvicide compared with control areas not using the larvicide (Kumar *et al.* 1994).

Larviciding is most effective in and around communities where breeding sites are limited. Desert areas are especially suitable because small quantities of larvicides applied at the appropriate season can have long-lasting effects. There are few opportunities for community and family participation in larviciding, but keeping people well informed may be important to maintain demand for this effective intervention. People must comprehend how malaria is acquired and transmitted and must have some familiarity with biological control as distinct from the use of chemical insecticides.

Community Participation and Malaria Control

Community participation has been a major feature of some malaria control programs. Many national programs have used community volunteers to prepare for spraying teams, distribute prophylactic drugs, and perform other tasks; and many programs have organized community labor to drain swamps, assist with larviciding, and perform other tasks. "Mass media campaigns can educate residents about the importance of minimizing mosquito/breeding habitats from the community—creating a community police force against the disease" (World Resources Institute 1998, p. 81). Community health committees or volunteers play roles selling, promoting, and retreating ITMs in many African programs.

- Participation of schoolchildren in Kisumu, Kenya, in environmental control of malaria led to decreases in clinical malaria and absenteeism (Ogutu *et al.* 1992).
- Sharma and Sharma (1989) report successful control of larval mosquitoes and reduction in adult vector populations in Gujarat, India, through village participation in bioenvironmental control measures.

Implementing the Minimum Package

5

Achieving Behavioral Change

As discussed in Chapter 2, behavioral change to achieve health results requires both individual and collective action. For example, individuals may adopt new water-handling behaviors in their homes; these behaviors will be complemented by community-level behaviors such as establishing a committee for operations and maintenance of the community water supply. Both types of action are associated with the "consume safe water" cluster of behaviors in the Minimum Package.

To implement behavioral change in the two domains, social marketing and community capacity-building activities should be blended. *Social marketing* applies the principles of modern marketing, modified by the application of the social sciences, to enhance the well being of individuals and society. It seeks to meet the needs and desires of the "consumer" or target audience—usually individuals—by engaging that audience in defining behavior and the process of behavioral change. Social marketing approaches address the system: they combine mass and interpersonal communication and counseling as well as training, policy change, and product and service-delivery activities needed to encourage the adoption of desirable new practices. *Community capacity building* employs a range of training, mentoring, and organizational and other support activities to enable community groups to undertake joint activities. The focus is on activities in the public realm that cannot be achieved by individuals alone. Methodologies for behavioral change through community action have been developed by a number of organizations. Two examples are the CIMEP process (Community Involvement in the Management of Environmental Pollution) developed by EHP and the PHAST process (Participatory Approach for the Control of Diarrheal Disease) developed jointly by WHO, Swedish International Development Cooperation Agency (SIDA), and the United Nations Development Program (UNDP).

Behavioral change in environmental health programs and projects may combine elements of both social marketing and community capacity building.

Behavioral change in environmental health programs and projects may combine elements of both social marketing and community capacity building. The disciplined and professional approach to communications of social marketing is needed for prioritizing, motivating, and facilitating key behavior changes in the private domain and establishing positive social norms for individual participation in some public domain behaviors, while community assessment, planning, and action skills and establishment of ties to local support groups are essential for behavior change in the public domain and important for the sustainability of new behaviors in both domains.

Ideally, programs should build a strategy that employs both methods on parallel tracks so that they become integrated and mutually supportive during implementation. The activities being implemented under social marketing (e.g., communication, preparation of products such as nets, and service delivery) would cover but not be

restricted to the same communities that are going through community capacity building.

The starting point for both social marketing and community capacity-building activities is a crucial formative research or information-gathering phase.

Gathering Information

Crucial formative research is the starting point for both social marketing and community capacity building.

A research phase is required, not optional. The objective of research or information gathering is to achieve an understanding of actual versus perceived disease risk factors; environmental conditions; technologies in use; community preferences; the institutional landscape [local leadership, governmental entities, nongovernmental organizations (NGOs)]; the specific behaviors selected for improvement on the basis of their feasibility and potential impact; the major attitudinal and other barriers that must be overcome; and the most effective motivations to action. Key program design decisions will be based on this information. (See Box 5-1 for examples of insights from research.)

Addressing environmentally related diseases requires an understanding of not only the etiology of the diseases but also the transmission routes. One must understand the impact of *environment* (and related behaviors) on *health.* The chain of disease causality can differ markedly from area to area, a factor that program efforts over a large region must strive to accommodate. Program staff should be confident that the behaviors targeted for modification are the most important ones for their impact on the target disease or diseases.

Individuals, communities, and stakeholders should be involved in data collection. There may be differences in how extensive the information-gathering phase is, who directs it, and how the information is collected, but all efforts should ensure that the community and stakeholders are involved in the process. The data-collection phase should not be carried out solely by outside consultants or experts; however, identifying risk factors needs to be a rigorous, objective process to separate actual from perceived risks.

Research may be projectwide with the goal of identifying common themes and generating data with wide applicability, or it may be focused on a single community to uncover factors unique to a locale. Community groups may be directly involved in collecting or generating some of the information, particularly when the focus is on the community. For example, communities can produce maps showing the location of water sources, latrines, waste dumps, and mosquito breeding areas. At a minimum, community groups should be brought into the process of planning for data collection. Determining or confirming the most important risk factors relative to a health outcome, however, necessitates a more objective and independent process.

At a minimum, community groups should be brought into the process of planning for data collection.

Numerous approaches are available for gathering information. Researchers should use a combination of information-gathering techniques to achieve a realistic appraisal. Among others, Boot and Cairncross (1993), Kaltenthaler and Drasar (1996), and various authors in Cairncross and Kochar, eds. (1994), give many useful suggestions regarding information gathering. (See Box 5-1 for examples of insights from research.) Approaches include

- collection of demographic and health data, review of literature, interviews with experts;

- in-depth interviews, focus group discussions, knowledge, attitude, and practices (KAP) surveys, and trials of improved practices (TIPs) (see Box 5-2);
- participatory community-based mapping and other techniques;
- comprehensive household survey that includes disease outcomes, behavior, and environmental conditions; and
- direct observation inside and outside of homes, and in public places to understand current practices (and later to monitor change).

Box 5-1: Insights from Formative Research

- In India, more than two-thirds of women judged water by whether they thought it "cooked well," a concept unknown to the implementing organization (Cairncross and Kochar 1994).
- For many years in Bangladesh, water-sealed latrines were promoted on the basis of protecting people from germs to protect their health. However, research showed that more than three-quarters of people were interested in latrines because of privacy, convenience, comfort of women, and prestige of ownership (McIntyre 1993).
- In focus group discussions in Jamaica, community members were given a list of 15 desirable characteristics of sanitary solutions and asked to discuss and try to reach consensus on the three most important ones. This exercise greatly assisted in defining two or three designs of sanitary solutions that met families' criteria (Jackson and Ramsey 1994).

Box 5-2: Trials of Improved Practices

Trials of improved practices (TIPs) are actual trials, by a small number of families, of proposed improved behaviors (and of motivations, instructional information, and information to overcome expected barriers) (Dickin, Griffiths, and Piwoz 1997). In some cases, families are invited to choose from a "menu" of possible improved behaviors that are most relevant to their particular family's situation, and then to try out the selected ones for the trial period (often a week or two). At the end of the period, the mother and/or father are reinterviewed to learn about their trial experience, what they did and did not do and why, what was easy and hard and why, what benefits or costs the new practices had, what if anything others advised, their intention to continue the practices, and other information. Widely used in nutrition and other areas of public health, TIPs have been little used in environmental health, although the potential contribution of this technique seems very promising. In Zambia, EHP assisted TIPs on obtaining and correctly using insecticide-treated bednets. Issues identified concerned the need to adjust the size of nets for use with floor mats, the need for portable nets for persons whose livelihood depends on travel, and the difficulty of accommodating menstruating women who traditionally sleep separate from the rest of the family.

Developing a Strategy

Research will provide the basis for a behavior-change strategy. Representatives of major implementing organizations and all stakeholders, as well as community groups, if feasible, should participate in strategy formation. Research should point to a range of options that program staff, stakeholders, and communities can consider. The strategy will likely consist of a combination of four basic action components to effect change in both the domestic and the community domain:

- Communication
- Training
- Provision or facilitation of new technologies
- Policies

Monitoring should focus not only on progress toward goals but also on the behavior-change strategy itself.

Strategy development includes setting specific goals and establishing indicators. Monitoring should focus not only on progress toward goals but also on the behavior-change strategy itself. Is behavior change taking place? If not, why not? The purpose of monitoring is to learn about problems and positive achievements that should trigger appropriate program adjustments. (See Chapter 3.)

Tracking progress often starts with a quantitative survey conducted just before implementation begins and repeated one or more years later (ideally at the same time of year, because practices and risks may vary by season). The organizations and communities implementing the program should monitor progress; whereas an outside group should conduct a formal evaluation so that findings are less likely to be biased and have more credibility.

Creating an Enabling Environment

The Minimum Package cannot be implemented in a vacuum. An enabling, supportive environment must be created for behavior change to be sustainable. Involving stakeholders in data collection and strategy development helps create an awareness of what their supporting roles should be. Activities aimed at increasing the capacity of key stakeholders are often incorporated into a behavior-change project. These may include training government officials who interact with communities or setting up regular meetings with key decision makers from relevant agencies to address obstacles—institutional, logistic, and financial—that emerge during implementation.

The following types of support are needed to ensure success and sustainability:

- Legislation/regulation/enforcement—for example, building permits or standards for latrine construction, countrywide sanitation policies, reduced tariffs on imported bednets
- Financing—for example, making loans or subsidies available for construction of community water supplies and sanitation facilities or for the purchase of bednets, providing funds for community-level microprojects
- Technical assistance in management, supply, and logistics—for example, training community groups in financial management, helping devise a community system for maintaining water supplies, or organizing delivery of insecticides for reimpregnation of bednets
- Facilitating community action

To provide the necessary support, governmental organizations (often municipal- or district-level) and NGOs may need to adopt new attitudes and practices, as listed below, to support and reinforce family and community actions and to improve their prospects for sustainability:

Governmental organizations and NGOs may need to adopt new attitudes and practices to support and reinforce family and community actions and to improve their prospects for sustainability.

- *New Attitudes*. Changing how institutions view communities and families—changing the paradigm from "provide services" to "work with our partners."
- *New Skills.* Learning skills and methods for working with communities to assess risk factors, define problems, and plan actions based on local behaviors, practices, conditions, resources, and capabilities.

Changed attitudes and new skills of teamwork lead to improvements in working collaboratively with other organizations and sectors and in mobilizing the organizations that can support improved family and community practices in such areas as policy, management, regulation and monitoring, providing services, and providing supplies.

In many countries, local and national government authorities have served the public poorly for over 30 years. The state's role has eroded due to corrupt behavior and a lack of resources. Yet, government officials remain and have shown a capacity for positive behavior change. Divorced from government bureaucracies, community-level behavior change will not be easily sustained. Failing to recognize the state and its assets makes sustaining behavior change more difficult, but, governments can help to popularize and support behavior change (see Box 5-3).

Box 5-3: How Do New Behaviors Become Habits?

- When new behaviors and their benefits are of value to the persons adopting them
- When new behaviors are related to the community's existing beliefs and culture
- When the community has something to say about the design of technologies related to the new behaviors
- When appropriate reminders are provided
- When those modeling or advocating the new behaviors are trusted and accepted by the community
- When public sector bureaucracies support and facilitate the new behaviors

Implementing the Minimum Package

Programs to implement the Minimum Package of behaviors will vary by location depending on baseline environmental conditions, the disease burden, existing infrastructure, current behaviors, available resources, and the scale and limitations of the proposed project. However, there are certain basic activities that should be part of most implementation plans. This section briefly discusses what some of these basic activities might be for each of the Minimum Package behaviors. The activities mentioned are not intended to cover all eventualities but are meant to be representative and to touch on most of the important implementation issues or considerations. Detailed implementation plans for a specific program should be based on the find-

Programs to implement the Minimum Package will vary according to baseline environmental conditions, the disease burden, existing infrastruture, current behaviors, available resources, and the scale and limitations of the proposed project.

ings of the information-gathering phase.

Two implementation issues are basic to all behavior clusters in the Minimum Package and thus are not mentioned in the discussions below. The first is the issue of general consciousness-raising on the relationship of environmental conditions to diarrheal disease and malaria. Depending on the program, the need for people to understand the role of fecal contamination in transmitting diarrheal disease or the nature of breeding sites may be met through social marketing, projectwide communication activities, or through a community process that concentrates on problem-solving techniques.

The second issue is that for many aspects of implementation, technical assistance or external resources may be needed, so their availability may be essential for creating the environment to facilitate change.

An implementation strategy for achieving change in a given behavior will focus not just on motivating people to make the change but also on making it *possible* for or enabling them to do so given their circumstances. In the sections below, for each behavioral cluster, communication activities are discussed first because they are most basic; then training and technology support are considered; finally, the elements of creating an enabling environment are summarized. Examples from EHP experience, summarized after this discussion of implementation, show the wide variation among programs.

1. Safely Dispose of Human Feces: Implementation Considerations

A key aspect of making safe disposal of feces a habitual behavior is creating a demand for sanitary solutions, typically latrines or toilets. Normally, households demonstrate a high demand for water but much less of a demand for sanitation. In designing an implementation strategy for this behavior, information on community preferences for latrines, attitudes toward defecation and privacy, willingness to pay, and use of existing facilities is vital. Such information will indicate how demand might be created.

Achieving this behavior is fundamental for diarrheal disease control. In areas highly contaminated by fecal matter, it is possible—but extremely difficult—for families to protect their water and food. Safe feces disposal behaviors are complex and can call for a relatively expensive technology and a major household financial commitment.

Communication

Communication activities will likely attempt to achieve one of three possible goals: promote safe, consistent, universal use and adequate maintenance of latrines already existing but not properly used; promote use of latrines by a key group found not to use them, such as young children; or support a program that combines latrine construction with promotion of proper maintenance and use, with a focus on household latrines or on latrines for schools, markets, or other public places. A program might also focus on proper disposal of infants' feces.

To achieve the first and second goals, a communications program might be launched in collaboration with the health sector to create a demand for sanitation through a well-created communication strategy based on formative research with potential beneficiaries. In addition, appropriate messages about latrine use could be

incorporated into health extension work or made part of hygiene education in schools or in health programs supported by NGOs. Communication strategies for achieving the third goal could be worked out and possibly cofinanced with the organization facilitating or funding latrine construction. Such a program could include messages on types of latrines available, benefits of latrine use, credit plans available, and self-help construction options.

Training

In programs that include provision of sanitation technologies, training activities might include latrine construction and maintenance skills. Individual families might be trained in self-help construction of their own latrines, or local contractors might learn how to apply their skills in a communitywide program. Community teams could be trained to manufacture latrine parts for sale in the community or to manufacture "pots for tots" or "pedi-pots" to encourage latrine use by young children.

Technologies

The type of sanitation technology selected for a specific program is extremely important and should be based on research. The technology must meet the following criteria:

- Adequate for safe feces disposal
- Culturally appropriate
- Technically feasible given the terrain
- Acceptable to the community
- Affordable
- Easy to maintain

Programs in which the government or a funding agency distributes or builds one-size-fits-all latrines have not generally been very successful. The latrines have not been used or have been used as storage sheds. The chance for success increases when the latrines meet local preferences and when enough demand has been created so that households pay all or a substantial proportion of the costs of construction. This hard-won lesson underlines the importance of communication to create a demand for sanitation.

Enabling Environment

Sanitation has been neglected in favor of water supply, not only in individual households and communities but also by governments. A strong national sanitation policy with specific goals and adequate resources creates an excellent environment in which to promote safe feces disposal behavior. Specific supports that governments can provide are to make credit available or provide subsidies for latrine construction; establish technical standards for latrines or other sanitary solutions; mandate sanitary standards for public facilities; and ensure that government programs in education, health, and community development incorporate messages promoting sanitation. Including government stakeholders at every level in planning and implementation and sharing lessons learned and results with them is an effective way to advocate for government support.

A strong national sanitation policy with specific goals and adequate resources creates an excellent environment in which to promote safe feces disposal behavior.

2. Consume Safe Water: Implementation Considerations

Depending on local conditions and risk factors, substantial reduction in diarrheal disease may be obtained just by improving water-handling behaviors.

Programs to promote safe water consumption behaviors may or may not include improvement of water supply. In some areas where diarrheal disease rates are high, a safe water supply is available, but the water is contaminated during collection, transport, storage, or use. Depending on local conditions and risk factors, substantial reduction in diarrheal disease may be obtained just by improving water-handling behaviors.

Because fecal matter harboring disease organisms often reaches people via water contaminated by unwashed hands, proper handwashing is an important aspect of consuming safe water. In fact, handwashing is related to all three diarrheal disease-related behavioral clusters and so should be considered in strategies promoting the safe disposal of feces and the safe storage and consumption of food.

In areas without access to improved water supplies, programs to promote safe water consumption should be carried out preferably in conjunction with infrastructure programs funded outside the health sector. Likewise, the health sector might support or promote community water system maintenance and operations for new or existing infrastructure. There is a trend in many countries to decentralize water utilities and give responsibility for operations and maintenance to communities. If infrastructure improvements are planned, water disinfection techniques might be supported. In a very few cases, the health sector may fund construction of water supplies—usually low-tech systems in rural areas—but normally new system construction is the responsibility of public works, housing, or other sectors. If building or improving a system is part of the behavior-change strategy, research should determine such factors as community preferences for level of service and design, willingness to pay, water usage patterns, and available water resources. While there is a greater demand for water than for sanitation, water systems built without community input may go unused—just like "imposed" latrines—or may not be properly maintained.

Communication

Communication interventions should focus on the basic elements: water handling (transport and storage) and handwashing. Messages about safe behaviors can be made part of health extension work and school programs. Children learning about safe practices at school may influence behaviors in their homes. Health center and school programs can be carried out in conjunction with marketing and advertising of handwashing soap and safe water storage containers. Similarly, messages aimed at promoting "good neighbor" water source maintenance activities could supplement infrastructure construction programs. Other messages, depending on local conditions, might promote water conservation, correct uses for different water sources, and prompt payment of water tariffs.

Training

If messages about safe water use behaviors or water disinfection are to be integrated in health extension work, health service personnel or community health workers may need training. For school programs to be successful, teachers may need training and curriculum support. Training may also be a part of programs featuring community operations and maintenance of water supply: topics that might be covered range from technical issues such as pump maintenance to bookkeeping and tariff collection.

Technologies

As mentioned, technologies to support safe water use behaviors are likely to be low-cost items for purchase and use in individual homes, such as storage containers, soap, handwashing water dispensers, and measuring containers for water purification. Technologies to support community maintenance of water supply might include tools, spare parts, and vehicles for transport. These may be provided by the water utility or the municipality.

Enabling Environment

Safe water use behavior is much easier to achieve if the water supply is convenient to the household. The health impacts of a behavior change program in water use may be much greater in areas where a safe supply exists.

Government loans and subsidies may be necessary for some communities to afford even relatively cheap water containers, although household purchase should be encouraged.

If drinking water is to be disinfected through home chlorination, distribution channels for the chlorine must be in place. These can often be established through private-sector partnerships.

Community operations and maintenance should be organized and implemented within the context of a government-supported initiative. Furthermore, some mechanisms must be in place for communities to call on government resources when needed to overcome barriers or constraints to effective management.

In some instances, the government can improve the water supply by enforcing regulations on water vending.

3. Consume Safe Food: Implementation Considerations

Promotion of safe food consumption behaviors could be incorporated in excreta disposal and safe water consumption efforts, based on the major risk factors in the locale.

Few programs focusing exclusively on food hygiene exist in developing countries. Most are linked with nutrition programs. However, promotion of safe food consumption behaviors could be incorporated in excreta disposal and safe water consumption efforts. It is important to base such efforts on the major risk factors in the locale. The major risk factor may be lack of handwashing at one or more key times related to food; it may be consumption of unwashed vegetables grown in fields fertilized with untreated wastewater; it may be use of unhygienic baby bottles; or it may be consumption of food from vendors who do not follow safe food preparation practices.

As mentioned in Chapter 4, cooked food that sits around uncovered and that is not reheated before being eaten can be contaminated by flies. Flies carry contamination to food from human fecal matter indiscriminately deposited around household compounds or mixed in with uncollected solid waste. However, there is no consensus on whether fly control or solid waste management should be given high priority in safe food consumption behavior efforts.

Communication

Depending on risk factors, communication may focus on food consumed at home or purchased and consumed elsewhere. Communication activities related to food consumption at home could stress safe food preparation and storage and handwashing as a part of health extension or school programs, as previously mentioned, or promotion of breastfeeding or fly control. Such activities could be linked with health

and nutrition programs. In communities with mothers clubs or other such organizations, making information on food hygiene available might be effective—perhaps combined with food preparation demonstrations or assistance in procurement of simple technologies. Communication activities related to food consumption in public places could consist of promulgating regulations to food vendors or restaurants or raising community consciousness about food vendor standards.

Training

Food vendors, restaurant workers, and market-stall operators might be trained in safe practices, perhaps in conjunction with a licensing program. Community teams could be assigned to monitor vendors or to manage solid waste collection and disposal. In such cases, they would need training to perform their duties, including financial management and technical aspects.

Technologies

Technologies to support behavior change in food consumption could include food storage containers, fly traps, screens, garbage cans—all relatively low-cost technologies available through the private sector. If food vendors and restaurant workers are targeted, purchase and use of new equipment might play a part in implementation.

Enabling Environment

An appropriate government agency should develop and enforce regulations relating to food safety including standards for food vendors and restaurants, for agricultural reuse of wastewater, and for commercial canning and other food preservation methods. Health department promotion of handwashing among food workers would be part of this effort. Thus, safe food consumption behaviors can be supported by activities in nutrition, agriculture, and water and sanitation.

4. Protect Self and Family from Mosquitoes: Implementation Considerations

Many malaria prevention and control programs have been implemented nationally. This may give the false impression that local considerations are not significant. A program for behavior change for malaria prevention must be built on an assessment of local conditions including environmental conditions, human behaviors, and vector ecology. Malaria can differ dramatically from area to area. For example, in some regions, the vector may bite mostly outdoors or mostly before people go to sleep; therefore, bednets—although proven highly efficacious in some settings—would not be effective there.

The most effective approach to malaria control is an integrated one incorporating personal protection, chemoprophylaxis, accurate and early diagnosis and treatment, and, in limited cases, environmental control and management.

The most effective approach to malaria control is an integrated one incorporating personal protection, chemoprophylaxis, accurate and early diagnosis and treatment, and, in limited cases, environmental control and management. Key preventive behaviors in this cluster are proper use of ITMs, particularly bednets; community environmental management for elimination of anopheline breeding sites; and prevention of the creation of new sites, such as burrow pits, excavation areas, and watery areas created by agriculture.

Communication

A communications strategy for ITMs will focus on creating demand and on promoting proper use including maintaining, retreating, and replacing the nets. Communication may also be incorporated in activities to ensure an adequate system to make bednets and insecticides is available through retail channels. For example, retailers need to be persuaded to make the necessary investment to stock these items before demand can be assured.

In USAID, promotion of ITMs is part of AIMI, a program that integrates malaria prevention and control with health facility-based maternal and child health activities. It follows that an effective communications strategy will be developed with the health sector, but it may be implemented by many different partners. To strengthen the idea of ITM dependence and to encourage the use of ITMs, it may be advisable to discourage use of household insecticides (coils, smokes, sprays) except under circumstances when using an ITM is not feasible (e.g., when someone must be walking outside at night).

In many regions, elimination of existing vector breeding sites or curbing practices that lead to the creation of potential breeding sites was once an integral part of malaria control, but the approach has been largely abandoned. Programs in which it is appropriate and feasible to revive the approach will need communication support for communities to once again recognize breeding sites and relearn basic environmental management techniques. These environmental controls should not be considered stand-alone methods for malaria prevention but complements to other measures.

In many regions, environmental management techniques once were an integral part of malaria control; strong communication support would be needed to revive them.

Training

A prerequisite for integrating an ITM program in maternal and child health is a fairly extensive program of training of health extension and community health workers and shopkeepers or others who sell ITMs or retreatments kits. Depending on how the program is organized, training topics for health workers might include the following:

- What are ITMs and how do they work?
- Who should use ITMs?
- What constitutes proper use?
- How should ITMs be maintained?
- How often should they be reimpregnated?
- What are the benefits and barriers to use?

Since it will be the job of these health workers to train community workers, training-of-trainers activities might be a training topic also.

Community members adopting the ITMs would need to be systematically oriented on their use. Devising ways to organize such training is one of the challenges of ITM programs.

For environmental control activities, community teams could be trained in identification of anopheline vector breeding sites and methods of drainage, filling of excavation or burrow pits, replanting swampy areas, reshaping water courses, and other methods. Training might also include management and community organization.

Technologies

ITMs must be available in program areas, and they should be designed to meet local preferences and practices. Likewise, insecticides for retreatment also must be available. Keeping the costs down is highly important. Since the minimum goal is for all young children and pregnant women to sleep under the nets, a family may have to purchase and retreat two or more nets. Families in many areas of Africa where malaria is a heavy health burden may not be able to afford ITMs.

Enabling Environment

High-level government policy support for integrating bednets into malaria-prevention activities is necessary for programs to be successful.

High-level government policy support for integrating bednets into malaria-prevention activities is necessary for programs to be successful. This support must include allocating sufficient resources and addressing issues regarding import duties for bednets and insecticides and the serious question of subsidies for household net purchase.

Making credit available may be an important element of an ITM program. Credit schemes might be organized through employers.

Considerable logistics support is necessary whether distribution is to be through private or public channels. Logistics support must extend not only to new net distribution but also to net retreatment. Programs must address the question of how retreatment will be organized. If individual households are to re-treat their own nets, logistics and support issues include ensuring proper timing, guaranteeing a supply of insecticide, and training in retreatment techniques. If treatment is to be carried out on fixed days for entire communities or neighborhoods under the supervision of teams, a whole new list of support and logistical issues will need to be addressed.

EHP Experience

Behavior change is an element found in most key EHP activities. Two EHP experiences are described below in mini-case studies (Boxes 5-4 and 5-5). The projects were selected to illustrate how the various implementation options covered in this chapter can be combined to achieve results. Additional projects that exemplify the range of possibilities include the following:

- In the Santa Cruz province of Bolivia where diarrheal disease rates remain high, even in areas with improved water and sanitation infrastructure, EHP is integrating environmental health activities in the ongoing Community and Child Health project. A comprehensive baseline study combined with community autodiagnosis of environmental and behavioral risks led to community micro-projects designed to improve handwashing techniques and timing, handling of children's feces, and better maintenance of water systems.
- In Haiti, a project to establish an autonomous water and sanitation district to manage a UNDP-funded system in Cité Soleil, a peri-urban community outside Port-au-Prince, combined institutional development and behavior change goals. For the new water system to be financially viable, a large proportion of residents would have to purchase its water. They would have to put aside old habits of obtaining free water from contaminated wells and springs or buying it from independent vendors whose water was not reliably safe. Other related behaviors—water storage and disposal of greywater, for example—were also targeted through a social marketing effort consisting of community meetings, fact sheets,

public announcements by megaphone, community animator training, and T-shirt distribution.

- In Central America and Zambia, commercial soap manufacturers are collaborating with USAID to combine commercial marketing and social marketing in soap advertisements to promote handwashing for prevention of diarrheal disease.
- In Zambia, the problem of urban malaria in Kitwe District was analyzed through a rapid assessment. Community-level interventions to prevent malaria, such as the use of insecticide-treated bednets and source reduction through environmental management, have been implemented.
- In Ecuadorian provinces where high rates of cholera persisted, EHP worked from 1994 to 1995 with USAID/Quito and the Ministry of Health to identify behaviors and beliefs that increase the risk of cholera. Regional and community health teams were formed and trained to analyze local beliefs and behaviors in indigenous communities and, in conjunction with community members, to design suitable interventions. A 1996 evaluation found evidence of behavior changes compared with baseline information (see Box 5-6) and a dramatic fall in cholera cases.

Box 5-4: The Jamaican Urban Sanitation Program

The Project in Brief. EHP strengthened the capacity of an NGO to (1) assist residents to install safe, on-site sanitary facilities using USAID housing guarantee-backed credit to residents and (2) to raise their health status by improving hygiene behaviors in two undeveloped peri-urban settlements of Montego Bay, Jamaica. The project met both its technology and behavior change goals.

Gathering and Analyzing Information. An interdisciplinary design team of Jamaican and U.S. consultants assessed what kinds of on-site sanitation systems the soil could support, found out what residents concerns and preferences were, and identified a local implementing agency: the NGO Construction Resource and Development Centre (CDRC). The community assessment consisted of a house-to-house sanitation survey, community meetings, key interviews, and focus groups. This phase culminated in a workshop of stakeholders to prepare a work plan. Early in implementation, the NGO had a plan in place to monitor changes in residents' health status and attitudes in the two communities.

Developing, Implementing, and Monitoring a Strategy of Behavior Change. Residents were given a range of technological options from which they could choose based on their personal preferences. Loans were available to families for latrine construction; most families hired local contractors for the construction. A special unit of CRDR, the Sanitation Support Unit (SSU) provided technical advice to residents for a fee. Respect for local priorities was key to the development of good relationships with the community.

The behavioral change activities, listed below, complemented construction of the technologies.

- Mobilizing community animators, health workers, and other public health workers
- Establishing demonstration areas to show technologies options available
- Organizing a public education program
- Developing social marketing tools to promote good sanitation practice: videos, published materials, and community animation materials

The program made effective use of carefully selected residents to sensitize others in their community to environmental conditions and to facilitate their ability to make informed choices regarding sanitation and healthy behaviors.

Creating an Enabling Environment. SSU addressed factors that constrained families from building sanitation facilities: development and promotion of technologies that were appropriate for the site, provision of credit, identification and training of private sector contractors, facilitation of permits and certifications, establishment of a monitoring and information system. It also ensured its own sustainability through cost-recovery and strong leadership and management.

SSU forged supportive links to the Jamaican Ministry of Health for the public action campaign and for training and orientation of public health inspectors.

Results:

Indicator	*Baseline (Jan-Feb 96)*	*Monitoring Survey (Aug 96)*
Acceptable sanitation solution present or under construction	28%	99%
Facilities meet Jamaican public health standards, are currently used, and are clean	21%	52%
Presence of an organized handwashing place (basin, water, and soap)	44%	83%
All water storage containers in household are covered	71%	92%

Box 5-5: Improving Environmental Health in Peri-Urban Communities in Tunisia

The Project in Brief. EHP worked with municipal authorities and communities in several neighborhoods in two Tunisian secondary cities in a pilot program to address health problems through provision of infrastructure and behavior change. Municipal teams in each town attended a series of skill-building workshops on identifying high-risk behaviors, improving skills in communication and facilitation, and monitoring changes in environmental health conditions, followed by practical work with community groups.

Gathering and Analyzing Information. Before the training workshops began, Tunisian consultants carried out an assessment of the socio-cultural conditions and behaviors that contribute to environmental health problems. Both quantitative information from official sources and qualitative information through rapid community assessments were used. Also, initial contacts with community groups involved them in collecting and analyzing information about environmental and health conditions in their neighborhoods.

Developing, Implementing, and Monitoring a Strategy of Behavior Change. As part of their training, municipal officials met with community groups to develop and carry out specific small-scale projects to address health problems. The projects generally consisted of low-tech infrastructure installation, its continued maintenance, and proper use; a range of options were available. Examples were latrine construction, housing improvements, distribution of trash containers, and corralling animals. Community resources were supplemented by a small-projects fund; at the end of EHP involvement, the Tunisian government asked for and received support from the World Bank to replicate the strategy in other towns and provinces.

Creating an Enabling Environment. At the end of each round of workshops and field work, a one-day decision-makers meeting was held to discuss the issues that constrained the work of the municipal staff in the communities and the best ways to remove those constraints. Institutional changes or legislative action to facilitate change were often called for. In this way policymakers created an environment for sustainable change.

Results:

An evaluation of behavior change in one of the communities indicated the following:

- Fewer families were allowing animals to live in their houses.
- Water storage techniques were improved.
- Water sources were protected from animals.
- Collection and disposal of solid waste was centralized and regularized.
- Toilets were used more hygienically.
- Residents had stopped throwing excrement into canals.

Infrastructure that facilitated behavior change included the following:

- Construction of animal corrals
- Provision of potable running water to limited number of families lacking it
- Distribution of garbage containers
- Construction of waste depots
- Construction of toilets for limited number of families lacking them
- Construction of an outhouse for one elementary school

The behavior changes achieved were clearly related to the population's growing understanding of the impact of environmental conditions on health.

Box 5-6: Behavior Change in Ecuador: Reducing Cholera Risk Factors

	Baseline	Year 2
Household Water Use		
• All household water treated	36%	70%
• Protection of drinking water in the household	6%	100%
Washing and Drying Hands, Food, Dishes		
• Hands washed with soap and water before cooking	25%	40%
• Hands dried after washing	20%	30%
• Hands washed after defecation	50%	77%
• Dishes washed	15%	57%
• Raw vegetables washed	30%	59%
Excreta Disposal		
• Excreta disposed in latrine	15%	72%
• Excreta buried	16%	23%
• Defecation in fields	69%	28%

6

Linking Health, Environment, and Democracy Objectives through Behavior Change

USAID-supported environmental health behavioral change programs can achieve more than health results. They can also contribute significantly to results in two other strategic areas—protecting the environment and building democracy—and, like many development efforts, they can contribute indirectly to broad-based economic growth. USAID Country mission strategic objective teams with strategic objectives (SOs) in health, environment, and democracy have an opportunity to develop links among them through programming in environmental health.

This report has already touched on the characteristics of environmental health behavior change programs that make it possible for them to achieve results outside of their main strategic area and to reflect USAID's core values of participation, customer focus, teamwork, and partnership. The principal links to environment and democracy SOs are briefly discussed below.

- *Environmental Protection.* Many of the behaviors, both individual and communal, involved in consuming safe water and food and properly disposing of feces also contribute to lessening or halting environmental pollution and degradation. The most obvious connection is between proper feces disposal and protection of ground and surface water.

  The September 1998 issue of *Population Reports*, published by Johns Hopkins University, examines in detail the links between population and water supply. It makes a strong case for the health dimension, pointing out that "dirty water" diseases cause 12 million deaths a year. It also discusses the role lack of sanitation plays in fouling the freshwater and coastal resources vital for expanding agriculture, industry, recreation, and tourism and protecting the ecosystem: "As coastal waters become clogged with raw sewage and agricultural and industrial pollutants, ecosystems begin to unravel."

  In the Jamaican example in Box 5-4, construction and appropriate use of latrines reduced pollution of Montego Bay by reducing the number of families that either disposed of feces in roadside gullies, where they wash down to the beach during rains, or in sink holes, which drain directly into the bay. Since 35% of the economy of the area is based on tourism, improving the environment is a high priority. In fact, the project was originally intended to achieve environmental SOs only; the health connection was made after the initial feasibility assessment.

Many of the behaviors, both individual and communal, involved in consuming safe water and food and properly disposing of feces also contribute to lessening or halting environmental pollution and degradation.

Environmental behavior change forces cross-sectoral dialogue and a team approach to problem solving at the local level.

- *Democracy and Governance.* The approach to behavior change described and advocated in this report, and summarized below, promotes and extends democratic processes.

- *Cross-Sectoral Cooperation.* Because environmental health is more than a health-sector issue, various sectors (environment, education, and agriculture) are encouraged to work together in partnership to find solutions to problems. Environmental behavior change forces cross-sectoral dialogue and a team approach to problem solving at the local level.

- *Participatory Decision Making.* For behavioral change programs to be effective, communities must be involved in planning and carrying them out; the greater the involvement, the greater the likelihood that changes will be sustained. True participation is the hallmark of good governance. The command and control approach common in public sector ministries and local municipalities does not achieve results in behavior change. The landscape in many developing countries is littered with dysfunctional or unused latrines and water systems put in place without community ownership or decision making. People were informed and sensitized but were not part of the decision-making process. An important aspect of community decision making is arriving at a common vision of the future.

- *Improving the Capacity of Local Government*. Behavioral-change programs need the support of local governmental organizations and NGOs. As they provide that support, leaders of organizations increase their ability to better identify the causes of and solutions for environmental health problems and to interact effectively with communities. Behavioral-change programs may also incorporate capacity building for local leaders.

- *Decentralization*. Environmental health behavior change brings issues of decentralization to the forefront. One reason for this is that environmental health problems and solutions are intrinsically local; they may vary even from neighborhood to neighborhood. Planning environmental health behavioral-change programs pushes municipal authorities out into the communities where the essential elements of successful programs may be found: social networks, financial and human resources, and the desire for a better life.

The CIMEP/Tunisia case study in Box 5-5 is an example of an environmental health program that combined health and governance goals. In addition to the changes in health-related behavior mentioned, several governance results were also achieved. Citizens became more articulate and able to present their concerns to government officials. As they gained skills in problem solving and prioritizing, they became less passive and showed greater initiative; instead of waiting for "outsiders" to fix their problems, they tackled them themselves through community institutions. Government officials began to view poor communities not as problems but as a source of ideas, skills, and capabilities. They became more comfortable with open meetings and discussions, joint decision making, and other aspects of democratic processes.

The Minimum Package of environmental health behaviors is straightforward and apparently uncomplicated: safely dispose of human feces, consume safe water,

consume safe food, and protect self and family from mosquitoes. But the apparent simplicity of these behavioral changes should not belie their significant potential, not only to prevent serious childhood illnesses, but also to achieve "cross-over" results in other areas of sustainable development.

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