

ENVIRONMENTAL HEALTH:
Technical and Program Background

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ACRONYM LIST

AAD	Activity Approval Document
ADS	Automated Directive System
CA	cooperating agency and contractors
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CTO	Cognizant Technical Officer
DALY	disability-adjusted life year
EH	Environmental Health (Activity)
EHP	Environmental Health Project
EPA	U.S. Environmental Protection Agency
FAA	Foreign Assistance Act
FANI	<i>Foreign Aid in the National Interest</i> (USAID, 2003)
FY	Fiscal Year
GH	Bureau for Global Health
HI	Hygiene Improvement
HIDN	GH Office of Health, Infectious Diseases, and Nutrition
IAA	Interagency Agreement
IAQI	Indoor Air Quality Improvement
IQC	Indefinite Quantity Contract
ID	Infectious Diseases
LWA	Leader with Associates Cooperative Agreement
NGO	Non-Governmental Organization
NIH	National Institutes of Health
OFDA	USAID Office of Foreign Disaster Assistance
OHA	GH Office of HIV-AIDS
PIO	public international organizations (e.g. UN agencies)
PLWHA	people living with HIV/AIDS
PMTCT	prevention of mother-to-child transmission (of HIV)
POU	point-of-use water disinfection and safe storage
PPP	public-private partnership
PRH	GH Office of Population and Reproductive Health
PVO	Private and Voluntary Organization
RBM	Roll Back Malaria
SWS	Safe Water Systems
USAID	United States Agency for International Development
USG	United States Government
WASH	USAID Water and Sanitation for Health Project (1981-1994)
WASH	water, sanitation, and hygiene advocacy campaign of the WSSCC
WAWI	West Africa Water Initiative
WHO	World Health Organization
WSSCC	Water Supply and Sanitation Collaborative Council

I. EXECUTIVE SUMMARY

This document describes a new USAID Bureau for Global Health (GH) Office of Health, Infectious Diseases, and Nutrition (HIDN) ten-year activity focused on implementation and scale-up of proven environmental health interventions to prevent morbidity and mortality from infectious diseases, primarily in young children, but also among vulnerable adult populations. This new **Environmental Health (EH)** activity is a follow-on to core elements of the USAID Environmental Health Project (EHP) and will commence in mid-2004.

The *goal* of the EH activity is to reduce mortality and morbidity in children under five years of age, as well as mortality and morbidity associated with infectious diseases of major public health importance. The EH *strategic objective* contributes to this goal by sustainable scale-up of priority interventions that reduce exposure to agents of disease and to hazards that exacerbate disease, by focusing on improvements in key behaviors and environmental conditions.

Diarrhea and pneumonia remain the two leading killers of children in the post-neonatal period, each responsible for approximately one-fifth of deaths of children under five years of age in the forty-two countries that account for 90% of the estimated annual global total of 10.8 million under-five deaths, according to a recent published analysis. Diarrhea is also closely linked with malnutrition, which is estimated to be associated with slightly more than one-half of such deaths. While key interventions to reduce mortality have made a significant reduction in deaths from diarrhea over the last two decades, there has not been as great a reduction in deaths from pneumonia nor in the overall morbidity associated with either of these diseases. It is therefore not surprising that the 2002 World Health Report identified underweight; unsafe water, sanitation, and hygiene (estimated to be responsible for 90% of diarrhea); and indoor smoke from solid fuels (which has been causally associated with a doubling or more of pneumonia prevalence) as the first, third, and fourth highest risk factors for the global burden of disease in high-mortality developing countries.

The EH activity directly addresses two of these leading risk factors and indirectly addresses underweight issues as well. Through the EH activity, USAID is committed to:

- **Hygiene Improvement (HI):** achieve measurable improvement in key hygiene conditions at a scale sufficient to attain significant public health impact in USAID-assisted countries, with inputs under the EH activity directly linked to the country-level outcomes;
- **Indoor Air Quality Improvement (IAQI):** develop program approaches to improving indoor air quality in the rural and urban households still reliant on biomass fuels and basic stoves to meet their energy needs for cooking and heating;
- **Innovative Program Approaches in Special Settings:** advance programming approaches in other specialized areas related to the EH strategic objective.

Hygiene Improvement activities, which will account for approximately 70% of total anticipated EH obligations, will focus on achieving sustainable changes in handwashing behavior, safe water quality at the point-of-use, and effective use of sanitation.

Indoor Air Quality Improvement will be a collaborative effort with USAID energy sector activities which promote fuel switching, energy efficiency, and stove improvements, focusing EH inputs on behavior change related to adoption of technologies and behaviors which reduce exposure to indoor air pollution, especially smoke; the development of health-relevant indicators in such programs; and the measurement of health impact.

The EH result focused on Innovative Program Approaches in Special Settings captures promising areas of activity not yet ready for full-scale implementation. Anticipated activities address:

- environmental health threats faced by the urban poor;
- integrated vector management for the control of malaria;
- integrated programming of health, population, and environment interventions, especially in regions of threatened biodiversity.

This result is also intended to capture other areas for innovation that may arise during the ten-year implementation period for the EH activity.

These intervention-focused results will be attained through several common program approaches, including:

- focusing on **changes in behavior** as key environmental health outcome indicators;
- using **community-based and community-focused programming**, where practicable;
- **building capacity** at local, national, and regional levels, including policy development and institutional strengthening;
- forging **multi-sectoral partnerships** within USAID, other USG agencies, and with the private sector, PVOs/NGOs, international organizations, multilateral development banks, and other donors, for the range of promotion activities and infrastructure improvements required for sustained behavior change;
- supporting **improved environmental health data collection and analysis** to support program and policy development; and
- answering key **operations and evaluation research** questions critical to achieving the overarching EH objective of sustainable scale-up of interventions.

Several of the EH outcomes and activities require that gender consideration play a key role in activity design, implementation, and monitoring. Clearly, the Hygiene Improvement and Indoor Air Quality components involve significant gender-related concerns relevant to both the design of inputs and the measurement of outputs. Participatory processes ensuring the input of both women and men will be used in implementing these components. In addition, where appropriate and possible, gender-disaggregated data will be gathered and reported on the desired outcomes of the EH activity, including those under the Innovative Program Approaches outcome.

The EH Activity will also provide a mechanism for USAID Missions and Bureaus to access a wide range of expertise in environmental health interventions not directly related to the three high-level results. Examples of such capabilities include design and construction of community water supply and sanitation infrastructure; reducing toxic substance exposure; reducing outdoor air pollution; injury control; hygiene and infection control in medical facilities, including medical waste disposal; evaluating environment impacts in infectious disease emergence and control; and the health dimensions of environmental disasters (e.g. floods).

II. INTRODUCTION AND BACKGROUND

This document addresses four key questions about the Environmental Health activity:

- What has been accomplished to date through USAID support to predecessor environmental health activities?
- What are the environmental health problems to be addressed?
- What are the goal and objective of the activity?
- What specifically will be accomplished, and how?

The Bureau for Global Health and its antecedents have a long history of supporting environmental health-related projects that directly relate to and inform the EH Activity described here.

The **Water and Sanitation for Health (WASH)** Project (1981-1994) provided technical assistance in over 85 countries. WASH formed a key component of the USG response to and support of the International Water Decade declared by the U.N. in 1980. It evolved considerably during the period of implementation, from a focus mainly on hardware (e.g. pumps, pipes, and their operation and maintenance) to the implementation of cutting-edge approaches for ensuring community participation and management as well as for achieving sustained behavior change. Indeed, the key WASH legacy to the environmental health field was the articulation of a rigorous process for engagement of communities and ensuring the sustainability of investments in water supply and sanitation.

The **Vector Biology and Control (VBC)** Project (1983-1993) provided technical assistance to USAID on a broad range of tropical disease issues, with an emphasis on malaria, dengue, schistosomiasis, and guinea worm disease. An innovative program feature of VBC was the use of diverse mechanisms (a contract, an interagency agreement with CDC, and a grant to WHO) to gain synergy from collaboration across key institutions. The contribution of VBC to the Global Malaria Strategy in the early 1990s, along with its contributions to the insecticide-treated bednet efficacy trials, helped to mainstream malaria programs within public health, child survival and, ultimately, USAID infectious diseases programming.

The **Environmental Health Project (EHP)**; see <http://www.ehproject.org>), which started in 1994 and for which GH funding will end in September 2004, was initially envisioned as a significant expansion in scope beyond the WASH and VBC projects, with attention to new-to-USAID environmental health topics, such as urban air pollution and lead exposure. However, with the establishment of central strategic objectives in 1994, core resources for EHP were focused on activities which directly supported child health and, later, malaria objectives, *i.e.* a strong mandate for the continuation of main lines of work established under WASH and VBC.

Another important dimension of EHP has been the increasing emphasis on health impact. Activities in environmental health are now well integrated with health sector programming within USAID, while at the same time maintaining a necessarily distinct sphere of technical expertise. The integrated package of technological, social, and behavioral interventions at the center of EHP's current programs is designed to maximize impact on health. The approach of focusing on health impact in water and sanitation programs, using behaviors as the relevant proxy, and using "hardware" and "software" to achieve sustained behavior change, has achieved general acceptance among several of USAID's key development partners, such as UNICEF.

EHP funding over the ten-year period 1994-2004 has been approximately \$107 million with activities in 52 countries. Roughly one-fourth of the total funding has been core funds from the Bureau for Global Health (and the previous Global Bureau Center for Population, Health, and Nutrition), and the balance has come from Missions and other Bureaus.

The EH activity design responds directly to current USG and USAID policy initiatives. The January 2003 USAID report *Foreign Aid in the National Interest* highlighted that "progress in health is not just in health programs." This design relies on active collaboration with other sectors, especially those involved in infrastructure provision, to achieve the objectives of the Activity. The Millennium Development Goals, which include targets in improving child survival and increasing access to safe water supply are directly related to the EH objectives, as is the global target on sanitation, agreed to by the USG at the World Summit on Sustainable Development in September 2003. The USG has responded with several new partnerships and initiatives, including the Water for the Poor Initiative, the Partnership for Clean Indoor Air, Safe Water Systems, and new efforts to revitalize child survival programming.

III. RATIONALE AND ANALYSIS OF OPPORTUNITY

3.1 *The Global Challenge of Environmental Health**

The World Health Organization (WHO) has estimated that approximately 21% of the overall global burden of disease is attributable to environmental health hazards. In developing countries, the fraction is higher, largely because the fraction of the burden associated with infectious diseases is higher. There is general agreement that (1) environmental quality is a major factor both in infectious diseases that tend to affect the poorest population groups and, to a lesser extent, in the chronic diseases that tend to affect richer groups; and (2) it is the health of children under 5 years of age that is most damaged by poor environmental quality.

It is useful to recall the dramatic decrease in deaths from infectious diseases that took place in the United States during the first half of the 20th century (**Figure 1**). More than 80 % of this reduction took place prior to the introduction of antibiotics in the treatment of disease and of immunization for vaccine-preventable diseases such as smallpox, polio, and measles. Much of this early decrease is directly attributable to improvements in water supply, sanitation, hygiene, housing, and nutrition in the early decades of the last century.

* Portions of Sections 3.1 and 3.2 have been previously published in J. Borrazzo, R. Walling, H. Falk, "Overview of International Environmental Health," *International Journal of Hygiene and Environmental Health*, **206**:257-262, 2003.

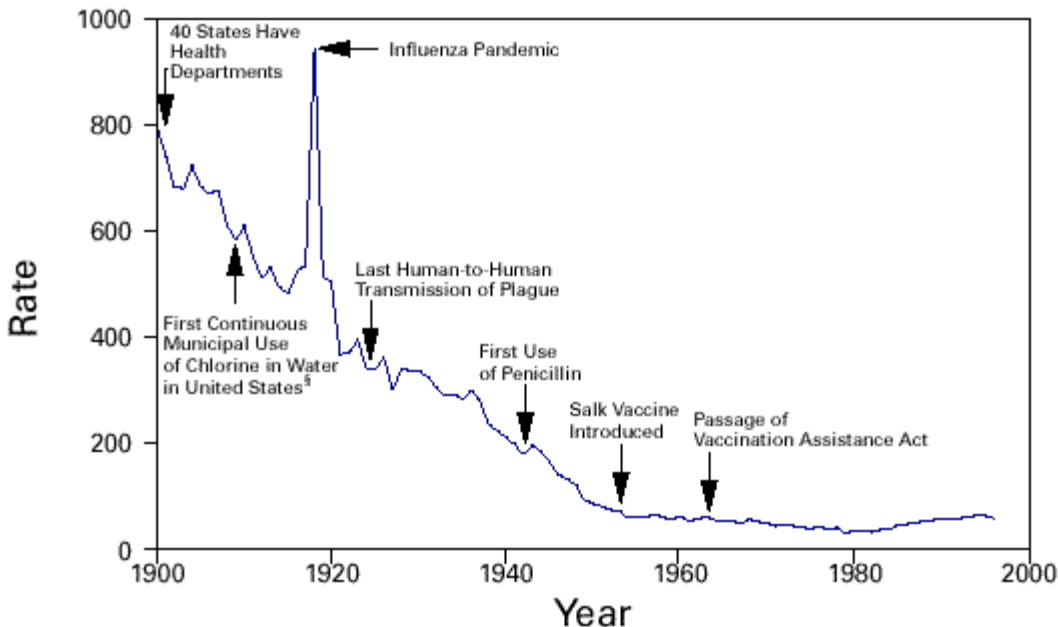


Figure 1: Crude death rates (per 100,000 population per year) for infectious diseases in the United States, 1900-1996 (National Center for Environmental Health, Centers for Disease Control and Prevention, 1999).

Poverty level, nutrition status, and urbanization are key development issues that influence health problems attributable to environmental factors as well as environmental health interventions to address these problems. The poor, in richer and poorer countries alike, are those most likely to be exposed to environmental threats to health, whether at home, in their communities, or in their workplaces. Nutritional status, also linked to poverty, plays an important role in determining the severity and outcome of environmentally related disease, such as diarrheal diseases and acute respiratory infections in young children. Urbanization in the developing world presents both opportunities and threats for environmental health. The increased economic prospects in urban areas are an important avenue for poverty alleviation and overall environmental health improvement, and the greater density of population in comparison to rural areas can lead to greater efficiency in service delivery by both the public and private sectors. Notwithstanding these advantages, the relative poor in many urban areas live in conditions of appalling squalor, with health outcome indicators as bad (or worse) than their rural counterparts. Inadequate or non-existent sanitation in many poor urban areas, especially in informal settlements, is a particularly acute problem with direct health consequences.

3.2 *The Highest Priorities*

WHO has examined the global burden of disease related to various risk factors, and the results were published in the World Health Report 2002. As shown in **Figure 2**, in high-mortality developing countries, several of the key risk factors for the burden of disease are either directly or indirectly environmental. Among the leading risk factors are underweight (the largest single risk factor), unsafe and inadequate water supply and sanitation (the third largest), and high levels of exposure to indoor smoke from solid fuel combustion (the fourth highest).

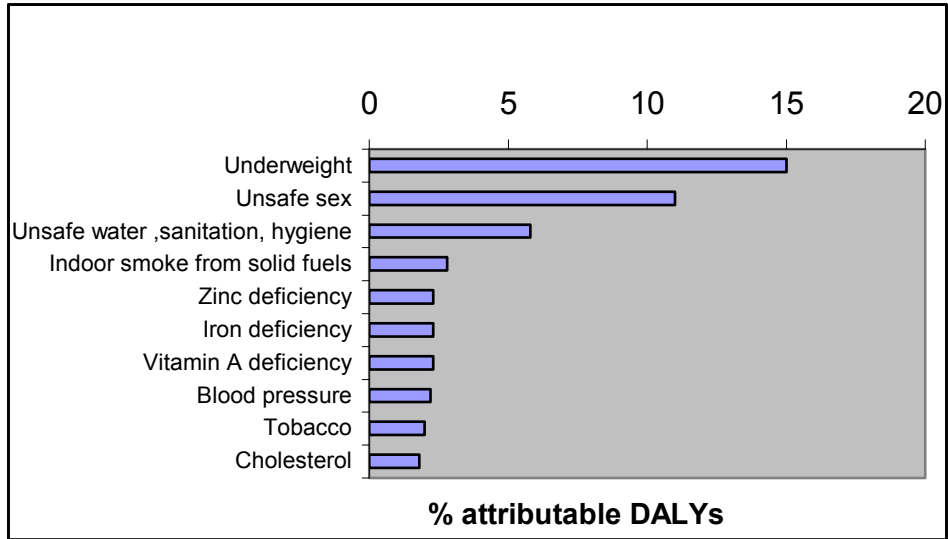


Figure 2: Percentage of burden of disease (as disability-adjusted life years lost) caused by the ten leading risk factors in high-mortality developing countries. (Based on the 2002 World Health Report)

Other work has highlighted the large disparities between regions. **Figure 3** and **Figure 4** depict the relative environmental burdens of disease in eight regions of the world, expressed as disability-adjusted life years (DALYs) lost, on both absolute and population-adjusted bases, respectively.

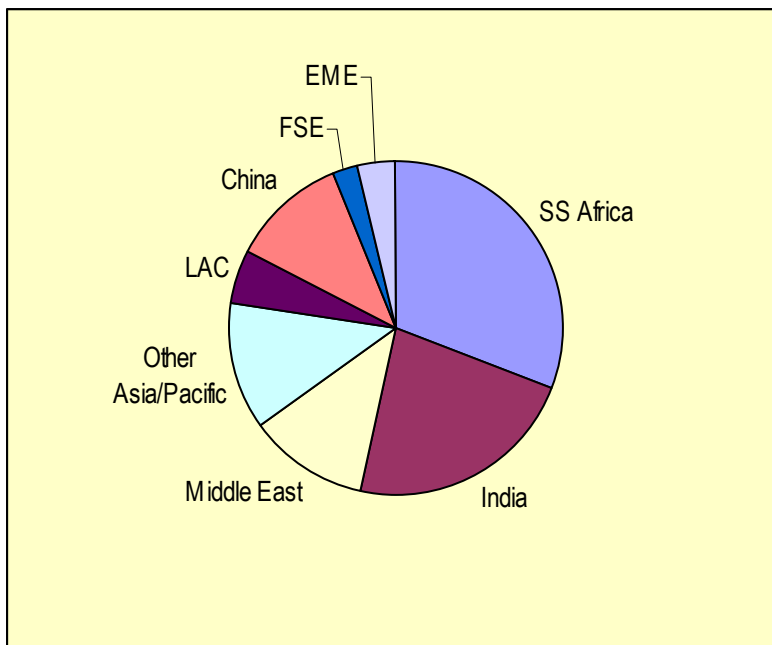


Figure 3: Relative regional contributions to the global total environmentally related burden of disease. SS Africa = sub-Saharan Africa, LAC = Latin America and the Caribbean, EME = established market economies, FSE = formerly socialist economies. (Based on Smith et. al,

Epidemiology. 1999 Sep;10(5):573-84, “How much global ill health is attributable to environmental factors?”)

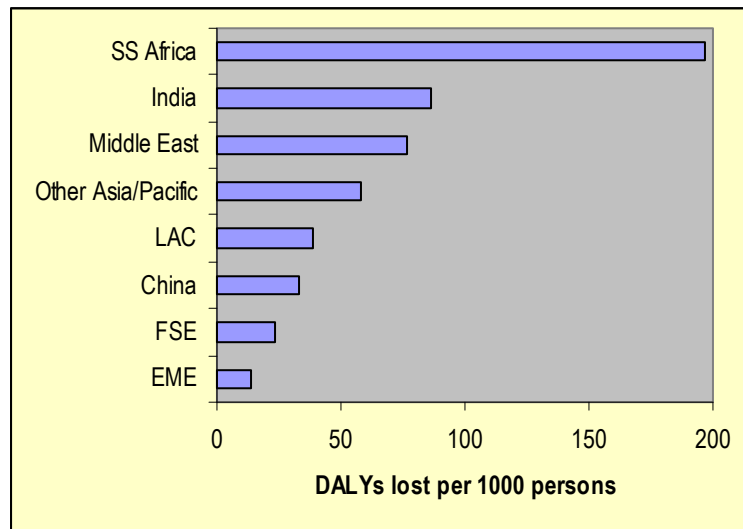


Figure 4: Annual disability-adjusted life years (DALYs) lost per 1000 population associated with environmental exposures in eight regions of the world. Included are 22 diseases accounting for 72% of the global burden of disease. SS Africa = sub-Saharan Africa, LAC = Latin America and the Caribbean, EME = established market economies, FSE = formerly socialist economies. (Based on Smith et. al, *Epidemiology*. 1999 Sep;10(5):573-84, “How much global ill health is attributable to environmental factors?”)

These figures starkly illustrate two key points. First, the environmentally related burden of disease is dominated by the contributions of sub-Saharan Africa and of India, which together account for over one-half of the total. Second, normalized for population, the environmental burden of disease on a per capita basis is highest in sub-Saharan Africa, followed by a middle tier that includes India, the Middle East, and the Asia and Pacific region (excluding China and India), and then by a lower tier including Latin America and the Caribbean, China, and the formerly socialist states of eastern Europe and Central Asia. The lowest per capita environmental burden is in the countries with established market economies, such as the U.S., Canada, Western Europe, and Japan.

These large environmentally-related disease burdens in sub-Saharan Africa and south Asia mainly reflect (1) the burden of infectious diseases among children under five years of age in these regions, especially morbidity and mortality from diarrhea, pneumonia, and malaria; and (2) the already-noted association of key environmental health risk factors with these disease outcomes. Children typically are more exposed to environmental threats to health at the household and community levels, and they are more vulnerable to the effects of such exposure, such as the association of pneumonia with high levels of exposure to indoor smoke, the risk of death and malnutrition from repeated bouts of diarrheal disease caused by contaminated water, soil, and food; or the risk of fever and severe malaria disease because immunological response is not yet fully developed.

3.3 Technical Focus Areas for the Environmental Health Activity

The results of these analyses have been used to inform the design of this EH activity. Three areas of technical focus are specified for EH:

- prevention of diarrhea through hygiene, sanitation, and water supply improvement (which will account for approximately 70% of EH activity effort among the three technical focus areas);
- prevention of childhood pneumonia through reduction of exposure to indoor smoke (15%); and
- prevention of malaria through integrated vector management (15%).*

Globally, diarrhea and pneumonia remain the two leading killers of children in the post-neonatal period, each responsible for approximately one-fifth of deaths of children under five years of age in the forty-two countries that account for 90 % of the estimated annual global total of 10.8 million under-five deaths, according to a recent published analysis in *The Lancet*. Diarrhea is also closely linked with malnutrition, which is estimated to be associated with slightly more than one-half of such deaths. While key interventions to reduce mortality have made a significant reduction in deaths from diarrhea over the last two decades, there has not been as great a reduction in deaths from pneumonia nor in the overall morbidity associated with either of these diseases.

As already noted, malaria remains a regionally important burden in much of sub-Saharan Africa, comparable for young children to the threats posed by pneumonia and diarrhea. While no single environmental risk factor among those analyzed by WHO for the 2002 World Health Report was directly associated with malaria, it is generally accepted that environmental factors play a key role in transmission, primarily through their influence on mosquito breeding and role in influencing human exposure to mosquitoes. The technical focus for EH with respect to malaria will therefore be on *integrated vector management*, described in detail below.

3.4 Geographic Focus Areas for the EH Activity

It is anticipated that the EH activity will be active in all USAID geographic regions. While on a global basis, the burden of environmentally-related disease looms largest in sub-Saharan Africa and South Asia, clearly there are sub-populations in all regions for which the EH technical focus areas are the dominant issues of concern. Nevertheless, EH will intensify USAID efforts to address these issues in the places where they are most critical and where they have been most neglected. Such determinations will be made on a country-by-country basis in consultation with USAID Missions and Regional Bureaus.

3.5 Known Interventions for Technical Focus Areas

Knowing that a risk factor is strongly associated (even causally) with diarrhea, pneumonia, or malaria is nonetheless different from having a practical intervention that addresses the risk factor

* This technical focus area will be included under the “Innovative Program Approaches” result, as noted in the Executive Summary and in Sections IV and V.

and reduces the prevalence of disease. The breakdown of effort across the technical focus areas partially reflects the maturity of known interventions in each of the three areas.

3.5.1 Prevention Of Diarrhea Through Hygiene Improvement

Hygiene improvement interventions are well defined and program approaches, while continuing to evolve, have been demonstrated to be effective, as well as cost-effective, in terms of public health impact. Key hygiene improvement interventions include:

- safe storage and treatment of water at point-of-use, which has been shown to typically result in approximately 30-40% reduction in diarrhea prevalence (with a greater range of observed impact);
- optimal handwashing, which can decrease diarrhea prevalence among children by an average of 40%; and
- sanitary disposal of human feces, with basic, low-cost systems that have been shown to reduce diarrheal disease prevalence by 30% or more.

It is important to note that point-of-use (POU) water quality improvement is not intended to supplant or minimize the importance of improvements in water supply, especially quantity. The World Health Organization recently published a review of the role of water quantity in health (“Domestic water quantity, service level and health,” Guy Howard and Jamie Bartram, World Health Organization, 2003). A key concept outlined in this report is that of “access” levels, determined by both distance to water and time required to gather it. These levels, in turn, have implications for quantities of water used, ranging from less than 5 liters per capita per day for “no access” to 100 liters per capita per day or more for “optimal access” (multiple taps in the home). “Basic access” which involved 5-30 minutes total collection time would be expected to result in per capita daily consumption of 20 liters.

With basic access assured, the various dimensions of hygiene, which are critical to preserving health, become more viable and will be the critical factors in reducing the risk of diarrheal disease. Indeed, there is good evidence indicating that implementation of the full package of handwashing, water supply improvements (both quantity and quality), and sanitation results in even greater health impact than any individual intervention, as much as a 65% reduction in diarrheal disease prevalence among young children as seen in one ICDDR, B and CARE study in Bangladesh (see http://www.ehproject.org/PDF/Joint_Publications/JP004SAFEr.pdf).

Safe storage and treatment of water at point-of-use

Maintaining safe quality at point-of-use, typically households but also schools, health facilities, and other locations, addresses one critical dimension of hygiene improvement. It is likely that water quality improvements at the point-of-use have a positive impact on health at all levels of water supply service, and this has been consistently observed in a wide variety of settings. Water stored in the home tends to be more contaminated than water at its collection point, suggesting that substantial contamination is taking place during transport, storage, and use. Clearly, those households drawing water from communal supplies must transport water to their homes and store it. Even those households with household-level taps may have intermittent

service or poor quality water. Therefore, maintenance of water quality through proper handling and storage, and if necessary, household-level disinfection, is a common concern.

Reviews published in the 1990s had suggested that water quality improvement interventions had less of an impact on diarrheal disease (accounting, according to these analyses, for roughly a 17% reduction) than either focused hygiene interventions (33% or more reduction), water quantity (27% reduction), or sanitation (22% reduction). However, more recent studies of field-level impact indicate that these earlier reviews did not focus on the quality of water at the point of use, but rather at the point of collection. This more recent evidence suggests that point-of-use water quality improvements alone result in a one-third or greater reduction in diarrheal disease morbidity, *i.e.* comparable to the impacts of water quantity improvements or focused hygiene improvement interventions (most notably handwashing).

Several options for ensuring safe water quality are available, including POU chlorination; combined flocculent-disinfectant packets; solar disinfection; ceramic filters; and others. The approach for which the evidence of programmatic effectiveness is most developed is point-of-use chlorination, and several USAID Missions (Madagascar, Zambia, and India) are already working on this approach. The principal method is an adaptation of the Safe Water System (SWS) developed by U.S. Centers for Disease Control and Prevention (CDC). SWS includes point-of-use chlorination with dilute hypochlorite solution, water storage in an improved vessel, and related hygiene promotion.

Measurement of health impact, mainly diarrheal disease in children, has been focused on improvements under non-epidemic conditions, *i.e.* the focus was not on epidemic diseases caused by fecal-oral transmission such as cholera or dysentery.[†] Studies by CDC have consistently found an average one-half reduction in the risk of diarrheal diseases in populations using the Safe Water System when compared to populations not using improved POU treatment and storage (see <http://www.cdc.gov/safewater>). These studies have focused on the most vulnerable populations, including young children and people who are HIV-positive.

Point-of-use water quality interventions can be implemented rapidly and at a low cost, having substantial public health impact in a matter of months. The 2002 World Health Report from WHO highlighted point-of-use water quality interventions as consistently among the most cost-effective interventions among those water and sanitation interventions evaluated, including provision of basic water supply and sanitation infrastructure. The developing world does need water supply infrastructure, but achieving this will take years and billions of dollars. For a fraction of the cost, point-of-use water quality interventions can help protect the health of vulnerable populations while progress toward development of infrastructure is underway.

A key program feature of POU interventions to be implemented through the EH activity is the integration of messages on key hygiene behaviors as important components of the overall program. Anecdotal evidence from the field suggests that sensitizing individuals, households, and communities to the importance of water quality elevates their overall awareness of the

[†] There is general agreement that water quality improvements are important in controlling epidemic disease, and, in fact, CDC conducted a cholera outbreak investigation in Fort Dauphin, Madagascar that suggested that the use of the Safe Water System reduced the risk of cholera by 90%.

importance of good hygiene in preserving health and improves other key behaviors, such as handwashing.

The main programmatic concerns do not, therefore, hinge on health effectiveness or even cost-effectiveness from a public health perspective. Rather, the key program concern is ensuring implementation and sustainability of the adopted approaches at a scale sufficient for significant public health impact. Current semi-commercial subsidized social marketing approaches do have drawbacks in terms of cost-recovery. For example, for chlorine disinfectant, subsidies are typically on the order of 1/2 to 2/3 of the direct cost of the product, while the indirect costs for social marketing and distribution are 100% subsidized.

Nevertheless, in terms of policy environment and stakeholder attention, the time is ripe to engage on this issue. In 2003, The World Health Organization convened a meeting of 30 organizations from a variety of sectors (including public and private sectors, NGOs, international organizations, bilateral donor agencies, and academic institutions) to establish the International Network to Promote Safe Household Water Treatment and Storage. The purposes of the Network are advocacy, setting guidelines for establishing an evidence base for new point of use technologies, disseminating information about these technologies, and fostering collaborative projects between Network member organizations. In addition, the USG has made public commitments to partnerships to advocate and implement POU approaches, at the World Summit on Sustainable Development (September 2002), the Third World Water Forum (March 2003), and at the G8 Summit (June 2003).

Optimal handwashing

Handwashing has been documented as an effective means of preventing diarrhea if it is done properly at appropriate times. Hands are a main vector of diarrheal pathogens, transferring them from surface to surface and from person to person.[‡] A recent review of all the available evidence suggests that optimal handwashing with soap could reduce diarrhea incidence by 42-46 % (Curtis *et al.*, April 2003, *The Lancet*).

Times and technique are crucial in handwashing for diarrheal disease prevention. Hands must be washed at a minimum of three critical times: (1) before cooking or preparing food, (2) before feeding a child or eating, and (3) after defecation, cleaning a baby, or changing a diaper. The three elements of proper technique are to use water and soap, rub one's hands together at least three times, and dry them hygienically (*e.g.* with a clean towel or by air drying).

While soap is found in most households, it is often reserved for washing clothes, dishes and bathing. Handwashing with soap is not common, though practice varies from country to country. For example, a study in urban Burkina Faso observed only 1% of mothers using soap to wash their hands after using the toilet, and only 18% after cleaning up a child's bottom. In rural Nigeria, observations showed only 10% of mothers were using soap to wash their hands after

[‡] Though the evidence base is weaker, similar arguments apply to acute respiratory infections. A number of studies suggest that handwashing could be very effective in reducing the incidence of clinical cases of ARI, although only one study has looked explicitly at pneumonia in children.

cleaning up a child. In slums in Lucknow, India, 13 % of mothers were observed using soap after cleaning up a child and 20% after going outside to defecate.

Nevertheless, knowing that an intervention is effective is not equivalent to having programmatic approaches that can reliably and sustainably implement such approaches at scale. While approaches such as soap distribution in refugee settings have been shown to improve handwashing and decrease fecal-oral transmission of disease, there is relatively little experience in large-scale efforts to change handwashing behavior as part of routine public health programs in developing countries.

To this end, from 1996 to 1999, USAID supported a public-private partnership among Ministries of Health, donors, and national as well as multi-national soap manufacturers to promote handwashing with soap for the prevention of diarrheal disease among children in Central America, implemented through the EHP and BASICS projects. Data collected during the baseline surveys confirmed a dramatic difference in prevalence of diarrhea in children based on mothers' handwashing behavior – more than a factor of two reductions between the inadequate and optimal behavior. Only 9 % of mothers demonstrated optimal handwashing behavior at baseline.

The Central America handwashing activity had four key results:

First, there were improvements in handwashing behavior and decreases in diarrheal disease. For example, in Guatemala, the fraction of mothers using good handwashing behaviors increased by more than 30% over the course of the initial twelve-month campaign, corresponding to roughly a 7% decrease in overall diarrheal disease prevalence at national-scale.

Second, the partnership involved significant co-leveraging of resources by USAID, the public sector, and private sector, with recognition that the achievements are far greater than what any single partner would have been able to accomplish individually.

Third, there has been sustained involvement of the private sector in ongoing campaign activities and adaptation of the approaches and partnership to other campaigns, such as diarrheal disease prevention in the wake of the 2001 earthquake in El Salvador.

Finally, other organizations with whom USAID collaborated on this activity have adopted the approach for new work in other geographic areas. A key opportunity for the EH activity is continued collaboration with and support of the resulting Global Public-Private Partnership to Promote Handwashing with Soap.

The Central America handwashing initiative demonstrated how a partnership could pool resources, share risk, and provide added value over and above what each party could achieve alone. Clearly, organizations will only join a partnership if they stand to gain from it. In the case of handwashing, there are obvious benefits for both public and private partners; industry may sell more soap and benefit from the public health agencies awareness-raising efforts, while agencies concerned with public health benefit from the private sector's expertise in designing effective communications and having financial resources to implement such communications efforts.

Sanitary disposal of human feces

Sanitation bestows health benefits at two levels. There is a benefit to individual households that invest in sanitation but also a benefit to the community as a whole. The available evidence indicates that effective use of sanitary facilities to dispose of human feces reduces diarrheal disease prevalence by one-third to one-half. Reductions are highest in communities achieving a threshold of coverage, which varies, but is typically 70%. The communal reduction is a function of fecal contamination in the environment, which can synergistically reinforce the health impact of other hygiene interventions such as point-of-use water quality improvements.

The handling and disposal of children's feces merits special attention. In many cultures, the feces of children are regarded as less harmful than other feces, when in fact they are more likely to contain pathogens. In addition, developing appropriate facilities for the use of children has repeatedly proven to be problematic, although recent progress on the use of potties for this purpose (with ultimate disposal in a latrine or other sanitary facility) has shown promise.

Programmatically, sustainable sanitation improvements have been difficult to achieve within public health, in both urban and rural settings. Subsidies for household-level infrastructure, such as latrine construction, have been misguided and have not insured appropriate or sustained use. Recent work focused on attitudes towards sanitation and behaviors to insure effective use of whatever sanitation solution is locally appropriate. This work has shown promise in overcoming the limitations of infrastructure-focused approaches.

3.5.2 Prevention of Childhood Pneumonia through Reduction of Exposure to Indoor Smoke

Household energy use is connected to virtually all of USAID's development sectors and activities, such as economic growth, natural resource protection, and human health. Two billion people, mainly the world's poorest, rely on solid fuels (wood, charcoal, crop residues, animal manure, etc.) for their domestic cooking and heating needs. The majority continues to cook over traditional 3-stone fires or inefficient stoves in poorly ventilated homes. As a result, an estimated 1 billion people, mostly women and children, are exposed to levels of indoor air pollution that far exceed the World Health Organization (WHO) guidelines.

Nearly three-fifths of the total global exposure to particulate matter occurs in the rural areas of developing countries. Exposure rates can also be very high in peri-urban and urban areas where there is continued reliance on wood and other solid fuels for cooking. According to WHO, acute lower respiratory infections (ARI), closely associated with exposure to biomass smoke, are the leading cause of death for children under five years of age. One estimate suggests that in India alone, indoor air pollution is responsible for as many as 500,000 premature deaths each year.

Until recently, this problem received little systematic attention at the international level, among both donors and international agencies such as the WHO. As a consequence, practical and programmatic approaches to scaling-up and sustaining existing interventions which are known to reduce smoke levels (e.g. improved stoves, improved fuels) have not been developed, and there is a need for new, more comprehensive interventions and approaches, which could be applied nationally and regionally.

As discussed, the principal health objective for this component of the EH activity is improved child health, specifically the reduction in incidence and severity of pneumonia in young children, which has been shown to be a substantial risk from exposure to high smoke levels. Other health impacts of potential interest include maternal and neonatal health, such as the impact of smoke exposure on low birth weight or the impact of chronic exposure to smoke on development of chronic obstructive lung disease in women, as well as the health and well-being of those who are immunocompromised, especially individuals with HIV/AIDS.

Ultimately, program success will be measured by sustained and at-scale changes in behavior, including adoption of improved stove technologies, use of higher quality fuels, improved household ventilation and other housing-based approaches to reduce exposure. Such practices are not the product of motivation alone to achieve such change, *i.e.* a change in knowledge and attitude, but will only result from a combination of such motivation with practical access to the “hardware,” *i.e.* fuels, stoves, and housing improvements.

The approaches to be explored in this EH component are not ready for at-scale adoption for field-level programming by Missions for two reasons: (1) they are not yet tested programmatically; and (2) our knowledge of the health impact of various interventions which will reduce smoke exposure is incomplete. The EH activity focus is on answering questions related to the first of these, *i.e.* building a programmatic evidence base, while other organizations (e.g. NIH) are supporting the research that will address health impact. It is anticipated that over the life of the EH activity, the health impact of various interventions and the dose-response for exposure to particulate will become better understood – and will be used to inform the EH programmatic approaches to be tested.

The EH activity explicitly recognizes the need for cross-sectoral collaboration to improve household energy-related health impacts. Various factors such as access to clean energy technologies, household socio-economic status, existing health threats and services, cultural practices and biases, subsidies and market forces, all play a role in influencing indoor air quality and, consequently, health.

The comprehensive strategy advocated here is designed to create new approaches to address the critical development needs of household energy and to lay the groundwork for at-scale implementation by USAID Mission programs. It is anticipated that lessons will be learned in diverse USAID geographic and program settings to better inform these new program approaches.

For this intervention areas as well, the current policy and partnership environment is opportune, with both USG commitment at the World Summit on Sustainable Development to the EPA-led Partnership for Clean Indoor Air and the interest/activity of the Shell Foundation in complementary activities.

3.5.3 Prevention of Malaria Through Integrated Vector Management

Integrated Vector Management (IVM) is receiving increasing attention as a basic methodology for the implementation of malaria and other vector-borne disease control activities at the global and country levels. USAID Missions have been asked to provide support for vector control in a number of locations, ranging from malaria-endemic countries in sub-Saharan Africa to countries or regions with periodic malaria epidemics such as Eritrea and Central Asia. However, currently

there are only a few proven tools, a lack of consensus on a coherent methodology for selecting their use, and a general lack of capacity for local level application of IVM. In addition, IVM has not yet developed a firm epidemiological basis to guide application of larval control tools, or combinations of any of the available tools (insecticide-treated nets (ITNs), indoor residual spraying (IRS), larval control (LC)) at local levels. Recent operations research work has begun to provide groundwork on which to build such an epidemiologically based framework for local level applications. There is a need to work with WHO in its technical advisory capacity to increase consensus on the role of IVM in malaria control, to demonstrate the settings in which particular tools are effective, and to develop local access to technical assistance in implementing IVM through capacity building at various levels.

There are currently three main tools available for malaria vector control: ITNs, IRS, and LC. None of these tools is new, and larval control is actually ancient. The evidence base for ITNs and IRS is extensive, and each can be considered efficacious if properly implemented in most ecological settings. Neither one alone is likely to interrupt transmission in most of the African countries with endemic malaria. Both ITNs and IRS are in current use in Africa, and each has particular advantages in particular settings. Larval control interventions have been shown to be effective, and cost-effective, in the specific setting of long-term use in mining settlements in Zambia. A USAID-sponsored conference in Kampala, Uganda in 2002 identified a wider range of settings in which LC might be appropriate, and the Environmental Health Project (EHP) has begun work in collaboration with the University of Durham to establish an evidence base for the application of LC methods in particular settings. To date, evidence for combinations of interventions, either multiple vector-control interventions or vector control in conjunction with treatment, has been lacking. Epidemiological methods for such combination trials remain problematic, and attention has been focused on “proving” each intervention’s efficacy on its own.

As already indicated, it is anticipated that the major focus for IVM will be on malaria. Nevertheless, some of the interventions or activities could also be relevant (at least in principle or approach) to other vector-borne diseases such as dengue, lymphatic filariasis, or others that may emerge in policy importance over the life of the EH activity.

3.6 Opportunities and Challenges

Current USAID program approaches provide both opportunities and challenges for this EH activity. The key opportunity is one of partnership both within the Agency and with external partners. Clearly, addressing any of the environmental health challenges that are the technical foci for EH will require innovative partnerships. One example is the Global Development Alliance to support partnership activities with the private sector, already strong in USAID health programming. A recent relevant example is an Alliance launched in September 2003 with Procter & Gamble and other partners to test their household water treatment product, PuR, in several USAID settings. In general, USAID’s standing as a large bilateral development agency provides a platform through which to approach new partners and is an opportunity for EH.

Within USAID, there is also an opportunity to leverage health investments against those made in other sectors to meet EH objectives. Sectors other than health typically devote significantly greater resources towards construction or facilitation of physical infrastructure, such as water supply or energy. Program approaches vary from setting to setting, but include direct grant

funding, credit guarantees, and partnerships with the private sector. The approaches and activities for the EH activity both embrace and complement such infrastructure investments.

Emergency and humanitarian response also includes EH-relevant elements. Both Title II food aid and Office of Foreign Disaster Assistance support environmental health activities, such as clean water and sanitation to support improved nutrition or to reduce the threat of epidemic disease. The hygiene elements of EH effectively complement such investments and are, in fact, becoming more and more effectively integrated with these activities.

3.7 Demand from Missions and Bureaus

Missions and Bureaus contacted during the design of this activity indicated that it should have the capacity to:

- provide technical assistance on environmental health field activities, for design, monitoring, training, technical support, and evaluation;
- respond quickly to new technical assistance requests;
- provide easy access to services – e.g. have flexibility and the ability to accept Field Support funding;
- build upon existing platforms and objectives (e.g. child survival, nutrition, malaria, HIV-AIDS).

IV. STRATEGIC FRAMEWORK

The *goal* of the EH activity is to reduce mortality and morbidity in children under five years of age, as well as mortality and morbidity associated with infectious diseases of major public health importance. This goal is consistent with Agency-wide health goals. GH Bureau strategic objectives contribute to these goals by focusing on increasing use of key interventions. This overarching strategic approach informed the definition of the EH activity *strategic objective*:

Sustainable scale-up of priority interventions that reduce exposure to agents of disease and to hazards that exacerbate disease, by focusing on improvements in key behaviors and environmental conditions.

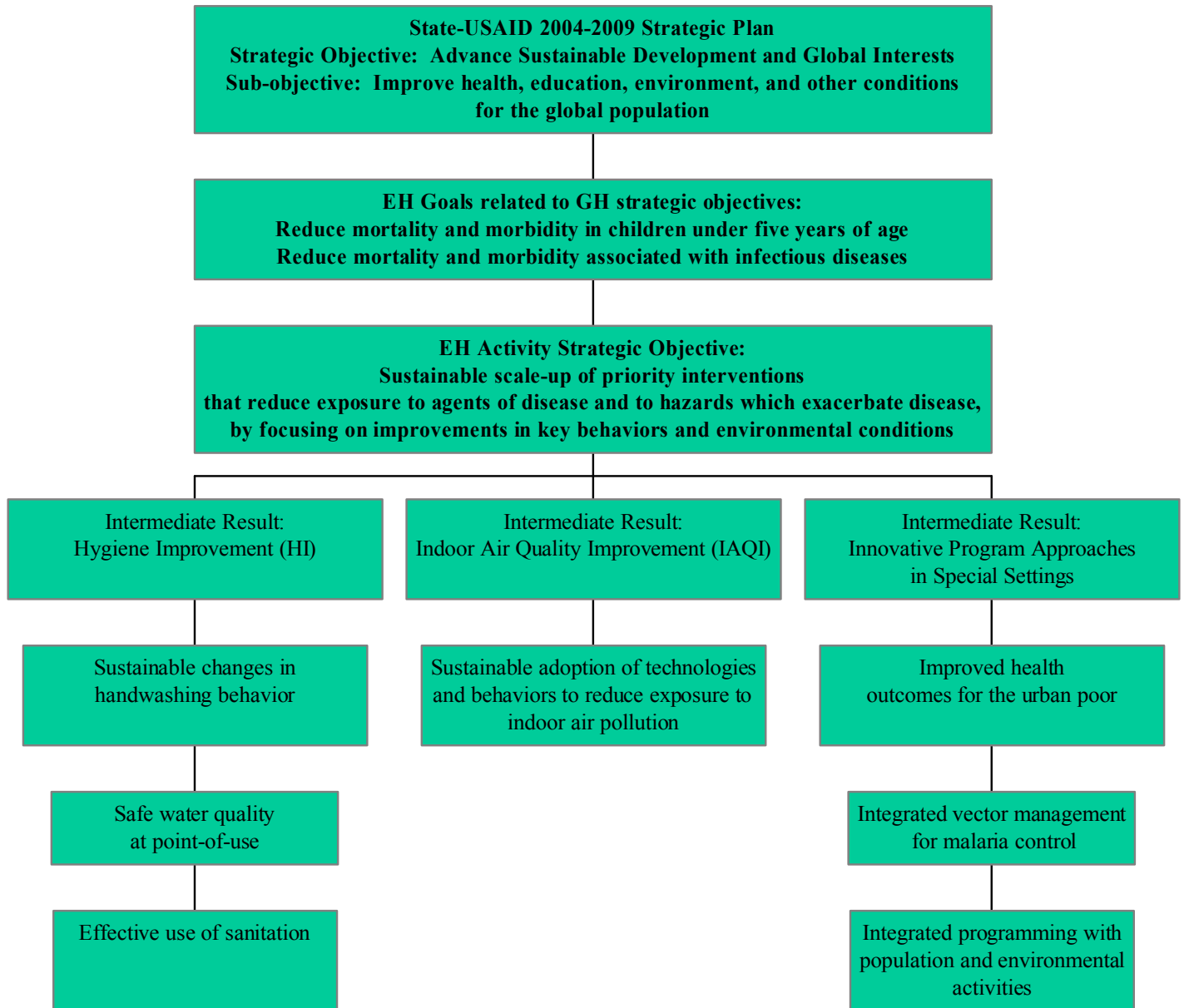


Figure 5: Environmental Health Activity Results Framework

Three high-level results are designed to achieve this objective:

- **Hygiene Improvement (HI):** achieve measurable improvement in key hygiene conditions at a scale sufficient to attain significant public health impact in USAID-assisted countries, with inputs under the EH activity directly linked to the country-level outcomes;
- **Indoor Air Quality Improvement (IAQI):** develop program approaches to improving indoor air quality in the rural and urban households still reliant on biomass fuels and basic stoves to meet their energy needs for cooking and heating;
- **Innovative Program Approaches in Special Settings:** advance programming approaches in other specialized areas related to the EH strategic objective, including Integrated Vector Management.

The specific outcomes intended under each of these results and the activities to achieve these outcomes are detailed in Section V below.

4.1 Relationship to GH Strategic Objectives

Population and Reproductive Health

Recognizing the important relationship between population pressures and environmental degradation, GH has worked on integrated population-environment program approaches for over a decade. Beginning in 1999, health was formally added as a component of these efforts, with an emphasis on exploiting field program synergies, with an initial effort in Madagascar. The outcomes described here are directly supportive of improved program integration. In Madagascar, the promotion of point-of-use water disinfection with chlorine solution and handwashing practices have been integrated into the activities of NGOs primarily focused on voluntary family planning. Likewise, environmental health activities can provide a useful platform for reproductive health, sometimes to populations who would otherwise be inaccessible to such activities.

Child Health and Nutrition

EH directly responds to intermediate results on the prevention of diarrhea and pneumonia under the GH strategic objective on child health (SO 3). The key outcomes under Hygiene Improvement and Indoor Air Quality are explicitly among the SO 3 Intermediate Results. In addition, hygiene improvement is one of the six components of the GH Nutrition Action Plan. Hygiene can be an important or convenient entry point for community approaches in child health, thus representing an important programmatic synergy for EH in support of child health and nutrition.

Maternal Health

While environmental health interventions have not played a large role in the prevention of maternal mortality, this is evolving. In particular, the importance of hygiene in infection control

and safe delivery is increasingly recognized. Field-level activities have included such components, and this experience has informed discussion of the interface of the EH activities with maternal health as part of the new GH maternal health strategy. Therefore, there is the potential for EH, over the life of this activity, to become increasingly engaged on maternal health activities.

Infectious Diseases

The GH infectious diseases strategic objective (SO 5) is focused on malaria, tuberculosis, antimicrobial resistance, and surveillance. The EH activity has focused on support to developing new tools for malaria programming as the key contribution to the infectious diseases objective, using the integrated vector management approaches described above.

HIV/AIDS

It is well known that people living with HIV/AIDS (PLWHA) are at a high risk of developing opportunistic infections caused by normally innocuous viruses and bacteria. Acute diarrhea is one of the most common opportunistic infections that accompany HIV/AIDS. Diarrhea can cause weakening when chronic and has the most serious nutritional implications for people with an impaired immune system. Interventions that prevent the occurrence of diarrhea can result in significant gains in life expectancy and quality of life among PLWHA. To effectively improve home based care of PLWHA, all people living in a household need a reliable source of water and sanitation and good hygiene practices.

Organizations such as The Joint United Nations Programme on HIV/AIDS (UNAIDS), IRC International Water and Sanitation Center, Family Health International (FHI) and others, have recognized the important role of safe water, sanitation and hygiene promotion as important strategies for helping people with HIV stay healthy and protecting PLWHA and their families against opportunistic infection and have begun to incorporate these interventions in community and home-based care strategies. Strategically, the EH objective and results relate to HIV/AIDS by helping:

- to reduce diarrhea and improve nutrition status of persons living with HIV/AIDS (PLWHA);
- to improve the quality of life of PLWHA and their caregivers (e.g. increased access to safe water and sanitation facilities- for bathing, privacy, etc.);
- to ensure the safe transition to exclusive replacement feeding for mothers with HIV-AIDS, as part of informed efforts to prevent mother-to-child transmission (PMTCT) of HIV through breastmilk.

V. OUTCOMES AND ACTIVITIES

5.1 Overview of the Approach

Outcomes for EH are centered on **behaviors** which require the confluence of physical infrastructure at various levels – typically personal, household, community, and municipality; personal knowledge of and positive attitudes towards behaviors considered optimal from a health perspective; and an enabling environment that permits the practice of these desired behaviors

over the long term, including, *inter alia*, financial access, cost recovery for sustainable service provision, and supportive policies.

Among the three technical focus areas, the example for hygiene is most advanced and will best illustrate this approach. The Hygiene Improvement Framework is shown in **Figure 6**. For hygiene, the desired behavioral endpoints are: safe storage and treatment of water at point-of-use; optimal handwashing; and sanitary disposal of human feces. No single component of the Framework is intended to stand alone – hardware, hygiene promotion, and an enabling environment are all required to achieve sustained behavior change. Within the context of this Framework, EH activity outcomes will in many cases require investments in complementary activities beyond those made directly under EH itself. For example, achieving optimal handwashing behavior requires access to soap, which may be promoted by the private sector, and water, the supply of which may need to be improved through other USAID activities or non-USAID stakeholders. Of course, there will be activities under EH in which USAID will directly invest in community water supply and sanitation infrastructure, household level technology, hygiene promotion, and activities that support the enabling environment, *i.e.* all components of the Framework. Nevertheless, a flexible approach to the use of the Framework by USAID programmers allows adaptation to particular country circumstances, including budget constraints.

5.2 *Overarching behavior change approach*

All of the technical focus areas for the EH activity target high-risk health behaviors and include activities to promote improved behaviors and facilitate their adoption (*e.g.* handwashing with soap or cooking with alternatives to biomass fuels).

Behavior change strategies will be developed in the context of specific activities and will:

- include formative research to identify the needs of the target populations, as well as the barriers to and supports for behavior change;
- ensure participation of the community in all phases of behavior change program development and in much of the implementation;
- utilize a mix of behavior change strategies and communication channels;
- include a strong monitoring and evaluation component; and
- achieve results through collaboration with other USAID central office and field activities and with other public and private sector partners.

A number of behavioral and social change methods that have found considerable application may prove useful in achieving sustained environmental health improvements. These include:

- *Behavior change communication*, an interactive process with communities to develop tailored messages and approaches using a variety of communication channels to develop positive behaviors; promote and sustain individual, community and societal behavior change; and maintain appropriate behaviors. In the environmental health context, effective communication strategies have been used to promote handwashing with soap and proper use and maintenance of community sanitation systems.
- *Social Marketing*, the process of identifying and targeting specific groups with particular strategies, messages, products or training programs through various mass media and

interpersonal channels. Some examples of applications to date include promotion of use of insecticide treated nets for malaria protection for young children and pregnant women, the promotion of oral rehydration therapy for the treatment of diarrhea, promotion of contraceptives, or the promotion of household disinfection of water with chlorine-based solutions.

- *Social Mobilization*, the process of bringing together all feasible and practical intersectoral allies to raise people’s awareness of and demand for public health programs;
- *School-based Programs*, involving teachers, students and the community in collaborative efforts to improve the health and safety of school children and the community at large. School-based and child-to-child education on hygiene and sanitation has been critical for achieving and sustaining hygiene behavior change among students and their families; and
- *Community participation*, the process of engaging the community to actively participate in the design, implementation and evaluation of programs to improve their health. Community participation has been a guiding principle of most successful environmental health interventions, including all of those cited above.

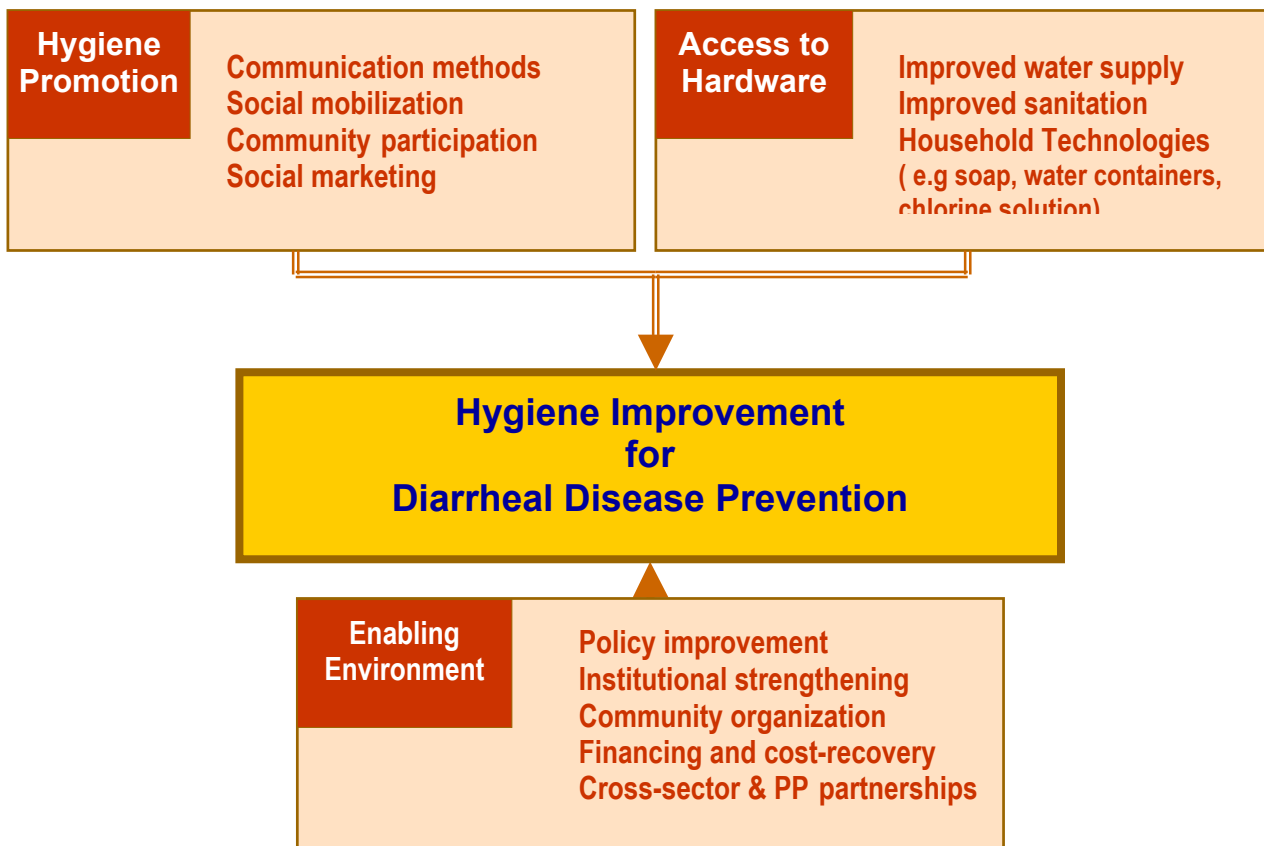


Figure 6: Hygiene Improvement Framework

5.3 *Outcomes and Activity Overview*

Five outcomes have been defined for the EH activity, including:[§]

under **Hygiene Improvement**

- Outcome 1: Sustainable, large-scale improvement in handwashing behavior
- Outcome 2: Sustainable, large-scale improvement in the quality of water at point-of-use
- Outcome 3: Sustainable, large-scale improvement in the sanitary disposal of human feces

under **Indoor Air Quality Improvement**

- Outcome 4: Program approaches developed to improve indoor air quality in households currently reliant on biomass fuels

under **Innovative Program Approaches**

- Outcome 5: New program approaches in specialized environmental health topics developed

The following general principles were used in developing the activities outlined below:

- scale-up proven interventions;
- reduce barriers to scale and sustainability (e.g. insure adequate cost recovery);
- achieve sustained behavior change through:
 - promotion activities (e.g. hygiene promotion),
 - small-scale hardware (e.g. bottled chlorine),
 - a supportive enabling environment (e.g. policies, financing);
- work through local/country/regional institutions (governmental and NGOs), including capacity building;
- exploit commercial approaches and public-private partnerships;
- work in partnership with non-health sectors (e.g. water, energy, agriculture, urban programs, food aid, OFDA) within and outside USAID; and
- actively work with diverse USAID health interests (e.g. child health, nutrition, infectious diseases, maternal health, HIV/AIDS, family planning, urban health, health systems/policy) as a platform.

The focus for all outcomes is on improved behaviors as well as on improved and sustainable access to those services, which support key behaviors. Whether such a vision can be taken to scale in a field setting will vary for each outcome. For the three outcomes under Hygiene Improvement, experience to date and current condition suggest that rapid progress in the field is probable. Activities under indoor air and innovative approaches will also be focused on ultimately changing behaviors and associated services at large-scale in field settings, but this may be more likely in the latter phases of EH activity implementation.

[§] Note that the Hygiene Improvement result has been disaggregated into three discrete outcomes, reflecting the proportionally greater effort to be devoted to that result.

5.4 *Description of Activities*

Crosscutting activities for all outcomes

- test and refine cost-effective approaches for taking behavior change interventions in environmental health to scale;
- increase the capacity of existing institutions (governmental and non-governmental organizations) to develop, implement and monitor EH priority interventions;
- document and disseminate best practices for EH priority interventions;
- strengthen networks and partnerships in EH priority interventions, including linkages among multisectoral partners in country;
- undertake operations research to improve sustainability and scalability of interventions (e.g. improving cost-recovery) and to explore synergies (e.g. added value of promotion of handwashing with soap in conjunction with point-of-use water disinfection); and
- develop partnerships to share, disseminate, and participate in resource networks in the environmental health technical areas supported under the EH activity.

Outcome 1: Sustainable, large-scale improvement in handwashing behavior

Illustrative activities include:

- technical assistance for design, implementation, monitoring and evaluation of national-scale activities to promote handwashing;
- collaboration with the Global Public-Private Partnership to Promote Handwashing;
- demonstrate effective integration of handwashing with other hygiene improvement interventions, at scale in field settings;
- conduct operations research to improve program implementation;
- improved policy and program guides on integrating the promotion of key hygiene behaviors such as handwashing into community and home-based HIV/AIDS care and support activities.

Outcome 2: Sustainable, large-scale improvement in the quality of water at point-of-use

Illustrative activities include:

- technical assistance for design, implementation, monitoring and evaluation of national-scale activities to improve water quality at point-of-use;
- support the International Network to Promote Safe Household Water Treatment and Storage;
- demonstrate effective integration of point-of-use water quality improvement interventions with other hygiene improvement interventions, at scale in field settings;
- develop new public-private partnerships at international and country-level to commercialize approaches to POU programming;
- develop guidelines to ensure the quality of water used in infant formula preparation to ensure the safe transition to exclusive replacement feeding for mothers with HIV who choose to make this choice and who are at risk of mixing formula with contaminated water;
- conduct operations research to improve program implementation.

Outcome 3: Sustainable, large-scale improvement in the sanitary disposal of human feces

Illustrative activities include:

- technical assistance for design, implementation, monitoring and evaluation of national-scale programs to increase effective use of sanitation;
- development of programmatic evidence for sustainable, behavioral impact of sanitation promotion in public health;
- demonstration in field settings of the effective integration of sanitation with one or more other hygiene improvement interventions;
- support national-scale implementation of sanitation promotion; and
- support the WASH campaign for sanitation and hygiene advocacy at national and sub-national levels.

Outcome 4: Program approaches developed to improve indoor air quality in households currently reliant on biomass fuels

Illustrative activities include:

- models for sustainable improvement in indoor air quality (through fuel, stove, or housing improvements, coupled with behavior interventions) to improve the health of the rural and urban poor will be developed and documented;
- grants and capacity building for in-country organizations;
- technical assistance to and collaboration with USAID bilateral activities (e.g. energy, health, Title II);
- coordination and complementary activities with other international organizations (e.g. Shell Foundation, World Bank);
- development of state-of-the-art behavior change components of improved household energy interventions, including the applications of new tools and approaches;
- testing and refining cost-effective approaches for taking such behavior-related interventions to scale;
- increasing the capacity of existing institutions (governmental and non-governmental organizations) to develop, implement and monitor effective behavior change interventions;
- promoting the documentation, dissemination, and application of best practices defined through this activity; and
- strengthening networks and partnerships with the institutions and organizations active in household energy and/or behavior change.

Outcome 5: New program approaches in specialized environmental health topics developed

Illustrative activities include:

- support for the technical development of IVM as a strategy through continued operations research and dissemination of relevant findings and experiences.
- provision of technical advice and support in planning and implementation of vector control activities;
- design, implementation and evaluation of behavioral change communication interventions for control of vector-borne diseases;

- research on efficacy of larval control interventions in selected settings;
- sponsorship and facilitation of technical meetings and symposia;
- assistance to key partners (e.g. WHO, WHO regional offices, RBM HDQ and regional networks, African institutions, academic centers, etc) in developing and producing advocacy documents and materials, presentations and technical reports;
- implementation and documentation of innovative approaches to urban environmental health, relying on platforms unique to the urban environment;
- implementation and documentation of innovative approaches to integrated population-health-environment programming at field level, working with non-governmental organizations and local governmental organizations where such integration is critical to long-term success, such as in areas of critical biodiversity or as part of comprehensive water resources management strategies.

VI. GENDER CONSIDERATIONS

Several of the key outcomes and activities described above require that gender considerations play a key role in activity design, implementation, and monitoring. For example, women are typically the prime caregivers for young children, and therefore any approach focused on the knowledge, attitudes, and practices of caregivers needs to insure the participation of women as key partners. Behaviors related to women's roles in the household and community may mean that they are disproportionately burdened by environmentally related disease, such as exposure to indoor smoke during cooking. In addition, women may suffer other, non-health losses from inadequate environmental health services, such as livelihood losses caring for young children ill from waterborne diarrheal disease or spending excessive time gathering water and firewood.

Clearly, the Hygiene Improvement and Indoor Air Quality components involve significant gender-related concerns relevant to both the design of inputs and to the measurement of outputs. Participatory processes ensuring the input of both women and men will be used in implementing these components. In addition, where appropriate and possible, gender-disaggregated data will be gathered and reported on the desired outcomes of the EH activity, including those under the Innovative Program Approaches outcome.

VII. IMPLEMENTATION PLAN

The EH activity implementation plan will be flexible, giving USAID access to the most appropriate and best expertise available for specific program elements. It is anticipated that over the ten-year implementation period, diverse mechanisms will be used. Examples include indefinite quantity contracts (IQCs), Leader-with-Associates (LWA) cooperative agreements, Interagency Agreements (IAAs), and grants to Public International Organizations (PIOs). Existing/planned USAID mechanisms will be used where appropriate. Examples include the Maternal and Child Health Technical Assistance and Support Contract (TASC-2), the Health Communications Partnership (HCP), MEASURE, Private Sector Partnerships (PSP), the CDC IAA, PIO grants to WHO and UNICEF, and mechanisms managed by other Bureaus (such as the EGAT LWA on energy).