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UNDERSTANDING SANITATION AT THE COMMUNITY LEVEL

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PREFACE

This paper is one of a series published by Volunteers in Technical Assistance to provide an introduction to specific state-of-the-art technologies of interest to people in developing countries. The papers are intended to be used as guidelines to help people choose technologies that are suitable to their situations. They are not intended to provide construction or implementation details. People are urged to contact VITA or a similar organization for further information and technical assistance if they find that a particular technology seems to meet their needs.

The papers in the series were written, reviewed, and illustrated almost entirely by VITA Volunteer technical experts on a purely voluntary basis. Some 500 volunteers were involved in the production of the first 100 titles issued, contributing approximately 5,000 hours of their time. VITA staff included Steve Oppenheimer as editor, Suzanne Brooks handling typesetting and layout, and Margaret Crouch as project manager.

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VITA is a private, nonprofit organization that supports people working on technical problems in developing countries. VITA offers information and assistance aimed at helping individuals and groups to select and implement technologies appropriate to their situations. VITA maintains an international Inquiry Service, a specialized documentation center, and a computerized roster of volunteer technical consultants; manages long-term field projects; and publishes a variety of technical manuals and papers.

UNDERSTANDING SANITATION AT THE COMMUNITY LEVEL

by VITA Volunteer Bruce P. Davis

I. INTRODUCTION

Sanitation at the community level is not significantly different

from sanitation at the individual level. Sanitation means healthful living conditions and clean practices for the handling of water and food and the disposal of personal wastes. Sanitation, in other words, means good hygiene. At the community level, this means provisions for a safe water supply, safe liquid and solid waste disposal, and a sanitary food supply.

Understandably, most people are concerned first and foremost with themselves. Individuals must obtain food and water and prepare them for use, relieve themselves, and find shelter. Unfortunately, the simplest and most convenient ways for individuals to meet these personal needs are sometimes not in the best interests of the community as a whole. It is essential, therefore, that the meeting of these basic sanitary needs is viewed as a community concern.

Because poor community sanitation leads readily to conditions of disease, the quality of community sanitation affects many different facets of community life. Life expectancy of adults and children, the physical condition of newborns, the availability of a healthy and productive work force, and the general well-being of the populace are all affected by the quality of the sanitation systems.

Most of this paper deals with the broad conceptual issues involved in choosing and implementing sanitary systems. The four major areas covered are:

o sanitary water supplies;

o the disposal of liquid and solid wastes;

o food supplies; and

o the safe use of insecticides.

Within these broad areas, a discussion of sanitation at the community level inv olves addressing several factors: contaminated water courses or ground supplies; exposed excreta or decaying organic matter; exposed garbage and trash; collection and delivery of water and wastes; control of flies, pests, and rodents; food protection; and insecticide use.

There is more to effective sanitation than just technology. Often, some highly unhealthy practices are part of the accepted and habitual lifestyle of the populace. To implement new methods of dealing with food, water, and wastes, the members of the community must be persuaded that change is necessary. For community education to have any impact, and for the needed resources to be committed, the community's political and spiritual leaders must be supportive of efforts to promote sanitation.

II. COMPONENTS OF SANITATION

WATER SUPPLY

A first step in the sanitary treatment of water is to determine whether any biological or chemical contaminants are present in

the existing supply. If contaminants are found, their source must be determined. For example, there may be industrial wastes or agricultural runoffs that are polluting the water supply. If the water supply is from wells or other underground sources, it must be determined if the wells are protected from animal and agricultural wastes. (Step wells are so prone to contamination that they should be avoided.)

Some sources of pollution may not be immediately evident. For example, contaminants may enter the water far upstream. A variety of standard procedures exists to test for contaminants, and to conduct a sanitary survey of the entire water supply. Field test kits are available that will determine if certain bacteria (known as the "fecal coliform" group) are present from human wastes. For other kinds of pollutants, such as agricultural chemicals and industrial wastes, most testing must be done in a laboratory. Usually water samples are collected from several sites and then sent to the laboratory.

In many cases, it is possible to eliminate the sources of contamination. Where this cannot be achieved, the water supply must be disinfected and is sometimes cleaned by simple filtration. Plants can be built for the treatment of polluted streams. These plants usually use clean sand as a filter and add chlorine or other disinfectant to the water to kill harmful bacteria. Polluted wells can also be treated with chlorine. However, these kinds of treatments will do nothing to remove many pesticides or other chemicals; the only way to deal with chemical pollutants is to stop them from entering the water supply. If the contaminants

cannot be eliminated or cleansed, then the water supply must be considered unacceptable.

The same considerations that apply to the source of the water also apply to its transport. Are the transport containers or pipes that carry the water protected from contamination? Are the transport devices clean and safe?

In addition to water quality, there are several other factors to consider when managing water resources. While we cannot discuss them here in detail, they must at least be mentioned: Is the present quantity of water being supplied adequate for present and future needs? What effect does the removal of water at one site have on the supply of water at other locations--downstream or at neighboring wells, for example?

Special care must be taken to ensure the cleanliness of water at the point where it is delivered to homes or to other distribuion points within the community. For example, if the water is transferred into storage containers, it is important that the containers be cleaned often. It is also important that the people who do the cleaning are themselves careful in their personal hygiene.

Dip storage containers--that is, water containers into which each family dips its own smaller water containers--should not be used. This is because each family, by dipping into the water supply, distributes its dirt and disease carriers into the water and spreads them to the rest of the community. In general, the

stored water supply should not come in contact with individual persons or household containers; rather, the stored water should be transferred into private containers through a pipe or spigot. Water containers should always be covered.

WASTES--LIQUID AND SOLID

If not properly handled, waste products serve as a breeding ground for disease-carrying insects, mice, rats, and other pests. Moreover, poorly handled waste products can find their way directly into the water supply or the food chain. Adequate transport, treatment, and storage of wastes is therefore essential for good sanitation.

Liquid Wastes

The term "liquid wastes" refers to human and animal excrement and urine. Before deciding what changes, if any, should be made in the existing disposal systems, it is helpful to make a survey of the existing systems to answer the following questions:

1. Are the existing liquid waste disposal systems adequate for the number of people presently being served, and for the number of people anticipated in the future?

2. Is the current system sufficiently isolated from surface and ground water drinking and bathing sources? If not, does the system need to be moved to a different

location, or can it simply be repaired to prevent leakages? Would it be possible/practical to move the water source?

3. Are there sufficient numbers of comfort stations, bathrooms, or waste holding and collection facilities in the community?

Ideally, every possible step will be taken to control and contain liquid wastes within the disposal system. If possible, a planned layout of the housing locations and the latrines (if these are outside the homes) should be carefully designed to minimize containment problems. Places of deposit of exposed excreta (such as latrines and public comfort stations) must be screened or otherwise protected from access by flies and other disease carriers, such as rodents and mosquitoes. Domestic animal manure must be treated similarly.

A crucial aspect of liquid waste management is the selection, monitoring, and maintenance of a discharge location. There are three main types of waste disposal facilities (there are advantages and disadvantages with each kind of disposal):

1. surface water discharge (into a stream or river);

2. ground surface deposit (onto or under the ground); and

3. pipe system to a treatment or disposal facility.

Surface Water Discharge (into a Stream or River). If a surface water discharge system is already in place, it must be determined if the discharge location is sufficiently distant and isolated from wells or other water sources. Again, this determination should be based in part upon the sanitary survey of the local facilities. If pollutants found in a water supply are the same as those in a nearby discharge location, then the discharge location and the water supply are probably too close together. Generally, discharge locations should be at least 45 meters from an underground water supply and as much as several kilometers for surface supplies, especially in the tropics. The minimum separation distance may vary depending on a number of factors. Equally important, a survey of the downstream waters is needed to find out if contaminants from the liquid wastes pose a danger to downstream water users.

In general, naturally occurring biological processes tend to cleanse the water. The larger the volume of the surface water, and the faster it moves, the quicker and more effective this cleansing action will be. Slow moving or small volumes of water result in a longer time for the biological action to cleanse the water. During this waiting period, disease organisms are alive within the water, and unpleasant odors may develop. Also, if some of the solid waste materials become lodged in debris or in the bends and turns of the surface water course, disease carrying fly populations may develop. Bathers and people using the water to wash clothes may also be affected.

If the downstream water quality is not safe, it may be necessary

to prohibit its use. Alternatively, it may be necessary to discontinue the surface water discharge and find an alternative means of disposal. Trained health workers should evaluate the water quality, and contribute to discussions of the various alternative courses of action in the event the water quality is not safe.

Ground Surface Deposit. If liquid wastes are being deposited in or on the ground, it is necessary to determine where the populace is depositing the wastes. Some of the possible sites include latrines, pit privys, roadways, drainage ditches, and backyards.

There are several possible problems with the surface discharges of liquid wastes, particularly if the wastes are not properly stored and isolated. Liquid waste depositories can be breeding grounds for disease-carrying flies and a source of parasitic worms. As a result, there is a high potential for the transmission of internal diseases, especially to children who may have direct contact with the polluted waters while playing. In addition to the risks of disease, there is a strong nuisance odor associated with these deposits.

These problems may be alleviated in a number of ways. First, area comfort stations should be provided in sufficient numbers for the population. If the wastes are not to be transported to a separate location (via sewers or other transport), an underground septic tank should be used and the effluent disposed of in soakways or oxidation ponds. An oxidation pond is a shallow pool or pond in which the wastes are decomposed by the action of bacteria

over a specified period of time. Air must be available to the oxidation pond, and is sometimes even forced into the pond, to help the bacteria do their work. Once the waste has been reduced by the bacteria, it is relatively clean and can be discharged into a stream. A soakway is a kind of oxidation pond lined with pebbles; the pebbles hold onto the human fecal matter and other organic material, while allowing the purely liquid part of the human waste to drain into the ground.

Oxidation ponds and soakways are always covered with some water, both because the bacteria require some moisture to work, and because the water helps to control odors.

In rare cases, liquid wastes can simply be deposited on the ground and covered with soil. An estimate must be made of the amount of area needed, given the number of years of expected use. The waste deposit area must not be in close proximity to ground or surface water sources, wells, or bathing or play areas. Most important, it must be determined if adequate quantities of soil will be available to cover the wastes.

Alternatively, liquid wastes may be composted for use as fertilizer for vegetables (but not green leaf vegetables). Human wastes should be treated with disinfectant before composting.

If liquid wastes are not to be stored at the location of the comfort stations, or transported through sewers, then provisions must be made for the pickup of the wastes and delivery to the storage site. In the design of a transport system, a number of

considerations arise. The people designated to pick up the wastes must be trained by health workers on the proper handling of wastes. A variety of containers and transport vehicles may be used, including tank trucks or wagons, buckets, and lined and covered ditches.

Whatever ground surface deposit method is used, it is essential to avoid stagnation (or ponding) of the wastes. Stagnant pools of wastes are breeding grounds for insects and other carriers of infection and disease, especially in crowded or congested areas.

Pipe System. The movement of liquid wastes by a pipe system eliminates many sewage collection and delivery problems, including those associated with fly breeding and disease, and odors. However, pipes are costly and difficult to install, especially in areas with winding streets or unstable population locations. Moreover, pipes require routine maintenance and checking and water to carry the waste.

Because sewer pipes significantly reduce the risks of disease and water supply contamination, their installation should be considered. One way to reduce the total costs and construction involved is to utilize the pipes in conjunction with community comfort stations. Provided a sufficient number of latrines are available to handle the needs of the population, this can prove to be an effective approach to waste and disease control.

When sewer pipes are used, discharge is usually into a waterway,

an oxidation pond, or other treatment/disposal facility. The location of the oxidation pond must be decided based on a number of partly conflicting factors. On the one hand, it should be located as far from the living areas as possible, in order to minimize odor and disease problems. On the other hand, to conserve sewage pipe, the pond should be located as centrally as possible. Finally, the pond should be located so that all the pipes run downhill to reach it--since gravity is what brings the wastes to the pond--to avoid costly pumping. The final choice of location will reflect a balance or compromise among these considerations. For an oxidation pond to be functional, some water may have to be added; in a dry climate, this approach may not be feasible.

Solid Wastes

"Solid wastes" refers to ordinary household garbage and trash; refuse from eating houses, markets, and hospitals; and any other items disposed of by people or businesses. These wastes may include everything from animal carcasses and manure to paper, metal, and food scraps. Sometimes excreta collected from roadside deposits is included. Because of the variety of materials in solid wastes, they can pose an unpredictable degree of health hazard.

To avoid the breeding of flies and vermin, the best approach is to collect, transport, and dispose of this material in a landfill that is covered daily by at least 15cm of earth. By following a few simple guidelines, it is possible to create a remarkably

effective and sanitary solid waste disposal system.

Ideally, covered individual or commercial collection containers should be placed on the streets, making sure that enough are available to handle the refuse created by the populace. In practice, however, refuse containers in poor, densely populated neighborhoods are apt to find other uses--for storage or even for shelter. Replacement costs could be substantial, so communities should address the need for surveillance.

If used, bins should be disinfected and sprayed with insecticides on a frequent basis. Collection bins should be kept covered, and sprayed with insecticides once a day. Spillage from these bins must be cleaned up promptly (otherwise it becomes a breeding ground for insects). All collection containers must be designed for ease of use, both in terms of putting material in and in terms of unloading it.

The astute reader will have noticed that there has been no mention of rats or cockroaches, despite the obvious sanitation problems these pests represent. In fact, the only way to control them, as well as flies, mosquitoes, and other rodents, is through effective sanitation. Chemical methods are of limited effectiveness with these pests, so the easiest way to control them is to limit their access to food and water. That, in turn means keeping food off the ground and the streets, and keeping trash containers sealed.

To transport the waste from the collection bins to the disposal

site, some kind of vehicle should be used. Whether powered by man, animal, or engine, the transport device should have solid sides, bottom and top to contain the trash.

The disposal site should be at least one kilometer from the living areas, and should also be in the downwind direction. The site should not be waterlogged, marshy, or near the edge of a waterway. The site must be kept covered by soil, both to prevent trash from blowing away and to keep pests from using the site as a breeding ground. Sufficient soil must be available to cover the site on a daily basis, so that flies, rodents, and other pests, will not be able to breed.

Surface water must be diverted away so that chemicals will not be drained from the site or leach through it. Seepage water from these dump sites will also be highly polluted; steps must be taken to prevent this water from reaching water courses used as water supplies or for water contact such as bathing and laundry.

Because unemployment is often a problem in the same areas affected by poor sanitation conditions, a large labor force may be available to aid in the collection of wastes. Indeed, in some urban areas, a significant portion of the force is employed in the collection and reprocessing of waste.

A key issue here is that many resources can be recycled, and some resources--such as paper, aluminum. rags, glass, ferrous materials, etc.--can be recycled with relatively low levels of technology. Recycling of wastes should be considered as an important

option, because it offers at least three advantages: It reduces the amount of dry waste that must be dumped and covered; it offers a cheap source of raw materials (wood pulp, metal, plastics, etc.) that would otherwise be expensive; and it offers gainful employment to members of the community. Consideration must be given, however, to the potential for personal injury and for the spread of disease.

Collection for recycling should be subject to the same concern for sanitation as collection for disposal; similar conditions for the spread of disease and pests exist in both operations. The people doing the collection/recycling should be educated about the hazards of their job and the role they themselves can pLay in the spread of disease.

FOOD SUPPLY

At the community level, good sanitation procedures for food deal mainly with the routes by which the food reaches the consumer. This means that the primary focus of sanitation efforts is in conditions at the markets; at the working locations of the street food vendors; and in the storage, preparation, and serving facilities of permanent food establishments. While control is difficult, certain objectives have a very high priority.

First, safe and sanitary water supplies must be made available. This is especially important in the marketplaces where vendors congregate. In these same markets, it is important that facilities be provided for the sanitary disposal of liquid wastes.

Flies and other vermin must be controlled, mainly by eliminating the sites where they breed such as garbage dumps or food dumped in the street. All food, and the utensils used to handle it, should be kept as clean as possible. All efforts to improve the personal hygiene of those who handle the food will contribute to the overall health of the community.

Depending on the resources available, several possible approaches may be used to implement these objectives. Ideally, new markets should be constructed that would be carefully designed to control the disposal of wastes and supply adequate quantitites of clean water to the vendors. A major source of contamination, particularly for green vegetables, is the practice of washing these vegetables with polluted water. One possible solution is to provide safe water supplies along the vendor travel routes, as well as at the markets.

Some of the greatest sanitation problems occur at fairs, festivals, and religious events. The sudden increase of population in small areas must be handled by provision of additional facilities for waste disposal and provision of clean water, as well as clean food. Special measures during such events should include the monitoring of the sale of cut fruits and uncooked vegetables, and the insistence that all food be covered or otherwise protected against flies. The quality of the water and ice (if available) used to prepare food and drinks should be carefully monitored. Provisions should also be made for the cleaning and disinfection of cooking utensils. A further step is to promote single use containers, such as those made from leaves and burnt clay.

INSECTICIDES

The use of insecticides to control insect pests is one of the most powerful techniques for maintaining good community sanitation. At the same time, it involves serious risks. If people are exposed improperly or excessively to these substances, they can be seriously harmed. If insecticide use is considered, costs, benefits, and alternatives should be carefully evaluated.

There are a few basic considerations involved in the safe and proper use of these pest control substances. Great care must be taken that these poisons do not enter water supplies. Similarly, these substances must not be sprayed at or near uncovered foods.

Insecticides should always be used according to directions; excess will not prove any more effective than the amount specified. Persons using insecticides must be properly trained, and must be provided with protective clothing and masks. These chemicals must be stored in well marked containers away from food, feed, and water, and secured in a safe place. Common sense plays an important role here, such as avoiding spraying into the wind or using one's hands to mix solutions.

III. IMPLEMENTATION OF SANITATION MEASURES

As a prelude to designing and implementing a community level sanitation system, it is important to assess the existing environment and life conditions in the community.

Sanitation is meaningless if survival is at stake. Before people can begin to think in terms of their health and cleanliness, they must already have the basics of food, water, and shelter available. If these basic needs have not been met, then it makes sense first to devote community resources to fulfilling them. However, sanitation must be considered simultaneously to make food, water, and shelter safe enough for human survival, to avoid a crisis such as an epidemic. Once a serious sanitation problem has developed, it may be too late to resolve it satisfactorily.

PLAN OF ACTION

To implement a sanitation system, it is necessary to conceive a plan of action. This plan is a series of specific steps that will put each piece of the sanitation system in place.

To begin with, a determination must be made of the problems or needs of the community, and priorities must be assigned to these needs. For example, perhaps liquid wastes are finding their way into the water supply. Then there is a need for some way to dispose of the liquid wastes without affecting the water. It may be decided that a new source of water is needed, and that wells must be built. Another example: perhaps garbage is piling up in the streets, creating a breeding ground for flies, cockroaches, and rats. Then a system must be developed to collect the waste from the streets and dispose of it in a safe place.

Once the community's sanitary problems and needs have been assessed,

priorities must be assigned among these needs. For example, it may be decided that the need for a safe water supply is even more important than the need to remove the garbage. So the water supply problem would be dealt with first, and the garbage problem later if only one can be resolved at a time.

A list of the problems and sanitary needs of the community forms the building blocks of a plan of action. Once these needs have been determined, several further factors must be assessed:

1. What are the resources available to meet each of the needs?

2. What are the anticipated problems and solutions in implementing the goals of the plan?

3. What are the specific sites for latrine construction, for example, or the pickup and delivery points for garbage?

4. Who will monitor and supervise the operation and maintenance of the sanitation system(s)?

EDUCATION

Apart from all the designing, planning, and construction, perhaps the most difficult aspect of implementing a sanitary system is the task of educating the people. Education is difficult even in the best of circumstances, and much more so in overcrowded slum

conditions and poverty-stricken communities. Interest and motivation are difficult factors to arouse in people, particularly if hunger and disease persist strongly in the population.

Yet, education is essential because the implementation of a sanitary system may require the people to change long-established habits. For example, the people may be called upon to draw their drinking water from a different source than they are accustomed to, to use different toilet facilities, or to handle their foods differently in the marketplace. There may be strong resistance among the people to changing old habits. Consideration should be given to minimizing changes, if this can be done without reducing the effectiveness of the sanitation efforts.

Another kind of education is also essential: Sanitation workers must receive special training to make sure that their activites do not make them into sanitary risks in their own right. For example, collecting wastes from homes and public places may be one important step. However, the people doing the collecting may, if they are not careful, acquire diseases that they will pass along to the rest of the community. The same is true for those people handling community water supplies and food.

For all such individuals involved in the running of sanitation systems, it is imperative that they be fully educated about the sanitation/health hazards in their jobs, and on the best ways to achieve personal hygiene. This kind of detailed education should generally be provided by trained health care workers, who can explain the interactipn between personal hygiene and community

hygiene, and the role that all people play in the common objective of ensuring public health.

Health care workers also play a significant role in the education of the general community. But the most important figures in community education are the political and religious leaders, or the community elders--whichever leaders can hold the attention of the people. These leaders should set out to make people aware of the problems, and the advantages to solving them, and help determine the best approaches to take.

Ultimately, to be effective, a sanitation system must reach the whole community, both in its physical extent and in the tendency of the people to take advantage of it. The community can provide the most modern water and waste disposal systems available; but if large segments of the people are not served by these systems, a major breakdown in the sanitation level is likely to occur, with the accompanying potential for the spread of disease and infection.

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