

**INTERNATIONAL TRAINING NETWORK
FOR
RURAL WATER & WASTE MANAGEMENT**

COURSE MATERIAL ON :

**HEALTH, SOCIO-CULTURAL & COMMUNICATION
ASPECTS OF RURAL WATER SUPPLY &
ENVIRONMENTAL SANITATION**

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CHAPTER - 2

HEALTH ASPECT OF WATER AND SANITATION

2.1. DECIDING ON HEALTH PRIORITIES

The International Drinking Water Supply and Sanitation Decade has recently ended. The declared goal of the Decade of providing all the world's population with adequate domestic water supply and excreta disposal has not been achieved. But progress has definitely been made in many countries including India. Also, the very important issue has been highlighted i.e., providing safe drinking water and sanitation system should get a priority among health issues.

Of course, there are other important issues, but it is indisputable today that safe drinking water and hygienic sanitation system can achieve a lot in reducing the incidence of infectious diseases, overwhelming causes of mortality and morbidity in all developing countries.

Though providing drinking water and sanitation for all population has been targetted in the "Health for all by 2000 A.D." - it is a difficult task. Resource of finance (especially recurrent finance for operation and maintenance), skilled labour and institutions are generally scarce and water and sanitation investments must compete with other pressing areas of public expenditure. The resources allocated to water and sanitation can only make limited improvements unless correct decisions are taken about which type of project will yield the greatest health benefits.

This climate of scarce resources makes it imperative that we have a detailed understanding of the health aspects of water supply and sanitation. The scarcer the resources the more is the need to know exactly how and why various changes in water supply and sanitation can influence infection and disease in the community.

2.2. CLASSIFYING DISEASES RELATED TO

WATER SUPPLY AND SANITATION

The diseases related to water supply and sanitation are numerous and the relationships are sometimes complex. Conceptual systems have been developed for understanding diseases related to water supply and those related to excreta. These classification systems are discussed below.

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2.2.1. Water Related Infections

Definitions

A water-related disease is one that is in some gross way related to water in the environment or to impurities within water. Water-related diseases may be divided into those caused by a biological agent of disease (a pathogen) and those caused by some chemical substances in water. The first group may be called the water-related infections and may include some of the greatest causes of disease and death in the developing countries (for instance diarrheal diseases and malaria). The second group includes diseases such as fluorosis (linked to high fluoride levels in drinking water) and infantile methemoglobinemia (related to high nitrate levels in drinking water). These chemistry related diseases are overwhelmingly overshadowed by the water related infections in the developing countries, but some of them are slowly gaining importance in India, particularly due to industrial developments. However, in this section only water related infections will be discussed, whereas the chemistry related diseases discussed in section 2.2.4.

Transmission Routes

The water-related infections are so described because their transmission, or the prevention of their transmission, depends in part upon water. There are four transmission routes that are water related. These are shown in Table 2.1 and are related there to the environmental strategies for disease control that are appropriate to each route. The four routes are

1. Water-borne route. Truly water-borne transmission occurs when the pathogen is in water that is drunk by a person or animal that may then become infected. Potentially water-borne diseases include the classical infections, notably cholera and typhoid, but also include a wide range of other diseases, such as infectious hepatitis, and some diarrheas and dysenteries. The term water-borne disease has been and still is, greatly abused so that it has become almost synonymous with water-related disease. It is essential to use the term water-borne only in the strict sense defined here.

Another source of misunderstanding has been the assumption that, because a disease is labeled water-borne this describes its usual, or even its only means of transmission. The preoccupation with strictly water-borne transmission has its origins in the dramatic water-borne epidemics of cholera and typhoid, which occurred in some European towns in the past century and

in the first quarter of this one, and were caused by urban water supplies with inadequate treatment facilities. Similar epidemics sometimes occur in tropical towns today, but it must be noted that all water-borne disease can also be transmitted by any route that permits fecal material to pass into the mouth. Thus cholera may be spread by indirect fecal-oral routes, for instance via contaminated food. Water-borne transmission is merely the special case of drinking fecal material in water, and any disease that can be water-borne can also be transmitted by other fecal-oral routes.

2. Water-washed route. There are many infections of the intestinal tract and of the skin that, especially in the tropics, may be significantly reduced following improvements in the domestic and personal hygiene. These improvements in hygiene often depend upon increased availability of water and the use for hygienic purposes of increased volumes of water. They may therefore be described as water-washed diseases and they depend on the quantity of water used, rather than its quality. The relevance of water to these diseases is that it is an aid to hygiene and cleanliness, and its quality is relatively unimportant for this purpose. A water-washed disease may be formally defined as one whose transmission will be reduced following and increase in the volume of water used for hygiene purposes, irrespective of the quality of that water.

Water-washed diseases are of three main types. First, there are infections of the intestinal tract, such as diarrheal diseases, which are important causes of serious illness and death especially among young children in poor countries. These include cholera, bacillary dysentery, and other diseases previously mentioned under water-borne diseases. These diseases are all fecal-oral in their transmission route and are therefore potentially either water-borne or water-washed. Any disease that is transmitted by the pathogen passing out in the feces of an infected person and subsequently being ingested (a fecal-oral disease) can either be transmitted by a truly water-borne route or by an almost infinite number of other fecal-oral routes, in which case it is probably susceptible to hygiene improvements and is therefore water-washed.

The second type of water-washed infection is that of the skin or eyes. Bacterial skin sepsis, scabies, and fungal infections of the skin are extremely prevalent in many hot climates, and eye infections such as trachoma are also common and may lead to blindness. These infections are related to poor hygiene and it is to be anticipated that they will be reduced by increasing the volume of water used for personal

hygiene. However, they are not fecal-oral and cannot be water-borne. They therefore relate primarily to water quantity and are not significantly related to water quality.

The third type of water-washed infection is also not fecal-oral and can never be water-borne. These are infections carried by lice or mites, that may be reduced by improving personal hygiene and therefore reducing the probability of infestation of the body and clothes with these arthropods. Louse-borne epidemic typhus and louse-borne relapsing fever are likely to be affected by improved personal hygiene. They are mainly transmitted by body lice which cannot persist on people who regularly bath themselves and launder their underclothes.

3. Water-based route. A water-based disease is one in which the pathogen spends a part of its life-cycle in a water snail or other aquatic animal. All these diseases are due to infection by parasitic worms (helminths) which depend on aquatic intermediate hosts to complete their life-cycles. The degree of sickness depends upon the number of adult worms that are infecting the patient and so the importance of the disease must be measured in terms of the intensity of infection as well as the number of people infected. Important examples are schistosomiasis and Guinea worm.
4. Insect vector route. The fourth route is via insects that either breed in water or bite near water. Malaria, yellow fever, dengue and onchocerciasis (river blindness), for example, are transmitted by insects that breed in water whereas West African trypanosomiasis (Gambian sleeping sickness) is transmitted by the tsetse fly (Glossina spp.) which bites near water.

Classification of Water-Related Infections

Table 2.1 lists these four water-related transmission routes and links them to their appropriate preventive strategies. In order that these concepts may be employed to assess the impact on health of a water improvement scheme, the chief water-related diseases have been listed in table 2.2. The diseases that are of particular interest in the Indian context, have been underlined. It must be noted, however, that all the fecal-oral infections can be transmitted by either the water-borne or water-washed routes, so they are placed in a special category of their own. The second category is reserved for infections that are exclusively water-washed, that is, the skin and eye infections plus diseases that are associated with

infestations of lice. Each water-related infection can then be assigned to one of the following four categories : (1) fecal-oral; (2) water-washed; (3) water-based; and (4) insect vectored.

2.2.2. Excreta-Related Infections

Definitions and Transmission Routes

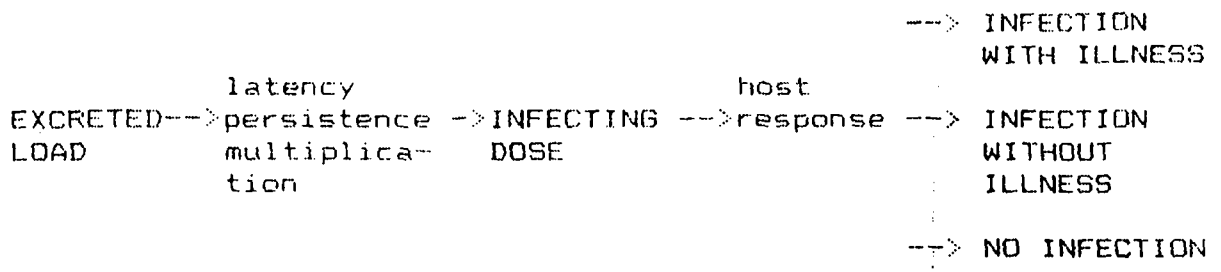
An excreta-related infection is one related to human excreta (meaning urine and feces). Only two transmission mechanisms are excreta related :

1. Transmission via infected excreta. The pathogen is released into the environment in the feces or urine of an infected individual.
2. Transmission by an excreta-related insect vector. An insect that visits excreta to breed or feed may mechanically carry excreted pathogens to food or an insect vector of a nonexcreted pathogen may preferentially breed in fecally polluted sites.

All excreta-related infections except one are also excreted infections, i.e., they are shed in the urine or feces of an infected individual. The one clear exception is Bancroftian filariasis, which in some parts of the world is transmitted by members of the Culex pipiens group of mosquitoes (especially by C. quinquefasciatus) that breed in sewage and other heavily polluted waters. All excreta-related infections are also water related except for the hook-worm Strongyloides and the beef and pork tapeworms. Several water-related infections are not excreta related (e.g., skin infections, trachoma, Guinea worm and malaria).

Factor Affecting Transmission (Refer Table 2.3.)

If an excreted infection is to spread, an infective dose of the relevant agent has to pass from the excreta of a case, carrier, or reservoir of infection to the mouth or some other portal of entry of a susceptible person. Spread will depend upon the number of pathogens excreted, upon how these numbers change during the particular transmission route or life-cycle, and upon the dose required to infect a new individual. Infective dose is in turn related to the susceptibility of the new host. Four key factors govern the probability that, for a given transmission route, the excreted pathogens from one host will form an infective dose for another. These are latency, persistence, multiplication, and host response. Diagrammatically the concept can be represented thus :



Excreted Load. There is wide variation in the concentration of pathogens passed by an infected person. For instance, a person infected by a small number of nematode worms may be passing a few eggs per gram of feces, whereas a cholera carrier may be excreting more than 1000000 Vibrio per gram, and a case may pass 10000000000000000 vibrios in a day. Where large numbers of organisms are being passed in the feces they can give rise to high concentrations in sewage. Thus, even in England, where water use is relatively high and salmonellosis is relatively rare, raw sewage may contain 10000 Salmonella per liter. At these concentrations, removal efficiencies of 99% in treatment works will still leave 100 pathogenic organisms per liter in the effluent.

Latency. Latency is the interval between the excretion of a pathogen and its becoming infective to a new host. Some organisms, including all the excreted viruses, bacteria and protozoa have no latent period and are immediately infectious when the excreta are passed. The requirements for the safe disposal of excreta containing these agents are far more stringent than for those helminthic infections in which there is a prolonged latent period. Among the excreted helminthic infections only three have eggs or larvae that may be immediately infectious to humans when passed in the feces. These are Enterobius vermicularis, Hymenolepis nana, and sometimes Strongyloides stercoralis. The remaining excreted helminths all have a distinct latent period, either because the eggs must develop into an infectious stage in the physical environment outside the body, or because the parasite has one or more intermediate hosts through which it must pass to complete its life-cycle.

Persistence. The persistence or survival of a pathogen in the environment is a measure of how quickly it dies after it has been passed in the feces. It is the single property most indicative of the fecal hazard in that a very persistent pathogen will create a risk throughout most treatment processes and during the reuse of excreta.

Multiplication. Under some conditions certain pathogens will multiply in the environment. Thus, originally low numbers can be multiplied to produce a potentially infective dose. Multiplication can take the form of reproduction by bacteria in a favoured substrate (e.g. Salmonella on food), or of the multiplication by trematode worms in their molluscan intermediate hosts. The former case is a mechanism whereby

light fecal contamination may build up bacterial numbers to reach the rather high minimal infective doses needed by many excreted bacterial pathogens. The need for this may determine the usual mode of infection, since multiplication in water is limited compared with the massive increases possible in food. Viruses and excreted protozoa cannot multiply outside their animal hosts. Among the helminths transmitted by excreta, all the trematodes (e.g. schistosomes) infecting humans undergo multiplication in aquatic snails. This introduces a prolonged latent period of a month or more while development is taking place in the snail, followed by an output of up to several thousand larvae into the environment for each egg that reached a snail.

Infective Dose. Although the minimal infective dose for some diseases may be a single organisms or very few, the doses required in most bacterial infections are much higher. Data bearing on this are very hard to acquire, since they involve administering a known dose of a pathogen to a volunteer. Also data obtained from controlled studies must be extrapolated cautiously in a country like India, as it has been found that in a malnourished condition, a much lower infective dose may cause the disease.

Host Response. Host response is important in determining the result of an individual receiving a given dose of an infectious agent. In particular, acquired immunity, and the relation of age to pathology, are important for predicting the effects of sanitation. At one extreme would be a short-lived parasite to which little immunity was developed and in which the relation between infection and disease was not age dependent. Then a close, tending to linear, relationship between exposure and disease might be expected with improvements in the appropriate aspects of sanitation giving health benefits proportional to effort. Ascaris may approximate to this model.

At the other extreme would be a viral infection that gives rise to long-lasting immunity and where the chance of overt disease in those infected rose with increasing age. An example is infection with poliomyelitis virus. Under very bad sanitary conditions all are infected at a young age, older children and adults are immune, and disease is limited to a few of the youngest children who may suffer chronic paralysis. If sanitation improves, infection is deferred and its pathological consequences later in life are more serious. Thus, although poliovirus transmission may be reduced by improving sanitation, reduction in disease is in practice achieved by immunization. The same may be true for hepatitis A.

Other hosts besides humans. Some excreted diseases are infections exclusively or almost exclusively of humans. Others involve animals either as alternatives to humans as

host or as hosts of other stages in the life-cycle. In the first case, where wild or domestic vertebrate animals act as alternative hosts (such infections are called zoonoses), control of human excreta is likely not to suffice for complete prevention of the infection.

Classification Of Excreta-Related Infection

The many excreta-related infections are harder to classify precisely than the water-related infections. A six-part classification, developed by the Ross Institute for the World Bank is shown in Table 2.4. Almost all the diseases mentioned in this table, except category V, are relevant in the Indian context.

I. Fecal-oral infections (nonbacterial). Improvements in excreta disposal will have differing degrees of influence on the various fecal-oral diseases. Some of these infections, caused by viruses, protozoa and helminths, can spread very easily from person to person whenever personal and domestic hygiene is not ideal. Among these, viruses need a special mention as the occurrence and medical significance of excreta viruses are being increasingly recognised. Over 100 different viruses are known to be faecally excreted by man and diseases caused by these organisms range from the trivial to the serious or even fatal. (Table 2.5.)

Changes in excreta disposal methods are unlikely to have much effect on their incidence unless accompanied by sweeping changes in personal cleanliness, requiring substantial improvements in water supply and housing, as well as major efforts in health education.

II. Fecal-oral infections (bacterial). For the fecal-oral diseases caused by bacteria, person to person transmission routes are important but so too are other routes with longer transmission cycles, such as the contamination of food, crops, or water sources with fecal material. Some of the pathogens in this category, notably Campylobacter, Salmonella and Yersinia, are also passed in the feces of animals and birds and are transmitted in affluent communities in Europe and North America which have high standards of sanitary facilities and hygiene. This suggests that they will not be greatly influenced by limited sanitary improvements among poor people in the tropics.

III. Soil-transmitted helminths. This category contains several species of parasitic worm, the eggs of which are passed in faeces. They are not immediately infective, but first require a period of development in favourable conditions, usually in moist soil. They then reach their next human host by being ingested, for instance on vegetables, or by penetrating the soles of the feet. Since the eggs are not immediately infective, personal

cleanliness has little effect on their transmission, but any kind of latrine that helps to avoid faecal contamination of the floor, yard or fields will limit transmission. However, if a latrine is poorly maintained and the floor becomes soiled, it can then become a focus for transmission. The eggs of these worms can survive for months between hosts, so that adequate treatment of excreta is essential if they are to be reused on the land.

IV. Beef and pork tapeworms. The beef tapeworm (Taenia saginata) and pork tapeworm (T. solium) live as adult worms in the intestines of humans. Eggs are passed in human feces and must be ingested by cattle or pigs (depending on the species) in which they develop to form cysts in the muscles and various other sites. Human beings are reinfected by eating the cysts in raw or undercooked meat. Transmission is prevented if human excreta are disposed of in latrines where cattle or pigs cannot go and if sewage and nightsoil are adequately treated prior to use for fertilizing fodder crops or pasture.

V. Water-based helminths. All of the water-based diseases already mentioned, except for Guinea worm, are caused by helminths which are passed in excreta and must then pass a stage in the body of an aquatic host, usually a snail. They then re infect humans through the skin or when insufficiently cooked fish, crabs, crayfish or aquatic vegetation are eaten. Appropriate excreta disposal methods can help to control them by preventing untreated excreta from reaching water in which the aquatic hosts live. However, in all cases except Schistosoma mansoni and S. haematobium, animal feces are a source of infection so that measures restricted to human excreta can have only a partial effect. Since one egg can multiply in the snail host to produce a thousand larvae, a low level of fecal contamination may still be enough to maintain transmission.

VI. Excreta-related insect vectors. These are of two main kinds. First, the Culex pipiens group of mosquitoes, found throughout most of the world, breeds in highly polluted water, for instance in septic tanks and flooded pit latrines, and transmits Bancroftian filariasis in some regions. Second, flies and cockroaches breed where feces are exposed. They carry pathogenic organisms on their bodies and in their intestinal tracts. Their nuisance value is great, but their importance in spreading excreted pathogens is uncertain.

Control of Excreta-Related Infections

The potential impact of sanitation improvements, and of improvements in personal hygiene, on the various categories of excreta-related disease, is summarized in Table 2.4. For most of these diseases, an improvement in

excreta disposal is only one of several measures required for their control. It is essential that people of all ages use the improved toilets and keep them clean. The disposal of children's excreta is just as important as that of adults. Studies in the past have often failed to detect beneficial effects from improved sanitation because although latrines were built, they were not kept clean and were not used by children or by adults when working in the fields.

2.2.3. WATER AND EXCRETA RELATED INFECTIONS

Separate classification of water- and excreta-related infections are summarized above and in Table 2.2 and Table 2.4. These two classifications are overlapping in that many water-related infections are excreta related and most excreta-related infections are water related. In projects that combine interventions in both water supply and excreta disposal, the use of the two classifications may cause confusion. In this final section, therefore, the water- and excreta-related infections are brought together in groups having similar epidemiological features and are tabulated in a way that highlights their amenability to prevention through interventions in water supply, excreta disposal, or hygienic behaviour (Table 2.6). The groupings considered are

1. The diarrhea-causing infections and enteric fevers
2. Poliomyelitis and hepatitis A
3. Worms with no intermediate host
4. Worms with intermediate stages in the pig or cow
5. Worms with aquatic intermediate stages
6. Skin and eye infections and louse-borne infections
7. The infections transmitted by water-related insects

The Diarrhea-Causing Infections and Enteric Fevers

The Diarrheal diseases are, when combined with malnutrition, a major cause or the major cause of childhood disease and death throughout the developing world. They are the most important group of water- and excreta-related infections. Diarrheal diseases are caused by a variety of excreta viruses, bacteria, and protozoa. In all cases transmission is fecal-oral and both water-borne and water-washed modes of transmission occur. It may be true that, in condition of extreme poverty, water-washed transmission

(e.g. person-to-person via fingers, food, utensils) is the dominant mode. This may explain why some studies have shown that improvements in water quality have not been accompanied by a reduction in diarrheal disease incidence. A Study in Bangladesh has shown that handwashing can be a very effective means of reducing the transmission of shigellosis.

Figure 2.1 represents the major transmission routes for diarrheal diseases and enteric fevers (typhoid and paratyphoid) and indicates the modes of action of several strategies for interrupting transmission. The relative merits of the alternative control measures are further elaborated in Table 2.7, which also indicate the likely differential effect of control measures on viral, bacterial, and protozoal diarrheas. There are many areas of uncertainty and ignorance and diarrheal disease research is a fast moving field at the present time. In particular, the next few years will see a great improvement in our understanding of the epidemiology and prevention of diarrheas caused by viruses E. coli and Campylobacter.

Poliomyelitis and Hepatitis A

Poliomyelitis and hepatitis A are entirely different infections but they have several epidemiological features in common. Transmission is fecal-oral; infective doses are probably low; infection usually confers long-lasting immunity; and transmission continues even under conditions of optimal water supply, hygiene, and excreta disposal. Water-borne transmission occurs but is probably of limited importance compared to person-to-person transmission. Prevention of poliomyelitis is achieved by vaccination and the prospects for an effective vaccine against hepatitis A are excellent. Figure 2.2 represents the major transmission routes for poliovirus and hepatitis A virus and indicates the modes of action of several strategies for interrupting transmission. The relative merits of the alternative control measures are further elaborated in Table 2.7.

Worms with No Intermediate Host

Several excreted helminths that infect humans have no obligatory intermediate host. The adult worms live in the human intestine, and their eggs or larvae are passed in the feces (or, if not actually in feces, then at least via the anus). The eggs of *Ascaris* and *Trichuris* must remain in a suitable environment (usually warm, moist soil) for 5-6 weeks before they become infectious. Reinfection is then oral, by ingesting food or dirt contaminated by infective eggs. The eggs of the hookworms also develop in warm, moist soil. After one week or more infective larvae are formed that cause reinfection by penetrating the unbroken skin,

usually of the foot. Figure 2.3 and Table 2.7 describe the transmission routes and control measures for these common intestinal worms.

Worms with Intermediate Stages in the Pig or Cow

The beef and pork tapeworms (Taenia saginata and T. Solium) are parasites with life-cycles that are theoretically easy to interrupt through correct management of human feces. The adult worms live only in the intestine of humans. Eggs, usually contained in worm segments, are passed anally and usually in the feces. These eggs must be eaten by a cow or pig (for T. saginata and T. solium respectively) following which they hatch and form encysted larvae in the muscle, tongue, liver, or other site. Humans are reinfected by eating inadequately cooked beef or pork containing cysts. Transmission and control of these tapeworms are described in Figure 2.4 and Table 2.7.

Worms with Aquatic Intermediate Hosts

A fascinating array of worms infect humans only having passed through developmental states in one or more aquatic hosts (in other words they are water based). Among them are infections like schistosomiasis which are of major public health importance in many countries in Africa, some areas of Middle East and China and infections like clonorchiasis which are of some public health importance in a few countries like China, HongKong, Korea, Vietnam etc. Of particular importance in India among this group is the disease caused by Guinea worm infection.

Water-Borne Reinfection

Guinea worm or Dracunculus medinensis requires an aquatic intermediate host, and reinfection in man is always and only water-borne. Female worms mature in the deep tissues and then migrate to lie subcutaneously in a limb. Numerous larvae develop within the body of the female which induces a blister in the skin, which breaks down. The female exposes her prolapsed uterus and the larvae are discharged whenever water is sensed by the worm. The life-cycle continues if these larvae reach water containing copepods Cyclops, which eat the larvae. Development to the third stage larvae takes place in the body of the cyclop and these are infective to human if ingested. Guinea worm is a unique water related infection in that it can be eradicated solely by simple improvement in community water supply. Measures that prevent larvae entering wells and other water sources (e.g. slow sand filtration) will eliminate Guinea worm transmission (Figure 2.5 and Table 2.7)

Skin, Eye, and Louse-Borne Infections

This mixed group of infections are not excreta related and are not water-borne but are transmitted in conditions of poor personal cleanliness (Figure 2.6 and Table 2.7)

Skin infections are extremely common and varied in the tropics. They are a very major cause of mild ill-health and can be personally disfiguring with consequent social distress. Superficial fungal infections are common in the moist tropics, as are various types of skin sepsis and ulcer of bacterial origin. In some regions the prevalence of scabies exceeds 50% among school children and the burrows made by the mites frequently become infected by bacteria. Transmission of these skin infections is by close contact; skin-to-skin or via clothes or bed linen.

Eye infection is a major public health problem in nearly all developing countries. Most serious of the common infection is trachoma, which is particularly prevalent in arid areas of India. Trachoma often leads to impaired vision and sometimes to blindness. Various forms of conjunctivitis (especially acute bacteria) are also very common, though usually without serious clinical consequences. Transmission is by direct eye-to-eye transfer of infective discharge by fingers, clothing or flies.

Diseases transmitted by body louse i.e. louse borne typhus caused by Rickettsia prowazeki and louse borne relapsing fever caused by Borrelia recurrentis can be reduced by controlling louse population and this can be achieved by increased body and clothes washing.

Infections Transmitted by Water-Related Insects

A large group of infections, several of them of major international public health importance, are transmitted by flies or mosquitoes which breed in water or bite near water. Only four will be discussed here : malaria, yellow fever, dengue and Bancroftian filariasis.

Malaria

Malaria is one of the most serious and widespread diseases of our time. It is caused by various species of the protozoon Plasmodium and is transmitted by various species of the mosquito Anopheles. Reduction of Anopheles breeding sites requires a detailed knowledge of the precise ecology of the main vector species in the given location. Domestic water supply projects are unlikely to reduce the number of breeding sites. In some arid areas malaria transmission is highly seasonal, occurring only when the rains create suitable breeding sites. In such areas it is

possible that the development of a water supply could create pools or puddles that would extend into the dry season and prolong the period of malaria transmission.

Yellow Fever and Dengue

Yellow fever and dengue are considered together because they are both caused by viruses transmitted mainly in urban areas from human to human by the mosquito Aedes aegypti. It must be noted however, that though Dengue is widely prevalent in India, outbreak of Yellow Fever do not occur. A. aegypti is a peridomestic mosquito that breeds in almost any small collection of rainwater or piped water. Favourite sites include jars, cans, gutters, cisterns, coconut shell and car tyres. A water supply and excreta disposal scheme that provides good drainage and reduces the need to store water may reduce breeding, although rainwater sites will be unaffected.

Bancroftian filariasis

Bancroftian filariasis is the mosquito-borne infection of greatest relevance because some water and sanitation projects have the potential to make matters considerably worse. Bancroftian filariasis on the East Africa coast, in northeast Africa, the Middle East, Asia, and Latin America is transmitted mainly by members of the Culex pipiens complex and particularly by Culex quinquefasciatus (previously known also as C.p. fatigans). This mosquito is a major nocturnal nuisance in many tropical cities and can breed in highly polluted waters. When the flow of piped water into a town or city increases, in the absence of adequate sewerage, drainage and sullage disposal systems, many stagnant and polluted bodies of water are created. Poorly maintained septic tanks, cesspools, and flooded pit latrines also tend to proliferate in rapidly growing tropical cities. These changes provide greatly increased breeding opportunities for Culex quinquefasciatus with consequent increase in the biting population. This in turn may lead to increased transmission of Wuchereria bancrofti with the result that the prevalence and intensity of infection increase and the serious clinical consequences (elephantiasis and hydrocele) are seen more frequently and in lower age groups. Unless the greatest care is taken, water and sanitation projects in urban areas may be accompanied by an increase in one of the most disfiguring diseases that afflict humankind.

2.2.4. Chemicals Causing Water Related Diseases (Table 2.8)

Arsenic :

The sources of Arsenic pollution in water are generally industrial wastes, contaminating water bodies, either directly or by leaching through soil and also some agricultural insecticides. Though rare, natural arsenic pollution can occur in groundwater from arseniferous belts in specific geomorphological conditions, as has been found in some areas of West Bengal.

The symptoms of chronic arsenic poisoning include various types of dermatological lesions, muscular weakness, paralysis of lower limbs etc. Arsenic is potential carcinogen and skin and lung cancer can occur after prolonged exposure.

Mercury :

Mercury poisoning can occur through food and water. The source of pollution is almost exclusively industrial waste. It must be noted however, that chronic mercury poisoning is less often water borne. Industrial wastes contaminate water bodies and is taken up by phyto and zooplanktons. These are then biomagnified in fish and other sea foods, eaten by man. In organic mercury poisoning various types of neural damages occur ranging from numbness, speech impairment to paralysis and death. With inorganic mercury poisoning renal damages can occur.

Nitrates :

Increase in nitrate levels in surface and groundwater is primarily due to agricultural fertilisers and manure, animal dung and other sources of nitrogenous materials in the environment. Human body is capable of reducing nitrates to nitrites in the digestive system. There are two distinct threats to human health from nitrites. First, nitrites can oxidise the haemoglobin to methemoglobin, which is incapable of transporting oxygen in the blood stream. This illness, known as methemoglobinaemia or blue baby disease, is especially harmful to infants since they are particularly susceptible to asphyxiation by methemoglobinaemia. Secondly, nitrites can combine with various amines in the gastrointestinal tract to form nitrosamines (particularly in low acidity conditions) some of which are carcinogenic.

Fluoride :

Fluoride occurs naturally in water. Though most waters contain below 1 mg of fluoride per litre, there are areas that are rich in fluoride containing minerals, where fluoride content of water can be very high.

There is good evidence to show that the presence of fluoride in water results in a substantial reduction of dental caries in both children and adults.

However long term consumption of water above the permissible level can give rise to dental fluorosis, manifested by mottling of teeth and, higher exposures can give rise to skeletal fluorosis, a crippling disease in which bone structure is affected.

There are several other inorganic chemicals like cadmium, lead and organic chemicals like pesticides polynuclear aromatic hydrocarbons etc. that can cause health hazards in man after prolonged exposure above permissible levels.

Also, radioactive substances, in surface and groundwater, either from natural sources or from human activities, can pose serious health hazards and has become an important issue internationally after the Chernobyl accident.

However these are as yet, not of great public health importance in India.

2.3. CONCLUSION

It is estimated that in India alone, 1.5 million children below 5 years die from diarrhoeal disease every year. Despite tremendous advances in medical knowledge and practice, morbidity and mortality due to water and excreta related communicable diseases continue to remain a heavy burden for all governments in the developing countries.

Water and sanitation has been accepted today, as a priority issue in health sector. But it is also clear that the health impact cannot be achieved by a simplistic policy of only supplying clean water. Only carefully designed programmes that integrate water quality improvements with improvement in water availability, sanitation and hygiene education will achieve substantial reductions in the transmission of water and excreta related infections.

TABLE 2.1

The Four Routes of Water-Related Infection Transmission
and the Preventive Strategies Appropriate to Each Route

Transmission route	Preventive strategy
Water - borne	<p>Improve quality of drinking water</p> <p>Prevent casual use of other unimproved sources</p>
Water-washed	<p>Increase water quantity used</p> <p>Improve accessibility and reliability of domestic water supply</p> <p>Improve hygiene</p>
Water-based	<p>Decrease need for contact with infected water^a</p> <p>Control snail populations</p> <p>Reduce contamination of surface water^b by excreta</p>
Water-related insect vector	<p>Improve surface water management</p> <p>Destroy breeding sites of insects</p> <p>Decrease need to visit breeding sites</p> <p>Use mosquito netting</p>

a Applies to schistosmiasis only.

b The preventive strategies appropriate to the water-based worms depend upon the precise life cycle of each and this is the only general prescription that can be given.

TABLE 2.2

Environmental Classification of water-Related Infections

Category	Infection	Pathogenic agent
1. Faecal-oral	<u>Diarrheas and dysenteries</u>	
(water-borne or water-washed)	<u>Amebic dysentery</u>	P
	<u>Balantidiasis</u>	P
	<u>Campylobacter enteritis</u>	B
	<u>Cholera</u>	B
	<u>E. coli diarrhea</u>	B
	<u>Giardiasis</u>	P
	<u>Rotavirus diarrhea</u>	V
	<u>Salmonellosis</u>	B
	<u>Shigellosis</u> (bacillary dysentery)	B
	<u>Yersiniosis</u>	B
	<u>Enteric fevers</u>	
	<u>Typhoid</u>	B
	<u>Paratyphoid</u>	B
	<u>Polioomyelitis</u>	V
	<u>Hepatitis A</u>	V
	<u>Leptospirosis</u>	S
	<u>Ascariasis</u>	H
	<u>Trichuriasis</u>	H
2. Water-washed		
Skin and eye infections	<u>Infectious skin diseases</u>	M
	<u>Infectious eye diseases</u>	M
Other	Louse-borne typhus	R
	Louse-borne relapsing fever	S
3. Water-based		
Penetrating skin	Schistosomiasis	H
Ingested	<u>Guinea worm</u>	H
	Clonorchiasis	H
	Diphyllobothriasis	H
	Fasciolopsiasis	H
	Paragonimiasis	H
	Others	H
4. Water-related insect vector		
Biting near water	Sleeping sickness	P
Breeding in water	<u>Filariasis</u>	H
	<u>Malaria</u>	P
	River Blindness	H
	<u>Mosquito-borne viruses</u>	
	Yellow fever	V
	<u>Denque</u>	V
	Others	V

*B = bacterium ; P = protozoan ; S = spirochete ; M = miscellaneous ;

H = helminth ; R = rickettsia ; V = virus.

TABLE 2.4

Environmental Classification of Excreta-Related Infections

Category	Infection	Pathogenic agent	Dominant transmission focus	Major control measures
I. Fecal-oral (nonbacterial) Nonlatent, low infectious does	Poliomyelitis	V	Person-to-person contact	Domestic water supply
	Hepatitis A	V	Domestic contamination	Improved hygiene
	Rotavirus diarrhea	V		Provision of toilets
	Amebic dysentery	P		Health education
	Giardiasis	P		
	Balantidiasis	P		
	Enterobiasis Hymenolepiasis	H H		
II. Fecal-oral (bacterial) Nonlatent, medium or high infectious does, moderately persistent and able to multiply	Diarrhea & dysenteries		Person-to-person contact	Domestic water supply
	Campylobacter enteritis	B	Domestic contamination	Improved housing
	Cholera	B	Water contamination	Provision of toilets
	E. coli diarrhea	B	Crop contamination	Excreta treatment prior to reuse or discharge
	Salmonellosis	B		Health education
	Shigellosis	B		
	Yersiniosis	B		
	Enteric fevers Typhoid Paratyphoid	B B B		
III. Soil-transmitted helminths Latent and persistent with no intermediate host	Ascariasis	H	Yard contamination	Provision of toilets with clean floors
	Trichuriasis	H	Ground contamination in	Excreta treatment prior
	Hookworm	H	Communal defecation area	to land application
	Strongyloidiasis	H	Crop contamination	
IV. Beef and pork tapeworms Latent and persistent with cow or pig intermediate host	Taeniasis	H	Yard contamination Field contamination Fodder contamination	Provision of toilets Excreta treatment prior to land application Cooking and meat ins- pection

Contd...2

TABLE 2.4 (Contd.)

Category	Infection	Pathogenic † agent	Dominant transmission focus	Major control measures
V. Water-based helminths Latent and persistent with aquatic intermediate host(s)	Schistosomiasis	H	Water contamination	Provision of toilets Excreta treatment prior to discharge Control of animals harboring infection Cooking
	Clonorchiasis	H		
	Diphyllobothriasis	H		
	Fasciolopsis	H		
	Paragonimiasis	H		
VI. Excreta related insect vectors	Filariasis (transmitted by Culex pipiens mosquitoes)	H	Insects breed in various faecally contaminated sites	Identification and elimination of potential breeding sites Use of mosquito netting
	Infections in Categories I-V, M especially I and II, which may be transmitted by flies and cockroaches			

† B = bacterium; P = protozoan; M = miscellaneous; H = helminth; V = virus.

CATEGORY V

<i>Clonorchis sinensis</i> 9	100	6 weeks	Life of fish	Yes 10	L	No	Yes	Snail and fish	
<i>Diphyllobothrium latum</i> 9	10000	2 months	Life of fish	No	L	No	Yes	Copepod and fish	
<i>Fasciola hepatica</i> 8	?	2 months	4 months	Yes 10	L	No	Yes	Snail and aquatic plant	
<i>Fasciolopsis buski</i> 8	1000	2 months	?	Yes 10	L	No	Yes	Snail and aquatic plant	
<i>Gastrodiscoides hominis</i> 8	?	2 months (?)	?	Yes 10	L	No	Yes	Snail and aquatic plant	
<i>Heterophyes heterophyes</i> 9	?	6 weeks	Life of fish	Yes 10	L	No	Yes	Snail and fish	
<i>Metagonimus yokogawai</i> 9	?	6 weeks (?)	Life of fish	Yes 10	L	No	Yes	Snail and fish	
<i>Paragonimus westermani</i> 9	?	4 months	Life of crab	Yes 10	L	No	Yes	Snail and crab or crayfish	
Schistosoma									
<i>S. haematobium</i> 8	4 per milli-liter of urine	5 weeks	2 days	Yes 10	L	Yes	No	Snail	
<i>S. japonicum</i> 8	40	7 weeks	2 days	Yes 10	L	Yes	Yes	Snail	
<i>S. mansoni</i> 8	40	4 weeks	2 days	Yes 10	L	?	No	Snail	
<i>Leptospira</i> spp.	urine (?)	0	7 days	No	L	Yes (?)	Yes	None	

L Low (<100); M medium (~10000); H high (>1000000).

? Uncertain.

1. Typical average number of organisms per gram of feces (except for *Schistosoma haematobium* and *Leptospira*, which occur in urine).

2. Typical minimum time from excretion to infectivity.

3. Estimated maximum life of infective stage at 20 deg - 30 deg C.

4. Includes polio-, echo-, and coxsackieviruses.

5. Multiplication takes place predominantly on food.

6. Includes enterotoxigenic, enteroinvasive, and enteropathogenic *E. coli*.

7. *Ancylostoma duodenale* and *Necator americanus*.

8. Latency is minimum time from excretion by man to potential reinfection of man. Persistence here refers to maximum survival time of final infective stage. Life cycle involves one intermediate host.

9. Latency and persistence as for *Taenia*. Life cycle involve two intermediate hosts.

10. Multiplication takes place in intermediate snail host.

TABLE 2.3

Basic epidemiological features of excreted pathogens by environmental category

Pathogen	Excreted load 1	Latency 2	Persistence 3	Multiplication outside human host	Median infective dose (LD 50)	Significant immunity ?	Major nonhuman reservoir ?	Intermediate host
CATEGORY I								
Enteroviruses 4	10000000	0	3 months	No	L	Yes	No	None
Hepatitis A virus	1000000 (?)	0	?	No	L (?)	Yes	No	None
Rotavirus	1000000 (?)	0	?	No	L (?)	Yes	No (?)	None
Balantidium coli	?	0	?	No	L (?)	No (?)	Yes	None
Entamoeba histolytica	100000	0	25 days	No	L	No (?)	No	None
Giardia lamblia	100000	0	25 days	No	L	No (?)	Yes	None
Enterobius vermicularis	Not usually found in feces	0	7 days	No	L	No	No	None
Hyænolepis nana	?	0	1 month	No	L	Yes (?)	No (?)	None
CATEGORY II								
Campylobacter fetus ssp. jejuni	10000000	0	7 days	Yes 5	H (?)	?	Yes	None
Pathogenic Escherichia coli 6	100000000	0	3 months	Yes	H	Yes (?)	No (?)	None
Salmonella S. typhi	100000000	0	2 months	Yes 5	H	Yes	No	None
Other salmonellae	100000000	0	3 months	Yes 5	H	No	Yes	None
Shigella spp.	10000000	0	1 month	Yes 5	M	No	No	None
Vibrio cholerae	10000000	0	1 month (?)	Yes	H	Yes (?)	No	None
Yersinia enterocolitica	100000	0	3 months	Yes	H (?)	No	Yes	None
CATEGORY III								
Ascaris lumbricoides	10000	10 days	1 year	No	L	No	No	None
Hookworms 7	100	7 days	3 months	No	L	No	No	None
Strongyloides stercoralis	10	3 days	3 weeks (free-living stage much longer)	Yes	L	Yes	No	None
Trichuris trichiura	1000	20 days	9 months	No	L	No	No	None
CATEGORY IV								
Tania saginata and T. solium 8	10000	2 months	9 months	No	L	No	No	Cow (T. saginata) or pig (T. solium)

ANNEXURE - I

ADVANTAGES AND DISADVANTAGES OF DIFFERENT MEDIA, MATERIAL AND TECHNIQUES FOR COMMUNICATION SUPPORT

A. PEOPLE-BASED	MAIN ADVANTAGES	MAIN DISADVANTAGES	COMMENTS
1. Public meetings and lectures.	Easy to arrange. Reach many people. Can have more than one speaker. Create public interest and awareness. Stimulate follow-up discussion.	Audience is usually passive. Speakers may not understand audience's needs. Difficult to assess success. Audience might not learn the main points.	Handouts should be used. Presentation should be clear. Use visual aids when possible. Audience should be encouraged to raise questions and to participate. Speaker should establish two-way communication.
2. Group discussion.	Builds group consciousness. Individual members of the group can understand where each member stands in regard to the discussed issue: provide chances for exchanging opinions and increase tolerance and understanding.	Some members may dominate. Sometimes difficult to control or to keep focusing on the main issue. Requires trained leaders.	Should be used with an interested audience to discuss a definite problem. Procedure should be flexible and informal. Summary of discussion should be made by group members regarding its stand on the issue discussed. Requires the selection of good chairman.
3. Role playing.	Facts and opinions can be presented from different viewpoints especially on controversial issues. Can encourage people to reevaluate their stand on issues and can invite audience participation. Deepens group insight into personal relations.	Cannot be used in community meetings. Some role players may feel upset by playing a role they do not agree with. Requires careful preparation for the selection of the issue and actors. Careful preparation is essential.	Can only be used in training courses. Follow-up discussion should focus on the issue rather than on actors' performances. Source material about the issue should be provided to the actors to prepare their arguments.

Contd...

municipalities, or others involved in sanitation frequently have little understanding of communication support, or appreciation of its importance. This is particularly the case where most of the experience in the past has been with conventional sewerage rather than low-cost alternatives. It is therefore another obstacle to be overcome: the first action in communication support is often to change the views and attitudes of decision-makers about the need to include it in a programme.

Difficulties in coordination. In the actual planning and implementation process, coordination of communication activities with upgrading or construction ones has proved to be another difficulty. A major cause seems to be timing: once the construction schedule is finalized, start-up of communication activities may already have been delayed.

3.14. Pre-Testing, Monitoring and Evaluation

Finally, a word about associated pre-testing and monitoring and evaluation. These are vital in determining the best communication plan, and adjusting it, if necessary, during implementation. They also cost money. Therefore they need to be allowed for in the budget.

In order to take the results of monitoring, and sometimes of evaluation (e.g., of a pilot phase), into account, the communication plan itself should be fairly flexible, much more so than the latrine design. The engineer should not be surprised if the communication specialist argues for changing it considerably after the first year or so of implementation. It does not mean that the original plan was wrong: new information may have become available or other factors may have changed (such as the community's whole attitude as a result of the initial project activities) which call for resultant changes in communication. It is important to remember that communication support is an attempt to change human behaviour- and this is an area about which we are learning every day, and about which we will never know enough.

terms of timing calls for a degree of flexibility in the communication strategy to adjust to any changes in the construction schedule; this is usually achieved better with field workers than with a mass media-based approach.

Primary emphasis is on out-of-school activities.

Unless there is heavy involvement in school sanitation, it is usually more important to reach adults than children, because: (a) adults are the main decision makers on sanitation in the community and the household; (b) it is usually important to encourage an immediate response or change; the next generation is not soon enough.

Phasing is usually a good idea. At this stage of our knowledge of the subject it is advisable, when possible, to start with some sort of a pilot test of the communication strategy, to evaluate and adapt the design as needed, and only then to expand.

3.13. Main Difficulties Likely to be Encountered

Experience so far suggests that there are three main problems which can be expected in planning and implementation of communication activities to support sanitation projects or programmes. These are: (a) the question of institutional responsibility; (b) lack of interest or understanding about the subject; and (c) difficulties in coordination with construction or upgrading activities.

Institutional responsibility. The question of institutional responsibility may well involve the project in a series of difficult decisions. Typically, the agency responsible for construction will be a "hardware" -oriented agency with little experience of software support. Should it go to the trouble of establishing a new unit to deal with the software aspects of its work (a unit which may become partially or totally redundant after completion of the project)? Or should it, on the other hand, seek to enter into collaborative agreements with the traditional software agencies - in particular the Ministries of Health and Education - which may involve delays while these agencies are reoriented to sanitation programme support, may lead to loss of control over essential project components, and can result in difficulties in budgeting, staffing and coordination generally? At present there is no final solution to this question, with each case decided individually. As in the case of costs (see "Costs need to be kept down" under 3.12) this is an area about which we are still learning.

Lack of interest or of understanding. Sanitation and water supply agencies, Ministries of Planning,

The communication plan should be simple. This is important for several reasons. More often than not, the implementing agency for communication support is institutionally weak and unable to cope with an ambitious and managerially complex activity, or it may give low priority to software (as would often be the case where the agency responsible for latrine construction is also the one that will take responsibility for communication support). While institution-building activities may be desirable, time constraints frequently do not allow proper staff training, motivation, or hiring of new staff. Also, the leverage that a comparatively small component can have on enforcing major institutional changes will be limited. It is therefore usually advisable to try to adjust the component to existing organisational structures and management and technical skills, together with any additional skills that can be brought in temporarily through short-term consultants or technical assistance. Minimising managerial complexity also requires that the number of agencies involved in implementation should be limited.

Impact has to be rapid. This is particularly the case where pre-construction and construction stage communication activities are concerned, since otherwise they may hold up the building process. In order to serve the project effectively, communication activities not only have to affect what people think or know, but how they act. This implies:

- (a) putting primary emphasis on reaching adults directly through non-formal activities, rather than trying to reach adults through children; and
- (b) wherever possible, relying on person-to person contacts reinforced by media or materials, but not on media alone, since the former strategy is more likely to effect rapid changes in people's behaviour.

Timing has to be carefully worked out and accurate. That is, the information, motivation and education activities have to be carefully tied in with construction, and operation and maintenance activities. Firstly, this means that they have to be ready in time, even though the lead time available is often very short. Therefore they should, to the extent possible, build on already existing structures, activities and materials, rather than attempt to set up new ones (this also keeps costs down). Secondly, the emphasis on timing requires that every communication activity be specifically related to stages in construction or operation and maintenance in as much detail as possible (and the project engineer, therefore, needs to make the construction schedule available as soon as possible to the communication specialists). Thirdly, good coordination in

- (i) past experience (successful or unsuccessful in using one or other of the "building blocks").

3.12. Special Considerations in Planning Communication Activities for Sanitation Programmes

There are a number of special considerations which must be kept in mind when planning communication components for low-cost sanitation projects or programmes. Those discussed below are general enough to allow the engineer/mission leader or project officer to satisfy himself that they are adequately covered in the work of the communication specialist.

Costs need to be kept down. These sanitation programmes are designed to benefit the poor, and every effort is being made to reduced the costs of the physical installations. A corresponding effort should be made to keep the costs of communication support activities within reason. However, no clear rule-of-thumb has yet been developed which indicates what is "reasonable" in this context, and costs will, of course, vary according to the problems communication activities have to deal with. There may be a tendency, particularly at a time when there is relatively little hard evidence to support one level of expenditure rather than another, for project managers to regard the "additional " costs of communication support as excessive. Such an attitude ignores two important aspects of sanitation projects. Firstly, that communication support is an essential element if the overall project package is to have the desired impact; it cannot be regarded as an optional extra component. Secondly, on-site sanitation will in most cases remain by far the least-cost solution to a community's needs irrespective of communication support costs. For example, if in a particular case the costs of providing on-site sanitation were 15% of those of conventional sewerage and disposal, then the addition of a communication support component costing 20% of the "hardware" costs--a percentage that might at first alarm planners--would still only increase the cost of the on-site option to 18% of the off-site alternative. Further research and case studies on this question are needed. Meanwhile, it will normally be useful at an early point in planning to prepare several proposals, estimate the costs and likely impact of each, and, as with most engineering problems, select the most cost-effective.

There may need to be models at various stages of completion so that both customers and builders can understand exactly what is involved.

Volunteers: These may be formal or informal leaders who are already in the area and have good relations with and influence people who should be included in the latrine programme or workers of non-governmental organizations (NGOs) or private voluntary organizations (PVOs) if they are available in large enough numbers. A major argument for involvement of local volunteers is that they are likely to be fairly permanent residents of the area and therefore could continue their input into operation and maintenance stage; they may even be able to help expand the programme after the responsible construction agency moves on. They are also likely to be knowledgeable about people's preferences, their ability and willingness to pay or provide labour, and the best timing of any such contributions. Finally, they allow considerable savings--if their commitment to the sanitation activities can be ensured. If it cannot, then it is better not to rely on them as the key element in a communication plan.

3.11. Tailoring Communication Packages to Particular Situations

The communication specialist is likely to take the following factors into account in deciding how the communication "building blocks" described above should be combined in a given sanitation programme or project:

- (a) the type of people to be reached, and where they are;
- (b) the availability of or easy access to each of the "building blocks";
- (c) the scale and geographic distribution of the latrine project or the programme;
- (d) the type and difficulty of the problems to be addressed;
- (e) the available budget (or a judgement on what is "reasonable");
- (f) the commitments and capabilities of the responsible institutions;
- (g) existing organisational arrangements, responsibilities and experience in this area;
- (h) existing timing constraints (established by the construction programme or by other factors);

Mass Media (such as radio, television, newspapers and billboards) which are free standing (that is, normally do not require someone to be there, close to the audience, to transmit the message) can serve to promote the programme in general and to make it and its objectives widely known. But they usually reach an audience larger than the immediate programme beneficiaries. This may be valuable when the wider audience needs to be encouraged to participate in the narrower programme (for example, if tariff increases for sewer service are envisaged to help finance a sanitation programme or if some aspects of community behaviour, such as indiscriminate dumping of garbage, threaten the narrower programme). It also serves to make the sanitation programme more highly "visible" and so may give it political momentum and boost the morale of the programme staff. On the other hand, mass media are extremely difficult to coordinate precisely with the sanitation programme: at least in its initial stages, the programme is likely to have limited delivery capacity, and mass media may give rise to unfulfilled expectations and so to disillusion. Mass media are also unlikely to effect the necessary behavioural changes on a wide scale, except in the case of very simple and easy to change behaviours and in a very homogeneous situation, where one set of messages will have general relevance; this rarely applies in sanitation programmes.

Local media and materials, in contrast, reinforce the efforts of field workers by giving their efforts greater audience attention, better impact and by spreading them more widely. Such materials may include cassette/slide presentations, films, charts and other similar media. Local programme staff may need to be specially trained to use materials and should, to the extent possible, be involved in their selection and pre-testing. Traditional media (such as puppet shows, folk theatre, or community debates) can also be effective, and can be combined with more modern media (for example, the use of loudspeakers with a puppet theatre, or suitable leaflets or posters used in combination with puppet shows). These local media and materials can usually respond better to different local situations and to changes in programme timing or detailed implementation procedures than can mass media. (See Annex I for further information on media, materials and techniques.)

Models of the available latrines (preferably actual size) or sometimes scale models of entire blocks (e.g., with a small bore sewer system) can be located in places where they can be viewed by large numbers of the intended beneficiaries and where questions can be asked and answered (e.g., at the community meetings, at the local office of the responsible agency, the municipal office yard, in the market place--with an educator /attendant on the spot).

they are reasonable.

per household served with a latrine, or an equivalent measurement, and detailed costing for at least the first year of implementation);

Checks for compatibility with agency or donor procurement requirements.

(h) procurement procedures (if relevant)

Checks on coordination with construction/upgrading schedule.

(i) implementation schedule (in as much detail as possible, particularly for the first year);

(j) poverty or other target group impact (depending on project objectives and possibly on the requirements of the likely funding agency).

3.10. Strategy Building Blocks

The communication package or component usually includes one or more of the elements in the following paragraphs. The relative importance of each will vary, depending on the strategy selected.

Field workers. These may be health auxiliaries, sanitation auxiliaries and inspectors, promoters, health educators or others, but rarely do they have responsibility solely for supporting latrine construction, upgrading and operation and maintenance. As a result, special controls and incentives may have to be worked out to make sure that the field workers are there when needed, even if their input is later decreased or even phased out. Engineers or engineering assistants may also share responsibility for instructing and motivating householders on the more technical aspects during the construction stage (for instance, on how to install the latrine, build the superstructure, or use and take care of the new facility).

3. Prepares the detailed design of the communication package or component, which will usually include :

(a) institutional responsibilities, both overall and for specific aspects (such as staff training, design and pre-testing of materials or media messages, materials distribution, monitoring and evaluation);

(b) specific objectives

(c) identity of audiences, and relevant information about them (such as access to channels to be used);

(d) personal and media communication channels to be used and how they will operate (this should include the level of effort and duration of each activity, and which objectives each will focus on);

(e) timing of activities vis-s-vis the construction and operation and maintenance activities (i.e., before / during / after);

(f) plan for monitoring and evaluation;

(g) costs (to include incremental costs

Provides latest information on technology option(s) selected or being made available for selection by beneficiaries, on delivery systems and cost-recovery/self-help arrangements, and updates this as further changes occur.

Provides latest construction or upgrading schedule.

Reviews linkage into general project/programme monitoring and evaluation activities.

Checks incremental costs per latrine constructed to ensure that

to IME or similar inputs.

2. Identifies a communication package or component, which at this stage would usually include initial proposals (which may later be revised) on:

Reviews such arrangements to see how they fit in with overall institutional arrangements for the project/programme.

Checks these objectives to make sure they are correct in technical terms.

Checks against construction schedule to see whether, e.g., piloting is feasible.

- (a) institutional responsibilities (or two or three alternative arrangements to be discussed further by government);
- (b) specific objectives (wherever possible, defined in behavioral terms);
- (c) type of communication strategy or package that will be used or, again, two or three alternatives from which a most cost-effective alternative would later be selected;
- (d) coverage and timing vis-a-vis the latrine project or programme (e.g., covering all of it; only the lower-income areas; or one or two pilot communities);
- (e) costs (in general terms, to provide an initial estimate), or again, two or three alternative cost scenarios for different strategies.

cases, the critical person for the communication planner to liaise with is the engineer. An initial briefing by the engineer, as well as later meetings to check and cross-check communication decisions with engineering ones, will be essential. In the ideal working situation, the cross-checking works both ways: the communication specialists also check those engineering decisions that rely on client response, to make sure they are feasible.

3.9. Steps Involved in Planning

In general terms, the planning of a communication component of a sanitation project usually proceeds as follows:

<u>Role of the Engineer or other Team Members</u>	<u>Task of the Communication Specialist</u>
Identifies overall project scope and objectives, technology options, strategy, timing, institutional arrangements, target areas.	1. Identifies specific needs for communication activities through: <ul style="list-style-type: none"> (a) review of the health and environmental situation of the populations involved, their sanitation conditions and related practices, beliefs, views or preferences; and resources (such as cash, time, or special skills);
Provides information on technology options being considered, delivery systems under review, cost-recovery/self-help expectations.	<ul style="list-style-type: none"> (b) review of the proposed technology options, delivery strategy, financial arrangements and assumptions made about response of the benefiting populations; (c) identification of specific problems or gaps between programme expectations and people's likely response, which would be amenable

Pre-construction:

- (c) encouraging demand (where no list of applicants exists or it is too small) through promotion or "advertising";

During construction:

- (d) smoothing the construction process by ensuring that the relationships between the programme and its beneficiaries develop as expected (through public relations; providing information to beneficiaries to help in selection of latrines; motivating local people to provide labour or materials if needed; and improving feedback to management);

During operation and maintenance:

- (e) increasing the life-span of facilities through motivating and educating beneficiaries on proper care and by discouraging destructive practices (such as breaking of the traps in the case of water-seal latrines);
- (f) taking some of the financial cost and workload off the public sector, through motivating and training people themselves to take a part in collection of payments or actual maintenance activities;
- (g) improving impact on health, through encouraging and teaching proper use and associated good hygiene habits.

3.8. The Planning Process

Communication support activities are planned in close association with the project or programme decisions on hardware, delivery system, cost-recovery procedures and institutional arrangements. It is therefore important to ensure that the person responsible for communication forms part of project team and so can have an ongoing dialogue with other team members such as engineers, financial analysts, economists and management specialists. If the team also includes a sociologist or anthropologist, then this person lays the basis for the communication component. If not, the communication specialist should be competent in background data collection and social analysis, so that he or she can perform a dual task. Most communication specialists (unless they only specialize in communication hardware) will be able to do this. Therefore, in most

of impact.

However, practice is never as tidy as theory. Many communication specialists are not qualified to do communication planning to support sanitation activities for any of a number of reasons: because of the type of training they may have received, their lack of development experience, lack of understanding of sanitation activities, and so on. Communication specialists are not always available. Others, such as health educators, community development specialists, sociologists and anthropologists may fill the role if they can handle the planning side and are familiar with sanitation activities. Care must be taken that overemphasis on the message and the media does not overwhelm the need for working within affordable budgets and feasible delivery systems.

Finally, there may be instances where engineers have to play a major role in planning simply because no-one else can be hired. In that case it is a good idea to recognize that such activities are not as easy to plan as they look. Three basic rules may help: (a) get a good understanding of your audience and the problems to be dealt with before you make decisions; (b) keep it simple; and (c) make arrangements for trying out everything first with people very like those in the project communities before full-scale implementation.

3.7. Specific Tasks that Communication Support can Perform in Sanitation Programmes

Communication activities play a supportive role in sanitation programmes or projects. That is, they serve to strengthen the parent project and help it achieve its objectives. They do this by providing critical input at certain key points (not all of them in every project, of course). They are summarized below (for fuller details, see Table 3.1) :

At the planning stage:

- (a) providing a better basis for planning by making explicit, through data collection, the important gaps that exist between people's actual interest, knowledge, behavior, etc., project expectations;
- (b) helping arrive at the best technology, delivery system, and financing and pricing mechanisms, through setting up a dialogue between planners and intended users (or their representatives -- such as leaders and community organizations);

- integrate;
- contract out.

The decision is a complicated one and several factors are involved. Here only a few words will be said on the subject, with emphasis on how the agency's long-term commitment or interest affects the decision.

Institutionalise: If the agency is convinced that it will have a long-term need for communication support, then it may choose to create a new unit or division within its existing institutional structure. However, this requires a fairly long-lead time, which is often not available.

Collaborate: The decision could, however, be to collaborate with another agency which has suitable experience and staff (which could be, for instance, a Ministry of Education or Health, a community development agency, or one or more voluntary agencies). This solution is attractive if the agency is unsure or cautious, does not have sufficient time or flexibility, or simply believes that such people and skills will not be needed after the project terminates.

Integrate: The third alternative, integration, occurs when the agency decides to build the duties and required skills on to existing staff (such as sanitation inspectors, health educators, or community development workers) through in-service training, as well as, at times, with provision of financial incentives. It may, however, hire specialized staff to supervise and coordinate activities. This approach allows the agency either to phase out or expand the function, in the light of its experience as the project develops.

Contract out: The fourth option is that of contracting out all or most of such activities to an outside entity, such as a university, an advertising firm, a private institute or organization. Probably this alternative is most suited to those communication activities which rely primarily on use of media rather than field staff.

3.6. Who plans it?

In theory, communication support activities are planned by communication specialists. If there is also a sociologist or anthropologist on the team, then they work in close cooperation, particularly on background data collection for the project and on monitoring and evaluation

Marketing: Marketing is the association of disciplines and techniques which are used in the design, pricing, distribution and promotion of goods and services. The major differences between it and communication support lie in: (a) the available budget and strategy used; and (b) in the community-wide and longer-term interests of the latter. Marketing usually has a much larger budget to work with, is more concerned with behaviors that are easier to change (such as change from one brand-name to another) and is satisfied with securing a reasonably small share of the market, whereas sanitation programs need to have a high percentage of acceptors and sustained usage if community and individual health benefits are to be fully realized. (Communication support is also often in the position of having to try to change long-standing practices which are closely interwoven with culture and with social structure.)

As a result, marketing makes greater use of short, intensive mass media campaigns and has the budget to conduct extensive background research and to design and implement such campaigns well. There are instances when communication support can also make use of such strategies, but only in the case of a very large and well-financed program. Even then they will almost always still need to rely upon a system of field workers, organization of groups of listeners or viewers, or at the least a system of dedicated volunteers.

Public relations: Public relations, on the other hand, tends to be more interested in changing perceptions and attitudes than in altering behaviors or encouraging new ones (as is the case with communication support). It also emphasizes one-way communication rather than the two-way communication encouraged by the latter. Its objectives are also usually much more limited. It has, however, an important role to play in the overall communication support package-- for example, in reassuring householders that, if they invest in improved sanitation, the executing agency will assist them in their dealings with private contractors, will provide and administer loans, and will empty latrines on demand--often contrary to the image the public may have of the agency.

3.5. Whose responsibility is it?

There are four basic institutional options available to an agency which needs the support of communication activities for its sanitation programme. These are:

- institutionalise;
- collaborate;

radio to promote the program and later on to remind people about the importance of proper use and care of latrines. Radio 'spots' are the primary means of promotion. A radio (comic) soap opera format is also used, employing locally popular actors to act out scenes which depict the importance of good health habits and proper latrine maintenance.

Examp1 5: Because of limited initial delivery capacity, care has to be taken not to generate demand which cannot be met. Therefore, it is decided to match supply and demand by using small contractors to do most of the promotion of latrines and, once they are built, to instruct on proper usage and care. In order to help the constructors in their efforts the government agency supplies them with materials such as leaflets, pamphlets, and manuals, and also pays for and arranges additional publicity through billboards and advertisements in local newspapers.

3.4. Related Activities

Communication support then refers to a fairly diverse group of activities. It is related to, but different from, health education, marketing and public relations, particularly when practised in developing countries and in connection with development projects. However, it owes something to each of these.

Health education: Health education (in its traditional formulation) differs from communication support in its objectives and methods: it tends to be more concerned with increasing knowledge over the medium-to-long term. communication support, on the other hand, is primarily interested in changing behavior over the short term. Health education tends to employ didactic one-way methods and appeals to reason, while communication support uses a variety of techniques, media and materials, frequently employs heavy emotional appeals, and is concerned with two-way communication. Finally, the connection between health education activities and other activities (such as construction or improvement of facilities) is often weak-although this need not be the case. This need for direct connection is the very reason for existence of communication support as a part of low-cost water supply or sanitation activities.

Therefore, when dealing with low-cost water supply and sanitation programs or projects, health education usually should be considered as only one aspect of a communication support package. It is generally more important during the post-construction stage than before or during it, and has the primary role of ensuring proper hygiene habits during use of the improved water supply or latrine.

Example 1: The government hires and trains temporary field workers, who are made responsible for promoting the programme, encouraging self-help inputs, and educating beneficiaries on proper use, care and maintenance of latrines. The government provides the field workers with educational materials to improve their effectiveness. These field workers are progressively phased out after latrine construction is finished, and local volunteers (such as religious workers and teachers) are increasingly involved in the programme. The main role of volunteers is to continue encouraging proper use and care of latrines.

Example 2: The government is unable to hire and pay the salaries of new staff for the sanitation project, so instead existing health educators in other towns are temporarily seconded to provide communication support for a short period (four months). Because their available time is limited, they are not brought in for the promotion stage. This is done by the town engineers and assistant engineers, with the active cooperation of the town councils. The health educators' main role is to encourage beneficiaries to use and care for the latrines properly, and at the same time to monitor these aspects. Once the health educators return to their normal postings, these activities are continued by the town engineers, but at a lower level of intensity. The health educators continue to visit the project area intermittently, as part of their normal duties.

Example 3: Because there are active community organizations in all project areas, and community leadership is accustomed to playing an active role in development, the communication strategy relies on these structures. Most of the promotion is done by the project engineers, who first meet with local leaders and later address public meetings. The engineers use charts and slides in their presentation. These materials have been prepared by a cooperating government institute in consultation with the engineers. They also leave pamphlets with the community leaders to remind them on how pits need to be dug or on other technical aspects. The local leaders are the ones who assume responsibility for compiling a list of applicants and for making sure that self-help inputs materialize. They set up temporary sanitation task forces of local people to see that latrines are properly used, paid for and cared for.

Example 4: The program covers a very large metropolitan area, but due to institutional weakness and budget constraints there is no possibility of hiring sufficient field staff. However, there is a local radio station, which has a good listening audience with very little spillover into non-project areas. Therefore, heavy use is made of

CHAPTER - 3

PLANNING OF COMMUNICATION SUPPORT IN WATER SUPPLY AND SANITATION PROJECTS

3.1. Introduction

This note deals with communication support as part of low-cost water supply or sanitation projects and programs, with particular attention to sanitation. It is intended for a dual audience:

- (a) the engineer, management specialist, financial analyst, program or project officer who is working on or concerned with low-cost water supply or sanitation but has no background in communication support; and
- (b) the communication specialist or health educator who knows his or her own field well but has no direct experience in applying this knowledge to low-cost implementation.

3.2. What is Communication Support?

The term "communication support" in this context refers to planned information, motivation and education (IME) activities, together with any associated training, monitoring and evaluation activities, which are specifically designed to :

- (a) encourage certain kinds of people to participate in the project;
- (b) make sure that they obtain full benefits from their participation; and
- (c) help to ensure that the project makes an overall positive contribution to development.

Above all, communication support deals with changing the behavior of people.

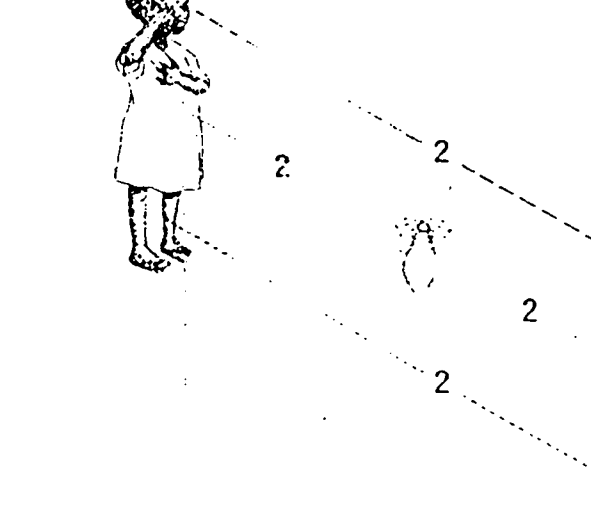
3.3. Some Illustrations

The following are five examples of what such communication support activities might look like in a sanitation programme. The examples should not be viewed as models.

INFECTED PERSON



SUSCEPTIBLE PERSON



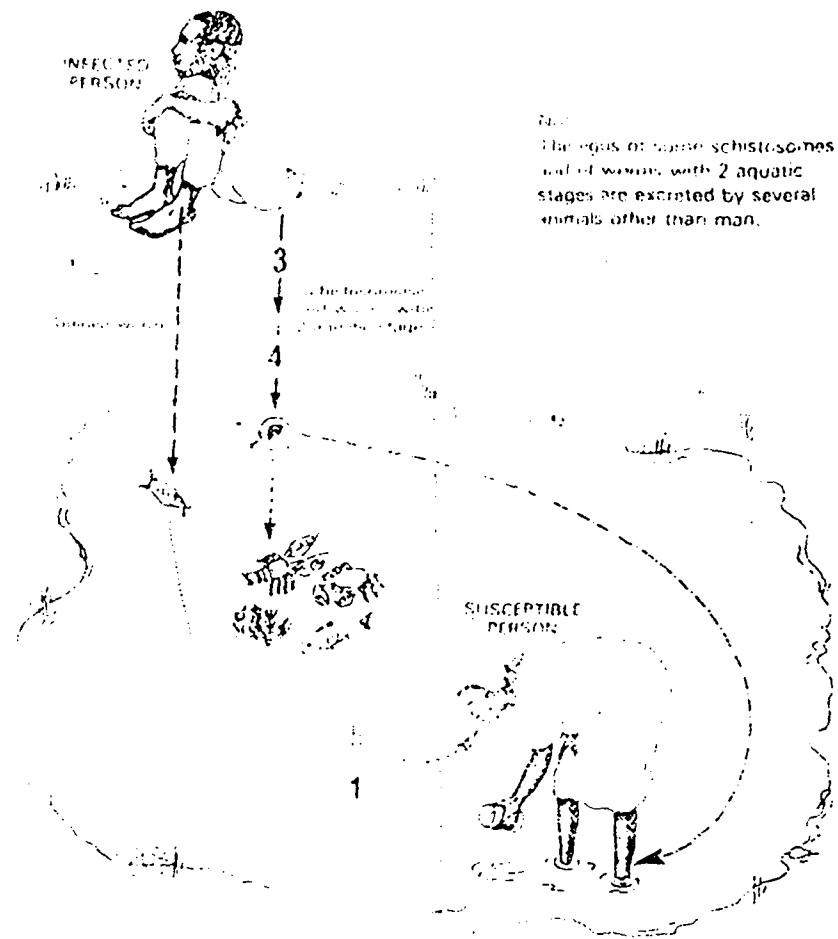
Transmission Route:

- Eye infections
- Skin infections
- Louse borne infections

Control Measures
(See Table 2.5)

- 2 Water availability plus personal and domestic cleanliness

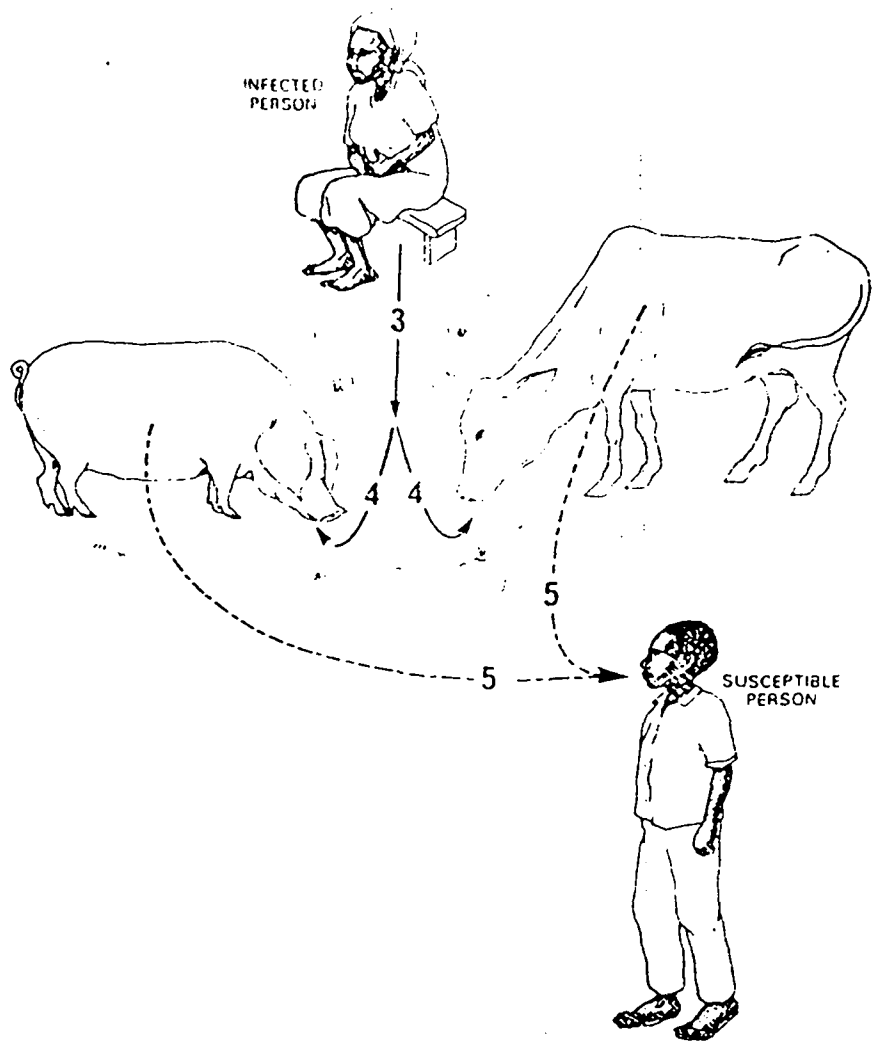
Figure 2.6. The transmission and control of skin, eye, and louse-borne infections.



Note:
The eggs of some schistosomes and of worms with 2 aquatic stages are excreted by several animals other than man.

- | Transmission Routes | | Control Measures
(see Table 2.5) | |
|---------------------|---|-------------------------------------|-------------------|
| ———— | Human feces | 1 | Water quality |
| - - - - - | Aquatic food
(worms with 2 aquatic stages) | 3 | Excreta disposal |
| - · - · - | Percutaneous (schistosomiasis) | 4 | Excreta treatment |
| ———— | Guinea worm larvae | 5 | Food hygiene |
| · · · · · | Water-borne | | |

Figure 2.5. The transmission and control of worms with aquatic intermediate hosts.



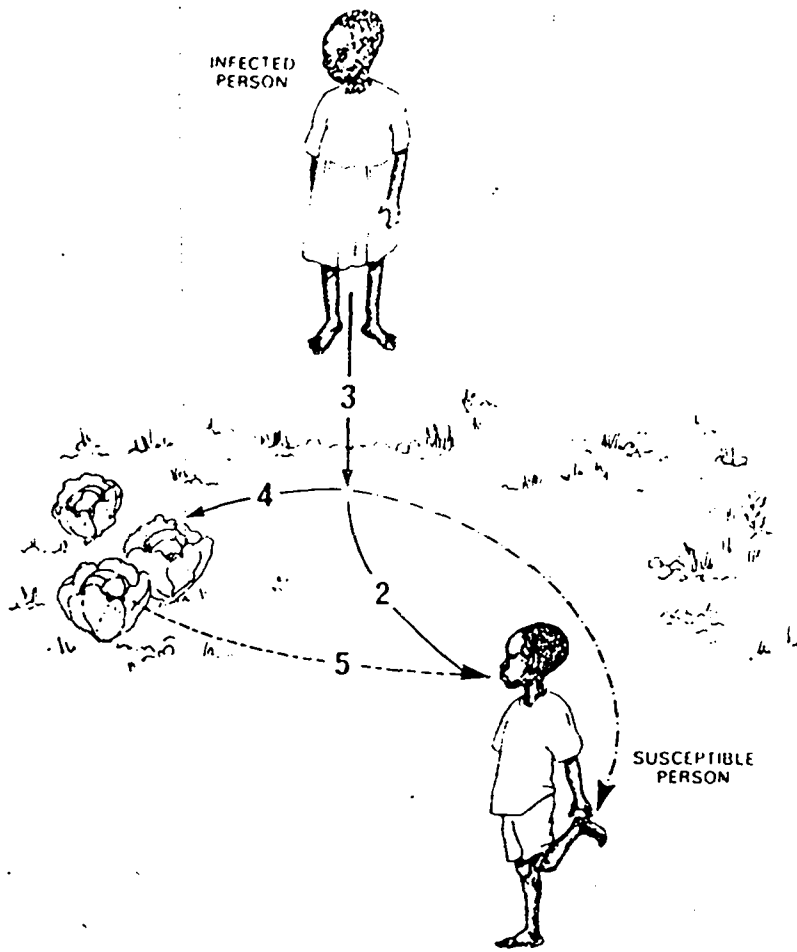
Transmission Routes

- Human feces
- - - Undercooked meat

Control Measures
(see Table 2.5)

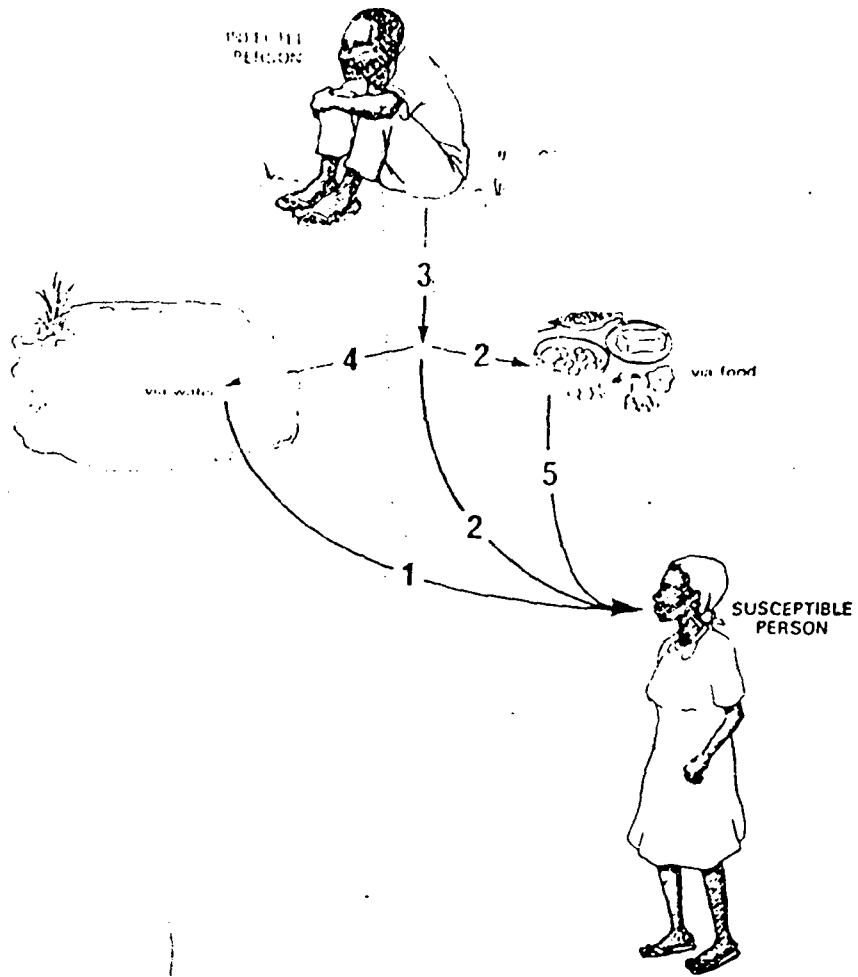
- 3 Excreta disposal
- 4 Excreta treatment
- 5 Food hygiene

Figure 2.4. The transmission and control of pork and beef tapeworms.



- | | | | |
|----------------------------|-------------------------------|--|---|
| Transmission Routes | | Control Measures
(see Table 2.5) | |
| ————— | Human feces | 2 | Water availability plus personal and domestic cleanliness |
| - - - - - | Contaminated vegetables | 3 | Excreta disposal |
| | Percutaneous (hookworms only) | 4 | Excreta treatment |
| | | 5 | Food hygiene |

Figure 2.3. The transmission and control of *Ascaris*, *Trichuris*, and hookworms.

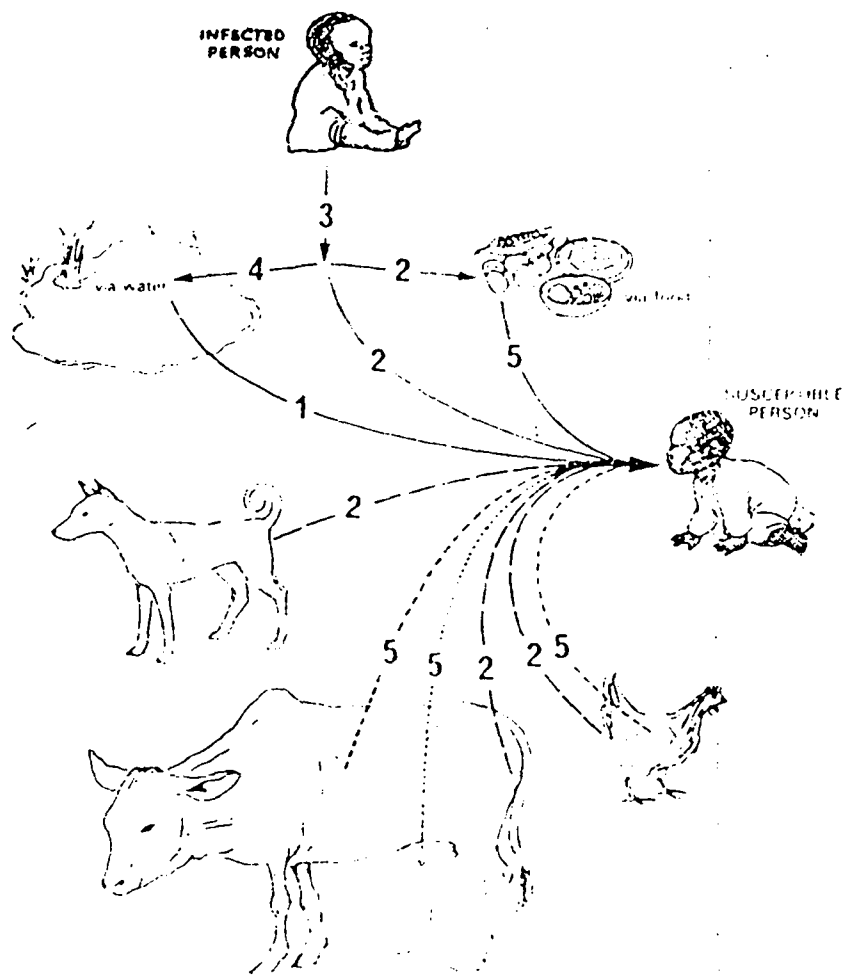


Transmission Routes
 Human feces

Control Measures
 (see Table 2.5)

- 1 Water quality
- 2 Water availability plus personal and domestic cleanliness
- 3 Excreta disposal
- 4 Excreta treatment
- 5 Food hygiene

Figure 2.2. The transmission and control of poliovirus and hepatitis A virus.



- | | | | |
|----------------------------|-------------------|--|---|
| Transmission Routes | | Control Measures
(see Table 2.5) | |
| ———— | Human feces | 1 | Water quality |
| ----- | Animal feces | 2 | Water availability plus personal and domestic cleanliness |
| ----- | Contaminated meat | 3 | Excreta disposal |
| | Contaminated milk | 4 | Excreta treatment |
| | | 5 | Food hygiene |

Figure 2.1. The transmission and control of diarrhoeal diseases and enteric fevers.

TABLE 2.8

Inorganic Chemicals causing water related diseases

Inorganic contaminant	Major source	Sphere most affected	Primary health effects
Arsenic	-Ore smelting, refining -Pesticides	-Air, water	-Arsenic poisoning (gastro-intestinal disorders, lower limb paralysis)
Cadmium	-Electroplaters, battery manufacturers	-Air, food, water	-Cadmium fumes, joint pain, lung, kidney disease -Possibly carcinogenic, teratogenic
Lead	-Leaded gasoline, batteries -Solder, radiation shielding	-Air, food, water	-Impairs nervous system, red blood cell synthesis -Depends on exposure
Mercury	-Inorganic form Electrical goods Chlor-alkali industry -Organic form Slimicides Fungicides	-Water, food	-Inorganic : disorders of central nervous system, possible psychoses -Organic : numbness, impaired speech, paralysis, deformity, death.
Nitrates Nitrites	-Nitrates, agricultural runoff Nitrites, meat preservatives	-Food, water	-Nitrates + amines (in body) yield carcinogenic nitrosamines Nitrates can cause methemoglobinemia in infants.

TABLE 2.7

The Water and Sanitation related Infections and Their Control

Infections	Importance of alternative control measures							
	Water quality	Water availability	Excreta disposal	Excreta treatment	Personal and domestic cleanliness	Drainage and sludge disposal	Food hygiene	Public health importance
<u>Diarrheal diseases and enteric fevers</u>								
Viral agents	2	2	1	1	2	0	1	3
Bacterial agents	3	3	2	1	3	0	3	3
Protozoal agents	1	3	2	1	3	0	2	2
<u>Poliomyelitis & Hepatitis A</u>								
	1	3	2	1	3	0	1	3
<u>Worms with no intermediate host</u>								
Ascaris and Trichuris	0	1	3	2	1	1	2	2
Hookworms	0	1	3	2	1	0	1	3
Beef & pork tapeworms	0	0	3	3	0	0	3	2
<u>Worms with intermediate aquatic stages</u>								
Schistosomiasis	1	1	3	2	1	0	0	3
Guinea worm	3	0	0	0	0	0	0	2
Worms with two aquatic intermediate stages	0	0	2	2	0	0	3	1
<u>Skin, eye, and louse-borne infections</u>								
	0	3	0	0	3	0	0	2
<u>Infections spread by water-related insects</u>								
Malaria	0	0	0	0	0	1	0	3
Yellow fever & dengue	0	0	0	0	0	1	0	3
Bancroftian filariasis	0	0	3	0	0	3	0	3

* 0 = no importance; 1 = little importance; 2 = moderate importance; 3 = great importance.

TABLE 2.6

Potential for control of Excreta-Related Infections by
Improvements in Sanitation and Personal Hygiene

Disease category	Impact of sanitation alone	Impact of personal hygiene alone
I. Nonbacterial fecal-oral	Negligible	Moderate
II. Bacterial fecal-oral	Slight to moderate	Moderate
III. Soil-transmitted helminths	Great	Slight
IV. Beef and pork tapeworms	Great	Negligible
V. Water-based helminths	Moderate	Negligible
VI. Insect vector	Slight to moderate	Negligible

TABLE 2.5

Human Excreted Viruses

Virus group	Family	Number of types	Diseases or symptoms caused
Enterovirus	Picornaviridae		
Poliovirus		3	Poliomyelitis, meningitis, fever.
Coxsackievirus A		24	Herpangina, respiratory disease, meningitis, fever
Coxsackievirus B		6	Myocarditis, congenital heart anomalies, meningitis, respiratory disease, pleurodynia, rash, fever
Echovirus		34	Meningitis, respiratory disease, rash, diarrhea, fever
New enteroviruses		4	Meningitis, encephalitis, respiratory disease, acute hemorrhagic conjunctivitis fever
Adenovirus	Adenoviridae	> 30	Respiratory disease, eye infections
Reovirus	Reoviridae	3	Not clearly established
Hepatitis A virus	? Picornaviridae	1	Infectious hepatitis
Rotavirus	Reoviridae	?	Vomiting and diarrhea
Astrovirus	?	?	?
Calicivirus	?	?	Vomiting and diarrhea
Coronavirus	Coronaviridae	?	Common cold
Norwalk agent and other small round viruses	?	?	Vomiting and diarrhea
Adeno-associated virus	Parvoviridae	4	Not clearly established but associated with respiratory disease in children

A. PEOPLE-BASED	MAIN ADVANTAGES	MAIN DISADVANTAGES	COMMENTS
4. Drama.	Groups can be active "learning by doing". Can attract attention and stimulate thinking if situations are effectively dramatised.	Actors require attention in training and preparing script. Preparations might be too difficult for the field worker. Difficult to organise because it requires considerable skills and careful guidance by the field worker.	Should be restricted to one issue. Can only be used during training courses. Can be used as entertainment if well prepared before a public meeting.
5. Case study.	Can illustrate a situation where audience can provide suggestions. Can elicit local initiatives if the case corresponds to local problems.	Difficult to organise. Rewording of events and personalities might reduce the effectiveness of the case. Some audiences may not identify themselves with the case.	Should be clearly prepared. Can be used in training course. Questions and discussions should lead to recommendations for audience action. Audience should be encouraged to prepare case studies relevant to its experience.
6. Home visit.	Establishes good personal relationships between field workers and families. Can provide information about rural families that cannot be collected otherwise. Encourages families to participate in public functions, demonstrations and group work.	Field worker cannot visit every family in the community. Only families in accessible localities can be visited.	Records should be kept for families visited. Schedule of home visits should be developed to assure allocation of time for field work activities. Hand-outs should be given to families visited.
7. Demonstration (with a small group).	Participants can be active and learn by doing. Convinces the audience that things can easily be done. Establishes confidence in field worker's ability.	Requires preparation and careful selection of demonstration topic and place. Outside factors can affect demonstration results and consequently might affect confidence in field worker.	Demonstration processes should be rehearsed in advance. Audience should participate in the actual process. Educational materials should be distributed to the participants at the end of the demonstration. Should be suitable for people to attend.

B. MASS MEDIA	MAIN AVANTAGES	MAIN DISADVANTAGES	COMMENTS
1. Radio.	Radio technology available in all countries and can reach mass audience cheaply. Receivers are inexpensive and available in the remotest communities. Messages can be repeated at low cost. Easy to reach illiterate audience. Can be used to support other channels of communication. Efficient to announce events and development activities, and, if properly used, can mobilize audience to participate in public events and projects of value to the community. It is flexible, and style can include drama, lectures, folklore songs, interviews and variety shows. Excellent in regular teaching and out-of-school correspondence of priorities for people's attention.	One-way channel. Complicated technical issues. Difficult to illustrate. Audience reaction, participation or interest in messages delivered, difficult to assess. Requires special skills and continuous training of radio personnel. Content may not be tailored to small communities and tends to be general in nature and is usually prepared for national audience, or special ethnic or language group thus reducing relevance to local problems. Difficult to use material broadcast as a reference without investment in radio documentation. Texts of radio programmes are usually needed for effective	Radio messages should often be supported by personal follow up. Radio effectiveness increases if messages used in group discussions (e.g., farm forums) or regular training courses. Desirable for radio to cover local events, assist in explaining and promoting local projects and development efforts. Programming should maintain balance between national and local coverage interviews and lectures, news and profile
2. Television.	Its novelty attracts audience and can be the main captivator in rural communities. Can be used to explain complicated messages because of its combination of sound and Picture. Programmes can be repeated at cost. It is suitable for mixed presentation of issues. Suitable for motivation through utilization of folklore art and music, community events, and animated public speeches and debates. Efficient in bringing issues to public attention, and powerful in setting public agenda for action and participation in development effort. Successful in creating awareness. Suitable for illiterate audiences if they have access to receivers or to TV clubs.	Expensive to operate. Receivers not available in many rural areas and among poorest population groups. Has traditionally been used for entertainment and politics more than for development and educational purposes. Programming skills more likely to be available for entertainment. Educational programs may face severe competition from entertainment. No audience participation. Present state of technology in many developing countries does not allow immediate coverage or timely relay of local community actions and events. Requires more planning and preparation, and technical, creative, and communication skills than other media. Difficult	Local television stations can play an important role in development. More educational training is required for staff. Easy to exchange information, and programmes are scheduled in advance, well-documented, with heavy involvement of and focus on local problems. Very effective for activating group learning when used in viewing centers or as part of multi-media campaign for education-information and motivation.

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B. MASS MEDIA	MAIN AVANTAGES	MAIN DISADVANTAGES	COMMENTS
		to use material televised as a reference without investment in television documentation. Texts of television programs are needed for follow-up. This is not always possible.	
3. Newspapers.	Can provide detailed information. Easy to present technical data in clearly designed text. Important topics can be covered in a series of articles. Can influence the attention of audience by where they place information and on what page. Influential in creating awareness and mobilising public opinion. Material published can be shared and used as reference. Can be used to support radio and television for education purposes and follow-up on lessons, issues and topics discussed by the other two media.	Can be used by literates only. Difficult to reach isolated communities. Can be expensive for poor families. Requires special writing and editing skills which are not always available. Like all other mass media, it is one-way communication channel. Feedback is difficult because of audience reluctance or inability to contact the editor. Difficult to publish at regional level. Small communities can not afford to publish their own newspapers without continuous support from national government.	Best source of information if topics of development are covered on regular basis. Can be used to establish community local papers and bulletin boards. Can be circulated to community members to reduce cost per individual family. Could be used to support literacy classes: sectors could be prepared especially for poor readers and semi-literates.
4. Cinema.	Captures attention well. Reaches big audiences in selected countries and can be very cheap (particularly with semipermanent and travelling cinemas). Can reach lowest strata in certain countries and even have large rural audience.	Is expensive in some countries and may only reach certain sub-groups in the target audience (such as the rich, youth, females). Distribution can be a problem. May be distracting setting for educational messages.	Great care must taken in preparing the film clips.
5. Folk theatre.	Culturally relevant. In some countries is easily available and inexpensive. Often more credible to the traditional elements of society than the modern media.	Can lose control of the message. Format can distract from content.	Flexibility of the form can vary from country to country. One of the best uses is often a combination with a modern medium such as television, radio, or supported by loudspeakers.

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8. MASS MEDIA	MAIN AVANTAGES	MAIN DISADVANTAGES	COMMENTS
6. Wall paintings. Billboards.	Potentially available to large audience. Low costs per person reached if well located.	Can be easily ignored. Limited to simple messages.	Message must be extremely well designed and pretested. Siting is critical to be able to reach the kinds of people intended.
7. Mass media group listening.	Combines mass media and personal channels. Can be prepared and used for many audiences over a period of time. Encourages group participation.	Requires preparation for recruiting groups, training group leaders, and preparation of educational material. Can be expensive. Dropout can be a problem if special efforts are not made.	Should be regularly held. Participants should be provided with educational material. Can be effective in enforcing literacy and adult education. Programmes selected should be about local problems. Tape recorders can be used. They are flexible. Can be used to tape role-playing, group discussion and interviews with local personalities.

C. OTHER MEDIA AND MATERIALS	MAIN ADVANTAGES	MAIN DISADVANTAGE	COMMENTS
1. Publications and loose leaflets.	Excellent for indepth presentation of issues and technical information. Can cover more than one topic. Easy reference and can be directed to specific audiences. Can be illustrated and made attractive. Can support other media for education purposes.	Expensive. Can only be effective if well designed and produced. Poorly printed publications may be expensive but not be read. Require special editing design and production skills.	Should be used to support special campaigns, such as literacy and adult education. Most useful if topics are covered in series of publications. Could be used successfully in group discussions and as back up for public meetings. Can also be used for in-service training of field staff and to keep up morale, particularly if field staff are widely dispersed.
2. Video (Forum).	Can be used to introduce new ideas to selected audiences. Excellent tool for micro-teaching. Can introduce complicated concepts and technical issues in a series of presentations; can record field operations and activities and use them on numerous occasions; can be used to teach skills and change attitudes. Feedback to the broadcaster can be immediate and relatively accurate. Can be handled by model farmers and community leaders; can build useful libraries for teaching in the case of literacy and adult education classes.	Is expensive. Forum members tend to drop out. Breakdown in hardware is common, and batteries are often exhausted. Forum requires highly skilled personnel and extensive hardware. Restricted to communities where trained field agents are available. Requires continuous servicing and maintenance and up-dating. Can become negative tool for development if it fails to attract different sub-groups in the community (such as the poorest, and religious or racial minorities). Sometimes, because of difficulty in finding needed materials or training manpower, many events in the community go by without being recorded or utilised.	Forums require continuing attention from professional organisers. Most successful in small group learning. Group discussion leaders must be carefully selected and trained. Training materials and programmes must be carefully organised and kept in order. Its efficiency increases if used in combination with booklets and handouts at the end of the discussion. Should be used to teach special skills, for structured instruction and, where possible, as a tool to generate participation among a

C. OTHER MEDIA AND MATERIALS	MAIN ADVANTAGES	MAIN DISADVANTAGE	COMMENTS
			rural community or one that is for other reasons isolated from on-going programmes or slow to cooperate.
3. Films.	Use of sight and sound can attract audience's attention. Can make great emotional appeal to large audiences.	Good films are rare. Equipment costly to buy and maintain. One-way communication unless properly used. Requires skill in running film projectors.	Best if combined with discussion groups. Much work to be done regarding getting good films made. Attention should be given when getting audience to evaluate the film. Film should be used for stimulating discussion rather than for teaching alone.
4. Filmstrips.	Much cheaper and easier to work than films. Easily made from local photographs. Encourages discussion.	Usually sight only. Not so dramatic as motion pictures. Could be expensive.	Can have recorded commentary. Strip can be cut up and individual pictures mounted as 2" slides; then can be selected and re-arranged.
5. Slides.	Have all the advantages of film strips plus more flexibility and can be more topical. They can be used in a series to illustrate a concept.	Could be expensive. Difficult to have them on all subjects of teaching.	They should be used after careful preparation of logical sequence and a good commentary.
6. Flannelboard.	Can be portable and mobile. Can be prepared by expert in advance. Little skill required in actual operation. Could be used to make presentation more dynamic.	Can only be used for what it is prepared. Cannot adapt to changing interest of group. More elaborate equipment than ordinary blackboard. Difficult to keep up-to-date.	Very useful but only for the prepared talks. Audience can participate. It should be used step-by-step. Flannel materials should be stored properly for future use. Flannel-graphs should be numbered according to their order in the presentation.

C. OTHER MEDIA AND MATERIALS	MAIN ADVANTAGES	MAIN DISADVANTAGE	COMMENTS
7. Bulletin Board.	Striking, graphic, informative, flexible, replaces local newspapers. Keeps community up-to-date with information.	Requires preparation and attention to community needs.	Should be combined with maps, talks and photographs. Very suitable for posting articles, announcements and news of development in the community.
8. Flip charts	Cheap and simple. Can be stopped at will for analysis. Can be prepared locally. Ideas could be illustrated in sequence. Illustrations on flip chart could be used many times for different audiences in different sessions.	Soon torn. Can only be seen by a few at a time. Can be difficult to illustrate complicated ideas.	Should not be overlooked for illustration of simple sequences - especially with small groups. Lectures should be prepared in advance for use on several occasions.
9. Models, exhibitions and displays.	Appeal to several senses. Can be used in various occasions and situations. Can illustrate ideas in detail.	Not many workers can build them or use them properly.	Useful models and exhibitions could be built up locally. Should be used in familiar places-centers.
10. Maps, charts, diagrams.	Visual appeal. Should simplify details. Permit leisurely study. Can develop sequence on display boards.	May mislead by oversimplicity. Can create transport and storage problems.	Should be made especially for groups. May need careful explanation at first. <i>Could be used as summary of information.</i> Symbols and layout should be familiar to the audience.
11. Blackboard.	A flexible tool. Easy to make and to use. Can be very attractive if used properly. Use of colored chalks can add to its visual appeal. Can be portable.	Requires some manipulation skill (though quickly acquired). Requires teaching skills to make best use.	Should be essential in every group. Very useful for schematic summaries or talk or discussion. Audience can participate. Small blackboards can be portable. Writing should be clear and organized.

TABLE - 1

THE COMMUNICATION SOLUTION TO PROBLEMS IN SANITATION PROJECTS

PROJECT STAGE	EXPECTED PROBLEM	LIKELY CAUSES	POSSIBLE COMMUNICATION ACTION	NON-COMMUNICATION ACTIONS:
Pre-implementation or implementation	lack of interest in improved sanitation	a) no knowledge about improvements available	promotion campaign, which may use health arguments but usually works best if it also relies heavily on others (e.g., privacy, prestige convenience).	
		b) lack of understanding of the health or other benefits of improvement	- ditto -	
		c) Dissatisfaction with cost of improvement.	- ditto -	increase level of subsidy/ arrange financing/choose lower-cost technology.
		d) satisfaction with existing alternatives	- ditto -	legal action to prevent use of existing alternatives, if this are unsatisfactory on health or other grounds. move to more interested populations

Contd...

PROJECT STAGE	EXPECTED PROBLEM	LIKELY CAUSES	POSSIBLE COMMUNICATION ACTION	NON-COMMUNICATION ACTIONS†
		e) Distrust of responsible agency	public relations campaign stressing new approaches (better loans, technology, institutions, etc.)	coordinate with another more trusted (often voluntary) agency for field staff.
		f) previous bad experience (own or neighbours in construction or operation.	- ditto -	
	Dissatisfaction with the technical options offered	a) desire for more costly options, which have been in houses of high-status people	education or motivation to explain the advantages of the options provided; and to persuade people to adopt them.	provide a wider technology choice or upgrade to technology desired
		b) poor presentation or explanation of available options.	- ditto -	change project area.
	inappropriate choice of technology by the clients or those who represent them (e.g. leaders	a) wrong technology package presented.	change technology package.	
		b) choice to narrow to suit everyone.		expand the number of options available

Contd...

PROJECT STAGE	EXPECTED PROBLEM	LIKELY CAUSES	POSSIBLE COMMUNICATION ACTION	NON-COMMUNICATION ACTIONS
		c) information given with the package inadequate for clients to make a sensible choice	provide better information to clients or their representatives (e.g. on space constraints water dependency or recurrent costs) so they can make a more satisfactory choice; built models or demonstration units.	
Implementation	Delays in self-help (e.g., pit-digging, or erection of super-structure).	a) lack of time		reschedule project to suit householder's free time (e.g., to suit seasonal labor effects).
		b) problems in access to materials or money.		provide better access to materials, technical advice, loans, etc.
		c) insufficient interest from strategy.		eliminate self-help input from strategy. If self-help critical to project finances, change project area.
		d) Self-help component beyond technical competence of beneficiaries.	Description and explanation of legal and other constraints and of acceptable options.	Revise component or provide external technical assistance or both.

PROJECT STAGE	EXPECTED PROBLEM	LIKELY CAUSES	POSSIBLE COMMUNICATION ACTION	NON-COMMUNICATION ACTIONS
	Mistakes in type of superstructure selected, (resulting in contravention of building codes, rapid destruction, etc.)	<ul style="list-style-type: none"> a) Lack of necessary information on building codes etc. b) Lack of access to alternative materials, cash. 	<p>Information on available sources of materials, credit.</p> <p>Motivation or instruction, or both.</p>	<p>Revise building codes to accommodate low-income families' options.</p> <p>Assistance with financing or delivery of materials.</p>
Operation & Maintenance	Abuse of facilities	<ul style="list-style-type: none"> a) Superstitions or beliefs. b) Poor understanding of how technology operates or its limitations. c) Breakdown of supporting services (e.g. water system needed for RT). 	- ditto -	<p>Improve supporting service.</p>
	Poor use	a) Poor appreciation of the necessity to do so (especially older people, children).	Motivation and education to encourage those who are reluctant to use.	

Contd...

PROJECT STAGE	EXPECTED PROBLEM	LIKELY CAUSES	POSSIBLE COMMUNICATION ACTION	NON-COMMUNICATION ACTIONS
		b) Inconvenience or unpleasantness involved (e.g. distance, rain or flooding, lack of light, poor access to water, etc.)		Adjust details of the design or siting to the extent possible at this stage.
	Poor hygiene practices	a) Custom	Motivation and education.	
		b) No understanding of the need for better practices, or lack of familiarity with them.	- ditto -	
	Poor maintenance of facilities	a) Low value placed on facilities	Motivation and education.	
		b) Belief that maintenance is someone else's responsibility.	Clarify responsibilities.	
		c) Ignorance of need for maintenance or of proper maintenance procedures.	Motivation and Instruction.	
		d) Poor access to necessary materials.		Facilitate access to materials.

Chapter = 4

SOCIO-ECONOMIC SURVEY : METHODS OF DATA COLLECTION AND PROCESSING

4.1. INTRODUCTION

To respond to the needs of low-income families in developing countries the field of water and sanitation engineering has taken a major shift in emphasis, from sophisticated piped water and sewer systems to simpler low-cost water supply and sanitary disposal of excreta. The current challenge is to find quick and cheap ways to provide satisfactory quantities of clean water, acceptable latrines and drainage, using local materials, expertise and resources. These, when combined with training in systems operation and maintenance, and with promotion and education activities designed to encourage proper use and care of facilities, should result in improved health status for millions of people.

The task of planning and implementing water and sanitation projects for low-income communities is complicated by the diversity of cultures, ethnic groups, and settlement and residence patterns found in most developing countries. This diversity calls for and understanding of the local context of water and sanitation projects; this in turn requires that people such as sociologists and anthropologists become involved early in the design stage of the project.

Engineers increasingly find themselves working in interdisciplinary teams which may include anthropologists, sociologists, health educators or a combination of these. They may be asked to hire such people to play a part in project design, implementation, monitoring or evaluation. In many cases, however, the engineer himself may be asked to gather social science data on the community to be provided with water supply and sanitation improvements, or to direct other team members untrained in methods for gathering social science data. In such cases, it is useful for the engineer to have a guide to the various types of data-gathering methods that social scientists use, to help him either in hiring and in communicating with social scientists and in planning for their activities in the project cycle, or in undertaking these activities himself in the absence of social science colleagues.

This paper is therefore intended primarily for engineers, as a source of basic information about social science methods of data gathering, and secondly for social

scientists who may work with engineers, to improve their mutual communication. The orientation of this paper is toward projects for smaller communities, although most of these methods can be adapted for use in larger areas and under more severe time constraints. A number of engineers may have only limited need for such guidance because of their experience in working in other cultures and with social scientists. Some engineers are clever at rapidly extracting information about the local culture, and are acute and sensitive observers and excellent at engaging local leaders to organise community participation. On the other hand, for engineers who know little about social science data gathering and how to fit into project development, this intended to demystify that process. Given the wide range of engineers' exposure to the social sciences, it is difficult to prepare a paper which is comprehensible to newcomer but not too superficial for more experienced workers; decisions on what to include in this paper are based on discussions between engineers and social scientists in formal settings, together with the experience of the author in working with multidisciplinary teams in the field.

Anthropological methods are emphasized here because they seem to be the appropriate ones for data-gathering on small-scale projects and in diverse cultures. The techniques for designing promotion, motivation or health education programmes from the data gathered are not described here, for that is a field in itself. It is worth noting, however, that the modern health educator utilizes many of the data-gathering techniques described here as a basis for design.

Each project is unique; it has its own time and budget constraints, and involves different personalities. Thus, the approaches described in this paper must be adapted to suit each particular project.

4.2. SOCIO-CULTURAL DATA REQUIREMENTS

Designing low-cost water supply and sanitation projects for developing countries often requires information on several aspects of community life. This is because low-cost designs should, as far as possible :

- (a) use local materials and local expertise;
- (b) depend upon cooperation from community leaders;
- (c) meet local preferences and values; and

- (d) fit in with traditional patterns of water use and excreta disposal and associated practices or beliefs.

In addition, the design of a communication support programme to promote the project and bring about behavioural change will need to take into account such matters as:

- (a) local beliefs and attitudes regarding water, sanitation and health;
- (b) traditional water use or defecation habits and excreta-handling practices; and
- (c) current levels of knowledge in the community especially among community leaders and other influential persons about disease transmission.

Since all knowledge, values, beliefs and practices vary according to social class, ethnic group, educational attainment, and family tradition, and since communities are rarely homogeneous, project designers also need to know something about the diversity and prevalence of the various beliefs. For example, what percentage of the people believe that infant diarrhoea is caused by "the evil eye", and what percentage believe it is caused by "germs" from somewhere? Do people believe in both causes and fit them according to the situation? How are children bowel- and bladder-trained? Is there much variation in age of training or methods of training? Is it acceptable to share a latrine with persons other than members of one's own immediate family? Should a latrine be located or oriented in a particular way to be satisfactory to the user?

Since projects greatly depend upon cooperation from local leaders and from residents, project designers need some knowledge of the social and political structure of the community power groups, political factions and lines of authority. Some of the political information should be available even before initial contacts with communities are made, in order to avoid making serious errors at first contact. The planners must know how to work with the community, and how things get done.

A wealth of experience of the kinds of socio-cultural data needed already exists. Table 4.1 summarizes the range of socio-cultural information that may be required by low-cost water and sanitation projects.

Table - 4.1

RANGE OF USEFUL SOCIO-CULTURAL DATA

1. DEMOGRAPHY - S *

- population size, growth rate, mobility;
- household size and composition (special features such as women heads of households, sharing, individual or family renters).

2. HEALTH - KI *

- major health problems in the community and relative importance of water/sanitation-related diseases;
- seasonal variations.

3. OCCUPATION - KI, S *

- major occupations and approximate distribution;
- seasonality of employment.

4. ORGANISATION AND PARTICIPATION - KI *

- major local organizations and type of membership;
- community and family level leadership in decision-making;
- major local political or social factions which might affect participation;
- extent of previous interest and participation in water/sanitation or other development activities;
- important characteristics that would determine the acceptability and influence of outsiders working on projects in the area.

5. LEVEL OF INTEREST - KI, OE *

- evidence of popular interest in improving water supply/latrines, compared to other potential improvements in the community;
- evidence of leadership commitment to improvements.

6. PHYSICAL STRUCTURES - P, KI, S *

- types of dwellings, their physical condition and layout;
- types of building materials used;
- existing water supply and sanitation facilities;
- space availability inside and outside dwellings.

7. WILLINGNESS AND ABILITY TO PAY - KI, S *

- ownership of land and house;
- income;
- expenditure patterns;
- borrowing and savings customs.

8. WATER USE PATTERNS AND PRACTICES - P, KI *

- preferred sources of water (by purpose);
- quantity and uses;
- water-source-related activities (e.g., laundry, animal watering);
- possibilities for contamination of drinking water.

9. DEFAECATION HABITS AND ASSOCIATED PRACTICES, UNDERLYING BELIEFS, ATTITUDES - P, OE, KI *

- existing practices (noting important differences between : castes; religions; men, women and children; different age groups);

- cleansing and ablution materials and practices (e.g., anal cleansing materials; prevalence of bathing in latrines);
- underlying causes of above;
- important taboos, beliefs, related to locations, sharing etc.;
- latrine emptying and sludge reuse practices;
- general household cleanliness.

10. LOCAL TECHNOLOGY AND RESOURCE AVAILABILITY - P, KI *

- local availability of building materials;
- availability of skilled and unskilled labour (nothing seasonal variations);
- availability of technology-related inputs (such as water for pour-flush latrines).

11. EDUCATION ACTIVITIES AND POTENTIAL - KI, S *

- literacy level;
- mass media access in area;
- coverage by field workers, volunteers;
- ongoing formal or non-formal health education activities.

* KEY:usual means of obtaining data:

- P - Participant-observation
- KI - Key-informant interviewing
- OE - Open-ended interviewing
- S - Survey

These methods are described in item no. 4.3 - 4.4

4.3. METHODS FOR SOCIO-CULTURAL DATA GATHERING

Traditionally, social scientists have allowed themselves months, if not years, to study the social systems of communities. Typically, an anthropologist may live for some time in the community while gathering research data. However, the data-gathering phase for action or development projects may be as short as a few days or weeks, with reports due shortly after the fieldwork. Since these projects rarely have the luxury of time, the data-gathering methods must be adapted to these constraints.

Four basic kinds of data-gathering methods are discussed below:

- (a) participant-observation;
- (b) Key-informant interviewing;
- (c) open-ended interviewing; and
- (d) surveys.

Each will be described first as it is ideally used, then as it may be used in small-scale water and sanitation projects that provide limited (but adequate) time, funds and manpower. (For larger projects, and projects with extremely limited time and budgets, see Section ~~X~~ - choice of Methodologies under Various Circumstances - for further suggestions.)

The discussion of methods begins with the qualitative methods - participant-observation, key-informant interviewing and open-ended interviewing. This is then followed by a discussion of surveys and sampling. The order of discussion follows the logical order of use. The proper design of surveys usually must be preceded by a preliminary gathering of qualitative data upon which the survey is based. Under ideal conditions, then, data-gathering moves from qualitative to quantitative (when the latter is needed, which may not be the case in every project). *

4.3.1. Participant-Observation

Participant-observation is one of the most basic and widely used social science methods of data-gathering. The researcher establishes residence in the community to be studied and remains there weeks or months, observing and

* At other times, they may be used almost in parallel.

recording the activities and events of daily life; he ** is an active observer searching out information relevant to the data needed. He asks questions, entering houses and public buildings, attending public events, and seeking out the gossip. He also participates in community life - collecting water, fishing, house-building, and attending prayer-meetings. All the while, detailed notes are kept on what is heard, seen, and felt about the subject under study. These notes, as far as possible, are categorized and filed according to topic.

Participant-observation is a basic ground-level technique that is often combined with key-informant interviewing (discussed next) but usually precedes all other kinds of data-gathering methods. It can provide the details of daily life that are necessary for designing survey questionnaires or holding group discussions.

An abbreviated form of this method, mainly observation, can be adapted to water and sanitation projects by taking an "environmental sanitation walk" through the community, visiting water sources, noting street conditions, visiting inside homes and public buildings, asking to use the latrine, to get a general feel for conditions. Questions can be asked about sanitation problems, how many times per day water is collected and so forth. A great deal of information can be collected in this way, even in a one-day visit, if the observers are sensitive, experienced, keenly observant, and do not anticipate the answers to questions. In many low-income communities, a number of key activities concerned with environmental sanitation (fetching water, defaecation, bathing, dumping refuse) take place at dawn or dusk, and these are also the times when households and the community as a whole meet and discuss matters. The investigator has to time his work to cover these periods: a "9 to 5" study will miss much of the sanitary life of the community.

** The use of "he" in this context does not imply any preference for a male researcher. The choice of the investigator needs to be based on a careful analysis of all the factors affecting his or her effectiveness and acceptability, and in many communities gender may be an important factor (see also discussion in "Selection of Interviewers" under para 4.3.4.2)

If time will allow, a member of the research team could take up residence in the community for a short period of time, to count the number of trips women make to collect water, to see how the water is handled and used in the course of a day, to find out about washing and toilet habits, and question people further on their practices. A week of participant-observation can yield a great deal of factual data, and a month may yield important details on interpersonal relations, authority figures, and political structure, which are essential in projects that require community participation.

The presence of a participant-observer residing in a community can also benefit the project in other ways. It is likely that government teams have come through the community before, looking around and asking questions, but without a project being undertaken. In some instances, this may have left a legacy of mild hostility towards talk of new projects. If a team member lives in the community, even for a short time, residents are likely to feel that this project is a serious one that will be carried through, and that opinions of residents really matter. In short, it serves to build rapport with the community. However, this should not be done if there is any doubt about the viability or prompt execution of the project, as it will raise hopes and expectations.

4.3.2. Key-informant Interviewing

Another classic data-gathering method is the use of "key-informants"; these are people in the area itself who are particularly knowledgeable about certain matters. This method has been used mostly by anthropologists, usually to help reconstruct past ways of life (such as that of the American Indians prior to colonization). Key-informant interviewing is also employed by many social scientists studying living cultures, but it needs to be used with awareness of its limitations. One or two key-informants may provide only a distorted view of the society under study. Yond and Young (1961) found that key-informants were most reliable in giving information about:

- (a) Physical geography and public buildings ("Is there a health unit here?" or "What are your main sources of water here?").
- (b) Institutions and institutional roles ("Do you have a latrine-builder here?").
- (c) Dates of important community events ("When did you get a well in this town?").

When it comes to more evaluative questions, such as "what is the size of the average household?" or "what percentage of people here would like to have latrines?", researchers

have found that there is much lower degree of agreement (and hence of reliability) among informants. Where it is important to have exact quantitative information, surveys are more reliable than key-informants.

Key-informants also are not particularly accurate in reporting their own daily behavior. They may be asked about their own beliefs, attitudes and values and those of the community, but their answers should be viewed as preliminary and biased information. And it almost goes without saying that fieldworkers influence what key-informants tell them by their own social characteristics and the way in which they present themselves.

Key-informant interviewing can be most useful when combined with participant-observation. The fieldworker can question and probe while residing in a community, but at the same time must remember to cross-check to ensure that he does not record the views of only one informant.

In the development of water and sanitation projects, it is inevitable that key-informant relationships will naturally develop with persons who occupy specialized positions in the society. People whose cooperation with the project will be sought—community leaders, health workers, school teachers, local engineers or well-diggers — will provide, if rapport is good, information in order to be helpful. Piecing together these various viewpoints and facts not only helps to fill data gaps, but, more importantly, cements relationships between the project team and the community.

4.3.3. Open-ended Questionnaires

While participant-observation and key-informant interviewing are useful data-gathering techniques, their validity is often open to question. They are criticized because one never knows whether the interpretation of the facts by the fieldworker is credible, or whether the key-informants' statements are truly representative. Surveys have the advantage of overcoming this problem. But, when working in an entirely new cultural or community group or planning a new kind of development programme, it is usually difficult to design a meaningful structured interview schedule for conducting a large-scale survey because of lack of reliable knowledge about what is or is not relevant. In this situation open-ended interviews help to elicit information comparatively unbiased by the investigator. Data gathered from open-ended interviews can then be used to design survey questions, if a survey is deemed desirable.

One method that is especially good at removing interviewer bias and which can be administered to a number of respondents to check validity is "heuristic elicitation." This description means simply that the next question is based on the answer to the previous question. As a result, the questions are respondent-generated rather than investigator-generated, and so are likely to be more comprehensive. For example, much of our socio-cultural research in sanitation deals with latrine choice or preference. What type of latrine would residents prefer? What type of superstructure should it have? Where should it be located? Should latrines be communal or private? How much money or labor would individuals contribute to construction? These seem like simple, straightforward questions to which any investigator could get honest answers. While this may be true, they may not be all the questions about latrines one should ask in this particular culture or community. There may be other important considerations never dreamed of by project designers. Therefore, rather than designing a questionnaire that asks a person about what type of latrine he prefers, where he wants it located, etc., one way the interviewer could begin is by asking the respondent to describe all the attributes (characteristics, use-situations) of all of the places that he habitually urinates and defaecates, and then how he feels about each one, relative to the other attributes and in relationship to each other. In addition to receiving information on his preferences, other salient considerations of the respondent may be brought to the attention of the investigator (such as a reciprocal relationship with a neighbour with whom he shares a latrine; the people with whom one can or can not share latrines; or preconceived ideas that latrines are always dark and dirty places).

Annexure II contains sample questions and data sheets for using this type of open-ended questioning, with some hypothetical answers. It is desirable to use very large answer sheets that contain plenty of space for writing, or to allow one page for each answer. The sample questionnaires shown are condensed for illustrative purposes only.

The design of heuristic elicitation question forms must necessarily go through a series of steps: First, investigators must list the topics about which they have knowledge. Question sheets are then designed, translated into the local language, and then back-translated by a third party to check for translation errors in meaning or content (for example, occasionally translators will put all present tense verbs into past tense, or make all questions negative; errors such as these will usually be caught by back translation). Next, each prospective interviewer should pretest the questionnaire on at least two people very similar to those he will be using it on eventually.

This will serve to identify problems in question interpretation, inadequate writing space, and questions which are combined but which ought to be separated. The questionnaire should then be modified to correct any problems and pretested again.

These open-ended questionnaires should be administered to a minimum of about thirty people; this should provide an adequate range of responses. In water supply and sanitation projects, it is important to interview men, women, and children, as the project must be designed to reach each category of constituent. The wider the variety of people interviewed, the greater the range of answers that will be provided.

The last step is to analyze the results. Responses to questions can be categorized, counted and listed in tables. Local terms for people, objects, events, ideas and values can be collected and made into a glossary. In many cases, especially if time is short, the project can proceed based on this information, combined with observations and key-informant interviews. If open-ended questioning is used, key-informant interviewing can be kept to a minimum, for the former will provide more reliable data on attitudes, beliefs and values. If a large-scale survey is deemed necessary, answers from the heuristic elicitation questionnaires will provide the sub-categories for classifying answers and local linguistic terms for the structured survey form.

4.3.4. Surveys

Surveys are most useful for collecting demographic data, for systematically quantifying the occurrence of observable objects or characteristics (such as latrines with broken waterseals) and for estimating prevalence of particular attitudes, beliefs and values. Surveys have several drawbacks: they usually require more time; they sometimes cost more money; and they use pre-structured answers which tend to limit exploration into cultural beliefs and values and sometimes into personal practices (such as defaecation). However, when properly designed and based upon an earlier heuristic elicitation study, they can be most valuable. Some examples of how to transform the answers from open-ended questionnaires into survey questions are given in Annexure III.

Surveys may be either complete (100%) or based on samples drawn from the population. Complete surveys are usually done only in small communities numbering less than 200 households, unless manpower, budget and time permit.

complete surveying of larger communities. Complete surveys can have social and political advantages, as well as providing the statistical confidence gained from having surveyed all households. * Every household is introduced to the project through the survey and absolutely no household is left out. If only a sample of a small community is taken, those not interviewed may feel as if they were not chosen for some reason - their opinions did not count, they are not to be included in the project, or the village head wanted to exclude them. Bad feelings can result that will follow the project to its end.

In larger communities and urban areas, where 100% coverage is impractical, choosing which households to survey can be a difficult problem. The main consideration is that the sample must be representative of the "universe" of households. This leads us to consider various types of sampling.

4.3.4.1. Sampling

The first step if sampling is to define the universe from which the sample must be drawn. Defining the limits of a community is often a problem for social researchers, because communities rarely form neat packages. Homesteads can be spread along a stream, or villages may have satellite villages that are socially distinct but administratively joined, or socially joined but administratively divided. Urban communities can be even more difficult to delimit. Fortunately, most water supply and sanitation projects will be forced to decide early in the project what geographical area will be served. After those limits are set, a sample can be more easily drawn.

* But they can also result in the reverse - as when it is impossible to find everyone at home, or when the numbers simply do not add up. There is also the problems that they are very rarely updated: having expended all that time and effort on reaching every household the project authorities are reluctant to repeat it. When the later stages of a large project come to be implemented, after a lapse of several years, the survey statistical data may be badly in error.

The type of sample considered to be most representative is the random sample. By definition, it means that each household (the household will usually be the unit of sampling) has an equal chance of being selected. The procedure is as follows. If a total enumeration of families or households already exists, then each is assigned a number from 1 to X. From a random numbers table (found in the appendix of nearly every statistics text book) one starts at any point in the table and reads the numbers in sequence; numbers between 1 and X are chosen until the required total has been reached. These are the households to be interviewed.

If no enumeration of households exists, then a random sample can be drawn using an aerial photograph. The procedure is to number every house in the area on the photograph. Numbers are then selected from a table of random numbers, and the houses corresponding to these numbers circled on the aerial photograph.

A second way a random sample can be obtained, particularly in places where no prior enumeration exists, is to designate every nth house for interviewing. It may be every third, fifth, tenth, twentieth (or other nth), depending upon what percentage of the population is to be sampled. For example, if a community is believed to have 1,000 households, the decision to interview ten percent of them should result in 100 interviews, taking every tenth house.

Communities often vary by ethnic group, social class, caste, and wealth, so that the researchers may want to draw the sample in such a way that minority components are adequately represented. This is called stratified random sampling and is done by subdividing the groups and sampling each one separately. The smaller the group being sampled, the larger will have to be the proportion of households (or people) that are sampled to give a representative sample size. A sampling ratio of 1 to 6 for a large group may be adequate, whereas a ratio of 1 to 3 needed for a smaller group. Also, for most water and sanitation projects, the attitudes, beliefs and values of men, women and children need to be obtained separately, requiring a separate sampling frame for each.

Sometimes random sampling is totally impractical - perhaps local informants indicate that it would cause great suspicion. In these situations quota sampling is sometimes used although its drawbacks are recognized because it is non-representative. Local leaders could be asked to suggest 30 respondents typical of the community - ten high-income, ten low-income, and ten middle-income. Quota

sampling should be classified as an informal data-gathering method, since its reliability will not be much greater than the other qualitative methods described.

4.3.4.2. Questionnaires

Before drawing up questionnaires, project directors should have a very clear idea of the kinds of information required and a plan for the use of each piece of data. Nearly every water and sanitation project will require a household survey, if one does not already exist, to collect quantitative information on questions such as the percentage of households that already have latrines or water storage tanks.

Knowledge of the ability of households to pay for such items as latrine superstructure or monthly water charges is generally important to projects, but direct questioning on income may be too sensitive to allow this information to be obtained by direct surveys. It may be useful instead - or as a check on information obtained through questioning - to estimate household wealth or income using indicators from house structure (such as presence or absence of a metal roof, a concrete floor, or electricity) or material items owned (such as a radio, bicycle or electric fan). In rural areas, ownership of land and/or livestock will generally be good surrogate measures of wealth. However, such ownership is not easily observable and in many cultures even asking for such information is highly impolite. Guidance even about questioning should be obtained from key-informants from different economic and social classes.

Whether attitudes, beliefs, preferences, and values need to be quantified depends mainly upon the extent to which differences in these characteristics will have an important effect on project design. That needs to be determined at an early stage.* Whenever such questions are

* For example, it may be found that one section of the population in the project area prefers a latrine with a squat slab and including provisions for bathing, whereas another part prefers a latrine with a raised seat, and a separate ablution room. This difference in preference between the two groups, while important during implementation, may not need to be quantified during initial design unless, for example: (a) components are in short supply and have to be ordered well in advance; (b) the differences affect water usage and hence disposal technology; or (c) the differences, with their different superstructure layouts, may be difficult to accommodate in some houses and so may need special pilot designs.

included in the survey questionnaire, great care needs to be taken to base the design of the questions on the advice of key-informants and /or the results of a heuristic elicitation study. No questionnaire should be designed by one investigator alone, because what might be considered proper phrasing in one culture can be insulting in another. Survey questionnaires must also go through the steps of pretesting described for heuristic elicitation (item 4.3.3

Selection of Interviewers. Two important considerations in every study are whether to use male or female interviewers (or both), and whether to use people from inside or outside the community to conduct a survey or otherwise collect data. the choice of the gender of the interviewer is directly related to the respondents that have been selected. As a general rule, if information is required from both male and female respondents, then both male and female interviewers will be needed.

In the past, there has been a tendency for development projects to elicit information only from "household heads" who are presumed to be males, and therefore to use only male researchers. For water and sanitation projects this approach is often inappropriate, since women in most societies are the water-carriers and are responsible for household cleanliness and for inculcating children's attitudes to sanitation. Seeking to change the sanitation behaviour of women may be a major project goal that cannot be reached without good knowledge of their attitudes, beliefs and values.

The period of participant-observation will also reveal the cultural characteristics which determine who should speak for the family at the first interview. In many patrilineal societies, the oldest male represents his family to visitors, especially at first contact. Even though he may not know certain details of household management which are under the care of women, he feels obliged to be spokesman for the family. It is desirable to observe custom in this regard in the first few days of data-gathering, until enough rapport exists to ask permission to interview women and children. Female researchers may be needed in order to accomplish this successfully. For example, in some Egyptian and Iranian villages, it is considered shameful for a man to allow his wife to be interviewed by an unknown male, but impolite to refuse the interview to the stranger. Although outside males often accomplish interviews with women at first contact, such behavior may be so detrimentally regarded as to jeopardize the future of the project. Each cultural setting needs to be evaluated to determine (a) the degree of seclusion of women; (b) who in the household presents

the "public face"; and (c) whether both male and female researchers are required.

The decision whether to use people from inside or outside the community will vary by country, cultural group and personnel available within each community. There are well-known instances of employing people from within the community to collect data and to be village communication representatives; the same people may also be trained to mobilize and educate residents later on. On other programmes, experience has shown that it is preferable that a person from outside the community conduct the household survey, collect other socio-cultural data, and mobilize the community to action. In one particular case, in its early years the programme began by training and employing workers who were then assigned back to their home villages, but it was discovered that these "inside" people had an established status and role within their home villages that militated against their asking personal questions or taking any kind of leadership role. "Outside" persons from another region of the country more successfully defined their new roles in communities.

Timing of the survey. This is another important consideration. The period of participant-observation will reveal the best time of day to find people at home and able to receive visitors. Other timing factors may be the agricultural cycle and religious or national holidays.

Some of the methods discussed are better than others for acquiring the information listed in Table 1. The key to the table suggests which kind of methods might usually best be used for gathering the data in each category. This not only serves as a guide as to when a method might be used, but also shows how the methods might be combined.

4.4. CHOICE OF METHODOLOGIES UNDER VARIOUS CIRCUMSTANCES

4.4.1. When social science expertise is not available

Many water and sanitation projects are undertaken in regions where little or no social science expertise is available to project engineers. In other areas, sociology or anthropology may be taught as a philosophy, but students are not trained in field methods and so the professionals available may have little experience of gathering original data. However, trained social scientists are not necessarily required on all projects. Sometimes a short-term consultant can be brought in to look over and discuss

the field methods to be used, but engineers or other project staff will actually collect the data. School teachers, nurses, midwives, sanitations, agricultural extension agents or other persons with some higher-level formal education, can also be trained as observers and note-takers, or even be trained to use open-ended questionnaires and administer surveys.

4.4.2. When funds are limited

Limited funds for the social science component of a project will usually translate into limited numbers of personnel. When only one or two field researchers can be hired, then participant observation, key-informant interviewing and heuristic elicitation techniques should be given priority. These methods can be carried out concurrently in a relatively short period of time while the researchers live in the community. Costs can be reduced even further, if necessary, by not having actual residence in all communities, but this of course sacrifices some of the scope and value of the observational activities. If needed, a household survey could be carried out later on by other personnel when funds become available.

4.4.3. When time is short

Sometime projects will allow only a very short time for socio-cultural data gathering. In this situation surveys are likely to be inappropriate, because normal time requirements for preparation and analysis usually run into weeks rather than days. Observations, key-informants, and a brief questionnaire administered to a sensible quota sample (the size of this sample depending on the total population size) might prove most useful. Projects should endeavour, however, to allow adequate time for socio-cultural investigation in the preparation stage, so that findings may be taken into account in engineering design and financial arrangements. The time so spent may be good investment in preventing disastrous project results.

4.4.4. Large-scale projects

The previous discussion on sampling described ways in which socio-cultural information could be collected for populations in a single small community. But what if the project is large-scale in the sense of covering a thousand villages in a region, several large areas of a city, or several small cities? The sheer number of projects would preclude doing a study of each.

Again, good sampling techniques can be applied. If the one thousand villages are not too diverse culturally, then

a small sample of them can be chosen for study, depending on time, funds and manpower limitations. A random sample of five villages may be chosen for study. Or, if the one thousand villages fall into five separate categories (e.g., in terms of topography, climate, etc.) one village from each district could be randomly selected. If the project involves large urban areas that are economically, socially, and culturally diverse, then manpower and time for a larger study must be allocated. It is important to remember that, even in the case of large-scale projects, surveys will be better when based on the preliminary findings of the qualitative techniques described. Such qualitative data gathering techniques are also important in large-scale data gathering activities for : (a) taking some of the weight off the survey (to handle information that is needed but does not have to be highly quantified) ; and (b) for explaining the findings of the survey.

4.5. WORKING WITH SOCIAL SCIENTISTS

Many of the social science requirements now being placed on low-cost water and sanitation projects leave project planners or engineers wondering which way to turn and whom to hire. This paper has provided some information on netgidikigues for collection of socio-cultural information for project planning purposes. Still, when confronted with a particular project, the engineers may not be sure whom to hire, if they have funds for a professional.

There is a wide variety of social scientists, such as anthropologists, sociologists, social psychologists, political scientists, economists, communication specialists and health educators, all using slightly different methods in doing their work and with different skills. For example, most anthropologists feel comfortable working singly or with a small team, perhaps one or two field assistants, and focusing on in-depth studies of a few communities. Sociologists are usually more highly trained in statistics and are more accustomed to large-scale surveys and working with numerous assistants. They are usually more at ease with large projects than are anthropologists. Communication specialists and health educators are of course more specialized in planning of information, motivation and education activities. In addition to these broad differences in professional orientations, there are sub-discipline and individual variations in background and training. As social scientists in all fields acquire more experience, they tend to become more flexible and begin to use the best and most appropriate of each other's methodologies. Considerable field experience in developing

countried and in a project planning context, a knowledge of variety of methodologies and an ability to communicate well with other team members are qualities that may outweigh the professional's particular field or orientatioin. A working knowledge of the language of languages to be encountered in the project area is an enormous advantage, and is of course essential if no local translator can be found. The ideal, naturally, is to find someone with prior research experience in that particular geographic area and culture, who has previously worked in development planning.

In societies where there is a rigid social segregation of the sexes, it may, as noted earlier, be essential to hire a male and female team of researchers if they are going to do most of the field data collection themselves. Even in societies where the sexes are not so socially segregated, a male/female team will usually yield better information than a single individual.

Finally, if a professional is to be hired, it is important that the person be brought in at the beginning of the project, before the engineering components are designed and before design of any communication support or health education activities.

Engineers and social scientists need to work closely together to identify clearly the kinds of information required, the best methods to collect them, and time, personnel, and budget requirements. Social scientists can best design a study when they clearly understand the goals, technology and strategies of the project, and engineers are more likely to feel comfortable with the results after having expressed their own information needs right at the beginning and knowing how the data were collected and analysed.

ANNEXURE - II

Sanitation Study

Terms of Reference for

Background Data Collection, Analysis and Interpretation

Procedures

It is expected that the contractor, in carrying out the research, will make use of a combination of data collection techniques such as: household interviews; observation; in-depth interviews with key-informants; and collection and analysis of existing data, studies and records.

1. A preliminary review of project needs and research possibilities and problems suggests that the study would proceed along lines similar to those below:

- (a) a sample survey of households in project towns, using an acceptable sample size and sampling frame (sample size 5% to 10% depending on town characteristics; estimated number of questions: 5);
- (b) Observation of these same households to note physical aspects (estimated number of items: 9);
- (c) Town-level collection of more qualitative data, review and interpretation of existing data, in-depth interviews with informants (possibly averaging thirty per town, depending on preliminary findings; estimated number of items: 25);

2. A preliminary list of the type of information which is expected to be relevant is attached, together with the general approach to data collection which appears appropriate. This list should be reviewed as additional data are collected about the eight project towns, and in discussion with the Sanitation Unit.

3. In addition, it is expected that the contractor will ensure the following:

- (a) through pre-testing of questionnaires, and any adaptation necessary to reflect linguistic or idiomatic differences in or between the project towns;
- (b) training of all interviewers hired, and testing of them in the field prior to releasing them for the actual data collection;
- (c) use of professional or semi-professional staff as needed for in-depth interviews of key-informants and for other (open-ended) interviews which require greater technical competency, seniority, or experience;
- (d) use of skilled professional staff for interpretation of findings in terms of the specific operational needs of the project, in order to arrive at practical recommendations for:
 - (i) Selection and Adaptation of Latrine Technology, including special conditions or preferences in project towns (e.g., in terms of existing defaecation practices; ablution and cleansing materials; preferred siting and sharing arrangements and latrine design; location and orientation preferences; water, space or other constraints; etc.).
 - (ii) Definition of the Nature and Timing of People's Participation (e.g., in terms of access to ready cash; existing borrowing and savings customs; availability of labour for pit digging; willingness to undertake self-help construction; locally available materials and construction skills; etc.).
 - (iii) Emptying and Reuse of Pit Contents (e.g., in terms of access to people willing to undertake emptying activities; existing reuse practices and related taboos, etc.).
 - (iv) Prediction of the Likely Rate of Response to the Programme (including probable response differences among different towns or sub-groups within towns, e.g., on the basis of past related experiences; leadership commitment; modernity; attitudes towards government programmes; etc.).

- (v) Strategy for Promotion and Education Activities Needed to Ensure that the Programme Works (nothing, e.g., literacy level; age distribution; population dynamics; coverage by traditional and modern media and by field workers; past relevant experience; etc.).

Types of Data to be Collected

4. The types of data to be collected are listed below. This list is not exhaustive: it should be modified in the light of visits to the project towns and of review of material as it is collected, and among the first tasks of the social scientist will be identification and review of factors affecting programme design, acceptance or use which have not been or could not be foreseen by the technical planning staff.

5. Household interviews:

- size of household;
- primary source of income;
- existing water source and sanitary facilities;
- preference for latrine siting (inside/outside);
- renter or owner.

6. Household observation:

- location (possibly using old place names to designate sub-areas);
- house type and condition;
- space availability, inside and outside;
- check of existing water source and sanitation facilities responses;
- electricity connection (indication of income).

7. Informant interviews:

To be complemented by observation and other data collection activities. The categories shown below are not exclusive, but indicate the main uses of the data.

(a) relating to technology choice:

- existing sanitation practices and locations;
- cleansing and ablution practices;
- religious or customary constraints affecting siting or other aspects (e.g., placing pits under roads, orientation and location of latrines).

(b) relating to prediction of acceptance rate:

- demonstrated response to other similar development programmes;
- modernity (estimated from, e.g., access to other large urban centres, or travel patterns);
- attitude towards government services and programmes;
- attitude towards existing private latrines.

(c) relating to household contribution:

- willingness to undertake self-help construction;
- nature of local borrowing and saving customs.

(d) relating to strategy for promotion and education:

- literacy level;
- age distribution;
- population dynamics;
- media access;
- activities of field workers, voluntary groups, etc.

(e) relating to emptying and reuse:

- existence of sufficient lower caste persons to empty pits;
- willingness to undertake emptying;
- existing reuse practices.

ANNEXURE = III

(A) Sample Open-ended Questionnaires, and (B) Sample Survey Questions derived from them.

A1. WATER SOURCES

What are all the different places for
obtaining water that you know of?

What are the different reasons that people
obtain their water in _____ place ?

(PROBE: Any reasons ?)

1. The drainage canal 2 km away.

1. (a) In the dry season, the hand pump
dries up.

(b) It is free. If we have to buy water it
costs 3 pesos per litre from the
vendour.

2. The hand pump in the court yard.

2. (a) It is convenient.

(b) It is too salty for drinking but it is
fine for washing clothes.

3. Collect it off the roof in the rainy
season.

3. (a) This water is cleaner, not salty like
the ground water.

(b) It tastes good.

4. Buy it from a vendour.

4. (a) We only buy from a vendour in the dry
season.

(b) Some people say the drainage canal
water is not clean and makes you sick.
The vendour water comes from the towns
where it is treated.

A2. INFANT ILLNESSES

What are the different kinds of illnesses that babies and children under the age of five experience in this village?
(PROBE: Any other kind?)

What are the different causes of illness?----
(PROBE: Are there any other causes?)

1. Coughs, colds, pneumonia.

1. (a) The evil eye.

(b) Going out in the rain.

(c) Eating too many "cold" foods.

2. Diarrhea.

2. (a) Do not know.

3. Worms.

3. (a) Eating dirt.

4. Fevers.

4. (a) The evil eye (accidental from jealousy).

(b) Bewitching (purposeful).

A.2 (Infant Illnesses: continued)

What are the different possible cures (1) caused (1 [a], [b], [c])
(PROBE: Any other kind?)

Who can administer the cure?
(PROBE: Anyone else?)

1. (a) Have sorcerer determine who cast "the eye" on the child.

1. (a) Local midwife.

(b) Keep baby warm, feed him warm foods, no milk.

(b) Local sorcerer.

(c) Feed him this potion made from herbs.

(c) Nurse.

(d) Give him modern medicine.

(d) Doctor.

2. (a) Do not feed the baby anything.
(b) Give baby our local medicine for diarrhoea.
(c) Ask the doctor for medicine.

2. (a) Local midwife.
(b) Doctor.

3. (a) No cure.

4. (a) Only cure is determining who bewitched baby or gave it the evil eys.

4. (a) Sorcerer.

A.3. DEFAECATION HABITS
(Respondent, a woman with no latrine)

Where are the different places you usually defaecate?
(PROBE: Any other place?)

What do you like or dislike about using each of these places?

1. In the cow shed (at night).

1. I do not like or dislike - I just go there.

2. Behind the house (at night).

2. I do not like it because somebody might pass by and see me, especially if a man sees me it is very shameful.

3. At my cousin's house who has a latrine (daytime).

3. (a) My cousin's latrine I like but it is very far from here. If I have diarrhea which we get from time to time, I sometimes cannot make it there on time.

(b) Also, I am ashamed to use her latrine if I have diarrhea.

4. On Tuesdays and Fridays I can use the latrine of the family for whom I bake bread.

4. I also like using this latrine on the day I bake bread.

A.4. CHILD STOOL CLEAN-UP

Where are the different places that
your small child (children) defaecate(s)?
(PROBE: Any other place?)

When your child defaecates in
do you remove it, and if so, where do you put
it? (PROBE: Any other place?)

1. In the house.

1. (a) Yes, throw it in the cowshed.
(b) Throw it in the street.

2. In the courtyard.

2. (a) Yes, brush it to one corner.
(b) Throw it in cowshed.

3. In the street.

3. No, I just leave it.

B. Sample Survey Questions Derived from Open-ended Questions

1. What are the different places where you obtain water for drinking and cooking?

----- drainage canal
----- hand pump (note distance from house -----)
----- roof-collection
----- vendour (at what price -----)
----- other (specify)

2. Where are the different places you usually defaecate ? (Not a suggested wording)

----- cow shed
----- behind the house
----- at a relative's latrine (distance -----)
----- at another person's latrine
(describe relationship)-----

3. Where are the different places that your small child (children) defaecate(s) ?

----- in the house
----- in the courtyard
----- in the street
----- in our latrine
----- other (specify)

8. (continued)

4. Where do you encourage your small child (children) to defaecate?

----- in the house

----- in the courtyard

----- in the street

----- in our latrine

----- in a neighbour / relative's latrine

----- other (specify)

5. Do you encourage your small child (children) to use your latrine? (If latrine is present)

----- Yes

----- No

IF NOT, why not? -----

CHAPTER - 3

PARTICIPATION OF WOMEN IN WATER SUPPLY AND SANITATION PROGRAMME

5.1. WHY INVOLVE WOMEN ?

The participation of women in water supply and sanitation projects can have several benefits. It can contribute to the achievement of specific project objectives of functioning and use of facilities and also to the attainment of wider development goals. Further, their participation can also be of both direct and indirect benefit to the women themselves.

5.1.1. Traditional Roles

The potential contribution of women to these objectives emerges logically from their traditional participation in water supply and sanitation. As domestic managers, women decide where to collect water for various purposes and in various seasons, how much water to collect and how to use it. In their choice of water sources, they make reasoned decisions based on their own criteria of access, time, effort, water quantity, quality and reliability. In addition, much of the informal learning about water and sanitation takes place through interpersonal contacts between women. Thus their opinions and needs have important consequences for the acceptance, use and readiness to maintain new water supplies and for the ultimate health impact of the project.

In sanitation, demand for privacy of women is a determining factor settled communities. Women also maintain latrines or supervise maintenance by children, provide handwashing facilities, take care of excreta disposal and hygiene of young children, and assist and educate them in correct latrine use. Factors influencing latrine acceptance and use which have emerged from a review of a large number of publications are the desire to avoid visibility, cost, acceptable arrangements for sharing, status, location, appropriateness for children, and ease of operation and maintenance.

5.1.2. Economic Benefits

The introduction of improved water supply and sanitation may have welfare benefits, particularly when time and energy spent by women on water collection and waste disposal is reduced. These benefits differ considerably between and within households, depending on environmental

conditions, the age and position of women in the household, and socio-economic class.

Potential economic benefits from the time saved in fetching water are closely related to the extent of women's involvement in domestic, economic and community development work. In many rural areas, women are actively involved in agriculture, particularly food crop production and processing, and in animal care. In poorer households often they contribute substantially to the household income by working for others. Conflicting demands on time and energy, especially at peak periods of agricultural work have sometimes led to neglect of household tasks, such as cooking and child care, or agricultural tasks, such as weeding which in turn may lead to reduced harvest. Time and energy gains from reduction in water collection may also be used for community development and educational activities. In some areas, when time permits, women make the largest contribution to community self-help projects. Lack of time is often a major constraint to their participation in non-formal education.

Traditionally, women are also the main users of water and waste for the household economy, for example in vegetable gardening, animal husbandry, brewing, processing organic waste for fuel and compost and plastering walls and floors. These activities have consequences for the level of nutrition, income and hygiene of the family. There are strong indications in the literature, although not always supported by quantitative data, that the income of women is spent on basic family needs, such as food, clothing and household utensils, and also on improvements to and payments for domestic water supply and household hygiene. These patterns make women valuable partners in the expansion of productive use of water, time gains and processed waste, as part of water supply and sanitation projects.

5.1.3. Health Benefits

Water and sanitation related diseases are responsible for most of the morbidity and mortality in developing countries. The use of more water of improved quality and safe methods of excreta disposal, adequate personal hygiene and food hygiene by all members of the community can lead to significant reduction in these diseases. These measures can also decrease considerably the economic cost of these diseases and their treatment for individual households and for governments, and reduce the human suffering associated with them. Women play a key role in this process because traditionally, they manage domestic water use and household hygiene, educate and care for young children, provide health care in their household and often also in their community, and make decisions on use, and to some extent maintenance, of water supply and sanitation facilities.

5.1.4. Project Benefits

Their traditional roles are the obvious rationale for involvement of women in the introduction of improvements to water supply and sanitation and in concurrent arrangements for operation, maintenance and health education. Many cases of rejection and problems in the functioning and use can be explained, either partly or fully, by insufficient attention to the traditional roles and positions of women, and that the women have had sound reasons for non-use of facilities.

On the other hand, there are many accounts of specific contributions of women resulting in direct benefits to the projects and communities. As prime beneficiaries, they have promoted the interest and willingness of men to contribute to improving water supplies and installation of latrines. Other projects have benefited from their knowledge of local socio-cultural and environmental circumstances, including the identification of reliable water sources of acceptable quality and accessibility; reduction in construction cost by having shorter pipeline tracks, thus enabling more communities to be served with the material available; adaptation of the design of equipment for improved operation and use; and socially acceptable arrangements for sharing facilities.

Although awareness is increasing that participation in rural water supply and sanitation is more than merely the contribution of voluntary labour, the notion of self-help construction being equivalent to community involvement still persists. The main value of this type of participation is that, when well-organised, it has sometimes led to considerable savings in capital cost, particularly in gravity schemes. In areas with communal facilities, these cost savings have reverted to the agency or led to the provision of an extra tap or facility for the users. In areas with house connections, contributions in kind have reduced the connection cost so that at the time of installation more households could participate in the project. However, increased coverage has not necessarily resulted in access to all, and this form of participation in itself does not guarantee that facilities will be maintained. This depends more on joint agreement between agency and community, both men and women, that a particular improvement is wanted; is within the capability of the community to maintain, with additional institutional support and training where necessary; and that the design and location of facilities meet the needs of the users.

An important issue is that the traditional skills and knowledge of women can benefit water supply and sanitation projects. The value of their knowledge to local planning has already been discussed. Women have also made well-reasoned selections of community workers, such as members of local committees and candidates for training in health duration

and maintenance. Often, the women selected are older women heads of household because of their greater freedom of movement. Other reasons for preferring these women as community workers may be their greater need for and interest in part-time work which can be integrated with their household tasks, and their greater job motivation. Other more subtle criteria may also play a role. The main point is that when asked to select suitable community workers, women can make use of inside knowledge not necessarily available to the agency.

5.2 HOW TO INVOLVE WOMEN ?

Most accounts of the involvement of women concern isolated projects. There is a need to integrate the involvement of women in a systems approach to water supply and sanitation, including regular monitoring and feedback on both the process and the effect of their involvement in relation to the type of technology and the socio-economic and cultural circumstances.

5.2.1. Planning

For projects which have adopted a community participation approach, a common strategy in local planning is to inform all users, including minority and disadvantaged groups, about the project; to consult them about their needs, preferences and expectations; to discuss options and to reach an agreement on all major issues such as community maintenance and finance. Many reports and studies from the field show that, in spite of their traditional roles, women face problems in participating in this planning process. This also affects their participation in follow-up arrangements for health education, maintenance and management. These problems originate partly from the position of women in different socio-economic classes, age and stages in the life cycle, and in different cultures. In some cultures, integration of women in local socio-political structures is possible, and sometimes occurs. However, these structures do not always represent poorer women. In other cultures, men and women have separate and complementary tasks and responsibilities, which may have or have had equal status. Often women in these communities have traditional organizations and networks which could be involved in the planning process. In secluded societies, women are confined to the house and the immediate environment and contacts with other women are informal and usually limited to the family. Lack of involvement may also stem from the fact that external projects take water supply, sanitation and health out of the women's sphere into the male public decision-making domain. This occurs because the projects are carried out by male staff who communicate with male community

leaders, and may also explain why much traditional maintenance done by women has remained hidden. Both community leaders and women themselves have ascribed to men only decisions and work actually done by women. Very often the true role of women has not emerged until traditional maintenance and decision-making processes have been discussed, for example, in a meeting of local women with a woman field-worker.

Several strategies have emerged which have been used to involve women more actively in local planning. They have been integrated directly in general community participation structures by practical measures, such as facilitation of attendance at meetings and training activities, and by the development of positive attitudes of men to their involvement in accordance with women's customary tasks. In areas where women and men have segregated but complementary and equivalent spheres of influence, women have been consulted at separate meetings or at places where they gather for daily activities, and eventually join in other project activities. An alternative to an integrated approach is the involvement or development of separate women's organizations, either formal or informal, as for example in health education and site maintenance of communal water collection points. Finally, women have been reached individually at home, for example in community surveys in project planning or evaluation, and in health education, using both women workers and trained community women.

There are a number of examples of women and women's committees being excluded from planning and management decision-making by local leaders and project staff, and also examples of women's representatives and organisations contributing substantially to the continued functioning of community water supplies and to improvement of environmental hygiene. There is evidence that the women themselves know best which is the most appropriate approach in their society. Contributing factors to the success of either approach seem to be that the women are aware of their common interests, have united, and have received the support of the project. However, from the practical point of view of the agencies, each approach may have different implications. The process and effect of alternative approaches is an area for further study including aspects, such as inputs, costs, appropriate design and maintenance, changes in household and community level hygiene and training of women for group development, situation analysis and problem solving. Irrespective of whether such studies are carried out, agencies should ascertain whether their approach leads to involvement of women in the project in a way which the women themselves consider to be meaningful.

An issue for special consideration in agency planning is the integration or linkage to income generating activities for women. This is related to expenditure

patterns of income controlled by women, as mentioned previously. The income generated would not only benefit women and their families, but also contribute to the attainment of project benefits, such as total community coverage, cost recovery, continued functioning and improvement of public health.

5.2.2. Health Education

Many locally specific risks of transmission of water and sanitation related diseases, based on behaviour which continues after the introduction of improved facilities, make health education support programmes necessary. Where such a programme is added to a project, frequently it is the only part of the project in which women are involved. In many instances, local women have been involved in these programmes as individual receivers of health information in their homes and meeting places. Sometimes, programmes have been limited to the transfer of general health information, without attention to the accessibility of the information, the attitudes and practices of women, and the factors underlaying these practices. In other cases, information programmes are based on careful inventory of the local situation, practical knowledge, beliefs and behaviour of women. Even the rather conventional knowledge, attitudes and practices (KAP) studies which, with standardized questions, do not make it easy to gain insight into the practical knowledge of women, have revealed some sound practices and basic knowledge on which participatory health programmes can be based. Their practical knowledge of community practices, conditions and beliefs requires that women be involved, not as passive beneficiaries of general and academic health education programmes, but as active co-planners, implementers and evaluators of local action programmes.

Women have participated more actively in health education as community health workers, members of community committees and women's organisations. However, some of these organisations focus mainly on development of skills or only involve wealthier women. Further evaluation and reporting is required on the membership of these women's groups and their effect on changes in hygiene behaviour and conditions in the household and community. Projects should also report whether such changes were achieved by a didactic approach, or methods of joint analysis, planning, implementation and evaluation.

There are reports in the literature of poorer women in particular expressing a need for health education that is more adapted to the economic conditions of their families. In response to their needs, some programmes have provided implements or have helped women to make these with local materials, other programmes have included activities to generate income and to reduce expenditure. It is possible

that the conclusion of economic components in health education programmes is in the long term more cost-effective than more conventional health education for the total elimination of local risks of transmission of water and sanitation related diseases. This is not yet clear, because this type of health education programme with women is comparatively new.

There are also indications that men should be involved in local health education as husbands and fathers, and also because of traditional divisions of labour between men and women. Opposition from husbands to the participation of their wives in education programmes has been overcome by involving the men in some way in these activities. Traditional divisions of labour and authority have sometimes prevented women from achieving necessary improvements, such as roofing of latrines and kitchen improvements which are male responsibilities. In both cases, the women have drawn the attention of the agency to these problems or have suggested culturally appropriate solutions. More evaluation is required to assess the effectiveness of health education programme involving men and also of school health education in relation to domestic improvements.

5.2.3. Construction

In Latin America, Africa and in parts of Asia, women have participated actively in the construction of facilities, especially piped water supplies. This has taken the form of voluntary labour especially in areas where women are traditionally involved in agricultural field-work. Elsewhere, they have motivated and supported men to do unskilled voluntary construction work, or have fed and lodged construction workers, and have raised community funds for the project.

The interest and successful training of women in some areas in cement construction work, such as latrine slabs and rain-water collection tanks, may possibly be explained in terms of a connection with traditional skills in plastering, their responsibilities for domestic water supply and sanitation, and women workers being more acceptable to preserve household privacy. Water supply and sanitation projects and also food-for-work projects may benefit from the interest of women in sanitation improvements, both as domestic managers and project workers. Such interests exist particularly in areas where husbands disapprove of work being carried out in their homes in their absence, where the need for privacy creates a demand for better sanitation facilities, and where women work in modern or traditional construction.

5.2.4. Maintenance

Where women have been involved in maintenance, their role has been closely related to their traditional management tasks. They have been involved especially in the preservation of site hygiene and the control of source use. In some cases, arrangements have been made spontaneously, thus preserving their original tasks as users and informal managers. In other cases, special tasks have been formulated in consultation with the agency. These have varied from appointment of a nearby women to look after the water point, to a site committee, user roster, or a team of a male and a female caretaker with the women responsible for hygiene and the man for technical matters. Experience indicates that factors relevant in site upkeep are that maintenance is not imposed but agreed upon jointly; that the women know what to do and why; and that there is two-way communication with higher level maintenance so that users are informed when, for example, storage tanks are cleaned, and know whom to contact about problems. It has also become clear that to increase the welfare, health and economic benefits of the system, women as the main users and managers, should be involved in decision-making on water use at the tap or well.

Women have been involved in more technical maintenance and repair tasks, especially in areas of high male migration, and in specific women's projects. Although there are several positive accounts of their commitment and performance, no methodologically sound quantitative evaluation has been carried out which compares the performance of men and women caretakers under similar technical, social and environmental conditions.

5.2.5. Administration

In local administration, women seem to be particularly active in financial matters, including fund raising, fee collection, fund keeping and supervision of the local board. This may not only show their willingness to put effort into a good water supply and indicate the most recurrent problem and problem-solving approach, but also reflect their dependability in fund keeping. Other factors which facilitate fund collection by women may be the link with their roles in managing the domestic budget and in making social visits. At present, there are too few reports in the literature on which conclusions and implications for programme development and training can be based. This is obviously an area for further information and investigation.

5.2.6. Evaluation

Originally, the emphasis in evaluation of the benefits of water supply and sanitation projects was on separate

impact studies on public health and socio-economic development. While the large number of health impact studies in totality indicates that projects have important benefits, they also show that demonstration of these benefits depends on the soundness of the methodology of the studies. Factors for consideration include whether improved water supplies and sanitation facilities are better than existing facilities, function appropriately, and are used adequately by all men, women and children. Therefore, the focus has moved from ultimate impact studies to intermediate studies which investigate the functioning of systems and the behaviour of the people in the community as part of on-going water supply and sanitation programmes. This means not only involving women as knowledgeable informants in a survey, but also investigating the degree to which they were actively involved in the preceding process, and also whether greater involvement is indicated and feasible.

As with health impact studies, there are also indications that these benefits do not occur automatically in all cases, but depend on the way projects are carried out and on the associated support programmes. For an impact on public health, usually a supplementary health education programme is necessary. For greater socio-economic impact, support programmes may be the integration or link with developmental use of time gains, for example for non-formal education and of surplus water and processed excreta and organic waste, for example for vegetable gardening and tree nurseries. Cost-effectiveness studies can demonstrate the value of these additional inputs, and also disclose benefits to the financing of operation and maintenance. Further, information on such developmental use of project benefits would be valuable for policy development on project allocation, and promotion and subsidization of composting latrines in some areas.

Compared with the many studies on women's traditional roles showing the potential benefits of time and energy gains, increased welfare and socio-economic development, there are very few studies which have measured the multiple benefits of community water supply and sanitation projects in quantitative as well as qualitative terms. More studies are needed in order to demonstrate more clearly that water supply and sanitation projects can improve the situation of women, their families and their communities in a multitude of ways, and to indicate which type of communities and which participation processes will bring about the most benefit.

A matter of special concern in evaluation are the issues to be addressed to ensure that improvements in water supply and sanitation do not lead to deterioration of the position of some or all women in the communities concerned. Most of these problems can be prevented by more careful planning and better dialogue with the women themselves. A special issue for study and experiment in this respect,

which has already been taken up by some water agencies, is the development of an equitable system of water rates for systems with unmetered yard or house connections.

Annex - IV

**Water & Sanitation Related Disease Associated with Women's
Work and the Contribution of Women to Disease Prevention**

Activity	Disease or accident	Environmental factors in Disease & Disease Transmission	Contribution of women to disease prevention
Clothes washing	Schistosomiasis (bilharzia)	Infestation by schistosomes resulting from prolonged standing in infested water	Participating in design and management of washing and bathing facilities at safe water sources
Drawing water from ponds and rivers			Collecting water early in the morning and late at night only, 48-hour sedimentation Avoiding crowded places and prolonged contact with infected water Educating Children about bathing and swimming risks Removing topsoil from domestic ponds in the dry season
	Onchocerciasis (river blindness)	Simulium fly breeding in fast flowing water	Participating in design and management of washing and bathing facilities at safe water sources

Contd...

Activity	Disease or accident	Environmental factors in Disease & Disease Transmission	Contribution of women to disease prevention†
	Trypanosomiasis (sleeping sickness)	Tsetse fly in vegetation on river banks	Adapting washing and bathing practices to avoid use of high-risk sources Women-to-women health education and peer influence for general use of washing facilities
	Dracunculiasis (Guinea worm)	Infested water users release larvae from leg ulcers when standing in water, others are infested from drinking the water	Filtering drinking water through folded fine textures cloth
	Back and head pain, injuries from falls, miscarriages	Lifting, carrying heavy loads on steep and slippery paths	Participating in design and use of lifting and transport devices
Domestic work	Faecal-oral diseases	Wiping babies' bottoms, washing soiled garments, cleaning latrines, preparing food	Improving handwashing, latrine hygiene, food hygiene, hygiene of children Participating in latrine design and location

Contd...

Activity	Disease or accident	Environmental factors in Disease & Disease Transmission	Contribution of women to disease prevention
	Skin & eye diseases	Small quantities of water collected for bathing and washing clothes	Using more water Using transport facilities to collect more water
	Chagas' disease	Vectors live in cracks in house walls and animal shelters	Carrying out housing improvements and maintenance
	Filariasis	Vectors breed in latrines & sullage water	Participating in improving drainage design and upkeep of water facilities latrines, and bathing areas
	Yellow fever, Dengue fever	Vectors breed in old tins, domestic water storage containers etc.	Safe water storages and disposal of reuse of sullage water

Contd...

Activity	Disease or accident	Environmental factors in Disease & Disease Transmission	Contribution of women to disease prevention†
Agricultural & other work	Snake bite	Night visits to defaecation areas and latrines	Participating in latrine design and location
	Schistosomiasis	Transplanting rice in flooded fields	Supporting snail collection and habitat destruction campaigns
	Faecal-oral diseases	Collecting night-soil; working in fields fertilized with night-soil and visits to traditional defaecation areas	Motivating installation and use of latrines Promoting social norms on avoidance of contact with stools, ablution and foot washing; burying excreta in fields
	Hookworm		
	Zoonoses	Working with animals	

† In all cases, women can participate in problem analysis and identification.

CHAPTER = 6

HYGIENE EDUCATION

6.1 Establishing Identity in a Community

A water supply and sanitation project is a long-term commitment. For the project to run smoothly throughout, project staff should start correctly by visiting the community several times before any of the construction work is begun.

It is always easier to change technology than it is to change people's behaviour and practices. With this thought in mind the project engineer and staff must prepare the community. This involves more than simply telling them that a hygiene education programme and new technology will be coming into their village. It requires more than just asking the people to cooperate. The project staff must encourage the community to actively participate in the planning and execution of the project. This is the specific role that a hygiene education team can play as members of the project staff.

Hygiene education in a water supply and sanitation project involves the work of two groups of professionals who function as teams. The first is the planning team which includes among its members the project manager / engineer, and many other technical professionals such as health specialities, biologists and experts in various technologies. The planning team gathers information through technical and social surveys, from discussions with villagers and other methods about the community or area where the project will operate. With this information and the team's wide range of expertise, the team develops a suitable and effective hygiene education programme with the community.

When the project actually begins, the second team goes into action. This implementing team is made of field staff. It includes many of the same technical professionals who were on the planning team, although the project engineer may not be directly involved. This team implements the hygiene education programme developed with the assistance and support of local people such as teachers, community leaders, midwives and other groups.

The team effort in hygiene education also extends to any staff members of government, ministries and agencies who are involved in related activities. An overall team effort is essential because appropriate technology by itself does not improve community hygiene. It takes the skills of the social experts on the team to understand how the community can improve its hygiene practices and support individuals, especially mothers, in watching for the needed behavioural changes. The improvements in hygiene and better health can begin. This has proven to be the best way to make hygiene education succeed.

6.2 Background Information of the Community

To develop a hygiene education program, staff members must first find out as much possible about the community before going there. This can be done by talking to people who have visited or worked in the community. Important information would include the following :

- name and location of community leaders and other respected persons;
- customs of addressing people which are considered polite and correct (if staff are all male, can they talk to the women, if staff are all women, can they talk to the men?);
- the correct times to visit without conflicting with important community activities;
- how staff can communicate with women to understand their beliefs and needs and encourage them to participate in the planning and execution of hygiene education.

Community members must be familiar with project staff before co-operation can be expected. During introductory visits staff should try to meet a broad cross-section of the people, from the formal leaders to the men or women in the market and on the street, and in a few households. Establishing identity and trust is crucial because people are often suspicious of strangers. They may ask, 'why is this person roaming around our streets? Who gave him or her permission? Can we trust this person?' Such questions should be answered early.

It will take time to establish a good relationship with the community. Some time can be saved by entering the community with a known and respected person. It is a good idea to mix official visits with social visits by attending community functions like festivals or celebrations.

During discussions with people in the community, they will bring up other community needs. Some of these may not apply to hygiene education. But these other needs should not be ignored. The staff member should be willing to put the community in touch with other agencies that can provide assistance. The staff member can often show that there is a connection between hygiene education and other development objectives.

6.3 Community Leaders

Community leaders normally provide the encouragement and guidance for their communities to participate in a water supply and sanitation project and its hygiene education component. Before they will co-operate, these leaders must believe that the project will benefit their people and not conflict with their own interests.

The project engineer and staff must identify who the leaders are and meet with them. Leaders are generally of two types; formal and informal. The formal leader is someone with a title who has been officially chosen for a position. Such leaders may be found in :

- traditional hierarchy
- local government
- religious or cultural organizations
- trade associations
- craft unions
- self-help societies
- social clubs
- educational institutions.

A second important category is the informal leader. These leaders have no special title and appear at first glance to be ordinary citizens. But the opinions, request and suggestions of these people are well respected by the community. The quality of informal leaders comes from their personal qualities and abilities. Examples of informal leaders may be :

- the midwife who has years of experience delivering babies and raising children. She is directly involved in hygiene practices, and often prescribes curative and preventive remedies for illness. She also has the confidence of women in the community.
- a primary health worker or volunteer who has been selected by her community;
- a successful farmer or businessman;
- a successful market-woman or storkeeper;
- the oldest person in the community with a wealth of knowledge about the history and customs of the people, including those related to water and hygiene;
- the school teacher who may eventually be a valuable resource in teaching hygiene to the children.

Informal leaders do not have titles or hold offices, so the only way to locate them is by talking to people in the community. Questions like, "whom do the people usually turn to for help when they are sick or hurt?" may lead to informal leaders who are interested in health in the community.

The next case study shows the need to understand the overall structure of the community and to take care in identifying leaders. It demonstrates the importance these community members can have in hygiene education.

6.4 Planning for Hygiene Education

The promotion of hygiene education will require a specific body in the community through which planning and action can be coordinated. The community's water supply and sanitation committee may be able to do this work. Or, an existing group in the community, which is involved in development work, may be the likely candidate for planning hygiene education.

If there is no appropriate existing group, a committee can be formed drawing in people from representative groups and interests in the community, such as farmers' unions or market associations. In communities which do not have any organizations like these, a completely new group might have to be formed. For the long-term benefit

of the community, this new organization should have the broad goal of community development, with water supply, sanitation and hygiene education as its first priority. It should be representative of the different ethnic, economic, religious and political sectors of the community.

Any committee formed to plan for hygiene education should involve women. Hygiene education is one of the principal roles of women within the household. It is essential that women as individuals and in groups, be involved as early and as fully as possible, if the expected changes in behaviour are to occur.

6.5 Finding Organizations in the Community Which Can Help the Hygiene Education Effort

In almost every community there are formal and informal organizations whose aim is to improve conditions in the community. They are valuable human resources and can provide moral support and materials that can aid in the development of water supplies, sanitation and hygiene education. For example, in many communities in Yorubaland in Nigeria you may find that women are not involved in any so-called 'important' activity. On closer examination, you may find 'market-women associations' where women, in their informal role have a great deal of influence.

Self-help groups may have obvious titles like the village council. Others are identified by words like 'development committee', 'improvement society', 'progressive union' or 'welfare council'.

The usefulness of such groups as a mobilizing force in community projects depends on two factors. First, such groups should represent citizens from most, if not all, section of the community. Secondly their aims should include serving the whole community and not just a small group within it.

One should discover the following about each organization :

- what projects they have attempted;
- what reasons there are for the success or failure of the projects attempted;

- whether the members are dedicated and hardworking.

Talking with villagers may also tell how good the various organizations are. Listen for comments like: "They are always doing fund raising, but then the money gets spent on parties and celebrations that benefit no one" or, "The town welfare union does good work. Anytime people are in need they can expect help".

6.6 Involving Outside Agencies

Although one agency will be in charge of the water supply and sanitation project, other outside agencies may provide useful assistance in hygiene education. For instance, a public health centre may be able to teach mothers the proper way to dispose of their babies' excreta. An agricultural extension agency could explain to men the health risks of defecating in open fields. All such agencies should be contacted. The community organization responsible for the project may wish to invite representatives of these agencies to share ideas on hygiene education methods and assistance.

6.7 Implementing Hygiene Education

The engineer or project manager should take care not to impose new models or organizations on existing structures in the community. In the case of hygiene education the community efforts toward primary health care through local committees and volunteer workers must not be ignored. Even though it may not be an ideal solution, the decision about whether to organize a new group, and what rules, activities and structures it should adopt, should be left primarily to the community. Imposing new organizations on existing nonformal groups can even be detrimental to overall health and hygiene by weakening local activities that are already functioning. The installation of improved water supply and sanitation facilities provide an opportunity for the engineer to identify and possibly correct some factors that have been obstacles to collective action. Communities can be encouraged to organize themselves to maximize the health benefits from the new technologies. To decide how to do this is not the choice of the engineer or planner alone, but of the community.

If a water and sanitation committee has been organized by the community to administer the new facilities its efforts should be linked to existing health and development activities in the community.

6.8 Community Awareness, Needs and Practices

A survey of the community helps project staff understand community needs behaviours, beliefs, attitudes, values and resources. At the same time, community members can begin to understand the alternative technologies available and how they relate to their needs. With this information the hygiene education team which includes the project engineer, government representatives and other technical professionals, can develop a program with the community.

Community members will always have answers to questions like "What could be done to improve hygiene and sanitary conditions?" Their answers will indicate what they believe is needed in the community. They may feel they need:

- piped water supply
- garbage or refuse collection
- water and latrines at the school
- a clean-up of the site used for open defaecation

They may not have acted before to meet these needs due to lack of skills or resources, but the potential for action is there.

Staff members of various agencies will see needs, to. They may identify problems like :

- high prevalence of gastroenteritis
- no handwashing after defecation
- poor nutrition
- dirty water containers

Agency staff and community members often see quite different needs for the same community or village. For instance, agency staff and community members will probably agree on the need for latrines to prevent hookworm, for hookworm is a major problem in the village. But if hookworm is only a minor health problem, the villagers may not feel the latrines are such an urgent need.

Improved hygiene will often fit in with the needs expressed by community members. For example, women may want to work in small business or crafts to

increase family income, but they have no time. It may turn out that taking care of sick children who suffer from diarrhea is a time-consuming task. One could then suggest that an investment in a clean community water supply would result in fewer sick children. Then there would be more time and energy for economic pursuits. Women can often provide the link needed between water supply and sanitation, and other development goals.

6.9 Paying Attention to Community Beliefs

Project staff should play close attention to the habits, beliefs and taboos of the villagers. This type of information, particularly when collected from the women, can provide a starting point for hygiene education messages to change the way people use water and dispose of excreta.

A program intended to provide latrines for all the household in an East African community shows why it is necessary to understand these beliefs and taboos.

The project staff were successful in getting one latrine built for each family compound, but the people would not actually use the latrines. Why was this the case?

The latrines were standard on-hole models. These were not appropriate for the community since there were taboos against males and females passing feces in the same place. Furthermore, it was not considered proper for in-laws to defecate in the same place. Another problem was the desire for privacy. To achieve this, many families built the latrines far from the house, making them inaccessible to small children. In fact, everyone feared walking far in the night to relieve themselves. This program failed because the staff had not asked the right questions to the villagers or involved them in identifying solutions beforehand.

Another important influence on behaviour is that people tend to avoid certain areas for historical or religious reasons. This has a bearing on the site of any project. For example, during a recent war in Southeast Asia, one community was occupied by the opposition forces. The soldiers forced the residents to dig them a well. After the war, the hatred by the villagers was so strong that they knocked down the well and filled it up with dirt.

Many years later water project technicians came to the area. They found that the best site for a well would be the one the soldiers had selected during the war. After spending a lot of money to repair the well, the project staff discovered their effort was not appreciated. The villagers could not overcome their deep-seated prejudices against the well and would not use it.

6.10 Staff training

Subjects to train workers in hygiene promotion may include

- communication and human relations skills;
- skills in making and using simple educational aids (stories, songs, posters, banners, role playing etc), using local materials and people;
- knowledge of the correct and healthy ways for people to use the new facilities;
- knowledge of the effects on health of water use and sanitation practices;
- understanding of how local beliefs, values, customs and attitudes may affect water use and sanitation practices.

6.11 Who Should Get The Message

6.11.1 Reaching Women

Women have a special role in hygiene education and they need to be involved in the early stages of program. The information and training planned for women should be closely related to the school's hygiene curriculum. Outlined below are some of the hygiene messages about household activities where mothers have the primary responsibility.

Figure : 6.1

Women Role in Hygiene Education

Water use and reuse

Drinking		Washing		Bathing		Watering
Human	Animal			Human	Animal	
Hands	Vegetables	Clothes	Vegetables	Patios		
Dishes / Jars	Children	Floors	Flowers			

Excreta Use and Reuse

Defecation	Infant Care & Training	Handwashing		Care of Toilet	Reuse
		When	How	Where	
Actual & pre-ferred practices	Sex Age class, prohibitions				Daily Monthly
				Appropriate	Casual (pigs, dogs, fish, others)
Bathing	Diapers, nappies or nothing	Laundry of soiled clothing			

Many of the same low-cost teaching aids prepared for classrooms instruction can be used in the special training programmes for clinics and groups of women. The teaching techniques must be planned with the users in mind, and so must be the location and time for these educational activities.

6.11.2 Reaching Parents through Health Centre

Maternal child health clinics and midwives should receive messages similar to those given to women. These types of clinics should be the first places in a community to have access to improved water supply and sanitation facilities.

6.11.3 Reaching Children in the Schools

The hygiene curriculum should be in use while the project works in the community. In this way pupils will be knowledgeable about the new facilities and can practice their new hygiene skills as soon as the project is completed.

The curriculum committee should consider how to make low-cost teaching aids from locally available materials. Models of clay and wood, hand-drawn posters and stories are examples. A workshop can be held to show people how to produce these materials.

The project planning group should make sure that schools have access to the water supply facilities being constructed in the community. Ideally schools should have their own taps or wells, latrines and refuse disposal systems. It is only when these facilities are present that pupils can learn how to use and care for them correctly. Health educators need to teach a complete procedure for using the facilities, including the use of soap and hand washing. Teachers in charge of the facilities, need to make sure there are cleansing materials on hand and a place to keep the soap. They should also give clear instructions on how to dispose of cleaning materials.

6.11.4 Children

Children from a large group of water users in some communities do much of the labour involved in fetching water and disposing of refuse. The children can be taught at school to use water supply and sanitation facilities to improve their health. They can also help their mothers change the hygiene behaviour of their brothers and sisters. However, the mothers must also understand and appreciate good hygiene practices. As a first step in planning hygiene education activities in a school, project staff planning group members should meet with school authorities. They should assess how well the existing curriculum deals with hygiene education. An assessment should be made of how much time is available to teach the subject

and the ability and interest of the teachers in teaching the subject, including evening classes for parents, particularly the mothers.

6.11.5 Reaching Parents Through the School

Parents may not listen to what their children tell them what they have been taught in school. An active effort by the schools to reach the parents can help children introduce new ideas learned at school to their family. Some of the following activities may help educate and involve parents.

- presentation at meetings by parents and teachers;
- efforts to get contributions (money, materials, technical advice and labour) to help provide water supply and sanitation facilities for the school;
- plays by the children about water, sanitation and hygiene practices presented to the parents;
- special visiting days where parents can come to school and see art or science projects their children have done on water and sanitation related subject

6.12 **How to Get The Message Across**

Achieving the educational goals usually involves using various types of mass media and 'large group' educational techniques. These must be reinforced by personal contact and locally relevant materials to be effective. The best results will be achieved by a mixture of communication methods that combines a presentation of information with instructions and demonstrations of how parasites spread, how to use the new sanitation facilities, etc.

Some of the communication methods may require electricity, literacy, or large audiences and may be more feasible in urban settings. For rural areas, traditional plays, story-telling or festivals can be made part of the educational process.

Mass education programmes should be in a language most commonly used by the community. Presentations can be enhanced by familiar proverbs, songs or poems that are relevant to the topic. The messages should be simple and clear to the average citizen. They may be presented

in the form of talks, slide-sound shows, discussions, or demonstrations.

Educational programs should be planned for as many different groups as possible. The presentation should be about the interests of the group. Here are some examples :

The group might be an association of shop owners. A discussion about new latrines could show how the streets would be cleaner, making the shopping area more attractive to customers, and reducing the diseases caused by insanitary conditions.

A talk to a farmers co-operative could be about the problem of hookworm. Talk about how the latrine will stop the spread of the diseases. Tell them the physical and financial benefits for stopping hookworm.

It is best to have a member of the agency team and someone from the community organization present at meetings with community groups. The person from the agency can answer technical questions, and the community person can explain the role the community must play in the project.

6.13 Review of Hygiene Education

Here are some of the main points about hygiene education that have been discussed in these notes :

- Hygiene education must be a multi-disciplinary effort by the planning team, the implementing team and the community.
- The community must be involved in planning the hygiene education program.
- Hygiene education is a long-term activity - health improvements and changes in hygiene practices can take years to achieve.
- Good health and good hygiene are made possible by a combination of education, improvement in personal hygiene and appropriate water and sanitation technologies.
- Community needs and community development objectives can be related to better health and improved hygiene.
- Background information on a community is needed before planning can begin for the hygiene education program. Project staff should be aware of local leadership, local

customs and which outside agencies and local institutions can assist in hygiene education.

- A detailed community survey must be carried out to determine local hygiene conditions, needs, perceptions of health and hygiene, local attitudes towards water use, defecation and choice of new facilities, and local resources for education.
- Project staff should identify community self-help organizations which can help promote hygiene education.
- Hygiene messages must be designed for their specific audience, particularly women and children.
- Hygiene messages can be passed on using many techniques—from hand drawn posters to short radio broadcasts.

CHAPTER - 7

WATER QUALITY SURVEILLANCE

7.1. ORGANISATIONAL FRAMEWORK

The precise meaning of "surveillance" in relation to the control of drinking water quality is not always clear. As used here, it means the keeping of a careful watch at all times, from the public health point of view, over the safety and acceptability of drinking water supplies. Surveillance requires a continuous and systematic programme of surveys, carried out at different points of the water distribution system. A surveillance programme aimed at ensuring a consistently acceptable level of drinking water quality, if it is to be fully effective, may also require legislation supported by regulatory standards and codes of practice. However, in developing countries - many of which lack adequate community water supplies - and in particular in the rural areas and urban squatter settlement of such countries, surveillance should take into account local conditions and be adapted to the levels of economic and manpower development.

The organisational arrangements aimed at ensuring compliance with the requirements of legislation, standards or codes of practice for drinking water quality must provide for surveillance to be shared between the water-supply agency and a separate and preferably independent, surveillance agency. The former is responsible at all times for the quality and safety of the water it produces. In this publication, the routine testing and monitoring carried out by the water supplier will be called water-quality control testing; this should not be confused with the separate checking and testing carried out by the surveillance agency. Both water-quality control testing and testing by the surveillance agency should be applied to all the types of water available to the community, e.g., piped or unpiped, treated or untreated supplies, derived from any suitable source, such as rivers ponds, wells, roof run-off etc.

The surveillance agency should preferably be established with national support and operate at central, provincial (regional), and local levels, usually through the health authority. It should be concerned with the public health aspects of drinking water supplies and have overall responsibility for ensuring that all such supplies under its jurisdiction are free from health hazards. To this end, it should carry out periodic sanitary inspections and analyses of water samples to determine whether the suppliers are fulfilling their responsibilities.

Because the water-supply agency and the surveillance agency have different and sometimes conflicting interests, it is important that the latter is separate and independently controlled. Nevertheless, the roles of the two agencies are essential complementary since surveillance activities, although independent, in combination result in the proper control of drinking water quality.

Some important aspects of the surveillance programme are as follows :

- a) The agency should have the sole responsibility within the health authority for providing surveillance services to protect the public from waterborne diseases and other hazards associated with the water supply.
- b) Water-quality surveillance should be integrated with other environmental health measures, especially sanitation.
- c) Surveillance requires specialised knowledge and the agency should thus include personnel specially trained in matters such as sanitary engineering, community health, epidemiology, chemistry, biology etc.; additional support should be provided by the medical profession, particularly during an outbreak of enteric of enteric disease.
- d) Health authorities should possess centralized laboratories and other services which can be advantageously used for the conduct of programmes of surveillance of water supplies.
- e) Periodic reports to the government regarding the public health situation of the country's water supplies are essential.

If the operational standards of water supply agencies are high, the duties of the surveillance agency can be reduced to a minimum. In these circumstances, the surveillance agency, while still retaining the ultimate responsibility for ensuring the safety of all public water supplies, should be able to give greater attention to the supply systems having water of the poorest quality.

Both the programme and the level of surveillance should be adapted to local conditions and economic resources of the country and take into account the following :

- the type of water-supply system (size, type of source, water quality etc.);
- the equipment used and available;

- local employment practices and level of training of personnel;
- the socio-economic level of the community served by the water-supply system;
- community participation;
- geographical and climatological conditions;
- the local communication and transportation infrastructure.

Although the main objective of a surveillance and control programme is to ensure a safe and adequate supply of drinking water, certain other subsidiary objectives can be defined, for example :

- a) determination of trends in drinking water quality over time;
- b) provision of information to public health authorities for general public health protection purposes;
- c) identification of sources of contamination;
- d) assessment of the performance of water-treatment plants; if necessary, appropriate modifications may be suggested;
- e) evaluation of water-supply systems with a view to improving them.

Because of the limited resources available, particularly in developing countries, it may be advisable to start with a fairly basic surveillance programme and then to improve on it in stages. In planning for the future ultimately reaching an advanced level.

For practical purposes, two levels of surveillance can be identified and characterised as follows :

Initial level : irregular surveillance or a basic programme that is severely limited in scope and effectiveness;

Advanced level : all surveillance and control elements fully operational.

The principal activities at these two levels of surveillance are summarized in Table 7.1.

7.2. ASSESSMENT OF EXISTING SITUATION

Water-supply systems vary greatly in size, ranging from small systems serving individual families, e.g., from a well or a rainwater cistern, to systems serving many consumers. Adequate and safe water supplies may not be available in a large number of villages in the rural areas and in many squatter settlements in urban areas, where the control, operation and maintenance of water systems is often inadequate. Small-community populations are often at great risk from waterborne diseases and their water supplies need to be safeguarded, something that can be achieved only through effective surveillance. Information on general health, gathered at central, provincial (regional), and local (or equivalent) levels, will help to define priorities for the surveillance programme within a country. An inventory of the existing and proposed water-supply systems should be prepared at each level and should include details of the water source, size and type of any water-treatment plant, the distribution systems (if any), populations served etc. The supporting services available, such as transportation and facilities for analysis, also need to be identified. From an analysis of all the information in the inventory, the workload for the surveillance activity can be assessed and the cost of surveillance calculated; this is essential if a realistic programme is to be undertaken. A suggested form for the inventory of water supply systems is given in Fig. 7.1.

Fig. 7.1. Suggested form for inventory of water-supply systems

Date of inspection	Day	Month	Year
	/	/	/
	---	---	---
	---	---	---
	---	---	---
	---	---	---

General information :

Name of supply

Owned by

Location

Persons in charge

Number of person served :

- by house connections	/	---	---	---	---	---
	---	---	---	---	---	---
- by standposts or public hydrants	/	---	---	---	---	---
	---	---	---	---	---	---
- total	/	---	---	---	---	---
	---	---	---	---	---	---

Contd...

Source of water

Groundwater /--- Surface water /--- Rainwater /---
 / / /

Water Collection and Treatment

Dug well /---
 /
 Spring /---
 /
 Drilled well /---
 /
 Infiltration gallery /---
 /
 Surface-water intake /---
 /
 Simple rainwater collection System /---
 /
 Rainwater collection system with treatment /---
 /
 Slow sand filtration /---
 /
 Coagulation and rapid sand filtration /---
 /
 Aeration /---
 /

Disinfection

Is there any means of disinfection ? Yes /--- No /---
 / /
 Is the system functioning continuously ? Yes /--- No /---
 / /

Reservoirs

Are there reservoirs in the system ? Yes /--- No /---
 / /
 If yes, how many ? /---
 /

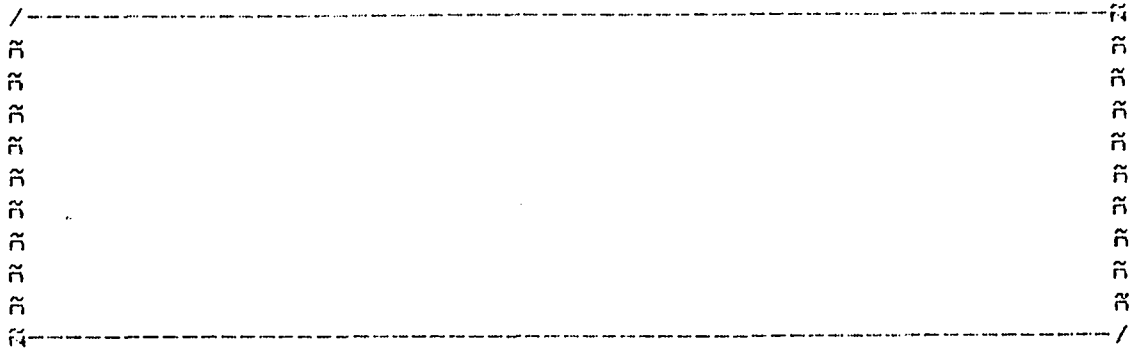
Distribution system

Number of house connections /----------
 /-- /-- /-- /-- /-- /
 Number of standposts or public hydrants /----------
 /-- /-- /-- /-- /-- /
 Total /----------
 /-- /-- /-- /-- /-- /

Contd...

Open systems /---□ Closed Systems /---□
□----/ □----/

Schematic diagram of water system from source intake to distribution (rough sketch only) :



Laboratory facilities

Nearest laboratory : in community /---□ outside /---□
□----/ community □----/

If outside community, in which place

Name of laboratory

Owned by

Distance from community to laboratory (in km) -----

Best form of transport between community and laboratory :

.....

Frequency of ----- days per month ----- days per week
transport- -----
tation

Fastest transportation time (in hours) -----

Surveillance facilities

Nearest personnel for in community ----- outside -----
sanitary inspection ----- community -----

If outside community, in which place

Distance from community to -----
sanitary inspector's office (in km) -----

7.3. SANITARY INSPECTIONS AND WATER SAMPLING

The planning of sanitary inspections and water sampling programmes for bacteriological testing depends on the workload in relation to the number and type of existing and proposed water supply systems, and the size and type of the control systems used.

Suggested frequencies of inspection and sampling are indicated in Table 7.2 and 7.3; these may be increased as the level of surveillance improves.

7.4. HANDLING AND USE OF INFORMATION

7.4.1. Results of Water Analysis

In the case of water quality testing carried out by the surveillance agency, the lines of communication normally pass through a regional surveillance agency. Field testing and sampling for microbiological analysis can be carried out by selected local personnel; this saves time and effort but requires the prior training of such personnel. Samples can be transported to a designated laboratory in the region, which should be responsible for handling and communicating the results of the analyses.

Where the regional surveillance agency decides that the results of the water analyses are unsatisfactory (also taking into account the results of sanitary inspections) and that immediate remedial action is required, that decision together with the appropriate instructions must be conveyed (ideally by radio or telegram), both to the surveillance agency and to the responsible water supply agency at local level. In addition, written confirmation must be sent as soon as possible. In case it may be necessary to exert pressure on the local water supply agency to deal with any problems relating to the water supply, the water supply agency at the next highest level should be informed in writing of the situation as soon as possible. Depending on the structure of the water supply agencies in the country, it is often necessary for the surveillance agency also to inform the highest level water supply agency; this ensures that records are available for use in future planning. The water supply agency sampling, tests or other activities are necessary.

As a guide for those carrying out remedial measures, the surveillance agency should provide them with the following :

- a) a report on the situation;
- b) information on the date, time and place at which the contamination or other problem occurred;

c) suggestions as to the remedial measures required.

The remedial measures may consist of "high-level" disinfection of the water supply, i.e., the provision of a gross excess of chlorine or other disinfectant, and/or flushing of the distribution systems, where appropriate and re-disinfection.

In addition, the surveillance agency should also immediately alert the population to the situation and advise them to boil all their drinking water.

Although less urgent, it is also very important that, whenever feasible :

- the water supply should be resampled for microbiological examination as soon as possible;
- residual chlorine levels should be checked at appropriate points;
- a full sanitary inspection should be made;
- the cause or source of the problem should be identified and the situation rectified;
- the water supply agency should be informed of the action taken.

7.4.2. Results of Sanitary Inspections

If the results of sanitary inspections are unsatisfactory, action should be taken in a manner similar to that previously described for water quality analysis. Certain of these actions are carried out by the surveillance agency, and others by the water supply agency. Ideally, the remedial measures applied to the water supply system should be the responsibility of the water supply agency. However, in many circumstances, at local level in developing countries, the surveillance agency may carry out some of the necessary work, even including practical control measures, simply because it happens to be on the spot at the time. Normally, at this local level, the actual sampling and resting of the water should be the responsibility of the surveillance agency. This is because, in many developing countries, the local surveillance agencies are likely to be more active than any local water supply agency. However, the ultimate responsibility of the surveillance agency should be to ensure that the responsible water supply agencies control their drinking water supplies to the best of their ability at all times.

The level of training of those concerned in sanitary inspections often needs to be higher and more specialized

than in the case of water quality sampling alone. In the case of sanitary inspections carried out by the surveillance agency, those responsible should be at the level of a regional laboratory, and preferably even higher.

The actions taken and the lines of communication for the surveillance agencies and water supply agencies are shown in Fig. 7.2.

7.4.3. Comprehensive Information Processing

In some countries, many regions have qualified staff to carry out surveillance but, in others, such staff will be available only at the central level. To avoid difficulties in communication, every effort should be made to ensure that the transmission of information is as direct and simple as possible. In small communities, it is usually recommended that the sanitary inspections carried out by or for the surveillance agency should not be responsibility of local personnel.

It is most important that the bodies responsible for surveillance ensure that any instructions they issue, whether written or verbal, are clearly understood. This should help to avoid any misunderstanding and conflict between the different activities of the various bodies. Cooperation and collaboration among the different bodies is of great importance and should be fostered so as to ensure a good working relationship. If any negligence is found, this should be immediately and thoroughly investigated with the aim of correcting the situation and improving conditions for the future.

TABLE - 7.1

**SUMMARY OF PRINCIPAL ACTIVITIES FOR INITIAL
AND ADVANCED LEVELS OF SURVEILLANCE**

ACTIVITY	LEVEL OF SURVEILLANCE	
	INITIAL	ADVANCED
laws, regulations & policies	basic	complete
enforcement	basic	complete
drinking-water standards	bacterial & some physicochemical parameters	numerous parameters as defined in guidelines published by WHO, or equivalent
technical assistance	limited	active
training of : staff	on-the-job, plus short courses	as for initial level plus technical institute
waterworks operators	seminars plus short courses	as for initial level plus technical institute
sanitary inspections	all urban and some small communities	all urban, many small communities
approval of sources	all urban and some small communities	all urban, many small communities
sampling and monitoring	urban areas	urban and special rural situations
water analysis	bacteria and residual chlorine	as given in guidelines published by WHO, or equivalent

Contd...2

ACTIVITY	LEVEL OF SURVEILLANCE	
	INITIAL	ADVANCED
remedial action	as needed	as needed
laboratories	existing health laboratory	as for initial level plus reference laboratory
design standards or criteria	advisory	those applicable nationally
control of cross-connection	advisory	active programme
plumbing code	advisory	codified and enforced
laboratory support services	basic media and reagents available	fully equipped laboratories available
standards for materials and additives	advisory	approved listing
regulations for special water supplies :		
institutional	hospital, major rail and air terminals	as for initial level plus other establishments
temporary	none	large camps, markets, fairs etc.

TABLE - 7.2

SUGGESTED FREQUENCY OF SANITARY INSPECTIONS OF WATER SUPPLIES

SOURCE AND MODE OF SUPPLY	MINIMUM NUMBER OF SANITARY INSPECTIONS PER YEAR		
	BY COMMUNITY WORKERS	BY WATER-SUPPLY AGENCY	BY SURVEILLANCE AGENCY
<u>Groundwater</u>			
open wells for community supply	12	-	once initially, thereafter as situation demands
covered dug wells and shallow tubewells with hand-pumps	4	-	once initially, thereafter as situation demands
deep tubewells with hand-pumps	4	-	once initially, thereafter as situation demands
wells and piped supplies	1	1	once initially, thereafter once every 5 years, or as situation demands
springs and piped supplies	1	1	once initially, thereafter once every 5 years, or as situation demands
<u>Surface water and rain water</u>			
filtered and/or chlorinated and piped supplies :			
population up to 5000	12	2	once initially, thereafter once every 5 years, or as situation demands
population 5000-20 000	-	24-48	every system once per year
Community rainwater collection system	1	-	once initially, thereafter as situation demands

TABLE - 7.3

SUGGESTED FREQUENCY OF SAMPLING AND ANALYSIS OF WATER SUPPLIES

MINIMUM FREQUENCY OF SAMPLING AND ANALYSIS			
SOURCE AND MODE OF SUPPLY	BACTERIOLOGICAL	PHYSICAL/CHEMICAL	REMARKS
<u>Groundwater</u>			
open wells for community supply	Nil	once initially for community wells	pollution usually expected to occur
covered dug wells and shallow tubewells with hand-pumps	Nil	once initially, thereafter as situation demands	situations requiring testing: change in environmental conditions, outbreak of waterborne disease, or increase in incidence of waterborne diseases
deep tubewells with hand-pumps	once initially, thereafter as situation demands	once initially, thereafter as situation demands	situations requiring testing: change in environmental conditions, outbreak of waterborne disease, or increase in incidence of waterborne diseases
wells and piped supplies	once initially, thereafter as situation demands	test periodically for residual chlorine if water is chlorinated	situations requiring testing: change in environmental conditions, outbreak of waterborne disease, or increase in incidence of waterborne diseases
springs and piped supplies	once initially, thereafter as situation demands	test periodically for residual chlorine if water is chlorinated	situations requiring testing: change in environmental conditions, outbreak of waterborne disease, or increase in incidence of waterborne diseases
<u>Surface water and rain water</u>			
filtered and/or chlorinated and piped supplies	once per month	residual chlorine test daily	increase frequency if situation demands
community rainwater-collection system	sanitary protection measure; bacteriological testing only if situation demands	not needed	-

ANNEXURE - V

COMPREHENSIVE RECORD FORM

WATER QUALITY
CONTROL PROGRAMME

(Name of body responsible

1. General Information

01. Locality

02. Name of service

03. Owned by

04. Address

a) Population served by :

05. House connections	/--N--N--N--N--N
	N--/---/---/---/---/
06. Public fountains	/--N--N--N--N--N
	N--/---/---/---/---/
07. Total number	/--N--N--N--N--N
	N--/---/---/---/---/

b) Total water production :

08. Daily average	/--N--N--N--N--N
	N--/---/---/---/---/
09. Annual average	/--N--N--N--N--N
	N--/---/---/---/---/
10. Unknown	/---N
	N---/

c) Restrictions in supply during the past year :

11. Number of occasions	/--N--N--N
	N--/---/---/
12. Unknown	/---N
	N---/

2. Sources of Water

a) Groundwater

	Yes	No
13. Is the immediate vicinity of the abstraction point (well) free from	/---N	/---N
	N--/	N--/

<u>b) Surface water</u>	Yes	No
14. Is the intake correctly sited with respect to pollution outfalls ?	/---N N---/	/---N N---/
15. Is the intake correctly placed with regard to depth and distance from the bottom ?	/---N N---/	/---N N---/
16. Is the intake pipe firm and stable in position ?	/---N N---/	/---N N---/
17. Is the intake system functioning properly ?	/---N N---/	/---N N---/

c) Rainwater

18. Is the rainwater collection surface free from weeds and dirt ?	/---N N---/	/---N N---/
19. Is there a drain-off system for diverting the first portion of the rain to the waste drain ?	/---N N---/	/---N N---/

3. Water Collection and Treatment

a) Dug wells

20. Is the water-raising system (bucket, ropes etc.) inaccessible to users, animals, birds, insects etc. and is it impossible for water drawn from the well to drain back into it ?	/---N N---/	/---N N---/
21. Is there an impermeable platform preventing entrance of any surface water into the well ? (This is particularly important if local flooding may occur.)	/---N N---/	/---N N---/

b) Springs

22. Is there a surface-water diversion ditch ?	/---N N---/	/---N N---/
23. Does the collection chamber have an inspection manhole ?	/---N N---/	/---N N---/
24. Is there a drainage tube ?	/---N N---/	/---N N---/

	Yes	No
25. Are all openings protected against the entry of animals and direct access by humans ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /

c) Drilled wells

26. Is there an impermeable platform and adequate grouting around the pump casting to prevent the entry of surface water ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

27. Does the well-casing extend 30 cm. above the platform and is it unbroken ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

28. Is there a casing tube for at least 3 m below ground and is it unbroken ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
---	---------------------------------	---------------------------------

29. Does the area surrounding the well drain away from the well ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
---	---------------------------------	---------------------------------

d) Infiltration galleries

30. Does the gallery have an inspection manhole ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
---	---------------------------------	---------------------------------

31. Is the manhole protected by a cover and lock ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

32. Is there an impermeable platform to prevent entry of surface water ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

33. Does the casing extend 30 cm above the platform and is it unbroken ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

34. Does the casing extend for at least 3 m below ground and is it unbroken ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
---	---------------------------------	---------------------------------

35. Does the area surrounding the pump head drain away effectively ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

e) Slow sand filtration ?

36. Is the turbidity of the water flowing into the slow sand filter less than 15 NTU ?	/--- <input type="checkbox"/> /	/--- <input type="checkbox"/> /
--	---------------------------------	---------------------------------

	Yes	No
37. Is the turbidity of the water drawn from the slow sand filter less than 5 NTU ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
f) <u>Coagulation/sedimentation</u>		
38. Is the coagulant disperser functioning properly and the coagulant does controlled correctly ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
39. Will the supply of coagulants last untill the next batch arrives ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
40. Is the flocculator operating properly ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
41. Is the turbidity of the water leaving the sedimentation tank less than 10 NTU ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
g) <u>Rapid sand filtration</u>		
42. Is the turbidity of the finished water leaving the filter less than 5 NTU ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
43. Are records kept of the frequency and duration of filter backwashing?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
h) <u>Process control laboratory</u>		
44. Are there facilities at the plant for carrying out the jar test ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
45. Are there instruments at the plant for measuring turbidity ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
46. Are there facilities at the plant for measuring pH ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
47. Are records of analyses and tests kept ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
i) <u>Rainwater treatment</u>		
48. Is the water treated by rapid/slow sand filtration ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---
49. Is the turbidity of the water drawn from the filter less than 5 NTU ?	/--- <input type="checkbox"/> / <input type="checkbox"/> ---	/--- <input type="checkbox"/> / <input type="checkbox"/> ---

4. Disinfection

	Yes	No
50. Is the chlorination being carried out at the time of the inspection ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
51. Is chlorination carried out continuously ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
52. Is the chlorination equipment functioning correctly ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
53. Is the contact time 30 minutes or more ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
54. Is there a sufficient reserve of chlorine or chlorine-releasing substance to last for some time to come ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
55. Is there a means of determining total or residual chlorine in the treated water ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
56. Are daily chlorination records kept ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /

5. Storage reservoirs

57. Does the reservoir have an inspection manhole ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
58. Is the inspection manhole protected by a cover and a lock ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
59. Do the outlets of the vents and overflow pipes face downwards ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
60. Are the vents and overflow pipes protected by grilles ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
61. Is rainwater prevented from entering the reservoir ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /

6. Distribution network

62. Is the distribution system free from leaks ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
63. Is pressure maintained continuously throughout the system ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /
64. Are cross-connections with poor-quality water absent ?	/-- <input checked="" type="checkbox"/> /	/-- <input checked="" type="checkbox"/> /

- | | | Yes | No |
|-----|--|--|----|
| 65. | Have any new or repaired mains been disinfected ? | /--- <input type="checkbox"/> /--- <input type="checkbox"/>
<input type="checkbox"/> ---/ <input type="checkbox"/> ---/ | |
| 66. | Is residual chlorine present at the various points of the system ? | /--- <input type="checkbox"/> /--- <input type="checkbox"/>
<input type="checkbox"/> ---/ <input type="checkbox"/> ---/ | |
| 67. | Is the system free from back-siphonage ? | /--- <input type="checkbox"/> /--- <input type="checkbox"/>
<input type="checkbox"/> ---/ <input type="checkbox"/> ---/ | |
| 68. | Are there any plumbing regulations related to back-siphonage ? | /--- <input type="checkbox"/> /--- <input type="checkbox"/>
<input type="checkbox"/> ---/ <input type="checkbox"/> ---/ | |

7. Water-supply operators

69. Is the general professional level of the chief of service :
- | | | | | | | | |
|------------|-------------------------------|-----------|-------------------------------|---------|-------------------------------|-----------|--|
| University | /--- <input type="checkbox"/> | Secondary | /--- <input type="checkbox"/> | Primary | /--- <input type="checkbox"/> | Other.... | |
| | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ | | |
70. Is the level of training of the chief as regards water treatment :
- | | | | | | | | |
|------------|-------------------------------|-----------|-------------------------------|--------|-------------------------------|------|-------------------------------|
| University | /--- <input type="checkbox"/> | Technical | /--- <input type="checkbox"/> | Short | /--- <input type="checkbox"/> | None | /--- <input type="checkbox"/> |
| | <input type="checkbox"/> ---/ | College | <input type="checkbox"/> ---/ | course | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ |
71. How many years' experience in water treatment has the chief ?
- | | |
|--|-------------------------------------|
| | /--- <input type="checkbox"/> years |
| | <input type="checkbox"/> ---/ |
72. How long has the chief been working in the present service ?
- | | |
|--|-------------------------------------|
| | /--- <input type="checkbox"/> years |
| | <input type="checkbox"/> ---/ |
73. Is he working full time ?
- | | | | |
|-----|-------------------------------|----|-------------------------------|
| Yes | /--- <input type="checkbox"/> | No | /--- <input type="checkbox"/> |
| | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ |
74. Is the number of the personnel currently employed adequate ?
- | | | | |
|-----|-------------------------------|----|-------------------------------|
| Yes | /--- <input type="checkbox"/> | No | /--- <input type="checkbox"/> |
| | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ |
75. Is the quality of the personnel currently employed adequate ?
- | | | | |
|-----|-------------------------------|----|-------------------------------|
| Yes | /--- <input type="checkbox"/> | No | /--- <input type="checkbox"/> |
| | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ |
76. What is the academic level of the head of the laboratory (if applicable) ?
- | | | | | | | | |
|------------|-------------------------------|-----------|-------------------------------|---------|-------------------------------|------------|--|
| University | /--- <input type="checkbox"/> | Secondary | /--- <input type="checkbox"/> | Primary | /--- <input type="checkbox"/> | Other..... | |
| | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ | | <input type="checkbox"/> ---/ | | |

85. Name of supervisor :

86. Remarks :

- i)
- ii)
- iii)

CHAPTER - 8

EVALUATING HEALTH IMPACT OF WATER SUPPLY, SANITATION AND HYGIENE EDUCATION

8.1. CONTEXT

Although there is general agreement that water, supply and sanitation facilities do play a role in health, there is disagreement on the priority that should be given to the sector as a whole or to specific activities within the sector. Improved information on the impact of different levels of specific water supply and sanitation activities and different mixes of these activities are thus needed for two purposes. First, planners have to decide how resources should be allocated between water supply and sanitation programmes, on the one hand, and other health programmes (such as oral rehydration and immunization programmes), on the other. Second, once the level of resources available to the water supply and sanitation sector is set, planners have to decide the appropriate allocations to specific water supply, sanitation and hygiene education activities, and the levels of service to be provided.

Because water supply and sanitation programmes have economic and social, as well as health, implications, these decisions are not and should not be made solely on the basis of health considerations. Nevertheless, it is evident that reliable information on the impact of water supply and sanitation programmes on health in some settings is necessary if sound decisions are to be made.

8.2. KEY QUESTIONS

- Under what conditions should health impact evaluations (HIEs) be undertaken ?
- What indicators should be used to measure health impact ?
- What study designs should be used in HIEs ?
- How should the result of HIEs be interpreted ?

8.3. STUDY DESIGNS FOR HIEs

Before addressing the four key questions outlined earlier, the options available for designing HIEs will be outlined. Among analytic or hypothesis-testing studies, there are some primary distinctions that define different

basic approaches. These distinctions and the subsequent study designs are illustrated in Fig. 8.1. The first distinction separates those studies for which the measurements of exposure and disease refer to a single point in time (cross-sectional studies) from those that depend on measurements at more than one point in time. The second distinction deals with the method of control of variables other than water supply and sanitation conditions : in "experimental" designs, control for the influence of these other variables (such as income and mothers' education) is sought by setting up comparison groups that are equivalent to the "treatment" groups in every way except exposure to the treatment (which is, in this case, improved water supply and sanitation), whereas in "nonexperimental" designs the influence of these other variables on diarrheal disease is controlled through statistical means. The third distinction concerns only the experimental designs and deals with the method of assigning individuals to groups : where such assignment is made on a random basis, the design is a "true experimental" design; where assignment is made on a systematic but nonrandom basis (as is generally the case in water supply and sanitation interventions), the design is termed "quasi-experimental." The fourth distinction concerns only the nonexperimental designs and deals with the sequence in which exposure to risk (in this case through water and sanitation) and health outcome are treated in the study : the "cohort" designs, like the experimental designs, proceed forward in time from exposure to disease, whereas the "case-control" designs work backward in time from disease to history of exposure. The fifth and final distinction deals with the timing of the health outcome relative to initiation of the investigation in both quasi-experimental and cohort designs : where the outcome occurs prior to the initiation of the investigation, the design is a "historical" quasi-experimental or cohort study; where the outcome occurs after initiation of the investigation, it is a "concurrent" quasi-experimental or cohort study.

8.4. CONDITIONS UNDER WHICH HIEs SHOULD BE UNDERTAKEN

The literature is replete with examples of HIEs of water supply and sanitation projects that have been undertaken under conditions in which a satisfactory evaluation was not useful, not sensible, or not feasible. Before examining how HIE studies should be designed and interpreted, therefore, an important first task is to define whether a proposed HIE is "useful" (do the benefits outweigh the costs ?), "sensible" (is it reasonable to assume that a measurable health impact exists ?), or "feasible" (are the necessary scientific and other resources available ?).

8.4.1. Criterion I : Is a HIE "Useful" ?

A HIE of a water supply or sanitation program makes two distinct contributions. First, each study contributes to a global store of knowledge upon which all scientists and planners can draw. Second, a study may contribute site-specific information to be used directly by planners in making investment decisions and designing projects in a specific location. Several factors determine which of these two contributions is of primary importance.

To illustrate a general point, consider the relative contributions of Jhon Snow's investigations of water and cholera in London in 1854 and of the unpublished recent investigation by the United States Center for Disease Control on sewerage and typhoid in Mauritius. Although Snow's study provided valuable practical information to the city of London, this local contribution pales beside the contribution made to a universal understanding of the health impact of contaminated water. In contrast, the excellent epidemiological study of the effect of an inadequate sewerage system on typhoid in Mauritius, although making an important contribution to 'local' policy, was considered to be of so little "global" importance that the study was not even published. The implication is that, as knowledge of the relationship between water supply and health has matured, so the primary contributions of HIEs have become the clarification of the way in which this general relationship operates under the specific epidemiologic, environmental, and cultural conditions pertaining in a particular locality.

An additional factor affecting the relative importance of the universal and the local contributions of a HIE is the nature of the agency that funds the evaluation. Whereas some HIEs are funded by agencies with a mandate to develop a global data bank, in most cases HIEs are funded by multilateral, bilateral, national or local agencies whose prime interest is providing improved data to planners at a national, regional, or local level.

Accordingly, while bearing in mind that each well-conducted HIE does make a contribution to the development of a global data base upon which all can draw, in this analysis it will generally be assumed that the usefulness of a HIE is to be judged primarily in terms of the contribution made to improved decision-making in the specific setting in which the HIE is undertaken.

HIEs may be undertaken for two quite different purposes. In some instances, information may be needed to decide whether health sector funds should be used for, say a water supply or an immunization program. In far more instances, it has already been decided that a water supply and sanitation program will be undertaken, and the planners

wish to specify the appropriate levels and mix of services to be provided.

Loosely interpreting a fundamental principle of optimization, the "usefulness" of a proposed HIE will depend on the balance between the expected benefits accruing from an evaluation, on the one hand and the costs incurred by the evaluation, on the other. Although not providing a mechanical answer to the question of whether or not a particular HIE would be "useful," the principle provides guidance in answering some important questions.

1) Under what Conditions are the Benefits of the Information Generated in a HIE Likely to be Large?

First, it is important to bear in mind that health benefits are never the sole, and seldom the major, benefit of a water supply and sanitation project. For instance: in urban areas, where people are accustomed, and willing, to pay for water, investments in water supplies are usually justified solely on financial criteria; in arid rural areas, time saved by improving water supplies is often so highly valued that water programs have high priority for valid economic and political reasons; and in urban areas, improvements in excreta disposal facilities may permit increases in plot density, thus reducing the costs of other elements of urban infrastructure.

Because these economic and social considerations are frequently of greater significance than health considerations, most decisions to invest in water supply and sanitation projects are made without reference to the health impact of such projects. Under such conditions, the analyst responsible for the investment decision is correctly indifferent to the health impact of the project. Translated into the terms of the simple "principle" outlined above, the additional information on the health impact of the project has no effect on the decision and has, in this narrow context, no value. Under such circumstances, a HIE is not "useful."

The corollary is that it is only when these other, nonhealth, considerations leave the investment decision in the balance that health considerations become important and it becomes "useful" to develop specific information on the likely health impact of the proposed investment. Because these other (especially economic) justifications for water supply and sanitation programmes are more likely to be dominant in urban than in rural settings, it is usually in rural settings that information on the health impact of water supply and sanitation interventions becomes critical to investment decisions, and thus it is often in rural settings that HIEs will be most "useful" to planners deciding on the level of resources to be devoted to the

water supply and sanitation sector.

Once the level of resources devoted to the water supply and sanitation sector is set, planners in developing countries have to decide the level and mix of services to be provided through water supply and sanitation programmes. They have to decide, for instance, whether water will be provided through house connection, through yard taps or through public standpipes; whether house connections, through yard taps or through public standpipes; whether flush toilets or improved pit latrines will be built and what proportion of resources should be devoted to hygiene education programmes..

Even though other factors (such as the willingness of those served to pay for the services) are generally of major importance in such decisions, the anticipated health impact will often play a significant role in determining the appropriate level and mix of services to be provided.

In deciding the overall level of resources to be devoted to the water supply and sanitation sector, therefore, "other" impacts will generally be most important and the value of a HIE correspondingly less important. In deciding the content of a water supply and sanitation sector project, however, information on the health impact of different levels and mixes of service will often be vital and in this context, HIEs will often be "useful".

A final consideration in assessing the usefulness of a HIE is the delay between formulation of the need for information and completion of HIE. Although development of information for use by planners in the future is a legitimate task, in most practical cases the time horizon is far more limited. Information on the likely impact of different levels and mixes of services is generally needed when the planner does a preliminary screening and ranking of alternative projects (in World Bank terms, the "prefeasibility" phase). If it is possible to design, conduct and analyse a HIE in a 9- to 12-month period, the result of the HIE would be useful; if the study design was such that it took several years to obtain results, the information would be of no use to the planners responsible for preparation of the current programme.

In summary, the benefits of a HIE are likely to be large when other (especially economic) benefits are not decisive in specifying investment priorities and levels and mix of services and when the results are available rapidly.

ii) Under What Conditions are the Costs of a HIE Likely to be Large ?

The cost of a HIE depends on the study design. Well-designed and well-conducted HIEs using the standard quasi-experimental design (Fig 8.1) are extremely expensive, with a single study costing as much as a million dollars (World Bank 1976). When the cost of a HIE is this great, it is evident from the proposed "decision rule" that a HIE will be "useful" only if the benefit of the information, too, is great. After careful examination, the 1975 World Bank Expert Panel concluded that, even where large investment projects are contemplated, the benefits of HIEs carried out using these conventional designs are not commensurate with the costs of the evaluations (World Bank).

Sometimes the case-control method offers promise as an alternative method for assessing the impact of water supply and sanitation facilities on severe diarrheal diseases at much lower cost (of the order of USD 50 000 per study). If the information available from such an inexpensive HIE is of equal or even greater validity than the information generated through the conventional study designs, then there will be a sharp increase in the number of situations in which HIEs will be "useful".

iii) Should a Fixed Proportion of the Budget of a Project be Allocated to Evaluating Health Impacts ?

Where consideration is being given to replication of a project on a large scale, the benefits from improved information on the health impact of the project will be large. That is, ceteris paribus, where large investment decisions are at stake, the likely benefit of a HIE will be large and vice versa. The benefits of the information generated by an evaluation of a project are, therefore, dependent on the size of the next project to be undertaken and bear no particular relationship to the cost of the project that is to be evaluated. Similarly, because the sample sizes required bear no relation to the cost of the project to be evaluated, the cost of the evaluation (which is closely related to its sample size) should bear no particular relationship to the cost of the project to be evaluated. It is, thus, evident that the appeal of the "fixed proportion" criterion, which has been used for allocating resources to HIEs is bureaucratic simplicity rather than scientific logic.

6.4.2. Criterion II : Is a HIE "Sensible" ?

Having decided that a HIE would be "useful", a judgement has to be made of the likelihood that the project will have had a measurable impact on health, i.e. is it not

only "useful" but also "sensible" to conduct a HIE ?

i) What are the Characteristics of Projects that it May be "Sensible" to Evaluate ?

It is never sensible to conduct a HIE of a project that has been installed for a short time. Because new projects invariably face a variety of "teething problems," it takes time for the system to function effectively. In addition, it takes time for users to decide how they will make use of the new opportunities and in some cases, time to purchase the necessary ancillary equipment (such as washbasins) needed to effect the desired changes in behaviour. In most instances, it is advisable not to undertake a HIE before a prior evaluation of the functioning and utilisation of the new facilities has been undertaken using the "minimum evaluation procedure" of the World Health Organisation or a similar procedure. Even then, it should be realized that, as has been shown for the impact of improvements in water supply and sanitation conditions in urban France in the 19th century, the full effects of a project may be realized only generations after the completion of the project.

Whether or not a HIE will be "sensible" also depends on the comprehensiveness of the intervention to be evaluated. Water supply and sanitation projects are frequently introduced not in isolation but as part of a complex set of changes in the medical, nutritional, social, political and economic spheres. Where this is the case, evaluation of the specific effect of a single intervention is often very difficult, whence a HIE of water supply and sanitation interventions under such conditions is often not "sensible".

ii) What Study Designs may Lead to More "Sensible" HIEs ?

In general, it is not "sensible" to choose a representative sample from the population of the study area. For instance, for a given sample size, the likelihood of demonstrating a significant health impact can be substantially increased by sampling only from the most vulnerable age group (young children), and even by sampling only from particularly vulnerable groups, such as non-breast-fed children or family members who are exposed to secondary infection from other family members who have become infected. Likewise, under certain conditions, focused studies of "early adaptors" might provide clues to the impacts that might be forthcoming later in the population at large.

By choosing restricted rather than representative samples, an implicit choice is made to maximize "internal validity" (the capacity to apply the effect relationship) by sacrificing "external validity" (the capacity to apply the

findings to the community at large). As will be argued elsewhere in this report, in the future HIEs will no longer deal with "inscrutable" syndromes, such as "diarrhea identified through field surveillance," but will become investigations of the role of water supply and sanitation on well-defined outcome variables (including restricted groups of diarrheal pathogens, nutritional status indicators, and specific eye infections). In other words, HIEs will assume many of the characteristics of focused etiologic research studies. Experience with etiologic research in other fields has shown that "internal validity is the sine qua non of etiologic research" and that "the ill-advised pursuit of representativeness has caused unnecessary work and reduced the precision of epidemiologic studies". We conclude that, although the search for external validity has been of primary importance in previous HIEs, internal rather than external validity will be the trademark of the "new" generation of HIEs. The strategy, then, should be to use HIEs to obtain valid answers to specific well-formulated questions, and to deal with the extrapolation of these specific findings to the broader questions of interest to policymakers in a poststudy phase.

8.4.3. Criterion III : Is a HIE "Feasible" ?

If it is judged that a proposed HIE would be "useful" (the benefits accruing from the evaluation would exceed the costs of the evaluation) and if it is judged that a HIE would be "sensible" (it is likely that the project to be evaluated has had a significant impact on the outcome measure), then the final factor to be considered before undertaking the evaluation is whether or not, from both scientific and resource considerations, an evaluation is "feasible".

1) Under What Conditions is a HIE Feasible Scientifically?

A major decision in undertaking a HIE is the study design to be used. The scientific issues to be dealt with include : the methods for accounting for the effects of extraneous variables, the sample sizes required, the effects of less-than-perfect information on exposure and outcome variables, and the effects of systematic errors in the selection of study subjects. Each of the available study designs deals well with some of these issues and poorly with others. To illustrate the seriousness of just one of the problems with the conventional quasi-experimental HIEs, Table 8.1 specifies the sample sizes required to detect differences in diarrhea incidence of public health significance at reasonable levels of statistical significance and study power. Assuming that on the average a child under the age of 5 years has 2.2 attacks of diarrhea per year, if data on

diarrhea are based on a 48-hour recall period, the frequency of positive answers to the question "has your child had an attack of diarrhea that started in the past 48 hours?" will be 1.2%. Assuming that the study is designed to detect a 33% reduction in diarrheal incidence, and assuming that a cluster sampling technique is used, over 20,000 questionnaires will have to be administered to the group with improved water supplies and similar number to the group without improved facilities. If only severe episodes of diarrheal disease are included in the study, the number of episodes is reduced to about 10% of the total number and the sample sizes are an order of magnitude larger. It is evident that for any reasonable assumptions, sample sizes very much larger than those used in most actual HIEs are needed for studies of this sort. In other words, many existing HIEs were not "scientifically feasible" simply because of the large sample sizes required.

There are study designs for which the required sample sizes are less daunting. If a case control design is used, and if between 30 and 70% of the population is exposed to unimproved conditions, then (Table 8.2) about 600 subjects are required in each of the two study groups.

In some cases, the critical problem is not that of large sample sizes, but the control of biases in the estimated impact of the water or sanitation project. Because the most common and serious shortcoming in HIEs of water supply and sanitation programmes, as in HIEs of other interventions, is poor design, execution and analysis due to insufficient skill and experience on the part of the evaluation team, a key requirement for "scientific feasibility" is that the core skills (epidemiology and statistics) be adequately covered by the evaluation team.

ii) What Resources are Required to Make a HIE Feasible ?

As in other health-related areas, systematic information on costs of impact evaluations is not available. A primary determinant of the cost of a study is the sample size, although other factors, including the comprehensiveness of the study and the salaries of the researchers, are important too. To illustrate the orders of magnitude of the costs involved in HIEs, it is instructive to consider two recent studies, both carried out in the same developing country by joint groups of United States and national scientists. The first study, a quasi-experimental study of the impact of a water programme, took 7 years to complete and cost about a million dollars. The second, a case-control study of the effect of water supply and sanitation facilities on severe diarrheal disease, took about a year to complete and cost about USD 70 000. Although there may sometimes be special circumstances under which sensible HIEs can be conducted at lower cost, in general the

cost of such evaluations are substantial. Unless the necessary resources can be secured, HIEs should not be undertaken.

Table B.1 : Required sample sizes in experimental, cohort and cross-sectional studies.

Frequency of disease in the unserved population (%)	Reduction in frequency to be detected					
	10%	20%	30%	33%	40%	50%
0.2	1600000	380000	160000	130000	85000	50000
1	320000	76000	32000	25000	17000	10000
5	62000	15000	6000	5000	3200	2000
10	29000	7000	3000	2400	1500	950
25	10000	2400	1000	800	550	330

Note : The sample sizes are calculated so that there is a 90% chance of detecting the specified reduction at the 5% significance level. Because we are interested in reduction only, a one-sided test is used. The calculations are based on an approximate formula (developed by Cochran and Cox 1957), which slightly underestimates the sample size given by the exact formula (Fleiss 1981). When, as is usually the case, samples are drawn from clusters, there will generally be a positive correlation between elements in the same cluster; thus, assuming that the sample will be drawn from a given number of clusters, to show a specified difference with a specified precision, the required sample size is increased. In studies of diarrheal diseases, the sample sizes typically have to be 2-4 times larger to account for this intraclass correlation. The sample sizes given above assume an intraclass correlation coefficient such that the "design effect" is 2 and are thus twice the values that would pertain if there were no intraclass correlation. Because the numbers in the table indicate the numbers required in each group, in the standard case of a single treatment and a control group, total sample size is twice that indicated in the table.

Table 8.2 : Required number of cases in case-control studies

Percentage of population using improved facilities	Relative risk (equivalent reduction)					
	1.1 (9%)	1.2 (17%)	1.4 (29%)	1.5 (33%)	1.7 (42%)	2.0 (50%)
10	22000	6000	1900	1400	850	540
20	12000	3400	1100	740	450	280
30	9000	2600	780	540	330	200
40	8000	2200	660	460	270	170
50	8000	2100	610	420	250	150
60	8000	2100	620	420	250	140
70	9000	2400	680	460	270	140
80	11000	3000	860	580	330	190
90	20000	5300	1500	1000	560	310

Note : The sample sizes are calculated so that there is a 90% chance of detecting the specified relative risk (or equivalent reduction) at the 5% significance level. The calculations follow the method of Schlesselman (1982). It is assumed that one control is chosen for each case. Note that implicit in the calculations is the assumption that the exposure rate among controls in the target population may be estimated from population information relating to overall exposure rate, an assumption that is reasonable when studying rare diseases (Schlesselman 1982), as in the case of diarrhea reported to a clinic over a 3-month period.

FIGURE - 8.1

