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A DRAFT FRAMEWORK FOR EMERGENCY WATER AND SANITATION INTERVENTIONS

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ABBREVIATIONS

WVE	World Vision Ethiopia
WVZ	World Vision Zimbabwe
UNHCR	United High Commissioner for Refugees
WFP	World Food Programme
NGOs	Non-Governmental Organisations
UN	United Nations
UNICEF	United Nations Children's Fund
DHA	Department of Humanitarian Affairs
CERF	Central Emergency Revolving Fund
UNDP	United Nations Development Programme
TB	Tuberculosis
FC	Faecal Coliforms
NTU	Turbidity Units

1. INTRODUCTION

Since the collapse of the Soviet Union, there have been more regional conflicts and civil wars than at any other time this century (1). According to the recent European Conference on Conflict Prevention, intra-state conflicts alone, have, since 1990, resulted in 24 million internally displaced people, and 18 million refugees (2). While somewhat overshadowed by these high profile emergencies, natural disasters with major human impacts also continue to occur on a frequent scale.

The result is that non-government organisations are increasingly becoming involved in emergency relief activities. The provision of necessities for survival in emergency situations is however no simple matter. Furthermore, agencies involved in this work normally face each situation with a different approach and this has caused a lot of inconsistency. One of the results of this is that some very critical factors - most notably perhaps, water and sanitation related disease transmission routes - are not given enough consideration.

While NGOs are perfecting their relief intervention techniques, it is still possible to find increased death rates in refugee centres despite the quick provision of water and latrines to the refugees (1). What is needed, therefore, is an effective water and sanitation programme that can help reduce the death rate of the refugees being helped; operating agencies do need appropriate and effective water and sanitation guidelines.

A number of agencies, like Oxfam, RedR and Care, are now aware of the need for such guidelines. In the process they have come up with very useful information which have been used as a resource base in the development of this preliminary document.

World Vision Uganda, with its long experience in relief work, itself sees the development of acomprehensive Emergency Water and Sanitation Manual as a vital requirement in the promotion of Water and Sanitation capacity in relief programmes.

The objective of this document is to offer a preliminary framework for relief workers (technicians / engineers) in effective provision of emergency water, sanitation and hygiene education.

2. BACKGROUND INFORMATION

This draft framework seeks to address Water and Sanitation emergencies in Tropical Africa resulting from both man made and natural disasters. Before moving on to more technical issues, however, there is a need to clarify some of the terms used and to provide a brief overview of a relief 'scenario'.

2.1 *Definitions*

A disaster (4) can be defined as any disruption of human ecology that exceeds the capacity of the community to function normally, and may be man made, or natural. Man made disasters are caused by human beings like in war / conflict situations and political expulsions. They could be sudden like Rwanda 1994 or slow onset like in Southern Sudan conflict. Natural disasters, on the other hand, are situations due to naturally induced hostile environment and usually beyond man's control. They could be sudden like earthquakes, hurricane and flood disasters or slow onset like drought, famine and epidemic diseases.

The term emergency relates to the crisis that arises when a community has great difficulty in coping with a disaster, and may have the following characteristics;

- High rates of mortality and morbidity especially among the young and the elderly.
- Risky and delicate situation - especially the impact phase.
- Need for spontaneous response often cause uncoordinated activities and are very costly.

2.2 *Classifying Emergencies*

Emergencies have themselves also been classified in several ways:

By Cause:

By examining the cause of an emergency, we could classify it as complex or a well defined situation. For instance, a crisis arising out of a political or a military action might exacerbate drought, famine and poor living situations of a community. At the time of a relief intervention, the whole situation is a complex.

By Need / Duration of a Crisis:

By looking at duration of the crisis / need one could classify an emergency as long term or short term. Again looking at how long the crisis is persistent in the community, long term emergencies are often divided into phases; impact / immediate, stabilisation, recovery and settlement phases. For their respective durations, see table 2.1 at the back of this section.

By Severity:

Relief Agencies often go in to help control the crisis by reducing the death rates and eventually enable the affected community resume a normal living. In massive refugee movements, death rates might be of a great concern to the relief agency and the emergency here is classified on its severity. See table 2.2 at the back of this section for the table showing emergencies classified under their respective levels of severities.

2.3 *The Affected Population*

Those displaced by a disaster - either internally or across national borders - are invariably those worst affected.

According to UNHCR report (5), the global refugee question has experienced significant changes in scale, scope and complexity in the recent 5 years. Political terror, armed conflict and social violence have increased so much that the consequential human displacements increasingly become difficult for governments and humanitarian organisations to cope with. In 1991 UNHCR recorded 17 million refugees to their concern (4,791,000 were in Africa). In 1993 UNHCR recorded 23 million.

In 1995 UNHCR recorded 27,418,900 refugees (11,816,000 were from Africa. Among them 6,752,200 were refugees by 1951 definition, 3,084,000 were returnees, 6700 were other displaced people of concern, 1,973,000 were internally displaced people).

In the East African region, more than a million Rwandese poured into Zaire in mid-1994, and this was registered as one of the largest and fastest refugee movement ever seen. Presently, UNHCR is providing protection and assistance to 2.2 million displaced people in Burundi, Rwanda, Tanzania, Uganda and Zaire.

In the Horn of Africa UNHCR has registered 1.6 million people who are displaced. Some have been in this state for 30 years (Eritrea-Sudan situation).

In West Africa, a conflict in Liberia and Sierra Leone caused about a million people to run away from their homes to Guinea and Cote d'Ivoire. Even those displaced within the country were seriously affected and lacked International support.

In Mozambique 1.6 million refugees have been returning from 6 neighbouring countries since 1992. They need support to integrate within their community. It is quite similar to the Luwero returnees situation in Uganda 1986.

2.4 *International Relief Systems and Co-ordination*

In an emergency situation there are many actors involved in the provision of relief. These include (7) neighboring countries; national or local governments; outside governments; multilateral agencies such as the UN system; the Red Cross; and NGOs.

Often the government of the country that is hosting the refugees has not much choice but to take up the responsibility and establish a forum for relief co-ordination. Experience (7) in the Tropical Africa shows that a suitable forum normally is comprised of representatives from government departments and other agencies like the UN agencies, NGOs, Red Cross and major donors. Co-ordination is very key in effective relief operations.

Recently in the Rwanda crisis, over 200 relief agencies were involved in relief provision. It is evident that without good co-ordination the whole operation could have become another disaster. Where refugees are involved, it is often UNHCR that take up the leading role as a co-ordinator for international agencies and NGOs.

However, it remains the role of the host government through the forum formulated to oversee the operations. Examples are; Relief and Rehabilitation Commission (RRC) in Ethiopia and Sudanese Commission for Refugees (COR).

In case of a political structure being eroded by conflict, the UN system is utilized to offer an immediate solution. The DHA is normally responsible for co-ordination of International relief in complex emergencies (DHA Geneva is concerned with the operational aspects of emergency management and assistance).

Subgroup co-ordination at the field level:

Activities at the field level are more specialized and are often undertaken by specific agencies yet the ultimate goal is the same for all participants. For effectiveness, a sub-group is often set up at the field level to address specific activities like water and sanitation. Such a group normally comprise of a field engineer of the government water authority, UNICEF, UNHCR, NGOs and private sector members and representatives of the affected community.

In situations where a high level of technology has been used, an agency taking up a specific activity like water should consider during the very early stages (7) the required skills for a professional assessment; and the potential resources and local expertise available: funds, government departments, other agencies and local consultants.

Table 2.1 A table of emergency phases with their respective durations

PHASE	DURATION
Impact/Immediate phase	1-2weeks
Stabilisation phase	0.5-2 months
Recovery phase	several months
Settlement phase	several years

Source: RedR.

Table 2.2. A table of emergencies with their respective levels of severities.

CRUDE MORTALITY RATE DEATHS/10000/DAY	SEVERITY OF EMERGENCY
UP TO 0.5	NORMAL/NON-EMERGENCY RATE
LESS THAN 1	UNDER CONTROL
MORE THAN 1	VERY SERIOUS
MORE THAN 2	OUT OF CONTROL
MORE THAN 5	CATASTROPHIC

Source: RedR

Fig.2.1 Some of the Largest Refugee Populations by Country of Origin in 1995

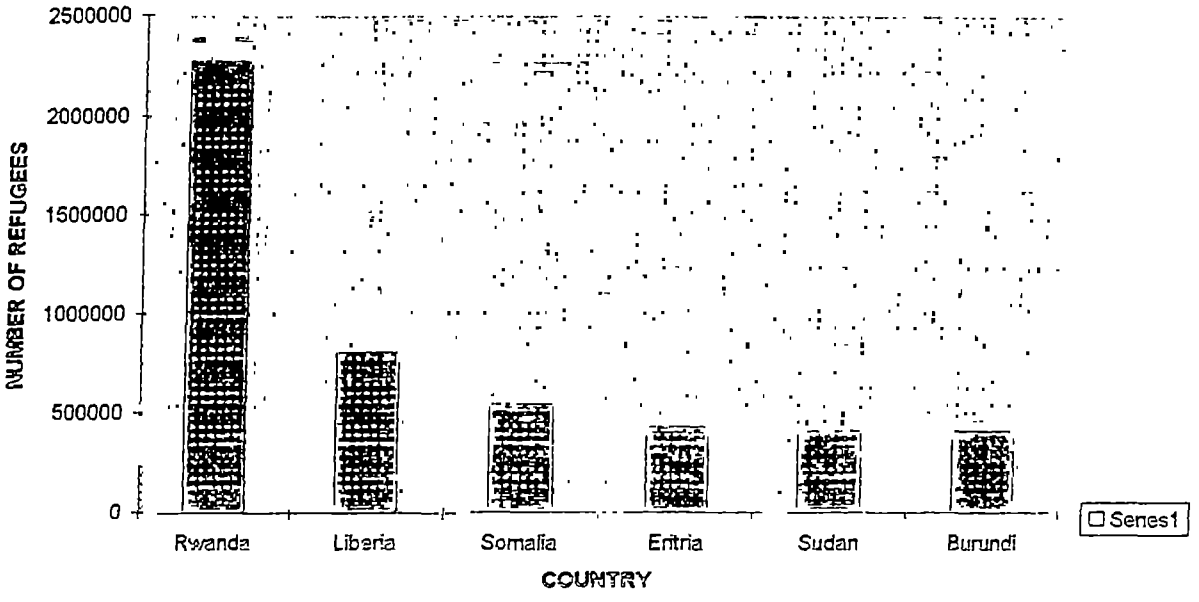
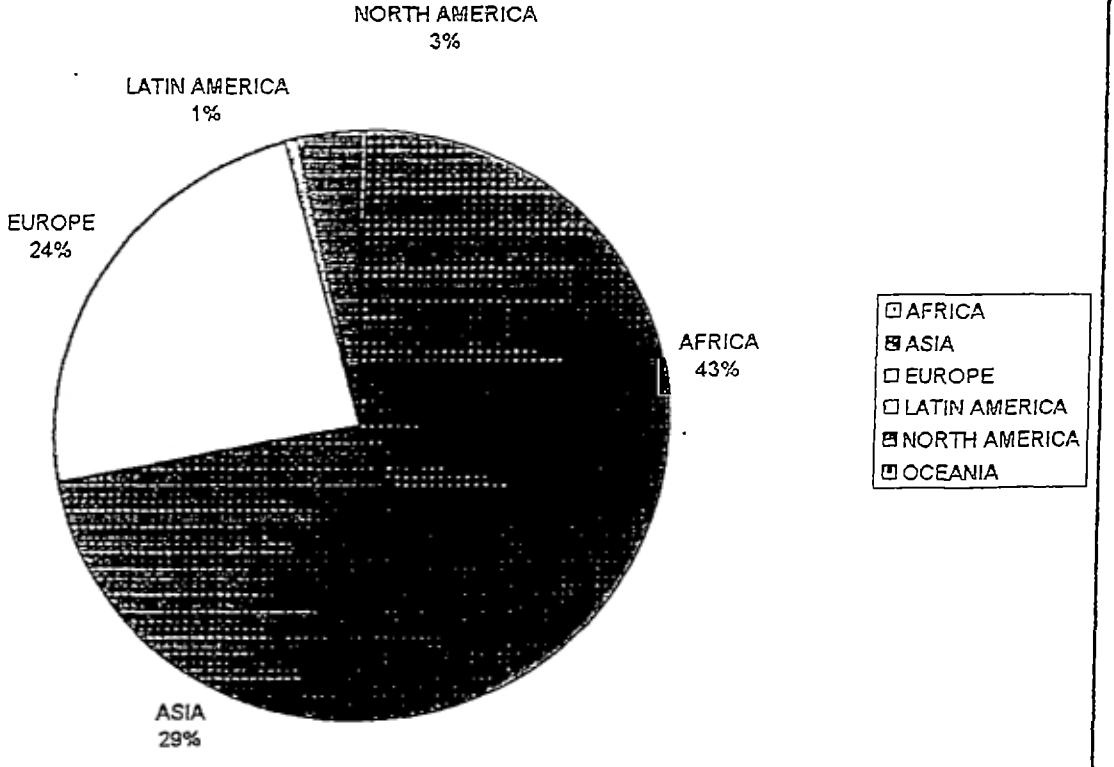


Fig. 2.2 Refugees and other people of Concern to UNHCR,1995



Source:UNHCR,1995.

3.0.WATER AND SANITATION RELATED DISEASE TRANSMISSION ROUTES IN EMERGENCY SITUATIONS

3.1 Introduction To Typical Communicable Diseases Found In Refugee Camps.

Communicable diseases are often a potential risk to refugee population. If not well controlled, they become the major cause of the high mortality rates in the refugee camps. Looking at the statistics in refugee camps in Sudan, Ethiopia, Somalia and Malawi between Feb.1985 and July 1990, you realize that 60% -95% of the deaths were due to communicable diseases(8). Although some diseases could be new to the refugees, where by they just find the disease in the camp or amongst the local community, often the displaced people come with their diseases from their country of origin. One of the reasons why the same diseases are more hazardous in the refugee population is the increased transmission rates of the diseases in the over crowded community, with low levels of nutrition and hence increased severity of the infectious diseases.

Refugees are more susceptible to infectious diseases due to their reduced immunity, stress and the induced hostile environment. The major causes of mortality and morbidity among the refugees include, measles, diarrhoeal diseases (including diarrhoea, cholera and bacillary dysentery), acute lower respiratory track infections (ALRIs) and malaria.

Looking at what happened to children under 5 in a refugee camp in Eastern Somalia, you realize that diarrhoea took the lead in claiming children's lives; 41% of the deaths were due to diarrhoea, 34% were due to pneumonia and hepatitis was 3%.

In Eastern Sudan in 1985, between 25%-50% of the deaths in four major camps were attributed to diarrheal diseases. In Somalia(1980),Malawi (1988) and in Ethiopia (1989), between 28%-40% of all deaths in refugee camps were attributed to diarrhoea. Between March and Oct. 1991,35% of deaths among Somalia refugees in the Liboi camp in Kenya were caused by diarrhea(7).

In a study(8) done in a refugee camp in Ethiopia, it was found that out of the 200 diarrhea patients sampled 15.6% had positive cultures for E.coli, 3.5% for Shigella spp., and 2% for Salmonella spp. This indicated that the pathogens responsible for diarrhea in emergency

situations are the same often found in diarrhea cases of the non-refugee people in tropical Africa. Other diseases of concern are meningococal meningitis, scabies, hepatitis, trachoma, typhoid and typhus, TB and HIV/AIDS.

The ever warm climate in tropical Africa offers a suitable breeding environment for the infectious parasites. The situation is exacerbated by the overcrowding and the poor hygiene behaviors in the camps, resulting into disasters in the refugee camps. It is therefore important to discuss the prevalence of the communicable diseases in tropical Africa which forms an environment for the camp disease crisis .

The principal tropical diseases(8)

Malaria

Malaria exerts the heaviest toll in terms of death and suffering. Some 300-500 million persons are infected , of whom over 20 million will die during the present decade. In Africa alone, every hour of the day 120 children aged under 5 years die from malaria. About 40% of the world's population is at risk(9).

Evaluating the prevalence of malaria.

It is important to know the frequency and age distribution of the people infected and the details of the mosquito transmitting the disease if control measures are to be properly planned. Malaria transmission is often seasonal. If there is a marked wet season, malaria incident will usually peak during the latter part of it.

There are 3 ways of estimating malaria in a population sample;

- parasite rate
- spleen rate
- malaria seropositivity rate

Dracunculiasis or Guinea-worm disease;

Total eradication of this parasitic disease, which is transmitted through contaminated drinking water, is within reach by the end of this century. In 1989 there were one million cases, but by 1994 just 164941 cases were recorded in 16 countries of Africa, south of the Sahara, plus Yemen and India.

Schistosomiasis(or Bilharziasis);

This blood fluke infection is closely associated with dams, irrigation canals and stagnant pools infested with water snails which act as host to the larvae of the fluke. There are 200 million sufferers and one sixth of the world's population is at risk.

Foot borne trematode infections;

One fifth of the world is at risk and 40 million people suffer from debilitating trematode (flatworm) infection. At least 10000 people die each year as a result.

Onchocerciasis;

Fear of river blindness drove villagers away from rich arable lands beside West Africa's rivers. Until 1987, control efforts focused on reducing the blackfly vector. With the advent of the drug ivermectin, the strategy changed to more cost effective single dose treatment of the 17.6 million people still infected.

Lymphatic Filariasis;

Transmitted by mosquitoes, this parasitic worm infection affects 73 endemic countries of the tropics and sub-tropics. There are around 100 million victims, of whom 43 million suffer from acute or chronic manifestations, including elephantiasis, hydrocele and gross swelling of the limbs.

Sleeping sickness or African trypanosomiasis;

The tsetse fly transmits a blood parasite to humans, who subsequently suffer from fever, body wasting and somnolence; there is high fatality rate. An estimated 300000 people are affected in Tropical Africa.

In a refugee situation, the disease could be picked up from any where. Refugees with infections who have been in the camp for more than 4 weeks are most likely to have caught the disease in the camp itself or in the surrounding area, because most communicable diseases have incubation periods of less than 4 weeks. This does not apply to the parasitic and helminthic infections or to TB or to leprosy, all of which have long incubation periods.

Among the early major problems in a refugee camp is malaria. This is common especially where refugees migrate from an upland area or one free from malaria to a highly malariaus zone. Transmission may already be brisk among the local population and anopheline

mosquitoes can transmit malaria to the refugees. Out breaks should be prevented but if they occur prompt control measures are necessary. You need to give women a special consideration to protect them against malaria.

Some malaria parasites appear to attach them selves to proteins that are thought to be found only in the placenta, which may explain why women are more likely to become infected with malaria when they are pregnant. Worst of all, the parasites that affect pregnant women are not recognized by the immune system. This is due to the protein called chondroitin A to which the malaria parasites bind in placenta.

Cholera

20 separate cholera outbreaks were reported in Mozambique and Malawi in the period between 1988 and July 1992. A MMWR report(8) shows that an investigation done at that time identified polluted water sources, Shared water containers and cooking pots, lack of soap, failure to reheat leftover food, and possibly contaminated food (dried fish) to have been the most important risk factors for infection.

Epidemics

Epidemics may be caused by infectious diseases such as measles gastro-enteritis, meningitis, typhoid or typhus, or toxic substances like agricultural sprays and poisons in food. An epidemic is said to be present when an excessive number of new cases is being reported. This means that one needs to know the expected incidences for the disease at that time of the year in the host country

Show on a map where the patients live and draw an epidemic curve (incident graph).

Analyze the known cases to see how many females or males and how many they are in each main group.

Transmission routes for most of the diseases found in camps can be categorized as below(10);

<u>Water-borne transmission route</u>

When infested water is drunk directly or indirectly due to unhygienic food preparation, the pathogen is passed into a human host

Examples of the associated diseases in a camp are diarrhoeas, cholera, and typhoid.

Water washed transmission route

Due to lack of sufficient water for washing, the infected person passes on the disease to a another. The infectious organism could be living on people's bodies like the most common skin diseases or infected hands after toilet use.

Examples of associated diseases in a camp are scabies, conjunctivitis, dysentery and other diarrhoeas.

Water-based transmission route

There are pathogens whose life cycles are completed partly in water and partly in a human host. They could be ingested by drinking the contaminated water or pierce into the skin when the human body gets in contact with the infected water.

Examples of associated diseases in a camp are guinea worm and schitosomiasis.

Water-related disease vector

There are insects carrying the disease parasite which breed or live and bite near water. When they bite a human being, a parasite is passed on and infects the human being.

Examples of associated diseases in a camp are Malaria, yellow fever and sleeping sickness.

The first 2 categories are more related to human excreta pathogens being passed to human beings and they are actually called faecal-oral diseases. This brings a concern on how human excreta is managed in the refugee situation.

The list for excreta diseases is endless but by use of an environmental classification, the diseases can be put under 6 major categories;

1. Faecal-oral (non-bacterial) including polio, Hepatitis, Giardiasis, amoebic dysentery, etc. The major transmission mechanisms are person to person contact and domestic contamination.

2. Faecal-oral (bacterial) including cholera, diarrhoea, dysenteries, shigellosis, enteric fevers, typhoid, etc. The major transmission mechanisms include person to person contact, domestic contamination, water contamination and crop contamination.

3. Soil-contaminated helminths including roundworms, whipworms, hookworm etc. The major transmission mechanisms include yard contamination, ground contamination in communal defecation areas and crop contamination.

4. Beef and pork tape worm mainly taeniasis and this could be spread through yard contamination, field contamination and fodder contamination.

5. Water-based helminths including clonorchiasis, schistosomiasis, etc. Transmission is still by water contamination.

6. Excreta-related insect vector diseases including Filariasis and all infections in categories 1-5 which can be transmitted by cockroaches and flies. The transmission mechanisms are the breeding behaviour of the insects in various faecal contaminated sites.

Fig.3.1 Principle Diseases in the Tropics

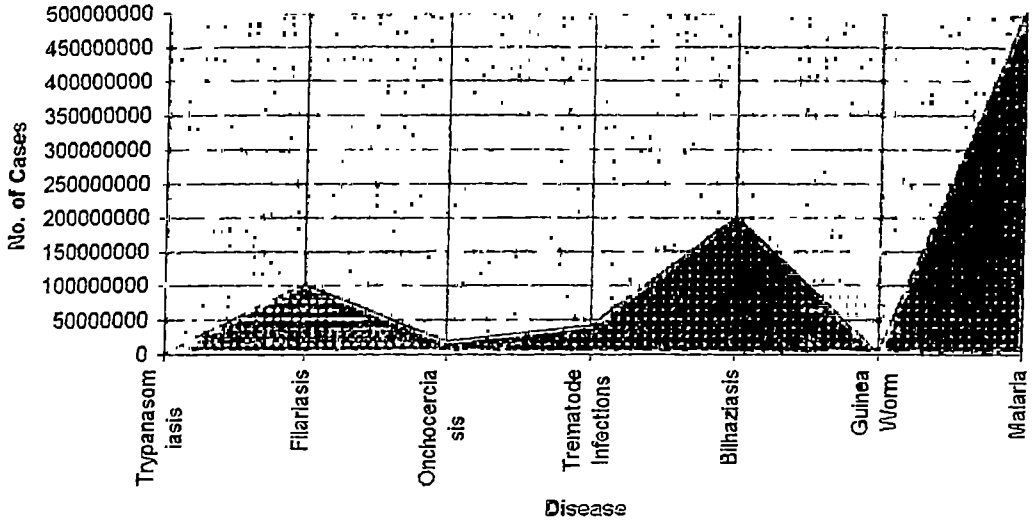


Fig.3.2 An Example of Diseases killing Children under 5 years in RefugeesCamps -Malawi,July 1990.

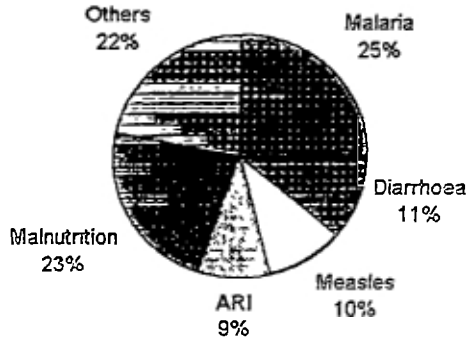
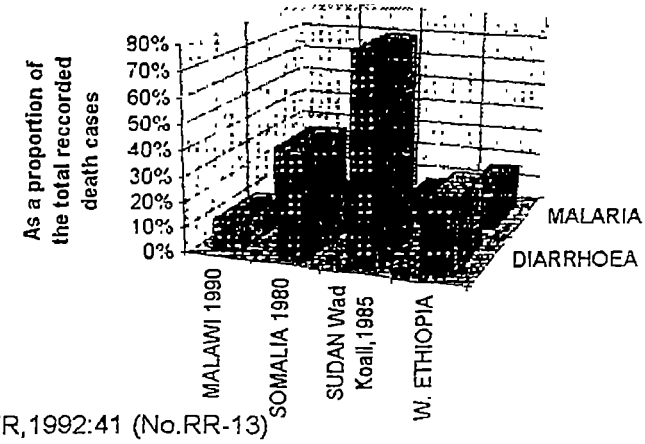


Fig.3.3 Deaths in Children under 5 years in Refugee Camps due to Diarrhoea and Malaria



Source: MMWR,1992:41 (No.RR-13)

3.2 Consequences Of Neglect.

As a relief engineer, take a careful look at the whole environment and analyse the disease transmission routes. Excreta disposal facilities could be provided for in a camp, but when people are not educated in their use and maintenance roles are left unclear, they may instead become a health hazard

Statistics show that most deaths in refugee camps are due to water and sanitation diseases. The most fundamental way to reduce the risk is to focus on the control of the disease transmission routes. If they are neglected, death rates have to rise up in any camp. A typical example is the Shigella which was being transmitted by flies in a refugee camp in Koboko of Uganda. The problem became a puzzle to the relief workers in search for a solution(11).

3.3 Priorities For A Relief Engineer

Preventive health care (protect health of the most vulnerable)

This includes the following activities(12),

- provision of adequate safe water
- organisation of excreta disposal
- provision of an effective hygiene education
- Solid waste mangement
- Vector control
- Drainage

An understanding of the checklist assessment and its implications.

In case of an epidemic, swift actions related to environmental health are needed plus organisational measures.

Preparedness.

This is necessary for sudden population displacement and maximum collaboration with Health Information Systems is expected.

3.4 Appropriate Control Measures In An Emergency.

In general terms there are 3 main methods of controlling communicable diseases in an emergency situation. They include the following(13);

1. Attacking the source of infection
2. Interrupting the disease transmission route
3. Protecting susceptible individuals.

A relief engineer should focus more on the second method while the medical personnel take charge of 1 and 3.

The most appropriate measures in interrupting the routes are;

- Improvement of environmental health & hygiene education. This will involve the control of excreta disposal, both for the adults and the children alike.
- Improvement of water supplies for quantity and quality.
- Promotion of good hygiene behavior especially in food management and personal hygiene. Women's needs should be considered more critically.
- Identify the potential disease transmission vectors and break their life cycles.
- In case of an epidemic, you could disinfect and sterilize the surroundings.

Focusing on the major killer diseases in refugee camps in Tropical Africa, namely malaria, cholera and diarrhoeas, the following measures are necessary;

malaria

- Reduce mosquito breeding sites.

- Identify the mosquito specie in the area that is responsible for the parasite and target at its specific habitat(species sanitation approach). Altering their breeding sites will break the life cycle and the problem will be reduced.

- Spraying for mosquitoes which bite inside the house, endophilic vector, spray the inside walls and roofs of the shelters with any residual insecticide. Consult the local health authorities before spraying for the right choice of insecticide to be used in that particular area. However, some mosquitoes bite from outside (exophillic), and in such cases spraying should be done outside the rooms and if (and only if) necessary an aerial spraying of the camp could be done.

- use of mosquito nets.

Identify the biting behavior of the mosquito responsible for the parasite in the area. If it bites indoors and at night, then provide mosquito nets to the refugees. Again consider the refugees willingness and knowledge to use the mosquito nets for effective control of the parasite.

Cholera

For an effective control of cholera, an epidemiological survey is necessary and a good understanding of the affected area is needed. Then plan environmental sanitation program. Control further pollution of the water sources and provide adequate safe water to the refugees. Try as much as possible to control the transmission routes by intensifying hygiene education and put more emphasis on use of safe water, hand washing, food protection and organized burial procedures.

Diarrhoeas

Ideally, diarrhoeas need to be controlled at a level of <1% per month. Specific control measures include;

- Provision of adequate safe water and ensure clean water in all the nearby water sources. Disinfection could be a solution if you can not protect them before the refugees use them.
- Effective hygiene education accompanied with improved camp sanitation. Latrine use and maintenance need to be emphasized.

Again, the whole thing rotates around the control the relevant disease transmission routes. So, you need to identify the potential Health Risk and the appropriate control method.

4. ASSESSMENT IN EMERGENCY WATER AND SANITATION

4.1. Assessment And The Type Of Data Required

4.1.1 The Importance Of Assessment

Experienced relief workers have observed that it is very important to take time to assess carefully what needs to be done and avoid the temptation of rushing headlong into poorly thought out actions(13).

A good assessment at the beginning will enable;

- an initial decision to be made on whether assistance is needed at all.
- a decision to be made on whether local capacity is adequate or external resources are required.
- priority for intervention to be established and strategies for intervention to be identified.
- the collection of base line data to facilitate monitoring

4.1.2 Principles Of Assessment

- Assessment is very important at the beginning of an emergency programme but it should be taken as an ongoing process.
- The assessment team should include people with specialised skills to assess local epidemiological profile and health service capacity, and the health and nutritional status of the refugees and interpret the findings.
- References should be made to as many sources as possible for relevant information.

It is important to collaborate with other agencies in the area for the existing information. Often local Universities, government departments and some projects in the area could have very useful reports and data to give you a beginning.

However much desk information you have so far gathered beforehand, you still need to go the field and verify your information.

While in the field it is important to take note of the following points(13);

1. Water and sanitation needs can usually be seen, touched, heard, smelled and even tasted. This calls for the assessor to use all the senses in the field.

2. Water and sanitation in an emergency is a public health response. This calls for an understanding of public health problems.

3. The methodology used in an assessment is critical but again time factor is key in it's selection.

4. Assessment period ranges between a few days and 2 weeks. As soon as enough information for planning is gathered, field assessment should be stopped.

5. It is often good to collaborate with other agencies for information generation but data should be interpreted with care and some professional judgement is needed in this area.

6. If you are working in a team, roles and communication links should be clear at the very beginning.

7. Daily consultative meetings are important for the overall goals of the team. Cross-check and compare information from different sources and evaluate methods of collection. Use up to date checklists to remind team members of the key questions.Standardised questions are in the next subsection(30)

8. Feed back to the refugees and other partner agencies is very important.

4.1.3 Type Of Data Required

- The number of people affected and how long they have been affected.
- The type of population affected
- The affected population's principle needs and the difference between the immediate and long term needs.
- The most needy/marginalised people among the refugees.
- water and sanitation needs, present and future.
- topography, rainfall and hydrogeology
- the nutrition status of the refugees
- the clinical services.
- the health status of the people and their vulnerability to disaster.
- people's behaviours which might effect diseases transmission
- the locally available resources.
- any limiting factors.

4.1.4 Check-List Of Information Required For Assessment

Demography

How many people have been directly affected by the emergency?

Is the population figure static or likely to change?

(remember that the number of people affected by the emergency will impose a cost-benefit point of view on the planned program(13). If people are expected to return to their own country or homes soon or rather later, donors are less likely to be willing to fund an expensive program.)

How have these numbers been collected or estimated?

What is the average household size?

Has a simple map of the affected area been prepared?

What proportion of the affected population are men, women, boys, girls?

What proportion of the children are under five and what is over five?

What proportion of the women are pregnant, unaccompanied minors, and elderly?

Is data on mortality available? Is it possible to calculate the daily rate?

Environment

Did they flee from armed conflict?

Where have the affected population come from?

If they are refugees or internally displaced people, how long have they been on the way?

What conditions have they experienced on their way to the camp?

Are there any security problems around or near the camp?

Does the community have any provisions, and were they able to bring any possessions with them?

What is the general situation with respect to food availability, health and health services in the surrounding area?

What is the attitude of the local leaders and the community to the new arrivals?

What is the terrain (desert plain, mountainous, swampy)?

Is the site planned or ad hoc? If it was planned who was responsible?

What is the current season (rainy, dry, cold, hot) and what change is expected?

Who is involved in administration of the emergency?

Is the local government involved?

Is there any community participation?

Are there local or international agencies involved?

Are women involved in camp administration?

How is the co-ordination between agencies? Is it structured or ad hoc?

Who is responsible for the co-ordination?

Is there any duplication of activities or funding?

Environmental Health

Water

How is water supplied to the population (standpipe, tanker)?

What is the source of water(river, well, cistern, rain)?

Is the source relatively clean and likely to remain so?

Is the source adequate in all seasons?

How close is the source to the affected population's shelters or houses?

What is the approximate consumption rate of water per head?

Is there evidence of a severe water related disease like typhoid, diarrhoea and skin diseases?

Is there any possibility for the water source to get contaminated by the latrines?

Is water tested regularly? Is it tested at source, during distribution, or at the household level?

Is there any water treatment system?

If there is any pump in use , how is it serviced?

What contingent plans are there if it breaks down?

Are washing facilities provided? If so, where, and is there privacy for women?

Where are the animals watered?

How is water stored in the affected population's shelters/houses?

What containers are used for storage? Are they clean and covered?

Sanitation and vector control

Is there evidence of a high incidence of diseases which could be related to excreta disposal(diarrhoea, worms)?

What is the normal practice of defecation of the affected population (note that women's practices may be different from men's)?

How is excreta disposed of (family or communal system, pit latrines, water- borne system, cartage, random)? Is there a designated defecation area?

Is there sufficient space to allow for pit latrines to be dug?

Is water available for hand washing? And is it close to the defecation area?

How close is the water source to the sewage disposal point?

Is there any obvious problem with flies, rodents, cockroaches, mosquitoes, fleas, lice and bedbugs?

How is solid waste and rubbish disposed of (collection system, burning, burial)?

Is the water table high or low?

What is the soil structure (rocky, sandy)?

How will different seasons affect existing sanitation systems (flooding)

How is waste water drained off the site?

Are there pools of standing water?

Hygiene promotion

What are the acceptable beliefs and practices among the affected community?

Are there cultural sensitivities, or taboo subjects?

Does the affected population understand the relationship between water, sanitation, shelter, vectors and disease?

Does the affected population have a previous experience of communal living?

What are the common hygiene practices among the population (washing hands after defecation, storage and covering of cooked food, disposal of children faeces)?

Is hygiene promotion integrated both with technical work on water and sanitation and also with health services?

Similar standardised questions relating to logistics, shelter, health status and medical care, and psychosocial issues are given in appendix 1.

4.2 Techniques For Collecting Information

The techniques which have been widely used in rapid rural appraisal are adaptable and most of them can be used both for very rapid assessment, taking a few minutes in the field and for more in-depth analysis when more time is available(13).

Typical techniques include, direct observations, interviewing, ranking, participatory mapping, questionnaire surveys, refugee profiles and focus group discussions.

Interviews

This is a very good technique in reaching people of different categories but you need to identify the key informants before you apply it to maximise information on a particular topic. You could interview government officials, aid agency staff in the area, refugee community and the local people.

Participatory mapping

This technique is easy for any one in the community to grasp and it generates a lot of discussions which provide on the spot insight into local knowledge of the host community and the refugees. On simple map drawn by the people you can easily locate the existing water sources, roads and resources of interest.

You can also learn about people's behaviour especially regarding sanitation. People are likely to draw what they actually want to see in their camp. This again facilitates a lot in the camp planning and the choice of technology.

Physical survey

This involves a number technical skills like leveling, geophysical, topographical and sanitary. This means a specialist must always be on the team doing this kind of survey. Information generated here need to be well documented because it will affect the designs of the facilities to be provided. Thus, the cost and effectiveness of the program.

Questionnaire survey

This method can help to quickly generate quantifiable data that can be analyzed statistically. The questionnaire form should have the minimum number of questions required and they should be ordered logically from the general to the most particular ones. For instance,you could start asking a mother how people dispose off children's faeces,then ask how it is done around her shelter, then in her household and lastly how she does it her self. Try to use direct, closed questions which have a limited range of answers for analysis purposes.

Epidemiological survey

This is done in the event of a suspected outbreak and it should be done as quickly as possible. It is often done by the health staff with the purpose of confirming the threat or existence of an epidemic and identifying the causative agent, it's source and mode of transmission; to determine the geographical distribution and the public health impact of an epidemic, identifying those groups or persons who are at high risk for the disease; to assess local response capacity and identify the most effective control measures.

To determine who is at risk you need to get the data from a file/register showing each patient, the place he/she comes from and the time he/she reported at the center

Prepare a graph showing the number of cases per day. This epidemic curve will indicate the point at which the outbreak first occurred, the magnitude of the outbreak, the incubation period, and possible mode of transmission.

By marking the residence or section of the camp of each case as it is reported may help to identify clusters of patients and this may help to pinpoint a common source of infection.

Refugee Profile

This helps to understand who the refugees are, their background and the context in which they now operate in after loosing their homes, property and dignity.

4.3 Information Interpretation And Analysis

Bearing in mind that refugees might stay for long, you need to analyze the data further and develop long term plans.

Do not take much time on this part during the impact phase of the emergency.

Data analysis

- assemble and train team
- code and transfer to summary sheets or computer
- prepare statistics
- analyze and draw conclusions

Among the above mentioned data collection methods, only the questionnaire are recorded in a well structured manner. It is important to structure your information for the ease of analysis and planning This will be achieved through the following procedure;

During every assessment discussion and observation, take brief notes and develop your own abbreviations to help you note all key words in response to questions raised.

At the end of each day expand on the brief field notes to develop expanded field notes. Use the key words noted to remind you of the phrases and ideas that came up during the discussions.

As you prepare the expanded notes, use the guide (which categorizes the discussion topics) given to record information under the respective topics.

Read through the expanded notes everyday to see how the discussions are flowing. In case any question comes up in your mind as you read through, note it down in your diary and get an opportunity in the subsequent days to ask the target group.

Another easier way of compiling information is use of a laptop. At the end of each day you feed your information from the brief field notes directly into your desired data

processing program. This requires you to use specific key words per field. These are more related to the guide being used in the whole assessment process

Coding

Close-ended questions are easier to code than open ended. For closed-ended questions, categorize the responses and they must be mutually exclusive. Every answer needs to fit in a certain category. A code book could be helpful to show the location of each question on the coding sheet.

Coding answers from open-ended questions requires you to develop categories into which the respondents can be classified.

Consider the objectives of the question asked and write a set of code categories that satisfies those objectives. The code may represent manifest or latent information.

Information interpretation

You need to consider the impact of the methodology error on the data and the interviewers perceptions. Be aware of the non-attitude influence on the information.

Data analysis and presentation(14)

Flow charts

These describe and contrast a flow of events

Taxonomies

They constitute a useful approach to organize data and interpret research findings. The information gathered is classified according to cultural themes or domains and represented in the form of taxonomies.

Frequencies

Because most of the information generated from the discussions is qualitative, you need to use simple statistical frequencies other than the complex ones. These will capture the silent characteristics in the camp like beliefs, knowledge and behaviors.

Use descriptive matrices to show time periods, persons, groups, roles, settings, processes and other key variables.

For attitudes, you could use the cross-tabulation method to show people's responses. For instance, you can classify the group into; girls(G), mothers(M), Old women(O) and then show their attitude towards a facility into 3 groups; negative(N), mixed(M), and positive(P).

Table 4.1 An example of using a cross tabulation method

attitudes towards use of a trench latrine	G	M	O	total
N	50	75	12	137
M	8	2	7	17
P	0	0	4	4
Total	58	77	23	158

4.4 Principles For Planning In Emergencies.

- Use a staged approach in drawing up your plans;(7)

. first identify the priority needs and their responsive actions to enable you take an immediate action.

. have an attitude of upgrading your schemes later.

. your plans should not be static; keep on developing them as you get used to the situation and as the level of severity changes.

- Use a logical framework approach to clarify the aims, objectives, outputs, inputs, and indicators of your objectives.

- Look for opportunities of encouraging the refugees to participate in the schemes to be developed.

- Consider possibilities of long-term development at the very beginning of the program. It would be sad if you only thought of temporally facilities and after your planned period, the refugees remain in the same camp but helplessly.

- Be flexible to population changes. They might increase or decrease as the environment dictates.

- Consider use of appropriate technology at any opportunity available.

4.5. Assessment Process

The process could include the following stages;

- Rapid reconnaissance

This is a stage where general plans in the immediate aftermath of the crisis are formulated.

It is often done jointly by multi-disciplinary teams of major relief agencies, aiming at identifying the overall situation , the scale of response needed and specific sectors which require priority action.

- Out line design;

This is a stage where experienced engineers at specific sector levels need to sit down and draw up detailed proposals and order for equipment.

- Detailed design

This is a stage where a field engineer is expected to draw up a detailed plan of action and attach specific designs for implementations.

- Monitoring could be done both during construction and during any subsequent operation and could reveal further needs to be addressed.

- Evaluation

This is meant to check on the effectiveness of the response, considering lessons learned for the improvement of future responses.

It is still important to emphasis the issue of time in emergency responses. Although the assessment process seem to be long , we are discussing hours and days in this situation.

4.6 Assessment Report

General considerations(13)

- need to write a report for every assessment carried out and information collected. A report could be as brief as one a few A4 pages.

- for effective reporting , there is a need to know the reader of the report, it's use and influence on content.

- need to consider the various stages in reporting like draft, discussion, review and revision, finalisation and distribution of the report.

- A typical outline of an assessment report;

For major assessments a final report could include the following;

- Title, authors, agency, location, date
- Executive summary, 1 page

(key recommendations, proposals, main budget and staffing requirements, responsibilities for implementation).

- Action plan, 1-2 pages
- Introduction, 1-2 pages

(objectives of assessment, background to work, methodology used)

- Presentation of key results, 1-2 pages
- Detailed recommendations, 1-2 pages
- Resource implications(human, financial, institutional),1-2 pages
- Terms of reference (if they have been specified)
- Appendices: relevant analyses of data collected, maps, design drawings etc.

4.7 Other Factors That May Affect The selection of Water and Sanitation facilities in the Manual.

In addition to the prior assessments made, there are other very important technical factors you might need to consider in a choice of technology regarding the environment you are working in. They deal with the climate, vegetation, hydrology and hydrogeology in the region. Because they are discussed in details and they could easily abstract the reader from the prior assessment made, they are deliberately attached in the Appendix 2. They are part and parcel of chapter 4

5. SANITATION COMPONENT

5.1 Introduction

Sanitation in tropical African refugee context

What characterises sanitation in African refugee camps;(15)

- sudden arrival of refugees in areas often deemed difficult by the local community to habitat. These areas are normally near swamps, in a plain wasteland, in the mountain forests etc. Examples are the Nalweyo camps in Bugangaizi county which was already abandoned by the local people. The camps were sited in the middle of very thick bushes and some near the swamp.
- no latrines or safe water sources readily available.
- due to warm climates, insects and parasites are common.
- large numbers of refugees result in overcrowding and public health problems.
- lack of normal household facilities result in unhealthy behaviours like indiscriminate defecation, irregular bathing and hand washing, poor food storage, irresponsible waste water spillage and waste disposal, etc.

Whatever the situation, a relief engineer needs to immediately device means of controlling human excreta in a safe and culturally acceptable manner. Then modify the environment to contain disease carrying organisms movements.

This calls for your urgent concern on safe excreta disposal facilities, drainage, refuse disposal, vector control and death crisis.

5.2 Guidelines For Excreta Disposal In Emergencies

5.2.1 Assessment and planning

- Get data on current excreta disposal practices and the physical parameters of the site which might affect the choice of the disposal method. See Appendix 2. You could have gathered a lot of the relevant data by now if you used the earlier assessment list correctly.
- draw a site map/sketch to facilitate your planning.
- use a staged approach to prepare a sanitation plan indicating the immediate, mid-term and the long-term plans.

Immediate Plan of Action

The time period for the immediate plan of action is as long as the impact phase. This will often take a few days or weeks.

Major activities should include;

- an immediate and effective control of indiscriminate defecation and provision of designated defecation sites.

Take appropriate measures to ensure that refugees do not defecate in the following areas:

1. by the side of or into the surrounding water bodies within a 15M radius of any water source, treatment plant or storage.
2. on slopes uphill the camps and the water sources in any agricultural gardens in and around any publicly used area, roads, buildings and feeding centres.
3. near any food storage facility.

You could fence off the critical areas and place some guards to prevent defecation in these areas

Where applicable use community representative to inform the people which areas are prohibited and which areas are permissible for defecation.

- Provision of defecation sites and or appropriate facilities, depending on the situation.
- use trench or open defecation fields. The latter in dry and hot areas, preferably on sandy sites. Even then limit the application time

Other options appropriate for the immediate phase include communal latrine depending on the ease of construction to meet the prevailing need in the camp.

In case you use communal latrines in the immediate phase, plan at 200 people per latrine and also consider location which needs to be in a range of 50M from the shelters and they are not the permanent facilities the refugees should always use.

Mid-term Plan of Action

The time period for this phase is often in months and years.

During this phase there is a crisis but it is under control.

The major activities should include;

- Consultations with the refugee community to establish what is culturally

  acceptable, what hygiene awareness the community already has, what technologies the people are used to, and how sanitation was managed before.
- Use of the acquired data to design the type of excreta disposal facilities which suit that particular situation.

During this phase communal latrines should be targeted to 20 people per latrine but 100 people per latrine at the beginning is acceptable.

Other options during this phase include;

- Deep and Shallow Trench latrines.
- Shallow family latrines.
- Borehole latrines.

Long-term Plan of Action

This is more of a developmental phase than an emergency response.

- Consider family toilet facilities
- Institutionalise the activity by training local artisans and equip them.
- Integrate the activity in the locally existing Health activities.

5.2.2 Technology Choice

Criteria for choosing technical options(7),

- Environmental

.Climate

Hot dry climate has a very big impact on the excreta sanitization and it is a very important factor to consider as you choose the type of defecation fields during the impact phase.

.Water table

In case of a high water table, avoid contamination by constructing raised platform latrines. If there is a real need to dig down, ensure a minimum of 2M between the pit and the water table.

.Materials available

Consider the locally available materials as you select the option to apply but avoid the negative impact on the local environment.

.Soil stability

You might need to construct wall lining in case of unconsolidated soils such as sands and fine grained alluvium.

For short term latrines, use timber, wooden boards or poles which ever is available in that area for lining.

For long term latrines, use relatively durable materials like blockwork, bricks, and stones but always allow slots in the 0.5M lower part of the lining for seepage of faecal liquor into the surrounding soil.

Insufficient permeability of the soil will limit the choice of a sanitation facility.

.digability

The depth of the hole will be affected by the ease of digging and the type of equipment used. Off site sanitation could often be the answer for rocky areas.

-Erosion.

Slope and terrain should be well considered especially in areas with heavy rains. Avoid options that may be subject to flooding or collapse otherwise it might cause a health hazard.

- Logistics

.roads and trucks

.human resources

.skilled refugees and the surrounding community.

.outside human resources necessary.

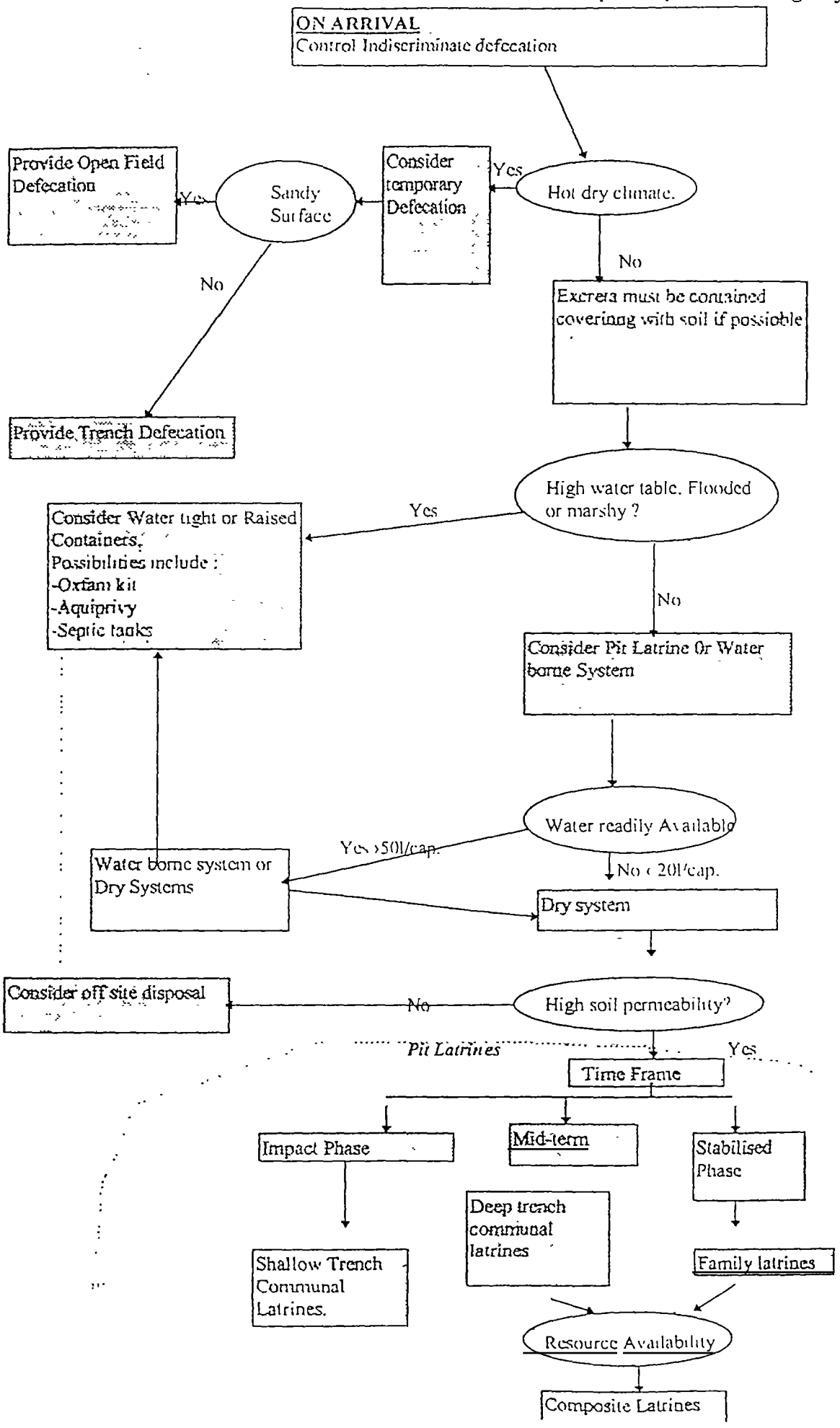
- Political and Financial factors.
- Camp plan
- Religious and cultural factors.

A number of technical options are available for emergency sanitation but you need to choose the most appropriate one in each situation. They include;

- open field defecation
- defecation fields
- trench latrines (shallow and deep)
- VIP latrines (drop-hole or pour flush)
- bucket latrines
- borehole latrines
- container type (above ground tank)
- septic tanks

flush sewerage

Figure5.1 A flow Chart for a quick choice of an excreta disposal option in emergency.



5.2.3 Key Elements In Design And Construction Of Various Emergency Excreta Disposals.

Defecation Fields(7)

Both open and trench defecation fields are laid out by enclosing and dividing a field into strips. They are appropriate only in dry and hot climate and for a very short time. Consider a defecation space of about 0.25 sq M per person per day, then calculate the amount of space you need to serve the population you have for the number of days you expect them to use the field. Separate women's fields from men's fields.

Fields must be sited on a slope for drainage purposes and the used part of the field should always be at the lower part of the slope while the entrance is at the upper part.

Provide hygiene education as soon as you choose to use defecation fields.

Each strip is 1.5m wide. Defecation should be done only on the lower part of the strip and leave the upper part free for walking through.

Always seal off the used strips and in case of inadequate sun shine excreta should be covered by earth. In such cases ensure presence of loose soil/sand within the strips and a spade at the entrance.

Trench defecation fields

The arrangement is quite similar to that of the open field except here trenches of about half a foot are dug along the strips to accommodate the excreta. In this case the excavated soil should be used to cover the excreta. *Ensure presence of a spade, water for hand washing and soap at the entrance of the field.*

Communal Latrines(16)

Trench latrines

Shallow trench latrines are designed for 2 to 4 weeks usage while deep trench latrines are designed for 1 to 3 months.

Base your design calculations on 50 people/metre length/day.

Maximum depth of trench should be 2M and width 0.8M.

Excavated soil should be put at the back of the trench for covering the excreta on each visit.

Improve users' privacy by constructing simple cubicles on top of the trench.

Each cubicle should be 0.9M wide. Use timber for foot rests or plastic slabs if available.

An ordinary trench of 5.6M length could accommodate 6 cubicles and that is about 300 people served per day but you should always remember that this option is for a very short period of time.

Family Latrines

Shallow family latrine.

A shallow family latrine is more like the trench latrine except that this one is family owned and it is nearer to the user family.

Pit dimensions are; depth 0.5M (pit should not be used at depth less or equal to 0 15M).

width 0.3M

length 0.5M

Use timber for foot rest and cover faeces with 100mm of soil every 2 days.

Use plastic sheeting or any locally available materials for privacy.

Borehole latrine

Ensure that there is no risk to ground water and you have a drilling equipment before you spend your time on this option. However, it is good and quick technique especially where the structural cover on a pit latrine is the problem.

A 5M deep borehole latrine will serve a family for at least 2 years.

You can use a hand auger to drill in the right soil a 400 mm diameter and 6M deep latrine. but always leave a 2M soil layer between the bottom of the hole and the water table.

Pit Latrines(10)

Consider the camp plan in locating pit latrines.

Calculate the volume of the required pit depending on how many people are going to use the latrine and for how long;

For a dry pit in a hot climate, consider an accumulation rate of 0.06 cuM/person.year.

In case of a wet pit, reduce the rate to 0.04 cuM/person.year.

If bulky materials are used for anal cleaning increase the volume by 50%.

The effective volume for the pit, V can be calculated as below;

V = (no. of users)*(solid accumulation rate, cuM/person.year)*(design life, years)

The top 0.5M of the pit should not be considered in the pit effective depth since at that depth the pit should be left to rest or buried

Simple pit latrines

Having got the volume right you can now dig the pit, line it where necessary and construct a simple superstructure on top.

Ensure safety of the pit diggers. You might need to dig through a reinforced ring in unstable soils.

In most cases you should reinforce the top part of the pit hole unless the soil proves to be extra stable.

Cover the pit with strong wooden poles and consider a space for the squat hole.

Back fill with earth and level before you add on a sanplat slab,(concrete or plastic).

In case you do not have strong wooden poles, consider using dome shaped concrete slabs or re-inforced slabs.

Use soil dug from the pit to raise the rim of the pit by at least 15 cm to avoid surface run-off water entering the pit.

For privacy, consider an appropriate super structure which fits in the peoples' culture and the available materials. In most cases a plastic sheeting will do the job very well.

In case of rain, roof the latrine to avoid rain water entering the pit.

The squat hole should be covered to avoid flies breeding and mosquitoes. Also, provide hand washing facilities near to the latrine.

Commonly used latrine slabs

- square concrete sanplat
- square reinforced concrete slab
- round dome shaped concrete slab

VIP latrines

For long term planning consider use of VIP latrines unless there are natural wind obstruction like mountain barriers and thick forests surrounding the camp site.

The major differences in the VIP design and the tradition latrine design are in the superstructure than in the pit hole. So, use the above procedure to calculate the right volume of the pit.

The slab this time should have 2 holes; a squat hole and a vent hole.

The VIP has an advantage of eliminating flies and odour in a latrine.

Oxfam sanitation unit(17)

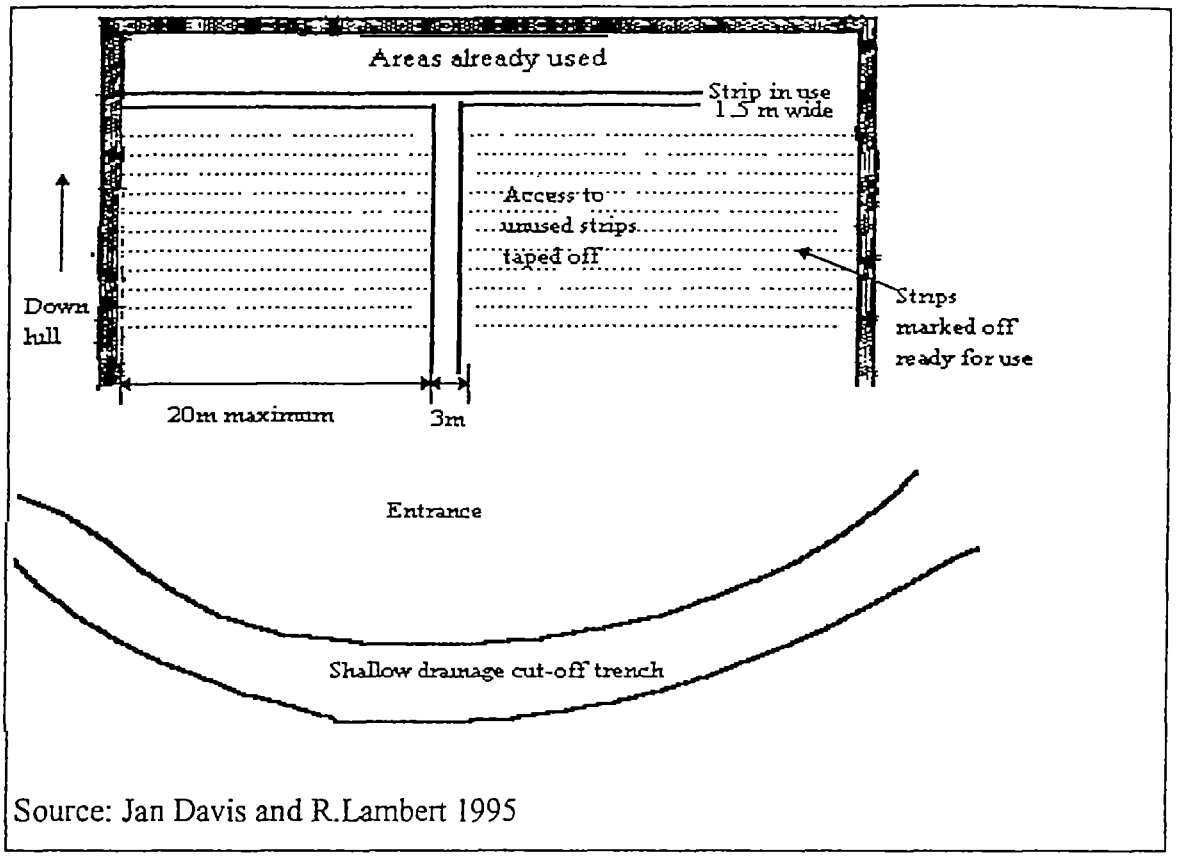
The unit can be applied where latrines have failed and excreta must be contained but consider the anal cleaning methods. This unit is suitable for those who use water for anal cleaning like the Muslim community.

It comprises of a communal collection and treatment system of 20 squatting plates, 2 flexible tanks made of nylon-reinforced butyl rubber for sewerage treatment and all the necessary pipes and fittings.

The unit is designed to serve 1000 people per day.

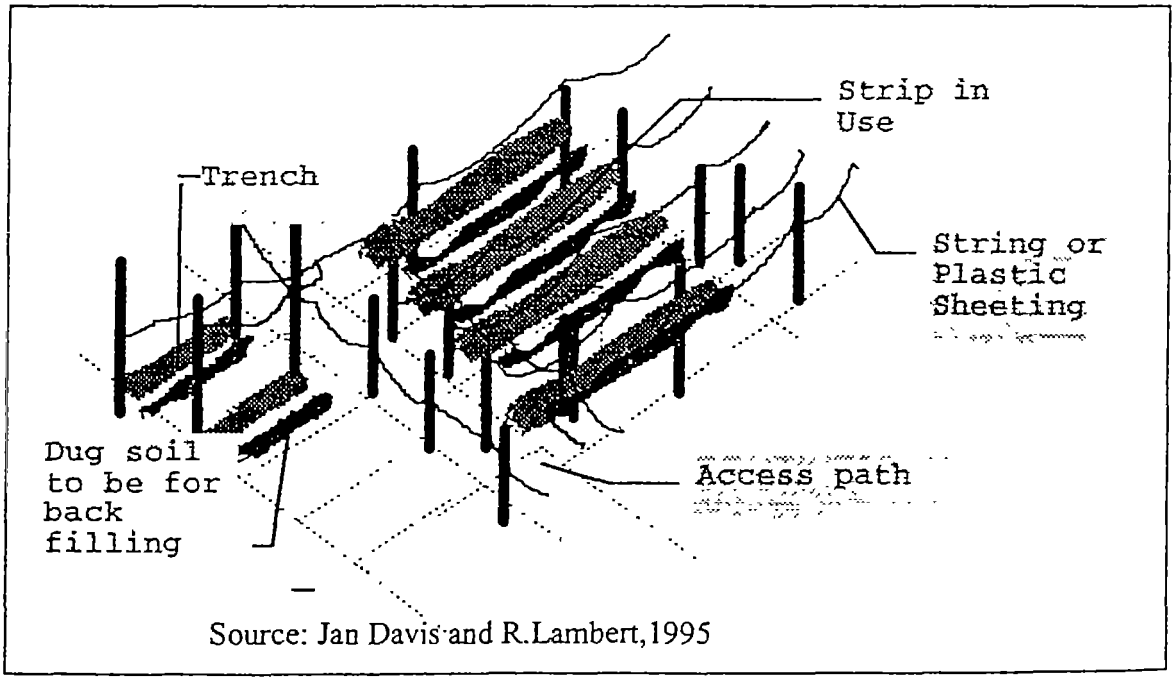
You need 3000 litres of water per day to use it's full capacity.

Figure 5.2 A sketch for open field



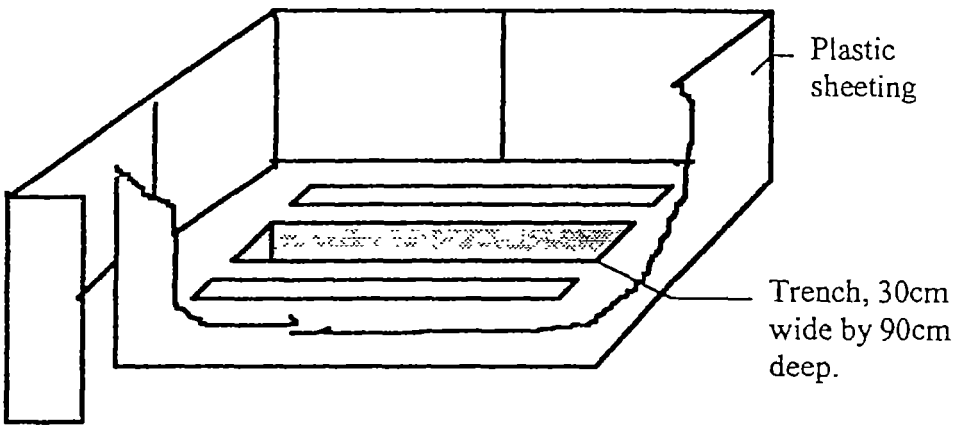
Source: Jan Davis and R.Lambert 1995

Figure 5.3 A sketch of a trench defecation field



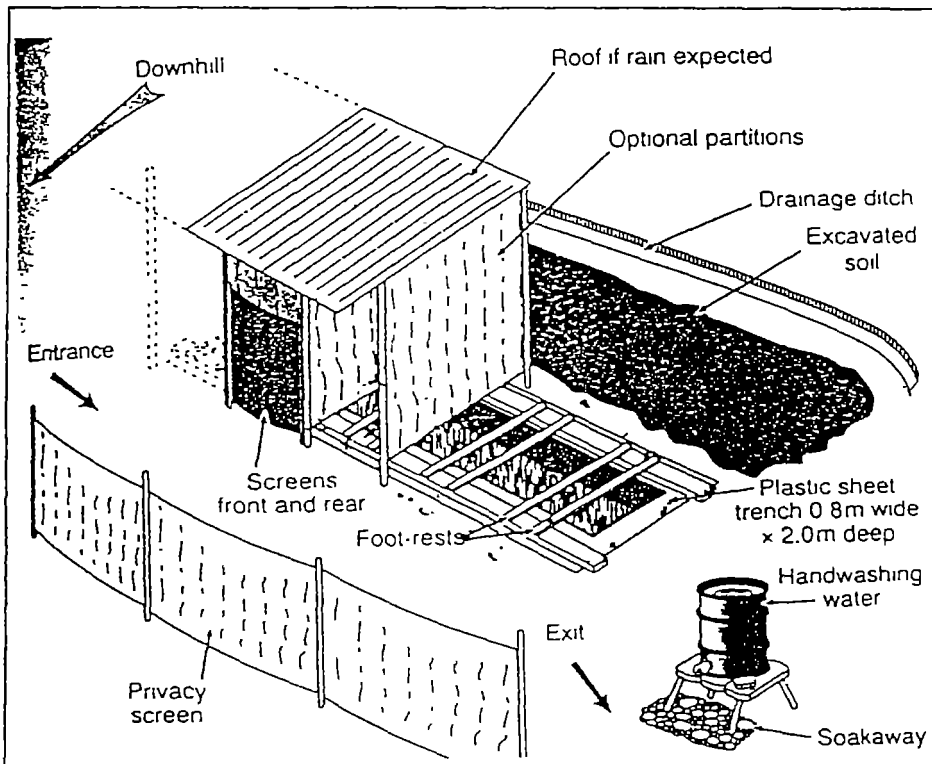
Source: Jan Davis and R.Lambert,1995

Figure 5.4 A sketch of a Shallow Trench latrine



Source: Jan Davis and R. Lambert,1995.

Figure 5.5 A sketch for a deep trench latrine



Source: Jan Davis and R.Lambert,1995

Figure 5.6 A Picture of a square concrete sanplat

Source: Kiboga Watsan Project, Uganda.1995.

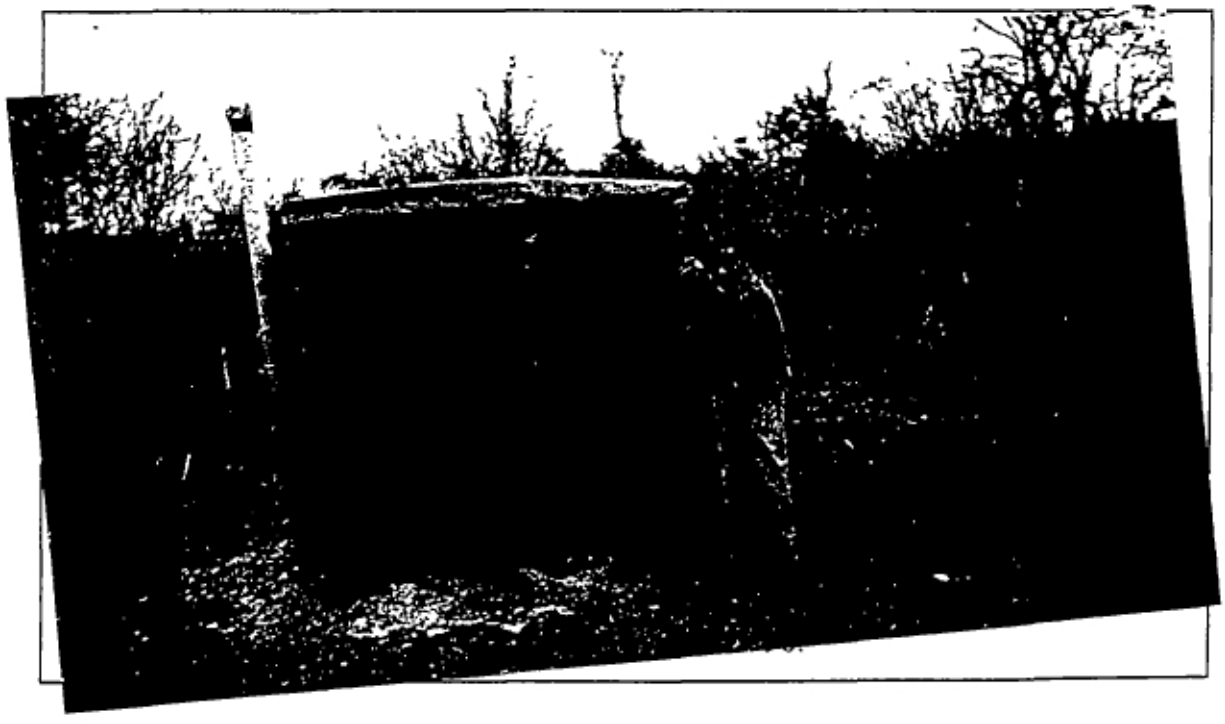
Figure 5.7. A picture of a square reinforced concrete slab

Source: Kiboga Watsan project, Uganda. 1995

Figure 5.8. A picture of a round dome shaped concrete slab

Source:RedR Seminar,Suffolk,UK.1996.

Figure 5.9. A picture of a VIP latrine constructed using plastic sheeting



5.3 Sullage

5.3.1 Introduction to sullage management

Sullage is waste water from all the domestic washing and spillage. Normally in a refugee situation water is expected to be scarce but where soil permeability is low and the camp site is generally flat sullage becomes a problem. *If sullage is not well managed. it can result in breeding sites for mosquitoes and many other water related diseases discussed in chapter 3.*

5.3.2 Guidelines for effective sullage management in emergencies.

Make quick estimate of water usage and discharges at each centre where waste water is expected to be a problem. Normally hospitals generate 55 litres/ person / day and feeding centres about 25l/person/day.(7)

check on the soil permeability.

If the soil is clayish and the land is sloppy consider natural drainage.

If it is in the range of loam sandy to sandy, consider localised disposal like soak away pit or an infiltration trench.

Avoid the sullage from forming ponds near shelters and do not transport it long distances because it cause a number of diseases.

5.3.3 Technical options

Natural drainage

Where appropriate, direct sullage into an existing river below any usable water source, and avoid natural pooling around the camp. Maintain the sullage carriage trench at a gradient of 1 in 200.

Soak away pit/infiltration trenches

- determine the type of soil and it's waste water infiltration rate.

Waste water infiltration rates for some soils.

sand 35-50l/sqM/day

sandy loam 24 l/sqM/day

silt loam 18 l/sqM/day

clay loam 8 l/sqM/day

clay negligible

- calculate the volume of sullage per day.
- calculate the required seepage surface area.
- dig a pit or trench of the equivalent internal side wall area.
- fill the pit with gravel. Reduce gravel size downwards away from the inlet pipe.
- In case of a trench, use a percolated pipe to evenly distribute the sullage along the length of the trench. Then fill the trench with gravel just like in the pit.

Cover with plastic sheeting and back fill with earth.

5.4 Run Off Management

5.4.1 Introduction to run off management (drainage)

In most parts of the Tropical Africa seasonal rains need to be considered very well before they make the camp shelters difficult to live in for the refugees. This means you have to consider drainage for surface run off at the very beginning of the camp planning and it is important to integrate it with other infrastructure developments of the comp. A complete network of large drains and feeder drains is needed to ensure proper delivery of surface run off to the downhill side of the camp and the water sources that are near the camp. *Always water pools should be avoided in the camp to reduce breeding sites for mosquitoes and parasites.*

5.4.2 Guidelines for effective run off management

- Collaborate with the camp planners in selecting a site with safe gradients.
- Avoid too steep slope which may cause unnecessary soil erosion.

The whole of this section should be done as a team of all camp planning personnel.

- Consider the whole camp setting and consider the main drains first.Avoid draining in the near by water sources down hill.
- Depending on the shelters distribution insert in the feeder drains which drain in the main drains.
- Check for any depressed land areas within the camp which might pool water for more than 3 days. If any longer, fill them with earth to avoid mosquito bleeding.
- Channel away water from large storm.

Ensure a good co-ordination with other infrastructure development in the camp.

5.5 Refuse disposal

5.5.1 Introduction to refuse disposal in emergencies

Refuse disposal is a problem which might be neglected in camp management until it becomes a health hazard. It is not an obvious problem during the impact phase. But as refuse continue to accumulate at random places all over the camp, a problem arises. *Uncontrolled refuse is a potential breeding site for disease vectors like flies, rodents and cockroaches.* On the contrary, well managed refuse could have a good economic potential. Products like composite manure can be used to promote agriculture among the refugees during the stabilisation phase. It is important to collect all refuse in the camp at specific places where it will be disposed of. Refuse from households should be collected in refuse collection containers one per 10 families(UNHCR 1982) or in a centrally dag

pit. Where refuse is directly damped into a pit, a layer of earth cover is necessary every day.(7)

5.5.2 Guidelines for effective refuse disposal in emergencies

There are 3 common methods of refuse disposal in refugee camps:

- Burying refuse within the camp.
- Removing the refuse from settlements to another safer place..
- Burning the refuse.

However, the method selected depends on the type and the quantity of refuse to be disposed of.

Burying the refuse

- .Dig a trench 2 M deep.
- .Fence it to avoid to avoid animal or human scavenging.
- Let the refuse from collection containers, apart from hospital sharps and pathological waste, be damped in the trench. But, do not allow filling the trench up to the ground level. Always leave a space 0.5M to be filled with earth.
- If you are bury hospital waste, use a pit or a trench 3M deep and the earth cover should be at least 2M deep.

Transferring refuse to a safer place outside the camp.

Where a waste disposal system is already existing in the area, you could simply encourage collection of the refuse in bins and then transport the refuse by the easiest means available like tractors to the disposal sites. Make your transport estimates on 1 truck of 10 cuM for 5000-8000 people per day.

Burning/ incineration

Sometimes you might need to reduce the volume of the waste or simply get rid of the hospital waste. It is however difficult to completely burn and destroy every thing especially, the pathogens. Therefore, you should bury the remains in a pit and still cover them.

5.6 Death crisis

5.6.1 Introduction to death crisis in refugee camps.

Death in refugee camps is not uncommon and it is caused by varying factors ranging from illness to violence. A good relief programme could reduce the number of deaths due to illness. But could do almost nothing to control the big numbers of death due violence. For instance, in April 1995 soldiers open fire and killed hundreds of people in Kibeho camp in Rwanda. Therefore, plan should be made on how to manage it, especially burial of the dead bodies. Bearing in mind that different communities have different behaviours regarding death and burial, you should always avoid introducing new methods which might offend the bereaved families and friends.

5.6.2 Guidelines for effective management of death crisis

- Death should be registered and camp records updated.
- Try to understand the refugee community cultural requirement regarding death and burial before you get involved at all.
- *Unless the cause of the death requires isolation of the body (like death due cholera), allow the refugees to manage their burial arrangements. You might need to play a facilitating role.*

In case of massive burials, consider it's impact on the environmental health and select a suitable site. You might need extra equipment like excavators, pick axes, shovels, plastic sheeting and protective clothings.

5.7 Vector control

5.7.1 Introduction to disease carrying vectors in Tropical Africa

The ever warm climate and the existence of breeding sites for arthropods in Tropical Africa favours multiplication of disease carrying vectors in the region.(19)

Disease carrying vectors found in the region include both the mechanical and biological. The mechanical vectors transport pathogens on or in their bodies from one place to another.(10) Examples are flies and cockroaches. Biological vectors are infected by the pathogens which develop or multiply inside their bodies. The important biological vectors were covered under chapter 3 in the control of communicable diseases.

Controlling these vectors is a very effective engineering method of controlling the disease they carry. In refugee camps where you find heaps of garbage, dirty communal and defecation sites, flies, cockroaches and rodents are so common. Vector-borne diseases found in a refugee camp will include those found in the local population as well as those generated by the unhygienic and overcrowded conditions.

5.7.2 Guidelines for effective control of vectors in emergencies

It might be necessary to launch an independent vector control programme under severe situations. But under normal circumstances the following considerations should be made:

- In case of flies, consider good sanitation, fly screens in hospital and kitchens during the first phase. You could as well spray on garbage heaps and dead animals.
- In case of mosquitoes, reduce chances of standing water. You could remove the unnecessary water bodies or spray a layer of diesel film on the water surface.
- In case of rats, you need to control waste as discussed in the waste disposal section. You could use rat poison and traps but you need to ensure disposal of the dead rats regularly.

An independent Vector control programme will be priority if:(18)

- the actual or threatened mortality rate from the disease is high and transmission is likely to occur in the camp.
- conditions exist for an epidemic and the control is relatively simple.
- there exists a vector-borne epidemic in the locality which could result in a high mortality rate.

Vectors of public health importance include;

- Mosquitoes (Anopheles, Aedes aegypti, and Culex)
- Synanthropic flies (Lucilia, Glossina and Simulium damnosum)
- Fleas (Xenopsylla, Pulex and Ctenocephalides)
- Bedbugs
- Lice (Pediculus humanus, Phthirus pubis)
- Cockroaches
- Ticks and mites
- Rats

Some of the common insecticide you could use include:

- Permethrin on mosquitoes, houseflies, lice, fleas, cockroaches and bed bugs.
- Pyrenthrin on mosquitoes.
- Pyrimiphos-methyl on rats
- Insecticidal dusts on jigger fleas

6. WATER SUPPLY

6.1 Introduction to emergency water supply

It is always important to remember that refugees during the impact phase are a desperate community and yet very vulnerable to all kinds of diseases. They indeed need urgent water available. They can at this stage draw water from anything near to them for survival. People can survive longer without food than without water.(17) As an engineer you need to move in as fast as you can to control usage and contamination of any water sources around the area. Disinfect them and protect those you can in the shortest time possible.

Much as the refugees may need water for their survival, the same water can be hazardous if not well managed, refer to chapter 3. This calls for a careful planning of a water programme for refugees, taking into account all the data you could have generated in chapter 4.

This chapter will look at issues of public health concern in water provision and also give a few tips on appropriete water sources in Tropical African emergencies. *The major concern is the provision of sufficient and acceptable quality of water to the refugees(10).*This manual will not go into detailed designing of specific schemes which always differ from place to place.

6.2 Assessment and planning

Like in sanitation you still need to use a staged approach in developing water facilities to the refugees. Consider an immediate, mid term and the long term actions depending on the severity of the crisis.

If you are entering at the impact phase, it is always safe to imagine that all the existing local water sources are polluted and this brings you into an immediate action.

Immediate action(7)

- avoid any further contamination of the existing water sources, disinfect them and control use of the protected sources.

- organise tankering if the minimum quantity can not be met by the existing sources.

As you plan for the minimum quantity it is important to consider the time spent in the queues ,the distance to the sources and size of the containers used by the refugees. Make quick estimate on how much time a woman refugee takes to collect water equivalent to 20 litre per member of her household, using the existing containers. If it comes to five hours per day, you need to quickly reduce walking distance and increase the yield. This could mean water tankering if you do not have any safe source to pump from.

- consider a safe water chain by providing collection and storage containers, followed by hygiene awareness.

- involve community representative to ensure safe use of all the water facilities put in place.

See table 6.1 for an indicative guide to help you estimate daily water requirement if you are to consider water tankering:(16)

Mid-term action

If the refugees are not going to move away from the site soon, then you need to consider upgrading the supply. You might need to develop new sources around the area depending on the data you have. At this stage try to observe the following:

- An adequate storage of water.

Your estimates should be for a 24 hours supply.

-As a reserve of water

-As a buffer between the source and the distribution points to allow for settlement and further treatment.

- Appropriate treatment of water.

Usually treatment is needed for surface water and not ground water. The basic treatment involves settlement in a storage tank followed by chlorination.

- An efficient distribution of water.

This will take into account factors like convenience, time in queues, walking distances, adequate quantities and quality.

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6.3 Standards and control of water quality

Water provided for refugees must be potable and palatable. Always ensure that the supply is free from the following:

- Visible suspended matter.
- Colour
- Taste and odour
- Bacteria indicative of pollution
- Objectionable dissolved matter
- Aggressive constituent.

Again when you are planning a water supply for a large number of refugees, do not dwell much on water quality at the expense of quantity since most communicable diseases could be avoided by large quantities of water(10).

Pure water is rarely found in nature and there are no set rules at the acceptable quality of potable water. Standard guidelines are given by WHO and UNHCR to help you operate within a reasonable range of parameters. Therefore, short term deviations from above the guidelines do not necessarily mean that the water is unsuitable for human consumption. However, periodical control of water quality in a refugee water supply is very important and it should be done routinely at watering points. Sporadic checks on the portability of water at individual households should be carried out to monitor the hygiene behaviour of the refugees.

See table 6.2 for some of the important parameters to consider in Drinking water for emergencies.(WHO/UNHCR guidelines).

When you are developing drinking water standards for any refugee situation, it is necessary to take into account it's geographical, social-economic, dietary and environmental conditions.

Surface waters have their maximum load of suspended matter during the flood and it could be seasonal. Underground water , depending on the geology in the area and the distance it travels, it could pick a lot of bicarbonates, Carbonates, Sulphates, Chlorides, Nitrates of Calcium, Magnesium, Sodium, Potassium, Iron and Manganese. The presence of Nitrates is indicative of organic pollution which need to be tested by E.Coli indicators. Iron and Manganese could cause taste and odour nuisance to the water. Bicarbonates, Sulphates and Chlorides of Calcium may cause Hardness to the water.

More than 500 mg/l Chloride in water results in a salty taste.

More than 1.5 mg/l of Fluoride are undesirable and when the concentration goes beyond 3 mg/l it causes mottling of the teeth.

Water with high content of dissolved CO_2, low pH and low alkalinity is very corrosive and it is not suitable for steel pipes.

6.4 Technical options for emergency water in Tropical Africa

In most cases surface will be polluted and it needs an appropriate form of treatment before you could supply it to the people. Where the source has no toxicants, that could always be treated in a very simple way and distributed to the people. There are two basic things you need to do:

1. *Lower the turbidity of the water to 5 NTU*

2. *Chlorinate the water*

Methods of lowering Turbidity/Pre-treatment

- Storage

Storage of water in a well aerated tank will naturally remove the suspended solids from the water which will settle down to the bottom of the tank. Tastes and smells could be eliminated too especially when you consider to optimise aeration as water is pumped into the storage tank.

- Coagulation and flocculation

This method is more suitable for the emergency phase because it is faster but expensive as it requires chemicals. The most common coagulant used is Aluminium sulphate applied at a pH ranging between 6 and 8. The required dose is determined by using a jar test. A series of samples with Aluminium sulphate of varying concentrations are rapidly stirred and then allowed to settle. By comparing the turbidity of each sample the lowest effective dose is determined.

- Roughing filters(11)

The most suitable roughing filters in emergencies are the Vertical flow roughing filters arranged in series. But you should consider a sedimentation tank prior to the filter system to avoid clogging frequently.

Chlorination

If Chlorination is done at a turbidity of 5 NTU, most pathogens in the water will be destroyed. Always check the on turbidity.

Add Chlorine to the Chlorination tank and ensure a residue of 0.2-0.5 mg/l and a minimum contact time of 30 minutes. Excessive Chlorine will often be offensive to the water consumers.

Determine the optimum dose by trials on the water sample. You could analyse Chlorine residue by using a simple Delagua kit which contains colour comparators and the necessary reagents.

Chlorine dosing could be done with a continuous flow of 1% solution of Chlorine or adding Chlorine tablets or powder directly to the tank.

6.4.1 Surface water abstraction

Water can be abstracted from surface water sources by:(7)

- Flow diversion into an off-take channel or pipe.

You might need a flow diversion structure if the water level in the stream is fluctuating from time to time. But in emergencies you don't need to use very expensive and time consuming structures. Where necessary simply use sand bags or gabions to make the diversion. The main point is to maintain the water level for pumping.

- Pumping from infiltration galleries or wells.

In case the turbidity of the river water is high, you could construct infiltration galleries or wells adjacent to the river.

River side wells

Use a hand auger to site wells above the river flood level and at least 20 M from the river bank. The longer the distance, the more purification you might achieve. But watch out for the clay barriers which might affect the well yield. Sink wells at least 1M below the level of the river bed to take advantage of any subsurface flows in the dry season.

Infiltration galleries

The principle at which the infiltration gallery works is quite similar to the river side well except that here the yield is improved by adding a more permeable filter media and a slotted pipe to deliver water up to the collector chambers. Depending on the level of the water in the river or any other turbid course , you could dig a trench in the bed or on the bank and connect it to the collector chambers.

When you dig a trench in the bed of a water course at the time when the water level is low, you will get higher yield in your collector chambers. If the water level is high. then simply dig the trench on the bank of the water course. Fill the trench with gravel and

place a slotted pipe in the gravel. The pipe position should ensure enough filter media at the top of the pipe and some on the bottom side.

The system will provide you with a relatively purified water for pumping.

Estimate the required surface area of the layer of gravel media from it's approximate hydraulic conductivity (k). And flow velocity in the infiltration pipe be a maximum of 1.5 m/sec. to limit head loss.

- Pumping directly from the source.

In cases where you are sure that water is fit for human consumption or when you have arranged to treat it further at the camp site, you could easily go in for direct pumping. If your budget permits, simply get an Oxfam pumping and storage kit. It contains everything you will need for the job. The pack has 2 Lister-Petter diesel engine powered water pumps. Their max. capacity is 3.5 l/sec. against a total head of 20 M . In case you need a more powerful pump, you could ask Oxfam to supply you with a Lister TS1 with capacity 18l/s. at a head of 20M or a 13l/sec. at a head of 30M. Spares and fittings up to the storage tanks are provided. Storage tanks of capacities 10.5, 45, 70, and 95 cuM are all available. They could also supply you with Filtration and Distribution packs.

Their filtration pack consists of 2 raw water storage and settlement tanks of 95 cuM capacity, followed by 2 units of 70 cuM tanks containing slow sand filters. Then they provide you with a 45 cuM capacity storage tank for storing treated water. A Delagua water testing kit and Chlorinator kits are also provided.

The distribution kit comprise of pipes and fittings necessary for transporting water from source to storage and/or from storage to users. It contains 150 × 4 M lengths of heavy duty plastic 3" diameter pipe, with socket and spigot push fit joints and simple rubber o-ring seals. The pack also include 6 × 50 M coils of 32 mm polyethylene pipe, used for connection between the main 3" pipe and water collection frames, which are provided ready for assembly with saving water taps.

All Oxfam packs are complete with their assembling and operation manuals. Therefore details a not included in this manual.

Table 6.1 A table of minimum water requirements in emergency situations.

1.HUMAN CONSUMPTION	
a) Minimum survival allocation	7 litres per capita
b) Minimum refugee camp allocation	15-20 litres per capita
2. SERVICES AT CAMP LEVEL	
a) Out-patient Health centres	5 l/patient
b) In-patient health centres	40-60l/patient
c) Schools	2l/student
d) Feeding centres	20-30l/patient
e) General camp administration	5l/capita
f) Staff accommodation	30l/capita
LIVESTOCK	
a) Cows	25-30l/head
b) Goats and Sheep	15-20l/head
c) Chicken and any others	10-20l/household
CROP IRRIGATION	
A simple rule of thumb	1litre/sec./ha

Source: RedR Seminar,Suffolk,UK.1996.

Table 6.2. A table of showing WHO/UNHCR guidelines for drinking water in Emergencies.

MICROBIOLOGICAL QUALITY	
Faecal coliforms	0 FC numbers/100ml
Coliform organisms	0 C numbers/100ml
	advise public to boil water when you can not meet this standard.
INORGANIC CONSTITUENTS	
Arsenic	0.05 mg/l
Cadmium	0.005 mg/l
Chromium	0.05 mg/l
Cyanide	0.1 mg/l
Fluoride	1.5mg/l
lead	0.05 mg/l
Mercury	0.001 mg/l
Nitrate	10 mg/l
Selenium	0.01 mg/l
ORGANIC CONSTITUENTS	
DDT	1 µg/l
AESTHETIC QUALITY	
Aluminium	0.2mg/l
Chloride	250mg/l

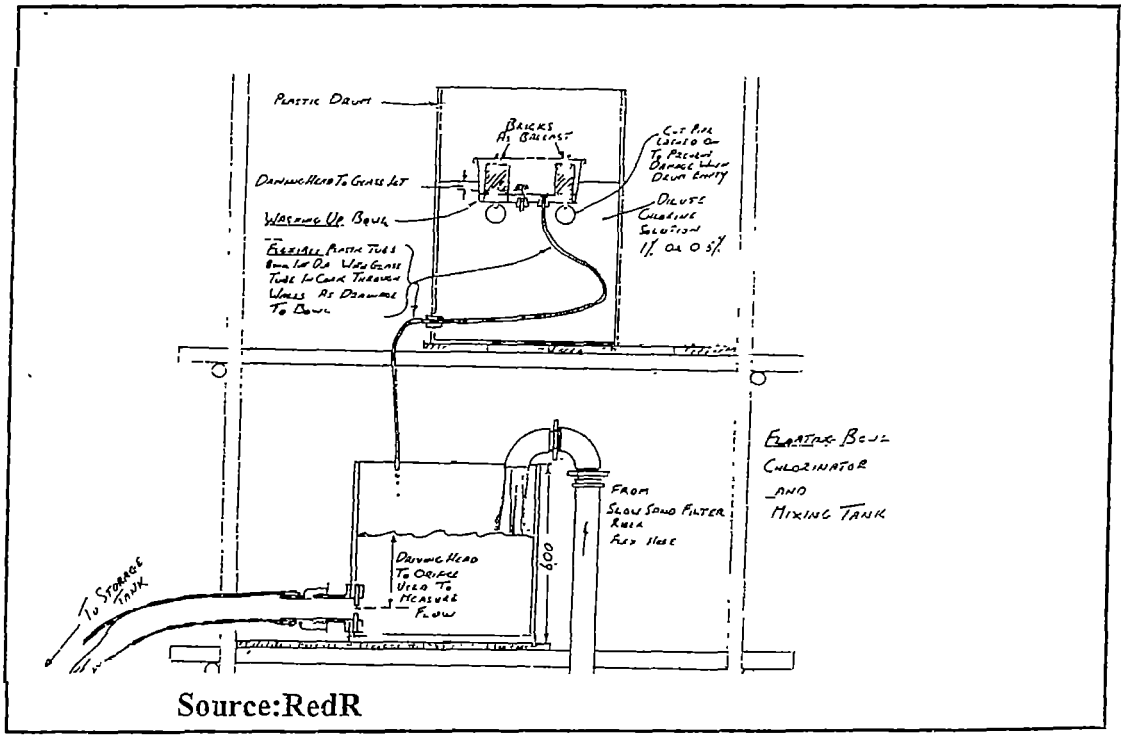
Colour	15TCU units
Copper	1 mg/l
Hardness	500mg/l (as $CaCO_3$.)
Iron	0.3 mg/l
Manganese	0.1 mg/l
pH	6.5-8.5
Sodium	200mg/l
Total dissolved solids	1000mg/l
Sulphate	400mg/l
Taste and odour	inoffensive to most consumers
Turbidity	5 NTU units

Source:UNHCR

Figure 6.1: Picture of vertical roughing filter

Source: RedR Seminar,Suffolk,UK. 1996.

Figure 6.2: A Sketch of a simple Chlorinator



Source:RedR

6.4.2 Ground water abstraction

The use of ground water during the refugee emergencies would be the most preferred solution but a lot information is needed before you could actually take the decision on the method of abstraction.(17)

You need to know the type of aquifer in the area and factors regulating the recharge. *You need to assess the potential productivity and maximum yield expected in that aquifer. including the physico-chemical and bacteriological characteristics of the water in that aquifer.*

The quantity of water stored in an aquifer depends on the recharge basin, annual rainfall, permeability of the soil, topography, land cover and storage capacity of the aquifer.

In case of excessive pumping, you need to first of all establish the relationship between ground water, surface recharge and surface water bodies.

A number of methods are available to exploit the ground water resource. They include spring protection, Hand dug and augered wells, and bore hole drilling.(20) *Which ever method you choose. consider the yield. the quality and the economic benefits of the source.*

Well design

- Establish the discharge rate(or supply demand) because it will dictate the size of the pump required, so is the internal diameter of the casing.
- Establish the type of aquifer in the area.

<u>The 3 broad classes are:</u>

- Crystalline aquifers.

Crystalline aquifers which are typified by igneous and metamorphic rocks. They have no primary porosity or permeability. The water bearing voids in them are usually in form of fissures. Since both weathering and fissuring decrease with depth, there will be a depth

beyond which the cost of drilling outweighs the chance of significantly increasing the yield of a borehole.

You could determine the optimum depth. of a location from the previous drilling experiences in the area or from surface geophysical surveys which will indicate the bottom of the weathered zone. Usually less than 100M.

Normally. yield of wells in a crystalline aquifer is low . around 50 M^3/day and rarely does it exceed 250 M^3/day. So. you do not need large diameters in such wells. Consider casing and grouting in the upper few metres. Where the water bearing zone is a shattered or incoherent weathered rock, incorporate a screening section in your design. To support a shattered rock, use coarse slot screen and slots matching to the grain size of the granular material in the incoherent weathered zone.

- Consolidated aquifers

Ground water flow in almost all consolidated aquifers is largely through fissures and zones of enhanced permeability, so you can not optimise well design here based on uniform aquifer. The depth of the borehole needed for specific discharge will depend on the distribution and size of water bearing fissures.

The fissures tend to be more frequent and open near to the surface . *Normally yield will increase with increase in screen diameter.*

Another factor to consider is that not all consolidated aquifers are completely stable. Where you have fissure flow within an aquifer you will get erosion of sediments which could damage the pump and silt up the surface works. You might need to incorporate screens and gravel pack sometimes. The best way is to assess the situation from the previously drilled boreholes in the area. In multiple aquifers, screen sections should end at least 1 metre from top and bottom of each aquifer.

- Unconsolidated aquifers

These are often alluvial deposits along river flood plains or terraces and they range from thin gravel beds along small rivers to multi-aquifer systems along major rivers. Unconsolidated aquifers require screening to protect the well from collapsing formations. The design is basically the same as in consolidated aquifers. *Drilling depth will depend*

on aquifer thickness and you could be guided by Logan's steady state equation. Depth = 1.22 $Q/S_w K$. Where k is the hydraulic conductivity, m/day; D is the saturated thickness of aquifer to be drilled (m); Q is the proposed discharge rate(m^3/d); S_w is the draw down (M).

The drilled diameter will depend on the casings to be used. It should always be 50 mm greater. The choice of the casings also depend on a number of factors like the use of gravel pack, strings, the pump chamber and the drilling tool space. Screen diameter should be at least 150 mm and avoid going beyond 300 mm.

Economics in well design

Over designing of the well will always lead you to unnecessary costs. Therefore,as you design observe the following:

- Do not drill deeper than necessary.
- Do not drill at larger diameters than necessary.
- Do not design a gravel pack thicker than needed.
- Do not design for a screen or casing diameter greater than necessary.
- Do not use expensive materials where cheap ones will do.
- Do not use more screen than is necessary.

BOREHOLE DRILLING

This manual is not intending to go into details of drilling. The field is varied with lots of methods and machinery. Therefore a few tips will be highlighted here to guide an engineer who intends to supervise a drilling contract. In emergencies you will definitely have no time to go into details but you need to be aware of what is going on.

Before you select the drilling contractor, you need to know it's drilling history and physically visit their depot to assess the following:

.adequate equipment to do the work.

.the way the equipment is maintained.

.availability of back-up facilities in case the plant breaks down.

.distance between the depot and the proposed drilling site and means of communication between.

Be aware of the Health impact of the type of drilling fluid used and method used in drillng.

Choice of drilling technique

Drilling techniques can be classified as either percussion or rotary. Percussion drilling is mostly used in shallow depth drilling, while Rotary is often chosen for deep boreholes or wells.

Driller's log

Whatever method used, well structured records for each borehole drilled must be kept for present and future use. Information on record should include the following:

- Site location
- Number of borehole
- Date
- Method of boring and rig used
- Depth of hole
- Type, length and diameter of casing
- Type, length and diameter of screen
- Length and diameter of open hole

- Water levels, with details of any fluctuations
- Description of each stratum encountered
- Depth below ground of any change in lithology
- Sample depth, type and characteristics
- Any other useful information

Percussion drilling

Percussion drilling is done by letting a heavy chisel(drilling bit) to repeatedly strike the rock at a frequency regulated by an engine speed. However complicated a percussion rig may appear to be, know that all it does is to improve and optimise the above simple operation-Vertical movement of a heavy chisel to break the rock.

The debris(chopped rock) is then removed by a bailer which is in a form of a cylinder with a clack valve at the bottom to let the suspended debris in water or slurry get locked in inside the cylinder and then the cylinder and it's contents are pulled to the surface where it is emptied. The process is repeated until the hole is clean. Then, a heavy chisel is pushed in again and the process continues until a desirable drilling depth is reached.

While the above method is good for hard rock drilling, soft and unstable formations require a shell type of drilling bit in order to bail out the cuttings with the same tool. So, it becomes a bailer with a cutting shoe. Often drilling casings are needed as work proceeds and situations differ from place to place. This part therefore should be left to drillers to use their own drilling experiences. It is important to note that when temporary casings are used, the design should ensure sufficient diameter to allow permanent casings to go through even in the smallest temporary casing. Removing the temporary casings could be very difficult and a lot of experience is needed.

Rotary-drilling

Rotary drilling could overcome the problems due to temporary drilling casings. The technique uses a rotary bit, a heavy hammer and a pressurised circulating fluid. Drilling can often go very deep while unstable formations are protected by a solid layer of mud cake or foam.

The choice of the drill bit used depends on the formation to be drilled. In soft formations a simple drag bit equipped with hardened blades can be used. The commonest rotary bit is the Tricone bit, which has 3 hardened steel, toothed conical cutters which can rotate on bearings.

Drilling fluids

The most common general purpose drilling fluid for sediments is a mud-based on natural bentonite clay.

A good bentonite mud will have a marsh viscosity of 30-40 seconds and a density of 1.2 kg/l or a specific gravity of 1.2. In severe caving in formations, the mud density could be increased by addition of heavy minerals such as barytes. But avoid excessive mud cake build up. It has disadvantages of keying into the porous formations which makes it difficult to remove during well development. You can as well use organic polymers which breaks down after a time and avoid the mud cake problems. The polymer breaks down to a low viscosity fluid which could be removed easily by well development. But if the water is bacteriologically contaminated or if the pH is below 4, the polymer will break down and the walls will collapse.

Therefore, when you choose to use polymer, monitor on the mud condition very closely. Also, the polymer can act as food for bacteria, so you need to ensure total removal of the polymer at the end of drilling to avoid bacterial infection.

Other techniques

Other techniques include, Down the Hole Hammer (DTH)drilling and Reverse circulation.

DTH hammer assembly is a pneumatic hammer, in which compressed air supply operates a slide action to give a rapid percussion blow to the bit face as it is rotated by the drill string.

In Crystalline rock formations, it drills faster than the conventional rotary drills. But it can not produce good results in Soft rock like clay. It also has problems of penetrating deeper into the aquifer. It might affect your required yield.

Auger drilling(21)

Auger drilling is a simple technology which could be picked by the community. In refugee situations, you might not need to get contractors to do the Auger drilling. You could simply get the equipment and train the refugees to continue doing the job. *This option is limited to soft formations. It might be very difficult to penetrate below the water table.* However, having done your survey very well and you have chosen to do Auger drilling, get the right equipment from the local manufacturers or from Oxfam. (In Uganda, Kenya and Tanzania local manufacturers are available). Normally, an 8 inch bore diameter is sufficient and it will be provided with all the necessary construction tool kit. You also need a survey kit.

- As with mechanical drilling, check on the depth of other wells in the area.
- Use a hand survey set to make up one or more small diameter exploration drillings.
- Test the production of the survey well with a Test pump.(should be provided in the kit)
- Test the water quality.

  Augered wells are normally shallow and subject to surface and sub-surface pollution.

- If the survey is successful, mobilise trainees and helpers to do the job.
- Start drilling with the big river side Auger
- Put materials in rows for each metre drilled
- Add some water if you get dry materials in the Auger
- Use the stone Auger for very hard layers
- If too hard for the stone auger, use the chisel

- If too hard for the large auger or chisel, use a small one
- After that, ream the hole with the large auger
- When the ground water is reached, check it's quality
- If quality is poor, stop further drilling
- If quality is good, continue drilling
- If the hole caves in, install the drilling pipe
- Continue with the small auger; see above
- Push drilling pipe down when lifting the auger
- Add some water if necessary
- When material is washed from auger, use the bailer
- Continue deepening till 6 metres below static water level
- Test water quality and well capacity again
- Capacity of more than 10l/min. is acceptable for handpumps
- Place the PVC casing, plain and slotted
- Pour in gravel, diameter 1-3 mm, and pull up the pipe simultaneously
- Back fill the top part with clay
- Compact the area around the well
- Prevent children from throwing stones into the well
- After 2-5 days install an appropriate pump for the area.
- Complete the masonry work on the apron and drainage
- Equip the trainees and commission them to continue the job.

Hand dug wells(21)

Hand dug well construction is also another simple technology which you might need to teach the refugees to enable them carry on. *There are many appropriate technologies under this option but this manual will concentrate on only one which will reflect the 3 basic elements in well construction; Depth. wall stability and pollution control. You might need to disinfect the well if necessary.*

Get the construction equipment including a conical mould for well wall lining and it's accessories. A well digging set will contain the a tripod stand, pulleys, axes, spades etc.

Digging procedures would be as follows:

- Dig a hole of 150 cm diameter and 15 cm deep.
- Grease and insert the conical inner mould
- Install the greased outer mould for the well wall and adjust until it is horizontal
- Pour in about 500 litres of concrete mix, made from 1 part cement, 2 parts washed coarse sand, and 3 parts gravel of 5-30 mm.
- Remove both moulds once the concrete has set, clean and grease them again, and let the concrete cure for about 1 week.
- Dig another 75 cm (diameter 150 cm)
- Install inner mould so that it is horizontal and in the centre, and fix one or two anchors.
- The next day dig another 75 cm
- Dismantle the mould, clean and grease, and lower to the bottom of the well, placing it horizontally and in the centre.
- Pour in about 400 litres of concrete mix.

- The next day dig another 75 cm and continue the process until the water level is reached.

- When you have reached the water table, try to dig 3 metres deeper and make the lining by lowering porous rings diameter 115/110 cm. You will definitely need to use a dewatering pump in this zone.

Well development and Pumping Test

Well development is necessary to improve on the aquifer, thus the yield. Basically, it is a technique to remove the finer grains interlocked in the gravel pack or in the aquifer to increase the freedom of flow.

Where bontonite mud was used in drilling. the mud has to be cleaned out. Some times it might fail and negatively affect the well yield.

There are various techniques of well development but this manual will recommend the surging technique. You could always ask the drillers which technique they prefer and that preference should be backed by their experience.

Pumping Test

Pumping Test is carried out for 3 main reasons:

.to measure the well performance

.to estimate the well efficiency or variations of well performance

.to measure the aquifer characteristics of storativity, hydraulic conductivity and transmissivity.

When you want to determine the pump capacity to install on the well, you could use the Step draw down test which will reflect the characteristics of the well.

When you want to pump large quantities water from the aquifer and you are mindful of it's impact on the environment, then do the constant-discharge test.

Results of each test could be interpreted by plotting graphs but computer programmes are now available to do this job. Therefore, this manual will not discuss the details.

Spring Protection

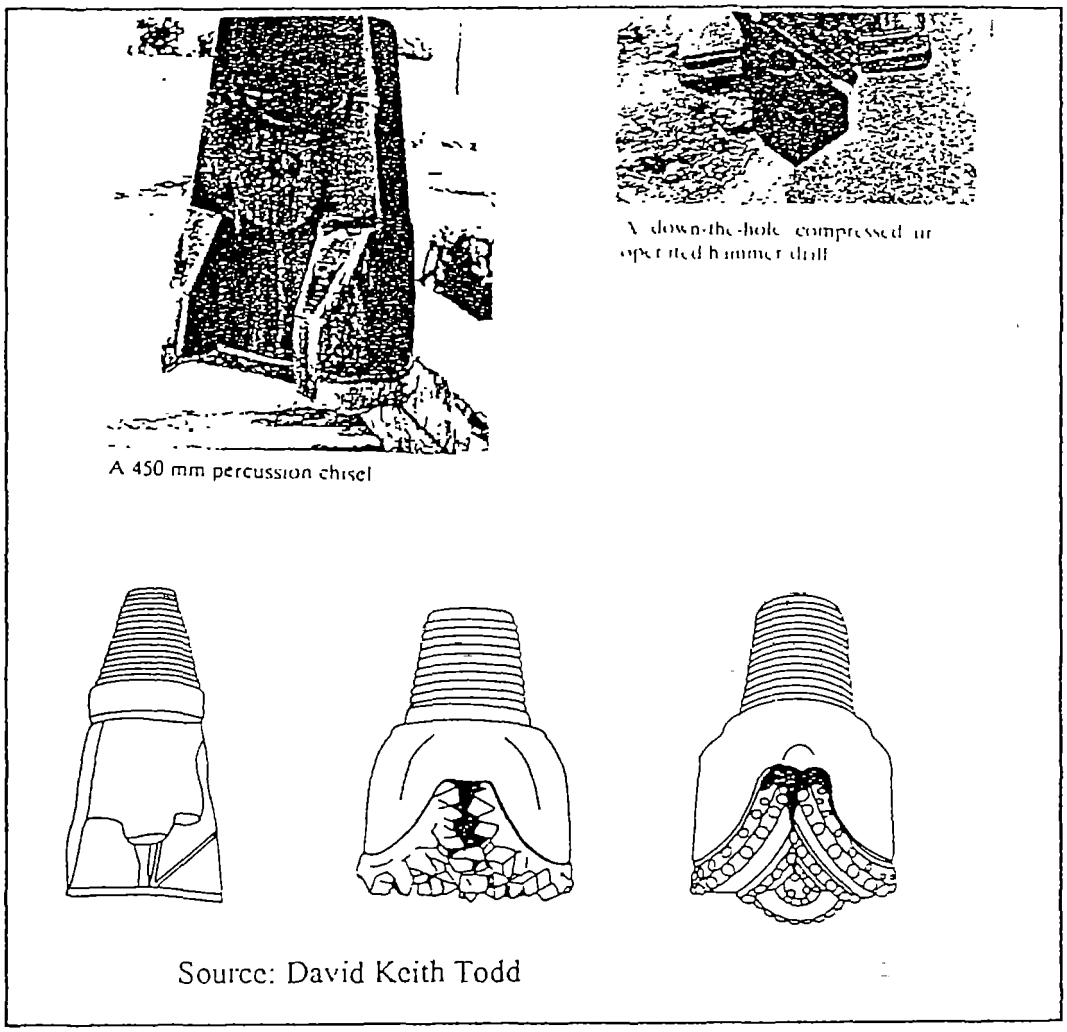
There are various designs in spring protection and they are influenced by the topology, available materials and the way water is collected from the spring. Choose the appropriate design for the area. In general, springs are points on the ground surface where ground water emerges out on it's own.

The basic requirement in spring protection therefore, is to protect that point from any possible surface pollution and channel the flow into a pipe for ease of collection.

Points to note in spring protection are:

- When excavating the foundations for the spring box or a retaining wall, try to avoid digging through the underlying impervious layer over which water runs to the surface.
- The spring eye(a point where water emerges to surface) should be covered with carefully selected sand or gravel. Start with fine materials which match with the eye site. then go on increasing the grain sizes outwardly up to where you want to collect the water from. That arrangement should be protected from disturbances and further pollution by covering it with paddled clay on top and a strong structure/wall around it.
- To avoid further pollution especially by surface run-offs, dig a trench on the uphill side to divert surface water away from the spring.
- Make a fence around the spring to keep people away from the protected zone and avoid any possible pollution.

Figure 6.3: Some sketches of the commonly used well drilling bits.



Source: David Keith Todd

7. HYGIENE EDUCATION

7.1 Needs assessment and planning

Hygiene Education is a very important component in the whole programme and the level of it's success has a great impact on the health status in a camp. Needs assessment and planning of hygiene education have to handled carefully. In each situation, you need to learn people's real needs, behaviour and design the appropriate methods to improve the situation. Emphasis should be on:

- Effective use and maintenance of defecation facilities.
- Good methods of collecting, storing and use of water.
- Good methods of waste disposal.
- The need for bathing and cloth washing.
- Good methods of food preparation and storage. Where powdered milk is provided, teach the people how to handle it safely. See Appendix 3 for the policy about use of powdered milk.

However, situations vary from community to community, so are the methods to improve them. Whatever method you use, match it with chapter 3 and target at raising people's knowledge about the risk and control of the diseases

Involving the local people in hygiene education campaign could be a good strategy. During the impact phase, when more and more refugees are coming in, you really have no time to study specific needs. In such cases, use information campaigns to control the risks due to overcrowding.

- As soon as possible, establish and train a team to mount information campaigns and to liaise with community representatives and volunteers.
- Keep messages clear and simple. Do not try to cover a broad range of topics but concentrate on priority issues.

- liaise closely with the community leaders. Work through existing social structures where they still exist and are identifiable. .Establish Hygiene education committees where there is no group with whom to work.

- Plan health messages and methods of promotion with community representatives to take care of the cultural backgrounds and practices.

- Be gender sensitive in your planning.

- Avoid offensive language

- Consider ways of monitoring the developments.

- Ensure that new arrivals in the camp are informed of the hygiene measures being promoted, why they are being promoted, and the rules regarding defecation, rubbish disposal and water collection.

Mid-term to long-term phases

Hygiene education has to be effective and sustainable When refugees have stabilised a bit you need to plan more effective methods to bring about behaviour change. This requires more time and information. Where possible, use logical frame work techniques which could generate the required indicators for monitoring and evaluation of your activities.

7.2 Methods of hygiene education

During the emergency phase, Information campaigns including meetings at emergency feeding centres would do very well.(7)

You could also try to hang pictures on walls and trees where appropriate.

For mid-term and long-term phases, try to adopt to Participatory methodologies. They will always help you to update the real needs and you could easily assess any behaviour changes as the programme continues.

You will need a specific manual on participatory methodologies. So, the various techniques are not discussed in this manual.

7.3 Monitoring and evaluation of hygiene behaviour

Monitoring and evaluation of hygiene education should be a continuous process. It is very important to assess the impact of hygiene education on the target group from time to time. It definitely affects the type of technologies you might need to use from phase to phase. There is no need to spend any more money on the type of a facility the refugees have refused to use.

- Use indicators set at the planning stage to monitor and evaluate the programme.

Give a feed back to the parties concerned to take action.

8. MECHANISMS TO REDUCE PEOPLE'S VULNERABILITY

Right from the start this manual has been stressing the issue of planning in phases including the long-term phase which caters for a stabilised refugee community or destabilised people who have recovered from the losses incurred. This phase can not be complete and would actually be a waste of resources if the beneficiary community are not helped to realise the causes of the problems(diseases and water shortages) and the methods on how to minimise those causes.

Another step is to build in capacity to control the causes. This calls for a slow but sure process and it should be planned for right from the mid-term to long-term phases of the programme. The key elements you might need to consider in building up mitigation mechanisms are(22):

- Training and advocacy
- Community participation in sustainable water and sanitation facilities.
- Networking and programme integration.

The above 3 elements are already considered in the formulation of this manual. Ensure that each intervention you take up, the 3 elements are observed.

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APPENDIX 1

A Supplement to the Check list in chapter 4.

Logistics

Transport

Are there all weather roads to the site? Is there access by air, river or sea?

Who provide the transport (private, government, military, agency)?

What facilities exist for servicing of and supplying fuel for vehicles?

Is there any problem of security on food deliveries?

Communications.

How is contact made with the capital or nearest government centre, and is it reliable?

Is an agency communication needed, or local facilities available?

Is radio equipment required, and if so , is it permitted?

Storage

What storage facilities exist, and of what capacity?

Are the storage facilities secure, and how are they administered?

What is the level of hygiene for food stores?

Are the food stores waterproof?

Staffing

What skills are available amongst the affected and the non affected local population?

How are skilled workers identified and recruited?

Do workers receive salaries, incentives, or food for work?

What NGOs are active and what is the general level of their staffing, training and funding capacity?

Money

What are the facilities for banking, money changing and bartering?

Shelter

Materials

What sort of housing are the affected population accustomed to, and are the materials available for building it?

Are there any constraints to obtain material locally (security of access, deforestation)?

Do materials available for housing allow for shade, protection from rain and privacy?

Are clothes and/or blankets required immediately or during cold/wet seasons?

Capacity

Are the shelters over-crowded? What is the average number of refugees per shelter?

Are families living separately or in groups?

Are there separate facilities for men and women?

Are cooking facilities separate from living areas?

Is there room for people to store their possessions and stocks of food?

Safety

What is the average distance between shelters?

Is there a high risk of fire, flooding , subsidence and landslides

Food And Nutrition

Nutrition status

What major changes to their normal diet have occurred since the start of the emergency?

What is the general impression of the nutrition situation?

Do more than 2 in 10 children appear very thin or wasted?

Are there children with evidence swellings?

What anecdotal information is there about deaths from malnutrition?

Has a nutrition (an anthropometric) survey been undertaken, and what were the findings? If no ,are there plans to carry out a survey?

If in a refugee or internally displaced camp, are the new comers in a better or worse condition than those already there, or about the same?

Is there any evidence of specific nutrition deficiencies (vitamin A,B and C or iron-deficiency, anaemia)?

Food availability

What foods are in short supply and is this expected to change?

What foods does the affected population obtain locally through purchase or bartering?

Has the availability and price of foods in the local markets altered recently?

If so, how has this affected the local people and the refugees?

General ration

Has any food aid been distributed?

If regular distributions are occurring, what is the content of the food basket, and the daily energy value?

In practice, how regular is the distribution?

Are the beneficiaries actually receiving the agreed ration?

How is the distribution system organised? Who distributes the food, How often, to whom, what records are kept and how orderly is the distribution?

In practice how fair is the food distribution? Is any group excluded? How do women get access?

Is the cereal given milled or whole? Are milling facilities available? What fuel is used for cooking?

Are there cooking shelters and pots?

What opportunities are there for bartering items in the food basket?

Selective feeding: supplementary and therapeutic

If a health agency is already present, a selective feeding [programme may be operational. Ask the following questions:

What amount has been agreed, and by whom, for distribution as supplementary food (type of foods,daily energy and protein value)? In practice, are these foods regularly available?

How is it distributed? As part of the general ration, or in selective wet or dry feeding programmes?

What are the admission and discharge criteria for supplementary feeding?

Are pregnant and lactating women and severely malnourished adults admitted?

What records are kept? How regular is attendance of individual children at wet feeding centres?

What is the coverage of the supplementary feeding programme in relation to numbers malnourished (from survey and screenings)?

Do people receive the full general ration that has been agreed, or is the supplementary food used as a substitute for an inadequate general ration?

Is the wet feeding centre clean and well organised? How is selective feeding linked with medical screening?

What nutritional and medical treatment is available for severely malnourished children?

Is vitamin A being routinely distributed?

Health Status And Medical Care

(Possible source of information could be Ministry of Health and any health agency working in the area)

Mortality

How is mortality being recorded? What is the extent of under reporting?

Is there a designated burial area?

What are the estimated mortality rate and under five mortality rate?

What is the main cause of death?

In what age group are most death occurring?

Morbidity

What are the incidence and the prevalence of diseases measured and recorded? Is there a standardised system? How is data analysed and used ?

What are the main health problems in the camp? Which group is most affected? Is there a high incidence of communicable diseases such as diarrhoea, malaria, or acute respiratory infection?

What are the major camp risk factors (inadequate water and sanitation facilities, crowding, Inadequate food)?

Are there cases of measles, and how are these monitored?

What is the rate of acute malnutrition, how is it monitored? Are there cases of micronutrient deficiency disorders, and how are these monitored?

Are there cases of dysentery, and how are these monitored?

Is the camp in a malaria endemic area? Are there cases of malaria, and how are these monitored?

Are there specific health problems for women (high birth rates, anaemia, sexually transmitted diseases)?

Medical care

What health structure exists locally, including referral capacity?

Who manages the health care system in the camp?

How are health resources for health care (material and human) distributed?

How much community participation is there? Is the affected community involved in decisions about health provision?

Are simple preventive measures being taken to reduce risk factors for communicable diseases?

Is measles immunisation taking place? What are the coverage rates?

Is there an effective cold chain?

Is there a facility for oral rehydration therapy?

Is there a sufficient supply of ORS?

Are any health promotion activities being organised?

Are there health centres or health posts already built in the camp? What medical equipment is available?

Are repairs to existing facilities or new construction required?

Are there special health facilities available for women and children?

Are essential drugs available and are standardised case definitions and prescribing and treatment protocols being followed? What personnel are available and what is their level of training and competence?

Are there female health workers?

How are health workers paid?

What training and supervisory systems for health workers have been organised?

Is there a system of triage of outpatients to identify the most seriously ill?

Is there a referral system for health problems which the camp medical facilities are unable to deal with?

Psycho-Social Issues

Were the affected people forced to leave their homes suddenly, under threat of violence?

Did the affected population suffer days, weeks or months of lack of food, water, security?

Is there still a continuing threat of violence or harassment (factional fighting, gun fire, rape, intimidation, abductions)?

What is the extent of bereavement (dead or missing relatives) and loss; loss of livelihood, personal possessions, privacy, social status, social cohesion, dignity (standing in queues, handouts)?

What is the extent of cultural bereavement?

Does the community have personal histories of torture, witnessing atrocities, or being forced to participate in atrocities?

Does the affected population constitute a fragmented community, with mixed ethnic, religious and political factions?

If in a camp, is there a lack of employment opportunities, boredom, a temporary-permanent-transit status in the camp?

What are the health beliefs and traditions of the affected population

APPENDIX 2

4.7 Other Factors That May Affect The Selection Of water And Sanitation Facilities In The Manual

4.7.1 The climate in tropical Africa

The climate is characterized by it's geographical position; Because of it's large land area,it receives large sums of solar heat(70 kCal/sq cm/year.

the low pressure belt created by the high temperatures around the equator places the region under influence of Northeasteries and Southeasteries blowing from high pressure belts of the subtropics towards the equator moisture is brought to the continent by the variable monsoon winds from the South Atlantic and Indian oceans.

Because of north-south movement of the sun, there is an even heating of the land mass and sea. In July, when the sun is in the Northern hemisphere, the equatorial belt is moved northwards and moisture is drawn in from the Atlantic and Indian oceans. These winds meet within the low pressure belt called the monsoon trough or the northern monsoon shearline. Their convergence result into rainfall due to the moist monsoon air which is forced to rise up to cooler altitudes and then by condensation release the moisture as rain. It can now be understood that rainfall in the region is a function of the physical features, north-south movement of the sun and the trade and monsoon wind systems.

The region however is subject to some extremes of flood and drought.

Areas prone to flood are the low-lying areas around the banks of the Niger river in Mali, the Nyando, Nzoia and Yala rivers in Kenya. There is also the flash floods in Madagascar caused by tropical cyclones and coastal lowlands bordering the mountain ranges in Sierra Leone and Guinea.

Drought problems are increasing in the region as one would observe the development of the Sahel drought since 1968. It is now affecting many areas of Africa basically in the regions above 10 degrees both North and South of the equator. There are no other climatic trends which would indicate increasing frequency of drought in Africa apart from the over-grazing and deforestation which in turn affects the local climate and the rainfall patterns.

4.7.2 Vegetation of Tropical Africa

Vegetation in Tropical Africa is more related to the climate and physical characteristics of the region.

The main types of vegetation include;

- Tropical moist forests at the low and medium altitudes; mainly found in Sierra Leone, Liberia, Nigeria, Cameroon and Congo.
- Tropical moist and dry forests on the Savannah mosaic; mainly found in the regions between moist areas and sudano-Sahelian and also in Southern Africa.
- Mountain Vegetation mainly found in Cameroon, Ethiopia and East Africa Highlands.

4.7.3 The hydrology of tropical Africa

The water circulation or the hydrological cycle is driven by the solar energy.

Between the tropic of Cancer and Capricorn, the sun is directly overhead twice a year and the greatest angle of elevation ranges between 43 and 90 degrees while day light hours range between 10.75 to 13.25.

During the hot season the clouds are of the cumulus type produced by convection currents. Sheets of rain clouds continue to develop and become thicker in the atmosphere under the influence of air currents from the sea and also local mountain formations. The cover reduces the number of hours the sun heats the land in the region, So is the effect on the regional temperature. This in turn affects the evaporation-precipitation ratio which determines the aridity index. This can be demonstrated in the water balance of the region.

Rainfall decreases from the equatorial to the arid Sahara and Kalahari and increases again in the sub-tropics, both in the Northern and Southern hemispheres.

Potential evaporation shows a reverse trend to that of rainfall. It increases from the equatorial zone to the desert regions which are actually found on both sides, and decreases again in the sub tropics.

Also runoff decreases from equatorial zone to the deserts and again in the subtropics.

Annual water surplus is observed in the region between latitudes 10N and 10S and between longitudes 20W and 20E. It reduces more Northwards and Southwards than Eastwards. It worsens in the desert regions but improves again in the subtropics.

4.7.4 The hydrogeology of tropical Africa

The crystalline basement of Africa comprises of 3 major suits of rock;

- the granite-gneiss-greenstone
- the strong deformed metamorphic suites
- the anorogenic intrusions

On top of the heterogeneous basement , there is a variable thickness of diverse, unmetamorphosed sedimentary and extrusive volcanic rocks and weathering products.

The youngest cover sequences include; Cenozoic volcano-sedimentary deposits associated with rifting, notably within the East Africa rift system, and the partly consolidated sediments such as the Kalahari beds currently infilling the major coastal depressions.

Crystalline rocks usually possess low permeability and primary porosities.

Basement aquifers which include both specific lithologies and fracture zones are a function of brittle deformation at high crustal levels.

The effects of high-level brittle fracturing and weathering largely control the ground water storage.

Weathering sequences, both ancient and modern, provide some of most important aquifer.

The most readily weathered basement rocks tend to be course grained, badly fractured and rich in high temperature minerals, with deep weathering commonly concentrated above major fractures.

Some of the important constraints in basement aquifer development;

- The high failure rates of boreholes, commonly in the range of 10-40% with the higher rate of drier regions or where the weathered overburden is thin.

- Shallow occurrence and fissure permeability of the bed rock aquifer component which provides chances to surface pollutants.

- Low storage capacity of basement aquifers which may therefore deplete significantly during sustained drought periods.

- Recharge is sensitive to certain land uses like overgrazing and deforestation.

Developers are therefore encouraged to consider the borehole success rates, the requirements for O&M, the methodologies for increased economic abstraction and evaluate resources and aquifer occurrence.

There is a close relationship between ground water occurrence and relief, surface water hydrology, soil and vegetation cover.

For instance in Malawi development is often restricted to the aquifer in the weathered overburden while in Zimbabwe, boreholes have to be drilled into fractured bedrock due to the thinner overburden.

Again barrier boundaries within the fracture system of the regional basement aquifer may result into some borehole failures, a wide range of yield despite the uniformity of the basic controls; climate, morphology and geology.

Soils

The main soil associations of Africa include;

Ferric Luvisol and cambisols;

These are the ferruginous tropical soils mainly in Mali, Northern Ghana and Nigeria.

Ferralsols and Acrisols.

These acid soils of tropical lowlands mainly found in the central region of Africa, Sierra leone and Liberia.

Nitosals and Andosols;

These are soils of tropical highlands mainly found along the rift valley.

Arenosols and regosols;

These are sandy soils mainly found in Angola and Congo.

Gleysols and Fluisols;

These are poorly drained soils mainly found in Chad, Northern Zaire and Angola.

Lithosols;

These are shallow soils mainly found in Senegal and Gambia.

Vertisols;

These are clay dark soils mainly found in Sudan.

Yermosols and Xerosols;

These are dessert soils and patches are found in Northwest Kenya.

4.7.5 The socio-economic status of communities in tropical Africa

The root cause of most of the tragic events in Africa is the silent crisis of underdevelopment; chronic and growing poverty, mounting population pressure, unemployment and the wide spread of environmental destruction.

For people who are looking for solutions especially for the refugee crisis in Africa, they need to consider development/socio-economic problems

Refugees can not easily settle down and live productive lives in countries where infrastructure has collapsed, the land has become infertile and prices are spiraling upwards. On the contrary, their sudden arrival in large numbers exacerbate the problems.

The issue of poverty, inequality and scramble for the limited resources has a great impact even on the type of facilities you expect to put in the camp. The refugees might be financially incapacitated to maintain family ties but they still desire to restore their dignities, live as homes and practice ownership over key facilities For instance, most rural communities in Africa are not used to communal toilets and bathrooms.

APPENDIX 3

The World Vision Procurement and use of Milk Policy(32)

World Vision International has a procurement and use of milk Policy which must be followed. Below are the clauses which one needs in hygiene education;

Clause 11. World Vision will advocate that when donations of milk product, DSM, and infant formulas are supplied to orphanages, or to programmers for displaced or refugee children, specific donors will also be approached for cash contributions to be specifically earmarked for operational costs, including provision of safe drinkable water to ensure the safe use of those commodities as well as use of clean cups and spoons for feeding purposes

Clause 12. All milk products supplied to orphanages and programs for displaced and refugee children must be of high quality and take into account the climatic and storage conditions of the country where they are used..

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WORLD VISION UK

World Vision UK Technical Report

A Draft Framework for Emergency Water and Sanitation Interventions

Since the collapse of the Soviet Union, there have been more regional conflicts and civil wars than at any other time this century. While somewhat overshadowed by the higher profile man-man emergencies, natural disasters with major humanitarian impact continue to occur on a regular basis. The result is that non government organisations have increasingly become involved in emergency relief activities.

While NGOs are ever-perfecting their relief intervention techniques, there often continues to be a need for greater consideration of water and sanitation interventions. Based upon World Vision's own experience of relief interventions, and with input from the staff of the Tropical Public Health Engineering at Leeds University and from RedR, Elisha Mutyaba Mukiibi of World Vision Uganda has developed 'A Draft Framework for Emergency Water and Sanitation Interventions'.

The objective of this document is to offer a few ideas towards a preliminary framework for relief workers (technicians/engineers) in the provision of emergency water, sanitation and hygiene education. We would hope that it be of use to you, and would also greatly welcome any thoughts or comments you might have.

If you would like information regarding the research publications of World Vision UK, please contact: The Policy and Research Department, World Vision UK, 599 Avebury Boulevard, Milton Keynes, MK9 3PG.

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