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B Z DIAMANT

THE NEED FOR APPROPRIATE ENVIRONMENTAL HEALTH TECHNOLOGY IN AFRICA

INTRODUCTION

The need for appropriate environmental health technology has been steadily growing in recent years in many third-world countries, following repeated failures in trying to copy solutions to environmental problems without paying due attention to local conditions and needs. Most such failures have been recorded in rural areas, where the need for environmental improvements is particularly urgent.

Unlike the developed countries, where most people live in urban zones, the majority of developing countries populations live in rural areas. It has been estimated that 72 out of each 100 people there live in rural areas (ref. 1). In the African continent, this ratio is far higher. Out of the 235 million African people not less than 195 million, or 83 % live in rural areas (ref. 2). The environmental problems in Africa are, therefore, more severe and urgent than in any other continent.

Environmental health surveys carried out in Africa in recent years, have revealed that the situation was not improving and was even getting worse. According to the findings of a World Health Organisation global survey on Water Supply and Wastewater Disposal in Developing Countries, that has been carried out in recent years (ref. 2), the ratio of rural African people provided with proper waste disposal facilities, had dropped from 23 % in 1970 to 21 % in 1975. The survey predicted an improved rate of 25 % for 1980, provided considerably large investments are made to meet this expected target (Table 1).

In view of the serious environmental conditions that exist nowadays in Africa, it has become, apparently, clear that only solutions based on, and planned according to, appropriate technology principles, can provide satisfactory results. This technology must not be confind only to technological matters, but also embrace social, economical and even political aspects that are usually involved in almost every large-scale environmental development. The various aspects of appropriate environmental health technology, can be grouped into the following major categories : Priorities ; Water Supply ; Waste Disposal ; Agricultural Irrigation ; Manpower and Legislation.

PRIORITIES

National budgets contain, normally, more or less suitable allocations for health development. Two major health trends usually compete on these allocations: curative medicine and environmental health. The latter is mainly geared towards preventive medicine. It is beyond argument that developing countries at present, are in urgent need for preventive, rather than for curative medicine activities. The latter are not only far more costly, but turn to be even less effective in the existing circumstances. For example, there is little use and

Table 1 Safe Drinking Water and Wastewater Disposal Facilities in Africa 1970-1980 (According to W.H.O. Survey)

FACILITY	PERCENT URBAN/RURAL POPULATION			ESTIMATED COSTS *) OF THE 1980 TARGET (in £)
	1970	1975	1980	
Urban water supply	67	65	80	800,000,000
Rural water supply	13	21	35	750,000,000
Urban waste disposal	69	80	95	410,000,000
Rural waste disposal	23	21	25	70,000,000

*) According to 1975 prices.

doubtful benefit in treating and curing a person infected with schistosomiasis, when he is released from hospital to his old infected environment, where he will be re-exposed to the disease. A small fraction of the huge costs involved in curative medicine (hospitals, medicines, medical staff etc.), can be quite often sufficient to control the disease in the area. Nevertheless, one always finds that priority is given, as a rule, to curative medicine that receives the lion's share of the health budget.

There are, ofcourse, various reasons, among them political considerations, for this strange and disturbing phenomenon. A modern hospital building has a much more impressive view, than say, proper pit-latrines installed in all housholds in the area. This view is particularly more demonstrative during election times, when the community leaders incharge of public expenditure, are eager to be re-elected. This may be also one of the reasons why numerous new hospitals were built in the continent in recent decades, though medical manpower to run them was not available. At the same time very little attention was diverted to environmental health activities. A serious repercussion of this policy is, no doubt, the preference of most medical doctors to practice curative, rather than preventive medicine.

This does not mean, however, that curative medicine is not needed in the developing countries. Vice versa, hospitals are very important establishmentsfor any community. But in the existing severe health conditions in Africa nowadays, national health budgets should, at least, be equally divided between curative medicine and environmental health.

Health as a whole, is sometimes found to be inferior to other development fields, even at the responsible international level. The United Nations Development Programme Progress Report for 1978 (ref. 3), has on its front page an impressive definition for development, which stated that "development has one end goal - improving human condition and bettering individual human lives." But a glance at the breakdown of the UNDP annual global investment, that amounted to over £ 200 million, reveals that among 11 various development fields benefiting from this amount, health has been ranked the 10th, with only about £ 5.7 million, or 2.7 % of the total investment. One can only wonder how the "bettering of individual human lives" can be achieved, when the health aspect in this multi-purpose process, is lagging far behind agriculture, economy, industry, transport, natural resources, science, education, labour and social security. Only international trade was found to be inferior to health... The Report includes, however, also a highlight. In the division of the investment to continents, Africa has won the largest share - 34.7 %.

Safe drinking water and proper waste disposal are considered to be the most important environmental health aspects in the developing countries. Their main appropriate technologies will be discussed later in this Paper. Water supply and waste disposal are two interrelated and complementing mutual activities. Proper waste disposal is, as a matter of fact, protecting the quality of the water supply. Therefore, some authors believe that the provision of proper waste disposal facilities, is more important and therefore should preceed the installation of the water supply (ref. 4). In practice we often find that priority is given, as a rule, to the water aspect in all development programmes. Very seldom are the two carried out together in the same development stage. In most cases the waste disposal is postponed to the "next stage" which is due for years to come. Meanwhile, the new water supply is constantly exposed to severe contamination.

This is a situation that exists mainly in the rural areas. According to one explanation to this paradox (ref. 5), the blame lies with the planners of the development programme, that do not find sufficient professional engineering challange in the design and construction of rural waste disposal devices (pit-latrines etc.) and, therefore, tend to neglect them. On the other hand, even the smallest rural water supply requires engineering design, such as capacity of pumps and diameter of piping.

The appropriate technology for the development of water supply and waste disposal, is to plan them simultaneously along all stages of design, construction, operation, maintenance and surveillance.

WATER SUPPLY

The lack of safe drinking water in Africa is considered to be one the main reasons for the high intestinal disease rate in the continent. Intestinal diseases are the second cause, after malaria, for the high infant mortality rate in Africa. The urgency of the safe water supply situation is indicated in Table 1, where targets for 1980 for rural water supply, that involve tremendeous investments, still leave 2 out of 3 African rural people without safe drinking water.

Water supply, unlike rural waste disposal, is a costly construction. In view of the poor economic stage of rural Africa, the relevant appropriate technology has to based first of all on low-cost solutions. Mechanized devices such as motorized pumps should be avoided as far as possible in therural areas. These devices are not only costly, but they also require skilled maintenance, which is not availalbe in most rural areas. However, if pumping can not be avoided, then solutions such as hydraulic rams, should be preferred on motorized pumps that require fuel (not mentioning electricity) which is costly, and in most cases not availalbe in the rural area.

Only minimal treatment can be applied to pumped surface water, under existing local conditions. This will include slow sand filtration and chlorination with bleaching-powder. The filter media will be ungraded river-bed sand. A load of 2 cubic metres of water per 1 square metre per day, can remove most parasites from the water. The maintenance of the filter is quite simple and a local man can easily be trained to perform it as a part-time job, together with the chlorination.

For emergency cases, such as outbreak of cholera in remote rural areas that can not be reached by road during rainy seasons, a flown portable water treatment plant has been proposed (ref. 6). The device cosists of a folding children swimming pool made of plastic sheets, a small portable motorized water pump, bleach-powder, a reel of barbed wire to protect the "plant" and a 100 ft. (33 metres) 1/2 " diameter plastic hose for transporting the water from the infected water course to the 500 litre capacity plastic container,for chlorination and distribution to the people. The whole lot can be flown in a light aircraft to destination. The device has been operating successfully during the cholera outbreak in Northern Kenya 8 years ago.

Wells

Wells seem to be at present the most appropriate solution to the rural water supply problem in Africa. Due to economical reasons, most wells will have to be dug shallow wells. If a hand pump can not be provided for a well, then at least the following arrangements must be performed: The top of the well should be protected by a 60 cm wall, to prevent contamination and children from falling in. A drain should encircle the well to move away flood water. A public bucket and rope only should be allowed to enter the well. Experience has shown that private containers and ropes caused serious contamination to wells. The well should be roofed and a pully can be fixed in the roof to allow safer drawing of water with the rope.

The best method for disinfecting wells is by means of clay-pot chlorination (ref. 7). The device uses the capilarity of the clay to pass gradually controlled quantities of chlorine to the water.

Hand pumps

A large research activity has been carried out in recent years, with the aim of designing the ideal hand pump (ref. 8). The golden rule for this expected design is that the hand pump should be economical, durable and locally repairable. The handle, for example, should be made of replaceable wood, rather than of breakable cast iron. The piston should be designed so that a local piece of leather should be fit to replace the washer. The pump must be easily disassembled with simple tools that should be provided with the pump. It might be worthwhile to experiment other pumping devices such as the Chinese Chain and Washer pump, that was specially designed for shallow lifts (ref. 9).

Roof catchment

The roof catchment is an ideal source for safe drinking water. This requires a corrugated sheeting roof to replace the straw roof. The method provides, therefore, a safe water supply source, as well as improved housing. Some 80 % of the rainfall can be collected through the roof in closed containers made of galvanised sheets. The users should be instructed to use the rain water only for drinking purposes and use water from other sources for domestic purposes.

WASTE DISPOSAL

The most urgent environmental health problem in rural Africa, is the human waste disposal. Less than a third of the rural population have adequate facilities for this purpose. A mass-solution is therefore, required in this respect.

Due to lack of piped water supply in most rural areas, the solutions are limited. The proper solution must be economical and simple so that it can be built by the future user. The known aqua-privy does not fit, therefore, for this purpose because it is too costly and requires craftsmen for the construction.

The most suitable device is the pit-latrine of the Ishara type (ref. 10). This device can be constructed by the user and built of local materials, apart from a half bag of cement required for the casting of the slab. The mold for casting the slabs will have to be provided by the body that organises the campaign (usually the Health Office). A properly prepared health education programme has to preceed and then follow the campaign, to ensure that the people will not only build the pits but will also use them.

It is not recommended to attach syphons to the slabs' holes, because the syphons can not be made by the users and because they require flushing water that is scarce. It is further not recmended to add to the pit domestic refuse for the production of compost. The proper disposal of the human waste is far more important than the production of compost, the domestic refuse portion of which, competes on the pit's capacity volume.

Urban waste disposal

Most people in Africa still drink water from raw sources such as rivers and lakes. It is, therefore, entirely forbidden to use any water course in the continent for the disposal of any wastewater, whether raw or treated. Fully treated sewage can achieve a maximum purification of 95 %. The remaining 5 % still pose a very serious health hazard when they reach and contaminate water used raw for drinking purposes (ref. 11).

Due to favourable climatical conditions in most parts of Africa, the oxidation ponds purification method should be used,as far as possible, for all small and average sized urban wastewater treatment plants. The treated effluent should not be disposed of by dilution in a water course, but by means of application to land in the form of irrigation.

AGRICULTURAL IRRIGATION

Growing shortages in locally produced food sfuffs, have been noticed in recent years in many developing countries. This alarming trend has given rise to a fast increase of modern agriculture development programmes, involving large-scale irrigation projects. Not always has the environmental aspect these projects,been adequately considered and as a result many of these costly operations have caused increased prevalence of water-borne diseases in the developed area. For example, since the impoundment of Lake Nasser near the Aswan Dam in Egypt in 1965, the bilharzia prevalence in the area has risen from

Table 2 Expansion Forecast of Irrigated Areas in the Third World (in million hectares) [12]

Z O N E	1962	1975	1985
Africa (South of the Sahara)	1.1	1.6	2.1
North-West Africa and the Mid. East	12.8	16.1	17.8
Asia and Far-East	49.5	75.0	102.7
Latin America	8.2	11.4	16.2
T o t a l	71.6	104.1	138.8

6 % to 60 %. In the Lake Volta area, near Akosombo Dam in Ghana, the incidence of bilharzia rose from almost nothing to 90 % in only 2 years after the completion of the dam in 1966 (13).

In view of the fast expansion predicted in irrigated areas in the Third World (Table 2), immediate appropriate technology measures must be introduced in the irrigation programming. These should include administration and professional management and proper design of the irrigation system and the cropland.

Adminstration and management

National irrigation projects are very costly investments that run into hundreds of millions of pounds. Though agriculture may be the major concern in these projects, other important aspects such as health can not be overlooked. Therefore, the executive agency for such projects should not be any specific ministry but the Prime-Minister's office (11).

Most irrigation projects constructed in recent years did not consult environmental health engineers and the few that did, asked the latter to join the projects as short-term consultants at the final stages of construction when nothing could be altered. Environmental health engineers must be permanent staff members of the project all along its development.

Design

The design of irrigation systems must consider the important vector control aspect. The impounded reservoir, as well as the irrigation channels, must be planned in respect of banks, slopes, lining ect., so as to prevent vector diseases organisms, such as mosquitoes, snails and black-flies from breeding in the systems.

The main channel should rather be designed as a closed underground pipe. Automatic shyphon spillways should be preferred on ordinary spillways in the dams, so as to disturb the quiet-water habitat, favoured by most vectors, by means of intermittent fluctuations of the water surface.

The types of raised crops in the irrigated land should be decided also according to environmental considerations. Rice that requires flooded irrigation, should not be raised in bilharzia infected areas. As far as possible, the irrigation method should be by sprinklers, rather than by flooding that encourages the breeding of disease vectors.

MANPOWER AND LEGISLATION

All above mentioned recommendations can not be executed without the professional advice of environmental health engineers. The training of these engineers should be carried out in local universities, rather than abroad in the developed countries, where stress is laid more on sophisticated matters, such as radioactive wastes and air-pollution, than on basic sanitation problems that mainly exist in the African continent. Environmental health engineering studies, have to be developed, therefore, in all African universities that provide engineering studies.

Legislation is a powerful means of imposing the above-mentioned recommendations. Special legislation has to be prepared for the various environmental health fields, such as, stream-pollution, irrigation development, water supply and waste disposal. Legislation is a time consuming operation and until it is completed, use can temporarily be made of the existing Public Health Law. This Law entrusts considerable power with the medical officer of health and his public health inspectors. They should be trained in environmental health engineering principles, so that they may, meanwhile, control all relevant urgent matters, until the long training of the engineering manpower and the legislation are completed.

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