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PLANNING WATER AND SANITATION
SYSTEMS IN DROUGHT-PRONE AREAS

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ABSTRACT

Drought intensifies the demand for safe drinking and domestic water where systems are often already marginal. Careful advanced planning can reduce the health consequences of drought, and can reduce the likelihood that people will be forced to migrate out of areas with chronic and prolonged water shortages. Careful planning involves designing water and sanitation systems which can withstand water shortages, water conservation techniques, and new approaches to operation and maintenance. A key to successful planning will be to integrate "soft-ware" factors, including socio-economic surveys, community organization, hygiene education, manpower development, evaluation and operational research. A sound knowledge of how people in drought-prone areas have responded to drought in the past as well as the recording of successful experiences in overcoming drought occurrences, will help planners in accurately anticipating future requirements in villages and in relief camps.

KEYWORDS

Planning for drought; hygiene education; water supply; sanitation; relief camps; community participation; technology.

INTRODUCTION

Inadequate amounts of safe and accessible drinking water, shortages of domestic water, poor sanitation facilities, and unhygienic practices are the primary reasons why some 80% of all hospital beds in developing countries are occupied by patients suffering from diseases associated with sub-standard water and sanitation. Regardless of whether malaria, typhoid fever, cholera, amoebic dysentery or a host of other diseases are classified as "water-washed", "water-borne", "water-based", or "water-related", all cause vast amounts of illness and death. And, while it would be fine if new vaccines and drugs came along to prevent and cure such afflictions, there is already ample evidence that the combination of protected water supplies, sanitation facilities, and the proper hygienic practices can remarkably reduce disease levels. Indeed, it has been said that there can be no long-lasting reduction of disease without adequate water and sanitation.

An estimated 1,200 million people lack access to safe and adequate amounts of water for drinking and domestic use. Even more lack proper sanitation facilities. And the world is only beginning to address what might prove to be the most critical issue of all, that is, traditional hygiene beliefs and practices. Evidence is growing that excellent water supplies have little or no measurable impact on morbidity or mortality without adequate sanitation facilities and appropriate hygiene behavior changes. Drought, the chronic and prolonged shortage of water, tragically intensifies the consequences of inadequate water, sanitation and hygiene.

Droughts commonly are caused by reduced rainfall, increasing the difficulty of storing adequate amounts of rainwater. Droughts also can be caused by changes in rainfall patterns resulting in increased runoff. In either case, drops in upper ground water levels and in the availability of surface water is commonplace. Safe ground water from shallow wells dries up, forcing families to turn to more contaminated and distant sources. Hand-washing, bathing, washing soiled clothing and general cleanliness declines even further. Drought saps the energy of women and children who carry water, dries up the milk of the thirsty cows, ruins food, crops, creates deserts, kills livestock and contributes to dangerous levels of malnutrition. Finally, it forces people responsible for planning and implementing water and sanitation programs to address these critical needs precisely when the demand for other health and development activities are most intense.

TECHNICAL PLANNING FOR DROUGHT

While it will not be possible to accurately predict the intensity, duration or periodicity of drought for a given area, water and sanitation officials can anticipate that prolonged water shortages will occur. Careful planning can: (1) lessen the impact of drought, (2) contribute to the conservation of scarce water supplies, and (3) help to assure continued maintenance and operation of systems.

The first way of preparing for drought is, while knowing that a given area is subject to periodic drought, for planners to establish technical policies and procedures permitting digging or drilling deeper wells, both to avoid loss of aquifers and to increase amounts of water available. This may require allocating additional funds for positive lift pumps rather than suction pumps. Residents can be taught to construct rainwater catchment and storage systems at their homes, schools and places of worship. Such systems are being built throughout Northeast Thailand and are becoming a major form of protection against periodic drought.

Even with advanced planning, existing water sources may prove to be insufficient. Advanced hydrological information or measuring devices, including resistivity testing, will be essential. Accurate information will be needed describing locations and amounts of supplies, rigs, trained manpower, transportation, and so forth.

There has recently been renewed interest expressed in collector wells which feature radial boreholes running outwards like spokes of a wheel from the bottom of well shafts. Such wells are currently being tested in Sri Lanka and Zimbabwe, and are planned for testing in Malawi. It should be noted, however, that this approach is expensive, particularly in hard crystalline formations.

Drought can influence technology choices in a number of indirect ways. Systems which depend upon purchases of fuel and chemicals may become inoperative during droughts as family and community funds from sales of crops and animal products decline. Alternative energy sources as from solar panels will have high initial costs but may prove to be cost-effective in the long run. Solar energy is being successfully used to pump water in Haiti and Senegal. Hand pumps may be the only source of safe water for communities which can no longer afford to operate motorized pumps.

Water conservation, the second way of preparing for drought, can be planned for in a number of ways. Automatic shut-off valves and household water meters can help to reduce water loss and to keep costs down. Authorities can attempt to regulate pumping practices by restricting pump sizes and pumping hours to avoid depleting aquifers or causing sea water intrusion, as is being done in the Sultanate of Oman. Limiting irrigation of cash crops may also be needed when domestic supplies are scarce. However, each of these options may be difficult to enforce without strong local support.

Another form of water conservation consists of seeking to reduce evaporation in community storage tanks and vessels with tight covers, which should bring the added benefit of minimizing mosquito breeding. Water which is lost through run-off can also be conserved through artificial re-charge of aquifers by the construction of dams and ponds. Considerable care has to be taken to avoid creating health hazards from surface water which might be consumed or become a source of insect breeding. One technique is to dig re-charge trenches which are allowed to dry out every few days, assuming that the community will understand and be willing to operate such systems correctly. Additional research is needed to find safe and efficient ways of re-charging aquifers and re-using waste water in drought-prone areas.

Planning for continued operation and proper maintenance of existing systems during drought is the third technical element. Drought intensifies the importance of maintenance as alternative safe water sources disappear. Adequate planning includes how much maintenance will be required, levels of technology, caretaker training needs, costs and requirements for community involvement. Dependence upon spare parts, special tools, and outside expertise take on added importance. Intermittant use of slow sand filters during droughts should be avoided since it can destroy filter organisms and dangerously reduce water quality. Similarly, intermittant water flow through piped systems increases the likelihood of ground water contamination, as well as wastage when taps are left open.

In addition to technology choices, proper maintenance of water and sanitation systems is equally, or even more important. It requires careful institutional arrangements, task analyses, and often formal control powers, sanction and contracts. Logistical support, including local manufacture of spare parts, private sector support, accurate inventories and monitoring, grow in importance during prolonged drought. Maintenance needs will be influenced by a variety of population factors. It is important to know whether communities are scattered, small, rural, or stable, and whether local technicians and artisans are always available or are likely to be employed elsewhere part of the year.

INTEGRATED WATER AND SANITATION PLANNING

In anticipating drought, planning water and sanitation systems must be carried out within the broader context of organizational, economic, and socio-cultural factors, as well as technical factors. The so-called "soft-ware" components include socio-economic baseline surveys, community

organization and education, human resources development, operational research, monitoring and evaluation.

Drought can increase community concern about water and willingness to cooperate. There are therefore new opportunities for meaningful participation and local responsibility to protect and expand water supplies. On the other hand, attention to sanitation and hygiene can decline, increasing the likelihood of epidemics. In the planning process support is to be given to greater sanitation and hygiene education efforts rather than focusing exclusively on the technical aspects of water supply, hopefully within the context of broad primary health care and community development programs.

Each society tends to respond differently to drought. Traditional beliefs will determine how people view the acceptability of alternative sources and practices. Water shortages may increase a community's willingness to cooperate, or may lead to competition and argument. Studies of how communities responded to past droughts will help planners anticipate future problems and requirements. Of particular importance will be the feelings and needs of village women who are usually the primary collectors and users of water. Planners will want to consider the extent to which people flee from drought-stricken areas to towns and cities, thereby placing added demands on those water and sanitation systems. Refugees who are likely to seek relief in temporary camps can be expected to be unfamiliar with water and sanitation facilities there. Special educational efforts will be needed to assure proper use and to avoid damage.

Engineers, sanitarians, hygiene educators, logistic support personnel, and others previously involved in water and sanitation work are likely to be seconded to other assignments during droughts as epidemics break out and other crises arise. Availability of a core of trained community workers who can help to maintain water and sanitation systems can make the difference between continued service or shut-downs.

For each of the problems under discussion, close coordination with primary health care workers, community development workers, teachers and other local leaders becomes an essential aspect of integrated planning. By planning ahead, appropriate roles of governmental and non-governmental leaders can be determined, emergency policies held in readiness, and resources laid aside. Action priorities will have already been established, hopefully including high priorities for steps needed to protect public health. The needs of population groups who are most vulnerable to the consequences of drought, such as infants and children, will have to be thought through.

COPING WITH DROUGHT CONDITIONS

Many lessons can be learned from the prolonged and devastating drought in the Sahel. The importance of early warning systems comes first to mind. The world community needs to be better prepared to respond to such situations with a greater capacity to assist in maintaining existing water and sanitation systems, developing new systems, and addressing human problems associated with system development and use. In Ethiopia, for example, where water and sanitation systems were already marginal, improved readiness might have prevented large numbers of deaths from diarrhoea, dehydration, and immunizable diseases.

Planning for water and sanitation needs of people in relief camps involves a host of unique issues. Shortages of water-tank trucks, storage tanks, pumping equipment, drivers, rigs, tools and supplies were commonplace in Ethiopia, not to mention preventive and curative health services.

Without careful planning which allows adjustments for such factors as the duration and severity of droughts, population numbers and their distribution, and anticipated public responses to chronic water shortages, it is likely that relief camp facilities for water treatment, distribution and sanitation will be inadequate. Opportunities for preventing the abandoning of villages due to water system break-downs will be missed. Relief agencies will not be prepared to work effectively together, and governments will be unprepared to take advantage of potential resources.

CONCLUSION

In compiling this paper, it appeared that recordings of experiences on the subject are only available to a limited extent. One useful outcome of this conference would be therefore, to lay the basis for an in-depth search into such experiences and to record them for the benefit of those charged with planning for careful and integrated advanced planning. It is essential to maintain existing water and sanitation systems when drought occurs, and to expand these systems as needed. A wide range of unique issues will be present in each area, as well as in relief camps and when populations migrate out of drought areas. A key to successful planning is to re-examine past experience in order to anticipate future technical and human demands. For as the poet, Khalil Gibran once said:

"And when one of you falls down,
he falls for those behind him,
a caution against the stumbling stone.

And he falls for those ahead of him,
who though faster and surer of foot,
removed not the stumbling stone."

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