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REACHING THE UNREACHED: CHALLENGES FOR THE 21ST CENTURY

Rapid assessment of emergency water sources

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DISASTERS CAN BE caused by man made (e.g. war or chemical accident) or natural events. They may be sudden onset (e.g. earthquake or flooding) or slow onset (e.g. famine or drought). Whatever the cause, a mass population movement often follows and the resulting confusion and chaos complicates the process of responding to the population's needs. In war or conflict situations options for response are further restricted, as movements and activities are often controlled by political and security constraints. Under these conditions an appropriate water source has to be selected and treatment process chosen so that sufficient quantities of potable water may be supplied. It is not surprising that sometimes inappropriate decisions are made and all aspects of water source selection that should be considered are not.

Displaced populations and water

Simplifying definitions found in the 1951 'UN Convention Relating to the Status of Refugees' and subsequent amendments, a person is deemed a refugee if they have crossed an international border in genuine fear of persecution. An 'internally displaced person' may have been displaced for the same reasons as a 'refugee' but has not crossed an international border. The United Nations High Commissioner for Refugees (UNHCR) is mandated to support refugee communities but not internally displaced persons. This group is therefore particularly vulnerable and tends to receive less assistance than those deemed as refugees.

According to the World Disasters Report 1995 (IFRC, 1995), there were over 16 million refugees and 25 million internally displaced persons in the world in 1993. The repetition of activities causing unrest in countries such as Liberia and Burundi continue to displace populations. During May 1996, tens of thousands of refugees fled from the areas in the north west of Burundi. Many of those who crossed over into the camps north of Uvira in Zaire, had to do so under cover of night, paying their way across the 'closed' international border. Others fled to other areas in Burundi and have become among the many internally displaced.

In the early stages of an emergency, displaced populations are often physically and psychologically exhausted and experience varying degrees of trauma. With such large numbers of physically weakened people living in close proximity to each other, diseases can rapidly spread. The outbreaks of cholera, dysentery and diarrhoea in the camps around Goma in Zaire and the subsequent deaths, leave uncompromising reminders of what can happen if the water and sanitation needs of such populations are not met within a short time frame. The scale of the problem in Goma was unprecedented but, the potential for repeat situations in the future cannot be ignored.

An emergency passes through several non-distinct phases which vary in length. Several classifications of the phases are used, such as UNHCR's 'emergency', 'care and maintenance' and 'durable solution' phases. These classifications roughly tie in with those used by the UK NGO, Register of Engineers for Disaster Relief (REDR) who use the 'immediate emergency' (1-2 weeks), 'stabilisation' (1-2 months), 'recovery' (several months), 'settlement' (several years), and 'resolution' phases (Davis and Lambert, 1995). In terms of water supply, the priorities during the emergency phase are to ensure that the displaced populations do not suffer from dehydration and to protect existing sources. Delivering water by tankers or pumping direct from the source to bladder tanks for chlorination are systems often utilised at this stage. As time progresses the supply can be improved to the stage where piped, or equivalent systems, may be utilised.

Water source selection and supply in an emergency situation therefore involves a phased or upgrading approach. However, it is important to recognise that there are constraints to the implementation of the subsequent upgrading phases such as:

- lack of will of the implementing agencies and local and displaced communities;
- finances (funds are often more widely available in the emergency stages); and
- Government restrictions.

Decisions made in the initial phases of the emergency are therefore likely to affect the longer term solutions and hence need to be professional and competent.

Water source assessment

Photograph 1 shows a spring source near Bukavu in Zaire which had already been developed prior to the arrival of the refugees and was being used by a local community. Today the spring protection has been improved and it supplies both the local community and two refugee camps with over 100,000 refugees. The water is of excellent quality and the only treatment undertaken is chlorination for post- supply contamination.

Photograph 2 shows a surface water source, north of Uvira in Zaire. The source is heavily polluted and is used for washing clothes and bathing as well as animal watering. The water is highly turbid and there are large seasonal variations. Water from this surface water source supplies a refugee camp and also local communities up and downstream. Treatment for the camp consists of assisted sedimentation with aluminium sulphate and then chlorination. Lime, although commonly used for pH adjustment, is not used in this particular instance.

Photograph 3 shows Nyamirangwe camp, near Bukavu in Zaire, for which the International Federation of Red Cross and Red Crescent Societies (IFRC) have responsibility for management of the WATSAN facilities. In front of the shelters a water supply tapstand (ramp) and treatment tanks can be seen. This camp was planned before arrival of the refugees, as identified by the lines of latrines and refuse pits in-between the shelters.

How would you chose between the sources in photographs 1 and 2 to supply a camp such as in photograph 3 ? The surface water would be the most obvious source and the quickest to develop for supply, but the spring could be more beneficial for the longer term. And what about ownership, the supply of chemicals, and seasonal variations in yield ? The questions are numerous.

When assessing sources a range of information should be considered:

- water requirements of the displaced populations, local communities and animals (relates to the phase of the emergency and recommended volumes for supply);
- yields and seasonal variations;
- water treatment requirements (see below);
- time of set up (relates to resource and logistical constraints and physical requirements for supply: source protection; abstraction; treatment; transmission; and distribution);
- legal, security, or social, cultural or political constraints;
- operation and maintenance requirements (relates to the physical requirements for supply);
- costs (capital and operation and maintenance); and
- impacts of development (on local communities and the environment).

The order of importance of the above factors will vary with the phase of the emergency. In the 'emergency' phase, time of set up is more important than the requirements for operation and maintenance. In the 'operation and maintenance' phase these priorities would be reversed.

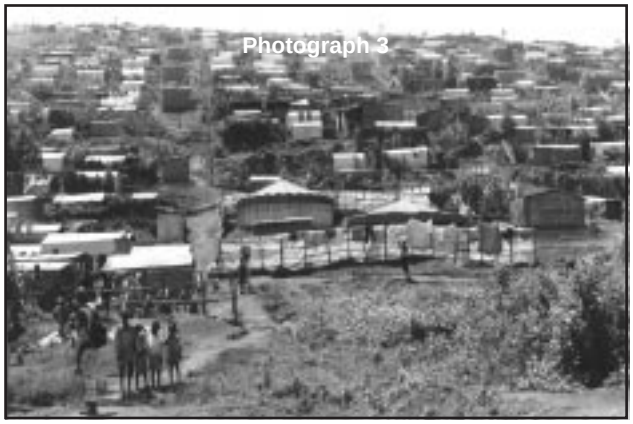
Treatment process assessment

Two of the key treatment processes involved in supply to camps of displaced persons are storage / sedimentation and disinfection (usually chlorination). The main constraint to effective disinfection and the inactivation of pathogens is the presence of turbidity. The process of assisted sedimentation (flocculation, coagulation and sedimentation), sometimes also with pH adjustment using lime, is often utilised for this purpose. An increase in the use of roughing filters to remove turbidity may also occur in the coming few years.

A simple process selection link is made between high turbidity surface waters and the assisted sedimentation process followed by chlorination. Low turbidity groundwaters are linked simply to chlorination. However what happens when a non-standard problem occurs: excessive algae, high levels of iron, nitrates or chlorides ? And with industrial pollution; a paper factory is discharging directly into the surface water source that you want to use to supply the refugees in the emergency stage. How much of a risk can you take ?

When selecting a treatment process the following information should be considered:

- water quality at present and predicted variations;
- sources of pollution and whether they can be reduced;
- how the water responds to treatment techniques;
- phase of the emergency and the respective water quality guideline levels;
- operation and maintenance requirements of the process;
- costs of the process;



- constraints (resources (human and material), logistical, funding available for capital installations and operation and maintenance, and social acceptance of the processes).

Present assessments

Initial assessment of water sources is often undertaken by experienced expatriate personnel from international aid agencies who fly into the situation from head office. On other occasions the assessment may be undertaken by (sometimes less experienced) field personnel. The agencies tend to have a high turnover of staff and because of this there is a limited number of personnel at any one time with experience specifically in the selection of sources or treatment processes. Between a range of personnel however there is a wealth of knowledge and experience.

Organisations such as Médecins sans Frontières (MSF) and REDR run short training courses prior to personnel travelling overseas to make personnel conversant with standard packages of water treatment, storage and distribution kits as supplied by Oxfam and MSF and to introduce the basics of water supply and treatment in the emergency setting. Various useful items of literature are also available on water sources and the treatment processes that can be used in the emergency situation, examples including those by: Jan Davis and Robert Lambert (of REDR) (1995); MSF (1994); UNHCR (1992); and United Nations Children's Fund (UNICEF) (1986).

However the **specific** process of **source and treatment process evaluation, comparison and selection** is still left very much up to the individual and his / her own judgement based on his / her own varied experiences.

Shortfalls

In the emergency phase it is often the most obvious source which is utilised and alternatives may not be considered, even for the later phases. This is partially due to emphasis being placed, correctly, on minimising time of set up in the emergency phase. In the later phases it may also be due to issues such as lack of funds and lack of will to implement modifications to systems already in place. A lack of awareness of the benefits of a more thorough assessment may also be a cause. During the initial stages of the emergency in Ngara, Tanzania and in Goma, Zaire, water trucking programmes were initiated. Several years later the expensive trucking operations still exist. With the benefit of hindsight, the installation of pipelines, moving the camps or other alternatives may have been more appropriate. Admittedly, the selection of a suitable system depends on the predicted length of stay of the displaced population which is always tenuous. It is also limited by restrictions placed by host Governments which prevent camps from developing infrastructure which could be interpreted as implying permanence. But, now that experience has shown that displaced populations often remain for long periods of time, assessment procedures should include these experiences in the decision making process. The above examples also highlight the interdependence of the availability of a suitable water source and the selection of a suitable site. Water is essential for life and a site without water can only be a recipe for further disaster.

From interviews with water and sanitation personnel from the major aid agencies, it has become apparent that procedures followed for the assessment of water sources and the selection of treatment options vary to some degree between agencies and between personnel within agencies. For example whether, during the assessment in the immediate stages of an emergency, you should aim to always contact and work with local authorities, you should test for faecal contamination, how demand is estimated, whether you should and could possibly consider the environmental implication of the development, whether mobile treatment units are appropriate etc. The reasons for these variations are linked to agency policies, individual's past experiences and the fact that every emergency situation will be different.

WEDC has received increasing numbers of requests for information from the field to interpret water quality results and recommend treatment processes. In the emergency situation decisions must be made on the appropriateness of the water quality for treatment and consumption. It has become apparent from discussions with field personnel and certain specialists, that in the emergency situation WHO guideline levels are difficult to reach and that some parameters, such as turbidity, already have generally accepted levels for the emergency situation as used in the field, but not formally agreed by the international community and agencies. In emergency literature a variation of acceptable levels (generally being the WHO guideline values) are noted. Relying on unobtainable standards can only make decision making more erratic and cause each individual to make up their own boundaries for acceptability.

Concern has also been shown from field personnel of the general lack of experience in the assessment of water quality where there is a threat of industrial or agrochemical pollution. Examples include emergencies in industrial-

ised nations or in urbanised situations such as in the former Yugoslavia and Chechnia.

As an accepted procedure for assessment of water sources does not exist, there is no way to ensure that the implications of abstraction are assessed. Examples of such implications are the effects on local communities or on the environment by the depletion of aquifers or the disposal of chemically modified sludges. In the camps north of Uvira in Zaire, the refugees were supplied with treated water but local supplies were not improved, even though siting of the camps meant that pollution levels increased in existing surface water sources used by local communities. In some cases locals walk several kilometres into the camps to collect water from the tapstands. Now several years after the formation of the camps an agency has taken on the task of specifically looking at the local supplies. This delay may have been reduced had the initial assessment included the requirement to assess local supplies and needs and equal priority given to minimising effects on local communities. Conversely in Malawi, problems were encountered where refugees were using local community hand pumps for their supplies. On the environmental side, in Goma, Zaire, a coffee plantation owner was concerned over sludges from chlorination tanks being deposited above his plantation, risking chlorinated organics reaching his crops. In Ngara, Tanzania, there are now problems with depleting aquifers due to abstraction for refugee camps.

Recommendations

Improvements can be made to the assessment procedure for the selection of water sources and treatment processes in the emergency setting in the following areas:

- development of a procedure for logical collection and collation of survey information;
- identification and agreement on water quality guidelines and parameters to be measured for all stages of an emergency;
- development of appropriate assessment procedures for waters at risk from industrial pollution;
- identification of appropriate water quality field testing equipment;
- development of guidelines to ensure consideration is given to the implications of abstraction, particularly on local communities and the environment;
- development of a clear link between water survey data and source and treatment process selections.

The WEDC research project 'Rapid assessment of emergency water sources' (RAEWS) aims to try and address these areas of weakness so that future assessors will not have to 're-invent the wheel' each time that an assessment is made.

Objectives of the RAEWS research

- Develop and disseminate a decision making tool and guidelines which will help the user, in an emergency situation, collect data in an orderly way and then process it to select a water source, establishing its suitability for human consumption, and the appropriate treatment required to make it potable.
- Produce training modules including student notes, lecturer support data and visual aids to provide guidance on the use of the selection guide.
- Disseminate the guidelines and training modules to the major aid agencies and NGO's with an interest in emergency water supply.

It is envisaged that the outputs will consist of flow charts, tables, checklists, survey sheets and general instructions supplemented by supporting information on how to undertake specific tasks.

Comments and discussions on this subject are welcomed and should be directed to the authors at WEDC.

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- However, the opinions stated in this paper are those of the authors alone and not necessarily of the aforementioned organisations.

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Observations noted in this paper have been highlighted from field work experience, numerous interviews, and personal communications with personnel from a range of agencies, undertaken under the RAEWS study. The specific examples noted in this paper were highlighted by the following personnel: John Adams, Oxfam (1996); Annick Barros, IFRC (1996); Tim Forster, Merlin (1995); Koos Messelink, Bonanae Cikola Rugendabanga and Paul Van Harperen, MSF Holland (1996); and Daniel Mora Castro, UNHCR (1996); although the opinions noted are those solely of the authors.