

# Experience and results from a water quality project in Zambia

by Hans Utkilen and Sally Sutton

**WHO/UNEP initiated a set of projects in three continents to examine the relevance of the WHO *Guidelines for Drinking Water Quality, Volume III, Drinking Water Quality Control in Small Community Supplies*. Thus in 1985, the Western Province of Zambia was selected by WHO for the development of a rural project on the control of drinking-water quality. Since the *Guidelines* emphasize the importance of bacteriological water quality, the project concentrated on this aspect.**

WESTERN PROVINCE consists of a vast elevated and sandy plain dissected by the Zambezi and its tributaries. Woodland, bush and seasonal marshland cover most of the area of the district chosen, which was the central, most accessible part of the province. Mongu district is the most densely populated part of the province, but even so the population is only 80,000. Villages seldom exceed 500 people and groups of less than 20 houses are the norm, except along the Zambezi valley edge, and in the peri-urban areas of the two main townships.

Water is not scarce, with shallow groundwater and surface water available both in the main Zambezi flood plain, and in the seasonal lakes

(dambos) which are found within the elevated woodland areas. Traditional water-holes in the sands are the dominant source of drinking-water. However, as many people (45 per cent) take their drinking-water from the 240 or so protected sources (shallow dug wells with lining and windlass, and from handpumps on well-points and boreholes) as from the traditional scoop-holes. The remaining 10 per cent use surface water. Safe sources constructed by the Department of Water Affairs become the responsibility of the community upon completion. Thus, cleaning the source and maintaining it are community activities in which local health workers may have an advisory role.

The main aims of the project were to set up a system to monitor water quality and initiate rehabilitation where necessary. This was to be done within the framework of the existing co-operation between the health and water sectors, and except for the appointment of the laboratory technician did not involve any new employment. The way in which the project used existing parts of the national, provincial and local levels of organization is summarized in the upper figure (see page 7).

## Structure and planning

The project was represented at national, provincial and local level. The project management committee — consisting of representatives of the Ministry of Health, WHO, and the Department of Water Affairs — was based in Lusaka, some 600km away from the project area. This committee was formed in 1985, and carried through unchanged during the implementation of the project.

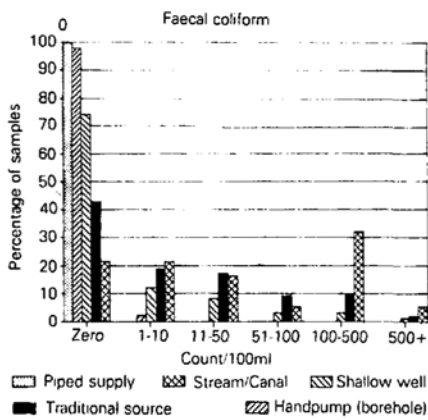
At the provincial level, water, sanitation and health education were co-ordinated by the WASHE committee, representing all government organizations with an interest in water supply, health, education, social development, agriculture and local administration. Similar committees were being established at district level, and the plan was that the Mongu WASHE committee would provide local management of the project. This body was regarded as especially appropriate for relating the water quality surveillance output of the project to the rest of the water sector in Mongu. Unfortunately, it was not in fact established until almost the end of the project implementation.

At local level the health assistants stationed at the 14 rural health centres were the field-workers who were to collect the samples and initiate necessary rehabilitation. They were to liaise with the laboratory that was established by the project in Mongu for water quality analysis, sending samples and responding to the results passed on to them by the supervising District Health Inspector.

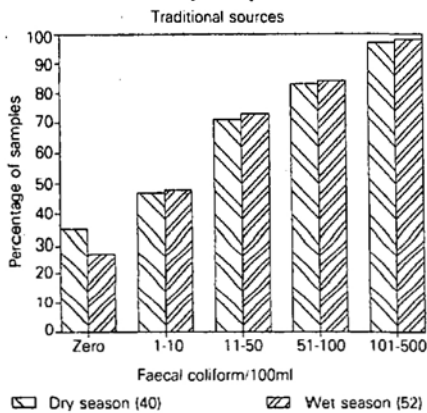


A WASHE health education session for villagers.

### Drinking water from different sources



### Seasonal quality variation



Early enthusiasm for the project which was expressed within Mongu by both health and water senior representatives was only partially carried through to the implementation of the project. This arose partly from the year's delay in the starting of the project, and partly as a result of changes in personnel. Integration into the WASHE programme was also a limited success, both because of the lack of a district-level WASHE committee, and because the management committee for the project was at the national level, based in Lusaka where the WASHE programme was not represented. Communication between the central administration and provincial bodies was poor.

### Communication problems

The project was planned by the project management committee and the liaison officer, based in Lusaka. Financial resources were disbursed at the national rather than local level. Incentives for sampling were poor, and in retrospect, it would seem that more responsibility for the day-to-day running of the project could have been delegated more to local personnel.

An opportunity to provide recognition and encouragement to the field-workers was also lost

during the training courses. These were arranged at the beginning and end of the project implementation, but no certificate was given to participants. This would have helped to evaluate their understanding and given them a useful record of their developing expertise. Timing of the second workshop in the middle of the project, rather than at the end would also have given the health assistants encouragement and given them a chance to discuss and solve some of their problems (many of which arose in the early stages) while there was still time for changes to be made.

Continuity of the staff involved at both the local and the national level was good, but at the intermediate level the Provincial and District Health Inspectors, whose roles were vital in the liaison between the upper and lower levels, changed five times during the implementation stage of the project. This led to difficulties in communication, as new personnel were not fully informed of the plans for the project, and their role within it.

As in many parts of the developing world, the major constraint to fulfilling targets was the lack of transport. Two health assistants had motor bikes donated for other aspects of their work, but many of the centres included in the project were far from Mongu, accessible only along poor tracks in thick sands, and sometimes through swamps at seasons of high water. When this constraint was realized, plans should ideally have been changed to cope with the situation. The rural health centres from which samples could not be collected should have been told to concentrate on sanitary inspections

and rehabilitation activities, which in the circumstances would have had a higher value for water quality than the sporadic collection and analysis of samples. For the health assistants it was discouraging to find that the samples (whose collection from distant villages had required several hours of hard walking in loose sand) were not collected for the next leg of the journey, and their efforts wasted.

The WHO *Guidelines* recommend a clear distinction between the roles of the surveillance agency and water supplier, but this separation may be difficult to maintain in developing countries and is unrealistic where transport is a major constraint. The project was supposed to be co-ordinated and run by both the Ministry of Health and Department of Water Affairs, as was the case with the WASHE programme, but this did not happen, showing that much better definition was needed from the planning stage of the responsibilities of the different agencies involved.

### Results of surveillance

The results from tests on bacteriological water quality show that handpumps and boreholes appear to offer safe and reliable supplies, free of faecal coliforms (see figures). Shallow wells provide lower quality supplies, but are seldom prone to more than very slight pollution. More often traditional sources are significantly polluted, and one in three samples showed relatively high levels of contamination. It should be noted, however, that in general the level of contamination for both shallow wells and traditional sources is low



*A traditional water source with little protection and high risk.*

**Table 1. Percentage of water samples from different sources**

| Source                | Number of sites | Number of samples | Percentage with no faecal coliform | Percentage with faecal coliform of <10/100ml |
|-----------------------|-----------------|-------------------|------------------------------------|--|
| Handpump (borehole)   | 32              | 40                | 100                                | 100  |
| Standpipe             | 34              | 35                | 100                                | 100  |
| Handpump (well-point) | 7               | 14                | 93                                 | 93   |
| Shallow wells (SW)    | 98              | 266               | 78                                 | 92   |
| Traditional sources   | 108             | 148               | 42                                 | 62   |
| Springs               | 4               | 9                 | 89                                 | 100  |
| Streams               | 6               | 14                | 28                                 | 57   |
| Unprotected SW        | 14              | 17                | 53                                 | 94   |

compared to that found in many other countries. There tend to be coliforms of some sort in almost all traditional sources (83 per cent) and in 49 per cent of shallow wells. The reason is probably partly because vegetation reaches right to the edge and often into the traditional source, and water is able to flow in. In contrast, the use of lids on most shallow wells keeps out wind-blown debris, and rings prevent the return of water.

While early sampling suggested that traditional source quality deteriorated in the wet season, comparisons with a greater number of samples did not show any real difference between wet and dry season samples (see lower figure, page 7). This may be because the risks of returning water in the wet season are counteracted by the shallower water in the dry season and the frequent need to stand in it to fill a container. Table 1 shows that the risk of some level of contamination is higher in traditional sources than in shallow wells. The former are twice as likely as the latter to have faecal contamination, and while no


shallow wells reach what might be termed 'moderate' pollution levels (>50/100ml), one in five traditional sources reached this level and one in 10 might be regarded as grossly polluted. In neither case is gross pollution (over 1,000 faecal coliforms per 100ml) apparent. These levels suggest that only a few sources present a permanent risk to health, but that in times of epidemics, such as cholera or typhoid, the protected sources offer supplies with a very much lower risk of disease.

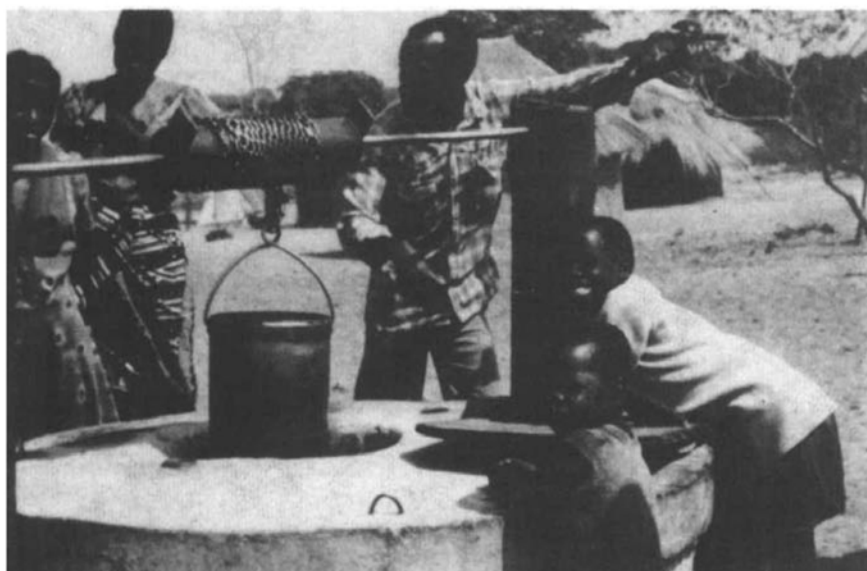
### Monitoring results

Sampling by the project to measure contamination followed sanitary inspections by the WASHE programme and it is interesting to note that these independent surveys could be closely correlated. Comparison of sanitary inspection and bacteriological results shows that of 26 protected wells with faecal coliform, all except one had previously been identified as being at risk and remedial work initiated. The combination of remedial work and community health education led to an overall improvement in water

quality. Of 41 shallow protected wells regularly monitored over 18 months, 21 improved in quality, 20 had no faecal coliform at any stage, two became slightly worse, and three remained with slight levels of contamination throughout. Barring one case, handpumps were not found to be contaminated, but remedial works were carried out to ensure they did not become so.

While the WASHE programme rehabilitated all protected wells in need of repairs during 1986-7, the WHO/UNEP/Norad project concentrated its efforts on the traditional scoop-holes. Thus health assistants initiated improvements in protection to some 30 sites, on the basis of the results they received from the laboratory. Consequent changes in quality were not, however, monitored.

By the end of 1989, some 30 per cent of the rural population will have access to supplies which offer no risk of the transmission of disease (handpumps), and a further 20 per cent will have access to sources where the risks are very low (shallow, lined wells). A second phase of the WHO/UNEP/Norad project, funded by Norad will now concentrate on finding low-cost technical solutions to the improvement of traditional scoop-holes, so that communities too small to qualify for new protected sources in the WASHE programme, can nevertheless benefit from better water quality. This second phase will build on the experiences of the work carried out in 1986-7, working with the health assistants who were most active in the first phase, but with greater emphasis on community education and participation. 



*Protected shallow well with windlass.*

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