



## Water quality monitoring in Angola

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THE RESURGENCE OF civil war in Angola at the end of 1998 forced over 500,000 Angolans to flee their homes and head for safety in Internally Displaced Persons (IDP) Camps. Unsanitary conditions and insufficient water coverage in these camps resulted in a high prevalence of water and sanitation related diseases.

In January 2000, a number of cases of typhoid were reported in a collection of IDP camps around the Central Highland City of Kuito. (MSF-B, 2000). As a result, Oxfam GB began a process of emergency hygiene promotion, chlorination/protection and water quality monitoring of existing traditional wells.

The programme proved to be an effective low cost emergency response, activated with quick implementation. Additionally, the chlorination programme resulted in a direct reduction in levels of faecal contamination as well as an indirect improvement in the IDP's health status. Due to its positive impact a total of 700 traditional wells were chlorinated in 3 Provinces in Angola.

This paper examines the methods of chlorination used and the software and hardware components required to improve the water quality.

### Methodology

In order to select appropriate areas and wells for intervention, 6 stages of project development were used. These stages are outlined in Figure 1.

### Details of Stages

#### Stage 1: area identification

Health data from the Department of Health and other leading NGO's was collected and analysed. From this data, areas with the highest prevalence of water-related diseases were selected.

However, due to the unreliability of health statistics in Angola, Oxfam social mobilisers undertook further house to house diarrhoea survey.

In these surveys a "Bean and Maize" exercise was done. This involved two buckets with 2 distinct posters: one with children passing watery faeces and the other of a healthy child. Parents were asked to put maize seeds into the bucket representing healthy children to approximate the number of children <5 they have in their homes.

They were then asked to put beans in one or other of the buckets to represent the number of children that have suffered/or have not suffered from diarrhoea during the last 2 weeks.

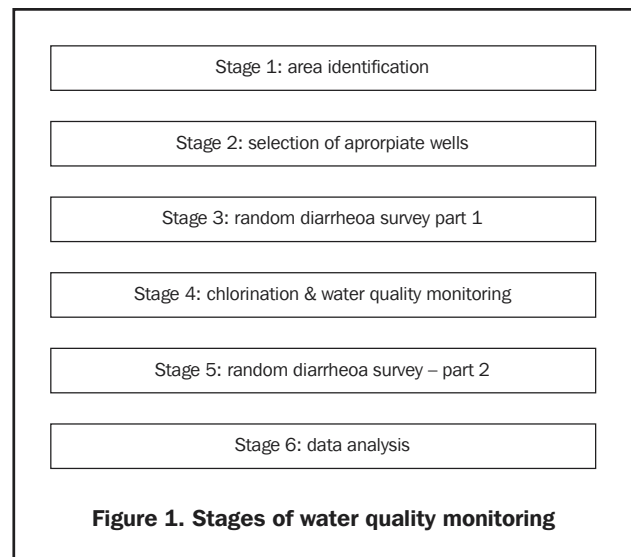


Figure 1. Stages of water quality monitoring

From this survey data was obtained which could be compared to the Department of Health data. This then enabled the team to identify appropriate areas for intervention.

#### Stage 2: selection of appropriate wells

Within the identified areas, wells were then selected according to the following criteria:

- Faecal Contamination (F.C.) per 100ml;
- pH – (6.7-8);
- Turbidity <10 NTU;
- Distance of well from a latrine;
- Number of Users;
- Individual or Communal Well; and
- Consent of Owner.

The parameters for the bacteriological and physiochemical analysis were based on 1997 WHO Guidelines for Drinking Water Quality.

#### Stage 3: random diarrhoea survey - 1

The survey was conducted before the first dosage of the wells. The objective of the survey was to gather baseline information on recorded cases of diarrhoea.

For each area, 3 'In' wells (conforming to the criteria outlined above) and 3 control wells (i.e. 'Out' wells, outside the programme) were selected in total.

There were 3 objectives to the survey:

- To obtain how many people use the well?;
- To obtain what the water is used for?; and
- How many children <5 years have been affected by diarrhoea @ 2 weeks.

“The Bean and Maize Exercise” was also used to gather information for point 3.

In order to achieve neutrality, the survey was undertaken by 2 volunteers (1 man/1 woman) from outside the evaluated community each with proficiency in their local language.

Results from the survey indicated that an average of 135 people use the wells. Of these 135 beneficiaries, approximately 25% were children <5. For each well the communities used the water for both bathing and drinking.

#### Stage 4: protection, chlorination and water quality monitoring

Once the survey was completed, the selected wells were upgraded with concrete headwall and equipped with a 20lt jerry can and rope.

The objective of the upgrading of the wells was both to reduce surface water intrusion and the number of recipients entering the well.

Following the upgrading of the well, the social mobilisation team undertook intense hygiene promotion activities using community-based drama. The drama was done in central meeting places such as churches and market places to reach the maximum number of people. The messages of the drama promoted the chlorinated wells as potable drinking water sources.

Following the hygiene promotion activities, the wells were chlorinated using the following method:

- Volume – Calculated as the difference between static and dynamic water levels multiplied by diameter of the well;
- Total Chlorine - Based on the modified Horrock’s method of a 3 Jar test. The parameters of 3, 4 and 5mg per litre were used in each jar to calculate total chlorine. (Shaw, R. 1999);
- Contact Time - Following a contact time of a minimum of 30 minutes, chlorine residuals were tested. (House et al. 1997); and
- Residual Chlorine – Parameters of 0.3-0.5mg/l of residual chlorine were used. (Shaw, R. 1999). Once residual chlorine levels @ 0.2mg/l, the well was re-chlorinated.

Once chlorinated, levels of Faecal Contamination in each well were tested using the DelAgua Kit on two weekly basis.

#### Stage 5: random diarrhoea survey – 2

The second survey was undertaken 3 months after the first survey to monitor the impact of the chlorination programme during its first 3 months. The same methodology as above was applied.

#### Stage 6: data analysis

Data Analysis was undertaken at various stages of the programme. These included:

- Bi-weekly Analysis of F.C/100ml;
- Bi-weekly Monitoring by Mobilisers;
- Monthly Analysis of Trends in Diarrhoea Related Diseases; and
- 3 Monthly Random Diarrhoea Survey.

Conclusively, bi-weekly results showed a reduction in the level of faecal contamination (see Figure 2).

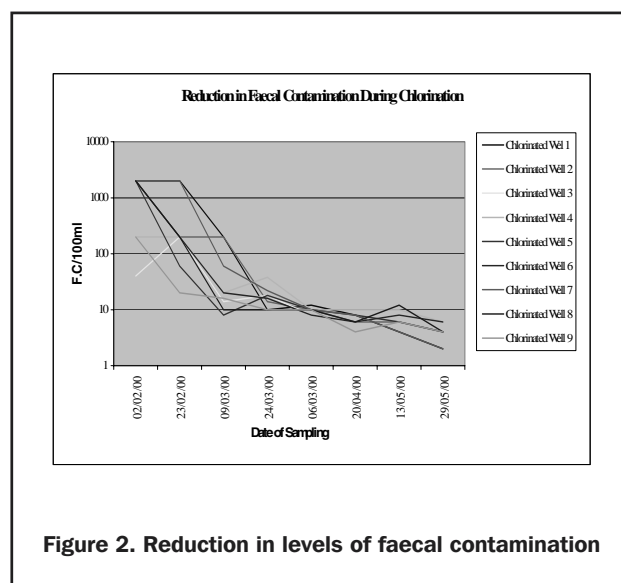


Figure 2. Reduction in levels of faecal contamination

Graph 1 illustrates a reduction in faecal contamination levels reduced from >2000F.C/100ml to WHO accepted level of <10F.C/100ml in 9 wells. (WHO, 1997.)

Variations were seen during the rainy season for the following reasons:

- Increased chlorine demand due to high recharge and rising water levels; and
- Increased surface water intrusion, resulting in greater turbidity (>10NTU) and therefore less effective chlorine. Following the rains the levels of contamination stabilised @ < 10F.C/100ml.

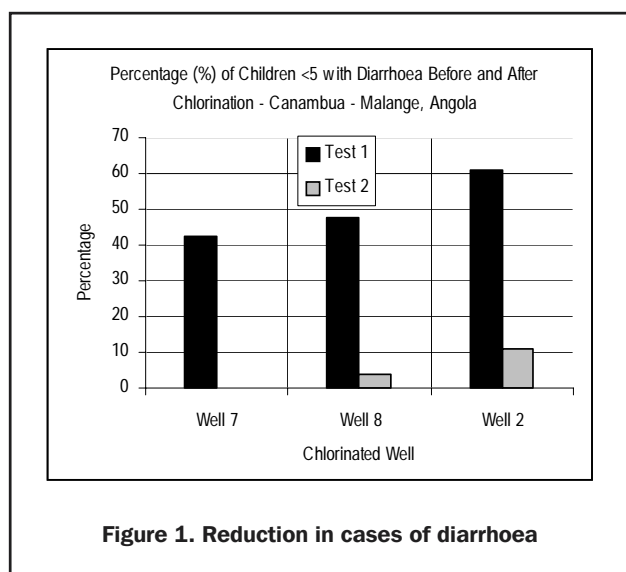
However, further problems were encountered with chlorination of the wells during the dry season. These included:

- Reduced volume due to limited recharge; and
- Inadequate contact time < 30minutes due to increased water demand.

Furthermore, the 3 monthly random diarrhoea survey showed an indirect reduction in levels of diarrhoeal diseases. The survey indicated a 50% reduction in children <5 years had diarrhoea within the 2 weeks before the first survey in both the ‘In’ and the ‘Out’ wells. (McCaffrey et al. 2001.)

However, following the 3 months of chlorination, the ‘In’ wells showed a 30% greater reduction in cases of diarrhoea compared to the ‘Out’ wells. (McCaffrey et. al. 2001). Graph 2 below outlines the percentage reduction in diarrhoeal related diseases in three ‘In’ wells.

It was acknowledged that Graph 2 is only an example of the reduction of diarrhoea related diseases in 4 specific wells. Although other surveyed wells showed a similar reduction in cases of diarrhoea, they were seen as non representative due to the noted presence of other factors such as improved Nutrition, hydration status, season and population movements around the well during the survey.



## Conclusions

Results from the chlorination process indicated a reduction in levels of faecal contamination within the well as well as a fall in trend of the number of recorded cases of diarrhoea related diseases.

Initially, the chlorination programme was seen as an emergency response. However, due to the immediate positive public health impact, members of the Governments' Provincial Water Department (DPEA's) have now been trained to expand the programme in to areas beyond the security limits of NGO's.

## References

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