



## Quality of drinking water

Eng. (Mrs.) C. Wethasinghe and K.M. Manickavasagar, NBRO, Colombo, Sri Lanka.



IN SRI LANKA the entire drinking water supply system is managed by the National Water Supply and Drainage Board (NWS&DB). Hence it is necessary that an independent organisation to carry out a surveillance programme for pipe-borne drinking water quality. As an independent agency the National Building Research Organisation (NBRO) in Colombo, Sri Lanka, commenced the on-going Water Quality Surveillance Programme for pipe-borne drinking water, supplied to the Greater Colombo area in May 1988, at the request of the NWS&DB. The full scale operations for the entire Greater Colombo area were met by September 1988. The objectives of this programme are;

- to survey the quality of water supplied through Standposts, taps in Households, taps in Public places, Overhead Tanks/Sumps and taps in Housing Schemes
- to provide information to the NWS&DB on the quality of water for remedial action
- to improve the reliability and the quality of supply of water and to create a general public health awareness of clean and safe water.

### Surveillance criteria

This programme is carried out in accordance with the criteria stipulated by World Health Organisation (WHO). WHO has defined criteria in terms of sample collection based on population (Table 1). This criteria was adopted in deciding the number of samples to be collected in each area.

The Water Quality Surveillance Programme covers the following areas in the Greater Colombo region; Colombo City, Dehiwela-Mount Lavinia-Ratmalana, Moratuwa, Panadura, Sri Jayawardanapura-Kotte-Kolonnawa and supply and service reservoirs at Kolonnawa, Mulleriyawa,

Labugama, Kalatuwawa, Churchill, Elihouse, Maligakanda, Dehiwela and Panadura.

The programme includes collection of water samples from various points in the distribution system; Standposts, Households and Public Utilities. Samples are also collected from the storage system; Overhead Tanks/Sumps and Housing Schemes. Samples from reservoirs are also analysed.

The sample estimations in the distribution system for each area were determined according to the above WHO criteria and is given in Table 2.

Biological Examination offers the most sensitive test for the detection of recent and potentially dangerous fecal pollution in drinking water supply system. It is essential that water is examined regularly and frequently as contamination may be intermittent and may not be detected by the examination of a single sample. Hence it is important that drinking water be examined by a simple test or series of tests. According to WHO guidelines priority must always be given to ensure that routine bacteriological examination is maintained whenever manpower and facilities are limited.

The standards set for drinking water quality in order to minimise public health risks have been based on the use of total coliforms, fecal coliforms, and fecal streptococci as indicators. Since it is very complex and often costly to perform virological analysis, the bacterial indicators continue to be the most reliable gauge of hygienic quality of water.

The membrane filtration technique is used for identification of coliforms.

All the samples are tested for fecal coliforms and residual chlorine. Though pH was determined for all the samples collected during the initial stage of the programme, at present it is carried out for only one sample

**Table 1: World Health Organisation Criteria for sample estimation**

Population Served	Minimum number of samples to be taken from the Distribution System each month
<5000	1 sample/month
5000-100,000	1 sample/5000 Population
>100,000	1 sample/10,000 Population

**Table 2: Sample Estimation**

Area	Number of Samples Collected/mopnth
Colombo City	70
Dehiwela-Mount Lavinia-Ratmalana	20
Moratuwa	15
Panadura	10
Sri Jayawardanapura-Kotte-Kolonnawa	20

Figure 1. Variation of Contamination (Distribution System)

Figure 2. Percentage of Samples with Residual Chlorine Level <0.2 mg/l

Figure 3. Variation of Contamination (Storage System)

Figure 4. Influence of Storage System on the Contamination in the Overall System.

collected from each zone. The samples from supply and service reservoirs are tested for fecal and total coliforms, residual chlorine, pH, Iron and alkalinity.

### Method of Operation

Routine sampling is carried out according to a schedule prepared at the beginning of each month. The results are reported in specially formed data sheets.

On detection of fecal contamination in a sample (suspect contamination), re-sampling of the same point is carried out within the next 24 hrs. Further detection of contamination is considered confirmed fecal presence., and all the confirmed fecal presence are immediately reported to the NWS&DB for corrective action. However if more than 75% of the samples collected from any zone showed "suspect contamination", re-sampling is not carried out and results are immediately reported to NWS&DB as confirmed fecal presence.

At the end of each month, the NWS&DB is provided with a monthly report including the test results and area summaries.

All data are currently being processed on Lotus 123.

### Evaluation of results

The data collected during the period January 1989 to December 1993 were analysed and evaluated in this paper.

#### *Distribution system*

The distribution system includes the samples collected from standposts, households and public utilities.

#### *Standposts*

Outlets of water from the distribution system by means of a standpost.

#### *Household*

Water supplied to the households directly from the mains.

### ***Public Utilities***

Water used directly from the distribution system in public places such as restaurants, hotels, hospitals, etc.

A total of 6203 samples have been tested from the distribution system during 1989 to 1993 and 384 contaminations from all sources in the system were detected. The area-wise distribution of this contamination is presented in Figure 1. The highest percentage contamination of 28 was recorded in Panadura in 1990.

The analysis of data indicates a low residual chlorine level in Pandura area where the highest contamination was also recorded (Figure 2). It is also observed a reduction of percentage of samples with chlorine level less than 0.2 mg/l in all the areas.

### ***Storage system***

Out of 1132 samples tested from the storage system during the period 1989 to 1993, 200 contaminations have been detected. The variation of this contamination is given in Figure 3. According to Figure 4 there is a significance contribution from the storage system to the overall

contamination. However the graph indicates a reduction of contamination due to storage system at present.

### **Conclusion**

The results indicate a direct correlation between the level of residual chlorine and the degree of contamination.

A positive downward trend in the contamination of storage system is currently observed consequent to highlighting the results at health committees in the past.

The feedback from MBRO to NWS&DB on the quality of water and their remedial action has improved the level of residual chlorine in the distribution system.

### **Acknowledgement**

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### **References**

WHO Guidelines for Drinking Water Quality, Vol I, II and III.