<u>ACQWS Paper No. 6</u> <u>Treated Water Quality Monitoring</u>

Preamble 199

To provide a reliable and adequate supply of wholesome potable water to consumers is one of the missions of the Water Supplies Department (WSD). All raw water, whether from Dongjiang or Hong Kong reservoirs, is delivered to the T/W where it goes through a stringent treatment process. Hong Kong adopts the World Health Organisation's Guidelines for Drinking-water Quality (1993) as the quality standard for drinking water. Treated water after leaving treatment works, in the distribution system and right up to the consumer taps is closely monitored so that we know how well the quality of the water has been maintained. As there is an increasing concern on our drinking water quality, this paper describes WSD's monitoring strategy on treated water in Hong Kong, which is comparable to the recommendations and practices of international organizations or national authorities e.g. the World Health Organization (WHO), the European Community (EC) and the United States Environmental Protection Agency (USEPA).

WSD's Monitoring Programme

2. At major water treatment works there are on-line monitoring equipment for monitoring continuously key parameters such as pH, turbidity, chlorine and fluoride of the water quality throughout the whole treatment process. The on-line monitoring results are useful to treatment works operators for fine-tuning the treatment process to ensure the quality of the treated water.

3. The treated water is subject to stringent quality monitoring by means of sampling and testing. WSD implements a comprehensive monitoring programme to ensure that the quality of treated water conforms chemically, bacteriologically and radiologically with WHO Guidelines for Drinking-water Quality (1993). Since July 1999, all 94 health related parameters of WHO have been included in the programme of sampling and meticulous testing.

4. Under the monitoring programme, samples are taken from carefully selected strategic points and random locations throughout the entire supply and distribution system, i.e. before leaving the treatment works, at service reservoirs, at trunk mains, at connection points and at consumers' taps to ensure a

full coverage. The sampling locations are selected based on experience, operational requirements and accepted international practice within the water supply industry.

5. The analysis of all samples is carried out by qualified professional and technical staff of WSD at laboratories located at major water treatment works using advanced analytical instruments and internationally practised methods. The monitoring programme covers physical, chemical, biological, bacteriological and radiological analyses. The competence of WSD's water analysis has achieved quality assurance recognition when the Mainland East Laboratory of WSD was accepted as an accredited laboratory under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) in 1996, a status which has since been maintained.

Sampling & Testing Frequency

The sampling and testing frequencies of treated water range from 6. hourly to 6-monthly depending on the health significance of the parameter, the complexity of the testing procedures (some of which can take several days) and results in earlier tests. The sampling and testing frequencies, therefore, vary between general quality parameters, heavy metals, volatile organics and pesticides, and radionuclides. Background levels, experience, operational requirements and good water science practice are taken into account in formulating the testing programme. The frequency of sampling and testing adopted is adequate and commensurate with operation requirements to provide accurate and useful information for proper monitoring and control of the treated water quality. For example, residual chlorine in water leaving treatment works is measured hourly and bacteriological testing at large treatment works is performed daily. The entire testing programme is under regular review and the testing frequencies and sampling locations will be adjusted to cover new areas e.g. new town developments, new treatment works. A summary of sampling and testing frequency is at the Appendix I.

7. The frequency of sampling and testing will be stepped up at times of fluctuation of raw water quality, after adjustments in treatment processes, occurrence of epidemics, change of raw water sources or other emergencies.

8. In 1999/2000, over 25,000 treated water samples were taken from treatment works, service reservoirs, connection points and consumers' taps.

Over 10,000 determinations on parameters of health significant were conducted. The test results indicate that the water we supply conforms to the Guidelines for Drinking-water Quality recommended by WHO. In accordance with international practice, compliance is based on annual averages. Practically all individual results meet the guideline values by a large margin. Occasional non-compliance does occur. Such random noncompliance does not necessarily constitute a breach of a water quality standard. It should be noted that WHO states that "short-term deviations above the guideline values do not necessarily mean that the water is unsuitable for consumption"; while USEPA stipulates that "for systems which are conducting monitoring at a frequency greater than annual, compliance with the maximum contaminant levels (MCL) is determined by a running annual average at any sampling point".

9. Depending on the nature and magnitude of a non-compliance result, WSD will take immediate actions to rectify the problem by adjusting the treatment process.

WHO's Recommendations on Sampling Frequency

10. WHO has recommended a minimum number of samples in relation to the population of the community to be taken per month for parameters including microbiological quality, turbidity, free chlorine residual and pH. For a population of about 7 million in Hong Kong this corresponds to a minimum of about 9,500 samples to be taken per year. WSD tested over 25,000 samples in 1999/2000. The much higher sampling frequency over the minimum required gives a much greater degree of confidence in the results and a better protection to public health. This is justified in view of the high population density in Hong Kong. WHO has not recommended minimum sampling frequencies for other parameters.

USEPA's Requirements on Sampling Frequency

11. The United States Environmental Protection Agency (USEPA) requires the operators of community water systems a minimum sampling frequency for total coliform monitoring, which translates to 5,760 samples per year for Hong Kong's approximately 7 million population. The sampling frequencies established by the USEPA again varies for different parameters. The sampling frequency may be reduced if deterioration of quality is consistently not detected e.g. if the levels of total trihalomethanes in the treated water

samples are consistently below the Maximum Contaminant Level (MCL) for one year, the sampling frequency can be reduced from 4 samples to 1 sample per quarter.

EC's Requirements on Sampling Frequency

12. The European Community (EC) requires a minimum number of samples per year for microbiological quality and a set of indicator parameters. For Hong Kong this works out to be about 7,600 samples per year. For other parameters, slightly over 100 samples per year are required.

Comparison of World Wide Practice on Sampling Frequency

13. In comparing WSD's treated water monitoring programme with the recommendations or requirements of WHO, USEPA and EC, it can be concluded that the sampling and testing frequency adopted by WSD is more than adequate to ensure that potable water in Hong Kong is pure and safe for consumption. Appendix II summarizes the comparison.

Advice Sought

14. Members' views on the subject are sought.

Water Supplies Department July 2000

Appendix I

Parameter	Raw		Final		
	Unmanned Lab	Manned Lab	Unmanned Lab	Manned Lab	
pH	1/w	2/d	1/w	6/d	
Temperature	1/w	1/d	1/w	2/d	
Colour	1/w	1/d	1/w	6/d	
Turbidity	1/w	2/d	1/w	6/d	
Conductivity	1/w	1/d	1/w	1/d	
Ammoniacal-N	1/w	2/d	1/m	1/m	
Albuminoid-N	1/m	1/m	1/m	1/m	
Nitrite-N	1/m	1/m	1/m	1/m	
Nitrate-N	1/m	1/m	1/m	1/m	
Oxygen absorbed value	1/m	1/m	1/m	1/m	
Dissolved oxygen	1/m	1/w			
Chlorine (free)			1/w	2/d	
Chlorine (total)			1/m	1/m	
Total hardness	1/w	1/w	1/w	1/w	
Total alkalinity	1/m	1/m	1/m	1/m	
Calcium hardness	1/m	1/m	1/m	1/m	
Chloride	1/w	1/w	1/w	1/w	
Sulphate	1/m	1/m	1/m	1/m	
Phosphate (ortho)	1/m	1/m	1/m	1/m	
Fluoride	1/w	1/d	1/w	2/d	
Iron	1/w	1/d	1/w	1/d	
Manganese	1/w	2/d	1/w	2/d	
Aluminium	1/w	1/d	1/w	2/d	
Silica	1/m	1/m	1/m	1/m	
Cyanide	1/q	1/q	1/q	1/q	
Coliform	1/w	1/w	1/w	1/w	
E. Coli	1/w	1/w	1/w	1/w	
APC	1/w	1/w	1/w	1/w	

<u>Appendix II</u> (Revised on 17.7.2000)

Minimum Requirements for Monitoring of Treated Water*

Quality Parameter	Water Supplies Department	World Health Organization (1993)	EC (1980)	EC (1998)	USEPA (1999)
	1999/2000 Actual No. of Samples	Minimum No. of Samples per Year	Minimum No. of Samples per Year	Minimum No. of Samples per Year	Minimum No. of Samples per Year
Bacteriological Parameters	25,483	about 9,500 *	about 720 *	about 7,600 *	about 5,760 *
Chemical Parameters (of health significance)	about 100-300 per 94 health related parameters (depending on parameter and complexity of analysis)	not specified	about 20 *	about 110 *	about 40 - 300 (depending on parameter)

* estimates arrived from pro rata projection of basic requirements in guidelines/standards, depending on quantity of water produced and population.