Sampling Protocols for Testing of Metals

1. Introduction

1.1 Under the Enhanced Water Quality Monitoring Programme, a two-tier sampling protocol [1] has been adopted to test six metals i.e. antimony, cadmium, chromium, copper, lead and nickel, in drinking water samples taken from consumers' drinking taps, which is: Tier 1 – Random Day Time sample ("RDT") taken for the purpose of determining the exposures[2] of consumer to metal from drinking taps and, Tier 2 – 30-minute stagnation sample ("30MS")[3] taken for verifying that the Tier 1 sample in case of exceedance in exposure of consumer to metal is not caused by unduly long stagnation before the Tier 1 sample is taken. To ensure that appropriate follow-up action and mitigation advice are disseminated in case of metal exceedance, auxiliary samples including one 2-minute flushed ("2MF")[4] sample and 30MS sequential samples ("sequential samples")[5] may be collected together with the RDT and 30MS water samples. The sequence of sample collection shall be: (1) RDT, (2) 2MF, (3) 30MS, and (4) 30MS sequential samples.

1.2 If individual consumers want to check the quality of the drinking water in their premises, they should consult a laboratory accredited for testing of antimony, cadmium, chromium, copper, lead and nickel ("accredited laboratory") and adopt an appropriate sampling protocol to take water sample. For example, if there is a need to investigate or check the plumbing system for metal contamination, a 30MS sampling protocol should be used.

2. General

2.1 Drinking water samples shall meet the following requirements:

a) To be taken by a competent person with proper training on the sampling procedure and handling of the drinking water samples taken.
b) To be drawn from the sampling tap that is representative of the drinking water quality within the premises for the specific purposes at the time of sampling.

[1] Tiered Sampling protocols have been adopted by different oversea jurisdictions for monitoring of metals at consumers' drinking taps.
[2] According to the Guidelines for Drinking Water Quality, 4th edition incorporating the 1st Addendum, published by World Health Organization in 2017, the RDT samples reflect most truly the water that the consumer drinks. RDT provides an unbiased assessment of zonal compliance for a water supply zone. Due to its random nature, the sampling consumers' tap is randomly selected from the consumers' taps of the water supply zone.
[3] 30MS is a tool for investigation and checking on metal contamination in plumbing systems.
[4] To confirm applicability of flushing advice as a mitigation measure in case of exceedance.
[5] For assessing whether the problem is confined to the premises or not.

c) To be free from contamination during the course of sampling, sample storage and transportation.

2.2 Sample bottles shall be made of PE, PP, FEP, PE-HD or PTFE[6], with a capacity of 1-litre each. Sample bottles and lids shall be: (i) thoroughly cleaned with a phosphate-free detergent solution; (ii) thoroughly rinsed with deionised water; (iii) soaked in nitric acid (~10% volume dilution of concentrated HNO_3) or hydrochloric acid (~25% volume dilution of concentrated HCl) for 24 hours; (iv) rinsed with deionised water several times, and (v) dried and kept tightly capped in storage.

2.3 A timer shall be used to time the period for flushing and stagnation.

2.4 All samples shall be taken from cold water taps for cooking, drinking or food preparation purposes e.g. drinking water taps in kitchens and pantry areas.

2.5 Drinking water samples shall not be taken at the following locations:

a) Leaking drinking water tap;
b) Drinking water tap installed with an inline water filter or a point-of-use filter with no bypass switch;
c) Insufficient space to accommodate the sampling bottle;
d) Environment with high risk of contamination such as close to works site or dirty drinking water tap.

2.6 All information and observation regarding the sampling location shall be recorded, in particular, when a tap at a sampling location is considered not representative and rejected due to unhygienic surroundings.

2.7 Never rinse sample bottle prior to sample collection.

3. Two-tier Sampling Protocol with Collection of Auxiliary Samples

3.1 Tier 1 – Random Day Time (RDT) Sample

[6] FEP: perfluoro(ethylene-propylene) plastic; PE: polyethylene; PP polypropylene; PE-HD: high density polyethylene; PTFE: polytetrafluoroethylene To verify that the exceedance is not caused by unduly long stagnation

3.1.1 A 1-litre unflushed sample shall be taken at random during normal working hours i.e. 9 am to 5 pm, from a cold water tap for cooking, drinking or food preparation, e.g. drinking taps in kitchens or pantry areas. If the tap is a single lever mixing tap, the water sampler shall ensure that only cold water is obtained without any mixing by switching the lever fully to the cold water supply.

3.1.2 Place a sample bottle under the tap. Start the timer and collect the first 1-litre of drinking water with the tap opened as much as possible. However, care should be taken to avoid water escaping from the sample bottle. During sampling, aerator or similar device shall not be removed. Never rinse the sample bottle with the tap water. Let the water run at the same flowrate after the RDT sample collection without interruption to the flow and the timing.

3.2 Auxiliary sample – 2MF sample

Collect another 1-litre of water when the timer shows exactly 2 minutes after the RDT sample collection has been taken by placing a sample bottle immediately under the tap. Care should be taken to avoid water escaping from the sample bottle. Let the water run at the same flowrate after sample collection with no interruption to the flow and the timing.

3.3 Tier 2 – 30-minute stagnation (30MS) sample

3.3.1 The timer shall continue running and so is the water tap. When the timer shows 5 minutes, turn off the tap and allow the water system to stagnant for 30 minutes during which no water shall be used in the premises. Continue the timing.

3.3.2 After the 30-minute stagnation (the timer shows exactly 35 minutes), place a sample bottle under the tap. Collect 1-litre of water with the tap opened as much as possible. Once again, care shall be taken to avoid water escaping from the sample bottle. Never rinse the container with the tap water.

3.4 Auxiliary sample – 30MS sequential samples

3.4.1 Inspect the plumbing system and estimate the volume of water in plumbing system to be sampled based on the pipe diameter (Table 1). Calculate the number of 1-litre sequential samples (n) required to be collected from the estimated volume of water.

Table 1: Volume per length of pipe

Outer pipe diameter (mm)	Typical pipe thickness (mm)	Volume per metre (L/m)
15	0.7	0.15
22	0.9	0.32

n = length of pipe (in m) x volume per length (in L/m) and rounded up to the nearest integer.

3.4.2 Immediately after collection of the 30MS sample, collect the required number of sequential samples. Place immediately each empty sample bottle under the tap once the preceding bottle is filled up without interruption to the flow, until all sequential samples are collected.

4. Sample Labelling and Transfer

4.1 All sample bottles shall be properly labelled immediately after they are lidded to avoid unintentional mislabelling and sample mix-up. Pack each water sample bottle in a plastic bag and store them in a cold box for transportation. Deliver the samples to an accredited laboratory for analysis as soon as possible after completion of the sampling. Care shall be taken to avoid sample contamination during sample collection and transportation.