# The 2021 Annual Report on Drinking Water Quality in Hong Kong

Development Bureau Drinking Water Safety Unit June 2022

# Content

3
5
0
3
8
0
1
2
3

Annex 1 – Monitoring of Drinking Water Safety in Hong Kong

Annex 2 – Third Party Audit and Surprise Check on WSD's Drinking Water Quality Management System

# Foreword

1. This report gives an account of the work of the Development Bureau ("DEVB") and the Water Supplies Department ("WSD") in assuring and enhancing drinking water safety in Hong Kong in 2021.

## Monitoring of Drinking Water Safety in Hong Kong

- 2. In Hong Kong, WSD is the sole water supplier supplying fresh water to over 99.99% of the territory's population, while the Food and Environmental Hygiene Department ("FEHD") with the assistance of other Government Departments<sup>1</sup> monitors regularly the water quality of streams and wells<sup>2</sup> for potable use to the remaining less than 0.01% of the population living in remote areas where mains water supply is not available.
- 3. The Government attaches great importance to drinking water safety with the prime objective of supplying clean and wholesome drinking water at all times compliant with the Hong Kong Drinking Water Standards ("HKDWS"). The Government also exercises regulatory control of plumbing works and materials to safeguard drinking water quality.
- 4. A dedicated team in DEVB, viz. the Drinking Water Safety Unit ("DWSU"), oversees and monitors the performance of WSD in respect of drinking water safety by:
  - (a) examining the results of WSD's water quality monitoring programme;
  - (b) monitoring the implementation of WSD's Water Quality Incident Management Plan ("WQIMP"); and
  - (c) conducting audits on WSD's Drinking Water Quality

<sup>&</sup>lt;sup>1</sup> Three Government Departments, viz. WSD, the Department of Health ("DH") and the Government Laboratory, provide technical advice and support to FEHD in monitoring the water quality of streams and wells.

<sup>&</sup>lt;sup>2</sup> Most of stream and well systems are under the maintenance of the Home Affairs Department.

#### Management System ("DWQMS").

- 5. DWSU's observations on WSD's performance in 2021 are summarised in paragraphs 15 to 24, 27 to 33, 36 to 43 and 52 of this report.
- 6. The main duties and responsibilities of DEVB, WSD and FEHD in monitoring drinking water safety in Hong Kong are listed in **Annex 1**.

#### Drinking Water Safety Advisory Committee

- 7. In January 2018, the Government set up the Drinking Water Safety Advisory Committee ("DWSAC") with members comprising academics and experts of related fields to advise DEVB on drinking water safety issues and to examine the Government's efforts in safeguarding drinking water safety. The terms of reference of DWSAC can be found in DEVB's website<sup>3</sup>.
- 8. DWSAC convened two meetings in 2021. DWSAC considered major international water quality incidents and developments on drinking water standards in overseas jurisdictions, and provided useful advice based on relevance of such incidents or issues to Hong Kong's context. In respect of the updates made by overseas jurisdictions on their drinking water standards, DWSAC agreed that a review on HKDWS was unnecessary for the time being while updates should be made to our Watch List<sup>4</sup> as appropriate. DWSAC acknowledged the Government's efforts in ensuring drinking water safety and in general was satisfied with WSD's follow-up actions on cases of the exceedance in HKDWS found in the year. DWSAC also suggested the Government continue to promote the implementation of Water Safety Plan for Buildings ("WSPB").

<sup>&</sup>lt;sup>3</sup> www.devb.gov.hk/en/boards\_and\_committees/drinking\_water\_safety\_advisory\_committee/ terms\_of\_reference

<sup>&</sup>lt;sup>4</sup> For more information of the Watch List, see paragraph 11 and footnote 7 below.

#### **Update of Hong Kong Drinking Water Standards**

- 9. In September 2017, the Government adopted the guideline values/provisional guideline values of 92 parameters in the World Health Organization ("WHO")'s Guidelines for Drinking-water Quality ("GDWQ") as HKDWS. With reference to WHO's advocacy to devise standards suitable to individual jurisdiction's own local context, the Government commissioned an expert consultant for a review to establish a set of drinking water standards suitable for adoption in Hong Kong. The expert consultant studied the practices/guidelines in two international organisations and seven overseas nations<sup>5</sup>, and reviewed potential relevant parameters for inclusion in HKDWS.
- 10. Taking into account the expert consultant's findings and recommendations, as well as with DWSAC's affirmation, the Government drew up and announced on 22 April 2021 the latest set of HKDWS. Parameters newly included or retained in HKDWS were decided based on their respective likelihood of occurring in Hong Kong's drinking water and their potential to cause adverse health effects. The latest set of HKDWS, as endorsed by the Secretary for Development, consists of 60 chemical, radiological and microbiological parameters.
- In addition to drawing up HKDWS, the Government also established the Surveillance List<sup>6</sup>, Watch List<sup>7</sup> and Aesthetic Guidelines<sup>8</sup>. In July 2021, the Watch List was updated after considering the then

- <sup>7</sup> For keeping in view of the international development and including parameters with their potential health risk not yet fully established scientifically.
- <sup>8</sup> For ensuring the aesthetic quality of the drinking water in Hong Kong.

<sup>&</sup>lt;sup>5</sup> viz. WHO, the European Union, the United Kingdom, the United States of America ("USA"), Canada, Australia, New Zealand, Singapore and Japan.

<sup>&</sup>lt;sup>6</sup> For surveillance monitoring and including parameters with their levels in the drinking water of Hong Kong at low or even undetectable level, and far below a level that would cause adverse health risk, as well as microbial parameters which serve to indicate the sanitary of drinking water supply systems.

developments of overseas drinking water standards and consulting with DWSAC. The latest HKDWS, Surveillance List, Watch List and Aesthetic Guidelines can be found in DEVB's and WSD's websites<sup>9</sup>.

#### Keeping Abreast of Developments of Overseas Drinking Water Standards

- 12. In 2021, the Australian Drinking Water Guidelines introduced a new guidance on short-term exposure values, while the United States Environmental Protection Agency promulgated the Lead and Copper Rule Revisions. After careful evaluation, the Government considered it unnecessary to kick-start a review on HKDWS arising from the above overseas measures for the time being.
- 13. In 2021, WHO did not update its GDWQ but published background documents<sup>10</sup> for some chemicals, similar to what it had done in 2020.
- 14. The Government will continue to keep abreast of latest international developments on drinking water standards and trigger necessary reviews of HKDWS at appropriate junctures, following the established framework, which would be conducted in a professional manner followed by consultations with stakeholders.

<sup>&</sup>lt;sup>9</sup> www.devb.gov.hk/en/issues\_in\_focus/hkdws and www.wsd.gov.hk/en/core-businesses/ water-quality/my-drinking-water-quality/hong-kong-drinking-water-standards

<sup>&</sup>lt;sup>10</sup> WHO's background document for a chemical substance evaluates the risks to human health arising from exposure to that chemical in drinking-water and derives its guideline value/ provisional guideline value, where appropriate.

#### **Drinking Water Quality in Hong Kong**

- 15. In year 2021, WSD continued to submit water quality testing reports of its routine monitoring programme to DWSU on a quarterly basis and publish the drinking water quality monitoring data on its website<sup>11</sup> half-yearly.
- 16. WSD adopted new frequencies for monitoring some parameters in HKDWS as planned according to the phased programme<sup>12</sup>. In April 2021, WSD extended the scope of its monitoring programme to cover its fresh water tanks<sup>13</sup>.
- 17. In 2021, WSD made over 28 300 sampling visits to different locations to take drinking water samples and conducted over 267 300 chemical, physical, bacteriological, biological, radiological, trace organics and trace inorganics tests as shown in Table 1 below. With the exception of an exceedance case in which *Escherichia coli* ("*E. coli*") was found in a drinking water sample collected from a water tank (see paragraph 27 below for details), all other test results complied with HKDWS.

<sup>&</sup>lt;sup>11</sup> www.wsd.gov.hk/en/core-businesses/water-quality/my-drinking-water-quality

<sup>&</sup>lt;sup>12</sup> More details can be found in paragraph 17 of the 2019 Annual Report on Drinking Water Quality in Hong Kong at www.devb.gov.hk/filemanager/en/content\_1178/The\_2019\_ Annual\_Report\_on\_Drinking\_Water\_Quality\_in\_Hong\_Kong\_Eng.pdf.

<sup>&</sup>lt;sup>13</sup> Previously, water samples of water tanks were taken to serve the sole purpose of verifying water quality after cleansing of the water tanks.

	Water Treatment Works	Service Reservoirs and Water Tanks	Connection Points <sup>14</sup>	PACTs <sup>15</sup>	Total
Chemical &	16 461	7 425	958	19 093	43 937
Physical	(59 950)	(22 479)	(3 340)	(66 602)	(152 371)
Destarials sizel	916	7 409	942	19 076	28 343
Dacteriological	(2 748)	(22 227)	(2 826)	(57 228)	(85 029)
Dialagiasl	62	0	0	0	62
Diological	(114)	(0)	(0)	(0)	(114)
Dadialagiaal	841	12	36	658	1 547
Kaulological	(2 948)	(24)	(72)	(2 530)	(5 574)
Trace Organics	1 348	16	576	577	2 517
	(8 376)	(40)	(3 312)	(3 314)	(15 042)
Traca Inorganica	616	16	72	72	776
made morganics	(6 860)	(368)	(1 008)	(1 008)	(9 244)

 Table 1 - Number of Drinking Water Samples taken in 2021

Figures in the parentheses indicate number of test conducted.

18. In addition to the sampling visits mentioned in paragraph 17 above, WSD also collected drinking water samples at consumers' taps in 675 randomly selected premises under the Enhanced Water Quality Monitoring Programme ("Enhanced Programme") to monitor the levels of antimony, cadmium, chromium, copper, lead and nickel, which might exist in inside services. Starting from May 2021, WSD extended the scope of the Enhanced Programme to also cover the testing of residual chlorine and *E. coli*, and a total of 423 water samples were tested for the two new parameters. The test results of the Enhanced Programme for year 2021 had been announced at WSD's website, with a summary given in Table 2 below.

<sup>&</sup>lt;sup>14</sup> Connection points are strategic water sampling points in the WSD water mains used to represent the drinking water supplied up to the lot boundary of buildings.

<sup>&</sup>lt;sup>15</sup> PACTs refers to "publicly accessible consumers' taps" which are consumers' taps used for drinking or food preparation purposes in non-domestic premises such as shopping centres, community facilities, clinics, management offices, government offices, etc. that are accessible for sampling by WSD without the need for obtaining prior written consent.

	Minimum	Maximum	Average	95 <sup>th</sup> Percentile	Standard Value	Compliance Rate with HKDWS*
Antimony (µg/L)	<1	<1	<1	<1	20	100%
Cadmium (µg/L)	<1	1	<1	<1	3	100%
Chromium (µg/L)	<1	4	<1	<1	50	100%
Copper (µg/L)	<3	620	32	120	2 000	100%
Lead (µg/L)	<1	17	<1	1	10	99.9% <sup>#</sup>
Nickel (µg/L)	<1	98	3	6	70	100%
Residual Chlorine (mg/L)	< 0.1	1.1	0.4	0.8	5	100%
<i>E. coli</i> (cfu/100mL)	0	0	0	0	0	100%

 Table 2 - Monitoring Results in 2021 under the Enhanced Programme

Note:  $\mu g/L = microgram/litre; mg/L = milligram/litre; cfu = colony forming unit$ 

\* Compliance with HKDWS for the six metal parameters is based on the two-tier sampling protocol<sup>16</sup>.

<sup>#</sup> One case of lead exceedance was found due to improper maintenance of the internal plumbing system of the premises concerned (see paragraphs 19 to 21 below for details).

#### A Lead Exceedance Case found under Enhanced Programme

- 19. One case of lead exceedance over HKDWS was found in the drinking water samples taken from a private non-domestic unit in Wan Chai in end October 2021. This was the first case of lead exceedance found in both the Tier 1 and Tier 2 samples since the launching of the Enhanced Programme in December 2017, under which over 2 110 samples had been collected and tested so far.
- 20. After confirming the exceedance in lead, WSD liaised with and gave advice to the parties concerned in a timely manner according to the established procedures. WSD also conducted checks (including surprise checks) to ensure the premises owner had posted notices to notify the occupiers of the premises about the incident and implemented necessary mitigation measures (e.g. provision of adequate bottled water) before the problem was rectified. The premises owner subsequently arranged a qualified person ("QP") to investigate the problem. The investigation revealed that the cause of

<sup>&</sup>lt;sup>16</sup> The Enhanced Programme adopts a two-tier sampling protocol for the six metals, involving Tier 1 – unflushed Random Day Time sample and Tier 2 – 30-minute stagnation sample for verification of exceedance(s) found in the Tier 1 sample.

the lead exceedance was attributed to improper maintenance of the fresh water tanks of the premises concerned, which had not been cleansed for an extended period of time with metal fragments found at the bottom<sup>17</sup>. Upon cleansing of the water tanks, the drinking water of the premises concerned was tested again by QP and found in compliance with HKDWS in respect of lead. Subsequently, WSD also did its own water sampling test in the premises concerned and affirmed the same.

21. In this incident, DWSU was content with WSD's swift actions taken and effort made. In particular, DWSU noted that in order to ascertain whether the lead exceedance might be attributed to a systemic problem, WSD took prompt action to collect drinking water samples at a restaurant at the ground floor of the premises concerned and found that the lead content complied with HKDWS. This had helped safeguard the well-being of the public from the drinking water safety perspective.

#### Monitoring of Cryptosporidium oocyst and Giardia cyst ("C&G")

- 22. As part of its routine water quality monitoring work, WSD continued to monitor the presence of  $C\&G^{18}$  in Hong Kong's raw and drinking water.
- 23. Over the past many years, *C&G* had not been detected in both the raw water and treated water at water treatment works. However, in July 2021, one *Giardia* cyst was detected in a raw water sample collected at the High Island Main Tunnel ("HIMT"), which conveys raw water collected from the High Island Reservoir catchment area. In response to the test result, WSD suspended immediately the abstraction of raw water from HIMT to water treatment works ("WTW") as a prudent measure. WSD also collected treated water

<sup>&</sup>lt;sup>17</sup> The water tanks contained foreign metal fragments and a lot of sediments. It is believed that these foreign metal fragments had been immersed in water for a long time and hence were seriously corroded, which gave rise to the exceedance in lead content in the drinking water samples collected.

<sup>&</sup>lt;sup>18</sup> *Cryptosporidium* and *Giardia* are common intestinal protozoan parasites. C&G are potentially present in surface waters, ground waters and other media. They can survive for prolonged periods of time in cool and moist environments.

samples at the downstream WTW (including the Sha Tin WTW and Pak Kong WTW) for testing and no C&G were detected. In addition, WSD arranged thorough flushing of HIMT with satisfactory test results in further raw water samples. Subsequently, HIMT resumed to its normal operation in October 2021.

24. While the above incident should not have adverse effect on drinking water safety<sup>19</sup>, the presence of *C&G* in raw water source nonetheless required attention from DWSU and WSD. As a follow-up action, DWSU conducted a surprise check in Q4 2021 on WSD's work on patrolling and water quality monitoring in the catchment area. The check revealed that WSD had carried out the work in accordance with its DWQMS. DWSU however noted that some lowland raw water pumping stations ("LRWPS")<sup>20</sup> in the catchment area had just resumed operation during the period when *Giardia* cyst was detected. DWSU thus requested WSD to review the risk assessment on the operation of LRWPS which might be attributable to the problem.

<sup>&</sup>lt;sup>19</sup> According to the Public Health Laboratory Services Branch of DH, there had not been any abnormal upsurge in the number of cases of C&G detected in patients' stool samples in 2021.

<sup>&</sup>lt;sup>20</sup> LRWPS operate on a need basis to pump raw water from lowland areas to HIMT.

#### **Drinking Water Quality Incidents**

#### Water Quality Incident Management Plan

- 25. WSD handles water quality incidents<sup>21</sup> according to its WQIMP which aims to help WSD: -
  - (a) assess expeditiously whether the water affected is still safe for consumption and the possible impact on water supply;
  - (b) decide necessary actions to be taken before resumption of water supply; and
  - (c) disseminate important information to relevant parties and consumers affected.
- 26. According to WQIMP, WSD should inform DWSU of any water quality incidents classified as notifiable cases<sup>22</sup> as soon as possible, via instant message (such as WhatsApp) and through email. DWSU will then oversee WSD's responses to such incidents to ensure that appropriate follow-ups are implemented.

#### Notifiable incidents

#### E. coli in Drinking Water Samples at Wu Kau Tang Fresh Water Tank

27. In 2021, there was one notifiable water quality incident. During WSD's routine monitoring, *E. coli* of 1 cfu/100 mL was found in the

> concerns raised by local resident groups or parties.

<sup>&</sup>lt;sup>21</sup> Water quality incidents are events that may affect water quality including aesthetic qualities which may not be related to drinking water safety; cause concerns to persons and/or give rise to impact on health of persons to whom the water is supplied; and/or likely attract media publicity on drinking water quality.

<sup>&</sup>lt;sup>22</sup> In general, a water quality incident is classified as a notifiable case if it leads to occurrence of any one of the following situations: -

<sup>&</sup>gt; negative impact on health and/or public confidence in the water supply;

exceedance of drinking water standards;

affecting localised area (e.g. whole estate or a number of building blocks) or even more extensive areas;

<sup>&</sup>gt; attracting significant media attention, and/or

drinking water samples collected from the Wu Kau Tang Fresh Water Tank ("WKTFWT") in late September 2021, which failed to comply with HKDWS, according to which *E. coli* should be absent from drinking water. Upon confirmation of the test results, WSD reported this incident to DWSU immediately.

- 28. WKTFWT supplies drinking water to more than 10 remote villages with about 200 households in total. As the presence of *E. coli* would mean that the drinking water in the water tank might have been contaminated, WSD issued a "boiling water" advice to the affected villagers immediately, and at the same time installed a bypass pipe to maintain drinking water supply to the villagers, so that cleansing of WKTFWT could be carried out upon its separation from the water supply system. The water supply system was also flushed during the course. Following the satisfactory installation of the bypass and the affirmation of absence of *E. coli* from the further water samples collected, the drinking water supply to the villages resumed normal in early October 2021 with the "boiling water" advice lifted. Subsequently, the cleansing of WKTFWT was completed in early November 2021 with water samples taken to affirm the drinking water quality. WKTFWT was then put back into service.
- 29. As a follow-up action, DWSU requested WSD to investigate the cause of this incident. In the process, WSD looked into (i) the water supply network, (ii) the design, operation and maintenance of WKTFWT, and (iii) the water sampling activity. WSD found that WKTFWT had been properly designed, maintained and operated<sup>23</sup> and no *E. coli* had been detected in the water supply network nor WKTFWT during previous monitoring. WSD therefore focused its investigation on how the water sampling had been conducted for WKTFWT. After detailed examination, WSD considered that in the process of collecting water samples via an access manhole on the rooftop of WKTFWT, there was a high chance that trace of loose soil surrounding the access manhole might have been accidentally introduced into WKTFWT by the samplers. Such loose soil could

<sup>&</sup>lt;sup>23</sup> As per the water samples tested since April 2021 for WKTFWT and WSD's visual check after the incident, the integrity of WKTFWT was satisfactory with no leakage.

contain fecal contaminants, thus causing bacteria including *E. coli* to enter WKTFWT, which was the likely cause of the incident.

- 30. To prevent recurrence of the incident, WSD proposed and DWSU agreed that future water sampling work for water tanks and the like should be carried out via sampling taps installed at the side wall of the tanks instead of via access manholes atop the tanks. In this connection, WSD would arrange to install sampling taps for WKTFWT and other freshwater waterworks facilities without proper sampling taps.
- 31. In the incident, DWSU was appreciative of WSD's decisive action to install the bypass pipe mentioned in paragraph 28 above which enabled immediate separation of the entire WKTFWT from the water supply network upon confirming that the water quality had failed to comply with HKDWS in respect of *E. coli*. For future water sampling work for water tanks or the like, in the event that non-compliant test results are obtained, DWSU considers it advisable for WSD to also take more water samples at the upstream and downstream sides of the tanks to facilitate assessment of the possible source(s) and extent of contamination.

#### Non-notifiable incidents

- 32. Apart from the above notifiable case, there were 45 non-notifiable incidents of minor nature in 2021. They were mostly complaints about aesthetic quality of drinking water such as discolouration or turbidity that had only affected a single or a few units, and were mostly related to inside services of the premises concerned, and their water quality resumed normal after flushing of the internal strainer of the water meters by WSD or before WSD staff arrived at the scene.
- 33. Overall speaking, DWSU was generally satisfied with WSD's performance in handling the water quality incidents in 2021.

#### Auditing of WSD's Drinking Water Quality Management System

- 34. WSD puts in place a DWQMS<sup>24</sup> to safeguard drinking water quality throughout the water supply system. DWQMS sets out the water quality policy and operational monitoring of the control measures in the drinking water supply. It also lays down a systematic plan for reviewing and auditing relevant procedures of WSD with a view to verifying conformity with documented requirements and improving the system continually.
- 35. As mentioned in paragraph 4 above, one of DWSU's duties is to audit WSD's DWQMS, and it consists of both audits by third party and surprise checks. The objectives and details of the third party audits and surprise checks are given in **Annex 2**. DWSU members also participate as observers during WSD's internal DWQMS audits.

#### Third party audit

36. A third party audit on WSD's DWQMS was conducted from 1<sup>st</sup> to 16<sup>th</sup> of December, 2021<sup>25</sup>. The audit adopted a risk-based approach to check if WSD's activities carried out between August 2019 and November 2021 were in conformity with the requirements set out in DWQMS. Review of records, site visits and staff interviews were carried out in areas covering the whole water supply chain up to consumers' taps, and the Regions/Divisions/Units selected by the audit team are shown in Table 3 below: -

<sup>&</sup>lt;sup>24</sup> As recommended by WHO, WSD has developed and implemented its Water Safety Plan ("WSP") since 2007. In July 2017, WSD promulgated DWQMS, a management system based on the Framework for Safe Drinking-water of the WHO Guidelines, which comprises health-based targets, WSP and surveillance to ensure drinking water safety.

<sup>&</sup>lt;sup>25</sup> This third party audit was originally scheduled for 2020. Owing to the COVID-19 pandemic, the third party audit involving an overseas certified WSP auditor was postponed and subsequently commenced in late 2021 after lifting of the travel restriction by the auditor's home country.

Water Supply Component	<b>Regions/Divisions/Units Audited</b>
Water Resources	Hong Kong and Islands Region
Water Treatment	New Territories East Region,
	Hong Kong and Islands Region
Distribution	Hong Kong and Islands Region,
	New Territories East Region,
	New Territories West Region
Laboratory Operation	Water Science Division
Customer Services	Kowloon Region,
	New Territories East Region
Warehouse, Workshop and	Mechanical and Electrical
Maintenance Services	Maintenance Division
Plumbing Material Control	Material Control Unit
Complaint Handling,	Special Duty Unit,
Incident Reporting,	Customer Telephone Enquiry Centre,
Prosecution and Internal Audits	Public Relations Unit, Prosecution Unit

 Table 3 – Scope of Third Party Audit in 2021

- 37. The audit revealed that WSD's DWQMS document had met WHO's recommendations in respect of WSP, with one non-conformity ("NC") <sup>26</sup>, 16 Opportunities for Improvement ("OFI") and 37 Observations ("OBS") identified.
- 38. Key recommendations of the third party audit were as follows: -
  - (a) licensed plumbers should be reminded to strictly adhere to the test procedures specified by the manufacturer of the test kit for checking the presence of lead at solder joints to better assure the accuracy of test results;
  - (b) the cause of each case of fresh water tanks with residual chlorine level found lower than the operational target of  $0.2 \text{ mg/L}^{27}$  should

<sup>&</sup>lt;sup>26</sup> The NC was a minor one related to the quality assurance of testing procedures for lead check at plumbing installation.

<sup>&</sup>lt;sup>27</sup> The 0.2 mg/L operational target of residual chlorine level at fresh water tanks is to ensure that the water is kept clean and hygienic on its remaining journey to consumers via the water supply system.

be looked into. If the cause is found to be common, appropriate actions should be taken to prevent recurrence, particularly for those fresh water tanks in remote areas;

- (c) the reliability of online analysers<sup>28</sup> should be improved to help optimising chemical dosing and process operation, providing earlier warning of any process failure, and enabling improved water quality control at reduced total cost; and
- (d) the practice for provision of temporary potable water supply should be aligned, including the frequency of tank sterilisation, record keeping of free residual chlorine test result, as well as the scope and regime of monitoring.
- 39. The external auditors also recommended, inter alia, WSD consider continuing the risk-based thinking approach with some enhancement of its internal audits to help narrow down the audit focus and dig out the pain points, and to update the department's DWQMS to capture new processes (e.g. on-site chlorine gas generation).
- 40. In gist, the findings demonstrated that WSD was in general aware of the preventive and mitigation measures specified in DWQMS and had taken appropriate corrective actions accordingly. DWSU would monitor the progress of WSD's follow-up actions before the next third party audit in its surprise checks as appropriate.

#### Surprise checks

41. Four surprise checks were conducted by DWSU in 2021 as summarised in Table 4 below: -

<sup>&</sup>lt;sup>28</sup> For water quality monitoring, grab samples from various stages of the water treatment process were collected and tested regularly by onsite operators and laboratory staff of WSD. Online analysers are used to supplement such monitoring work to give reference and early indication of any potential problems.

Month	<b>Bagions/Divisions Chasked</b>	Number of Findings			
WIUIIII	Regions/Divisions Checked	NC	OFI	OBS	
February	New Territories West Region	0	3	11	
	Water Science Division				
May	Hong Kong and Islands Region	129	5	4	
August	Kowloon Region	0	11	4	
	Water Science Division				
December	New Territories East Region	0	6	3	
	Water Science Division				

 Table 4 – Surprise checks in 2021

- 42. Key recommendations of the surprise checks were as follows: -
  - (a) pipe materials and other waterworks accessories should be randomly checked upon delivery, and acceptance records should be maintained;
  - (b) when the residual chlorine level is found below the operational target of 0.2 mg/L (see footnote 27) in fresh water tanks during routine water quality monitoring, the monitoring frequencies and response actions should be reviewed according to the principles set out in DWQMS, i.e. based on a risk-based approach, so that such low residual chlorine level could be detected earlier with the enhanced monitoring frequency in the future;
  - (c) measures should be devised to enhance the reliability of online water quality analysers at water treatment works to avoid prolonged breakdown;
  - (d) records of the mitigation measures implemented at water treatment works should be maintained in the summary reports for future reference;
  - (e) documentation of the guidelines on regular patrol and inspection of water gathering grounds should be maintained; and
  - (f) monitoring frequencies of C&G in impounding reservoirs should

<sup>&</sup>lt;sup>29</sup> The NC was a minor one involving keeping of acceptance records for random checks on pipe materials and other waterworks accessories upon delivery.

be reviewed by taking into account the risk assessment of presence of C&G in source water (e.g. previous detection of C&G in the raw water, identification of possible source of C&G in the catchment).

43. In gist, the surprise checks revealed that WSD's staff were in general found to have adequate understanding on the requirements of DWQMS, while several areas requiring improvement had been identified. In particular, based on similar observations found in earlier surprise checks and third party audits, DWSU considers that WSD should holistically review how the reliability of its online analysers at water treatment works could be enhanced, so as to enable a more efficient and effective monitoring of its water treatment operations. WSD accepted DWSU's recommendations as detailed in paragraph 42 in full, and DWSU would monitor the progress of WSD's corresponding follow-up actions.

#### Water Safety Plan for Buildings

- 44. Proper management and maintenance of internal plumbing systems is a key and essential element to ensure the safety of drinking water in This is well illustrated by the lead exceedance case found buildings. under the Enhanced Programme (see paragraphs 19 and 20), in which the cause of lead exceedance was attributed to the lack of proper management or maintenance of the internal plumbing system of the WSPB sets out a systematic and effective premises concerned. management framework for internal plumbing systems, which comprises (i) risk identification; (ii) implementation of control measures; (iii) monitoring of operation of control measures; and (iv) periodic internal audits and reviews. Since 2017, WSD has been promoting the implementation of WSPB and also recognising property owners' and/or management agents' efforts through issuing certificates under the "Quality Water Supply Scheme for Buildings -Fresh Water (Management System)".
- 45. To further promote the implementation of WSPB in the community, the Government launched the \$440 million "Water Safety Plan Subsidy Scheme" ("WSPSS") in July 2020 to provide financial incentive for the needed owners to implement WSPB. Details of WSPSS can be found in WSD's website<sup>30</sup>. Up to the end of 2021, a total of 255 applications involving 633 eligible buildings had been received. Subsidies had been disbursed to 47 buildings for their formulation of WSPB.
- 46. Leading by example, the Government launched a programme in July 2020 to implement WSPB in existing and new Government buildings. Under the programme, targeted existing Government buildings would implement WSPB in three phases<sup>31</sup> by 2027, and WSD was tasked to assist other bureaux/departments in formulating WSPs for buildings

<sup>&</sup>lt;sup>30</sup> www.wsd.gov.hk/en/water-safety/wspss

<sup>&</sup>lt;sup>31</sup> Phase 1 buildings include staff quarters, schools, clinic, health care centres, and priority cultural and recreational buildings. Phase 2 buildings include office buildings, building used by disciplined forces and other cultural and recreational buildings. Phase 3 buildings include buildings of other categories.

managed by the latter. As at the end of 2021, the phase 1 work was in progress with 80% of site inspections completed and formulation of WSPs underway.

#### **Review of Waterworks Ordinance (Cap. 102)**

47. The Waterworks Ordinance (Cap. 102) and its Regulations (Cap. 102A) ("WWO/WWR") is being reviewed to enhance drinking water safety and water use efficiency. Following the completion of a 90-day public consultation in February 2021 on the proposed legislative amendments, the Government has been reviewing the views and opinions collected for preparation of the related law drafting.

#### **Raising the Residual Chlorine Level**

- 48. It has been WSD's practice to maintain a small amount of residual chlorine in the treated water to ensure that the water is kept clean and hygienic on its journey to consumers. As the COVID-19 pandemic continued to affect the community of Hong Kong in 2021, WSD raised the residual chlorine level in the treated drinking water from around 1.0 mg/L to around 1.2 mg/L when it left WTW as a prudent measure. The raised residual chlorine level is still well below the standard value of 5 mg/L stipulated in HKDWS, and it helps kill bacteria and virus that may enter the water supply network downstream of WTW.
- 49. WSD will keep the development of the pandemic in view and will lower the residual chlorine level to the normal level when appropriate.

#### **Small Water Supply in Remote Areas**

- 50. As mentioned in paragraph 2 above, FEHD regularly monitors the water quality of streams and wells for potable use to the remaining less than 0.01% of the population living in remote areas where no mains water supply is available. Unlike drinking water supplied by WSD, the stream/well water has not undergone thorough treatment processes. Therefore, local villagers are advised by FEHD to boil the stream/well water before drinking, and to disinfect stored stream/well water.
- 51. In 2021, FEHD, in consultation with other relevant Government Departments and DWSU, completed reviewing their procedural guide for monitoring the water quality of streams and wells for potable use, and will start monitoring the stream/well water accordingly in 2022. If the sampling results are found unsatisfactory against the prescribed quality parameters for stream and well water for potable use, FEHD would conduct investigation and post up notice to advise local villagers, as well as bring the case to the attention of other relevant Government Departments.

#### **Conclusion and Way Forward**

- 52. In conclusion, Hong Kong's drinking water in 2021 remained very safe with high compliance rate against HKDWS. The two incidents of exceedance of HKDWS (see paragraphs 19 and 27 respectively) were isolated cases due to improper maintenance of the internal plumbing system of individual premises and possible contamination of the drinking water by WSD's sampling activity respectively. There was no sign of systemic problem in Hong Kong's drinking water treatment and supply system.
- 53. DWSU was in general content with WSD's efforts made in 2021 in assuring drinking water safety in the territory, as well as the department's positive responses to the findings and recommendations associated with the third party audit and surprise checks conducted by DWSU in the year.
- 54. DWSU will continue to oversee WSD's performance on drinking water safety through the established monitoring mechanism. DWSU will oversee the drafting work of the proposed legislative amendments to WWO in respect of drinking water safety, as well as steer the promotion and implementation of WSPB in both private and Government buildings.
- 55. WHO updated its GDWQ in March 2022 to incorporate the recommendations in its background documents for chemicals published in 2020 and 2021, inclusive of changing certain guideline values. A review of HKDWS will thus commence in 2022 to keep our drinking water standards up-to-date with the international practices.

~ End ~

## Monitoring of Drinking Water Safety in Hong Kong

1. The Development Bureau ("DEVB"), the Water Supplies Department ("WSD") and the Food and Environmental Hygiene Department ("FEHD") are the key government bureau/departments responsible for monitoring the drinking water safety in Hong Kong in different aspects: -

Development Bureau

- (a) To enhance public confidence on drinking water safety in Hong Kong, DEVB has set up a dedicated team, namely the Drinking Water Safety Unit ("DWSU") to undertake, among other aspects of work, the duties of overseeing the performance of WSD in respect of drinking water safety. DWSU operates impartially and independently from the Bureau's housekeeping team for WSD.
- (b) DWSU oversees and coordinates matters relating to revision of the Hong Kong Drinking Water Standards ("HKDWS"), including initiating review on a need basis with WSD's support and advice/recommendations provided by the Drinking Water Safety Advisory Committee ("DWSAC"). DWSU will seek endorsement by the Secretary for Development ("SDEV") for any revision to HKDWS.
- (c) DWSU reviews WSD's water quality reports, which cover Dongjiang water, raw water and treated water to ensure compliance with HKDWS at consumers' taps, on a quarterly basis. Although the reviews mainly focus on treated water, DWSU also looks into the quality of Dongjiang water and raw water which may have bearing on the quality of treated water.
- (d) DWSU monitors the operations of WSD in respect of drinking water safety from sources to consumer taps through regular surprise checks by in-house staff and third party audits by external auditors. DWSU also keeps track of follow-up actions by WSD on the recommendations from regular surprise checks and audits, if any, including revision of the department's Drinking Water Quality Management System ("DWQMS").

- (e) DWSU examines the performance of WSD in handling water quality incidents in accordance with its Water Quality Incident Management Plan ("WQIMP") as well as the corresponding improvement measures, if any, with a view to avoiding recurrence of incidents. Where necessary, DWSU may seek views from DWSAC on such incidents or engage external party for conducting further investigation.
- (f) DWSU monitors the performance of WSD in carrying out its duties under Waterworks Ordinance (Cap. 102) ("WWO") in ensuring drinking water safety in inside services. DWSU also oversees WSD's performance in taking forward administrative measures to enhance drinking water safety at consumers' taps.
- (g) DWSU also liaises with FEHD in monitoring the quality of small water supply, i.e. water drawn from streams and wells for potable use in remote areas where no mains water supply is available. When necessary, DWSU may examine the water quality data of streams and wells.
- (h) DWSU, with the advice from DWSAC and assistance of WSD, continues to review from time to time on the international development in relation to drinking water safety and steer WSD for making continuous improvement of its DWQMS.

#### Water Supplies Department

- (a) WSD strives to ensure drinking water safety from sources to taps to ensure compliance with HKDWS at consumers' taps.
- (b) WSD adopts a risk-based management approach under the DWQMS to conduct monitoring and to implement control measures in the drinking water supply, i.e. from source through treatment, distribution to point of consumption, so as to ensure drinking water safety.
- (c) WSD reviews regularly the latest international development on drinking water standards, studies any drinking water quality incidents both locally and internationally, and makes recommendations to DWSU, when necessary.

- (d) WSD sets out the specifications for the use of materials at government's new waterworks<sup>1</sup> to ensure drinking water quality. Besides, WSD ensures that the government's new waterworks are properly constructed and installed.
- (e) WSD implements control of plumbing materials, and construction and operation of inside services in accordance with WWO and by means of administrative measures to safeguard drinking water safety in inside services.
- (f) WSD will handle water quality incidents in accordance with its WQIMP. When there is a notifiable water quality incident<sup>2</sup>, WSD will report it to DWSU promptly.
- (g) WSD regularly reviews and revises, as necessary, DWQMS and WQIMP. Besides, WSD takes appropriate measures to ensure awareness of the department's staff of the DWQMS and WQIMP.

#### Food and Environmental Hygiene Department

- (a) FEHD coordinates with other Government Departments<sup>3</sup> to monitor the water quality of streams and wells for potable use in remote areas where mains water supply is not available and to take necessary measures when there is any exceedance in accordance with the Public Health and Municipal Services Ordinance (Cap. 132).
- 2. Head of DWSU shall report directly to SDEV and the Permanent Secretary for Development (Works) in discharging his/her daily duties. Where the case is related to water supply from streams or wells under the purview of FEHD, DWSU will liaise with FEHD for necessary follow up action.

<sup>&</sup>lt;sup>1</sup> For example, government's new water treatment plant or new water mains.

<sup>&</sup>lt;sup>2</sup> As defined in footnote 22 on page 10 of the main report.

<sup>&</sup>lt;sup>3</sup> Three Government Departments, viz. WSD, the Department of Health and Government Laboratory, provide technical advice and support to FEHD in accomplishing the task. When necessary, these Government Departments may provide advice/information to FEHD about the latest international practices in monitoring drinking water quality of streams or wells with a view to facilitating FEHD in devising monitoring regime.

3. To maintain public confidence over drinking water safety, DWSU publishes annually a report on its work as well as its observations over the performance of WSD in relation to drinking water safety.

- End -

#### Third Party Audit and Surprise Check on WSD's Drinking Water Quality Management System ("DWQMS")

# Third Party Audit

- 1. The objective of the third party audits is to verify the extent of compliance with the requirements of DWQMS across various functions and activities of the Water Supplies Department ("WSD"), and to identify areas requiring improvements.
- 2. To ensure the impartiality and credibility of the third party audits, external auditors with proven experience in management system and Water Safety Plan ("WSP") audits are engaged to form the audit team<sup>1</sup>.
- 3. The Drinking Water Safety Unit ("DWSU") arranges conducting a third party audit once a year which covers all major functions described in DWQMS. The frequency of the third party audits will be reviewed from time to time.

#### Surprise Checks

- 4. The surprise checks provide a more focused auditing of specific critical processes as well as the progress of the follow-up action in respect of the improvement and corrective actions identified via WSD's internal audits, water quality incidents, third party audits, surprise checks, etc.
- 5. The checks provide further assessment on the safety of drinking water in Hong Kong, which are carried out by DWSU members with chemistry/engineering background as well as auditing knowledge.
- 6. DWSU performs the surprise checks on a quarterly basis and will review its frequency from time to time.

- End -

<sup>&</sup>lt;sup>1</sup> The team will comprise ISO 9001 auditors and an overseas certified WSP auditor.