

Exemption Decision Paper

Exemption Number	EXE-00001014
Exemption Type	Residual Disinfection Exemption
Supply Name	Wellington Region Bulk Water
Supply ID	WEL003
Date	11 January 2024 / te 11 o Kohitātea 2024
Submitted by	Wellington Water Limited
Exemption Team	Jim Graham, Principal Advisor, Drinking Water India Eiloart, Senior Technical Advisor
International panel member	Charles Haas
Exemption	Waterloo WTP C.t value

Recommendation

For reasons set out in this paper, the Exemption Team considers that the application for exemption from the chlorine concentration/time (C.t) requirements of the Drinking Water Quality Assurance Rules (DWQAR) cannot be granted under section 58 of the Water Services Act 2021 (WSA) because chlorine C.t is part of primary disinfection and not residual disinfection.

Executive summary

1. On 5 December 2022, Wellington Water Limited (WWL) applied for an exemption from the requirement to use residual disinfection at Waterloo Water Treatment Plant (WTP). The Waterloo WTP is a part of the Wellington Region Bulk Water drinking water supply (supply ID WEL003). Under the WSA, a drinking water supply that includes reticulation is required to have residual disinfection.
2. The DWQAR include:
 - treatment / T3 rules for water treated with chlorine as a type of primary treatment
 - distribution / D3 rules, which provide detail about how to comply with the statutory requirement to use residual disinfection (most commonly chlorine) in supplies that include reticulation.
3. The exemption application indicates that the supply currently provides for residual disinfection as the water in the distribution system is likely to meet the D3 rules for chlorine.

4. Nevertheless, the application seeks an exemption under section 58(1)(b) of the WSA in relation to the inability of the Waterloo WTP to provide sufficient C.t to water that is chlorinated as part of the primary treatment process and delivered to the distribution network.
5. A residual disinfection exemption cannot be granted for C.t value requirements, as C.t is a part of the primary disinfection process of water treatment rather than part of the residual (secondary) disinfection process that section 58 of the WSA relates to. This is the case even though C.t requirements can sometimes be satisfied while treated drinking water is resident in a distribution network, before it reaches the first point of supply to a consumer.
6. Te Titriti o Waitangi and Te Mana o te Wai considerations have not been assessed in relation to this application as it is considered that an exemption to residual disinfection cannot be granted under section 58 of the WSA for non-compliance with DWQAR rules for C.t.

Supply information

7. The Wellington Region Bulk Water drinking water supply serves a registered population of approximately 350,000 consumers across Wellington, Hutt, Upper Hutt and Porirua Cities.
8. There are three source water bodies used across the supply. The one of interest in this application is the Waiwhetu Aquifer which lies beneath the Hutt Valley. It is accessed by two bore fields at Waterloo and Gear Island.
9. Waiwhetu Aquifer supplies around 40% of the annual water supply demand for the bulk water supply, which increases to almost 70% in summer periods due to flow restrictions on surface water sources. The current resource consent to abstract groundwater expires on 12 August 2033. Restrictions on water abstraction are in place based on groundwater levels measured at the Petone foreshore, downgradient from the bore fields. Previously when approaching the limit, WWL has restricted abstraction from the aquifer.
10. Saline intrusion of the Waiwhetu Aquifer due to over-abstraction is a significant risk, particularly in summer during high demand.
11. Waterloo is the primary bore field and focus of this application. It consists of eight bores located along Knights Road, Hutt Central and side-roads. In high summer demand, all eight bores will operate at full capacity. The bores range from 37 to 39 metres deep, and intake screens are installed in the lower 12-15 metres of each bore. Additional bores in this bore field have been shut down due to the risk posed by active contamination pathways identified in 2016 and 2017.
12. The aquifer recharge zone between Taita Gorge and Avalon may be vulnerable to contaminating activities. The aquitard at Waterloo bore field is considered relatively permeable, shallow and thin, making it unreliable as a protection from surface contaminants. Any disturbance around the bore field is considered as exacerbating the issue. Excavations deeper than 3 metres can potentially affect the aquitard.
13. The supplier has assessed the source bores as Class 2 bores under the DWQAR, requiring 3-log protozoal treatment. Taumata Arowai considers this assessment appropriate.

14. Raw water is abstracted through the bores and then transported to the Waterloo WTP 2.6 km from the bore field. The Waterloo WTP has a peak flow rate of 115 MLD but usually operates at about 70-80 MLD. The Waterloo WTP directly supplies approximately 155,000 consumers in Lower Hutt and Wellington City.
15. The Waterloo WTP requires pH correction due to low pH of the raw water (~6.2) and run-to-waste systems to manage elevated turbidity in the water upon bore startup.
16. Treatment at the Waterloo WTP consists of UV disinfection followed by aeration, hydrated lime and sodium hypochlorite dosing. This is performed in two identical parallel treatment trains to allow for redundancy during maintenance. Sodium silicofluoride is dosed at two points after the treatment plant to fluoridate the majority of the supply served by Waterloo.
17. Each treatment train starts with UV disinfection which provides a protozoa barrier. The UV reactors are each capable of delivering 40 mJ/cm² at an average flow rate of 33.5 ML/d, and 12 mJ/cm² at approximately 60 ML/d.
18. The UV dose can be maintained above 40 mJ/cm² which provides a bacterial barrier and does so at certain times, including during maintenance activities. However, the normal operation of the supply is to use UV to provide a protozoa barrier which requires a minimum dose rate of 12 mJ/cm². Therefore, the UV disinfection is capable of performing as a bacterial barrier but does not do that most of the time.
19. Water then enters the aeration chamber which is used for pH adjustment to remove CO₂. The aerator chamber is contained within the contact reservoir where chemical dosing takes place.
20. Lime is dosed as a dry powder to a carry water stream and dosed to each reservoir after aeration. Lime is used as a pH adjustment to reach the target pH range of 7 to 8.5, and to reduce pH fluctuations.
21. Chlorination is the intended barrier to bacteria and viruses and is administered by dosing sodium hypochlorite to the reservoirs post aeration. It is the primary barrier to bacteria and virus contamination. Residual FACE is set to be higher than 0.2 mg/L. Treated water chlorine residual of less than 0.4 mg/L for 3 minutes triggers a plant shut down and run to waste if possible.
22. There is no further storage at Waterloo WTP, and the contact tanks do not provide sufficient C.t contact time alone. Therefore, C.t contact time in the distribution system, after the water has left the treatment plant is relied upon to meet C.t contact time requirements.
23. The bulk distribution network is designed to disperse the water across the supply to the various local network zones at bulk supply points. It comprises of 187 km of water mains and 14 pump stations and provides multiple points of supply to zones depending on water availability.
24. There are 27 distribution zones in the local network, 11 of which are supplied by Waterloo WTP.
25. Bulk supply points can be at reservoirs or points where water is supplied directly to the network. Supply points also include an optimiser which automates inflow to the local distribution based

- on available water, expected demand, power charges, network charges, treatment costs and other factors to minimise the overall cost of operation.
26. The bulk distribution network connected to Waterloo includes cross-connections with the local network due to hydraulic constraints in the eastern hills of Lower Hutt, particularly Rata and Sunville areas. These cross-connections are in two locations, Epuni Street and Tilbury Street. The result is approximately 200-800 consumer properties receive water with an insufficient C.t value to meet DWQAR rule T3.2 which requires water post chlorination to achieve a chlorine C.t value of at least 15 min.mg/L for at least 95% of each day.
 27. C.t value calculations estimate the minimum value achieved before the first consumer due to cross connections is 6 min.mg/L. This has been estimated using a supply model to consider which connections may receive water with a contact time of less than 21.4 minutes with 0.7 mg/L chlorine dose. It assumes a 0.5 baffling factor in the contact tanks at Waterloo WTP and it is unclear if pH is considered in these calculations.
 28. A third cross-connection has been closed recently at Waterloo Road, after upgrades to pump stations in the affected zone remedied pressure issues.
 29. The bulk and local supply networks include facilities for manual top-up chlorination, but it is not clear whether these points are available for these affected zones.
 30. A backflow prevention programme is being implemented as a major risk management improvement; this is associated with the lack of consistent backflow prevention across the supply. It has been identified in the drinking water safety plan (DWSP) that the backflow programme requires acceleration after suffering delays from limited resources and the need to support multiple councils.
 31. Since it became the regulator in mid-November 2021, Taumata Arowai has received 23 notifications of non-compliance or potentially unsafe drinking water in relation to the supply. Of these notifications, two are classified as critical, five as high, one as low and the remaining 15 as medium. One notification relates to the C.t value shortfall, and the others relate to water main failures and loss of supply to consumers.
 32. The Exemption Team reviewed the Annual Reports on Drinking-water Quality published by the Ministry of Health in order to examine the previous compliance history of the Wellington Region Bulk Water drinking water supply and associated supplies: i.e. Porirua, Upper Hutt, Lower Hutt and Wellington City supplies. Reports dating back to the 2016/17 year were considered. Protozoal, bacterial and chemical standards have all been reported as being met across this period, as well as compliance with the Health Act 1956.

Information provided by the applicant

33. WWL's exemption application was accompanied by a covering letter.
34. The Exemption Team referred to the most recently prepared DWSP (copy provided to Taumata Arowai on 17 January 2023) where applicable.

35. Additional supporting information was also provided, namely the Waterloo Water Treatment Plant Disinfection System Review Report by Stantec (February 2022).
36. Upon request, an email of further details and clarifications was provided on 4 April 2023. This included Process and Instrumentation Diagrams for the aeration and reservoirs, UV treatment, wellfield collection and run to waste system, lime and blower system, chlorine dosing, and pH monitoring, the Rata and Sunville Rezoning Activity Brief, and an associated hydraulic modelling results presentation.¹
37. All information provided is considered relevant and has been considered by the Exemption Team.

Practical considerations

38. WWL's application and additional supporting information states that the reasons for seeking a residual disinfection exemption for rule T3.2 for the Wellington Region Bulk Water drinking water supply are:
 - (a) Cross connections between the bulk supply network and Lower Hutt City reticulation network provide water to consumers before a C.t value of 15 min.mg/L can be achieved.
 - (b) Wellington Region Bulk Water supply does not have water storage facilities at Waterloo WTP to provide suitable contact time prior to entering network.
 - (c) Cross connections need to be maintained open due to low pressure issues within the reticulation network. Closing the connections to resolve the chlorine contact time issue could, pending further works, mean some consumers receive an unreliable or insufficient supply of drinking water. Upgrades are underway to remedy this issue.
39. In response to questions from the Exemption Team, WWL stated that regardless of the exemption application result, they will be proceeding with the cross-connection closures and associated works. Physical works contracts for this project were programmed to be awarded in September 2023.

Available compliance pathways

40. The Wellington Region Bulk Water drinking water supply is a large and complex supply. It is categorised under the DWQAR as a large networked supply (supplying more than 500 people). As such, the supply must comply with the G, S3, T3 and D3 rules modules within the DWQAR.

¹ 641208-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram Chlorine Dosing System [1086184].pdf, 641203-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram Lime and Blower System [1086166].pdf, 64102-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram pH Monitoring [1086162].pdf, 641200-WF-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram – Wellfield Collection and Run to Waste System.pdf, 641200-AR-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram – Aeration and Reservoirs.pdf, 641209-UV-PID – Waterloo Water Treatment Plant – Process and Instrumentation Diagram – UV Treatment Plant.pdf, HCC X con Feb 2020 v2.pptx, Rata and Sunville Rezoning Activity Brief (1).pdf

41. The T3 rules module requires water supplies using chlorine as a primary bacterial disinfection barrier to ensure treated water achieves a chlorine C.t value of at least 15 min.mg/L for at least 95% of each day.
42. If chlorine dosing cannot meet the compliance requirements of the DWQAR and provide a primary bacterial barrier, either UV disinfection, ozone, chloring dioxide disinfection or chlorination/dichlorination could be used.
43. Acceptable solutions can be adopted as an alternative to complying with the DWQAR and preparing and implementing a DWSP (including the provision of residual disinfection). The Wellington Region Bulk Water drinking water supply does not meet any of the eligibility criteria for drinking water acceptable solutions made by Taumata Arowai to date.

Assessment process

44. Upon receiving this application, an initial review of the covering letter and associated documents was conducted, and additional information was requested from WWL.
45. The application was assessed by a Taumata Arowai staff member and then reviewed internally.
46. The resulting draft exemption application report was then reviewed by an international expert in drinking water systems.
47. Further consideration was given to the eligibility of C.t for residual disinfection exemption applications; particularly whether the C.t process relates exclusively to primary disinfection or also to residual disinfection.
48. After careful consideration, the Exemption Team has formed the view that C.t is not a matter for which a residual disinfection application can be granted, as it relates exclusively to primary treatment.

Assessment factors

49. WWL's application was initially assessed against the relevant factors arising under the WSA, Taumata Arowai policy and guidance material in relation to exemption applications, and other considerations relevant to decision-making by Taumata Arowai and its staff.
50. The exemptions team also considered the Taumata Arowai Compliance, Monitoring and Enforcement Strategy 2022-2025 (CME Strategy). This is a matter that the Taumata Arowai Chief Executive, and any delegate of the Chief Executive, must have regard to when determining exemption applications.²

² WSA, section 136(7); TAWSRA, section 11(2)(b).

The Treaty of Waitangi / te Tiriti o Waitangi and its principles

51. Taumata Arowai and its staff are required to uphold the Treaty of Waitangi (te Tiriti o Waitangi) and its principles when carrying out their functions.³
52. What this means in practice varies from situation to situation, depending on the relevance of Treaty/te Tiriti provisions and associated principles, including: partnership, self-determination, mutual benefit, honour, active protection, options, right of development, informed decisions, equity and equal treatment, and other principles that may be developed or identified as relevant from time to time. There is also some overlap between these principles and aspects of Te Mana o te Wai, which is discussed in the next section of this paper.
53. WWL does not specifically mention the Treaty of Waitangi / te Tiriti o Waitangi and its principles in the exemption application.
54. An assessment of the extent to which any decision on the application would uphold te Tiriti o Waitangi has not been undertaken as non-compliance with DWQAR rules for C.t is not a matter for which a residual disinfection application can be granted, as it relates exclusively to primary treatment.

Te Mana o te Wai

55. For the purposes of the WSA, Te Mana o te Wai is defined in the National Policy Statement for Freshwater Management 2020 and applies to water as it is defined in the Resource Management Act 1991. Everyone exercising or performing a function, power, or duty under the WSA must give effect to Te Mana o te Wai when doing so, to the extent it applies to the function, power, or duty.
56. WWL does not include commentary of Te Mana o te Wai in its exemption application or discuss the proposed works and operations from the perspective of Te Mana o te Wai.
57. An assessment of the extent to which any decision on the application would give effect to Te Mana o te Wai has not been undertaken as non-compliance with DWQAR rules for C.t is not a matter for which a residual disinfection application can be granted, as it relates exclusively to primary treatment.

Compliance, Monitoring and Enforcement Strategy

58. The CME Strategy outlines the approach Taumata Arowai will take to exemption applications. It provides part of the setting for the more detailed provisions in other Taumata Arowai policy and guidance material.
59. Amongst other things, the CME Strategy provides that Taumata Arowai will be guided by the following principles when determining exemption applications:
 - consumption of safe drinking water by consumers is paramount; and

³ TAWSRA, section 19(1)(b)(i).

- the scale, complexity and degree of risk associated with a drinking water supply will affect the assessment of whether an exemption would be consistent with the main purpose of the WSA, to ensure that drinking water suppliers provide safe drinking water to consumers.
60. The Exemption Team has had regard to the relevant parts of the CME Strategy when conducting its assessment and preparing this paper.

Application of section 58 of the Water Services Act 2021

61. Section 58(1) of the WSA states (emphasis added):

*The chief executive may exempt a drinking water supplier or class of drinking water supplier from the requirement **to use residual disinfection** in—*

- (a) a supply that includes reticulation; or*
- (b) any part of a supply that includes reticulation.*

62. The exemption application indicates that the supply currently provides for residual disinfection as the water in the distribution system is likely to meet the D3 chlorine rules in the DWQAR. The application nevertheless seeks an exemption under section 58(1)(b) in relation to the inability of the Waterloo WTP to provide sufficient C.t to water that is chlorinated as part of the primary treatment process and delivered to the distribution network.
63. A ‘part of a supply’ could be a particular physical part of a supply – e.g. a certain geographic area or distribution zone – or particular supply infrastructure. Alternatively, it could also arguably be a process applied as part of a supply’s operations and treatment processes.
64. C.t could be characterised as a process that is part of a drinking water supply that includes reticulation. However, for an exemption to be granted under section 58(1)(b) it must also be a process associated with *residual disinfection* – that is what an exemption under section 58 necessarily applies to.
65. The Exemption Team does not consider that C.t is something that is necessary and material for effective residual disinfection. Rather, it is required as an aspect of primary disinfection. While C.t compliance can in some cases be achieved while treated water is in a distribution system, that does not mean that it is a function of residual disinfection. It just means – where the necessary C.t. time is achieved – that primary treatment is completed within the distribution system.
66. Rule T3.2 in the DWQAR requires that treated water must achieve a chlorine C.t value of at least 15 min.mg/L for at least 95% of each day. The location of this rule in the treatment section of the DWQAR reflects the position that C.t requirements are part of a primary treatment process rather than part of a distribution system function. In contrast, the distribution system requirements in the ‘D’ rules of the DWQAR require a minimum free available chlorine level, but do not impose any C.t requirement. WWL has indicated that the free available chlorine levels

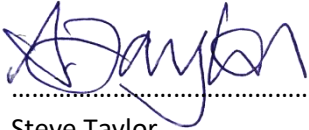
required by the D3 rule suite are achieved in the part of the distribution network served by the Waterloo WTP.

67. Section 58 cannot be used to seek an exemption to a process that is a function of primary disinfection, rather than residual disinfection. For this reason, it is not possible to grant an exemption from C.t. requirements in the DWQAR under section 58 of the WSA.

Decision

The Exemption Team recommends that you:

- (a) agree that an exemption cannot be granted under section 58 of the WSA for the concentration/time (C.t) requirements of the DWQAR, as C.t is part of primary disinfection rather than the residual disinfection process that section 58 relates to.



.....

Steve Taylor
Head of Regulatory

Date: 18 January 2024