Drinking Water Quality Regulator for Scotland

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Requirement and Expectations for Supply–specific Disinfection Strategies

Dear Peter

1. Regulation 25 of the Water Supply (Water Quality)(Scotland) Regulations 2001 requires all water to be disinfected before it is supplied to consumers. It also requires that Scottish Water verifies the performance of the disinfection process and designs, operates and maintains the disinfection process so as to keep disinfection by-products as low as possible without compromising disinfection. Microbiological safety needs to be maintained throughout the distribution system. Inadequate disinfection can have serious consequences for public health, and poor control of disinfection can render the water unacceptable to consumers.

2. This letter has been written to ensure Scottish Water is fully compliant with this regulation and that DWQR and consumers are provided with the necessary confidence that disinfection arrangements are adequate and under full control for every public water supply in Scotland. It has been written following a number of issues concerned with disinfection that have been brought to DWQR's attention at a number of different locations in Scotland over the past year.

3. Scottish Water is required to produce an over-arching disinfection policy for Scotland, plus individual disinfection strategies for each water supply. The disinfection policy document must be provided to DWQR by 31 October 2013. Individual supply disinfection strategies are not required to be submitted, but may be viewed and considered by DWQR during site audits, incident investigations and on request. It is expected that Scottish Water will maintain and update both documents on an ongoing basis.

4. The requirements for each type of document are specified below:

Scottish Water Disinfection Policy

5. This should set out Scottish Water's approach to disinfecting and maintaining microbiological quality of its water supplies. It should specify the general principles that will be applied and standards that will be met for the design, monitoring and operation of the disinfection process in all Scottish Water supplies. It is expected that this document will specify standards for Ct (*disinfectant concentration in mg/l multiplied by contact time in minutes*) and the measures to be taken if Ct is not met.

6. This document should sit alongside or within Scottish Water's standards and specifications so that the contents are taken into account as part of any capital investment.

Scottish Water Disinfection Strategies

7. These should be produced for each supply system to record how disinfection is to be achieved and maintained for that supply. It is for Scottish Water to decide what constitutes a supply system – in some circumstances it may be more convenient to consider a system with multiple treatment works blending to supply a number of water supply zones. Regardless of the chosen arrangement, it is expected that Scottish Water will ensure that all treatment works and water supply zones in Scotland are covered by a strategy.

8. It is important that the key points of each disinfection strategy are available to and understood by Scottish Water staff responsible for the operation and control of disinfection systems. Therefore it is expected that the strategies, or the key elements of the strategies, will be made directly available to staff at the sites to which they relate.

9. Scottish Water should set out how the disinfection system at each treatment works is designed to disinfect water under all flow conditions and challenges from the raw water. This should include the following as a minimum:

1. How the water is prepared for disinfection

10. This should detail the quality limits that Scottish Water is expecting to achieve in water that is presented for disinfection for relevant parameters, and how the treatment process is designed to achieve these. Relevant parameters are those that have the ability to have an impact on the effectiveness of disinfection, and will include the following:

- Turbidity
- Colour / TOC
- pH
- Ammonia

11. Scottish Water should confirm that appropriate monitors are correctly located, with telemetry alarms set at appropriate levels to enable operator intervention prior to the disinfection process being adversely affected. Any deficiencies in the design of the works should be recorded and addressed via the site's Drinking Water Safety Plan

2. Design of disinfectant dosing system

12. The type of disinfectant and the method and location by which it is introduced to the water should be described, along with normal operational settings and limits and all monitoring and critical control points.

13. Arrangements for chemical mixing should be described, along with details of contact tank (or pipe) design. The latter should include the following as a minimum:

- dimensions
- construction
- location of inlet and outlet
- presence and nature of any baffling
- whether Scottish Water is currently able to clean the asset

14. Contact time should be specified, under the full range of possible flow conditions at the treatment works. Scottish Water should be able to demonstrate their understanding of the flow characteristics through the contact tank. Actual contact time should be verified and documented using an appropriate method.

Where final water pH correction takes place, the location should be recorded.

15. Where ammonia is added to achieve chloramination this should be considered to be the end of the useful chlorine contact period. Dosing arrangements for ammonia addition should be documented in the same way as for chlorine. The chlorine to ammonia ratio that is to be used at the site should be documented and validated.

3. Disinfection control and monitoring

16. The method and principles by which disinfection is to be controlled at the site should be documented. Where there is more than one possible control regime available with the control instrumentation present on site, Scottish Water should specify which is (are) to be used, together with any operating conditions or constraints.

17. The monitors used to control the disinfection process should be documented, together with any delay or "loop" times, either physical or programmed, which should be verified. Consideration should be given as to whether multiple validation is desirable and present for each monitoring location and that there is an appropriate operating philosophy. Confirmation should be provided that each monitor is being operated in accordance with manufacturers' guidance. In particular, the appropriate use of buffer should be checked and documented. Calibration frequencies and methods should be reviewed and defined for each instrument. As pH is critical to the control of the disinfection process, associated pH monitors should also be included in this requirement.

18. Target, maximum and minimum values for chlorine concentration should be documented at every monitoring point, and these used with the verified contact time to calculate a Ct value for the works, under various conditions if necessary. In calculating Ct, Scottish Water may wish to consider the amount of available hypochlorous acid present for disinfection in the water under usual conditions at the treatment works (or a range of conditions if applicable). In this way it is acceptable to account for multiple stages of disinfection contact time at different pH values to produce a total Ct value. The chosen method of calculation should be documented in Scottish Water's disinfection policy.

19. Where the Ct falls below that deemed by Scottish Water to be the minimum acceptable, having followed guidance from the World Health Organisation, water industry best practice and other sources, improvements to the supply should be pursued via the supply's Water Safety Plan. Depending on the extent of any deficiency, it may be necessary to implement interim measures to protect public health until such time as the supply can be improved. Scottish Water is required to document the Ct value(s) it considers appropriate under certain circumstances within the company's disinfection policy and to notify DWQR of any sites that fail to meet the required Ct value, along with timescales for proposed improvements as they are identified by the site-specific disinfection strategy.

4. Verification of Disinfection

20. The absence of indicator bacteria, on its own, is insufficient to verify that disinfection has been achieved. Scottish Water needs to ensure that sufficient records of relevant measurements are kept and archived so that, when combined with verified site design data, it can be confirmed that disinfection has been achieved.

5. Security of disinfection

21. Supplying water that has not been disinfected is not only an offence in law, it also presents a serious risk to public health. Scottish Water must ensure that it has measures in place to ensure that consumers are protected from undisinfected water.

22. There are a number of ways in which this may be done. The appropriate combination of measures will be determined by circumstances at each works and supply system, and the selection of these will be a matter for Scottish Water. Options include:

- enhanced monitoring and telemetry, potentially including direct calculation of Ct on SCADA, with alarms
- automated shutdowns on low chlorine and other parameters relevant to disinfection
- the ability to run supplies to waste
- standby dosing pumps with auto-changeover
- back-up disinfection dosing systems

23. This list is not exhaustive. Scottish Water should document the method by which it will ensure security of disinfection at each site in the disinfection strategy. Where the measures are not considered to be adequate, provision should be made for the necessary improvements via the Water Safety Plan process.

6. Maintenance of disinfection in distribution

24. It is vital that water is not only safe when it leaves the water treatment works, but that it remains safe through the distribution system. In its disinfection strategy for each supply, Scottish Water shall document how it will ensure that water remains microbiologically safe through the distribution system. This will include target chlorine residuals for each storage point, defined on a site specific basis, and set with a view to achieving a balance between safety and consumer aesthetics.

25. Secondary chlorine dosing should only be used as a last resort in water supplies where other measures to maintain chlorine residuals have failed. At every site where Scottish Water uses secondary chlorine dosing it should set out the operating strategy for that dosing unit along with the means by which the performance of the secondary dosing point will be monitored and recorded. A plan for improving chlorine residuals via other means with the aim of, where possible, rendering secondary chlorination unnecessary at that site is also required.

26. Any other measures that Scottish Water considers necessary, whether existing or planned, should also be documented in the disinfection strategy for the supply.

7. Minimisation of disinfection by-products

27. For each supply, Scottish Water shall document the means by which it proposes to ensure that concentrations of disinfection by-products are as low as possible without compromising the performance of the disinfection process.

8. Timescales

28. It is expected that much of the information required in each disinfection strategy will already be available to Scottish Water as a competent water authority. However, it is acknowledged that other elements of the strategy may take longer to produce. Consequently a risk-based, phased approach to delivery is acceptable. Scottish Water should identify all those supplies it considers to be high risk and produce disinfection strategies for those by 31 October 2015. A list of these supplies, including a brief reason for the high risk classification, should be provided to DWQR by 31 December 2013. All remaining Scottish Water supplies should be covered by a disinfection strategy by 31 October 2018. DWQR will expect that Scottish Water will review and update supply disinfection strategies to ensure that they reflect any significant changes in the treatment process or distribution system.

29. This letter has been copied electronically to Alan Sutherland, Water Industry Commission; Dr Colin Ramsay, Health Protection Scotland; Prof. Jeni Colbourne, DWI England & Wales; Margaret Herron, DWI Northern Ireland.

Yours sincerely,

Matthew Bower

Operations Team Leader
Drinking Water Quality Regulator for Scotland