



## **GUIDANCE ON THE IMPLEMENTATION OF THE WATER SUPPLY (WATER QUALITY) REGULATIONS 2016 IN ENGLAND AND THE WATER SUPPLY (WATER QUALITY) REGULATIONS 2010 (as amended) IN WALES**

### **The Regulations**

#### **Part 8 – Water Treatment**

#### **Regulation 26 [27]: Disinfection and other treatment arrangements**

## PART 8 – WATER TREATMENT

### Regulation 26 [27] – Disinfection and other treatment arrangements

- 26.1 Regulation 26 [27] requires all water supplied for regulation 4(1) purposes to be disinfected. Where necessary the water also has to be subject to sufficient preliminary treatment. The point at which water is considered to be supplied for regulation 4(1) purposes is when it leaves the treatment works (regulation 26(6)(c) [27(6)(c)]).
- 26.2 Disinfection is explicitly defined in regulation 2 and sufficient preliminary treatment is also defined in regulation 26(6)(b) [27(6)(b)] - see below.
- 26.3 The choice of treatment and disinfection processes is not specified in the regulation. This means that companies are free to decide on the most appropriate technology to apply at each treatment works. The Inspectorate expects companies to have in place a water treatment policy and a disinfection policy covering all of the requirements of regulation 26 [27] for each of its treatment works. Both the design and operation of treatment works must be covered by this policy which should be kept under regular review and be informed by appropriate studies and technical performance data.
- 26.4 The Inspectorate also expects that at every treatment works, documents and procedures are in place which ensure it is unambiguous how regulation 26 [27] is being met both in principle and in practice. On-site policies and procedures should be clear and easy to use, to ensure that operational staff fully understand the disinfection arrangements, normal operating conditions and alarm settings at each works. Emergency plans should be in place for every treatment works, which include clear rules for escalation of incidents involving compromised disinfection and breakdown or compromise of critical treatment processes.
- 26.5 Companies' disinfection policies should be informed by sound science and by knowledge of the occurrence of pathogens in water sources in England and Wales, using information available from the Public Health England (PHE) or Public Health Wales (PHW). The disinfection policy should cover the design, maintenance and operation of all relevant components of companies' treatment works.
- 26.6 Regulation 26(6)(b)(i) [27(6)(b)(i)] defines the preliminary treatment that companies must have in place to prepare water for disinfection. This means that companies must treat the water to modify its quality in respect of any properties (e.g. pH) and substances (e.g. ammonia) known to adversely affect the performance of the disinfection process (or processes). Where no preliminary treatment takes place the Inspectorate expects the company to be able to demonstrate from robust data why no preliminary treatment is required.
- 26.7 Regulation 26(6)(b)(ii) [27(6)(b)(ii)] requires that the turbidity of water presented for chemical or ultra violet disinfection must be less than 1 NTU at all times.
- 26.8 The Inspectorate considers it to be good practice to have in place at each treatment works, continuous on-line monitoring for turbidity, residual disinfectant and other parameters that affect the effectiveness of disinfection (for example pH, ammonia, residual coagulant metals), with appropriate alarms, alarm-response procedures and automated fail-safe mechanisms in place, to prevent undisinfected or partially disinfected water from being put into supply. Such measures significantly reduce the risk of failure to comply with regulation 26 [27], and can ensure that 26(6)(b)(ii) [27(6)(b)(ii)] is complied with.

- 26.9 Where chlorine is used as a disinfectant and a minimum contact time is required to achieve effective disinfection (i.e. a target effective Ct value that takes into account flow rate, temperature, pH and chlorine concentration), the company should ensure that robust arrangements are in place for ensuring adequate contact time at all times, preferably through use of a purpose-designed, baffled contact tank that has been demonstrated to achieve optimum plug-flow conditions.
- 26.10 Contact tanks should not be used to provide on-site storage or for blending with other supplies, and arrangements should be in place to ensure that water from the distribution network is not able to flow back into the contact tank. If any of these situations apply, the Inspectorate considers that regulation 26(2)(b) [27(2)(b)] is unlikely to be complied with (see also paragraph 26.18 below).
- 26.11 The Inspectorate recommends that companies refer to standard reference texts, for example the *WHO Guidelines for Drinking Water Quality*, *White's Handbook of Chlorination and Alternative Disinfectants* (Wiley, 2010) and *Twort's Water Supply* (Butterworth-Heinemann, 2009) to inform their site-specific disinfection policies, to ensure that regulation 26 [27] is fully complied with.
- 26.12 Regulation 26(2)(a) [27(2)(a)] requires that disinfection systems are designed and operated in such a manner that the formation of disinfection by-products (DBPs) is minimised. Companies should focus their activities to minimise the formation of disinfection by-products on identifying and removing DBP pre-cursors and avoiding conditions that encourage the formation of DBPs, whilst ensuring disinfection itself is not compromised.
- 26.13 The regulations set a parametric value of 100µg/l for trihalomethanes (a group of four disinfection by-products, namely chloroform, bromoform, dibromochloromethane and bromodichloromethane) and 10µg/l for bromate. Furthermore, regulation 4(2) states that for water to be considered wholesome it must not contain any substance which alone or in conjunction with any other substance constitutes a potential danger to human health. Therefore, while there may not be specific parametric values for DBPs other than THMs and bromate, they must not be present in concentrations that constitute a potential danger to human health.
- 26.14 The factors which influence DBP formation include:
- The type and purity of disinfectant used
  - The concentration of disinfectant used
  - Concentrations of organic matter and other DBP precursors present in water presented for disinfection
  - Temperature
  - pH
  - Contact time
  - Length and condition of the distribution network.
  - Rechlorination in the distribution network
- 26.15 The use of sodium hypochlorite and chlorine dioxide can cause the formation of chlorite and chlorate. Where these chemicals are used, companies should regularly monitor for these DBPs to ensure that the WHO Guideline Values (GVs) are not exceeded, and that the supply remains wholesome at all times.
- 26.16 Where ozonation is practised, there may be a risk of bromate formation, in which case companies should monitor bromate levels at appropriate points through the treatment

process. It is also good practice to monitor total organic carbon upstream of ozonation, so that the ozone dose can be controlled to minimise the risk of DBP formation. Companies should assess the level of bromide in the raw water and include bromide within the risk assessment for the treatment works.

26.17 Information on other DBPs, and guideline values, can be found in Chapter 8 of the *WHO Guidelines for drinking-water quality*. Companies should include other DBPs as appropriate, in their monitoring strategies, to confirm that regulation 26(2)(a) [27(2)(a)] is complied with.

26.18 Regulation 26(2)(b) [27(2)(b)] requires that disinfection processes must be verified. This means that the preliminary treatment and disinfection process employed must be designed to remove and/or inactivate pathogenic organisms, with reference to standard texts such as those cited in paragraph 26.11 above. The absence of indicator bacteria is insufficient on its own to show that water has been disinfected, and verification should be assessed through the removal or inactivation of pathogens through the whole treatment process, including final disinfection. The Inspectorate expects companies to be doing this as part of existing operational practices covered by the policies and procedures described in paragraph 26.3 and 26.4 above, and use online continuous monitoring as appropriate to verify that conditions are met at all times. Companies must be able to demonstrate that the treatment processes are designed for the challenge present in the raw water, and that they are operated within these design criteria. Chapter 7 of the *WHO Guidelines for drinking-water quality* contains information on the effectiveness of a variety of disinfecting agents against a range of microbial pathogens, and information can be found in other reference sources such as those cited above.

26.19 Refer also to the Inspectorate's published Guidance [The use of Ultraviolet \(UV\) irradiation for the Disinfection of Public Water Supplies](#)<sup>1</sup> available on the DWI website.

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<sup>1</sup> Published August 2016